PHLEBOTOMY BY HOUSE OFFICERS

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Abstract

Background: Phlebotomy is a highly complex technique, requiring knowledge and skill to perform. In advanced societies, all phlebotomists undergo a well-structured training with certification**.**

Objective: This study examines the practice of phlebotomy by house-officers (HO) in Korle-Bu Teaching Hospital, as part of expediency in health service delivery.

Methodology: Self-administered questionnaires were obtained from 54 Ghanaian trained HOs (out of a total of 85 HOs) from four main departments of the Korle-Bu Teaching Hospital in December 2010. Data obtained were analysed statistically using SPSS (Version 12; SPSS Inc, Chicago, IL, USA) programme.

Results: There were 54 HOs who had worked for a minimum of six months. Thirty-five (64.5%) of them felt that venesection was not their job description.

Forty-nine (90.2%) received no formal training and 40 (74.1%) received informal training in phlebotomy during Medical School. Thirty 32 (59.3%) used the dorsum of the hand as the main site for venesection and 25 (46.5%) did not know avoidable sites during venesection. Fifty-three (98.1%) did not check for allergies to antiseptics and adhesives before performing venesection. Thirty-seven (68.5%) did not know the names of all the additives in the various sample bottles and 29 (53.7%) did not understand the colour coding of the sample bottles. In addition, 34 (63.0%) did not know the blood volume required for all the various tests. Twenty-nine (53.7%) did not know that laboratory results of analytes were affected by patient's posture.

Conclusion: Training in the Medical School does not adequately prepare the House Officer to carry out phlebotomy competently and efficiently.

Key Words: Phlebotomy, Training, Certification, House Officer, Medical School

Introduction

Phlebotomy is a Greek derived word which means the act or practice of drawing blood for diagnostic or therapeutic purposes[1,2], and venesection is the process of entering the vein. Phlebotomy is a complex process thus it requires knowledge and skill to perform. Laboratory test results obtained from blood samples drawn form an integral part of the medical decision-making process and therefore strongly influences medical diagnoses and therapies[3]. To obtain a reliable test result, calls for the phlebotomist to attain standardized level of competency. Every discipline requires standardized formal education by either licensure or certification. Certification sets a standard of demonstrated competency. Certification is evidence that an individual has mastered the skills required to perform in a specific technical area; in this case, phlebotomy. Phlebotomy is a highly complex technique, requiring knowledge and skill to perform. The blood samples for investigations must be properly obtained from the appropriate vessel, in the accurate quantity, using the requisite tubes and at the appropriate time, for optimal results. Any error in the blood sample obtained can affect the result and the devastating effect on patient management cannot be overemphasized. In the performance of venesection therefore, the phlebotomist must have the requisite knowledge of proper venesection procedures. Like any other technical/medical training, phlebotomy training can be obtained as a 4-year bachelor's degree or a 2-year associate's degree[4]. There is also phlebotomy certificate training which takes only 15 weeks to complete[4]. Here, the candidate is required to work at least 200 hours in a clinical setting and is trained in different ways and skills in order to competently perform venesection on a patient. In Ghana, there is no formalised training in phlebotomy for medical students in the two major medical training institutions, namely the University of Ghana School of Medicine and Dentistry (UGSMD), and the School of Medical Sciences (SMS), Kwame Nkrumah University of Science and Technology. Venesection is therefore informally learned during clinical rotations or internship. Over the years, House Officers (HOs) in the Teaching Hospitals who are the least experienced among doctors have been tasked with the duty of phlebotomy for in-patients for various investigations. Lack of appropriate training may result in improper

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specimen collection, which can lead to serious complications including misdiagnosis. Without the appropriate training, locating and using suitable veins for obtaining blood samples can be an arduous task. Due to ignorance, some of these HOs puncture any visible vein and some of these veins, which may be useful to save the life of the patient in future are destroyed. Phlebotomy is more than just the venipuncture technique. It involves standard operating procedures, the designs of blood drawing stations, bio-safety mechanisms, patient safety, language and attitude of the phlebotomist. With the requisite training therefore, our HOs could be equipped with these essential competences of phlebotomy. A well-trained phlebotomist, aside the essential competence and engendering accuracy in diagnosis, has an economic advantage. A review of the literature showed that only 13% of errors in laboratory results are analytical in nature whereas 56% occur during pre-analytical phase (collection, processing and transportation)[5-7]. Pre-analytical errors have financial implications on laboratory budgets due to the cost of repeated collection and re-testing. Thus, a well-trained phlebotomist can serve as a huge saving on laboratory budget. A well-trained phlebotomist also contributes to the efficiency and reputation of any laboratory. The lowest possible turnaround time (TAT) for analysis is the key to success for any laboratory[8]. Trained phlebotomist HOs can perform their task efficiently; this in turn, lowers the TAT. Thus, proper training of personnel who perform phlebotomy procedures remains crucial as institutions look to improve patient care and to decrease blood collection errors. In most developed countries like the United States and Australia[1] phlebotomists are trained professionals. The students learn in detail human anatomy, needle technique, creating patient rapport, medical safety, good record keeping and other courses which teach them how the blood cells are affected by diseases and infections[4]. Additionally, they go through academic as well as hands on training on handling several medical equipment, including containers for collecting bio-hazardous-spill kits, dermal puncture devices, syringes of various sizes, vacuum tubes, blood culture bottles, bandages and tape, tourniquets, locking arm rests etc[4]. The students also learn how to do cardiopulmonary resuscitation to be applied when needed in their duty. In the light of these we sought to evaluate the knowledge of HOs in the performance of phlebotomy in Korle-Bu Teaching Hospital.

Methodology

The research was a cross-sectional study carried out in Korle-Bu Teaching Hospital (KBTH) among HOs undergoing their internship in General Surgery, Internal Medicine, Paediatrics, Obstetrics and Gynaecology departments in December 2010. All HOs in the above-mentioned Departments of the Hospital were eligible for inclusion i.e. the study adopted a process of total enumeration of all eligible participants. There was a total of 85 house officers; a research assistant distributed the questionnaires to all of them. Overall, 54 HOs returned completed self-administered questionnaires, giving a response rate of 64%. All participants provided informed consent. Distribution of the questionnaires was done at 9:00am and 54 completed forms were collected at 5:00PM for analysis. Data was entered into a Microsoft Access database and analyzed statistically using SPSS (Version 12; SPSS Inc, Chicago, IL, USA) programme. HOs who were not on duty on the day of the study were not part of the study. Ethical clearance was obtained from the Protocol and Ethics Committee of University of Ghana School of Medicine and Dentistry prior to commencement of the studies.

Results

There were 54 House Officer respondents. 38 (70%) were trained in University of Ghana School of Medicine and Dentistry (UGSMD) and 17 (30%) in Kwame Nkrumah University of Science and Technology School of Medical Sciences (KNUST-SMS). Forty-three (representing 79.6%) were within their first 6 months of House job, 9 (representing 16.7%) were within 6-12months while the rest two (3.7%) were within their second year. 35 (64.8%) of them said venesection was not their job while 16 (29.6%) of them stated that venesection was part of their job. 49 (90.7%) had no formal training in phlebotomy but 5 (9.3%) stated they had a formal training in performing phlebotomy. Forty (74.1%) admitted to having informal training in performing phlebotomy while the rest had no informal training. The stated sites used for venesection were: dorsum of the hand, 32 (59.2%), forearm, 3 (5.6%) and antecubital fossa, 19 (35.2%). The following factors were the determinants for the choice of venipuncture sites: ease of accessibility, 47 (47.5%); safety, 24 (24.3%); pain at the site, 13 (13.4%); type of diagnosis, 13 (13.4%) and 2 (2.0%) considered local condition of the site (ulcers and previous venesection points). Blood drawing techniques were: needle and syringe aspiration, 44 (62.0%); cannulation, 23 (32.4%) and vacuum tube 4 (5.6%). For knowledge on sample bottle additives, 17 (31.5%) knew the additives, 8 (14.0%) did not and 29 (53.7%) knew some of the additives. In addition, 25 (46.3%) understood the colour coding of the sample tubes while the rest 29 (53.7%) did not understand at all or understood some of the colour coding. In terms of blood volume to be collected for various tests, 20 (37.0%) knew the volume of blood to be taken for various tests while 12 (22.2%) did not. The rest 22 (40.8%) knew some of the volumes required. Thirty-five (64.8%) adequately mixed blood specimen after venesection while the rest did not mix at all. Tourniquet was stated to be kept for less than 2 minutes by 41 (75.9%) of the HOs while the rest 13 (24.1%) kept it for more than 2 minutes. Twenty-five

(46.3%) knew results of analytes were affected by postural changes while 29 (53.7%) did not. Twenty-nine (53.7%) knew avoidable areas during venesection while the rest 25 (46.3%) did not. Fifty-three (98.1%) did not check for allergies to antiseptics and adhesives before performing venesection while 1 (1.9%) did. For management of post venesection site, 44 (81.5%) applied pressure dressing, 8 (14.8%) applied pressure for haemostasis but no dressing and 2 (3.7%) gave no answer. For 18 (25.3%) of the HOs, patient cooperation was the main challenge during the procedure while for 34(47.9%) it was vessel invisibility and for the rest 19 (26.8%), it was unsuitable vessels. When difficulty was faced in getting blood samples, 62 (77.7%) of them would call for help either from a senior colleague or a Laboratory Technician. Five (9.3%) of them would perform a femoral tap while 5 (9.3%) would try until they obtain a sample.

Discussion

Our results have shown that many of the HOs do not perceive phlebotomy as one of their job descriptions. In terms of formal training in equipping them with the necessary skills to perform phlebotomy, we found that almost all 49 (90.7%) had no formal training in the Medical School. Nevertheless, 40 (74.1%) admitted having some informal training in phlebotomy but that was not adequate in making them perform phlebotomy with the requisite knowledge and standard. Phlebotomy is relatively new to most of these HOs and demand for qualified and certified technicians or phlebotomists have been growing over the last decade[4]. The training and certification of phlebotomists have therefore become imperative as their responsibilities continue to change with a high demand for professionalism in the discharge of their duties. Phlebotomy training and expertise is also required because the need for phlebotomy arises for all types of patients. Neonates and children require phlebotomy so do the elderly. Locating the veins, extracting blood without pain to the patient and analyzing it for the required purpose requires good amount of training and expertise[9]. Most of the house officers used the commonly recommended sites for venipuncture. The best veins for venipuncture are usually found in the antecubital fossa; cephalic/basilic or median basilic veins[10]. These vessels often satisfy the characteristics of a good vein for venipuncture; they should be bouncy, refill when depressed, large lumen, straight, soft, visible and well supported. Veins to avoid are those which are bruised, hard, mobile, thin or those near bony prominences. Our results showed that the dorsum of the hand was used by majority of the HOs. Other lesser used areas were the antecubital fossa and the femoral region. If these HOs were to have had a formal training in phlebotomy, the dorsum of the hand that has more tortuous, less supported and small veins may not have been the commonest site chosen for venipuncture. In addition, the dorsum of the hand has more nerve endings and therefore patients experience more pain and a greater discomfort during blood sampling. For most of the HOs, ease of blood vessel accessibility and patient safety were the overriding factors that determined the choice of the vessel for venipuncture. Pain at the site, type of diagnosis and local condition of the site of the vessels were also considered by a minority. Closed systems for blood sampling are preferable because they have proven to be safer than the open system[11]. The use of vacuum extraction tube systems as closed systems for blood collecting reduces the risk of direct exposure to blood and has made it easier to take multiple samples from a single venipuncture. That technique therefore reduces pain from likely multiple punctures from the other techniques. From our results only 4 (5.6%) of the HOs used the vacuum extraction tube method for blood sampling. Majority, 44 (62.0%) used the open needle aspiration method. The rest used another open system technique which is the cannulation method. That observation could be due to lack of formal training in the use of vacuum method. Another possible basis could be the unavailability of the vacuum tubes. An advantage of the vacuum tube system is that it avoids needle stick injury potential of the open syringe needle or cannulation technique during transfer of blood from syringe to the collection tubes. It is also faster and the system allows the draw of several tubes of blood by preventing leakage of blood as tubes are changed. The vacuum system also produces the best blood samples for analysis as the blood goes directly from the patient's vein into appropriate test tubes[12]. Although vacuum extraction systems are safer, more training and skills are required for their application[11]. Our study also revealed that the HOs have varying limited knowledge on the blood sample tubes in terms of additives and colour coding. Only 17 (31.5%) knew the names of the various additives in the sample tubes for basic haematological and biochemical tests. The rest either have partial or no knowledge about them. In terms of colour coding, only 25 (46.3%) understood it while the rest had knowledge on some or none at all. Knowledge on the colour coding of the stopper on each tube is paramount for the phlebotomist as it indicates presence or absence of an anticoagulant and also determines the order of draw of blood into the test tubes[13]. The draw of blood in the correct order avoids cross-contamination of additives between tubes which might affect accuracy of results[11]. For example, red code means no anticoagulant (for blood chemistries, viral serology/antibody test and Group and Cross-matching), light blue code tubes have sodium citrate (for clotting profile studies), purple code contains EDTA-ethylenediaminetetraacetic (for Full Blood and Reticulocyte Counts), green codes have heparin (used for blood chemistries using plasma), grey code contain potassium oxalate or sodium fluoride (for blood glucose, ethanol and lactic acid levels) and yellow contain sodium polyanethol sulfonate (for blood

culture and sensitivity) and acid citrate dextrose (for use in blood bank studies, HLA phenotyping, DNA and paternity testing). Thus, based on the United States Committee on Clinical Laboratory Standard Institute (CLSI) Consensus in 2003, the order of draw is as follows: sterile/blood culture yellow bottle, blue coagulation tubes, red non-additives tubes and last draw for additive tubes-green, purple, gray etc. in that order.

The knowledge of the HOs on quality control measures in terms of sample blood volume, duration of tourniquet application, mixing of blood samples obtained and effects of postural changes on test results was found to be unsatisfactory. For example, we observed that 63.0% of the respondents could not tell the volume of blood required for various tests. The volume of blood needed for laboratory analysis varies widely with the type of test being conducted[9]. Obtaining the accurate volume of blood for each tube is important to ensure that the proportion of blood to chemical additive is correct, otherwise, the test results may not be accurate or the specimen will be rejected and will need to be recollected[13]. The duration of tourniquet application before the blood sample is drawn has been a common source of pre-analytical laboratory errors[14]. As reported by many authors, tourniquet placement during venipuncture might provide alterations in the results of several biochemical analytes due to the prolonged stasis[15, 17]. Our results have shown that almost all the HOs applied the tourniquet for more than 1 minute. Ideally, the tourniquet should be in place no longer than one minute to prevent haemoconcentration. A prolonged tourniquet time may lead to haemoconcentration at the venipuncture site. Haemoconcentration can cause falsely elevated results for glucose, potassium, and protein-based analytes such as cholesterol[18]. It therefore follows that some of the results obtained by these HOs upon which clinical decisions were made might have been erroneous. More so, more than half the respondents admitted that they were unaware that postural changes affect some blood test results. Postural change during venous blood collection however is a major source of bias in biochemical testing. Lippi et al found plasma volume change of 3.4% from supine to sitting; 14.1% from supine to standing and 9.7% from sitting to standing and these led to significant bias in results of Full Blood Count and Chemistries when patient posture changes from supine to sitting and from sitting to standing[19]. Our study also showed that many of the HOs do not observe safety precautions during the venipuncture. From the results, 46.3% have no idea about avoidable or dangerous areas such as palmer surface of the wrist, bony areas and thumb and index finger during the venipuncture[20]. Almost all of them do not check for allergies to antiseptics and adhesives employed during the procedure. Failure to identify allergies may cause reactions that vary from minor to fatal in nature[20]. For safety issues regarding haemorrhage and sepsis, 81.5% do apply pressure dressing at the venipuncture site but 8(14.8%) do not apply any dressing exposing the patients to potential bleeding and sepsis. We have also found that though many of the HOs are able to take blood samples, they do face some challenges. These include vessel invisibility, uncooperative patients and thrombosed/fibrotic vessels. In such instances, most of them would resort to help from either senior colleagues or Laboratory Technicians as generally recommended in clinical practice.

Limitation

The main limitation of this study was the relatively low response rate of 64% among the HOs. This was due mainly to the limited time provided for completion of the questionnaire.

Conclusion

Our findings have demonstrated the inadequacies in the knowledge of the HOs in the performance of phlebotomy. The present training in the major medical schools in Ghana does not adequately prepare the HOs with the requisite skills and competences to carry out phlebotomy to meet standard operating protocols. There is therefore the need for an urgent review of the Medical School Curriculum or introduction of formal training of phlebotomy professionals for deployment in our hospitals.

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