

CLINICAL PRACTICE

BASIC LABORATORY INVESTIGATION OF THE CRITICALLY ILL EMERGENCY PATIENT

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Introduction

During the past 10 to 20 years, the demand for emergency medical service has grown almost exponentially and major hospitals throughout the world have set up emergency medical units. Recognition of Emergency Medicine as a specialty has also catalysed this development.

In Ghana, the Komfo Anokye Teaching Hospital (KATH) in Kumasi took the lead in setting up an Emergency Department a few years ago. A new Emergency Department will soon replace the Central Out-patient Department (COPD) at Korle-Bu Teaching Hospital.

The National Cardio-Thoracic Center at the Korle-Bu Teaching Hospital has run an Intensive Care Unit (ICU) for many years. The ICU cares not only for cardio-thoracic patients but also for patients suffering from a wide variety of emergency ailments such as acute renal failure, cerebral malaria and stroke. The theme for this year's (2014) Annual General and Scientific Meeting (AGSM) of the Ghana College of Physicians and Surgeons is "Improving Emergency Care in Ghana."

The author considers it timely, therefore, to write the article now. This article will focus on the laboratory needs of Emergency Departments (ED), with particular emphasis on appropriate diagnostic services for the new ED at Korle-Bu Teaching Hospital.

Management of the Emergency Patient

It must be kept in mind that management of an emergency patient is not always based on a clear-cut diagnosis, but on the presented clinical picture.

A common practical approach for the emergency physician is to distinguish and address a disorder which is immediately life-threatening or which requires admission, from other less urgent complaints.

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This strategy combined with a high patient throughput means that a final definite diagnosis is often not made at the Emergency Department, but much later after admission and treatment of the patient.

To deal with emergency cases, clinical experience, the appropriate use of clinical decision rules and use of supportive investigative methods such as analysis of blood and urine samples are of utmost importance.

The Emergency Laboratory

A limited set of standard analyses will help the emergency clinician to diagnose and accordingly treat immediately life-threatening disease.

Immediately life-threatening pathologies include, in order of the ABCDE-approach, hypoxia and respiratory insufficiency, shock and circulatory collapse, coma, acute neurological impairment, meningitis, sepsis, hypothermia and hyperthermia.

These conditions can be grouped (for ease of memory) into the following well-known categories:

- A. Airway (impaired): Trauma, foreign body, bleeding, infection (e.g. diphtheria) angioedema, tumour, coma.
- B. Breathing (respiratory insufficiency): Pneumothorax, pulmonary oedema, asthma, pulmonary embolism, pneumonia, pleural effusion, bulbar poliomyelitis.
- C. Circulation (shock): Cardiac tamponade, bleeding, cardiac arrhythmia (fibrillation), acute (left ventricular): cardiac failure, acute myocardial infarction, anaphylaxis, intoxication, acute Addisonian crisis, dehydration, electrolyte disorders.
- D. Disability (coma): Hypoglycaemia, diabetic ketoacidosis, HONK, hyperosmolar states, intracranial pathology, epilepsy, intoxication, infection (sepsis or meningitis), cerebral malaria.
- E. Exposure (temperature): Hypothermia, Hyperthermia.

Need for rapid Laboratory Analyses at the ED

The ED must set up a small multi-purpose laboratory of its own (housed under its roof).

"Point of care" (POC) testing equipment in the ED can reduce "turn-around times" and enable rapid provision of some laboratory measurements.

Developed in connection with Sports Medicine, POC testing devices now produce results as accurate as large central laboratory instruments. They have the further advantage that they can be easily brought to the patient's bedside.

Whole (uncentrifuged) blood samples as little as 100µL suffice for analyses on some of these POC

instruments. Acid-base parameters and blood glucose result can be obtained within seconds of introduction of blood specimens into the instruments. Lactate as well as Na⁺, K⁺, ionised calcium (Ca⁺⁺), magnesium, creatinine, urea, Li and osmolality can be obtained together on some instruments.

TABLE I. Emergency Laboratory Analysis

Heamatology	"Electrolytes"	Liver/ Prot	Coagulation	Infection	Additional
FBC	Na ⁺	ASAT	INR	CRP	HCG(pregnancy)
Hb	K ⁺	ALAT	aPTT		Troponins
Haematocrit	Ca ⁺⁺	ALP	D-Dimer	Urinary Dipstick	Myoglobin
MCH	Mg ⁺⁺	γ-GT			TSH,T ₃ ,T ₄
MCHC	Cl ⁻	LDH	Platelets		
	Urea	Tot.Bilirubin		Mononucleosis	Tox-screen
Leucocytes	Creatinine	Conjugated			
5- Diff	Lithium	Bilirubin		Malaria	Alcohols/Ketones
Platelets	Arterial Blood Gases			Sepsis	Paracetamol
Erythrocytes		Amylase		Viral hepatitis	Valproic acid
	Glucose	Lipase		Influenza	Carbamazepine
ESR				Typhoid	Local panel
	Lactate	Total protein		HIV	
Blood Grouping		Albumin		Ebola	
Ab - Screen	Osmometry				<u>LIQUOR</u> Erythrocytes Tot. Leucocytes Differential Xanthochromia Glucose Lactate Z-N stain Culture

Therapy before Analysis of Blood Samples

If the patient is comatose and is a known diabetic or suspected to be one, as soon as a blood sample for glucose determination is taken, without waiting for results of the analysis, a therapeutic trial with intravenous glucose can be made. If the patient is shown to be hyperglycaemic (instead of hypoglycaemic) no great harm would be done. If the coma is due to hypoglycaemia, the patient should wake up within seconds of the injection. Insulin therapy, on the other hand, should be withheld in a case of diabetic coma until the patient is settled in bed and 0.9% saline intravenous infusions started.

Choice of Laboratory Tests

This, of course, will depend on the clinical diagnosis or suspected diagnosis. In a broader view no

single analysis can be called the most important one, when the diagnosis is not clear.

However, with the limited set of blood glucose, arterial blood gases, lactate, Hb, platelet count, Na⁺, K⁺, Ca⁺⁺, and creatinine. INR, APTT, D-dimer, liver enzymes, amylase or lipase, troponins, limited toxicology screening (alcohols, Lithium, and the most common local intoxications), a WBC, CRP and ESR, the experienced physician should be able to manage the emergency presentation of the vast majority of common emergency and life-threatening disease conditions.

In case of infection or suspected infection complementary samples for urinary dipstick testing should be carried out.

If the patient is unconscious it may be necessary to obtain a catheter specimen of the urine.

In case of a febrile illness, pyrexia should be confirmed and malaria testing by direct microscopy, HIV or Hepatitis rapid test and PCR may be necessary to allow early identification of infectious agents. Cases of suspected Ebola infection should be referred to special isolation units. The Noguchi Institute at Legon is the only laboratory in Ghana accredited by the WHO to confirm the disease by tests.

Summary and Recommendations

The ED at Korle Bu should be well-equipped with the latest but basic "physiological" instrumentation (such as thermometers, pulse oximeters, defibrillators and ultrasound) necessary for the running of a modern ED.

Ambulance staff should have basic resuscitation skills to reduce the number of cases of BID ("brought in dead").

The Unit should have portable X-ray machines as well as bedside Doppler ultrasound. The ED should have its own small multi-purpose laboratory as well as POC instruments (that can be brought to the patient's bedside).

The ED should be manned by physicians. The radiology and laboratory facilities should be manned by skilled technical staff backed by medical laboratory consultants or specialists either working there all the time or on call 24 hours. Heads of the radiology and laboratory facilities should be medically qualified.

