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EDITORIAL

CONTEMPORARY NEEDS IN MEDICAL SPECIALIST SERVICES IN GHANA

Postgraduate medical training has been going on in Ghana for many years. However, it was in 2003 that the country established Ghana College of Physicians and Surgeons for the purpose of local training of specialists. This training programme has achieved some success by turning out over 1200 graduates at the Membership level. These graduates are deployed as specialists within the Ghanaian health delivery system. However only about 140 of these graduates have pursued further training to graduate at the Fellowship level. The low proportion of trainees who have progressed from the Membership to the Fellowship level is a cause of concern and we need to perform a detailed analysis to identify and address the reasons for this slow progression. The areas of specialization of all graduates since the start of our local training is shown in Figure 1.

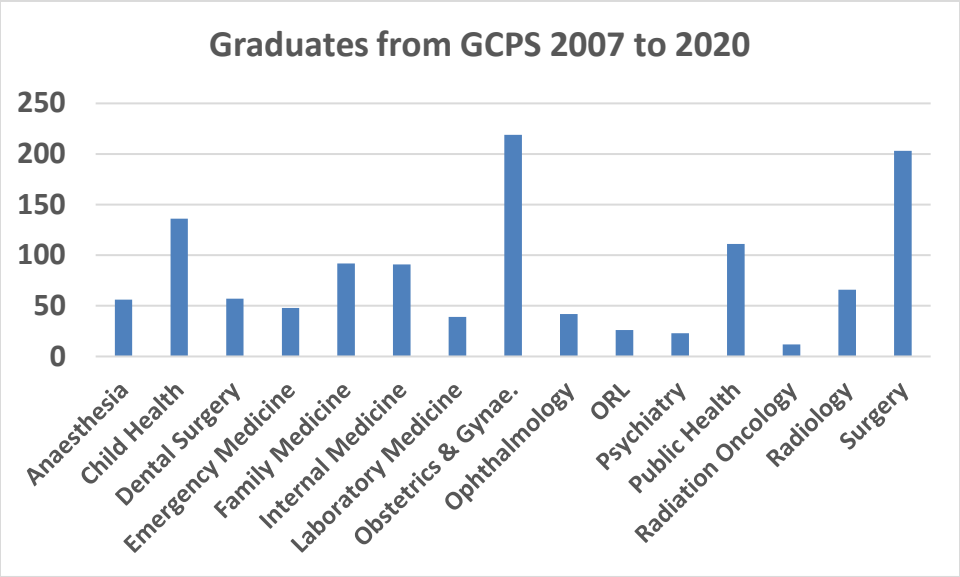

Figure 1: Areas of specialization of graduates from Ghana College of Physicians and Surgeons (2007 to 2020

This distribution of specialists shows that there are clearly some areas where the rate of production of specialists is much lower than desired. This observation however needs to be situated within the context that there is no specialty area that has the required number of specialists per population in the country. Specialists are needed in all these areas and need to be available in all parts of the country. It is therefore important to find ways of increasing the output of specialists in all areas while emphasizing the more deprived areas and to also put measures in place that would ensure that the specialist services are easily accessible throughout the country.

The most obvious reason for producing specialists is for the provision of necessary health services and this is what we currently focus on as a country. This focus is due to the relatively low number of specialists in the country and can be justified. This focus however tends to strongly influence the thinking of the specialists themselves so that they lose sight of other important reasons for specialist training.

A medical specialist who has been trained to the highest level possible is the person best suited to serve as a leader and advocate in the field. Such specialists must have been exposed to the practice of their discipline in different parts of the world either through direct contact or through reading and other means of communication. This exposure should help the specialists to come up with the best way of delivering training and service within the Ghanaian context. Given the reality that all the needed infrastructure for specialist training and services will not be fully available within a short time, specialists need to know how to make use of existing facilities to produce the best possible results. These leaders in healthcare must be actively involved in policy formulation processes as well as in the engagement of political leaders and other important stakeholders for advocacy. If specialists are only concerned with the practice of their discipline and will work within the context of available facilities, then the development of the specialty will be very slow and will be determined by people who do not have the full understanding of the practice.

The needs of the specialty area as well as the interventions best suited for our context can only be discovered through research. The person best suited to lead this kind of research are the fully trained specialists who practice in the country. Medical specialists generate

large amounts of data in their daily activities and it is important for these data to be properly collected and analysed to come out with the best way of improving the health of Ghanaians.

The need for specialists to be involved in service delivery, policy formulation, advocacy, training and research among many other things brings out the need for an acceleration in the rate of specialist production. It also brings out the need to ensure that specialist training is not overly focused on clinical skills but also addresses the other equally important skills.

Ghana College of Physicians and Surgeons must be aware of these contemporary needs in specialist training and practice and so should be actively engaged in reviewing training programmes and policies that are responsive to our national challenges.

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ORIGINAL ARTICLES

PROPHYLAXIS WITH IRON AND FOLATE SUPPLEMENTATION IN PREGNANCY; A HEALTH FACILITY-BASED ASSESSMENT OF ITS ROLE FOR PREVENTION OF ANAEMIA AT DELIVERY

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Abstract

Objective: Presumptive Iron and folate supplementation, (IFS), for both healthy and iron-deficient pregnant women in developing countries, is aimed to ameliorate the high prevalence of maternal anaemia.[1] This may be valuable only in selected women.[13] Its role for averting maternal anaemia at delivery is therefore analysed.

Methodology: The hospital-based cross-sectional study enrolled 413 ANC attendant parturients, exposed to IFS prior to delivery. Anaemia in pregnancy was classified by specifications of the Indian Council of Medical Research (ICMR) using maternal pre-delivery haemoglobin concentrations. Maternal haemoglobin concentrations and differential patterns of exposure to IFS were analysed across various maternal and environmental variables with epi info 3.5.4.

Results: Parturients were mostly aged 25-34 years and largely exposed to IFS for ≥ 6 months during pregnancy. Anaemic parturients, (typically defined by lower maternal age), initiated ANC attendance later than non-anaemic parturients. Patterns of maternal anaemia varied insignificantly despite differential patterns of duration of IFS and subjectively assessed degree of compliance. Self-reported full compliance with IFS weakly correlated with higher maternal Hgb concentrations. Mean maternal Hgb concentrations remained consistent with mild anaemia irrespective of duration of IFS.

Conclusion: Despite weak correlates between maternal anaemia and degree of compliance, the capacity of IFS to prevent mild, moderate or severe maternal anaemia remains unclear.

Recommendation: Indiscriminate IFS for all pregnant women, regardless of their Hgb concentrations, should be reviewed while investigation of factors that may underlie maternal non-response to routine IFS should be prioritized.

Key Words: *Iron, folate, supplementation, anaemia, pregnancy, effectiveness*

Introduction

Anaemia in pregnancy, a decrease in total red blood cell or haemoglobin (Hgb) in blood during pregnancy or postpartum, remains highly prevalent globally, conferring increased risk of morbidity and mortality for mother and fetus.[1] Anaemia from iron deficiency during pregnancy significantly predicts low birthweight and increased risk of preterm delivery.[2] Mechanisms causal to these effects are not clearly understood.[2] Prevalence of iron-deficiency anaemia, (the most prevalent nutritional deficiency during pregnancy), varies significantly among pregnant women by Region, country etc. due to varying socioeconomic factors, lifestyles and health-seeking behaviours across different cultures.[2] An estimated 52% of pregnant women in developing countries are anaemic compared with an estimated 23% in the developed world.[2] Maternal iron status in pregnancy significantly impacts the iron status of infants postpartum.[3] Inadequate folate during pregnancy is long associated with maternal anaemia and restricted fetal growth while prevalence of iron-deficiency anaemia in pregnancy lingers high among women in both developing and developed countries.[4, 5, 6, 7] At least, half of the global anaemia in pregnancy burden is assumed to be due to iron deficiency.[8, 9] The policy-prescribed, routine presumptive preventive treatment of anaemia among pregnant women with iron and folate supplementation (IFS) is premised on evidence indicating it significantly reduces risk of anemia.[9] Evidence further suggests that iron supplements increase Hgb and serum ferritin levels during pregnancy and also improve the maternal iron status in the puerperium, even in women who enter pregnancy with adequate iron stores.[9] The necessity of indiscriminate IFS during pregnancy has however been debated in industrialized countries where it is not universally practiced.[10] IFS during pregnancy is deemed a safe strategy for averting maternal anaemia mainly in developing countries, where traditional diets, typically, provide inadequate iron and where malaria

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and other infections, causing increased losses, are endemic.[10]

Despite evidence of associations between adverse pregnancy outcomes and high Hgb concentrations and increased iron stores, IFS remains preferred for both healthy and iron-deficient pregnant women in many developing countries.[11] Presumed universal benefits of IFS during pregnancy is occasionally debated with contrary positions questioning its importance for women who are iron replete or not anemic.[11] Correction of iron deficiency during pregnancy, even by supplementation with twice the amount of iron given to the iron adequate women, has been defined difficult.[12] Another study suggests that IFS during pregnancy for prevention or correction of maternal anaemia may be valuable *only in selected women*.[13] Routine IFS has also been historically partly linked to the era of economic depression and "welfare foods," which coincided with the development of organized antenatal care (ANC).[13] The need for objective assessment of benefits of old established traditions within an ANC context, in a changing community, is therefore emphasized.[13] The call for objective review is premised on the fact that haemopoiesis constitutes a function of more than minerals and vitamins made into a pill that may not be in an assimilable form as haem iron in the diet.[13] The prevalence of maternal anaemia, (defined as Hgb <11.0 g/dl), one week postpartum, is 14% in *iron-supplemented* women and 24% in *non-supplemented* women.[14] This study analyses the role of IFS for averting maternal anaemia during pregnancy and at delivery among ANC attendants.

Methodology

This hospital-based cross sectional study enrolled 413 consenting parturients (who attended ANC and were therefore on IFS prior to delivery) from the maternity units of the Kade Government Hospital and St. Dominic's Hospital (in Kwaebibirem and Denkyembuor districts respectively). Anaemia in pregnancy was classified by specifications of the Indian Council of Medical Research (ICMR) which defines anaemia in pregnancy (in an *iron-supplemented* population) as follows: Hgb concentration ≤10.9g/dl in the first trimester, ≤10.4g/dl in the second trimester and ≤10.9g/dl in the third trimester.[15] The clinical spectrum of severity is classified as follows: Hgb concentration of 10.9-10g/dl as mild, 9.9-7g/dl as moderate and 6.9-4g/dl as severe. Definition of Hgb concentration of ≤4g/dl as very severe anaemia was not distinctly analysed outside the spectrum of severe anemia.[15] Maternal pre-delivery Hgb concentrations, (checked routinely for all parturients accessing in-patient obstetric care), solely comprised the reference Hgb concentrations for maternal anaemia classification status; post-delivery Hgb concentrations were not preferred to avert possible significant changes resulting from inevitable delivery-associated blood losses. All abstracted information was validated from ANC booklets, personal folders and appropriate obstetric registers. Importantly further, albeit subjectively, *self-assessed* and *self-reported* perceived degree of compliance with IFS during pregnancy was assessed on a scale from *full, part to poor compliance*. The study excluded non-ANC attendants as the IFS policy during pregnancy remains a safe motherhood correlate within the confines of an ANC context. Classification of urban or rural community status was in accordance with definitions of the Ghana Statistical Service - communities with estimated populations of ≤ 5000 are rural. Ethical approval was granted by the Ghana Health Service Ethical Review Committee, (GHS-ERC No. 014/02/19). All data were analysed with epi info 3.5.4.

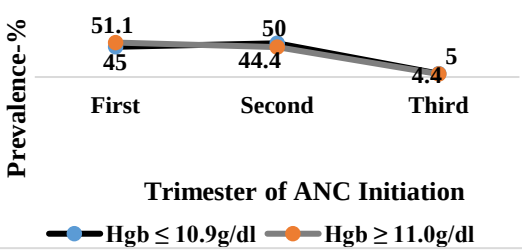
Results

The iron-supplemented population of parturients studied demographically comprised predominantly of women aged 25-34 years, characterized by a marginally higher population of rural residents and a markedly low proportion of women engaged in formal occupations. Parturients, largely married or cohabiting mostly initiated ANC in the first and second trimesters and were largely exposed to IFS for ≥6 months during pregnancy. Majority of parturients, largely of Junior High school educational background, were mostly exposed to IPTp-SP, (prescribed presumptively for the treatment of malaria during pregnancy). [Table 1]

The mean maternal age of 27.5 (±6.6) years, defined by wide standard deviation and variance, was marginally lower among parturients with Hbg ≤ 10.9g/dl. Mean parity and gestational age of initiation of ANC were marginally higher among parturients with Hgb ≤ 10.9g/dl than those of higher Hgb concentrations. [Table 2]

A significant proportion of parturients who initiated ANC attendance in the first trimester were anaemic at delivery. The highest prevalence of anaemia at delivery was observed among parturients who initiated ANC attendance in the second trimester. [Graph 1]

Graph 1. Prevalence of anaemia at delivery assessed by trimester of initiation of ANC attendance



Assessment of the prevalence of maternal anaemia at delivery, stratified by maternal age, area of

residence, maternal occupation etc., showed variations as indicated in the table below. Analyses of the clinical spectrum of severity showed that mild and severe anaemia at delivery increased inversely with decreasing maternal age. Mild anaemia at delivery was significantly higher among women engaged in formal occupations. The prevalence of moderate anaemia at delivery was markedly high among women who did not use bed nets during pregnancy. Notably, however, the prevalence of anaemia at delivery did not significantly vary among parturients despite their differential patterns of ANC attendance, duration of IFS and subjectively assessed degree of compliance with IFS during pregnancy. Parturients reporting poor compliance with IFS also recorded a notably high mild anaemia case burden. [Table 3]

Mean Hgb concentrations of parturients with Hgb ≤10.9g/dl remained comparatively low while that of parturients with Hgb ≥11.0g/dl also remained comparatively high irrespective of their differential durations IFS. [Table 4]

Assessment of the self-reported degree of compliance with IFS during pregnancy showed that parturients with maternal Hgb ≤10.9g/dl recorded a comparatively lower proportion of respondents who reported full compliance with IFS. This sub group further recorded higher proportions of parturients reporting self-assessed partial and poor compliance with IFS during pregnancy. Parturients with Hgb concentrations ≥11.0g/dl contrarily recorded significantly lower proportions of reports of partial compliance with IFS and notably no report of self-assessed poor compliance. [Table 5]

The severity of maternal anaemia, (among parturients with Hgb ≤10.9g/dl stratified by parturients' self-reported degree of compliance), largely varied insignificantly. The prevalence of maternal anaemia at delivery was however notably high among parturients engaged in formal occupations who also reported full compliance with IFS. [Table 6]

Mean maternal Hgb concentration, analysed by duration of IFS, generally remained consistent with mild anaemia irrespective of duration of exposure. Mean maternal Hgb concentrations among parturients aged ≤20 years however notably, though marginally, increased commensurately with increasing duration of IFS. [Table 7]

Table 1. Baseline demographic characteristics of the iron-supplemented population parturients

Characteristic	Frequency (n=413)	Percent - %
Age group in years		
≤ 24 years	157	38
25-34 years	173	41.9
35-44 years	81	19.6
≥ 44 years	2	0.5
Residence		
Urban	205	49.8
Rural	207	50.2
Occupation type		
Formal	56	16.2
Informal	290	83.8
Marital status		
Married/cohabiting	279	67.6
Single	134	32.4
Trimester of ANC commencement		
First trimester	189	46.3
Second trimester	199	48.8
Third trimester	20	20.0
Duration of IFS		
1-3 months	95	29.7
4-6 months	191	23.3
> 6 months	121	46.9
Maternal educational background		
≤ Junior High	282	68.4
≥ Senior High	130	31.6
IPTp-SP status		
Yes	362	87.9
No	50	12.1
Malaria in pregnancy		
Yes	127	30.8
No	285	69.2
Trimester of malaria in pregnancy		
First trimester	17	13.7
Second trimester	53	42.7
Third trimester	54	43.5
Used bed net		
Yes	286	70.8
No	114	29.2
Anaemia at term		
Yes	322	78.2
No	90	21.8
Anaemia severity at term		
Mild	149	46.3
Moderate	170	52.8
Severe	3	0.9
Parity		
≤ Para 2	213	52.1
Para 3-4	142	34.7
≥ Para 5	54	13.2

Table 2. Baseline characteristics of parturients analysed by maternal anaemia status

Characteristic	Parturients with Hgb ≤ 10.9g/dl			Parturients with Hgb ≥ 11.0g/dl		
	Mean Hgb	Std. Dev	Variance	Mean Hgb	Std. Dev	Variance
Maternal Age	27.5	6.6	44.5	28.1	7.2	52.0
Parity	2.7	1.6	2.8	2.5	1.7	2.9
ANC initiation (weeks)	15.2	5.8	33.6	14.8	6.1	38.2
Haemoglobin	9.6	0.9	0.9	11.6	0.6	0.4

Table 3. Prevalence of maternal anaemia analysed by maternal and environmental indicators

Characteristic	Severity of maternal anaemia - %		
	Mild	Moderate	Severe
Maternal age			
≤ 24 Years	40.30	36.50	66.70
25-34 Years	38.90	46.50	33.30
35-44 Years	20.10	17.10	0.00
≥ 44 Years	0.70	0.00	0.00
Residence			
Urban	47.8	50.5	1.90
Rural	45.1	54.9	0.00
Occupation type			
Formal	64.4	35.6	0.00
Informal	42.5	56.6	0.90
Marital status			
Married/cohabiting	45.1	54,5	0.50
Single	48.6	49.5	1.80
Parity			
≤ Para 2	49.4	49.4	1.30
Multipara (3-4)	39.7	59.5	0.90
Grand multipara (≥ 5)	55.8	44.2	0.00
ANC Initiation			
First trimester	49.7	49.0	1.40
Second trimester	43.4	56.0	0.60
Third trimester	56.3	43.8	0.00
Maternal education			
≤ JHS	44.7	53.9	1.30
≥ SHS	50.0	50.0	0.00
Exposed to IPTp-SP			
Yes	47.2	52.1	0.70
No	39.5	57.9	2.60
Sleep under net			
Yes	50.0	49.5	0.50
No	37.0	60.9	2.20
Duration of IFS			
≤ 3 months	46.1	53.9	0.0
4-6 months	46.6	52.0	1.4
> 6months	47.3	51.6	1.1
Degree of compliance			
Full	50.0	48.9	1.1
Part	40.2	59.0	0.8
Poor	83.3	16.7	0.0

Table 4. Assessment of mean Haemoglobin concentrations of parturients by estimated duration of exposure to Iron and Folate Supplementation during pregnancy

Characteristic	Parturients with Hgb ≤10.9g/dl			Parturients with Hgb ≥10.9g/dl		
	Mean Hgb	Std. Dev	Variance	Mean Hgb	Std. Dev	Variance
IFS ≤ 3 months	9.7	0.7	0.6	11.5	0.5	0.2
IFS 4-6 months	9.6	1.1	1.2	11.6	0.6	0.4
IFS > 6 months	9.6	0.8	0.7	11.5	0.7	0.5

Table 5. Prevalence of Anaemia at delivery analysed by self-reported maternal self-assessed degree of compliance with Iron and Folate Supplementation during pregnancy

Characteristic	Self-reported compliance (Hb≤10.9g/dl) - %			Self-reported compliance (Hb≥11.0g/dl) - %		
	Full	Part	Poor	Full	Part	Poor
Residence						
Urban	64.3	33.1	2.5	78.7	21.3	0.0
Rural	55.1	43.7	1.3	60.5	39.5	0.0
Mat. Occupation						
Formal	62.8	30.2	7.0	90.9	9.1	0.0
Informal	57.4	41.3	1.3	71.4	28.6	0.0
Partner Occupation						
Formal	60.4	32.1	7.5	75.0	25.0	0.0
Informal	59.7	39.5	0.8	69.2	30.8	0.0
Marital status						
Married/cohabit	58.7	39.4	1.9	69.2	30.8	0.0
Single	61.1	37.0	1.9	72.0	28.0	0.0
Parity						
Para 1	59.8	37.9	2.3	78.1	21.9	0.0
Para 2	60.6	36.6	2.8	66.7	33.3	0.0
Multipara	59.6	38.6	1.8	73.1	26.9	0.0
Grand multipara	57.1	42.9	0.0	45.5	54.5	0.0
Trimester of ANC initiation						
First trimester	72.0	27.3	0.7	71.7	28.3	0.0
Second trimester	49.4	48.1	2.6	70.0	30.0	0.0
Third trimester	50.0	50.0	0.0	50.0	50.0	0.0
Duration of Iron and Folate Supplementation						
≤ 3 months	48.6	50.0	1.4	57.9	42.1	0.0
4-6 months	56.6	41.4	2.1	72.1	27.9	0.0
> 6 months	74.2	24.7	1.1	75	25	0.0
Maternal educational background						
≤ Junior High	57.8	40.8	1.3	68.5	31.5	0.0
≥ Senior High	63.4	33.3	3.2	72.2	27.8	0.0
IPTp-SP exposure						
Exposed	60.0	38.2	1.8	71.8	28.2	0.0
Unexposed	55.6	41.7	2.8	71.8	28.2	0.0
Use bed net during pregnancy						
Used bed net	65.5	33.5	0.9	65.6	34.4	0.0
Not use bed net	47.3	48.4	4.4	80.8	90.2	0.0

Table 6. Prevalence of anaemia at delivery analysed by severity and self-reported degree of compliance with Iron and Folate Supplementation during pregnancy

Characteristic	Self-reported degree of compliance	Severity of maternal anaemia - %		
		Mild (10.9-10.0g/dl)	Moderate (9.9-7.0g/dl)	Severe (≤ 6.9g/dl)
Residence				
Urban	Full	49.5	48.5	2.0
	Part	40.4	57.7	1.9
	Poor	100	0.0	0.0
Rural	Full	50.6	49.4	0.0
	Part	40.6	59.4	0.0
	Poor	50.0	50.0	0.0
Maternal occupation				
Formal	Full	74.1	25.9	0.0
	Part	46.2	53.8	0.0
	Poor	66.7	33.3	0.0
Informal	Full	45.3	53.1	1.6
	Part	38.0	62.0	0.0
	Poor	100	0.0	0.0
Marital status				
Married/cohabit	Full	48.4	50.8	0.0
	Part	40.2	59.8	0.0
	Poor	100	0.0	0.0
Single	Full	53.0	45.5	1.5
	Part	40.0	57.5	2.5
	Poor	50.0	50.0	0.0
Parity				
≤ Para 2	Full	49.5	49.5	1.1
	Part	49.2	49.2	1.7
	Poor	75.0	25.0	0.0
≥ para 3	Full	51.1	47.8	1.1
	Part	32.3	67.7	0.0
	Poor	100	0.0	0.0
Duration of IFAS				
≤ 4 months	Full	50.8	48.3	0.0
	Part	40.2	58.8	1.0
	Poor	100	0.0	0.0
≥ 5 months	Full	49.3	49.3	1.4
	Part	39.1	60.9	0.0
	Poor	100	0.0	0.0
Maternal educational background				
≤ Junior High	Full	47.3	51.2	1.6
	Part	40.7	58.2	1.1
	Poor	100	0.0	0.0
≥ Senior High	Full	55.9	44.1	0.0
	Part	38.7	61.3	0.0
	Poor	66.7	33.3	0.0

Table 7. Mean maternal Haemoglobin concentration analysed by duration of exposure to Iron and Folate Supplementation across maternal and environmental factors

Characteristic	Mean maternal Hb concentration		
	IFS ≤ 3 months	IFS 4-6 months	IFS > 6 months
Maternal age			
≤ 20 years	9.8	9.9	10.1
21-30 years	10.1	10.0	10.1
31-40 years	10.2	10.2	10.2
41-50 years	9.8	10.7	8.8
< 35 years	10.0	10.0	10.1
≥ 35 years	10.4	10.5	10
Residence			
Urban	10.0	9.9	10.2
Rural	10.1	10.2	9.9
Marital status			
Married	10.1	10.2	10.2
Single	10.0	9.8	9.9
Parity group			
Para 1	10.3	10.2	10.1
Para 2	10.0	10.3	10.4
Multipara	9.9	10.0	9.8
Grand multipara	10.1	10.1	10.4
Trimester of ANC start			
First trimester	10.0	10.2	10.1
Second trimester	10.1	10.0	9.6
Third trimester	10.0	10.1	10.8

Discussion

An estimated ≥40% of pregnant women globally have Hgb concentrations consistent with various degrees of the clinical spectrum of anemia.[9] About half of this case burden is attributed to the micronutrient deficiency of iron.[9] During pregnancy, additional iron and folate is required to meet pregnant women's nutritional needs as well as those of the developing fetus.[9] All pregnant women in Ghana are expected to have their Hgb concentrations measured at initiation of ANC attendance, at 28 weeks gestation and at 36 weeks gestation to identify and manage anemia.[16] WHO recommends daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 µg (0.4 mg) folic acid for pregnant women to prevent maternal anaemia, puerperal sepsis, low birth weight, and preterm birth.[9] Benefits of this presumptive policy has been occasionally refuted with the argument that it may be valuable in selected women.[13] This study therefore analyses the role of IFS in eliminating maternal anaemia at delivery.

The study findings showed that the iron-supplemented population of women studied who had Hgb ≤10.9g/dl at delivery were marginally younger than women with Hgb ≥11.0g/dl. Majority of parturients were aged 25-34 years and were mainly married. These findings were fairly consistent with findings of a study that indicated that mean maternal age was 28.3 (±6.6) years;[16, 17] the mean maternal age in this study was however defined by a wider standard deviation and variance. Anaemia, defined by Hgb ≤10.9g/d, globally affects an estimated 29% of non-pregnant women and about 40% of pregnant women aged 15-49 years.[16] While the overall mean Hgb concentration of parturients in this study remained consistent with mild anaemia, (i.e. 10.1g/dl [±1.2]), the mean maternal Hgb of parturients with Hgb ≤10.9g/dl was 9 (±0.9); the mean Hgb concentration of women with Hgb ≥11.0g/dl was significantly higher at 11.6g/dl (±0.6). The mean maternal Hgb concentration assessed by the estimated duration of IFS showed no significant variations. While the overall mean Hgb concentration was 10.1g/dl (±1.2), mean Hgb concentration of parturients with Hgb ≤10.09g/dl varied insignificantly irrespective of the duration of exposure to IFS. Mean maternal Hgb concentration for parturients of Hgb ≥11.0g/dl equally remained high, unfettered by duration of IFS.

A higher overall prevalence of maternal anaemia in this study, (i.e. 71.2%), was measured than reported for pregnant women in Ghana at 45% in the latest Demographic and Health Survey.[16] This prevalence is sufficiently high for the classification of maternal anaemia as a public health problem.[16] This study's estimates however compares with the prevalence of 70% reported in 25 communities in the Northern Region of Ghana.[16] The national prevalence varies by geographical area i.e. 57.1% in Sekyere West to the south of Ghana and 34.4% in Secondi-Takoradi in Western Ghana.[16] This study's estimates further exceed

estimates of some countries e.g. 58% in South Eastern Nigeria, 51.9% in Southern Ethiopia, 63.1% in Kiboga, Uganda, 54.6% in Derna, Libya and Niger Delta and 69.6% in Nigeria among iron-supplemented populations of pregnant women.[16] Significantly lower estimates include 23.5% in South West Ethiopia, 25.2% in North West Ethiopia and Mpigi, 32.5% in Uganda.[16] Variations in estimates are attributed to differences in socio-economic circumstances, cultural practices, dietary patterns, preventive health practices and diagnostic tests.[16] Despite the variations, the prevalence of anaemia in pregnancy remains globally high.[18]

Mean parity was 2.7 (±); the demographic and health survey estimate Ghana's fertility at 4.4 per woman, (among the lowest in Sub Saharan Africa).[18] This study did not estimate mean fertility as data were not representative of the end of parturients' reproductive life. The mean gestational age of initiation of ANC was 15.1 (±5.8) weeks of gestation i.e. within the second trimester. Parturients with anaemia at delivery initiated ANC marginally later than women with Hgb concentrations not consistent with anaemia. The WHO recommends at least, eight ANC visits with the first visit during the first trimester.[19] Late initiation of ANC may lead to late detection of complications that may be detrimental to maternal and fetal health.[19] ANC forms the basis of all maternal health care services in Ghana, and encompasses the evaluation of the general health of pregnant women with aims to detect and prevent adverse maternal and neonatal outcomes.[19] The 2014 Ghana Demographic and Health Survey, (GDHS), showed that 97% of females who gave birth in the 5 years preceding the survey attended ANC at least once for their last childbirth and approximately nine in ten women had four or more ANC visits.[19] Studies on factors influencing timing of ANC initiation in Ghana remains pauce.[19] A study reported that an estimated 57% of pregnant women in Ghana initiate ANC attendance within the first trimester; this compares with the estimated 46.3% in this study who initiated ANC attendance in the first trimester further inextricably suggesting ample exposure to IFS.[19]

Consistently with extant evidence suggesting that less than 50% of pregnant women in Ghana initiate ANC attendance after first trimester of pregnancy, about 48.8% in this study initiated ANC attendance in the second trimester.[19] Parturients with Hgb ≥11.0g/dl had a marginally lower mean gestational age of initiation of ANC attendance (i.e. 14.8 [±6.1]) which was however still suggestive of a sustained preference for second trimester ANC initiation. This study suggests that mean Hgb concentrations of pregnant women at delivery varied insignificantly for both women with Hgb ≤10.9g/dl and women with Hgb ≥11.0g/dl irrespective of the duration of IFS during pregnancy. A study showed that most anaemic pregnant women were anaemic antecedent to conception and further posited that clinical benefits and risks of IFS remain unclear despite wide acceptance and WHO recommendation.[20] This study further reports the highest prevalence of severe anaemia at delivery among parturients aged ≤24 years while second in this series were parturients aged 25-34 years. Along the clinical spectrum of severity, the estimates of anaemia in pregnancy in Northern Ghana show that that about 61.2% have mild anaemia, 37.2% have moderate anaemia while 1.6% have severe anemia.[16] These estimates varied with those of this study as follows: 46.3% had mild anaemia, 52.8% had moderate anaemia while the prevalence of severe anaemia at delivery remained insignificant.

The estimated duration of IFS during pregnancy observably did not impact maternal Hgb concentrations at delivery, a particularly notable observation among parturients with maternal Hgb ≤10.9g/dl. A study indicates that iron requirements during pregnancy is approximately 1,000mg.[23] Hallberg posits that an estimated 350mg of iron is lost to the foetus and the placenta and 250mg is lost at delivery.[21] The large increase in maternal red blood cell mass additionally calls for an estimated 450mg while basal losses from the body, (amounting to 240mg), continue during pregnancy.[22] Total iron requirements during pregnancy, (outside delivery-associated losses), constitutes an estimated 1,040mg.[22] Permanent iron losses of about 840mg continue to the foetus and placenta, at delivery, and basal losses.[22] The total iron needs of ≥1,000mg, (equivalent to about 6mg of iron absorbed per day in a woman who starts pregnancy with absent or minimal storage iron), are concentrated in the last two trimesters of pregnancy.[23] This constitutes large amounts of iron to accumulate over a 6-month period, especially when compared with the average total body iron content of 2,200mg and the 1.3mg of iron absorbed per day by non-pregnant women.[23] Initiation of IFS is defined appropriate at about 12 weeks of gestation, (the beginning of the second trimester), when the iron requirements begin to increase at a dose of 30 mg per day.[23] Despite first and second trimester initiation of ANC attendance, (inextricably linked to IFS initiation after about 12 weeks per recommendations), prevalence of maternal anaemia at delivery in this study remained generally high. Fairly early initiation of IFS was not a correlate for enhanced Hgb concentrations at delivery.

Findings further showed that self-reported, (self-assessed), full and partial compliance with IFS during pregnancy were recorded in higher proportions among parturients with maternal Hb≥11.0g/dl. This group, notably, recorded no report of poor compliance. This lends credence to studies that reported that maternal Hgb concentrations significantly improved only among strictly compliant pregnant women by 0.3 g/dl, decreased among partially compliant women by, 0.36 g/dl and significantly decreased among the non-compliant by -1.4 g/dl.[24, 25, 26] Women engaged in

formal occupations in this study recorded the highest prevalence of self-reported full compliance and also the highest prevalence of mild maternal anaemia at delivery. Findings further supported a study that reported associations between maternal anaemia and non-compliance with IFS and a study that also suggested that maternal Hgb concentrations improved with community-based approaches to improving IFS compliance.[27, 28]

Mean maternal Hgb concentrations remained consistent with anaemia irrespective of duration of IFS and maternal or environmental factors by which it was stratified. These findings weakly support a study that refuted the importance of IFS for pregnant women irrespective of their Hgb concentrations.[30] Alizadeh *et al* posit that not using IFS during pregnancy did not impact the pregnant women with normal Hgb concentrations.[30] A study also importantly investigated factors predicting maternal non-response to oral iron replacement to inform decisions on transitioning to intravenous therapy in patients unlikely to benefit from oral iron.[31]

As IFS during pregnancy is not a global practice, research to establish its benefits for all women should be prioritized. Hibbard's dissenting views to IFS attributes its origins, in the United Kingdom, to the era of economic depression and "welfare foods," which coincided with the development of organized ANC.[13] Hibbard particularly recommends objective assessment of the benefits of all old established ANC traditions in a changing community.[13] This position maintains that haemopoiesis is dependent on more than the minerals and vitamins that can be conveniently made into a pill but may not be in an assimilable form, as haem iron in the diet.[13] Needed micronutrients may be provided only by a good mixed diet, typically available to the majority reasonably affluent Western societies, though women may not choose the right foods because of ignorance, inertia, or a lifetime of bad habits.[13] Hibbard also strongly posits that evidence supporting need for wholesale prophylactic IFS are flawed; firstly because assumptions that the physiological norms for non-pregnant women are applicable to pregnancy and that depletion equates with deficiency.[13] Secondly, studies based of selected populations may not be nationally applicable.[13] Also, assumptions that compliance with prescribed treatment will be full remain a remote probability.[13] Hibbard again further strongly indicates that the need for deprecation of blind uncritical prescription of any drug is usually disregarded for IFS during pregnancy on the basis that dietary intake is precarious in relation to needs.[13] Further investigation of benefits of IFS during pregnancy should importantly take cognizance of distinctions between iron deficiency and iron deficiency anaemia; failure of distinction renders many studies difficult to interpret.[32] Iron deficiency or sideropaenia is defined by qualitatively insufficient iron to supply its eventual needs.[33] Iron-deficiency anaemia, on the contrary, is characterized by decrease in the number of red blood cells or Hgb concentration i.e. anaemia caused by lack of iron.[34] If an estimated 50% of anaemia in pregnancy is assumed to be due to iron deficiency, justification for indiscriminate IFS of entire populations of pregnant women, (many of whom remain anaemic at delivery), needs further clarification.[8,9]

Conclusion

The iron-supplemented parturients demographically comprised predominantly of women aged 25-34 years, largely exposed to IFS for ≥4 months during pregnancy. Parturients with Hgb ≤10.9gdl had a marginally lower mean maternal age than those with Hgb ≥11.0g/dl. Non-anaemic parturients largely initiated ANC attendance earlier than anaemic parturients. Initiation of ANC attendance in the first and second trimesters was not correlated with reduced maternal anaemia at delivery. Mild and severe anaemia at delivery increased inversely with decreasing maternal age while moderate anaemia at delivery was markedly high among women who did not use bed nets during pregnancy. Prevalence and patterns of maternal anaemia varied insignificantly despite differential patterns of ANC attendance, duration of IFS and subjectively assessed degree of compliance with IFS. Self-reported poor compliance with IFS weakly correlated with a higher burden of mild anaemia. Mean maternal Hgb, (for both anaemic and non-anaemic parturients), was not amenable to duration of IFS. Self-reported full compliance with IFS mildly correlated with higher maternal Hgb concentrations, though marginal. Mean maternal Hgb concentrations remained consistent with mild anaemia irrespective of duration of IFS. The role of IFS for prevention of mild, moderate or severe maternal anaemia remains unclear. The very low prevalence of severe anaemia is likely attributable to ameliorative interventions initiated immediately it is detected and not necessarily to the IFS impact.

Recommendation

While maternal anaemia is largely attributed to the micronutrient deficiency of iron, increasing access to clinical investigations that may help to establish all underlying causes, (and not only iron-deficiency), should be prioritized. Further research should seek to investigate factors that may underlie maternal response or non-response to IFS during pregnancy. Policy directives indiscriminately subjecting entire populations of pregnant women to IFS, irrespective of their Hgb concentrations, should be reviewed. Maternal compliance with IFS should be prioritized for review to guide future approaches and preferences for prescription.

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EPIDEMIOLOGY AND TREATMENT OUTCOME OF PAEDIATRIC FOREARM FRACTURES AT THE GREATER ACCRA REGIONAL HOSPITAL

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Abstract

Objective: To investigate the epidemiology forearm fracture in the paediatric age group and its treatment outcome among patients presenting at the Greater Accra Regional Hospital (GARH).

Materials and Methods: Twenty-Four patients with paediatric forearm fractures presenting at the Trauma and Orthopaedic unit between November 2018 and October 2019 were prospectively followed up for six weeks; assessing re-displacement after one and 2 weeks and degree of supination and pronation at the end of the 6th week.

Results: A total of 24 children were recruited in this study. The median age of presentation was 5 years with a male to female ratio of 2:1. Sixty seven percent (n=16) of the patients reported to the facility within the first 24 hours of injury. Majority of the injuries (n=22) were as a result of fall on the outstretched hand (FOOSH). The school (n=13, 59.1%) and home environments (n=7, 31.8%) were the common places of injury; other places include recreational areas and footpath. Twenty-three (95.8%) of all patterns of forearm fractures were closed, with the commonest site being the distal third (n=17, 70.8%). Conservative treatment of the fractures sufficed in 19 patients (79.2%); with re-displacement occurring in 3 patients (12.5%). The remaining 5 cases were managed operatively. Functional assessment by way of supination and pronation was excellent in all the patients with no residual deformity.

Conclusion: The findings from this study point to the fact that, FOOSH occurring at the school environment is the commonest cause of forearm fractures in the paediatric age group. Conservative treatment sufficed in the majority of cases and remains a viable option if patients are carefully selected.

Key Words: *Paediatric, Forearm, Fractures, Epidemiology, Treatment outcome.*

Introduction

Globally, a quarter of all children sustain non-fatal injuries in a year[1]. Approximately 18 percent of children will experience a fracture by age 9 with children between the ages of 5 and 14 having the highest incidence[2]. Forearm fractures are the most common fractures among children and adolescents, with some studies showing an increasing trend in incidence [3,4]. It is noted that the majority of these fractures are located in the distal part of the forearm[5, 6], with major risk factors being falls from playground equipment (e.g. monkey bars) and from backyard trampolines; however, any fall with adequate force may result in a fracture[7]. These risk factors may defer from those in sub-Saharan Africa. Knowing the risk factors and the circumstances under which these injuries occur affords policy makers the opportunity to put in place the necessary preventive measures in our environment. Traditionally most of these injuries were managed conservatively with closed reduction and the application of Plaster of Paris (POP) casts because of the excellent remodelling potential in younger patients; of late, there is an increasing trend towards operative treatment in the western world[2]. A National Database Study from 2000 to 2012 revealed that, the proportion of patients treated with surgery increased from 59.3% in 2000 to 70.0% in 2012 in the United States[8]. Other studies have indicated that conservative management remains the gold standard [9,10]. Documenting the outcome of treatment of these injuries and comparing the results with those from other centres and regions will help make modifications to treatment if need be. This study sought to provide baseline data with respect to gender, age, mechanism of injury, treatment approach and outcomes for patients presenting at the Greater Accra Regional Hospital.

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Materials and methods

Study site and design

A hospital based longitudinal study was conducted at the Greater Accra Regional Hospital. The 420-bed capacity facility is the Regional Hospital for the Greater Accra Region with a wide catchment area.

This study received ethical clearance from the protocol review committee of the research and development division of the Ghana Health Service, with a Protocol ID NO: GHS-ERC: 002/06/18. The participants of this study were prospectively recruited from paediatric patients presenting with a radiologically confirmed forearm fracture at the orthopaedic clinic or emergency unit between November 2018 and October 2019.

Inclusion criteria: Patients with forearm fractures occurring in a skeletally immature bone with open physis were considered eligible.

Exclusion criteria: Patients with forearm fractures as a result of birth trauma or those presenting with pathological fractures were excluded from the study.

The patients' parents or guardians were interviewed after appropriate consent had been sought to ascertain the date and time of injury, time elapsed before reporting at facility, place where injury occurred and mechanism of injury. The criteria for conservative or operative treatment were dependent on the age of patient, the fracture characteristics, including the location and the degree of displacement of the fracture ends. Conservative management was indicated in all closed fractures with minimal or no displacement, or all closed fractures with acceptable reduction after closed manipulation predicted by the Price criteria[11], which uses a cut off of 15 and 10 degrees of residual angulation as being acceptable alignment for children 8 years old or less and 9 or more respectively. Indication for operative management were as follows: failed closed reduction of metaphyseal or diaphyseal fractures, unacceptable closed reduction as predicted by the Price criteria, open fractures requiring debridement, open fractures with associated neurovascular injury, or fractures with associated compartment syndrome.

Data collection and analysis

Data were collected in case report forms including the variables: patients' demographics and past medical history, marital status and level of education of the guardians, date, time, place and mechanism of injury, time from injury to presentation to hospital, Landin's modified trauma severity[12], type and pattern of fracture, anatomic location of injury with neurovascular assessment, type of treatment and follow-up results at 1, 2, and 4 to 6 weeks. The data were processed using the Microsoft Excel® 2010 Version 14.0 (Microsoft Corporation, WA, USA) and analysed with SPSS Version 21.0 (IBM Corp., Somers, NY, USA). Numerical data that were not normally distributed were reported with median and interquartile ranges (IQR). Ordinal variables were compared using the chi-square test with linear-by-linear association. Two-sided p values <0.05 were considered statistically significant.

Results

A total of 24 participants were recruited for this study. The median age of the patients was 5 years with a male to female preponderance of 2:1 (Table 1). A fall on the outstretched hand (FOOSH) was the commonest mechanism of injury (n=22, 91.7%), followed by road traffic accident (n=1, 4.2%) and direct blow (n=1, 4.2%). Sixteen patients (66.7%) presented to the hospital within 24 hours of injury. For the patients with the FOOSH injury, school was the most common place where the injury occurred, followed by home; 68.2% of these patients with forearm fractures were brought to the facility within 24 hours of injury (Table 2). Time of injury to presentation at the hospital was significantly shorter in guardians with higher level of education (p=0.019, Table 3). Twenty-three patients (95.8%) had closed fractures, with other characteristics as described in Table 4. The pattern of injury and severity of the trauma verses age and sex are depicted in Figures 1 and 2. Nineteen patients (79.2%) were treated conservatively (table 5). Re-displacement was observed in three patients, two (8.3%) during the first week and one (4.2%) during the second week. Twenty-three patients (95.8%) had excellent outcome with respect to acceptable residual angulation by PRICE criteria. Pronation and supination were acceptable in all 24 patients at 4 or 6 weeks after the injury.

Table 1. Demographics of the patients and their guardians

Variables	N=24 (%)	
Age (years, median, interquartile range)	5, (3.3-9.5)	
Sex		
Male	16 (66.7%)	
Female	8 (33.3%)	
Known Medical history		
Yes	1 (4.2%)[a]	
No	20 (83.3%)	
History of any fracture more than 3 months ago		
Yes	2 (8.3%)	
No	20 (83.3%)	
Marital status of the guardian		
Yes	20 (83.3%)	
No	2 (8.3%)	
Divorced	2 (8.3%)	
Level of education	1st guardian	2nd guardian
None	0	1 (4.2%)
Primary school	0	0
Junior secondary school	3 (12.5%)	0
Senior secondary school	3 (12.5%)	3 (12.5%)
Tertiary school	18 (75.0%)	16 (66.7%)

[a] *autism*

Table 2. Time from injury to visit to hospital, place of injury and Landin's severity grade in patients whose mechanism of injury was FOOSH

	N=22 (%)
Place of injury	
Home	7 (31.8%)
Recreational area	1 (4.5%)
School	13 (59.1%)
Others	1 (4.5%)[a]
Time from injury to visit to hospital	
Less than 24 hours	15 (68.2%)
After 24 hours to 72 hours	3 (13.6%)
After 3 to 7 days	0
More than 7 days	4 (18.2%)
Landin's modified trauma severity	
Slight	8 (36.4%)
Moderate	12 (54.5%)
Severe	2 (9.1%)

[a] *hospital*

Table 3. Time from injury to visit to hospital according to the level of education of their first guardians

Time from injury to visit to hospital	**Junior secondary school (n=3)**	**Senior secondary school (n=3)**	**Tertiary school (n=18)**	**p-value**
Less than 24 hours	1 (33.3%)	2 (66.7%)	13 (72.2%)	0.019
After 24 hours to 72 hours	0	0	4 (22.2%)	
After 3 to 7 days	0	0	0	
More than 7 days	2 (66.7%)	1 (33.3%)	1 (5.6%)	

Table 4. Characteristics of the fractures

Variables				**N=24 (%)**
Landin's modified trauma severity				
Slight				9 (37.5%)
Moderate				13 (54.2%)
Severe				2 (8.3%)
Type of fracture				
Open				1 (4.2%)
Closed				23 (95.8%)
Patterns of fracture				
Greenstick				4 (16.7%)
Torus				4 (16.7%)
Complete fracture line				16 (66.7%)
Location of fracture		Proximal 1/3	Middle 1/3	Distal 1/3
Ulna only	1 (4.2%)	1 (100%)	0	0
Radius only	11 (45.8%)	0	1 (9.1%)	10 (90.9%)
Both ulna & radius	12 (50.0%)	1 (8.3%)	4 (33.3%)	7 (58.3%)

Table 5. Types of treatment

Treatment	**N=24 (%)**	**Treatment in detail**	**N=24 (%)**
Conservative	19 (79.2%)	Cast immobilization	10 (41.7%)
		Closed reduction & cast application	9 (37.5 %)
Operative	5 (20.8%)	Closed reduction & K-wire	3 (12.5%)
		Open reduction & K-wire	1 (4.2%)
		Open reduction & plating	1 (4.2%)

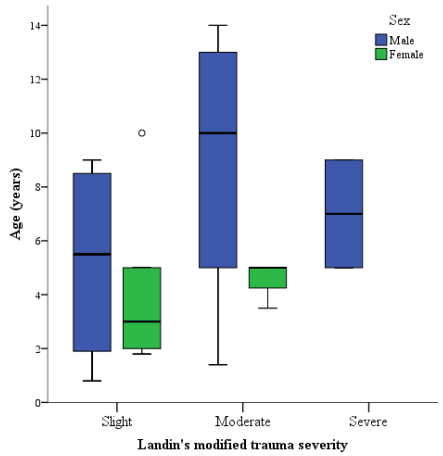

Figure 1. Age distribution in each sex according to Landin's modified trauma severity

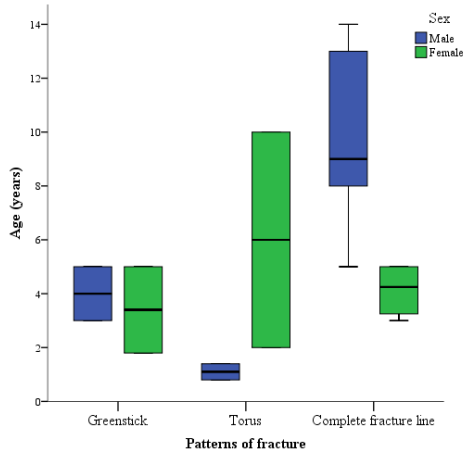

Figure 2. Age distribution in each sex according to patterns of fracture

Discussions

This study showed a preponderance of males in accordance with studies carried out in different regions of the world[3,7,13-15]. It can be reasoned that, males are more likely to be injured because of the socialization process which leads males, from the time they are little boys, to partake in more risky behaviour than females. This is supported by the evidence from this study that showed that more males suffered from moderate to severe degrees of trauma using the Landin's modified trauma severity scale.

In this study, the commonest mechanism of injury was a fall on the outstretched hand with a majority of them being closed fractures of the distal radius, which is in agreement with previous reports[16,17,18].

The most common place of injury in this study was in the school. This is in contradiction to what is in literature, identifying the playground as the most common place of injury [2,7,13,16]. There are very few designated playgrounds in Ghana, and the school environment in school-age children and home serve as a playground. Intensive supervision in schools and at home should be emphasized to protect children from hazards or harm that may arise in their daily experiences in play. As a nation we may have to consider adopting the safety round method as done in some western countries[19]. This is done once a year and entails the headteacher, group of teachers and pupils walking around the school yard to identify risks that may lead to injury. The importance of involving the pupils is that, they perceive risk from a different perspective to adults. This study revealed a statistically significant relationship between time of injury to presentation at the hospital and educational level of the guardian; parents with tertiary education are likely to report with their children to hospital within the first 24 hours of injury. There is reason to believe that educated parents understand the implications of these injuries and are likely to report earlier than the less educated parents.

Historically, most of these injuries have been managed conservatively with closed reduction and the use of POP casts because of the excellent remodelling potential in younger patients; but there is an increasing trend towards operative treatment in the western world[2]. However, Tarmuzi and his colleagues reported on the successful conservative management of 48 patients aged 4 to 12 years, with an 86% rate of excellent functional outcome[20]. In this study, conservative treatment gave satisfactory results in more than 79% of the children with an acceptably low rate of re-displacement in keeping with some studies[21-24]. This finding suggests that conservative treatment is still a viable option so far as the patient meets the inclusion criteria. Conservative treatment is cost effective, decreases length of hospital stay and avoids all anaesthesia related complications associated with relatively prolonged operative treatment as compared to conservative treatment.

Conclusion

Fracture of the bones in the forearm of children occurred more commonly in males; this was as a result of falls on the outstretched hand. In contrast, in the western world, the school environment accounted for the most injuries to the bones of the children's forearm. This contrasting finding calls for proactive measures to be put in place to forestall such injuries within the school environment. Although there is an increasing trend towards operative management for these fractures, conservative treatment in this series yielded very good results and could be a viable option when working in a resource constrained environment.

Limitation

The major limitation for this study was the small sample size which makes it difficult to generalize the results for the entire region and the nation as a whole.

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THE SOCIO-ECONOMIC BURDEN OF PAEDIATRIC LONG BONE FRACTURES IN A LOW RESOURCE SETTING

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Abstract

Objective: Paediatric long bone fractures are prevalent and a significant source of direct medical costs and indirect costs resulting from economic production losses within affected families. Our study aimed to describe the occurrence of paediatric long bone fractures and its direct and indirect costs to the affected families.

Methods: A prospective review and follow-up of all paediatric long bone fracture admissions at KATH A&E was conducted from March to June 2018. The study assessed the socio-economic burden of paediatric long bone fractures on the patients and caregivers.

Results: In the period, 97 children presented with mean age of 6.7years (SD=3.9 years) and 63.9% being male. Mechanism of injury was mostly falling during walking or running (39.1%) and 19.6% were pedestrian knockdowns. Most injuries occurred at home (41.2%) and school (30.9%) and 13.4% reported to the hospital in an ambulance. The most common fracture was both radius and ulna (26.8%) and closed fractures (83.5%) with 10.5% undergoing operative management. Caregivers were mostly females (67.0%) and the mean age was 39.3 years (SD=11.8years). The mean direct cost of treatment was GHS 928.91 (SD=GHS 1683.97) for all patients and GHS 3,587.50 (SD=GHS 3401.87) for surgically managed patients. The mean cost of treatment covered by health insurance was GHS 348.83 (SD=GHS 738.64). Mean missed workdays for caregivers was 24.5days (SD=31.1days)

Conclusion: Fractures of both radius and ulna were common in our paediatric population and occurred mostly at home. Paediatric fractures have a significant socioeconomic burden on the caregivers. There is the need to advocate for injury prevention strategies that target safety at home and in school.

Key Words: *Paediatric fracture; Socioeconomic burden*

Introduction

Children represent the most vulnerable population in the world and are at a high risk of injuries with up to one in every four children sustaining an injury annually.[1,2] Fractures are prevalent in the paediatric age group, representing a significant public health problem. The lifetime risk of sustaining a fracture in childhood is about 42%-64% in boys and 27%-40% in girls, with remarkable variation in the estimates worldwide.[1,3,4] This is a primary preventable and controllable public health concern that affects children in high income and even more in low middle-income countries, including Ghana. It causes morbidity, premature mortality and other related disability and unmeasured family burden and economic cost in families and communities of affected children[5]. Sadly, little attention is given to childhood injuries in developing countries. Often, in low and middle-income countries (LMIC's), people including children with disabilities as a result of injuries live in poverty and are excluded from playing a full part in society causing them not to reach their full potential in life.[6]

Long bone fractures are a significant source of direct medical costs as well as indirect costs resulting from economic production losses within families of affected children.[3,7] There is insignificant data on the impact of such injuries on children in Low-Middle Income Countries and on the psychological and social functioning of how children and families are affected.[3,4] Long bone fractures have negative long- and short-term impact on the development of children, including cognitive development that have a high probability of affecting their educational performances.

Conventionally, the socio-economic burden of long bone fractures have not been considered when making treatment decisions or in the evaluation of outcomes.[8] Paediatric fracture stabilization has relied on closed reduction techniques in which the fracture is manually reduced and immobilized by an appropriate cast.[9] Rehabilitation of the children who suffer from long term fractures is often left undocumented. To the best of our knowledge, the economic, psychosocial impact and family burden of paediatric fracture management, especially in the patient with multiple injuries, have not been studied, especially in a low middle-income country.

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This study can help determine the undocumented economic and family burden of long bone fractures among children, mainly in the Ashanti region of Ghana. The study seeks to determine the geographical distribution of children with long bone fractures. This would help measure health gaps as opposed to health expectancies of children with long bone fractures. Documentation of long bone fractures would be instrumental in adding to the body of scientific knowledge on paediatric fractures and improve on cost-effective injury prevention strategies that could save more than a thousand children's lives daily in the country.

Interestingly, paediatric trauma is mostly absent from child survival initiatives presently on the global agenda, though it is a common cause of morbidity and mortality in all LMICs.[10]

Injuries are also the commonest surgical problems affecting children in sub-Saharan Africa, accounting for the highest per cent of paediatric surgical admissions, and causing the most significant number of inpatient hospital days (49.1%), surgical deaths (48%), and life-long disability.[3,6,11,12] With fractures having a considerable impact on the daily living and activity of affected children, they represent an important topic of public health . Alarmingly, Disability-Adjusted Life Years (DALYs) related to injury is highest in children in sub-Saharan Africa, where 46% of the 1 billion people are under the age of 14 years.[11]

Materials and Methods

Study Design

A prospective cross-sectional study was conducted at the Accident and Emergency Unit of the Komfo Anokye Teaching Hospital (KATH A&E). The study population included all paediatric patients up to 16 years of age diagnosed with long bone fractures. The study commenced recruitment on 12th March 2018 and ended on 30th June 2018 to allow for follow-ups. Three-month follow up was conducted and ended on 30th September 2018, and a six-month follow-up ended on 31st December 2018.

The study included all patients 16 years and below with a long bone-fracture evidenced by an x-ray. Patients whose injuries were birth-associated were however excluded.

A convenient sampling technique was used to screen and recruit all eligible patients presenting to the KATH A&E during the study period.

Data collection

A research assistant was stationed at the Triage area of the KATH A&E to screen for eligible patients. After informed consent was signed, the research assistants extracted data from the patient notes and from caregivers at presentation and during their stay in the hospital. Data collected included the demographic characteristics of the child and the caregiver, the presentation of the injury and injury characteristics and the cost of the treatment. Information on injury incidence sites and residence of patients were collected and mapped. X-Ray images were also collected.

Classification of the all the fractures were done by two independent orthopaedic surgeons using the x-ray images and the clinical diagnoses from the patient notes using AO Classification. Differences were resolved through consensus with the surgeons and the consensus classification recorded. Research assistants followed up the patients through phone calls at 3 months and at 6 months after injury to assess their self-reported recovery to normal daily activities.

Data management and Statistical Analysis

Data were collected on tablet computers with a database designed with Research Electronic Data Capture (REDCap). REDCap is a secure web-based system which is access and privileges controlled. Varying levels of privileges were provided to the research assistants, and investigators.

Data collected from the study was exported to STATA version 16.0 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LP) for analysis. Bivariate analysis with chi-square/Fisher's exact test was conducted comparing age category, type of fracture, mode of transport and mechanism of injury. A confidence level of 5% was set for all comparisons. Student's t-test was used to determine significant differences in direct cost between caregiver's gender.

Ethics Considerations

Ethical approval for the study was sought from the Committee of Human Research Publication Ethics (CHRPE) a joint Institutional Review Board of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital. Written informed consent was obtained from the caregivers after the research assistant had explained the purpose of the study before proceeding with data capture. Confidentiality was assured, and respondents were free to withdraw from the study or refuse to answer any questions.

Results

In the study period, 97 paediatric patients presented with long bone fractures and were enrolled. 78 were successfully contacted via a phone call for the 3-month follow-up interview. 70 were successfully contacted after 6 months to complete their surveys.

The mean age was 6.7years (SD=3.9 years) with a range of 0-16 years. About 63.9% of the respondents were male. Mean age of their primary caregivers was 39.3 years (SD=11.8years) Most were female (67.0%). About 78.3% of primary caregivers were married. About 83.5% of the caregivers of the children were their parents. Most caregivers had a formal education, 32.9% had junior high education, and 22.6% had senior high education as their highest level of education. Only

10.3% had no formal education. Mechanism of injury included falls from walking and running (39.1%), pedestrian knockdowns (19.6%), fall from a height (15.4%), motor vehicle collisions (7.2%) and sports-related injuries (5.1%) (Fig. 1). Most injuries occurred at home (41.2%) and school (30.9%) (Table 1). The commonest fracture was the fracture of both radius and ulna (26.8%), followed by femur fractures (25.7%) and humerus fractures (22.6%). Most were closed fractures (83.5%) (Table 2). Adolescents (11-16years) were more likely to sustain open fractures (47.3%) p-value=0.003. Preschool children (2years - <6 years) and school children (6years - <11years) were more prone to fractures (74.2%). Diaphyseal fractures (41.2%) and distal metaphyseal fractures (40.2%) were common (Table 3). For epiphyseal fractures, salter-harris 2 pattern was the commonest (55.5%) followed by salter-harris 1. Most patients came to the hospital with a taxi cab (53.6%). Only 13.4% reported to the hospital in an ambulance. About 77.0% of the children were referrals from other health facilities (Fig. 2). Treatment was mainly non-operative, only 10.5% had operative management. Sixty-nine per cent (69.0%) had reduction and plaster of Paris application. The mean cost of treatment at discharge from the hospital was GHS 928.91 (SD=GHS 1683.97). The mean cost of treatment for patients who had surgical management was GHS 3587.50 (SD=GHS 3401.87) with a maximum cost of GHS 10,846. The mean cost of treatment covered by the national health insurance was GHS 348.83 (SD=GHS 738.64). The mean cost of treatment for children who were treated and discharged from the emergency unit was GHS 89.3 (SD=GHS 97.3) with a maximum cost of GHS 515. Mean missed school days due to fracture was 25.5 days (SD=31.9 days), with the maximum being 120 days. Mean missed workdays for caregivers was 24.5days (SD=31.1days). Two (2) children died on the ward.

Most of them were triaged Yellow (urgent) (78%) followed by Orange (very urgent) (14%) using the South African Triage Scale (SATS).

Table 1: Comparison of location where injury occurred and age category

Where did fracture Location of injury	**<2years**	**2 to <6yrs**	**6 to<11yrs**	**11 to 16 yrs**	**Total n(%)**
Home	4 10.0	20 50.0	12 30.0	4 10.0	40 100
School	1 3.3	10 33.3	15 50.0	4 13.3	30 100
Public place/street	1 4.0	5 20.0	10 40.0	9 36.0	25 100
Farm/bush	0 0.0	0 0.0	0 0.0	1 100.0	1 100
playground	0 0.0	0 0.0	0 0.0	1 100.0	1 100
Total n (%)	**6 6.2**	**35 36.1**	**37 38.1**	**19 19.6**	**97 100**

Fisher's exact = 0.025

Table 2: Type of fracture

Age Category	**Closed Fracture**	**Open Fracture**	**Total**
<2years	6 100	0 0.0	6 100
2years to <6years	32 91.4	3 8.5	35 100
6years to <11years	33 89.2	4 10.8	37 100
11 years to 16 years	10 52.6	9 47.3	19 100
Total n (%)	**81 83.5**	**16 16.5**	**97 100**

Fisher's exact= 0.003

Table 3: Distribution of fractures according to bone segment and age

Bone segment	<2yrs	2 to <6yrs	6 to<11yrs	11 to 16yrs	Total n(%)
Proximal epiphysis	0 0.0	0 0.0	0 0.0	1 100	1 100
Proximal metaphysis	0 0.0	3 33.3	5 55.5	1 11.1	9 100
Diaphysis	3 7.5	15 37.5	15 37.5	7 17.5	40 100
Distal epiphysis	0 0.0	0 0.0	3 37.5	5 62.5	8 100
Distal metaphysis	3 7.7	17 43.6	14 35.9	5 12.8	39 100
Total n (%)	**6 6.2**	**35 36.1**	**37 38.1**	**19 19.6**	**97 100**

Fisher's exact= 0.137
<2years (infants/toddlers)
2 to< 6years (pre-school children)
6 to <11 years (school children)
11 to 16 years (adolescents)

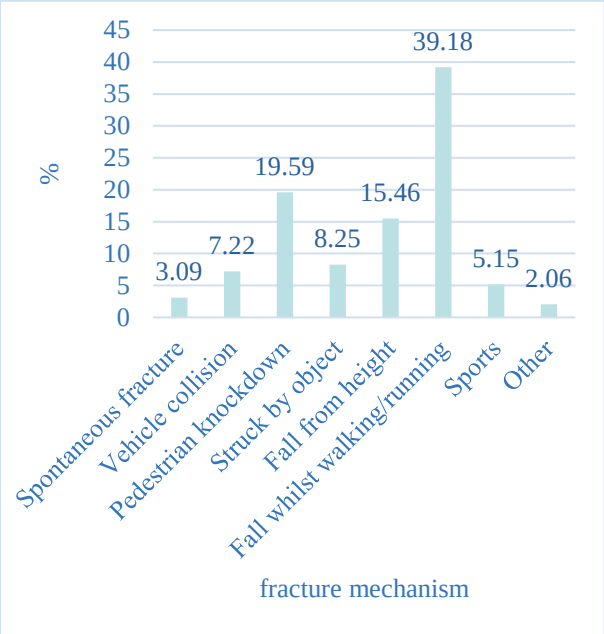

Figure 1: Mechanism of injury

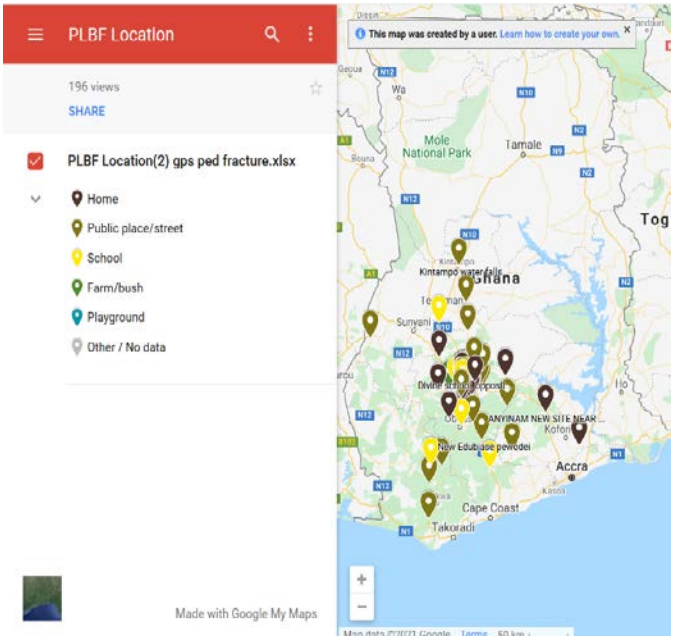

Figure 2: Geographical distribution of children with long bone fractures

Discussion

Demographic characteristics

Children

Males were mostly affected by paediatric long bone fractures. The male predominance of 63.9% in this current study corroborates with the 61.3% identified in Austria by Schalamon et al.[13] and 60% documented by Joeris et al. in Switzerland.[14]. A similar study conducted in Nigeria also showed male predominance of 61.2% which was similar to that of this study.[15] Majority of injuries affect the male gender because they have a higher level of activity and constituent risk in their activity compared to their female counterparts. Again, due to differences in gender socialisation, boys are allowed to explore their environment without supervision much more than girls.[16]

The mean age (SD) of 6.7 (3.9) years in our study was younger than what was found in Austria (9.0 years) and Switzerland (8.2 years).[13,17] The likely reason was that in both studies, participants included older children.

Caregivers

Majority of primary caregivers were females, usually mothers who had education beyond the basic

level similar to what was found in Singapore.[18] This can be attributed to greater availability of mothers in the house than fathers who would be out working.

Fracture characteristics

Mechanisms of injury

The most common mechanism of injury was falls (54.6%), mainly on level ground while running or walking (39.1%). The same plane falls observed was similar to what was reported in Austria (41.9%)[13] and Sweden (24%).[19] Our observation also correlated with what Gyedu et al. identified earlier that, falls were the most frequent cause of household and neighbourhood injuries in Ghana.[20] Although in Switzerland, falls predominated as the mechanism of injury, unlike the level ground falls we noted, falls were from heights less than 1 metre (57%).[17]

Road traffic injuries were the second commonest mechanism of paediatric long bone fractures in our study. Our observation correlated with other studies.[13,17] However, in a study conducted in Nigeria, road traffic accidents were noted to be the commonest cause of paediatric fractures.[15] Road traffic crash has been identified as the leading cause of paediatric injuries in LMICs including Ghana.[21] According to Abantanga et al.,[22] transportation-related injuries are significant causes of childhood trauma in Ghana

Five per cent (5%) of long bone fractures resulted from sporting activities which were comparable to what Joeris et al.[17] found among Swiss children. It was, however, lower than the over thirty per cent (30%) of sport-related fractures documented in an Austrian study.[13] Unlike Ghana where soccer is the primary sporting activity children may engage in, the Austrian children engaged in other forms of sporting activities such as skiing and playing rugby which may have increased the percentage of sports-related paediatric fractures. The sports injuries significantly occurred only in children who were 6 years and older in our study. It has been found that children start participating in organised sports after age 5 and that may have accounted for no sports-related injury under 6 years in our study.[19]

Place of injury

The fractures mainly occurred at home (41.2%) and school (30.9%). Inadequate adult supervision when children are playing both at home and school may have resulted in this observation.[16] The home was the second place where paediatric fractures occurred in Austria[13], and the third place in Switzerland.[17] Sixty per cent of children who sustained a long bone fracture at home were less than 6 years old. On the other hand, more than sixty per cent of those who suffered a long bone fracture at school were 6 years and above. Most of the fractures occurred in urban and peri-urban areas (see figure 2) Both parents and teachers have a great responsibility for ensuring that children are safe in these environments.

Mode of transport to the hospital

Compared to Taxis and private cars (74%), only 13% of children with long bone fractures arrived at the KATH A&E in ambulances. It contrasted the 60% Emergency Department attendance by ambulance in an unpublished study at the same facility.[23] The disparity may have arisen from the fact that the unpublished study involved paediatric traumatic brain injury patients who may have had a relatively more severe injury and were therefore transported in ambulances. With close to eighty per cent of the children with long bone fractures being referred from another health facility, it can be assumed that health care providers in referral facilities were flexible with the mode of transportation when the injury severity was considered mild but recommended ambulance when they considered the injuries severe.

Severity of injury

In this current study, most of the long bone fractures were closed (83.5%), which was significantly associated with younger children. Only one per cent of children in Switzerland sustained an open fracture.[17] What may have accounted for the difference is that relatively more of our participants were involved in road traffic crashes (27%) compared to the Switzerland study (11%). Road traffic crashes tend to transfer a lot more energy to the patient resulting in more severe injuries (such as an open fracture) unlike most falls.[21]

Most of the children with long bone fractures were triaged Yellow (urgent) (78%) followed by Orange (very urgent) (14%) according to the South African Triage Scale (SATS)[24]. All children with open long bone fractures were up-triaged to higher triage colour, Orange, according to the SATS.[24]

Site of fracture.

The frequent site of long bone fracture was the radius and ulna (27%), followed by the femur (26%), and humerus (23%). In most childhood fracture studies; the radius and ulna are identified as the common site of paediatric long bone fractures.[13,17,19,25,26] When children are falling, they try to break their fall or protect their heads with their upper limbs and they sometimes sustain fractures to their radius and ulna.[16]A study done in Nigeria however had femur fractures (33%) as the commonest site of long bone fractures in children.[15]

Over forty per cent of fractures occurred in the diaphysis and the metaphysis of the long bones in children. It corroborated with the 47% metaphyseal fractures Joeris et al. found in a recent study in Switzerland.[26] In the same study, close to half of the epiphyseal fractures were classified as Salter-Harris type-II, which was very similar to our study (56%).

Treatment

Majority of the long bone fractures in the study were managed non-operatively with closed reduction and application of plaster of Paris (POP). Eleven per cent of children with long bone fractures in the study had

operative management compared to 22% in an Austrian study.[13] Other unpublished studies at our facility have shown an unexpected lower operative rate. Reasons accounting for this may be inadequate resources including human resource (orthopaedic surgeons, perioperative staff), materials (theatre gowns, drapes, power drills and implants) and money (unaffordability of operative management especially for patients who are not members of a health insurance scheme) as was found in Nigerian study.[27]

Socio-economic burden

Cost

The average cost of treatment at discharge from hospital was GHS 928.91 (USD162.97). The amount escalated to GHS 3,587.50 (USD629.39) for children who had operative management and could go as high as GHS10,846.00(USD1,903.78). Non-operative management by Emergency Physicians at the emergency room had an average direct cost of GHS 89.30 (USD15.67). Participants who had health insurance had a percentage of their hospital bills paid by the insurance company. However, the direct cost to caregivers was always higher than what the insurance companies paid. Elderly caregivers (above 60 years) had a higher direct cost compared to caregivers in the working-age group. Although male caregivers had a higher direct cost compared to their female counterparts, the difference was not significant. Childhood injuries in LMICs have been found to deplete the already meagre family resources due to the cost of treatment.[16]

Missed school and workdays

Children who suffered from long bone fractures almost missed a third of a term's work in school while their caregivers also missed a whole month of work. The missed days in school have been found to impact the child's academic work negatively. Coupled with lower income due to caregiver's absence from work, the children drop out of school.[16]

Limitations

This study had some limitations regarding data collection and participants. The sample size was small because of the short period of the study. It was a hospital-based study, and a more appropriate study would have been a population-based study. Seasonal variability may have also influenced the results.

Conclusion

Falls at home were the most common cause of paediatric long bone fractures leading to hospital admission. Fractures of both radius and ulna are the most common fractures among participants. Paediatric fractures have a significant socioeconomic burden with caregivers losing about a month's income in addition to out of pocket payments. The average cost of treatment was a significant financial burden to the caregivers. The children also missed a substantial part of the school term due to long bone fractures. Implementation of injury prevention strategies that target safety at home, school and better child supervision will reduce the impact of long bone fractures on children and their family.

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PREVALENCE OF ALCOHOL USE DISORDER AMONG WORKERS

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Abstract

Objective: Alcohol use disorder (AUD) is a common but usually undiagnosed and untreated condition. Persons with the condition tend to maintain their jobs until it severely incapacitates them. The ten years lag between frequent use of alcohol and development of AUD significantly contributes to this and until organizations actively screen and manage persons with the disorder, it continues to negatively affect productivity. The aim of this study was to determine the prevalence of AUD in an engineering company and establish a case for employee assistance program (EAP) for the management of AUD.
Method: Staff of the company were systematically sampled and administered a questionnaire which involved the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. A cut off score of 8 was used as a positive screen for AUD.
Results: Thirty-five (9.4%) out of 373 staff screened positive for AUD and half of them were between 31 and 40 years. Men were twice as likely to have AUD compared to females. Muslims were 2.4 times more likely to have AUD compared to Christians and junior staff were 4 times more likely to be diagnosed with AUD compared to senior staff.
Conclusion: AUD is common among industry workers and therefore human resource policies are necessary for early detection and treatment for improved productivity and employee motivation.

Key Words: *alcohol use disorder, audit, employee assistance program*

Introduction

Ethanol (C_2H_5OH) is the active compound in the many alcoholic beverages consumed the world over. There is no biochemical equation in the body that requires exogenous ethanol and many people who drink alcohol do so to overcome stress or perceived stress and to facilitate social interactions at occasions.[1,2] Ghana like many cultures around the globe, has alcohol drinking as a part and parcel of many social functions.[3] Some studies have suggested drinking alcohol in moderation may have some protective value but this is not for everyone.[4] This assertion sometimes is what some people use to justify their drinking: to promote the health of their heart.

The regular consumption of alcohol has the potential to cause some brain changes especially among teenagers whose minds are brittle and not fully matured. The young and developing brain has the potential of developing alcohol use disorder (AUD) when exposed to chronic alcohol use. The changes become overt in symptoms of AUD some 10 or more years later so many young people do not appreciate the harm they do to their brains when drinking alcohol in excess.[5] It is this lag in development of overt symptoms of AUD that get many people with the condition developing it in their prime and working life. If we are therefore going to screen for AUD it needs to be at workplaces where they are most likely to be found.

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Alcohol consumption is responsible for some 5.3% of all deaths worldwide in 2016. Approximately 5.1% of global disease and injury burden was attributable to alcohol in the same year and represented 132.6 million Disability-Adjusted Life Years (DALYs) globally. Over 100 million DALYs are attributable to years of life lost (YLL) and this accounted for 5.8% of all YLL globally in 2016.[6] These numbers of deaths and injuries are considerable looking at it from the perspective that it is preventable only if they did not consume alcohol which is not essential for normal functioning of the body anyway.[7]

However, for those who drink in excess and do not seem able to control their drinking, they get many medical conditions that alcohol is necessary and sufficient to cause. AUD is no longer a matter of choice, but an illness that needs to be managed. It is the recognition of this fact that will require screening, diagnosis and intervention, particularly at the work place, to reduce injuries and cost of treating other medical conditions induced by alcohol abuse. This can improve productivity for the general good of society.[8]

Just like any other medical condition that employers take care of in their employees so they can be productive, the same way they will need to treat AUD to improve productivity. One common way is to institute and Employee Assistance Programme (EAP). Many employers have questioned the quantum of the problem of AUD and the need to "treat behaviour". It is for this evidence that this study became necessary.

The aim of this study was to determine the prevalence of AUD in an engineering company and

establish a case for employee assistance program (EAP) for the management of AUD.

Methods

Study design

The study was a cross-sectional study done to assess the disease burden of alcohol use disorder among staff of an engineering company in Ghana using the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. The AUDIT questionnaire at a cut-off point of 8 has a sensitivity of 81.4%, a specificity of 94.6% and 0.97 AUROC curve.[7] This therefore makes it almost diagnostic and not just screening.

Study Setting

The study sites were the company sites located in four cities in the southern part of Ghana and have over five hundred staff working in each of these sites.

Inclusion/exclusion criteria

Those included in the study were staff of the company who were present in their various offices when questionnaires were being administered. Using the nominal role of staff, every fourth staff on the role was sampled to be in the study and this made about 450 people. All staff who filled and returned their questionnaire were included in the study. Staff who were on leave or out of the office during the administration of the questionnaire (59 of them) were excluded, even if pre-sampled. This resulted in a study population of 373 staff.

Data analysis

Using a cut-off of 8 on AUDIT, returned questionnaires were analysed to determine the epidemiology of persons working with the company who were most likely to have alcohol use disorder. This was done manually and the results put in stata as a categorical variable. *Chi*^{2} was used to determine differences among the different variables.

Ethical and Legal Considerations

The study was approved by the ethics committees of University of Ghana Medical School (UGMS) and by the Human Resource Department of the engineering company and their labour union.

Results

Of the total 373 staff sampled, 35 (9.38%) were observed to have AUD and 17 (50%) were between the ages of 31 and 40 years, while a quarter were 30 years or younger and the last quarter, 41 years or older. (Fig1)

From Table 1, we see that 4 out of the 77 (5.2%) women sampled had AUD while 31 out of 296 (10.5%) males sampled had AUD. This means the odds of male at the company having AUD was twice that of their female colleagues. The odds of a junior staff having AUD was almost four times that of a senior staff and this was statistically significant from Table 2. This is important as those who did not return their questionnaires were more likely to be junior staff. There were 218 senior staff compared to 155 junior staff.

There were 320 staff who identified their faith as Christianity, 37 Islamic, one traditionalist and 15 others. Twenty-eight of the Christians and 7 Muslims were found to have alcohol use disorder. This means the odds of a Muslim having AUD was 2.4 times that of Christians. None of those who identified as other faith had AUD, just as the traditionalist.

Tribe was only significant for staff who identified as *Ewes*, who compared with *Akans* (the majority) had 2.8 times odds of having AUD. There were 13 persons out of 70 Ewes who had AUD.

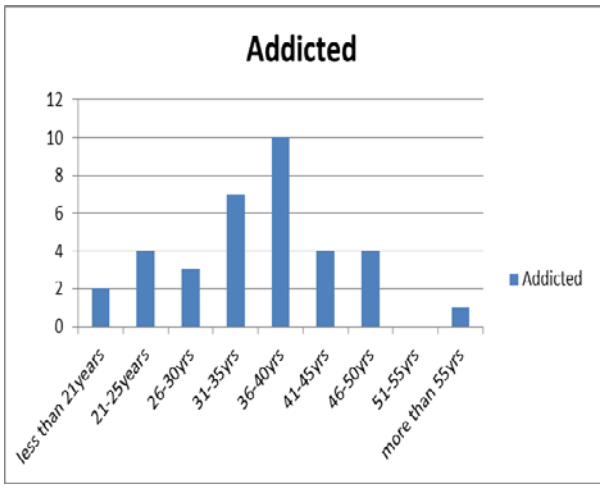

Figure 1

Table 1

```
. tabulate Sex StatusofAUD, cchi2 cell chi2 expected
```

Key
frequency
expected frequency
chi2 contribution
cell percentage

Sex	Status of AUD: Not Addic	Addicted	Total
female	73	4	77
	69.8	7.2	77.0
	0.1	1.4	1.6
	19.57	1.07	20.64
male	265	31	296
	268.2	27.8	296.0
	0.0	0.4	0.4
	71.05	8.31	79.36
Total	338	35	373
	338.0	35.0	373.0
	0.2	1.8	2.0
	90.62	9.38	100.00

Pearson chi2(1) = 2.0020 Pr = 0.157

Table 2

```
. tabulate Position StatusofAUD, cell chi2 expected

┌────────────────────┐
│ Key                │
├────────────────────┤
│     frequency      │
│ expected frequency │
│  cell percentage   │
└────────────────────┘

    Position |      Status of AUD
        held | Not Addic   Addicted |      Total
-------------+----------------------+-----------
junior staff |       135         20 |       155
             |     140.5       14.5 |     155.0
             |     36.19       5.36 |     41.55
-------------+----------------------+-----------
senior staff |       203         15 |       218
             |     197.5       20.5 |     218.0
             |     54.42       4.02 |     58.45
-------------+----------------------+-----------
       Total |       338         35 |       373
             |     338.0       35.0 |     373.0
             |     90.62       9.38 |    100.00

          Pearson chi2(1) =   3.8642   Pr = 0.049
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Discussion

From the results, close to one in every 10 staff sampled had AUD as diagnosed using AUDIT. This is also true for the general population as studies show that for every 10 persons exposed to alcohol use, one of them is likely to develop alcohol use disorder and a lifetime prevalence sometimes going up to about 30% in some populations in developed countries.[9] This supports the genetic theory of addiction which explains that, the tendency for one to get a substance use disorder is largely due to genetic predisposition. That is, not everyone who is exposed to drinking alcohol will develop alcohol use disorder (AUD) but rather those who are genetically predisposed will be the ones who will go ahead and develop the disorder.[10]

With over 70% of all those who screened positive to AUD being between the ages of 31 and 50 years, this is worrying. These ages represent largely the brain and brawn potential of the company. This group has the experience and institutional knowledge to make the company most productive. If these are not managed, presenteeism, absenteeism, frequent arguments and accidents that occur with chronic alcohol use will in fact decrease the productivity of the company in general. Males were twice as likely to have AUD compared to their female colleagues. Again, this is similar to the general public.

A junior staff was up to four times more likely to have AUD than senior staff and this was statistically significant. As the senior staff earn more than the juniors, they could be using the more expensive beers and stouts which have lower ethanol content compared to the cheap locally distilled spirits which could be in excess of 50% ethanol v/v. This should be of concern to management of the company as they are likely to be working directly with equipment that can cause serious injuries in an accident compared with their senior colleagues who will be working largely in the office.

More intriguing is the finding of staff who professed Islamic faith being 2.4 times more likely to have AUD than their Christian colleagues. This is because the Islamic faith totally abhors drinking of any kind of alcohol while many Christian denominations in Ghana allow some drinking though not to intoxication. Generally, the Catholics, Jehovah's Witnesses and the protestants are more liberal to alcohol use compared to the Pentecostals and charismatics. Traditionalists in Ghana use alcohol during their prayers but the single staff who identified himself as a traditionalist did not have AUD. Apart from the Ewes who seemed to have a relatively higher likelihood of being diagnosed with AUD, tribe did not significantly influence being diagnosed of AUD.

Conclusion

One in ten likely to have AUD undiagnosed will significantly affect productivity and the quality of life of the employees. Investment into Employee Assistance Programme (EAP) will be very useful to improve productivity and motivation of the staff. With EAP in place, employees will feel that management considered their welfare and they will be willing to give their all to the company and thereby increase productivity. This study has shown that persons with AUD are more likely to be working and the workplace if designed to be therapeutic, will improve the health of persons with AUD and productivity.

Limitations

Not all persons who got the questionnaire returned them. It would have been interesting to know the demographics of those who did not return the questionnaire, probably, they had obvious substance use disorder that could have raised the percentage of persons with AUD even higher.

Sample size could have been increased for a higher power of the study.

Recommendations

As these staff were only screened and not diagnosed, it will be desirable if the management of the company took this up and gets the diagnosis confirmed and institute human resource policies that will encourage voluntary disclosure of drinking habit and treatment using EAP.

EAP should be introduced to our industries which should be championed by Occupational health specialists.

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ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN GHANA: A 2-YEAR OUTCOME ASSESSMENT.

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Abstract

Objective: The goal of this study was to evaluate the treatment outcomes of arthroscopic anterior cruciate ligament reconstruction among patients at the Komfo Anokye Teaching Hospital, (KATH) in Ghana.

Methods: A prospective cohort study. We enrolled consenting patients who underwent arthroscopic anterior cruciate ligament (ACL) reconstruction at the KATH over a 3-year period, from January 1, 2015 to December 31, 2018 and followed up each study participant for 2 years. Post-operative assessments were performed at 2, 6, 12, 24 weeks, 1year and at 2 years, to record outcome variables such as range of motion, pain, swelling and laxity of the affected knee as well as excessive discharge from the surgical site, suggestive of infection. Tegner Lysholm knee scores were obtained for each patient at 2-years following surgery. The follow-up was concluded in 2020.

Results: Over the 3-year period, 40 primary arthroscopic ACL reconstructions were performed in 40 patients. Most of the patients were young adult males who sustained a tear of the anterior cruciate ligament following a fall from a standing height. Out of this number, 31 had isolated ACL tear, 4 had ACL tear associated with LCL tear and 3 had ACL tear with associated meniscal tear. Two of the participants had ACL, PCL and LCL tear and a complex medial meniscal tear, with associated posterolateral corner rotatory instability. ACL reconstructions that were performed within 12 months following injury had higher mean Tegner Lysholm score of 7 (range of 5-9), than those carried out later than 12 months after injury. Overall, 37 of the patients (93%) had good to excellent outcome at 2 years post-operatively. Three of the patients who were competitive athletes before injury had returned to competitive sport within 1 year of surgery. There was one case of surgical site infection giving an infection rate of 2.5% and one case of graft rupture that required revision ACL reconstruction.

Conclusion: Arthroscopic ACL reconstruction is feasible at the study site with low complication rate and provides good to excellent outcome in 93% of patients. The procedure is generally safe and effective in restoring knee function following an ACL tear. Patient reported outcomes are superior when reconstruction is performed within 12 months of injury compared to later reconstructions.

Key Words: *Anterior Cruciate Ligament (ACL), Lateral Collateral Ligament (LCL), Posterior Cruciate Ligament (PCL), Tegner Activity Scale (TAS).*

Introduction

The Anterior Cruciate Ligament (ACL) is a 2-bundle structure - anteromedial and postero-lateral bundles. It provides restraint to anterior displacement of the tibia on the femur and is particularly important in antero-posterior stability when the knee is flexed. [1] Anterior cruciate ligament injuries are the most common ligament injury of the knee and affects predominantly physically active young people.[1,2,3] A rupture of the ACL is functionally incapacitating and causes joint instability, with associated reduced activity level, unsatisfactory knee function and an increased risk of knee osteoarthritis, especially when associated with meniscal damage.[1] An ACL tear also predisposes to further injuries. [1] In the USA, the age- and sex-adjusted annual incidence of ACL tears is estimated at 68.6 per 100,000 person-years and approximately 200,000 ACL reconstructions are performed each year. [4,5] Similarly, in Australia, 52 ACL reconstructions per 100,000 person-years have been reported.[6,7]

Surgical reconstruction of a torn ACL, which may involve the use of an open or arthroscopic technique, is regarded as critical for a good outcome particularly in those wishing to resume sporting activities.[8,9] The primary objective of ACL reconstruction is to provide a functionally stable knee and to maintain knee kinematics and proprioception.[9] In addition, the goal of ACL reconstruction is to reduce the complications associated with graft-harvest. The best choice of graft tissue to use is a subject of controversy. Semitendinosus-gracilis tendon or central third patellar tendon autograft is used in most ACL reconstructions.[10] The use of central-third

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patella tendon autograft may be complicated by patellofemoral pain, weakness of the quadriceps muscle, rupture of the patellar tendon and patellar fracture.[11] The use of semitendinosus-gracilis tendon autograft may be attended by poor graft incorporation, hamstrings muscle weakness and prominence or pain from the hardware used in the fixation. However, good or excellent outcomes can be expected in over 90% of patients following arthroscopic ACL reconstruction. In ACL reconstructive procedures, the pre-injury anatomy of the ACL is simulated as closely as feasible and early reconstruction of ACL tears offers a higher mean Tegner Lysholm score than late reconstruction.[12]

Arthroscopic reconstruction of a torn ACL is a less invasive and less morbid surgical approach to restore knee stability. In a review of patients who had undergone arthroscopically assisted ACL reconstruction versus those who had had open reconstruction, Buss and colleagues, reported comparable results. However, the frequency of patellofemoral joint pain and the need for knee manipulation on account of stiffness were lower in the arthroscopically assisted group. [13] Moreover, in a prospective randomized study to compare arthroscopic and open ACL reconstruction, Scott and others found that 1-month post-operative range of motion and 6-month post-operative thigh atrophy were more favourable for the arthroscopic method ($p<0.05$). Noyes and others in their study, similarly, observed a decreased thigh circumference within the first few weeks of surgery, in spite of a closely supervised inpatient and outpatient rehabilitation programme, in the open ACL reconstruction group compared to the arthroscopic group.[14] Anderson and co-workers in a study to assess the effect of operative technique on ACL reconstruction, concluded that, the initial graft tension does not affect clinical outcome and that bioabsorbable screws and titanium screws produced similar results irrespective of the graft type used.[15]

The Tegner Lysholm activity score, first described in 1985, is widely used to assess functional outcomes after treatment for ACL and Meniscal injuries.[16] In a study to test the reliability, validity and responsiveness of the Tegner Lysholm scale for knee anterior cruciate ligament injuries, Briggs and others[17] found this scale to be a reliable measure of outcomes. Its main disadvantage is that it is related to sports more than to functional activities of daily living.[9] In a retrospective review of 876 arthroscopic procedures that were performed in a community hospital in Baerum, the overall complications rate was found to be 5%. [18] A survey of the American Board of Orthopaedic Surgery database found complications relating to ACL reconstruction to account for 9% of all complications recorded. Overall, infection was the most common complication with a rate of 0.84%. The rate of pulmonary embolism was 0.11% and anaesthetic complication accounted for 0.22%. [17]

Methods

In this study, we enrolled consenting patients who underwent arthroscopic ACL reconstruction at the KATH over a 3-year period, from January 1, 2015 to December 31, 2018 and followed up each study participant for 2 years. Post-operative assessments were performed at 2, 6, 12, 24 weeks, 1year and at 2 years to record outcome variables such as knee range of motion, pain, swelling, knee laxity and excessive fluid discharge from the surgical site. Tegner Lysholm knee scores were obtained at 2-years following surgery for each patient. The follow-up was concluded in 2020.

At the time of enrolment, sociodemographic data of participants, such as age, gender and occupation were recorded as well. The mechanism of the ACL tear, concomitant injuries, type of ACL tear as reported by a radiologist and/or determined at arthroscopy, the time interval between injury and arthroscopic reconstruction were captured.

Surgical procedure

A double bundle ACL reconstruction with interference screw graft fixation to the tibia and endobutton graft fixation to the femur using ipsilateral semitendinosus and gracilis tendon autograft was performed in 39 patients. One patient underwent reconstruction with bone-patella tendon-bone autograft. All surgical reconstructions employed a similar surgical technique by the same surgical team. Patients with Lateral Collateral Ligament (LCL) tear underwent LCL reconstruction with ipsilateral fascia lata autograft with interference screw fixation of the graft to the distal femur, just above the epicondylar ridge and those with ACL tear with concomitant LCL and Posterior Cruciate Ligament (PCL) tear and posterolateral corner rotatory instability underwent, in addition to ACL reconstruction, posterolateral corner reconstruction with fascia lata autograft. All patients underwent a similar structured rehabilitation programme after surgery with increased attention to building quadriceps and hamstrings strength and restoration of optimal range of knee motion. Following isolated ACL reconstruction, the knee was immobilized at 30 degrees of flexion for 7 to 10 days after which braced motion from 20 to 60 degrees was permitted. The operated knee was braced and patients were allowed full weight bearing on post-operative day 1 with a pair of axillary crutches. The crutches were discarded after 2 weeks. In cases of meniscal repair, the affected knee was braced and was non-weightbearing for 4 weeks, and knee motion from 0 to 90 degrees commenced at 5 weeks. All knees were braced for 6 weeks following surgery and progressive resistive exercises began thereafter. Return to light sports was permitted 12 weeks post-operatively and resumption of competitive sports was allowed 6 months after surgery.

Study Site

The study was conducted at the trauma and orthopaedics directorate of the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana. The KATH is a 1,500-bed hospital and serves as a main referral hospital for the northern two-thirds of Ghana. It is a centre for training doctors, nurses, anaesthetists, radiographers and several other healthcare staff. The hospital is located in the city of Kumasi which has a population of 1,730,249. The KATH serves people across Ghana and some neighbouring countries. It provides Trauma and Orthopaedic care for patients 24 hours a day and seven days a week. The centre provides specialized trauma and orthopaedic services which include arthroscopic ACL reconstruction.

Study design

Prospective cohort study.

Inclusion Criteria:

All patients who underwent arthroscopic anterior cruciate ligament reconstruction at the KATH and who gave participation consent were included in the study.

Exclusion Criteria:

Patients who refused consent to participate in the study as well as polytrauma patients who underwent anterior cruciate ligament reconstruction were excluded. Open or revision anterior cruciate ligament reconstructions, patients with diabetes or underlying immunosuppression and those who underwent ACL reconstruction as part of a complex procedure were not considered for this study.

Statistical analysis

Data were analysed using STATA SE version 16.0. Our primary analysis looked at pain, swelling, stiffness and instability of the affected knee as well as excessive wound discharge suggestive of surgical site infection. Descriptive statistics such as means and standard deviations were used to assess demographics, physical examination and outcome data. Analysis of data was performed with 95% confidence interval. P-values less than 0.05 were considered statistically significant. Fisher's exact test was performed to test an association between treatment method and outcomes as well as demographic data; significance was set at $p< 0.05$.

Ethical approval of the study was obtained from the Institutional Review Board of the Komfo Anokye Teaching Hospital, Kumasi, RD/CR20/141

Results

Over the 3-year recruitment period of the study, 40 primary arthroscopic ACL reconstructions were performed at the KATH, in 40 patients. No patient with bilateral arthroscopic ACL reconstruction was recorded during the time of the study. Out of this number, 31 had isolated ACL tear, 4 had ACL tear associated with LCL tear and 3 had ACL tear with associated meniscal tear. Two of the participants had ACL, PCL and LCL tear and a complex medial meniscal tear, as reported by a radiologist, with associated posterolateral corner rotatory instability. The medial meniscus was involved in 2 of 3 patients who had meniscal tears associated with an ACL tear. The characteristics of the 40 patients are summarized in Table 1. Most of the patients were young adult males who sustained a tear of the anterior cruciate ligament following a fall from a standing height. The mean age of the participants was 38.1 years with a standard deviation of 11.9 and a male to female ratio of 5:3. Forty percent of the participants of the study had surgery within the first 12 months or less after sustaining a tear of the ACL, whereas the majority of patients (60%) underwent surgery after a time lapse of 12 months. No complication was recorded in 95% of patients. Two patients (5%), had complications- one patient developed septic arthritis of the affected knee on post-operative day 9 and the other patient reported with recurrent knee effusion consistent with osteoarthritis of the knee that was operated on. In the patient who had septic arthritis of the operated knee, E. Coli was isolated and the infection resolved on arthroscopic washout and antibiotics. This participant recorded a fair outcome.

The second patient who similarly had a fair outcome was a seaman who had a recurrent ACL tear during sea diving 9 months after surgical reconstruction. He was counselled for revision ACL reconstruction but declined surgery. The third patient had recurrent knee effusion involving the operated knee at 2 years, no bacteria was cultured from the effusion. The fair-outcome-patient category, described their knee as abnormal. They reported mild to moderate knee pain with moderate difficulty to run. Engagement in light-level physical activity was not compromised. Patients who had a good outcome, 15 (38%) qualified their knee function as near normal and had mild to moderate limitation of strenuous work or sports. Those whose outcome is reported as excellent, 22 (55%) described the function of their operated knee as normal and had no limitation of activities of daily living, participation in strenuous work or sports. Overall, good to excellent outcome was recorded in 37 out of 40 patients, (93%). Study participants within the age range of 31-40 years in our cohort had the most favourable outcomes. A statistically significant association was observed between age and outcomes, $p=0.015$. No statistically significant association was detected between gender, diagnosis or type of procedure performed and outcomes.

Outcomes Following Arthroscopic ACL Reconstruction

Patients reported their level of function in terms of walking, running, stair climbing, squatting, jumping, level of activities of daily living as well as participation in sports. Three of the study participants who were competitive athletes before injury had returned to competitive sport within 1 year following surgery. It was found that isolated arthroscopic ACL reconstruction and arthroscopic ACL reconstruction with concomitant meniscal repair offered the most favourable functional

outcome with a mean Tegner Lysholm score of 9 (range of 5 to 10), followed by arthroscopic ACL and attendant LCL reconstruction, which had a mean score of 8.5 (range of 7 to 10). Patients (2 in number) who had simultaneous arthroscopic ACL reconstruction, partial meniscectomy and posterolateral corner reconstruction recorded the lowest Tegner Lysholm score of 7.5 (7 and 8). Participants who had arthroscopic reconstruction within 12 months following injury, had superior results, with a mean Tegner score of 7 (range of 5-9), as compared to those who had it later than 12 months after injury. The latter cohort had reduced levels of activity owing to knee pain and stiffness with a mean Tegner Lysholm score of 3.5 (range of 2-5). However, the association between timing of surgery and outcome was not found to be statistically significant (p= 0.258). Similarly, no significant association was observed between patient reported outcome and the nature of knee injury (isolated ACL tear, ACL and LCL tear and ACL and meniscal tear) after surgery. There was however, a statistically significant association between patient age and functional outcome after surgery (p=0.015).

Table 1: Distribution of the 40 patients by gender, age, mechanism of injury, diagnosis and type of procedure performed, is depicted in the table below.

Variable	Frequency (n=40)	Percentage (%)
Gender		
Female	15	37.5
Male	25	62.5
Age (years)		
≤30	12	30.0
31-40	16	40.0
>40	12	30.0
Diagnosis		
Isolated ACL tear	31	77.5
ACL and LCL tear	4	10.0
ACL and meniscal tear	3	7.5
ACL, PCL and LCL tear and a complex medial meniscal tear	2	5.0
Mechanism of injury		
Fall	26	65.0
RTA	4	10.0
Sports	8	20.0
Other	2	5.0
Type of procedure performed		
ACL reconstruction	31	77.5
ACL and LCL reconstruction	4	10.0
ACL and meniscal repair	1	2.5
ACL and partial meniscectomy	2	5.0
ACL and LCL and partial menisectomy and posterolateral corner reconstruction	2	5.0
Time lapse from Injury to Surgery (months)		
≤12	16	40.0
>12	24	60.0
Complications		
None	38	95.0
Surgical site infection	1	2.5
Recurrent knee effusion	1	2.5
Outcome		
Fair	3	7.5
Good	15	37.5
Excellent	22	55.0

Table 2: Factors that determine outcome of surgery

Variable	Outcome of surgery			P-value
	Fair n (%)	Good n (%)	Excellent n (%)	
Gender				0.287
Female	1 (12.5)	6 (40.0)	8 (47.1)	
Male	7 (87.5)	9 (60.0)	9 (52.94)	
Age (years)				**0.015***
≤30	-	7 (46.7)	5 (29.4)	
31-40	7 (87.5)	2 (13.3)	7 (41.2)	
>40	1 (12.5)	6 (40.0)	5 (29.4)	
Diagnosis				0.836
Isolated ACL tear	7 (87.5)	12 (80.0)	12 (70.6)	
ACL and LCL tear	-	2 (13.3)	2 (11.76)	
ACL and meniscal tear	-	1 (6.7)	2 (11.76)	
ACL, PCL and LCL tear and a complex medial meniscal tear	1 (5.9)	-	1 (5.9)	
Type of procedure performed				0.678
ACL reconstruction	7 (87.5)	12 (80.0)	12 (70.6)	
ACL and LCL reconstruction	-	2 (13.3)	2 (11.8)	
ACL and meniscal repair	-	1 (6.7)	-	
ACL and partial meniscectomy	-	-	2 (11.76)	
ACL and LCL and posterolateral reconstruction and partial menisectomy	1 (12.5)	-	1 (5.88)	
Time lapse from Injury to Surgery (months)				0.258
≤12	5 (62.5)	4 (26.7)	7 (41.2)	
>12	3 (37.5)	11 (73.3)	10 (58.8)	

Table 3 Distribution of procedure by range and mean Tegner Score

ACL reconstruction	9 (5-10)
ACL and LCL reconstruction	8.5 (7-10)
ACL and meniscal repair	9
ACL and partial meniscectomy	8.5 (9,8)
ACL and posterolateral corner reconstruction and partial menisectomy	7.5 (7,8)

Appendix: Tegner Lysholm Activity Scale.

Please grade each symptom that you experience currently during your highest level of activity.

	Left Knee				Right Knee			
	NONE	MILD	MODERATE	SEVERE	NONE	MILD	MODERATE	SEVERE
Pain	○ 1	○ 2	○ 3	○ 4	○ 1	○ 2	○ 3	○ 4

How does your knee affect your ability to:

	Not Difficult	Minimally Difficult	Moderately Difficult	Extremely Difficult	Unable to Do
Run	○ 1	○ 2	○ 3	○ 4	○ 5

Currently, how does your knee function:

○ Normal ○ Nearly Normal ○ Abnormal ○ Severely Abnormal

What is the highest level of activity you can participate in on a regular basis?

○ Very Strenuous ○ Strenuous ○ Moderate ○ Light ○ Unable

Rate your current ability to perform

	NO LIMITATION									UNABLE TO PERFORM
Activities of Daily Living	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1
Strenuous Work	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1
Sports	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1

Discussion

A cardinal finding of this study was that enrolled patients had significant improvement in knee function after arthroscopic ACL reconstruction. In the prospective evaluation of the 40 study subjects, 37 (93%) of them had good to excellent outcome 2 years after surgery. A similar finding was reported by Corry and others[7] who after a study on patient outcomes following arthroscopic ACL reconstruction concluded that good or excellent outcomes can be expected in over 90% of patients following this procedure. Furthermore, the benefits of arthroscopic reconstruction after ACL tear has been demonstrated in several studies. Kowalk and his colleagues[20] reported in their study that following this procedure, antero-posterior knee laxity reduced significantly from 7.9 mm to 5.8 mm and knee score increased from 70.4 to 88.5 with improved restoration of antero-posterior knee stability and subjective knee function. In a study in South Africa[20] of non-operative treatment of ACL tears, one third of the cohort of patients studied, despite rehabilitation, had worsening knee instability. The authors concluded that some patients were unable to develop compensatory adaptations to knee instability and their continued participation in strenuous activity would lead to radiographic changes of knee osteoarthritis and recommended ACL reconstruction for patients with a torn ACL.[20]

Three of the 40 patients studied developed complications following surgery giving a complication rate of 7.5%. Our rate of complication approximates those of similar studies. In the USA, Salzler and others [19] in a review of the American Board of Orthopaedic Surgery Database reported that arthroscopic ACL reconstruction accounted for 9% of all complications recorded. A community study of 876 arthroscopic procedures in Baerum reported an overall complication rate 5% and concluded that simple arthroscopy is safe and has few serious complications.[18] Sazler and colleagues[19] also found that, subjects younger than 40 years had higher complication rate than those above 40 years of age owing to higher injury complexity in this age group and reported infection as the most common complication of arthroscopic procedures with an overall rate of 0.84%. In our study, however, age below 40 years was not significantly associated with a higher complication rate and an overall infection rate of 2.5% was recorded. Participants aged between 31 and 40 years had the most favourable outcomes. The variance between our findings and those of Sazler and co-workers, was probably due to a lower injury complexity observed in our cohort of patients.

In our prospective assessment, patients who underwent arthroscopic ACL reconstruction within 12 months of injury had higher Tegner scores 9 (5-10) than those who underwent the procedure after 12 months of injury with a mean Tegner score of 4.4 (1-7). This finding is supported by several studies. In a similar study by Chhadia and others[20], it was shown that following a tear of the ACL, the associated knee instability may cause a secondary damage to the articular cartilage and the medial meniscus. They reported that with increasing time to surgery after a tear of the ACL, there is a greater risk for medial meniscal and cartilage damage and stated that arthroscopic ACL reconstructions that delay longer than 12 months tend to have a poorer outcome than those performed in less than 12 months after injury.[20,21] The authors concluded that to reduce the risk of meniscal tears and degenerative knee changes, reconstruction of ACL tears should be performed within 12months of injury.[20,21]

Kowalchuk and colleagues[22] reported that concomitant ligamentous and meniscal injuries as well as the time from injury to surgical reconstruction were not material predictors of patient-reported outcome. Similarly, in this study, it was found that isolated ACL tears and ACL tears with associated ligamentous and meniscal tears, after arthroscopic surgical treatment, did not make a significant difference in patient reported outcomes such as muscle strength, knee laxity and overall function. However, contrary to the findings of Kowalchuk and others, time to surgery was found to be significant in terms of patient-reported outcome, being more favourable in arthroscopic ACL reconstructions performed within 12 months of injury. A longer time from injury to surgical reconstruction as a predictor of poor outcome has been reported by Laxdal and co-workers.[23] In a study of 948 subjects, the authors, Laxdal and others, observed a slower return to sports in subjects who had surgery after 12 months of injury. This finding supports the finding of our study where arthroscopic ACL reconstructions performed after 12 months had a less-favourable patient reported outcome.

Conclusions

We have provided a report on our initial experience with arthroscopic ACL reconstruction in a third world country on 40 patients after a 2-year post-operative follow up period. Arthroscopic ACL reconstruction is feasible at the study site with low complication rate and provides good to excellent outcome in 93% of patients. The procedure is generally safe and effective in restoring knee function following an ACL tear and patient reported outcomes are superior when reconstruction is performed within 12 months of injury. Concomitant ligamentous and meniscal injuries were not material predictors of patient-reported outcome. Isolated ACL tears and ACL tears with associated ligamentous and meniscal tears, after arthroscopic reconstruction or repair (for meniscal tears), did not make a significant difference in patient reported outcomes in terms of muscle strength, knee laxity and overall function. Analysis of potential predictors of outcome such as tunnel positioning, patient self-efficacy, motivation, compliance, and expectations are recommended in future studies. In addition, studies involving larger sample sizes and spanning longer periods are recommended to enable stronger

associations between injury type, surgical treatment and outcomes to be established.

Limitations

Our study involved a prospective review of 40 patients. A larger sample size could have allowed the determination of stronger associations as well as the drawing of stronger conclusions between arthroscopic ACL reconstruction and outcomes. In addition, psychological factors of patients have been shown to be an important predictor of time to return to pre-injury activity level, in patients undergoing ACL reconstruction. If psychological profile of patients' expectations and motivations had been measured in this study, the estimate of time to return to pre-injury level of activity could have been more accurate.

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Conflict of interest

The authors have no conflict of interests.

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BREAST MALIGNANCIES IN NORTHERN GHANA: A 7-YEAR HISTOPATHOLOGICAL REVIEW AT THE TAMALE TEACHING HOSPITAL (2013 – 2019)

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Abstract

Objectives: The Clinicopathological features of female breast malignancies (BMs) diagnosed in northern Ghana have not been documented adequately. The objectives of this review were to describe the annual trend, the clinico-pathological features of female BMs in northern Ghana, and offer recommendations.

Material and methods: Clinical and biographical data of the patients were correlated with pathological data, such as tumour size, histological subtype, histological grade, TNM stage and the completeness of excision (Tumour margins). The data were analysed using SPSS software version 26.0 (Chicago). Fisher's exact test was used to compare tumour variables.

Results: There were 712 (61.0%) benign and 455 (39.0%) malignant lesions (P<0.0001). There was an annual rise in BMs over the review period. The mean age at diagnosis with invasive BMs was 47.5±15.4 years. Approximately, 35.0% were aged ≤39-years, compared to 65.0% aged ≥40-years (p<0.0001). The commonest clinical presentation in both age groups was a painless palpable lump. Painful swelling (7.9%vs4.6%) and skin involvement (27.2%vs22.5%) were more common in women aged ≤39-years. Increased prevalence of positive tumour margins (P=0.0544), high histological grade (P<0.0001) and TNM stages (P<0.0001) were common in women≤39-years. However, mean nodal involvement by tumour was more common in women' aged ≥40-years (6.1±4.5 vs 8.4±5).

Conclusion: There was a steady annual rise in breast malignancies over the study period. Breast malignancies commonly affect relatively younger women with advanced stages at presentation. There is the need to intensify breast self-examination and early reporting to health facilities for treatment.

Key Words: *Breast malignancies, clinical features, histopathological features, Tamale Teaching hospital*

Introduction

Malignancies of the female breast are common causes of morbidity and mortality across the globe and therefore are of a great public health concern.[1-2]In Sub-Saharan Africa, malignancies of the female breast are the leading cause of deaths among women.[3-5]In Ghana, available published data reported breast malignancyas the commonest cause of cancer related morbidity and mortality in women.[6 - 10]

The reported incidence of breast malignancies vary globally, more so in Sub-Saharan Africa, where it is reported to be on the rise.[2,11-14]The increasing numbers of breast malignancies among women in Sub-Saharan Africa has been attributed to increased urbanization with the associated changes in life style, the use of hormonal birth control pills, improved health delivery services, increased awareness of the disease, the practice of breast self-examination and early reporting with breast abnormalities to health facilities for treatment.[15-20]

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Breast malignancy in the published literature from Africa, reported the disease to be common among younger women with advanced stages at presentation.[21-24]Similarly, published data on breast malignancies in Ghanaian women between 1956 and 2019, from the middle and southern belts of the Ghana found the disease to affect relatively younger women who presented late with large palpable masses, some with skin involvement.[7-9,14,25,26]Data on breast malignancies in northern Ghana are very scarce, but the disease is reported to be a major component of cancers in this part of the country.[27] For the past years, efforts have been made by the staff of the Department of Pathology of the School of Medicine, University for Development Studies (SOM, UDS), as well as nurses and doctors from the Tamale teaching hospital (TTH) to create awareness of the disease among the public and the need for early reporting of any breast abnormalities to health care facilities.

There is the need to know how these breast cancer awareness activities in northern Ghana have impacted on the disease pattern. The objectives of this retrospective study were to describe the annual trend and

the clinicopathological features of female breast malignancies diagnosed in northern Ghana, and to offer recommendations. These findings could help to inform future planning, research and policy implementation in the catchment area.

Materials and Methods

Study Design: This was a retrospective histopathological review, using data and material from 1st January 2013 to 31st December, 2019.

Study Site: The Department of Pathology, Tamale Teaching Hospital (TTH). This is the largest referral hospital serving the five regions in northern Ghana and beyond, particularly, neighbouring Burkina Faso, as reported in previous studies.[33]

Data collection, entry and Analysis: Histological request forms and the completed histopathological reports of all breast samples submitted to the department from 1st January, 2013 to 31st December, 2019, were retrieved. All cases of neoplastic breast lesions were selected (n=1,167). Malignant breast lesions (n = 455) were extracted. Finally, malignant tumours were further grouped into invasive (n = 431) and non-invasive (n = 24) lesions. The invasive breast lesions were used as the sample population (n = 431).

Data were collected on the age at presentation (grouped into ≤39-years and ≥40-years), relevant clinical history (symptoms, duration, laterality, type of operation) and type of surgical specimens. We also collected data on the histopathological characteristics of malignant breast lesions: size of primary tumour (only for excision biopsies and mastectomy specimens), histological diagnosis, histological grade (for invasive ductal carcinoma), lymph node involvement, the TNM stage and the status of the resection margins (forexcision and mastectomy specimens). Tumours with malignant tumour cells within 3.0mm of the excision margins were considered incompletely excised (positive tumour margins).

In this study, breast malignancies were classified according to World Health Organization (WHO) classification which is based on the tissue type. Histologic grading of female breast cancers in this study was performed according to the modification of Bloom-Richardson system by the Elston and Ellis.[50] The TNM staging (pathological) for breast cancers in this study was the system recommended by the American Joint Committee on Cancer (AJCC), (AJCC 6th edition of the cancer staging manual, 2002, New York)which takes into account the size of the primary tumour (T) measured macroscopically and in some instances microscopically by the pathologist, presence and extent of regional lymph node involvement(N), and whether or not the cancer has spread to other areas of the body (metastasis) (M).

The data was entered into a statistical database and analysed using SPSS software version 26.0 (Chicago). Fisher's exact test was used to compare tumour variables. The results were presented in bar charts and frequency tables.

Inclusion criteria: All breast malignancies diagnosed during the period of review and were histologically confirmed by the pathologist.

Exclusion criteria: All cases of improperly stored (melted) paraffin embedded tissue blocks and those with incomplete records were excluded.

Results

Annual trend in the number of breast cases diagnosed (2013 – 2019) in the department of pathology, TTH

Of the 1,167 neoplastic breast lesions reviewed in our institution, 712 (61.0%) were benign, with 455 (39.0%) malignant forms. A total of 431 (94.7%) of the malignant breast lesions were invasive, with 24 (5.3%) non-invasive lesions (P<0.0001). There was a sharp rise in the trend of absolute numbers of invasive breast malignancies during the period of review, especially from 2016 to- 2019 (Figure 1).

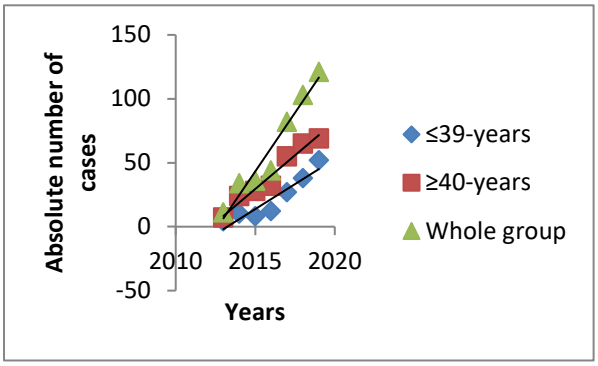

Figure 1: *Yearly Trend in breast malignancies over the study period (Age)*

Age characteristics of women diagnosed with invasive breast cancer

The ages of women diagnosed with invasive breast cancer ranged from 15 – 88 years, with a mean of 47.5±15.4. The modal age group was 30 – 39 (27.1%) years. A total of151(35.0%) were aged ≤39-years, compared to 280 (65.0%) who were aged ≥40-years (p<0.0001). A significant number 60 (13.9%) were aged 70-years and above (figure 2). There was an annual rise in the total number of cases in the two age categories (Figure 1).

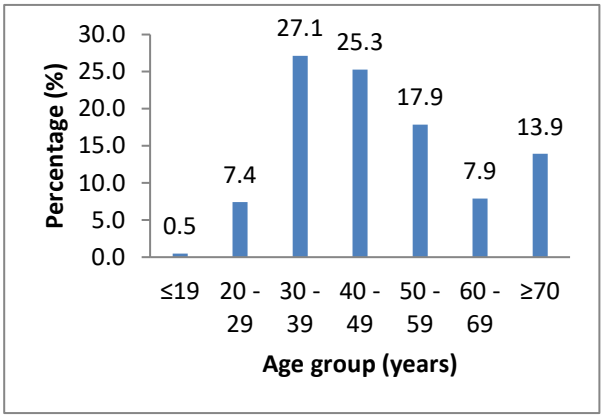

Figure 2: *Age distribution of women diagnosed with breast malignancies (2013 – 2019)*

Clinical presentation of breast cancer among the study group

The commonest clinical presentation of malignant breast lesion in the women studied was a painless palpable breast lump 286 (66.4%). There were 99 (23.0%) with skin involvement and25 (5.8%) with painful breast swellings. A little above half, 220 (51.0%) of the malignant breast lesions involved the left A total of 334 (77.0%) women out of the 431 with invasive lesions had stated duration of illness at presentation, and this ranged from 1 – 60 months with a mean of 11.3±9.3. The great majority (87.0%; P<0.0001) reported at least 3 months after noticing the lump. A total of 306 (71.0%) of the cases were diagnosed in small samples (trucut and incision biopsies), while 125 (29.0%) were in large samples (mastectomy and excision biopsies) (Table 1). The size of primary tumour diagnosed in large samples varied from 1 – 16 cm, with a mean of 7.5±2.7. Many (43.2%) were larger than 5.0cm (Figure 3).

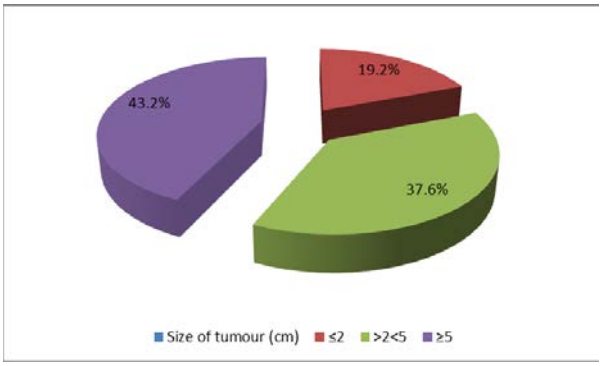

Figure 3: *Size of primary tumour in large samples (N = 125)*

Histopathological features of invasive breast cancer

i. Histological subtypes of invasive breast cancer

The common histological subtypes of malignant breast lesions were: invasive ductal carcinoma (IDC-NOS) (84.3%), invasive papillary (2.8%), metaplastic (2.6%), medullary (2.1%), mucinous (1.9%) and lobular carcinomas respectively (1.2%) (Table 2).

ii. Lymph node involvement by tumour

A total of 42 (32.8%) of the large samples had lymph node metastasis, and the number of nodes involved ranged from 1 – 28 with a mean of 7.5±5.2. Majority 33 (78.6%) of the samples had 4 or more positive lymph nodes (p<0.0001) (Table 2).

iii. Histological grades of invasive breast malignancies

A total of 361 (99.4%) of the cases diagnosed with IDC-NOS had Bloom-Richardson grading, with a mean grade of 2.4±0.6. The great majority 342 (94.7%) were in grades II –III (P<0.0001) (Table 2).

iv. TNM Stage of invasive breast malignancies

A total of 207 (47.8%) breast lesions with dimensions macroscopically and in some instances microscopically determined, had TNM staging done, and many 101(48.7%) were in stage IV, followed by stage III 43 (20.8%) (Table 2).

v. Positive tumour margins

Positive tumour margins were found in 44 (35.2%) of the large samples, many arising from local excision breast samples (54.5%) (Table 2).

Relationship between age at diagnosis and tumour variables

The commonest clinical symptom at presentation in both age groups ages: ≤39-years and ≥40-years was a painless palpable lump. However, painful swelling (7.9%vr4.6%) and skin involvement (27.2%vr22.5%) were common among women aged ≤39-years (Table 4). Values for the mean duration (months) at presentation and the mean size of primary tumour (cm) as measured macroscopically in large samples were slightly higher in women aged ≥40-years (Table 4).

High histological grade and TNM stages were common in women aged ≤39-years. Again, increased prevalence of positive tumour margins was commonly identified in women aged ≤39-years. However, higher rate of lymph node involvement was found in women aged ≥40-years (Table 4).

Table 1: Clinical presentation of invasive breast cancer among the study group

	Frequency (n)	Percentage (%)	P-Values
Symptom at presentation			0.0001
Painless lump	286	66.4	
Lump with skin involvement	99	23.0	
Nipple discharge	7	1.6	
Lump with nipple retraction	9	2.1	
Mass fixed to chest wall	5	1.2	
Painful swelling	25	5.8	
Total	431	100.0	
Laterality			0.3369
Left breast	205	47.6	
Right breast	220	51.0	
Bilateral	6	1.4	
Total	431	100.0	
Duration at presentation (months)			0.0001
≤3	44	13.0	
4.-6	116	35.0	
7.-12	96	29.0	
>12	78	23.0	
Total	334	100.0	
Type of surgical specimen			0.0001
Small biopsies	306	71.0	
Trucut	225	52.2	
Incision	81	18.8	
Large biopsies	125	29.0	
Excision	55	12.8	
Mastectomy	70	16.2	

Table 2: Histological subtypes of invasive breast cancer (n = 431)

Subtype	Frequency (n)	Percentage (%)
IDC-NOS	363	84.2
Lobular	5	1.2
Mucinous	8	1.9
Medullary	9	2.1
Invasive papillary	12	2.8
Neuroendocrine	3	0.7
Apocrine	1	0.2
Clear cell	1	0.2
Malignant Phylloidestumour	3	0.7
Spindle sarcoma	9	2.1
Metaplastic carcinoma	11	2.6
Tubular	2	0.5
Lymphoma	1	0.2
Paget's disease	1	0.2
Signet ring carcinoma	2	0.5
Total	**431**	**100.0**

Table 3: Histological grade, TNM stage and positive tumour margins of invasive breast malignancies

	Frequency (n)	**Percentage (%)**	**P-values**
Histological grade			0.0001
1	19	5.3	
2	177	49.0	
3	165	45.7	
Total	**361**	**100.0**	
Positive lymph nodes			0.0001
≤3	9	22.0	
≥4	32	78.0	
Total	**41**	**100.0**	
TNM stage			
I II	10 28	8.0 22.4	
III IV	32 55	25.6 44.0	
Total	**125**	**100.0**	
Positive tumour margins			
1. Excision biopsy Yes No	 30 25	 54.5 45.5	
2. Mastectomy Yes No	 14 56	 17.5 82.5	

Table 4: Age characteristics of some key prognostic factors

Variable	**≤39-years (n/%)**	**≥40-years (n/%)**	**P-values**
1.Clinical Presentation of breast malignancies			
a. Painless lump	92(60.9)	194(69.3)	<0.0001
b. Painful lump	12(7.9%)	13(4.6%)	1.0000
c. Lump with skin involvement	41(27.2%)	63(22.5%)	0.0035
d. Nipple involvement	6(4.0%)	10(3.5%)	0.2890
e.Mean duration at presentation (months)	10.9±9.2	11.5±9.4	
f.Mean of primary tumour (large specimens)	2.2±2.2	2.3±2.2	
2.Histological characteristics of breast malignancies			
a. Mean number of positive lymph nodes	6.1±4.5	8.4±5	
b. Positive tumour margins	17(11.3%)	27(9.6%)	0.0544
c. Histological grade of tumour at diagnosis			
I	11(9.1%)	8(3.4%)	0.5171
II	47(38.8%)	130(54.6%)	<0.0001
III	63(52.1%)	100(42.0%)	<0.0001
Total	**121(100.0)**	**238(100.0)**	
d. TNM stage at diagnosis			
I - II	20(27.4%)	43(32.3%)	<0.0001
III - IV	53(72.6%0	90(67.7%)	<0.0001
Total	**73(100.0)**	**133(100.0)**	

Discussion

The incidence of malignancies of the female breast varies across the globe, more so in Sub-Saharan Africa, where it is reported to be on the rise.[1,2,11-14]The current study in Tamale, Ghana although a single institution-based study, found a rising annual trend in the absolute numbers of breast malignancies diagnosed in the histopathology department specifically the period 2016 to 2019.This trend is similar to that reported in a previous institution-based study conducted at the Korle-Bu teaching hospital in Accra Ghana using mastectomy specimens.[14]The reasons for the rising yearly trend of breast malignancies in the Tamale Metropolis are currently not clear, but may be similar to those reported in previous studies in Ghana and other developing countries.[13-21] For instance; rapid urbanization with the associated changes in life style, the use of hormonal birth control pills, improved health care delivery system, increased awareness of the disease, health education on the disease, increased practice of breast self-examination and early reporting of breast abnormalities to health facilities have been identified as factors contributing to the rising trends in breast cancer in Ghana and some developing countries.[13-21]

However, in the opinion of the authors, the important driving factors for the rising trend of breast malignancies in health facilities in Ghana and beyond are increased awareness of the disease, the increasing use of non-invasive methods of breast examination in health facilities, the practice of breast self-examination and early reporting. For instance, Der et al[19]in a study in Tamale Ghana titled "Assessing the knowledge and attitude of tertiary students on the risk factors of breast cancer in the Tamale Metropolis" found that the great majority of their respondents were aware of breast cancer and that more than half practice monthly breast self–examination. That study found that the main source of information on breast cancer was the electronic media.[19] Ouyang et al[21] in a study among women in China titled "The effect of breast cancer health education on the knowledge, attitudes, and practice: a community health centre catchment area" reported a significant increase in the practice of breast self-examination among the women following health education on the disease. Similarly, Kocaöz et al[18] in Turkey reported an increase in breast self-examination in women after public education regarding early detection and diagnosis of breast cancer.

The current study reported a mean age of women at diagnosis with breast malignancies to be 47.5±15.4 years and that many were within the age group of 30 – 39-years. The commonest clinical presentation of breast malignancies was a painless palpable lump. However, painful breast lump, skin involvement, and nipple destruction, all symptoms of clinically advanced disease, were common in women aged ≤39-years. The clinical presentation of breast malignancies in this study are similar to other published data from Africa[22-24] and Ghana (between 1956 and 2019), that found the disease to affect relatively younger women who presented late with large palpable masses, some with skin involvement. [7-10,14, 20,25-27]

A significant finding in the Tamale study is the fact that 35.0% of the women were aged ≤39-years at the time of diagnosis with breast malignancies. This is higher than the 19.6% reported in Accra Ghana,[10] The expected outcome for these 35.0%women is not clear, but previous studies in Ghana[10] and across the world found young age at diagnosis with breast malignancies to be a poor prognostic indicator, because of the aggressive nature of the disease in this age group.[28,29]

The commonest histological subtype of invasive breast malignancy was invasive ductal carcinoma, not otherwise specified (IDC-NOS), in line with findings of previous publications in West Africa.[8,10,30]

High histological grades were reported in this study, but more significantly in women aged ≤ 39-years (P<0.0001). Our findings support studies in the past that associated high histological tumour grade with younger age at diagnosis. [8,31,32]

In this study breast malignancies were more commonly diagnosed in small samples (trucut and incision biopsies) 306 (71.0%), compared to mastectomy and excision biopsies 125 (29.0%) (P<0.0001). This is similar to what was reported in earlier institution-based studies in the department of pathology, Korle-Bu Teaching Hospital.[8,10]The mean primary tumour size measured in the large samples was 7.5±2.7; with approximately 43.2% being larger than 5.0cm, much larger than the sizes reported in other studies.[8,33]

Of the 125 large samples, only 42 (32.8%) had positive nodal involvement by tumour, with a mean of 7.5±5.2 positive nodes, and majority 33 (78.6%) of these cases had 4 or more positive lymph nodes (p<0.0001). Regarding age at diagnosis, women aged ≥40-years had mean positive nodes of 8.4±5.0, compared to 6.1±4.5 for women aged≤39-years. The differences in the mean values may partly be explained by the fact that women aged ≥40-years had slightly larger size primary tumours and a longer duration (months) before presentation (11.5±9.4 vs 10.9±9.2), and this is in line with previous studies.[34-37] Studies globally, have stressed on the prognostic significance of positive lymph nodes, particularly those with four or more positive nodes, and their association with reduced disease free interval.[38-40] Our findings however differ from studies that found young at diagnosis with breast malignancy as a predictor of increased nodal involvement.[41-43]

Again, the current study reported higher TNM stages at diagnosis to be associated with younger women aged ≤ 39-years (P<0.0001). Our findings support similar studies conducted previously at the Korle-Bu Teaching Hospital in Accra Ghana.[10,14]

Positive tumour margins in excised breast mass has been reported to be associated with increased risk of local recurrence and systemic disease.[44,45] However, the rate varies globally based on the study types and

methods.[14, 46] In this current study conducted in the northern part of Ghana, the prevalence of positive tumour margins in large samples was 35.2%.This rate is much higher than what was reported in previous studies in Ghana.[14,46] For instance, Der et al.,[46] in Accra Ghana reported a rate of 21.1% in wide local excision specimens.

A further stratification of the prevalence rate of positive tumour margins based on the age at diagnosis, revealed that, women aged ≤ 39-years had higher prevalence rate, compared to those aged ≥40-years (11.3% vrs 9.6%). This may be due to the fact that in dealing with younger age group with breast malignancies, surgeons attempt to conserve as much breast tissue as possible and this may be a contributory factor for the incomplete excision. This age group is therefore subjects of poor treatment outcome as reported in other studies.[47-49]

Conclusion: There was a steady rise in the numbers of breast malignancies diagnosed in our institution over the period of review. Breast malignancies commonly affect relatively younger women, with advanced stages of disease at presentation. There is the need to increase awareness of the disease among women, especially the need for breast self-examination and early reporting of any breast abnormalities to health facilities for appropriate management.

Recommendations:

1. The government of Ghana, the ministry of health and other organisations should support efforts in intensifying the awareness of the disease at all levels in our society.
2. Women should be encouraged to practice regular monthly breast self-examination, as this is the first and the most important step in the fight against breast cancer in Ghana.
3. Women should further be educated on the need to report early with detectable breast abnormality to a health facility for prompt diagnosis and treatment. Furthermore, family support is required for a good treatment outcome of the disease.

Limitations:

1. The present data depended largely on the availability of surgeons and pathologists during the review period.
2. Cases reported in laboratories outside the catchment area were not part of the data used in this article.
3. Inadequate relevant clinical history, particularly the duration of symptom at presentation was a major limitation.
4. Being retrospective in nature, the data used here are associated with problems/issues inherent in retrospective studies globally.

Conflict of Interest: The authors have no conflict of interest to declare

Ethical consideration/informed consent: Permission to write and publish the data in this manuscript was granted by the head of department of pathology of the Tamale Teaching hospital.

Author's contributions: DEM conceptualized the manuscript, collected and analysed data, and wrote the manuscript. SM, SA provided the needed clinical information. DEM, SM and SA, read through the final manuscript and approved it for publication.

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BURDEN AND OUTCOMES OF BIRTH ASPHYXIA IN NEONATES ADMITTED TO THE NEONATAL INTENSIVE CARE UNIT OF THE TAMALE TEACHING HOSPITAL

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Abstract

Objective: The aim of this study was to determine the burden, outcomes and factors associated with outcomes of birth asphyxia among sick neonates admitted to the Neonatal Intensive Care Unit (NICU) of the Tamale Teaching Hospital (TTH).

Patients and Methods: A retrospective descriptive study design was used. Subjects included all neonates admitted to the unit with diagnosis of birth asphyxia, during the study period (January 2018-December 2019), who met the inclusion criteria. Descriptive statistics were presented in tables and graphs. Multiple logistic regression was used to identify independent predictors of mortality.

Results: The prevalence of birth asphyxia was 17.6% of admissions. There were more males (594,60.3%) than females and most (707,74.3%) of the cases seen were inborn. Majority (617,63.3%) were delivered via spontaneous vaginal delivery. APGAR scores ≤ 3 was seen in 259(26.3%) of the babies. The case fatality rate was 14.9% and more than half (78,53%) occurred within the first 24 hours of admission. Outborn babies were 2.7 times more likely to die from birth asphyxia compared to inborn babies(p-value=<0.001). Babies with APGAR scores ≤ 3 were 3.9 times more likely to die compared to babies with APGAR scores 4-6 at one minute, (p-value=<0.001) and babies born to mothers < 20 years of age were 2 times more likely to die as compared to older mothers (p-value=0.048).

Conclusions: Birth asphyxia is common in our facility. Outborn babies, babies with one-minute APGAR score ≤3, and maternal age < 20 years were significantly associated with mortality.

Key Words: *Birth asphyxia, APGAR score, case fatality, Tamale*

Introduction

Birth asphyxia is defined as failure to initiate and sustain breathing at birth.[1] The World Health Organization (WHO) in their International Classification of disease (ICD-10) used a one (1) minute APGAR score of 0-3, and 4-7 to describe severe birth asphyxia, and mild and moderate birth asphyxia respectively.[2] It is ranked as the sixth commonest cause of death in children under five, accounting for 8% of these deaths, globally.[3] In neonates globally, it is the second commonest cause of mortality, after prematurity and related complications.[4] There is disparity in the trends of the mortality with most of the deaths occurring in Low and Middle Income countries.[5]

Birth asphyxia has been recognized as a major cause of admission and death in Neonatal Intensive Care Units (NICU).[6,7] In Africa, varying occurrence have been reported. Ilah et al reported a prevalence of 21.1% at a specialist clinic in Nigeria with a similar prevalence (21%) seen in a study in Tanzania and Ethopia.[8,9,10] Siakwa et al reported that 20% of neonatal deaths in a teaching hospital in Ghana were due to birth asphyxia[11] and a study in Korle Bu Teaching Hospital showed high prevalence of asphyxia, with case fatality rate of 21.8%.[12]

Babies with birth asphyxia may have unfavourable outcomes such as mortality[12-14] and neurological disabilities such as cerebral palsy and developmental delay.[13-15] Dilenge et al concluded from a review of studies that intended to determine the developmental outcome of asphyxiated term neonates, that 5% to 100% of neonates that met the asphyxia criteria in each study developed severe neurological deficits later in life.[16]

Despite the reduction in the incidence of birth asphyxia with the institution of various interventions like the helping babies breathe, the mortality still remains high. Improvement in perinatal care and frequent training of staff is key to improving survival.

Our study aimed to determine the burden, outcomes and factors associated with outcomes of birth asphyxia among sick neonates admitted to the NICU of the Tamale Teaching Hospital (TTH), Tamale, Ghana.

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Conflict of Interest: None Declared

Patients and Methods

Study design and setting:

This retrospective descriptive study was conducted in the NICU of the TTH, the only tertiary hospital serving the Northern part of Ghana. The hospital serves as the teaching hospital for the University for Development Studies School of

Medicine, Tamale, Ghana. The NICU is a 50 cot/incubator capacity unit that receives and manages neonates with both surgical and medical conditions either born within or referred from other facilities within the catchment area.[17] Referrals to the unit are especially common from primary and secondary health institutions from the Northern, North East, Savannah, Upper East and Upper West Regions of Ghana.

Operational definitions:

Severe birth asphyxia: one (1) minute APGAR score between 0 and 3.[2]

Mild - moderate birth asphyxia: One (1) minute APGAR score between 4 and 6. [2]

Study population:

The study included all neonates born in the TTH, referred from other facilities or delivered home and subsequently admitted to the NICU with diagnosis of birth asphyxia, during the two-year study period (January, 2018 to December, 2019).

Inclusion criteria

All babies admitted to the TTH NICU with admission diagnosis of Birth asphyxia, defined as an APGAR score <7 at one (1) minute.[2]

Exclusion criteria

Babies with birth weight less than 2500g; gestational age < 35weeks; and babies with birth defects and congenital infections were excluded from the study.

Data collection procedure and tool:

Our NICU keeps electronic record of all admissions and outcomes of babies admitted into the unit. This database was set up in 2018 to capture routine data at discharge. The study team designed a data collection tool to extract neonatal and maternal demographic information, birth records of baby, clinical information on admission and outcomes of the admission. The electronic data base was then searched for all patients with a one-minute APGAR score < 7. Out of these, records of babies who did not meet the inclusion criteria as defined earlier were excluded from the data. The information of all eligible patients was then extracted into an excel sheet and cleaned.

Data analysis:

The data that was cleaned was transferred to the Statistical Package for Social Science (SPSS) version 23 and STATA12.1 for the data analysis. Descriptive statistics of frequencies and means (SD) were analysed and results were presented in tables and graphs.

Using STATA 12.1, we determined the influence of our independent variables (gender of baby, place of delivery, mode of delivery, birthweight, APGAR scores, maternal parity and maternal age) on our dependent variable (mortality). Analysis was done at two levels: bivariate and multiple logistic regression. Independent variables that produced P values of < 0.1 in the bivariate logistic regression were included in the final multiple logistic regression model that produced adjusted odds ratios (AOR). P values < 0.05 at 95% confidence interval (CI) were considered statistically significant in the final model.

Ethical considerations:

We obtained permission from the Research and Development Department of the TTH before carrying out this retrospective chart review. The investigators had no contact with participants or their parents during the study period.

Results

Demographic and baseline characteristics

Out of 5,590 neonates admitted to the NICU, 985 neonates met the study inclusion criteria and were recruited into the study. The prevalence of birth asphyxia, using our study definition, was 17.6%. There were more males (594,60.3%) than females (391,39.7%) and most (707,74.3%) of the cases seen were delivered in TTH. Majority (617,63.3%) were delivered via SVD. The APGAR score at one minute were 4 - 6 in most (726,73.7%) cases, with a score ≤ 3 seen in 259(26.3%) of the babies.

With respect to maternal factors, 110 (42.8%) of the cases were seen in primigravida mothers and 612 (83.5%) of the mothers were aged between 20 and 35 years. Table 1 shows the details of baseline characteristics of the study participants.

Outcomes

Out of the 985 babies included in our study, 147 died giving a case fatality rate of 14.9%. In all groups, that is both survivors and those who died, the duration of stay at NICU ranged from 0 to 40 days, with a median of 3 days. In the mortality group, the median length of stay at the NICU was one (1) day (range 0-34 days), and in the patients that were discharged, the median was 3 days (range 0 to 40 days). Figure 1 gives the distribution of the length of stay at the NICU among the babies who died in admission.

With respect to mortality, more than half (78,53%) were seen within the first 24 hours of admission and most of the deaths (92.5%) occurred within 6 days of admission.

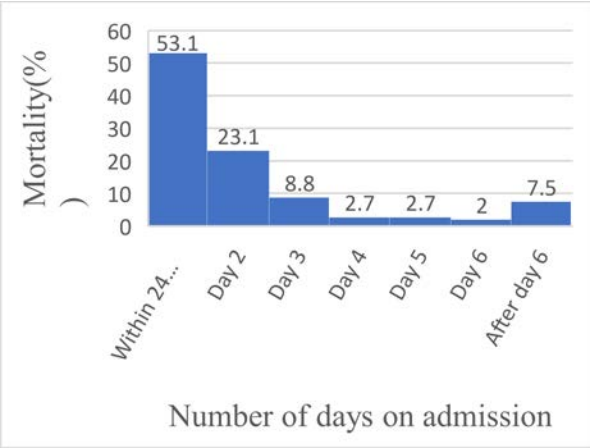

Figure 1: Distribution of death at the NICU by length of stay

Factors associated with outcomes

Gender, maternal parity, mode of delivery, birth weight, APGAR scores, place of delivery and maternal age was analysed to find out their effect on the outcome variable (mortality).

In the bivariate analysis, outborn babies, babies with APGAR scores ≤ 3 and babies born to mothers <20 years of age were more likely to die (table 2). In the multiple logistic regression analysis (table 3), outborn babies were 2.7 times likely to die from birth asphyxia compared to inborn babies (AOR = 2.75; P <0.001). Babies with APGAR scores ≤ 3 were 3.9 times likely to die compared to babies with APGAR scores 4-6 at one minute. (AOR = 3.92; P <0.001) and babies born to mothers < 20 years of age were twice more likely to die as compared to older mothers (AOR = 2.01; P =0.048).

Table 1: Demographic and baseline characteristics

Variable	Frequency (%)*
Gender of baby	
Male	594(60.3)
Female	391(39.7)
Place of delivery	
Inborn	707(74.3)
Outborn	249(25.7)
Birth Weight(kg)	
2.5 to 4	945(95.9)
>4	40(4.1)
Mode of delivery	
SVD	617(63.3)
C/S	358(36.7)
APGAR scores at 1 minute	
4-6	726(73.7)
0-3	259(26.3)
APGAR scores at 5 minutes	
4-6	433(88.4)
0-3	57(11.6)
Temperature on arrival (℃)	
>36.5	374(68.5)
36.5-37.7	118(27.1)
<37.5	54(9.9)
Maternal parity	
1	110(42.8)
2-4	108(42.0)
>4	39(15.2)
Maternal age(years)	
< 20	56(7.6)
20-35	612(83.5)
>35	65(8.9)
Age on admission	
Within 24 hours	801(81.3)
2 days	64(6.5)
>2 days	120(12)
Median:0 day	
Range: 0 to 28 days	

**Not all frequencies add up to 985 due to missing data for some of the variables. Percentages are calculated using the total valid count for each variable*

Table 2: Bivariate logistic regression analysis of predictors of mortality among babies admitted in our NICU with birth asphyxia.

Variables	Mortality*		COR (95% CI)	p-value
	Yes (%)	No (%)		
Gender				
Male	94(15.8)	500(84.2)	Reference	
Female	53(13.6)	338(86.4)	(0.580-1.200)	0.328
Place of delivery				
Inborn	83(11.7)	624(88.3)	Reference	
Outborn	60(24.1)	189(75.9)	2.387(1.649-3.455)	<0.001
Mode of delivery				
SVD	99(16.0)	518(84.0)	Reference	
C/S	45(12.6)	313(87.4)	0.752(0.515-1.099)	0.141
Birth Weight (kg)				
2.5 to 4	143(15.1)	802(84.9)	Reference	
>4	4(10.0)	36(90.0)	0.623(.218-1.778)	0.377
APGAR scores				
4-6	71(9.8)	655(90.2)	Reference	<0.001
0-3	76(29.3)	183(70.7)	3.831(2.666-5.506)	
Maternal parity				
1	13(11.8)	97(88.2)	0.590(0.277-1.255)	0.171
2-4	20(18.5)	88(81.5)	Reference	
>4	5(12.8)	34(87.2)	0.647(0.225,1.862)	0.420
Maternal age(years)				
<20	6(28.6)	40(71.4)	2.381(1.278-4.438)	0.006
20-35	88(14.4)	524(85.6)	Reference	
>35	11(16.9)	54(83.1)	1.21(0.610-2.410)	0.582

**Not all frequencies add up to 985 due to missing data for some of the variables. Percentages are calculated using the total valid count for each variable*

Table 3: Multiple logistic regression analysis of predictors of mortality among babies admitted in our NICU with birth asphyxia.

Variables	Mortality*		AOR (95% CI)	p-value
	Yes (%)	No (%)		
Place of delivery				
Inborn	83(11.7)	624(88.3)	Reference	
Outborn	60(24.1)	189(75.9)	2.750(1.760-4.30)	<0.001
APGAR scores at 1 minute				
4-6	71(9.8)	655(90.2)	Reference	
0-3	76(29.3)	183(70.7)	3.921 (2.548- 6.034)	<0.001
Maternal age(years)				
<20	6(28.6)	40(71.4)	2.013(1.007-4.024)	0.048
20-35	88(14.4)	524(85.6)	Reference	
>35	11(16.9)	54(83.1)	1.214(0.591-2.496)	0.598

**Not all frequencies add up to 985 due to missing data for some of the variables. Percentages are calculated using the total valid count for each variable*

Discussion

Birth asphyxia constitutes a global risk to neonatal survival with almost a quarter of neonatal deaths attributable to it.[18] In Africa and Ghana, it is on record as one of the major causes of neonatal morbidity and mortality.[12,19-21] Studies from Ghana's two largest hospitals have reported high burden of birth asphyxia and case fatality rates.[11,12] Our study aimed to document the burden, outcomes and factors associated with outcomes of birth asphyxia among sick neonates admitted to the NICU of the TTH, Tamale, Ghana.

We recorded a prevalence of birth asphyxia of 17.6% out of all the admissions during the study period. This was similar to the 17.5% reported in a study in Tanzania.[6]

Our finding was, however, lower than the 61.8% incidence reported by Mumuni *et al* in a study in Accra, Ghana and the 22.6% reported by Woday in Ethiopia.[1,12] The lower prevalence could be explained by differences in inclusion criteria in our study, that is the exclusion of low birthweight neonates and patients with congenital anomalies. Woday et al included babies with gestational age of 28 weeks and above whereas the study in Accra,

Ghana included term neonates.[1,12] Studies have shown that neonates with low birthweight have increased risk of birth asphyxia.[10,22,23] Our prevalence was however higher than the 9.7 % reported by Üzel et al in Turkey and the 5.1% in India.[24,25] This is expected as the rates of birth asphyxia is known to reduce with improvement in obstetric care.[26]

A case fatality rate of 14.9% was seen in our study. This was lower than the 21.8% reported in a previous study at the Korle-Bu Teaching hospital.[12] Methodological differences may account for this difference, as we excluded babies with birth weight < 2.5kg from our study, a variable has been associated with poor neonatal outcomes.[22,27] In addition, the APGAR scores in the Korle Bu study were relatively lower compared to what we documented in our study, although this parameter has been stated to be a poor predictor of early neonatal outcomes.[28] Our case fatality rate of 14.9% was similar to studies in Nigeria(14.7%) and Nepal(15.7%).[29,30] Predictors of mortality in our study were severity of APGAR scores at presentation, place of delivery and maternal age. Babies with APGAR scores ≤3 at one minute were 3.9 times (AOR = 3.92; P <0.001), likely to die compared to babies with an APGAR score of 4-6 at one minute. Lower APGAR scores have been linked with poor outcomes such as mortality and cerebral palsy in previous studies. [8,14,31] Outborn babies were 2.75 times (AOR = 2.75; P <0.001) likely to die from birth asphyxia as compared to inborn babies, a finding that conforms with reports of previous studies.[32,33] This could be explained by delayed presentation to the hospital, especially those presenting from other regions. A previous study showed that mortality in birth asphyxia is associated with late arrival to the NICU.[34]

Low maternal age has been generally associated with poor pregnancy outcomes and an association between maternal age and outcome of birth asphyxia has also been noted.[32,35,36] In our study, babies delivered by mothers of ages < 20 years were twice likely to die from birth asphyxia (AOR = 2.01; P =0.048) as compared to those delivered by mothers between 20 and 35 years of age. Biological immaturity of teenage mothers has been suggested as one reason responsible for this observation.[37,38] Teenage mothers are still growing, even during pregnancy, and thus compete with the developing fetus for nutrients. This coupled with the immaturity of the blood supply to the uterus may account for the poor outcomes seen in mothers < 20 years of age.[37]

Limitations

The main limitation of this study is the retrospective nature. We were limited with respect to maternal factors, such as diseases in pregnancy and information on frequency and quality of antenatal care provided. We could not also capture labor related factors such as duration of labor, and complications in labor that may contribute to birth asphyxia, as these information were not documented in the records of the patients.

Conclusions and recommendations

Birth asphyxia was common in our facility during the study period. Outborn babies, one-minute APGAR score ≤3, and maternal age < 20 years were significantly associated with increased risk of death. Further studies are needed to elucidate, especially maternal and health system factors associated with birth asphyxia in our facility, so that interventions can be planned to address them.

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Author contributions

Alhassan Abdul-Mumin: Conceived the study, contributed to data collection, cleaning, analysis and writing and revision of the manuscript
Kingsley Appiah Bimpong: Contributed to the data collection, performed the initial data analysis and contributed to writing of the manuscript
Sheila Agyeiwaa Owusu and Mary Joan Kpiniong: Contributed to the study design, data collection and writing of the manuscript
All authors revised the final manuscript and approved of its submission to the Post Graduate Medical Journal of Ghana.

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KNOWLEDGE AND UTILIZATION OF PRECONCEPTION CARE SERVICES AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE AT THE KORLE BU TEACHING HOSPITAL

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Abstract

Objectives: Our study explores the knowledge, perceived importance, utilization, and barriers to preconception care services among pregnant women attending antenatal care in Accra, Ghana.

Design: This is a descriptive cross-sectional survey design.

Patients and Methods: Participants are pregnant women receiving antenatal care at the Korle-Bu Teaching Hospital in Accra, Ghana.

Interventions and Outcome Measures: Participants completed a questionnaire on demographics and their knowledge, perceived importance, utilization, and barriers to preconception care services.

Results: Of 120 participants, 71.7% (n=86) had not heard of preconception care, 76.7% (n=92) did not know any elements involved in preconception care, and 27.5% (n=33) were able to select the appropriate definition. One third of participants (39.2%, n=47) viewed preconception care as important. Only 15.8% (n=19) had personally utilized preconception care; most common components received were folic acid supplementation and management of anaemia. Of those who utilized preconception care, 100% felt the care was beneficial. 21.1% faced a barrier in accessing care, including cultural beliefs, religious beliefs, and lack of time. The majority of all participants (n=75, 62.5%) felt that public education about preconception care could help overcome the barriers.

Conclusions: We demonstrate a significant gap in knowledge and awareness of preconception care among pregnant women in Ghana. Women who do receive preconception care have good knowledge about the importance of the care, and universally feel that the care was beneficial. This highlights the importance of public education and healthcare provider counselling on the role, components, and benefits of preconception care.

Key Words: *Preconception care, pregnancy, Ghana, maternal health, LMIC*

Introduction

Pregnancy-related morbidity and mortality remains high globally, particularly in Low and Middle Income Countries (LMIC)[1]. Many aetiologies of maternal and neonatal morbidity are modifiable if identified and managed prior to conception, including tobacco use, intimate partner violence, maternal undernutrition, infectious diseases, and iron-deficiency anaemia[2]. Optimizing health and healthcare behaviours prior to the first prenatal visit is an important window of opportunity to promote healthy pregnancies[3].

Preconception care is defined by the World Health Organization (WHO) as the provision of biomedical, behavioural and social health interventions to women and couples before conception occurs[4]. Preconception care addresses a range of key areas including nutritional health, genetic conditions, mental health, environmental hazards, vaccine-preventable diseases, and substance abuse[4]. Preconception care aims to improve maternal and child health by reducing unintended pregnancies, optimizing management of maternal chronic disease, preventing birth defects, and minimizing neonatal infections including vertical transmission of Human Immunodeficiency Virus (HIV)[5].

In spite of the numerous benefits that preconception care offers, challenges to utilization of preconception counselling exist in LMIC, such as Ghana[6]. Our study explores the knowledge, perceived importance, utilization, and barriers to preconception care services among pregnant women attending antenatal care at the Korle-Bu Teaching Hospital in Ghana. Understanding patients' perspectives on preconception care can inform public educational interventions and healthcare policies surrounding preconception care services.

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Materials and Methods:

This is a descriptive cross-sectional study performed at the Korle-Bu Teaching Hospital (KBTH) in Accra, Ghana. KBTH is the third largest hospital in Africa and is the leading national referral centre in

Ghana. Institutional review board approval was obtained (UGMS-CHDRC-167/2020).

Participants were pregnant women, with age greater than or equal to 18 years, who received care at the antenatal clinic at KBTH. Purposive non-probability sampling was used, by recruiting sequential women presenting for antenatal care. Data collection was carried out from 3RD August, 2020 to 28TH August, 2020. Written informed consent was obtained from all participants. Questions were verbally administered to participants in English or Twi, according to their preference.

Participants completed a five-part questionnaire, consisting of multiple-choice questions with categorical responses. Section 1 focused on demographics, including age, educational level, employment status, and parity. Section 2 focused on knowledge about preconception care. Participants were asked if they had heard of preconception care, and if so, where they were first exposed. Factual questions were then asked on the definition, components, and benefits of preconception care, as well as specific questions on knowledge about harms of alcohol and exposure to cat litter during pregnancy. In Section 3, participants indicated whether they thought preconception care was important. Those who responded "no", were asked to indicate their reason. In Section 4, participants were asked whether they had personally utilized preconception care. Those who responded "yes" were asked about specific components received, and whether they felt that their preconception care was beneficial. Finally, Section 5 focused on barriers to utilization of preconception care. Participants who received preconception care were asked if they faced barriers obtaining care, and which specific barriers were encountered. All participants were asked whether they believed public education on preconception care would overcome these barriers.

Data was collected on paper questionnaires and uploaded into Statistical Package for Social Sciences (SPSS version 20) for analysis. Descriptive statistics were calculated using frequencies (proportions) for all categorical responses.

Results

A total of 120 pregnant women participated in this study. The majority of respondents (n=86, 71.7%) were between the ages of 20-35 years. All levels of education were represented, with 38.3% (n=46) having completed tertiary education. The majority of participants were employed (n=103, 85.8%). 27.5% (n=33) of participants were nulliparous, 60.8% (n=73) had a planned pregnancy, and 14.2% (n=17) underwent fertility treatment.

The majority of participants (n=86, 71.7%) had not heard of preconception care. Out of the 34 respondents (28%) who had heard of preconception care, 13 learned about it from a health facility, 7 from family/friends, and 11 from the media. Regarding the definition of preconception care, 33 respondents (27.5%) selected the appropriate definition. 33 of 34 participants (97.1%) who had heard of preconception care selected the correct definition. Most of the respondents (n=92, 76.7%) did not know any elements involved in preconception care. Screening / management of hypertension, screening / management of diabetes, cessation of smoking, and regular exercise was correctly identified as components of preconception care by 19.2%, 16.7%, 13.3%, and 11.7% respectively. Similarly, the majority of respondents (n=88, 73.3%) did not have knowledge about the benefits of preconception care. When queried about specific exposure in pregnancy, 93.3% (n=112) correctly identified alcohol as a risk, however only 33.3% (n=40) identified cat litter as a risk.

Regarding attitudes toward preconception care, 39.2% (n=47) view preconception care as important. Of the one participant (0.8%) who believed preconception care is not important, the selected reason was that the outcome of a pregnancy is determined by God. Among all participants, 15.8% (n=19) had personally utilized preconception care. Of those who utilized preconception care, the most common components were folic acid supplementation and management of anaemia. 100% of participants who utilized preconception care felt that this care was beneficial. Of those who utilized preconception care, 21.1% (n=4) felt that they faced a barrier in accessing the care, which included cultural beliefs, religious beliefs, and lack of time. The majority of all participants (n=75, 62.5%) felt that public education about preconception care could help overcome the barriers.

Table 1: Demographic Characteristics

Characteristic		**Frequency (Proportion)**
Age (years)	< 19	1 (0.8%)
	20-35	86 (71.7%)
	> 35	33 (27.5%)
Education	No formal education	7 (5.8%)
	Primary	5 (4.2%)
	Junior high school	27 (22.5%)
	Senior high school	35 (29.2%)
	Tertiary	46 (38.3%)
Ethnicity	Akan	61 (50.8%)
	Ga	26 (21.7%)
	Ewe	18 (15.0%)
	Dagomba	7 (5.8%)
	Other	8 (6.7%)
Employment Status	Employed	103 (85.8%)
	Unemployed	17 (14.2%)
Religion	Christianity	102 (85.0%)
	Islam	18 (15.0%)
	African Traditional	0 (0.0%)
Gravidity	1	26 (21.7%)
	2	30 (25.0%)
	3	33 (27.5%)
	4	19 (15.8%)
	>4	12 (10.0%)
Parity	0	33 (27.5%)
	1	35 (29.2%)
	2	34 (28.3%)
	3	10 (8.3%)
	>3	8 (6.7%)
Gestational Age at Recruitment	1-13 weeks	6 (5.0%)
	14-27 weeks	31 (25.8%)
	28-40 weeks	80 (66.7%)
	> 40 weeks	3 (2.5%)
Whether Pregnancy was Planned	Planned	73 (60/8%)
	Unplanned	47 (39.2%)
Underwent Fertility Treatment	Yes	17 (14.2%)
	No	103 (85.8%)

Table 2: Knowledge About Preconception Care

	Frequency (Proportion)
Heard of Preconception Care	
Yes	34 (28.3%)
No	86 (71.7%)
Source of Hearing About Preconception Care (n=34)	
Health facility	13 (38.2%)
Family or friends	7 (20.6%)
Media	11 (32.4%)
Other	3 (8.8%)
Definition of Preconception Care	
Care given to a woman before pregnancy to prepare them for a healthy pregnancy	33 (27.5%)
Care given to children	0 (0%)
I don't know	87 (72.5%)
Knowledge of Elements Included in Preconception Care	
Screening / management of hypertension	23 (19.2%)
Screening / management of diabetes	20 (16.7%)
Cessation of smoking	16 (13.3%)
Regular exercise	14 (11.7%)
I don't know	92 (76.7%)
Knowledge of Benefits of Preconception Care	
Prevention of birth defects	23 (19.2%)
Prevention of transmission of HIV/AIDS	26 (21.7%)
Prevention of complications during pregnancy and delivery	28 23.3%)
Prevention of death of mother or baby	18 (15.0%)
I don't know	88 (73.3%)
Can Alcohol Intake During Pregnancy Affect the Unborn Baby?	
Yes	112 (93.3%)
No	2 (1.7%)
I don't know	6 (5.0%)
Can Exposure to Cat Litter During Pregnancy Affect the Unborn Baby?	
Yes	
No	40 (33.3%)
I don't know	19 (15.8%)
	61 (50.8%)

Table 3: Attitudes and Utilization of Preconception Care

	Frequency (Proportion)
Preconception Care Perceived as Important	
Yes	47 (39.2%)
No	1 (0.8%)
I don't know	72 (60.0%)
Reasons why preconception care is not perceived as important (n=1)	
Some women have safe pregnancies without preconception care	0 (0.0%)
Outcome of pregnancy is determined by God	1 (100%)
Other	0 (0.0%)
Utilization of Preconception Care	
Yes	19 (15.8%)
No	101 (84.2%)
Elements of Preconception Care Received (n=19)	
Screening/management of hypertension	7 (36.8%)
Screening/management of diabetes	7 (36.8%)
Management of anemia	9 (47.4%)
Folic acid supplementation	13 (68.4%)
Weight management and exercise	3 (15.8%)
Perception that Preconception Care was Beneficial (n=120)	
Yes	19 (15.8%)
No	0 (0.0%)
I don't know	101 (84.2%)
Faced Barrier while Getting Preconception Care (n=19)	
Yes	4 (21.1%)
No	15 (78.9%)
Barriers Faced to Utilization of Preconception Care (n=4)	
Lack of time	2 (50.0%)
Husband refusing care	1 (25.0%)
Cultural beliefs	1 (25.0%)
Financial	0 (0.0%)
Religious beliefs	0 (0.0%)
Negative attitudes of healthcare providers	0 (0.0%)
Belief that Public Education Could Help Overcome Barriers	
Yes	75 (62.5%)
No	0 (0.0%)
I don't know	45 (37.5%)

Discussion:

We demonstrate that knowledge about preconception care services is low among women receiving antenatal care at KBTH, with only 28.3% of participants having heard of preconception care. Our findings are consistent with studies done in Ethiopia[7], Sudan[8], and Nepal[9] which demonstrated 28%, 11%, and 16% of respondents knew about preconception care respectively[10]. Interestingly, awareness of preconception care is higher in Nigeria, where 78% of participants reported awareness, although 66% did not know that preconception care was available in Nigeria [11]. This may be explained by a more educated study population with 80% having completed tertiary education. Additionally, a main source of exposure in Nigeria was the media, which suggests a role of the media in increasing public awareness of preconception care. As expected, awareness of preconception care is greater in high-income countries such as the United States, where 48% of men and 57% of women had heard of preconception care[12]. In our study, only 27.5% of participants were able to select the appropriate definition of preconception care, and specific knowledge about components and benefits of preconception care were low. This contrasts with 71% of Nigerian women correctly defining preconception care, among a population where awareness of preconception care is higher [11]. Other studies demonstrate that an increased awareness of preconception care is associated with higher completed education, older age, and use of family planning methods.[7]

Regarding the importance of preconception care, only 39.2% of women in our study considered it important. This finding is unsatisfactory but expected given low awareness in our population. This contracts with a study done in Malaysia that found 90% of participants agreed that preconception care is important for reproductive age women[13]. Importantly, all participants in our study who received preconception care unanimously agreed that it was beneficial. This highlights the importance of increasing initial access and awareness to preconception care, which may facilitate continued utilization throughout reproductive years.

We found low utilization, with only 19 of 120 participants (16%) having received preconception care. It is also important to note that although 28% of women had heard of preconception care, only 16% utilized it. This discordance between the level of awareness and utilization of preconception care may be attributed to a lack of comprehensive explanation of the components and benefits of care. This suggests that simple awareness of preconception care is not enough to promote utilization, and more detailed education is necessary. Regarding specific elements of preconception care, 11% received folic acid supplementation, which is less than the 30% in Malaysia[13] and 26% in Nigeria[11]. Folic acid helps in the formation of new red blood cells and reduces fetal neural tube defects such as spina bifida[14]. Regarding optimization of chronic maternal conditions, 6% of participants had screening and management of diabetes and hypertension. Poorly controlled diabetes and hypertension can lead to abnormal fetal growth, stillbirth, increased risk of caesarean delivery, diabetic ketoacidosis, and preeclampsia [15,16]. Only 7.5% of participants received treatment for maternal anaemia. Anaemia increases the risk of maternal death, low birthweight and preterm labor[17]. Finally, only 2.5% received weight management and exercise as a form of preconception care, compared to 11.7% in Nigeria[11]. Undernutrition or obesity can lead to poor fetal growth, increased risk of caesarean delivery, gestational diabetes, and preeclampsia[18].

Among participants who had received preconception care, 21% reported that they experienced barriers to their utilization of that care. Cited barriers included a lack of time, religious beliefs, and cultural beliefs. It is notable that medical appointments at KBTH often require long travel times and long waiting times before being seen by a provider. Cultural beliefs were also reported as a barrier to care in Nigeria[6,19]. In the literature, barriers to preconception care also include poverty[11,19], the husbands' acceptance of the maternal healthcare services, language barriers, and attitudes of healthcare providers[6]. These range of barriers highlight the importance of understanding local religious and cultural beliefs and their role in impacting acceptance of preconception care. Importantly, 63% of participants in our study believed that the education of the public on preconception care and its importance could help overcome some of the barriers. The perspectives and attitudes of reproductive age women are important to incorporate in these public health messages.

This study fills a gap in the literature by evaluating knowledge, utilization and barriers to preconception care in a LMIC setting where preconception care is available. There was a high participation rate of 100%, which limits potential response bias. Importantly, only women receiving antenatal care were eligible for participation. We anticipate that women who do not receive antenatal care are both at higher risk of maternal and neonatal morbidity, and also less likely to have awareness or utilization of preconception care. This study was done at a single tertiary care hospital, in an urban capital city. In this population, one-third of women had completed tertiary education and the vast majority were employed. This may limit generalizability to women living in peri-urban and rural areas. Our participants do demonstrate a range of education levels, religions, and ethnicities, which helps support a diversity of responses. Notably, Ghana has robust postgraduate residency training programs for Obstetrician/Gynaecologists who are trained to provide or supervise preconception care. Thus, experiences of

pregnant women in Ghana may not be generalizable to other LMIC where preconception care is less accessible. Finally, participants in our study were limited to categorical responses. Additional qualitative research is needed to more fully explore topics addressed in the survey.

Conclusion

We demonstrate a significant gap in knowledge and awareness of preconception care among pregnant women in Ghana. This has far-reaching health implications for this at-risk population. Women who do receive preconception care have good knowledge about the importance of the care, and universally feel that the care was beneficial. This highlights the importance of public education and healthcare provider counselling on the role, components, and benefits of preconception care in low-resource settings.

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MALARIA CONTROL WITH BED NETS; ASSESSMENT OF CORELATES OF ITS EFFECTIVENESS FOR PREGNANT WOMEN IN KWAEBIBIREM

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Abstract

Objective: This study aimed to investigate correlates of the effectiveness of Insecticide-treated Bed Nets (ITNs) for prevention of malaria through pregnancy till delivery.
Methodology: The hospital-based cross sectional study enrolled 413 Antenatal Care (ANC) attendants at the maternity ward of the Kade government hospital. Differential patterns of use of ITNs among women who had malaria during pregnancy and women who did not have malaria during pregnancy were compared across various variables. Self-reported information by participants were objectively validated from maternal health record books, patient folders and other relevant maternal health registers.
Results: ITNs are an important malaria prevention and control intervention among pregnant women who report using them during pregnancy. The period prevalence of malaria through pregnancy however remained high among adolescents irrespective of ITN use while tertiary educational background and exposure to Intermittent Preventive Therapy with Sulfadoxine-pyrimethamine (IPTp-SP) reduced risk of malaria in pregnancy irrespective of ITN use.
Conclusion: Malaria morbidity was generally higher among pregnant women who did not use bed nets during pregnancy despite variations by maternal age, area of residence, gestational age, occupation type, marital status, parity, maternal educational background and IPTp-SP status.
Recommendations: Strategies aimed to reduce the period prevalence of malaria during pregnancy should be intensified particularly targeting adolescents. Barriers to sustained universal access to ITNs and IPTp-SP should be eliminated while policies aimed to increase formal education should be prioritized.

Key Words: *Malaria in pregnancy, effectiveness, mosquito bed nets.*

Introduction

The mutually aggravating condition of malaria in pregnancy constitutes an obstetric, social and medical problem whose solution calls for multidisciplinary and multidimensional ameliorative interventions.[1] Pregnant women and children ≤ 5 years comprise the main risk group for malaria with the two sub populations accounting for an estimated 80% of the disease's mortality in Africa.[1] Malaria's associated perinatal mortality, (largely attributable to infection with p. falciparum species),[2] is an estimated 1500 per day and remains an established predictor of low birth weight in 20-40% of babies born in endemic areas.[1] While placentae of pregnant women may have high parasitemia causing anemia even in the documented absence of peripheral parasitemia, malaria in pregnancy is usually asymptomatic in high transmission settings where levels of acquired individual immunity tend to be high.[2] Control programs largely aim to reduce the disease's associated morbidity and mortality by attaining a low prevalence that ceases to be a public health problem; this defines 'malaria control', achieved through several treatment and prevention interventions, the choice of which is determined by the level of transmission.[3] Preventive interventions include diagnosis and treatment, the use of Insecticide-treated Bed Nets (ITNs), Intermittent Preventive Treatment during pregnancy (IPTp), Intermittent Preventive Treatment during infancy (IPTi), Indoor Residual Spraying (IRS), larval control and other vector control interventions while efforts to develop effective licensed vaccines are far advanced, currently undergoing pilot implementation in selected sites.[3] Comprising the second most common cause of infectious disease-related mortality globally after tuberculosis, malaria during pregnancy accounts for over 10,000 maternal and 200,000 perinatal deaths per year out of an estimated twenty-five million at risk sub population.[4]

Bed nets, among other control and preventive interventions, have been used as physical barriers to prevent bites since the sixth century BC but extensively for malaria in the mid-1980s.[5] Combinations of insecticidal and irritant effects of the pyrethroids with the physical barrier of the bed net helps reduce vector density, sporozoite rates, malaria parasite prevalence, disease incidence, and mortality when evaluated both in clinical trials and as part of routine public health programs in areas where principal malaria vectors are largely endophagic, (biting indoors), and endophilic, (resting indoors).[5] ITNs therefore comprise the cornerstone of malaria prevention in Africa.[5] An estimated 300 million ITNs were distributed in Africa 2010-2012 at a cost of more than US$1 billion for their

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purchase and distribution.[5] Prevalence of malaria in pregnancy remains high despite broad and continuous distribution of treated bed nets among other interventions particularly targeting pregnant women and children under 5 years. Mean period prevalence of malaria among pregnant women, 2012-2018, accessing care at the Kade district hospital, Kwaebibirem, was 5%. Together with a commensurately high mean perinatal mortality burden of 12 per 1000 births over the same period, these outcomes are of public health concern (despite no currently established correlations between the municipality's maternal malaria prevalence and its perinatal mortality. This study therefore aimed to investigate correlates of the effectiveness of the use of bed nets for the prevention of malaria through pregnancy till delivery in Kwaebibirem, Eastern Ghana.

Methods

This hospital-based cross sectional study, carried out at the Kade government hospital, enrolled a total of 413 participants. The study enrolled women who reported having had malaria at any time during pregnancy and compared them with women who indicated not suffering from malaria at any time during pregnancy; 'malaria at any time during pregnancy' status, reported by participants, was objectively validated with the participants ANC booklets, personal folder and other relevant registers. Malaria at any time during pregnancy was limited to the pregnancy preceding the current delivery for which the client had been admitted to the maternity unit of the hospital. 'Woman' operationally defined all participants i.e. parturients who delivered at any gestational age after 28 completed weeks of gestation, irrespective of maternal age. Participants' self-reported ownership of a bed net was objectively validated from their maternal and child health record booklets indicating a bed net was issued at ANC. This was used as a proxy to objectively validate bed net use among women who reported having nets and using them through pregnancy. Married women comprised those reporting being currently married or cohabiting while single women included the currently unmarried or divorced. Participants were interviewed with a structured questionnaire, pre-tested at the maternity unit of the St. Dominic's Hospital to eliminate ambiguity. Non-ANC attendants were excluded as the study posited that there was no source document to objectively validate their self-reported 'malaria at any time during pregnancy' status, the main outcome of interest. Client folders therefore also comprised key source documents for data abstraction and validation on participants. Urban or rural status of area of residence was defined consistently with specifications of Ghana Statistical Service that define rural areas as towns or communities of less than 5000 population. The sample size was calculated using open epi while data were analyzed with epi info 3.5.4.

Results

The period prevalence of malaria at any time during pregnancy among women who attended ANC through pregnancy till delivery was 30.8%. The mean age of women who had malaria at any time during pregnancy was 26.3 years; their ages were characterized by high variance of 46.3 and a standard deviation (SD) from the mean age of ±6.8. Ages of women who were not diagnosed with malaria at any time during pregnancy varied marginally with a mean age of 28.3 years, variance of 45 and a SD insignificantly different from women who had malaria at any time during pregnancy. The mean age of women who, despite reporting using bed nets, had malaria at any time during pregnancy, was marginally higher than women who had malaria at any time during pregnancy who reported not using bed nets. The mean age of women who did not have malaria at any time during pregnancy who reported using bed nets was insignificantly higher than that of women who reported not using bed nets and had malaria at any time during pregnancy. [Table 1]

Table 1: Age-Specific Measures of Central Tendency for Malaria during Pregnancy

Central Tendency	Malaria During Pregnancy=Yes (%)		Malaria During Pregnancy=No (%)	
	BN=Yes	BN=No	BN=Yes	BN=No
Mean Age	28.2	25.1	28.8	27.1
SD	7.6	5.9	6.5	6.9
Variance	59.0	35.9	42.3	48.1

BN=Bed Nets

Women aged 11-12 years recorded the highest period prevalence of malaria through pregnancy irrespective of whether they reported using a bed net or not. While malaria's morbidity burden declined steadily with increasing age among women who reported not using bed nets through pregnancy, it observably plateaued after declining from 35.5% through 16.2% to 22.2% among women who reported using bed nets. [Fig 1]

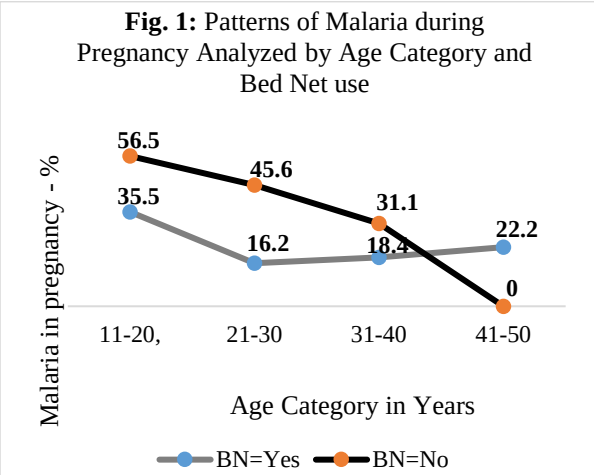
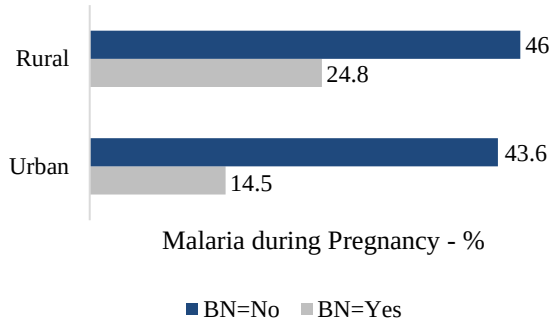


Fig. 1: Patterns of Malaria during Pregnancy Analyzed by Age Category and Bed Net use

BN=Bed Nets

Women resident in rural communities who reported using bed nets still recorded a higher period prevalence of malaria through pregnancy than women resident in urban communities who also reported using bed nets through pregnancy. [Fig. 2]

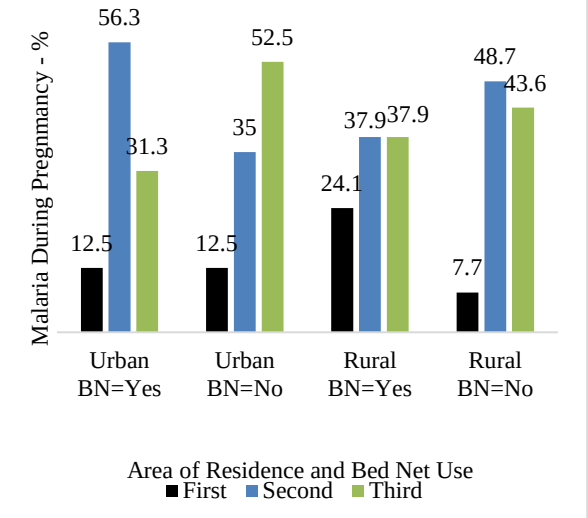
Fig 2: Patterns of Malaria during Pregnancy Analyzed by Area of Residence



BN=Bed Nets

Further analyses of patterns of distribution of malaria at any time during pregnancy stratified by trimester of occurrence showed that malaria's case burden among urban residents who used bed nets was highest in the second trimester; the morbidity burden among urban residents who reported not using bed nets was notably highest in the third trimester. Among women resident in rural communities who used bed nets, the highest period prevalence occurred in the second and third trimesters while the disease burden among women resident in rural communities who did not use bed nets notably peaked in the second trimester. [Fig. 3]

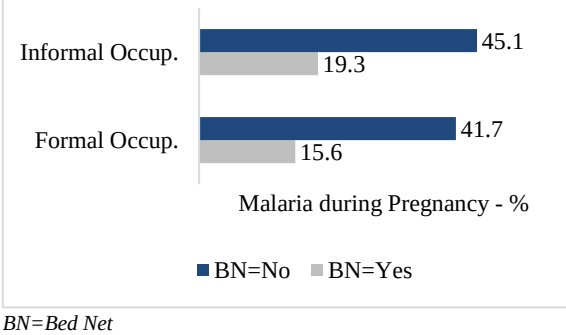
Fig. 3: Patterns of Malaria during Pregnancy Analyzed by Area of Residence and Trimester



BN=Bed Net

The morbidity burden of malaria at any time during pregnancy was observably higher among women engaged in informal occupations for both groups of women who used bed nets and those who reported not using bed nets. [Fig. 4]

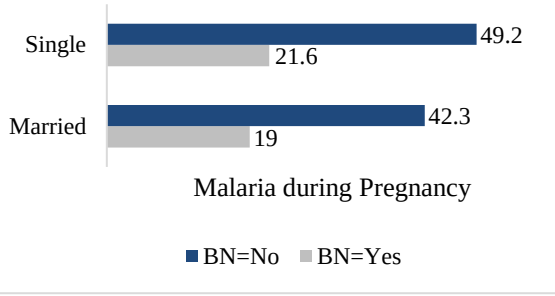
Fig 4. Patterns of Malaria during Pregnancy Analyzed by Occupation



BN=Bed Net

Though the malaria morbidity burden at any time during pregnancy remained comparatively higher among women who reported not using bed nets through pregnancy, analyses by marital status indicated that it was generally higher among single women irrespective of bed net use. [Fig. 5]

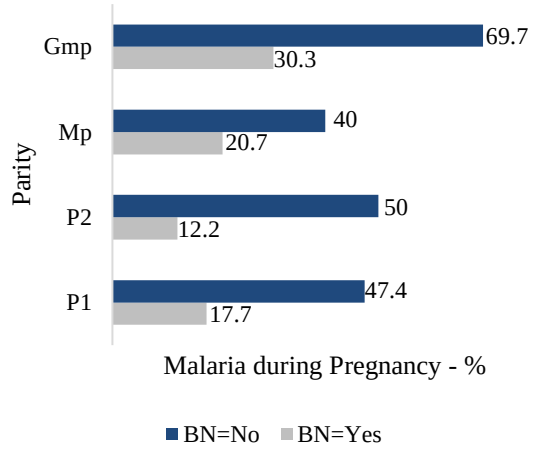
Fig. 5. Patterns of Malaria during Pregnancy Analyzed by Marital Status



BN=Bed Net

The mean parity of women who had malaria at any time during pregnancy and women who did not have malaria through pregnancy varied insignificantly i.e. 2.73 and 2.71 respectively. Malaria's morbidity burden at any time during pregnancy analyzed by parity further showed a higher period prevalence among women who reported not using bed nets through pregnancy irrespective of the parity. Malaria's morbidity burden among women who reported using bed nets through pregnancy and those who did not, with the exception of multiparous women, showed a rising trend from uniparous through to grand multiparous women. [Fig. 6]

Fig. 6: Patterns of Malaria during Pregnancy Analyzed by Parity

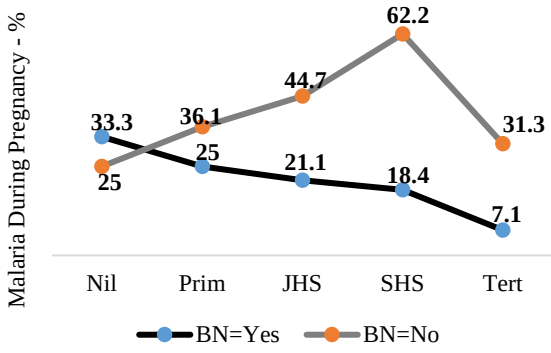


BN=Bed Net, P1=Para 1, P2=Para 2, Mp=Multipara, Gmp=Grandmultipara

The morbidity burden of malaria at any time during pregnancy analyzed by parity and stratified by trimester showed a consistently higher case burden among women who reported not using bed nets through pregnancy particularly in the third trimester irrespective of parity. Grand multiparous women in the first trimester who reported using bed nets during pregnancy notably did not have malaria. [Table 2.0]

Malaria at any time during pregnancy analyzed by a woman's highest level of education attained consistently showed that women who reported not using bed nets during pregnancy accounted for a comparatively higher period prevalence of malaria during pregnancy than women who reported using them. Women of tertiary educational background who reported using bed nets through pregnancy observably had the lowest period prevalence of malaria during pregnancy irrespective of bed net use. [Fig. 7]

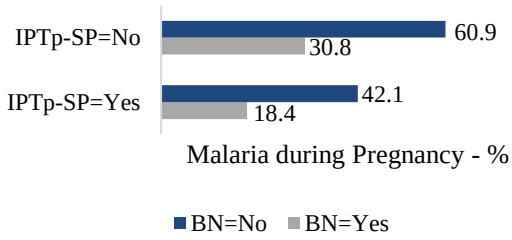
Fig 7. Patterns of Malaria during Pregnancy Analyzed by Maternal Educational Background



BN=Bed Net, Nil=No Education, Prim=Primary, JHS=Junior High School, SHS=Senior High School, Tert=Tertiary

Malaria's morbidity burden among women who differentially used bed nets through pregnancy analyzed by their exposure to the presumptive and prophylactic treatment of IPTp-SP showed a higher period prevalence of malaria during pregnancy among women who reported not using bed nets, irrespective of exposure to the IPTp-SP. Malaria's morbidity burden was however notably significantly lower among women who were exposed to IPTp-SP and also reported using bed nets to prevent mosquito bites - an estimated prevalence reduction of about 12.4% (i.e. from 30.8 to 18.4%). [Fig. 8]

Fig. 8: Patterns of Malaria during Pregnancy Analyzed by Bed Net use and Exposure to IPTp-SP



BN=Bed Net

Women who reported owning bed nets were subjectively investigated for use of the nets. Analyses of this variable showed that 19.8% of women who reported owning bed nets had malaria during pregnancy compared with about 44.5% of women who reported not owning bed nets and had malaria at any time during pregnancy. Further subjective investigation of bed net usage and not only ownership still however suggested that malaria's morbidity burden at any time during pregnancy remained higher among women who reported owning bed nets but were not investigated for sustained usage of the nets through pregnancy i.e. 24.5% and 47.5% respectively.

Women who had malaria at any time during pregnancy were further investigated for patterns of occurrence of malaria by trimester and use of bed nets stratified by exposure to routine IPTp-SP presumptive malaria treatment. This aimed to study malaria's morbidity burden among women differentially exposed to IPTp-SP and bed nets. An estimated 12.5% of women, not exposed to IPTp-SP in the first trimester, had malaria during pregnancy. IPTp-SP within the policy framework typically starts in the second trimester. At least 51.4% of women who reported using bed nets during pregnancy and were also exposed to IPTp-SP had malaria during that gestational period compared with 43.1% of women who had malaria and reported not using bed nets but were exposed to IPTp-SP during pregnancy. [Fig. 9 and 10]

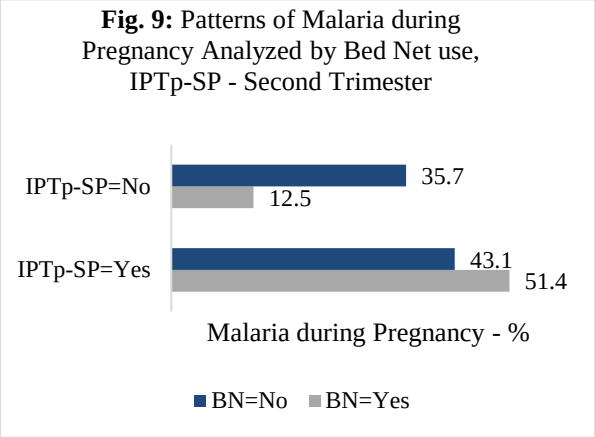


Fig. 9: Patterns of Malaria during Pregnancy Analyzed by Bed Net use, IPTp-SP - Second Trimester

BN=Bed Net

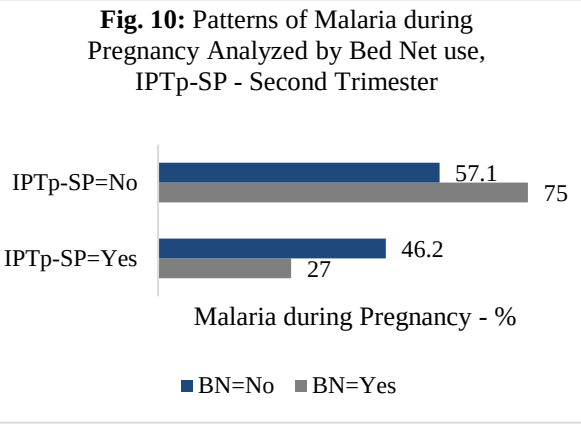


Fig. 10: Patterns of Malaria during Pregnancy Analyzed by Bed Net use, IPTp-SP - Second Trimester

BN=Bed Net

Table 2. Prevalence of Malaria during Pregnancy Analyzed by Trimester of Gestation and Parity

Parity	Malaria Morbidity by Trimester (%)					
	First		Second		Third	
	BN=Yes	BN=No	BN=Yes	BN=No	BN=Yes	BN=No
Para 1	0.0	3.8	54.5	42.3	45.5	53.8
Para 2	33.3	13.6	33.3	40.9	33.3	45.5
Mp.	17.6	18.2	52.9	40.9	29.4	40.9
Gmp	40.0	0.0	30.0	50.0	30.0	50.0

BN=Bed Net, P1=Para 1, P2=Para 2, Mp=Multipara, Gmp=Grandmultipara

Discussion

Malaria, a mutually aggravating condition in pregnancy comprises an obstetric, social and medical problem whose solution calls for multidisciplinary and multidimensional ameliorative interventions.[1] The period prevalence of malaria during pregnancy of 30% among women who attended ANC remains high as it has established associations with adverse obstetric outcomes e.g. maternal anemia, low birth weight, preterm labor, maternal and perinatal mortality etc. The mean age of women who had confirmed malaria at any time during pregnancy and those who did not varied insignificantly irrespective of differential bed net use between the two groups. The period prevalence of malaria at any time during pregnancy remained highest for the group of women aged 11-20 years irrespective of bed net use. The malaria morbidity burden for women who reported not using bed nets reduced inversely with increasing age and no case was recorded among women of advanced maternal ages i.e. group 41-50 years. The prevalence among women who reported using bed nets during pregnancy was comparably lower through the various age groups ranging between 11 to 50 years. A downward trend was observed among women who did not use bed nets but however slightly increased with increasing age for women aged 21 to 50 years. Maternal age constitutes one of the established maternal factors associated with increased risk of malaria during pregnance. The higher risk of malaria infection among younger women, especially adolescents, (primigravidae and multigravidae) than older women independent of parity, comprises a finding well established in extant evidence base.[6] The comparatively high period prevalence of malaria during pregnancy observed among adolescents was not significantly ameliorable by the use of bed nets as compared with women of older age groups.

The prevalence of malaria during pregnancy remained higher among rural residents than urban residents consistent with extant evidence on distribution patterns of malaria infection during pregnancy.[7, 8] This therefore implied that bed nets averted more malaria infections among urban residents than rural residents. However, irrespective of this variation in urban-rural malaria infection prevalence, bed nets averted the infection among significantly higher proportions of pregnant women who reported using them at any time during pregnancy than not for both urban and rural residents.[9] The period prevalence among urban residents who reported using bed nets was observably highest in the second trimester while it was notably highest in the third trimester among urban residents who reported not using bed nets. The disease prevalence was highest in the second and third trimesters among rural residents who reported using bed nets during pregnancy while it remained highest in the second trimester among rural residents who reported not using bed nets. This suggested that the morbidity burden of malaria infection at any time during pregnancy varied insignificantly between urban residents who used bed nets and those who did not.

Women who were engaged in formal occupations recorded a comparatively lower malaria case burden than women engaged in informal occupations. Despite the notable variations in period prevalence of malaria

during pregnancy for women of the two occupation categories, the use of bed nets showed wider variations between women who used them and those who reported not using them. Analyses by occupation, (a proxy for individual socioeconomic status), weakly pointed to the importance of socioeconomic factors in differential patterns of occurrence of malaria at any time during pregnancy. There however currently exists limited evidence on the importance of socioeconomic variables on malaria risk. Interventions aimed to increase the number of health centers in rural communities and improve access to care, improving the economic status and increasing awareness about malaria prevention should therefore remain a priority for malaria control.[10] On the basis of formal occupation, (a proxy measure for individual socioeconomic status), being linked to reduced malaria period prevalence, attainment of objectives of community based interventions seeking to generally improve standards of living, access to healthcare facilities and health awareness may significantly impact malaria control.[11] A comprehensively clear understanding of the effects of housing structure, education, occupation, income and wealth on malaria risk can help to better design socioeconomic interventions to control the disease.[12]

Findings suggesting higher malaria period prevalence among single pregnant women than married or cohabiting pregnant women are likely explained by the comparatively higher proportion of younger women (with a therefore higher likelihood to be single) among unmarried women. Established evidence indicates adolescence independently bears higher risk for malaria infection during pregnancy. The mean age of married women was 30 years compared with a mean age of 22 years for women not married and not cohabiting at the time of the study. Findings also indicated that married or cohabiting women marginally used bed nets more than single women. Though malaria's period prevalence remained high among women who did not use bed nets irrespective of parity, its morbidity burden showed a rising trend among the two groups of women who used bed nets and those who did not. Despite the lack of consistent evidence on associations in extant literature between malaria during pregnancy and parity, it remains conceivable that with repeated pregnancies (likely associated with established repeated subclinical malaria infections/parasitemia), multiparous and grand multiparous women should have a declining period prevalence of malaria during pregnancy resulting from acquired partial malaria immunity.[13, 14] This was not observed in this study and should be prioritized for future research.

The impact of maternal education in prevention of malaria during pregnancy has been emphasized by some studies indicating low maternal educational background was associated with the most significantly increased risk of malaria during pregnancy. Such evidence indicate that low education independently remains a risk factor for malaria infection during pregnancy.[15] Consistently with findings of extant evidence that have emphasized important associations between malaria during pregnancy and maternal education, an inverse relationship between maternal educational background and malaria during pregnancy was established for both women who reported using bed nets during pregnancy and those who did not. Tertiary educational background remained importantly linked with reduced risk of malaria infection during pregnancy even without the use of bed nets as a sharp drop in malaria morbidity was observed among women of tertiary educational background who reported not using bed nets through pregnancy.

Intermittent preventive therapy with sulphadoxine-pyremethamine, IPTp-SP, remains a policy-prescribed intervention importantly linked with risk reduction of malaria infection during pregnancy, an established association in extant evidence base.[20] The period prevalence of malaria during pregnancy for women exposed to IPTp-SP yet reporting not using bed nets through pregnancy remained notably lower than that of women who did not use bed nets through pregnancy and were not exposed to IPTp-SP, the presumptive prophylactic malaria treatment. The precise magnitude of preventive effect i.e. risk difference between exposure to IPTp-SP and the use of bed net through pregnancy should however further be comprehensively investigated in future studies to facilitate establishment of the quality of the statistical relationships between the two i.e. synergistic or complementary using analytic epidemiological studies.

Women who reported owning bed nets were subjectively investigated for use of the nets. This was aimed to subjectively investigate the differences between owning a bed net and actually using it. Analyses of this variable showed that 19.8% of women with bed nets had malaria during pregnancy compared with about 44.5% of women without bed nets who had malaria at any time during pregnancy. Further subjective investigation of bed net usage and not only ownership still however suggested that malaria's morbidity burden during pregnancy remained higher among women who reported owning bed nets but were not further investigated for usage of the nets i.e. 24.5% and 47.5% respectively. Future research should prioritize establishment of the risk difference between ownership and usage.

Exposure to IPTp-SP remained importantly linked to reduced risk of malaria during pregnancy. This comprises a second trimester policy directive that prescribes administration of an antimalarial for preventive as well as curative purposes in malaria endemic areas of the world. Women who were exposed to IPTp-SP during pregnancy, irrespective of bed net use, had a comparatively reduced period prevalence of malaria during pregnancy; the morbidity burden of malaria infection during pregnancy observably

remained comparatively lower among women who reported not using bed nets during pregnancy but were exposed to the IPTp-SP malaria prevention and control intervention than women who reported not using bed nets and were further not exposed to IPTp-SP. Differential exposure to IPTp-SP among pregnant women during ANC constitutes a challenge inherent in the prescription criteria more than an issue of differential compliance.

Observations of occurrence of malaria during pregnancy by trimester and exposure to IPTp-SP further suggested that the malaria risk reduction associated with exposure to IPTp-SP was not emphasized in the second trimester as malaria prevalence was observably higher among women who were exposed to IPTp-SP during pregnancy than those who were not. The third trimester contrarily recorded a higher malaria case burden among women who were not exposed to IPTp-SP during pregnancy. The protective effect of IPTp-SP combined with bed nets was therefore more pronounced in the third trimester than second. The first trimester was not reviewed for this variable as IPTp-SP, within the context of its policy framework, typically commences in the second trimester i.e. at about sixteen completed weeks of gestation.

Conclusions

Malaria, a mutually aggravating condition with pregnancy, remains an obstetric, social and medical problem whose solution calls for a multidisciplinary and multidimensional interventions.[1] An estimated 30% of women who attended ANC during pregnancy had malaria during pregnancy. The mean age of women who used bed nets and did not have malaria during pregnancy was marginally higher than that of women who did not use bed nets and had malaria during pregnancy. The highest period prevalence of malaria during pregnancy was observed among women aged 11-20 years irrespective of bed net use. The period prevalence of malaria was higher among rural residents who used bed nets during pregnancy than urban residents who also used bed nets through pregnancy. The malaria morbidity burden among urban residents who used bed nets was highest in the second trimester and remained notably highest in the third trimester among urban residents who did not use bed nets. The highest malaria period prevalence among rural residents who used bed nest was in the second and third trimester while it remained highest in the second trimester among rural residents who did not use bed nets.

Women engaged in informal occupations, irrespective of bed net use, recorded a higher malaria morbidity burden during pregnancy. Women who reported not being married had a comparatively higher malaria morbidity burden during pregnancy irrespective of bed net use. Though the period prevalence of malaria during pregnancy was observably higher among women who reported not using bed nets irrespective of parity, the disease burden weakly showed a rising trend with increasing parity as grand multiparous women recorded the highest period prevalence. For women who used bed nets, the prevalence of malaria during pregnancy reduced steadily with increasing maternal education while it increased with increasing maternal education for women who did not use bed nets; Tertiary educational background however reduced risk of malaria in pregnancy irrespective of bed net use. Exposure to IPTp-SP remains important for prevention of malaria during pregnancy and its associated adverse outcomes.

Recommendations

Research should consistently prioritize identification of specific factors associated with increased risk of malaria during pregnancy among adolescents, a sub population that independently comprises a high risk group during pregnancy despite the myriad of current preventive interventions. Factors contributing to higher period prevalence of malaria during pregnancy among rural residents and grand multiparous women irrespective of exposure to bed nets should be further investigated together with the influence of socioeconomic factors on risk of malaria infection during pregnancy. Policies aimed to increase literacy in the general population should be prioritized as education has an established broad association with reduced incidence of disease. Strategies aimed to ensure increments of IPTp-SP coverages among pregnant women together with bed net distribution at various service delivery points in various districts in Ghana should be intensified towards enhancement of malaria infection risk reduction. Future research should prioritize investigation of differences in the period prevalence and risk difference of malaria during pregnancy among women who owned bed nets and women who, not only owned bed nets, but were further investigated for usage.

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TRENDS IN DIRECT CAUSES OF MATERNAL DEATHS AS SEEN AT THE KORLE-BU TEACHING HOSPITAL MORTUARY (1995 –2014): A RETROSPECTIVE AUTOPSY STUDY

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Abstract

Objectives: Our main research aim was to describe the relative proportions and trend of direct causes of maternal death over a period of 20-years in the largest tertiary hospital in Ghana.

Material and methods: This was a descriptive retrospective review of cases of maternal death for which autopsy examination was conducted at the KBTH mortuary from 1995 to 2014. Data on direct maternal deaths were collected on the age, local of death (coroner and permission), the anatomical site and diagnosis: 1) obstetric haemorrhage, (including abruptio placentae, placenta praevia, uterine atony, and retained products of conception, etc); 2) abortion, 3) hypertensive disorders in pregnancy (pre-eclampsia, eclampsia), 4) ruptured ectopic gestation, 5) ruptured uterus in labour, 6) amniotic fluid embolism, and 7) genital tract sepsis.

Results: There were 1,846 maternal deaths of which 86.4% were classified as direct maternal deaths (P<0.0001). The mean age was 28.72 ±6.47 years. The majority, 1,346 (84.4%) were coroner cases (p< 0.0001). Abortion (27.4%), hypertensive disorders in pregnancy (27.3%), and obstetric haemorrhage (27.0%) were the common causes. There was a general declined in the trend of maternal deaths over the 20-year period, particularly those due to abortion, obstetric haemorrhage, ruptured tubal gestation and ruptured uterus in labour. However, deaths due to hypertensive disorders in pregnancy showed a relative rise over the period.

Conclusion: Abortion, hypertensive disorders in pregnancy and obstetrics haemorrhage, were the major causes of maternal deaths. There was a general decline in the trend of maternal deaths over the study period.

Key Words: *Maternal deaths, direct obstetric causes, trend, Ghana, Korle-Bu teaching hospital, Accra.*

Introduction

The main goal of Millennium Development Goal 5 was to reduce maternal mortality ratio by three-quarters between 1990 and 2015.[1,2] For this reasons, WHO and other international and local agencies implemented programmes aimed at achieving this goal.[3,4] It is however clear from the available data that this has not been universally achieved, particularly in sub-Saharan Africa.[1,2,5] The inability to achieve the Millennium Development Goal 5 globally and for the fact that maternal mortality is a preventable death but still a leading cause of death among women aged 15 – 49 years,[6,7,8,9] resulted in the formulation of Sustainable Development Goal (SDG) 3, target 3.1; which aims at reducing global maternal mortality to fewer than 70 per 100,000 live births by 2030.[10] However, achieving this target requires reviewing the causes and patterns of maternal deaths, effective strategies and interventions built on previous experiences to improving maternal health and enhancing the monitoring and evaluation processes.[11] Understanding the relative proportions and trends of direct causes of maternal deaths is essential for planning health programs, setting priorities, and allocating resources especially in countries with limited resources and dysfunctional health information systems. Unfortunately, accurate data on direct causes of maternal deaths in most developing countries from vital registration systems are limited.

In Ghana, the lack of accurate mortality data is further hindered by the non-existent of robust vital registration systems in most regions of Ghana, or where they exist, the data is incomplete.[12,13] There is thus the need for an alternative source of accurate data on maternal deaths.

Maternal autopsies are thus required for accurate death certification, determination of the underlying causes of death, and establishment of maternal mortality rates.[14] Autopsy as investigative tool, provides valuable information about the pathophysiological changes in various organs which may be important in the delineation of the sequence of events leading to death.

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The use of autopsy data as a tool to ascertain causes of maternal deaths has been documented in most developed countries and also in some West African countries.[14,15,16,17] Despite the vital role it plays in accurately determining the cause of maternal death, only few hospitals in Ghana performed autopsy. Information provided on autopsy data has been shown by previous studies to increase the accuracy of cause of death reports, even in cases where the cause of death can be wholly based on clinical evaluation.[18,19,20] Our main research aim was to describe the relative proportions and trends of direct obstetric causes of maternal death over a period of 20-years in the largest tertiary hospital in Ghana.

Material and Methods

In this retrospective study covering the period 1995 - 2014, "maternal death" was defined according to the tenth revision of International Classification of Diseases (ICD-10) by WHO. It is described as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.[43] "Direct maternal deaths" were defined as maternal deaths resulting from complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events arising from any of the above. "Indirect maternal deaths" were defined as maternal deaths due to previously existing disease or diseases that develop during pregnancy, and not due to direct obstetric causes but which were aggravated by the physiological effects of Pregnancy.[21] Coroner's deaths were deaths that occurred in the community or within 24-hours of admission to a health facility, where no definitive diagnosis was arrived at before death. Hospital deaths on the other hand were deaths that occurred in a health facility while the patient was on treatment for a given diagnosis.

Study design: This was a descriptive retrospective review of cases of maternal death for which autopsy examination was conducted at the KBTH mortuary from 1995 to 2014.

Study site: All data were gathered from the autopsy logbooks of the Korle-Bu Teaching Hospital Mortuary, the largest mortuary in the country. This mortuary receives cases from Korle-Bu Teaching hospital, the largest referral hospital in Ghana; as well as cases within the Accra Metropolis, neighbouring towns and Districts, and in special circumstances, cases from other regions across the country.

Study population: Women aged 15 – 49 years who had autopsy examination at the KBTH mortuary from 1995 to 2014.

Data collection and analysis: Maternal deaths were first classified into direct and indirect causes. Direct maternal deaths were further classified based on the specific anatomical site and diagnosis as: 1) obstetric haemorrhage, (including abruptio placentae, placenta praevia, uterine atony, and retained products of conception, etc); 2) abortion, 3) hypertensive disorders in pregnancy (pre-eclampsia, eclampsia), 4) ruptured ectopic gestation, 5) ruptured uterus in labour, 6) amniotic fluid embolism, and 7) genital tract sepsis. Underlying causes of maternal deaths were recoded for bivariate analysis. Finally, maternal deaths were classified based on the location of death, into community (coroner) and hospital (permission) deaths.

All available autopsy logbooks were reviewed for the period of 1st January, 1995 to 31st December, 2014, and all cases of pregnancy-related deaths were recorded. Data were collected and cross-checked by two Pathologists, to prevent double entry. For each case of maternal death, data were collected on age, cause of death and category of death (Coroner's or hospital). The age categories used in this study is that recommended by the United Nations (UN).[22] The data obtained was entered into a computerized spreadsheet and analysed using SPSS software (Version 23). Frequency distributions and descriptive statistics were calculated for each variable. Chi-square analysis was performed where applicable, with the P -value set at 0.05. The relative proportions and the spectrum of direct underlying and immediate causes of maternal deaths were determined. Associations between cause of death (underlying and immediate) and age at death were determined. The associations between the category of death by location and the cause of death were also examined. Also the trend in the underlying causes of maternal death over the 20-year period of review was described.

Results

Age distribution of maternal deaths that had autopsy performed

There were 1,846 maternal deaths during the period of review (1995 to 2014), that had autopsies performed at the Korle-Bu Teaching Hospital (KBTH) mortuary. The majority 1,595 (86.4%) were classified as direct maternal deaths with 13.7% indirect maternal deaths (P<0.0001). The age ranged of the 1,595 who died from direct causes was 15 to 48 years, mean age 28.72 ±6.47years and median age 28.00 years. The modal age group was 25 to 29 years (26.4%) (figure 1).

Category of maternal deaths by location

The majority, 1,346 (84.4%) of the maternal deaths were coroner (community) cases, with 249 (15.6%) being hospital or permission cases (p< 0.0001).

Underlying and immediate causes of maternal deaths

The top five underlying causes of maternal death were: abortion (27.4%), hypertensive disorders in pregnancy (27.3), obstetrics haemorrhage (27.0%), ruptured tubal gestation (11.5%) and ruptured uterus in labour (5.1%) (Table 1).

The top five immediate causes of maternal death were: haemorrhagic shock (41.8%), septicaemia (19.4%) disseminated intravascular coagulation (DIC) (7.5%), anaemia (6.8%), and acute heart failure (6.6%) (Table 1).

Association between underlying causes of maternal deaths and other variables

Relationship between maternal age group and underlying cause of death

The common (62.3%) underling cause of maternal death among women aged group < 20 years and those within 20 - 24 years age group (41.6%) was abortion (P<0.0001). For women within the age groups of 25 -29 and 30 – 34, the common causes were hypertensive disorders in pregnancy (29.0%) and obstetric haemorrhage (35.65) (P<0.0001). Again for women aged 35 – 39 and 40 – 44 years, the common cause of were obstetric haemorrhage: 35.6% and 33.3% respectively (P<0.0001). However, hypertension in pregnancy was the commonest (55.6%) cause of death in women aged 45 -49 years (P<0.0001) **(**Table 2).

Relationship between location of maternal death and underlying cause of death

Among the coroner cases, the most (30.5%) underlying cause of death was abortion, p < 0.0001. For permission cases, the most (60.2%) underling cause of death was hypertensive disorders in pregnancy, p = 0.0001 (Table 3).

Relationship between year of underlying cause and immediate cause of maternal death

Haemorrhagic shock was the commonest immediate cause of maternal deaths in women dying from obstetric haemorrhage (49.1%) followed by ruptured tubal gestation (26.5%), and ruptured uterus in labour (11.4%). Septicaemia was the major immediate cause in those dying from abortion (80.6%) . For hypertensive disorders in pregnancy as an underlying cause of maternal deaths, the commonest immediate cause of death was intracranial haemorrhage (96.0%) (Table 4).

Trends in underlying causes of maternal death over years of deaths

Yearly distribution of the relative proportions of maternal death (1995 – 2014)

The highest proportion of deaths was recorded in 2002 (7.1%), followed by 2005 (6.9%), 2009 (6.8%), 2006 (6.2%), 2007 (6.2%) and 2004 (5.6%) (Table 5). There was a relative percentage rise of death within the first half of the review period of 0.38, compared to a decline of – 0.38 in the second half of the review period (Table 5). In general, maternal deaths declined over the 20-year period (Figure 2a and 2b).

Similarly, abortion, obstetric haemorrhage, and ruptured uterus as causes of maternal death have showed downward trends (figures 3a, 3b,3c and 3e). However, hypertensive disorders in pregnancy showed a relative rise over the period (figures 3a and 3d).

Table 1: Underlying and immediate causes of maternal deaths

Underlying cause of death	**Frequency (n =1595)**	**Percentage (%)**
Obstetrics haemorrhage	430	27.0
Abortion	437	27.4
Hypertensive in pregnancy	435	27.3
Ruptured tubal gestation	183	11.5
Ruptured uterus in labour	82	5.0
Amniotic fluid embolism	6	0.4
Genital tract sepsis	22	1.4
Total	**1,595**	**100.0**
Immediate cause of death		
Haemorrhagic shock	667	41.8
Septicaemia	310	19.4
Disseminated intravascular coagulation	119	7.5
Anaemia	108	6.8
Intracranial haemorrhage	99	6.2
Acute renal failure	94	5.9
Acute cardiac failure	106	6.6
Cerebral oedema	80	5.0
HELLP syndrome	12	0.8
Total	**1,595**	**100.0**

Table 2: Relationship between maternal age group and underlying cause of death

UNDERLYING CAUSE OF DEATH									
	Obst. haemorrhage	**Abortion**	**HDs in pregn**	**Ruptured tubal gestation**	**Rupture uterus**	**Amniotic fluids embolism**	**GTS**	**Total**	**P-Values**
≤20	17	76	19	9	1	0	0	122	0.0001
	13.9%	62.3%	15.6%	7.4%	.8%	0.0%	0.0%	100.0%	
20 – 24	53	133	73	50	8	0	3	320	
	16.6%	41.6%	22.8%	15.6%	2.5%	0.0%	.9%	100.0%	
25 – 29	104	111	122	61	12	3	8	421	
	24.7%	26.4%	29.0%	14.5%	2.9%	.7%	1.9%	100.0%	
30 – 34	139	70	110	31	30	2	8	390	
	35.6%	17.9%	28.2%	7.9%	7.7%	.5%	2.1%	100.0%	
35 – 39	94	34	88	22	22	1	3	264	
	35.6%	12.9%	33.3%	8.3%	8.3%	.4%	1.1%	100.0%	
40 – 44	23	11	18	9	8	0	0	69	
	33.3%	15.9%	26.1%	13.0%	11.6%	0.0%	0.0%	100.0%	
45 – 49	0	2	5	1	1	0	0	9	
	0.0%	22.2%	55.6%	11.1%	11.1%	0.0%	0.0%	100.0%	
Total	430	437	435	183	82	6	22	1595	
	27.0%	27.4%	27.3%	11.5%	5.1%	.4%	1.4%	100.0%	

Chi-square (X^2) = (36, 1595) = 227.364, P ≤ 0.001

KEY: *OBST= obstetric, HDS =hypertensive disorders, GTS genital tract sepsis*

Table 3: Relationship between the underlying cause and the category (location) of maternal death

CATEGORY OF DEATH					
		Coroner N(%)	**Permission N(/%)**	**Total N(/%)**	**P-Values**
UNDERLYING CAUSE OF DEATH	Obstetric Haemorrhage	371	59	430	0.0001
		(27.6)	(23.7)	(27.0)	
	Abortion	411	26	437	
		(30.5)	(10.4)	(27.4)	
	Hypertensive disorders in pregnant	285	150	435	
		(21.2)	(60.2)	(27.3)	
	Ruptured tubal gestation	181	2	183	
		(13.4)	(0.8)	(11.5)	
	Rupture uterus	82	0	82	
		(6.1)	(0.0)	(5.1)	
	Amniotic fluids embolism	5	1	6	
		(0.4)	(0.4)	(0.4)	
	Genital tract sepsis	11	11	22	
		(0.8)	(4.4)	(1.4)	
Total		1346	249	1595	
		(100.0)	(100.0)	(100.0)	

Chi-square (X^2) = (6, 1595) = 213.925, P ≤ 0.001

Table 4: Relationship between year of underlying cause and immediate cause of maternal death

UNDERLYING CAUSE OF DEATH										
		PPH	**Abortion**	**PIH**	**Ruptured tubal gestation**	**Rupture uterus**	**Amniotic fluids embolism**	**GTSs**	**Total**	**P-values**
IMMEDIATE CAUSE OF DEATH	Haemorrhagic shock	328 (49.2)	68 (10.2)	18 (2.7)	177 (26.5)	76 (11.4)	0 (0.0)	0 (0.0)	667 (100.0)	0.0001
	Septicaemia	16 (5.2)	250 (80.6)	17 (5.5)	3 (0.1)	2 (0.06)	0 (0.0)	22 (7.1)	310 (100.0)	
	Anaemia	33 (30.6)	74 (68.5)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	108 (100.0)	
	DIC	26 (21.8)	17 (14.3)	68 (57.1)	0 (0.0)	2 (1.7)	6 (5.0)	0 (0.0)	119 (100.0)	
	Heart failure	17 (16.0)	8 (7.5)	79 (74.5)	1 ((0.9)	1 (0.9)	0 (0.0)	0 (0.0)	106 (100.0)	
	Acute renal failure	9 (9.6)	14 (4.3)	70 (74.5)	1 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	94 (100.0)	
	Intracerebral Haemorrhage	0 (0.0)	4 (4.0)	95 (96.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	99 (100.0)	
	HELLP syndrome	0 (0.0)	0 (0.0)	12 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	12 (100.0)	
	Cerebral oedema	1 (1.3)	2 (2.5)	75 (93.8)	1 (1.3)	1 (1.3)	0 (0.0)	0 (0.0)	80 (100.0)	
Total		430 (100.0)	437 (100.0)	435 (100.0)	183 (100.0)	82 (100.0)	6 (100.0)	22 (100.0)	1595	

Chi-square (X^2) = (48, 1595) = 2007.972, P ≤ 0.001

Table 5: Yearly trend in maternal deaths from autopsy data *(1995 to 2014)*

Year of death	Frequency (n = 1595)	Percentage (%)	Relative percentage (%) rise
1995	50	3.1	-
1996	50	3.1	0
1997	88	5.5	2.4
1998	67	4.2	-1.3
1999	60	3.8	-0.4
2000	71	4.5	0.7
2001	85	5.3	0.8
2002	113	7.1	1.8
2003	68	4.3	-2.8
2004	90	5.6	1.3
2005	110	6.9	1.3
2006	99	6.2	-0.6
2007	99	6.2	0
2008	89	5.6	1.2
2009	109	6.8	-1.9
2010	78	4.9	0.6
2011	87	5.5	-0.3
2012	83	5.2	1.8
2013	54	3.4	-0.6
2014	45	2.8	-
Total	1595	100.0	

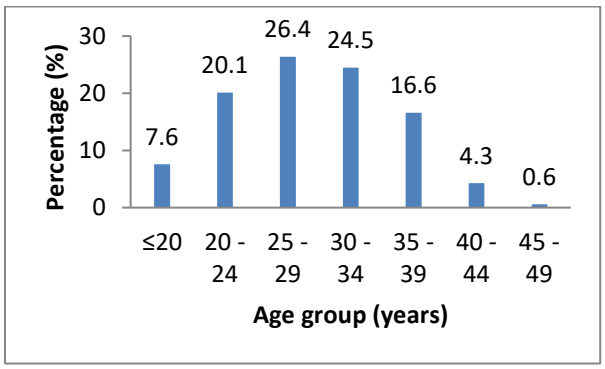

Figure 1: *Age distribution of study population*

Figure 2a: *Trend in all maternal deaths over the study period (1995 – 2014)*

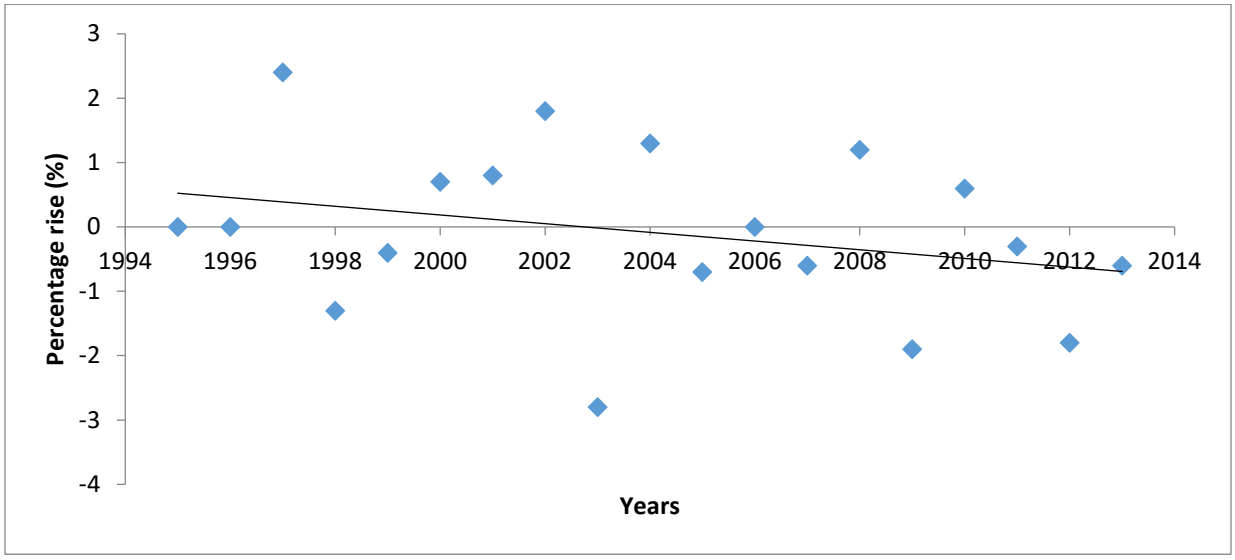

Figure 2b: *Trend in all maternal deaths over the study period (1995 – 2014)*

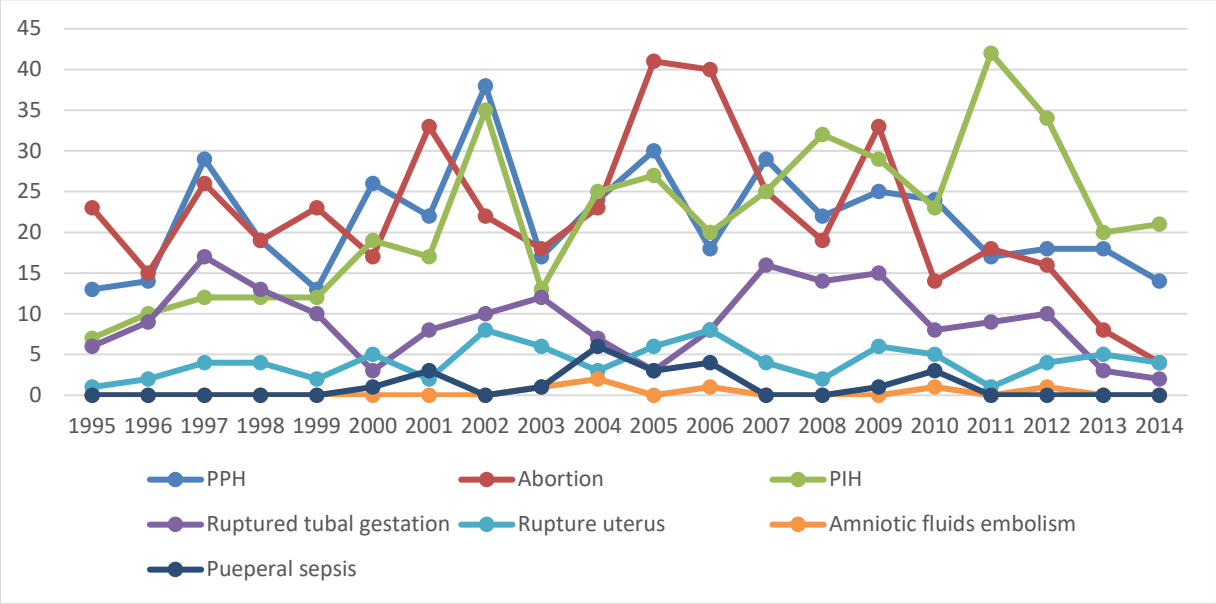

Figure 3a: *Trends in underlying causes of maternal death over the study period (1995 to 2014)*

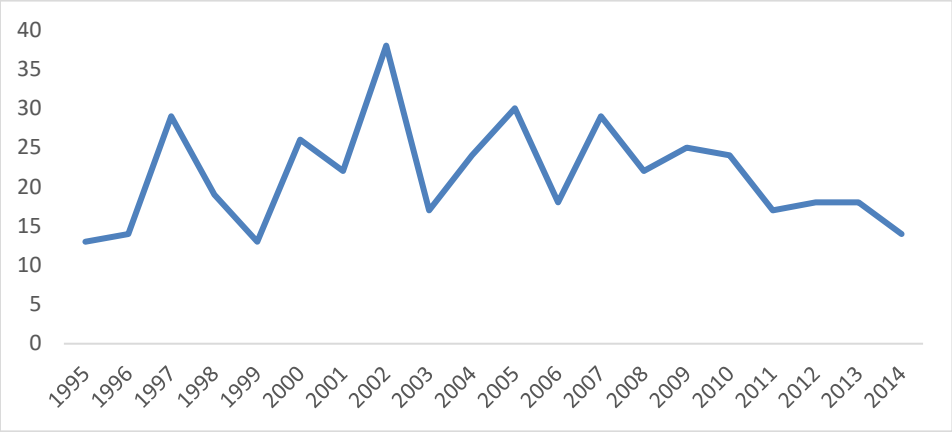

Figure 3b: *Trend in obstetric haemorrhage as underlying cause of maternal death over the study period (1995 to 2014)*

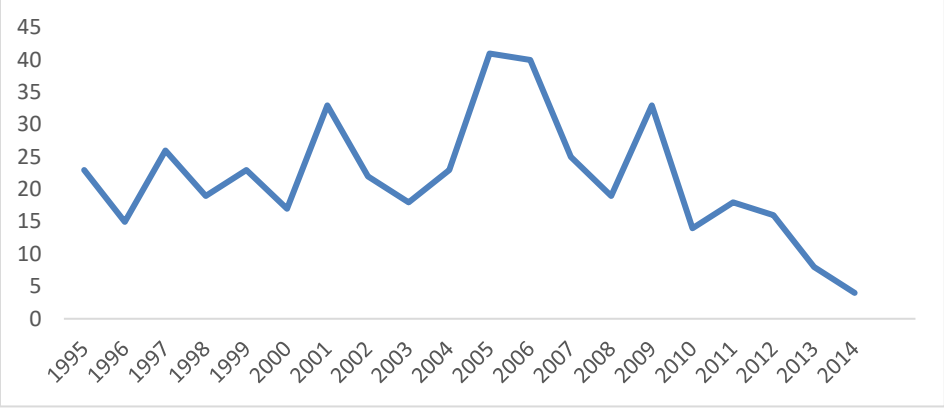

Figure 3c: *Trend in abortion as underlying cause of maternal death over the study period (1995 to 2014)*

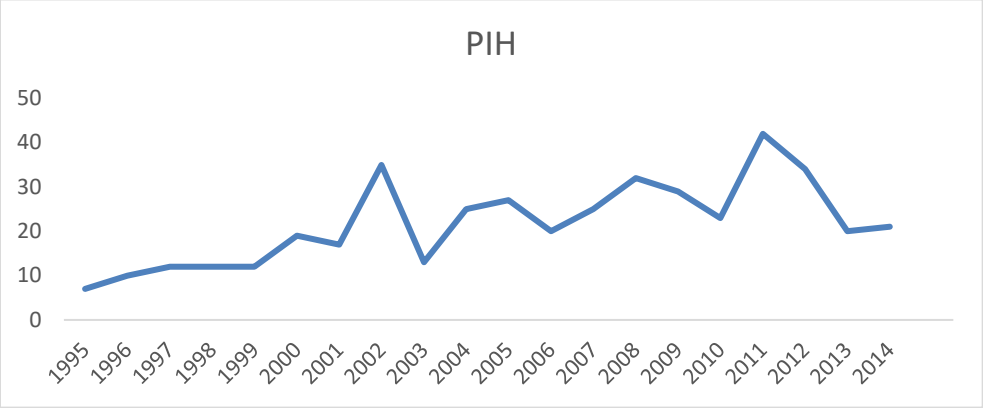

Figure 3d: Trend in hypertensive disorders in pregnancy as underlying cause of maternal death over *the study period (1995 to 2014)*

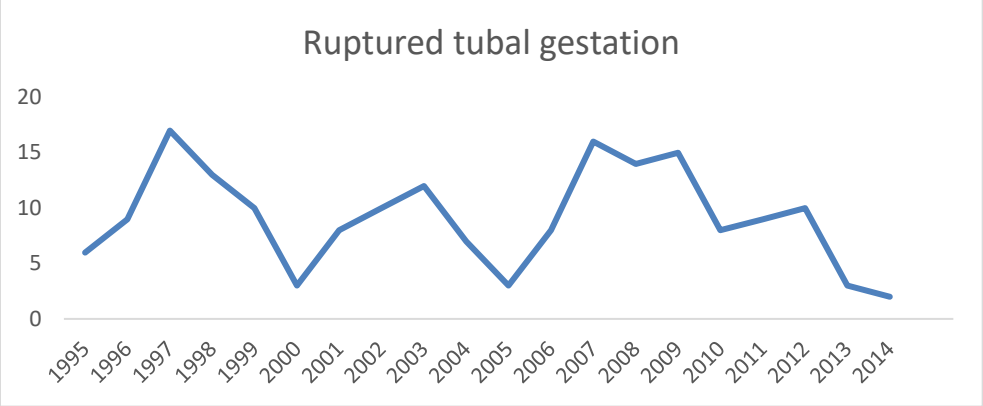

Figure 3e: *Trend in ruptured tubal gestation as underlying cause of maternal death over the study period (1995 to 2014)*

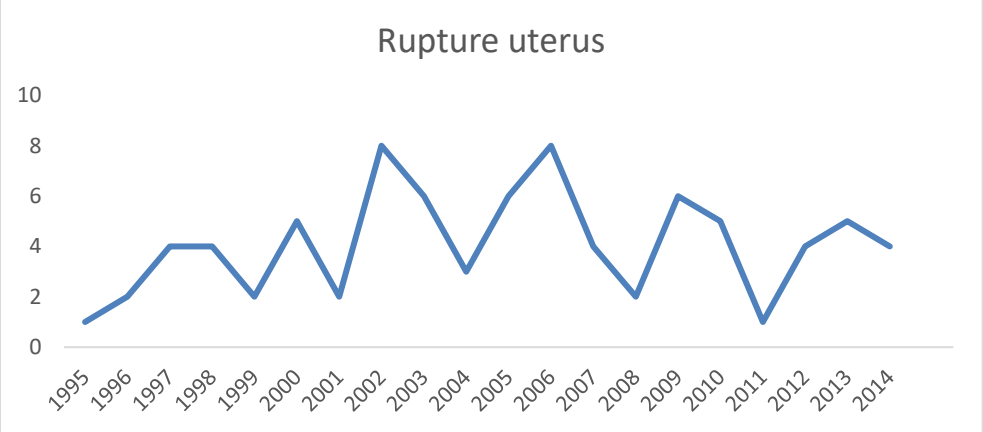

Figure 3f: *Trend in ruptured uterus in labour as underlying cause of maternal deaths over the study period (1995 to 2014)*

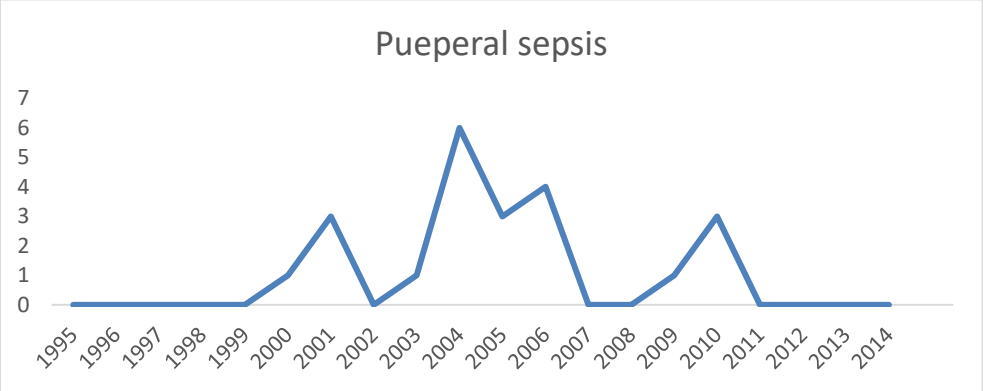

Figure 3g: *Trend in genital tract sepsis as underlying cause of maternal deaths over the study period (1995 to 2014)*

Discussion

Our analysis of the autopsy data on direct causes of maternal death at the KBTH mortuary from 1995 to 2014 provides new evidence on the relative proportions and trends of deaths. The majority of the deaths in this current review were classified as direct maternal deaths (86.4%; P<0.0001), involving very young women (mean age 28.72 ±6.47years), and that more than half were younger than 30-years of age. These findings are in line with previous studies in Africa[23,24,25], For instance, Dinyain *et al*., (2013) in their study of 48 autopsies certified maternal deaths reported a mean age of 27.9±7.5 [24]. This age group is consistent with the peak age of active female reproductive years. Also, Faduyile *et al.*, (2017), recently in Nigeria reported that maternal deaths were common among women younger than 35-years of age.[25] Direct obstetric causes being the major cause of maternal death in this current study differs from Panchabhai et al., (2009) study in India who found indirect causes as the common causes of maternal death.[19] However, our findings are similar to previous autopsy and clinical studies in Ghana[15,16], Nigeria[14,17,18,20,23,24,25] and across the globe[26,27] which reported direct obstetrics deaths as the major causes of maternal mortality.

The majority of the maternal deaths in this current study were coroner cases (84.4%, P<0.0001). This supports findings of previous studies conducted across the globe, that most maternal deaths occurred outside a health facility or shortly on arrival in the facility.[16,18,19] For instance, Der et al., (2013) study in Ghana reported that 81.6% of all pregnancy related deaths occurred in the community.[16] This may indicate that a proportionately higher number of young women are dying in the communities from pregnancy related causes.

The top five direct causes of maternal deaths were: abortion (27.4%), hypertensive disorders in pregnancy (27.3%), obstetric haemorrhage (27.0%), ruptured ectopic gestation (11.5%) and ruptured uterus in labour (5.1%). Also, the top five immediate causes of maternal death were: haemorrhagic shock (41.8%), septicaemia (19.4%), DIC (7.5%), anaemia (6.8%) and intracranial haemorrhage (6.6%). This is in agreement with the findings of previous autopsy and clinical studies in Ghana[15,16,28,29] west Africa[14,17,18] and India[19].

Among the coroner cases, the common (30.5%) underlying cause of death was abortion, (P<0.0000). For the permission cases, many (60.2%) of the underlying causes of death were due to hypertension in pregnancy (P<0.0000), similar to previous studies in Ghana.[15,16]

Abortion in this study was found to be the leading direct cause of maternal death and more so in the community. Again, abortion was most likely to be complicated by septicaemia as the immediate cause of death (P<0.0001). Autopsy studies in other parts of the world similarly found abortion and its associated complications to be the major predictor of maternal mortality.[15,30,31] The current findings however, disagreed with others who found obstetric haemorrhage as the leading cause of maternal death.[16,32,33] Furthermore, the study also found a positive significant statistical association with younger age at death (P<0.0001), similar to the findings in a previous study in Ghana.[16] Among factors that may have accounted for this association in this age group is the fact that most of the women within this age group are unmarried and therefore, more likely to seek illegal abortion to avoid stigmatization, as noted by previous publications.[16,34,35] Another study by Fubara *et al*., (2007) in Port-Harcourt, South-South Nigeria on abortion-related deaths showed that septic shock accounted for 50% of abortion-related maternal deaths.[18] Similarly, abortion related complications were identified globally by Say et al., (2014) as contributors of maternal mortality.[26]

Obstetric haemorrhage as a cause of maternal death was the third in descending order of magnitude and was also found to be common among women aged 30-years and above (P<0.0001). The leading immediate cause of death was haemorrhagic shock, and this means that a woman with peripartum haemorrhage in the Ghana is at a higher risk of dying from haemorrhagic shock, as women in other parts of Africa[5]. Obstetric haemorrhage being the third cause of maternal death in this current study is in line with some studies in Africa[15] and India[19], but differs from others reports in Africa [7,16,17,26,36], thus a mixed picture than. For instance, Dinyain *et al.*, (2013) in their autopsy study in Nigeria

reported haemorrhage as the leading direct cause of maternal death and this accounted for more than half of their study population.[24]

Hypertensive disorder in pregnancy was identified as the second direct obstetric cause of maternal death in this study. It was also found to be significantly common in women aged 30-years and above (P<0.0001). Furthermore, a good proportion of these deaths occurred in health facilities. These findings support previous autopsy studies in Ghana[15,16] and Nigeria[24,25]. It however differs from findings from other studies in Ghana[21,37] and India[19,20] which reported hypertensive disorders in pregnancy as the leading cause of maternal death. For instance, Lee *et al.,* (2011) reported the top five causes of maternal death as hypertensive states of pregnancy (26.4%), haemorrhage (16.8%), genital tract sepsis (10.6%), early pregnancy deaths (8.4%) and infection (8.7%).[23] The common immediate causes of death in women dying of hypertensive disorders in pregnancy in descending order were: intracranial haemorrhage, heart failure, cerebral oedema, acute renal failure and DIC similar to Der et al., study in Ghana.[16]

Historical trends in maternal mortality

Maternal mortality in the 1870s in areas now called developed world exceeded 600 per 100,000 live births, a figure comparable with current maternal mortality ratios in many developing countries; Safe Motherhood Inter-Agency Group, 2000.[38] Significant reductions in maternal mortality were accomplished first in northwestern Europe (Sweden, Norway, Denmark, and the Netherlands) in the mid- to late-19th century, and several decades later in Britain and the United States.[39]

In the 21st century, the risk of a woman dying during childbirth has declined significantly across the world, yet inequality in health infrastructure and personnel across the globe, countries, and in some regions still remains major predictors of pregnancy outcome. Published data available indicated a significant decline in maternal death in countries such as Finland, Greece, Iceland, and Poland as at the end of 2015.[40] The 100-fold decline of maternal mortality is attributable to the modern scientific understanding of the cause of maternal mortality and the adoption of practices which appear surprisingly simple in hindsight. This is however not true of countries in Asia and Sub-Saharan Africa.[40,41] The five countries with the highest number of maternal deaths in 2015 were: Nigeria (58,000); India (45,000); Democratic Republic of Congo (22,000); Ethiopia (11,000); and Pakistan (9,700).[41]

A significant finding in this current retrospective autopsy study in Accra Ghana, is the decline in total maternal deaths, especially during the second half of the study period (2005 – 2014). Of course, the chances that a woman dies from maternal causes are not only dependent on the risk per pregnancy – which we looked at above – but also the number of pregnancies she has. With the increased family planning rate in Ghana over the years, this is expected. This supports the general trend in maternal globally.[40,41,42]

Specifically, we found a decline in maternal deaths relating to abortion, obstetric haemorrhage, ruptured ectopic gestation and ruptured uterus in labour over the study period. The decline in obstetric haemorrhage as a direct cause of maternal over the 20-year period supports studies in both developed and developing that reported a declined peripartum death between 1990 and 2015.[5, 42]

However, hypertensive disorders in pregnancy is not only major cause of maternal death as reported by Adu-Bonsaffoh et al., (2013)[37], but showed a rising trend during the period of this review. This may be attributed to the fact that hypertensive disorders occur in pregnancy, continue throughout labour and the early puerperium. Again the pathogenesis of hypertension in pregnancy is not clear. More recently, the report of the Ghana Maternal Health Survey indicated that the relative proportion of maternal death due to hypertension in pregnancy has doubled over the past decade, showing an increment from 9% in 2007 to 18% in 2017.[43] This recent national report buttresses the finding of rising trends hypertensive maternal deaths determined in this study. Recent global WHO estimates indicates that the maternal mortality ratios in Ghana remains unacceptably high (308 per 100,000 live births) despite implementation of several measures to improve maternal health in the country.[44] There is the need to re-strategize as a country to improve maternal health by instituting evidence-based and locally appropriate measures with specific reference to the major underlying causes of maternal morbidity and mortality

Conclusion

The major direct obstetric causes of maternal deaths identified by this study were: abortion, hypertensive disorders in pregnancy, obstetrics haemorrhage, ruptured tubal gestation and ruptured uterus in labour. Most of the deaths occurred in the community and commonly involved younger women. There was a general decline in most of the underlying causes of maternal death, except hypertension in pregnancy, which showed a rising trend. This autopsy based maternal mortality study would have been more robust if the enforcement of the Coroner's law was in place so that all cases of maternal deaths are investigated by autopsy. We therefore recommend the Ghana Government to have a second look at this Act and its strict implementation.

Strength of the study

1. The large sample size in current study conducted in the mortuary of the largest referral hospital in Ghana can be said to have a better representation of the prevalence of the direct causes of maternal deaths.

2. The present study provides detailed pathological analysis of maternal mortality in a tertiary hospital covering a period of 20-years.
3. The study further highlighted the importance of autopsy in the investigation of maternal mortality, especially in countries where the vital registration systems are not robust.

Limitations of the study

1. The retrospective nature of the study design is a major limitation.
2. All the maternal deaths in the catchment area of the referral hospital were not subjected to autopsy investigation, and this may have introduced a bias in the study findings. Thus, it is possible that exclusion of cases which were not autopsied may have skewed the data.

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CASE REPORT

CASE REPORT OF BIPOLAR DISORDER WITH SUBSTANCE USE DISORDER; COMORBIDITY OR CONFOUNDERS?

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Abstract

Objective: Bipolar disorder commonly presents with substance use and there is the diagnostic challenge of one being a sequela of the other or the two being co-morbid conditions. The distinction is important as the effective treatment of the primary condition can lead to a concomitant remittance of the other. A misdiagnosis and a consequent ineffective treatment on the other hand, can lead to worsening prognosis of both conditions in the person. This aims at bringing attention to this diagnostic dilemma and the need to hone skills for proper diagnosis and eventual effective treatment.

Case Presentation: Ms. KK is a 28-year-old divorcee and Human Resources Manager who presented with gregariousness, sleep difficulty and smoking of marijuana for two months. She had resumed smoking of marijuana after some 6 months break. She admitted to suicidal ideation and behaviours even though she also had many big plans to transform mental healthcare in Ghana. She was admitted a year earlier as schizophrenia for less than a week after which she had a divorce.
Ms. KK was referred for management of substance induced psychosis to include residential rehabilitation. She was managed after review for bipolar disorder with substance use disorder. She was treated with long-acting second generation antipsychotic and she quit smoking with the remission of her mood symptoms after two months.

Conclusion: Mood disorders can occur with substance use disorder as a co-morbid condition or part of the symptomatology of mood disorder. Substance use disorder can also present with mood symptoms or unmask mood disorders. When the correct diagnosis of a primary mood disorder, bipolar disorder in this case, with co-morbid substance use disorder is made, effective treatment of the mood disorder can remit substance use.

Key Words: *bipolar disorder, comorbidity, substance use disorder*

Introduction and background

The two main mood disorders according to the Diagnostic and Statistical Manual, fifth edition, DSM V, are bipolar disorder and depressive disorder. Over 60% of persons with bipolar disorder were observed to have substance use disorder in the National Institute of Mental Health (NIMH) Epidemiological Catchment Area (ECA) study in the US[1]. Many theories have been given for this co-morbidity and *Quello* et al put them into 3 main categories: disorder fostering disorder, overlapping neurobiology through kindling and diagnostic confounding[2]. They explained disorder fostering disorder as persons with mood disorder self-medicating for relief of their symptoms and chronic drug abuse unmasking subclinical mood disorder. Thus, persons with mania will take opioids which depresses and those with depression will take stimulants like cocaine.

A disorder fostering disorder may also be explained by substance use disorder being a sequela of mood disorder, particularly, bipolar disorder in the manic phase. One feature of mania is impulsivity[3] and this leads them to undertake risky ventures which include taking of substances of abuse. The impulsivity makes them try substances available to them and not necessarily stimulant or depressant as all substances of abuse give some euphoria and this is what they seek. There is not much published data on the drug seeking behaviour of persons with bipolar disorder.

It is important to establish a primary diagnosis of bipolar disorder and the substance use disorder as a "complication" of the mood disorder rather than another condition starting de novo. This is more so as bipolar disorder has been shown to be missed in up to 70% of cases, and in some instances up to 10 years, including periods of seeing a psychiatrist[4]. Once the primary diagnosis is missed and the focus is turned on substance use disorder, the patient gets an ineffective treatment moving from one rehabilitation centre to another in search of treatment for the "wrong" disorder.

The converse is even more complex and confounding in nature when a person with substance use disorder presents with symptoms of mood disorder. There is reported over-diagnosis of mood disorder among persons with substance use disorder as many of them will present with mood symptoms[5]. Over-reliance on the presenting symptoms to make a diagnosis is usually what will lead to a misdiagnosis. A careful longitudinal history

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is necessary to make the right diagnosis of a primary substance use disorder presenting with a mood episode.

It is essential the correct diagnosis out of a possible three; co-morbid bipolar disorder with substance use disorder, substance induced mood disorder or bipolar disorder using substances, is made as each of them is managed significantly differently[1]. While the person with outright co-morbid conditions will require a lifetime management of both conditions, the other two will require management of only the primary disorder. Again, substance use disorder is managed mainly by psychotherapy in Ghana beyond the initial detoxification, while bipolar disorder will require a lifetime pharmacotherapy treatment[6].

In areas, where screening of substances of abuse are not common and clinical history is largely used to make diagnosis, care needs to be taken to avoid the over-diagnosis of substance induced disorders which require the substance of abuse to be necessary and sufficient to cause the presenting symptoms[7]. Even where the screening is available, they tend to only detect the presence or not of the substance of abuse and the sheer presence of a substance of abuse is not enough to make a diagnosis of substance induced disorder.

Case report

Ms. KK is a 28-year-old human resources manager who divorced a year prior to presentation. She had been unemployed for some 5 months at presentation and was living with parents in the city. She was referred to our facility as cannabis induced psychosis for detoxification and subsequent management at a rehabilitation centre. Both parents are highly educated health professionals and were very concerned. They initially discussed how we will manage her rehabilitation in a phone conversation. The father followed up later to the facility alone and arranged for patient to be seen alone later.

Ms. KK had over an hour interview with the consultant psychiatrist on their first encounter, but subsequent visits were much shorter. She presented with sleep difficulties, gregariousness and resumption of smoking marijuana for at least two months. She admitted meeting many people at her instance but explains it was because of her "big plans" to transform the mental health system in Ghana. She explained she could change things pretty quick with her experience from living abroad. Even though she admitted smoking marijuana on a few occasions, she claimed it was not regular and occurred once or twice every 2 - 3 weeks. She was sleeping less than 4 hours every night but attributed that to her courses she was taking online and the need to stay awake and work on her many projects. Moreover, her parents also worked a lot at night and dawn so she explained it away as just a family culture. The parents admitted waking up early to read themselves and confirmed her online courses as well.

Ms. KK admitted to suicidal ideation as she sometimes felt like walking up a cliff and throwing herself down. She explained her heightened eroticism during this period as that is how she has always been but unnoticed by people close to her and was now discovering her sexuality. Though mother says she is the loudest among siblings, Ms. KK seemed to be talking a bit too much. Her speech was understandable, but they did not see the relevance of some of the themes she talked about. She visited many people and sometimes lied about who she was visiting claiming they were close relatives when they were not. For instance, she told her psychiatrist she was visiting an uncle in the same city only to realise she had no other relatives in the city. The father said she has once admitted she was a "pathological liar" and smoked marijuana. This is what led parents to believe she might be smoking too much and possibly will need a rehabilitation.

Ms. KK was admitted to a psychiatry department of a hospital abroad and managed for psychosis on risperidone, an antipsychotic used as adjunctive therapy to mood stabilisers for mania[8]. She described periods when she felt lonely in her one-year marriage as husband was usually not home. She recalls an argument with her then husband (among a series of arguments before) directly led to her admission. She was discharged after less than a week in hospital on same medication but had stopped taking it for some 6 months before presentation. There is no known family history of any mental illness.

On presentation, Ms. KK looked appropriately dressed and well kempt. She was disinhibited and talked a lot. Most of her speech was about her great plans to improve our department as an HR consultant. She denied any special powers, wealth or abilities when asked directly though she admitted sleeping very little to work on her many plans. She had no hallucinations. Her concentration was impaired as she made 5 mistakes with the serial 7 and lasted more than a minute. She was however well oriented in time, place and person, had good attention span, intact memory, good judgment and intact abstraction. She admitted she had a problem related to mental ill-health and was ready to take medication prescribed for her as long as it will get her better.

Ms. KK was managed for a bipolar disorder, manic episode with mild cannabis use disorder on oral aripiprazole and lamotrigine. This improved her sleep which she liked, but stopped taking the medications once she could sleep better. A few weeks after non-compliance almost every symptom she presented with re-appeared and this time was put on long acting paliperidone. Paliperidone is not easily accessible in Ghana due to cost. A monthly maintenance cost in Ghana is about same as how much a qualified nurse will earn in a month. This is not covered by national health insurance and patients will have to pay out of pocket. Her parents offered to pay for the cost of her treatment.

Ms. KK improved on the long-acting second generation antipsychotic and quit smoking marijuana. Parents admitted she talked less and slept better.

Discussion

Ms. KK presented with symptoms of mania and could be diagnosed bipolar disorder. A similar manic episode most likely necessitated her hospital admission a year earlier and also led to her divorce. The impulsivity of her manic episode led her to resume the smoking of marijuana which was not regular. A primary diagnosis of bipolar disorder with non-compliance to oral medication required we use long-acting second-generation antipsychotic for her treatment in addition to motivational interviewing for cannabis use disorder. When the primary mood disorder was controlled, she quit the smoking of marijuana and had remorse for smoking.

Substance induced disorder diagnosis can only be made when symptoms on presentation can be sufficiently explained by the substance of abuse. Just the use of substance is not enough to make a diagnosis of substance induced disorder. Patients using substances of abuse who present with mood symptoms need a "cool off period" when substance is not used and observed for resolution of mood symptoms. If mood symptoms persist after detoxification, a co-morbid diagnosis can be considered if the history confirms the diagnosis of both.

Diagnosis of substance use disorder is still largely by clinical history and not just the presence of substances in body fluids. The presence of substance or the screen is important for the follow up and monitoring of substance use and not necessarily for diagnosis. Non-disclosure of extent of substance use is a symptom of substance use disorder and care need to be taken when taking history of drug habits for the correct diagnosis. Skilled motivational interviewing is necessary for finding the fine balance between how much substance patient is using and how much they are prepared to disclose in the history.

Nonetheless, it is crucial to make the right diagnosis for effective management as the wrong diagnosis worsens the prognosis of either condition in the patient.

Conclusion

The co-morbidity of bipolar disorder and substance use disorder poses significant diagnostic challenge as one can lead to symptoms of the other. In spite of this difficulty, it is important for clinicians to methodically tease out which is the primary diagnosis as the two are managed significantly differently. The effective treatment of the primary mood disorder can alleviate the symptoms of the co-occurring substance use disorder.

Recommendation

It is important when seeing patients with comorbidity of mood disorder and substance use disorder, the substance use is quantified by the determination of the frequency and amount used to know which of them is the primary disorder. For substance induced mood disorder the substance of abuse should be necessary and sufficient to cause the disorder and treatment should be focused on the substance use disorder. Similarly, if the mood disorder precedes the use of substances which is not in significant amounts to cause a mood disorder, then the focus should be on the mood disorder which will require medication.

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EIGHTEEN-YEAR-OLD NULLIPAROUS WOMAN WITH MASSIVE MUCINOUS CYSTADENOMA IN PREGNANCY: CASE REPORT

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Abstract

Background: Ovarian mucinous cystadenoma is rare in adolescents. We report the diagnosis and management of a massive ovarian mucinous cystadenoma in a pregnant adolescent.

Case Presentation: An 18-year-old G1PO was referred by a midwife to the Komfo Anokye Teaching Hospital on account of excessive abdominal distension at 25 weeks' gestation and an ultrasound scan finding of a large non-septate cystic adnexal mass. She, however, reported to the hospital 6 weeks later with a complaint of worsening abdominal distension and discomfort. A transabdominal ultrasound scan revealed single intrauterine gestation and a large non-septate cystic adnexal lesion measuring more than 19 cm in its widest plane. She had a conservative in-patients management followed by emergency caesarean delivery, exploratory laparotomy and unilateral salpingo-ophorectomy at 33 weeks 1 day. The outcome of the delivery was a 1.8 kg female infant with Apgar score of 4 and 6 at 1 and 5 minutes respectively. A 6.8 kg cystic ovarian mass measuring about 40 cm at its widest diameter was removed.

Conclusion: Although pregnancy-associated adnexal masses are not uncommon, significant socio-economic challenges may render the diagnosis and treatment of extremely large pelvic masses in pregnant adolescents difficult. The decision to optimize maternal and fetal outcomes is essential in managing rare conditions in marginalized obstetric populations.

Key Words: *Adolescent Pregnancy, Adnexal tumours, Mucinous cystadenoma, Antenatal care & Conservative surgery*

Introduction

Adnaexal masses can be found in both pregnant and non-pregnant women of any age, with prevalence of 0.19-8.8%.[1] Only 3-6% of all these masses are malignant, and the detection of asymptomatic and clinically in-apparent adnexal lesions are on the increase. [2] This is largely due to increased access, coverage of antenatal care and the availability of prenatal ultrasonography. Most of these lesions are diagnosed in the first trimester, and the incidence decreases with increasing gestation.[3] The benefits of this shift in the practice are not fully realized in the rural and the peri-urban areas of the West African sub-region due to delayed entry into antenatal clinics, logistics and human resource factors in the maternal health system.[4,5] They are consequently diagnosed late, at enormous sizes in late trimesters. Further, antenatal care in the adolescent age is characterized by poor attendance and inadequate care.[6] The underlying factors range from poor economic support, long commuting distances, unfriendly antenatal care programmes to the lack of insight into the usefulness of the care. The set-up makes it even more challenging to diagnose and treat these masses among adolescents in the low- and middle-income countries (LMIC).[7]

Functional cysts (follicular, corpus luteum and theca lutein cysts) account for the majority of benign adnaexal masses in pregnancy.[8] Other benign tumours include mature cystic teratoma, serous and mucinous cystadenoma. The ovarian mucinous cystadenoma is often a multilocular cyst with smooth outer and inner surfaces. Benign ovarian mucinous cystadenoma are common between the third and the fifth decades, but rare at the extremes of age, including the adolescent age.[9] Although they can grow to an enormous size, literature is scanty on rapidly growing ovarian mucinous cystadenoma in a pregnant adolescent.

There is no agreement among authors regarding the definitive management of adnexal masses in pregnancy.[10] Assessment using clinical, biochemical and ultrasonographic indices are helpful in choosing appropriate management recommendations. While some obstetricians prefer the conservative non-surgical approach because majority of these lesions resolve with increasing gestation, others prefer elective surgical treatment in the second trimester with

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concerns of ovarian malignancy, torsion, rupture, entrapment or obstruction of labour.[8] The considerations for the definitive management of ovarian tumours during pregnancy are strongly influenced by clinical, biochemical and imaging findings suggestive of ovarian malignancy or the decision to maximize maternal and fetal outcomes. Conservative surgery (ovarian cystectomy or salpingo-oophorectomy) often suffices as a treatment for most of the benign ovarian tumour.

We, therefore, present a case report of a massive ovarian mucinous cystadenoma in a pregnant adolescent.

Case Report

An 18-year-old nulliparous woman was referred from a peripheral healthcare facility to Komfo Anokye Teaching Hospital (KATH), on account of a suspected ovarian tumour in pregnancy.

The patient made an unusual early visit to the antenatal clinic (ANC) in the first trimester on account of signs and symptoms of anaemia. A full blood count and peripheral blood film assessment reported a haemoglobin level of 6.1 g/dL and a microcystic normochromic picture, respectively. She was treated with haematinics and dietary modifications. A dating ultrasound scan reported a single intrauterine gestation at 8 weeks 3days with no comment on the adnaexa. At a scheduled antenatal visit, the midwife noticed unusual distension of the abdomen. Follow up ultrasound scan reported a large non-septate cystic adnexal mass and appropriately grown fetus at 25 weeks + 6 days. Therefore, she was referred to KATH, but she defaulted and reported later to KATH at 31 weeks + 3 days gestation with worsening abdominal distension and discomfort. Apart from a low haemoglobin level, all the other screening investigations at the booking visit were normal.

She had had regular menstrual cycles prior to pregnancy, and she had never used any form of modern contraception. She had no significant previous medical or surgical history. The family history was negative for ovarian, colon, cervical, breast and endometrial carcinoma. She lived in a rural area, was unemployed and married to a labourer. She had an active health insurance card.

General physical examination revealed normal vital signs except for tachypnoea (respiratory rate 24 cycles/minute). Her weight and height were 64 kg and 162 cm respectively. Her breasts were bilaterally symmetric, with normal looking nipples with prominent areolar. The abdomen was grossly distended, with tribal marks running radially from the umbilicus (Figure 1). There was an obvious bulge in the suprapubic region, and laterally to the flanks bilaterally. The abdomen was tense but non-tender in all regions. The fetal heart rate was 158 beats per minute using sonicaid. The pelvic examination revealed a normal looking vulva, vagina and cervix. There was fullness in the cul-de-sac. It was difficult assessing the pelvic side walls.

Figure 1: A massively distended abdomen with a bulge in the suprapubic region.

An immediate transabdominal ultrasound scan reported a non-septate cyst with internal echoes (Figure 2). The cystic lesion appeared to originate from the right adnaexum. It measured more than 19 cm in its widest plane. The left ovary could not be visualized. There was minimal free intraperitoneal fluid.

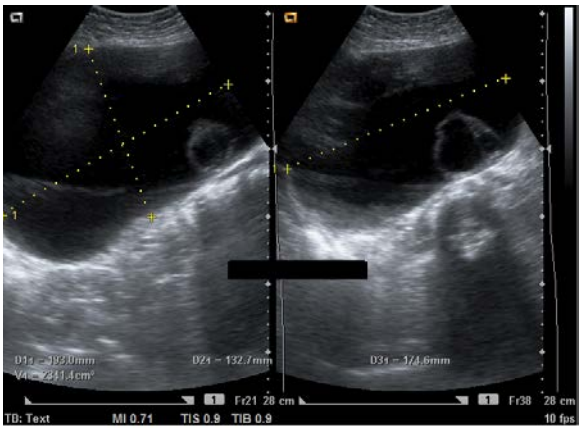

Figure 2: An ultrasound scan of a non-septate ovarian cyst with internal echoes.

Laboratory investigations including full blood count, serum biochemistry, cancer antigen-125 (Ca-125), Latic acid dehydrogenase (LDH) and alpha-fetoproteins (AFP) reported the following findings: normochromic microcytic anaemia with haemoglobin level of 9.3 g/dL, platelet of 240 x 10^3 / microlitre, LDH 349 U/L (225-450), CA-125 29U/ml (0-39), alpha-fetoprotein 123.3U/ml (0-10), and normal liver and renal function tests.

The case was discussed by a multidisciplinary team (MDT) consisting of physicians, nurses and midwives from feto-maternal, gynaecologic oncology, anaesthesia, paediatric and radiation oncology units.

The findings on evaluation were more suggestive of a benign lesion. The decision was to deliver at term by c-section, followed by exploratory laparotomy and treatment of the ovarian tumour. The probability of preterm delivery was also anticipated in this case. She was given dexamethasone to accelerate fetal lung maturation and put on folic acid and iron supplementation. A blood sample was also taken and cross-matched against four units of her blood type and saved at the blood bank. The findings and the management plan were explained to the patient, and informed consent sort for the in-patient care on the antenatal ward. A biweekly non-stress test (NST) was done as part of antepartum fetal monitoring during the in-patient care.

On the tenth day of admission, at 32 weeks + 6 days, she started experiencing mild to moderate lower abdominal pain. The pain was constant with no aggravating factors, and the pain was relieved after taking tramadol injection. This was not associated with vaginal bleeding or show. She could perceive fetal movements. It was not possible to assess contraction by palpation. The findings on vaginal examination were as follows: the cervix was closed, 2cm long, firm and posterior. An urgent ultrasound scan reported an adequate for gestation fetus with normal biophysical profile and umbilical artery velocimetry findings. The uterus was displaced to the left flank, and the nature of the lesion was confirmed as non-septate cystic with internal echoes. The lesion extended to the epigastrium and both hypochondria. The liver had a normal echo-pattern, and there was moderate bilateral hydronephrosis. The NST tracings were normal.

The lower abdominal pain became severe on the twelfth day of admission (33 weeks + 1-day gestation), and this time was associated with vomiting. On general physical examination, she looked agitated. She was moderately pale, not jaundiced and had a temperature of 36.7C. Her blood pressure was110/70mm/Hg and she had a pulse rate of 92 bpm, regular with good volume. Her chest was clinically clear. Her abdomen was grossly distended, very tender and tense with guarding in the umbilical region. Uterine contractions could not be assessed. The fetal heart rate was 148 bpm and was regular. Vaginal examination revealed a central, 2cm long cervix with closed external os.

A diagnosis of suspected ovarian cyst rupture was made. She was immediately prepared for emergency laparotomy and caesarean section. The neonatology team was informed to receive the baby. Under general anaesthesia, an abdominal midline incision was made from the suprapubic region to the epigastrium (Figure 3). The lower uterine segment was poorly formed; hence J-uterine incision was made in the lower segment to deliver the baby, placenta, and membranes. The uterus was repaired in layers (Figure 4).

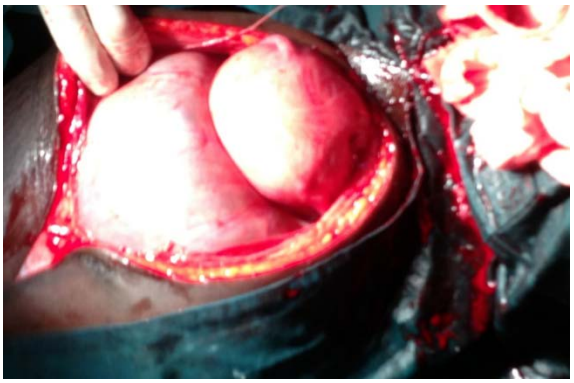

Figure 3: The large cyst and the gravid uterus during the surgery.

Figure 4: Intact ovarian cyst and the gravid uterus after the caesarean section.

The findings of the surgery were 1.80 kg female infant with Apgar score of 4 and 6 at 1 and 5 minutes respectively; and a 6.80 kg right cystic ovarian mass with an intact capsule. The surface of the ovary was smooth, with no external growths or adhesions (Figure 5). The ipsilateral fallopian tube was elongated and firmly attached to the capsule of the ovarian cyst.
Other intraoperative findings were:

- Grossly normal appearing left ovary and tube.
- Extensively stretched right infundibulopelvic and broad ligament.
- There was no ascites.
- The liver, bowels and the omentum felt normal and had no suspicious lesions.
- No tumor nodules were seen in the parietal and visceral peritoneum, including the Pouch of Douglas (POD), paracolic, subphrenic and subhepatic spaces.
- Pelvic and paraaortic lymph nodes were not enlarged.

Figure 5: Intact ovarian tumour showing smooth outer surface without external growths.

Right salpingo-oophorectomy was done. A window was created in the ipsilateral broad ligament to access that side of the pelvis retroperitoneum. The corresponding infundibulopelvic and round ligaments were skeletonized. The lesion was removed in one piece through the development of a series of pedicles and ligatures. Haemostasis was secured, and the abdomen was closed in layers. She was transfused with 2 units of whole blood. The right ovarian specimen was sent for histology. The patient had an uneventful recovery and was sent to the post-natal ward.

The baby was received and resuscitated by the neonatologist and sent to the Mother-Baby Unit (MBU). The neonate was given caffeine citrate and intravenous fluids, and breast feeding was initiated within four hours of delivery. The random blood sugar (RBS), heart rate (HR), respiratory rate (RR), S_PO^2 of the neonate were monitored every 2 hours for the first 24-hours. The body temperature of the baby was maintained between 36.5 and 37.5°C

She had an uneventful recovery, and both mother and baby were discharged from the hospital on a post-operative day-5 for scheduled post-natal clinic and then follow-up every 3 months.

Macroscopic and microscopic histopathologic examination reported multilocular ovarian cystic measuring 40 cm at its widest point and weighed 6.8 kg (Figure 6-8). It contained gelatinous substance, had both smooth inner and outer surfaces with no papillae and solid areas. The attached tube was 13 cm long and was grossly normal. On the micro-level, the specimen showed a multilocular ovarian cyst lined by simple mucinous adenomatous cells without stromal invasion, no evidence of pleomorphism or atypia. The picture is compatible with mucinous cystadenoma. The fallopian tube shows insignificant pathological changes.

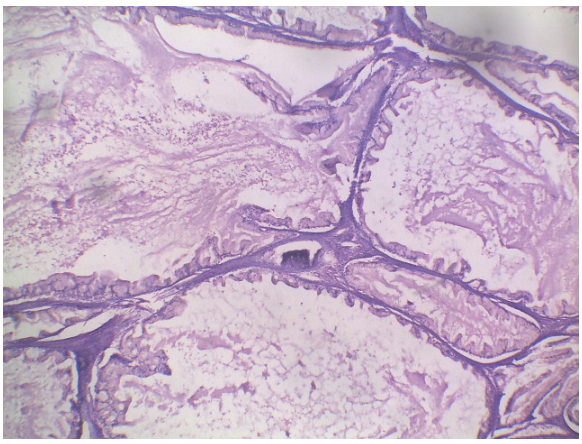

Figure 6: Magnification X40

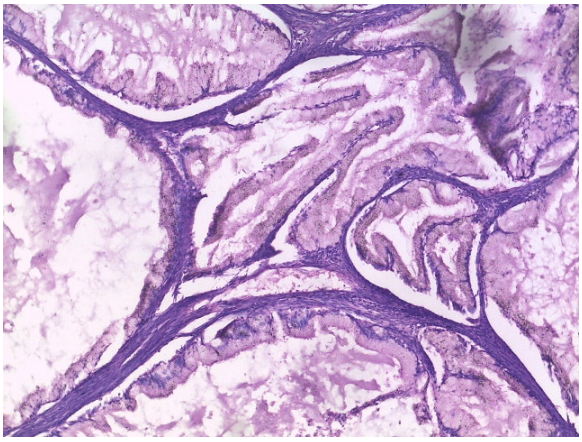

Figure 7: Magnification X 100:

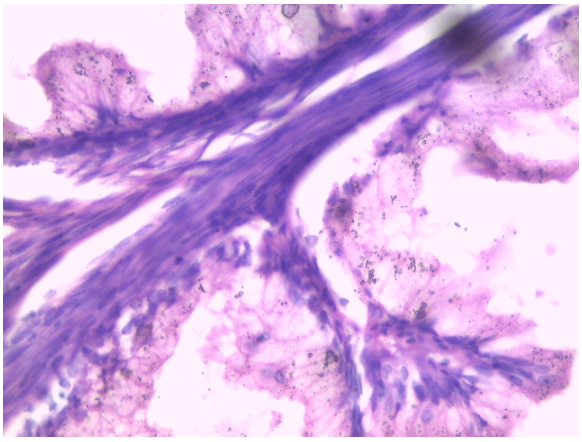

Figure 8: Magnification X 400:

Figure 6,7 & 8: Multilocular mucin-filled cysts supported by scant stroma and lined by bland mucinous columnar epithelium.

Discussion

The availability of sensitive pregnancy test kits, ultrasound scans and increased access and coverage of antenatal clinics in early pregnancy is increasing the detection of asymptomatic and clinically in-apparent adnexal lesions.[11] Accessible and adequate antenatal care, through early detection of danger signs and

management of potential complications, is cardinal in preventing maternal and perinatal morbidity and mortality.[12] An antenatal care in the adolescent age is characterized by poor attendance and inadequate care. Several factors ranging from poor economic support, long commuting distances, through unfriendly care antenatal care programmes to lack of insight into the usefulness of the care are key issues affecting the care. While it is exciting to demonstrate the evidence of pregnancy, the number of foetuses and cardiac activity, it is even more important to be meticulous in ensuring that the adnexae are assessed to rule out masses that may have devastating consequences on the pregnancy.

Ultrasound imaging is important in differentiating between benign and malignant adnexal tumours but difficulties exist in using antenatal ultrasound assessment to differentiate tumours of low malignant potential from benign neoplasms.[13] Certain features like septations, solid areas and papillary projections, when reported on ultrasound scan increase the suspicion for a possible malignant adnexal mass. Although colour flow doppler interrogation may be helpful in the assessment of adnexal masses, it has a false-positive rate of nearly 50% due to the overlap of the low-capacitance blood-flow patterns of pregnancy and malignancy.[14] When in doubt, further evaluation by magnetic resonance imaging (MRI) scan can help to distinguish benign from malignant, with an overall accuracy of 93% for malignancy. [15]

Apart from elevated alpha-fetoprotein level, the rest of the markers: LDH and CA-125, had their serum level within the normal range. The relevance of elevated level alpha fetoprotein was an issue of debate. Some of these oncofoetal molecules are involved in biological function associated with development, differentiation and fetal maturation. Alpha fetoprotein is routinely used for fetal surveillance rather than tumour detection during pregnancy.[16] Elevated maternal serum alpha fetoprotein (MSAFP) may be associated with increased risk of adverse outcomes of pregnancy such as fetal loss, prematurity and intrauterine growth restriction (IUGR).[17] Moreover, placenta and fetal anomalies (morbidly adherent placenta, trisomy 21 and neural tube defect) may also present with an increased level of these markers. The CA-125 is less specific, and its serum level exhibit significant variation in pregnancy.

The findings on evaluation were more suggestive of a benign lesion. Studies recommend surgical intervention for suspected ovarian malignancy, tumour torsion, tumour rupture or obstruction of labour in carefully selected adnexal masses in pregnancy.[3] The size of the mass made ovarian torsion less likely, but complications such as cyst rupture, cyst entrapment and intracystic haemorrhage were anticipated.

The realization of the ideals of ANC is often a difficulty among pregnant adolescents.[12] It is not the usual practice to consider early delivery in the absence of significant obstetric indication. At the time of laparatomy, the caesarean section was appropriate to enhance perinatal outcomes, especially in this case where there were significant socioeconomic challenges. It was not certain that adequate antenatal care would be maintained between the laparotomy and eventual delivery at term, as this was evidenced by the patient's delay in reporting to the teaching hospital. Further, her rural residence and long commuting distance to the teaching hospital made it impractical to delay delivery till term. It is critical that these lesions are also managed by taking cognizance of the specific needs of a marginalized population to optimize maternal and fetal outcomes.

It was, however, difficult to explain the cause of the asphyxia. Birth asphyxia and prematurity are two common causes of neonatal mortality in Ghana.[18] Acute deterioration of fetal heart pattern may have been caused by transient maternal hypotension that may have resulted from aortocaval compression during induction of anaesthesia and the delivery.[19] The presence of a neonatologist for immediate resuscitation and follow up NICU admission were important in ensuring good neonatal outcomes after the delivery.

Although no immunohistochemical staining was done to assess the hormone receptive status of the cyst, earlier case reports have reported rapid growth in mucinous cystadenoma with luteinized stroma.[20,21] These tumours have been reported to demonstrate oestrogen and human chronic gonadotropin positivity on immunohistochemical staining.

Conclusion

Although pregnancy-associated adnexal masses are not uncommon, significant socio-economic challenges may render the diagnosis and treatment of extremely large pelvic masses difficult in pregnant adolescents. The decision to optimize maternal and fetal outcomes is essential in managing rare conditions in marginalized obstetric populations.

Abbreviation

ANC: Antenatal Clinic
MSAFP: Maternal Serum Alpha Fetoprotein
MRI: Magnetic Resonance Imaging
POD: Pouch of Douglas
IUGR: Intrauterine Growth Restriction
LDH: lactic Acid Dehydrogenase
KATH: Komfo Anokye Teaching Hospital

Declarations

Ethics approval and consent to participate

The case report was approved by the Research and Development Unit of the Komfo Anokye Teaching Hospital (KATH). The client was assured of confidentiality. Participation was voluntary and the

patient was informed of the right to pull out at any point which would not affect the care she was receiving. An informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Consent for Publication

The patient gave a consent for the publication of potentially identifying images and clinical details. The findings and the management were explained to the patient and informed consent sort for publication. The research and development Unit of the Komfo Anokye Teaching also approved the publication of the case report.

Availability of data and materials

The dataset is stored in a repository, this is with the Record Department, Komfo Anokye Teaching Hospital Library, Kumasi. Other details can be made available on reasonable request through the corresponding author.

Competing interests

The authors declare no competing interests.

Funding

There were no external grants received for the case report. Researchers of this study bear all expenses related to the study

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RURAL HEALTH:
FROM DISEASE ERADICATION TO MEDICAL FIELD UNITS

During the 1930`s, reported rates of trypanosomiasis (Sleeping sickness) and yaws increased. Along with malaria, yaws was considered to be one of the biggest contributors to ill health in the country, with the heaviest burden in the north but a significant burden everywhere. In Accra, Cape Coast, Sekondi and Kumasi, 30% of children reporting to infant welfare centres had yaws. In 1937,the government undertook a trypanosomiasis control programme and 1944 a yaws eradication campaign was launched. Both campaigns where enormously successful in reducing the incidence of disease.

Governor Burns advocated for the continuation of medical services to rural areas as the eradication campaigns reached an end. He assigned personnel from the eradication campaigns to medical field units and arranged for them to receive additional training in the identification of several common diseases and pathogens in rural areas (such as malaria, guinea worm, bilharzias, leprosy) as well as training in basic vaccination and laboratory work. Headquarters was at Kintampo, centrally located for rural outreach work. Drs. Waddy and Saunders provided the leadership for the organization and development of the Medical Field Units.

Doctors such as Dr. Akiwumi, M.A. Barnor, and Frank Grant undertook groundbreaking medical research based out of the Medical Field Units, including the gathering of data on bilharzias, onchocerciasis, and guinea worm.

UNIVERSITY OF GHANA MEDICAL SCHOOL

Sir Frederick Gordon Guggisberg

First Medical School Building
(Basics Sciences Building)

Dr. Kwame Nkrumah

In 1891 Governor Sir Brandford Griffith proposed training of doctors at the Accra Hospital. Also in 1913 Governor Hugh Clifford also made a similar proposal .

The most serious attempt was made by Sir Frederick Gordon Guggisberg, Governor of Gold Coast from 1919 to 1927.

He planned to set up a medical school centred around Gold Coast hospital (Korle-Bu hospital).The prospect was scuppered by 1928 partly because Guggisberg left Gold Coast in 1927.
In 1962 President Nkrumah decided that Ghana should, on its own, establish a medical school. That year, 59 students were enrolled to commence pre medical courses at the University of Ghana.

The basic sciences building was the first structure built for the medical school and is situated where Governor Guggisberg had planned to establish the medical school in Korle Bu. Four (4) Tower blocks were built to house the Departments of Medicine, Paediatrics, Obstetrics and Gynaecology and Surgery to complement the Wards built by Guggisberg.

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Book Chapter
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