

Routine Preoperative Laboratory Testing: Economic Burden on Pre-Surgical Patients

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Abstract

Background: Routine pre-operative test, results in significant cost to the hospital and expense for the patient. The cost of a single laboratory test may be negligible but too many tests have increased cost for many national health schemes. Most of these patients cannot afford this extra cost thereby delaying surgery and adding up to emergencies. Implementation of change is necessary to reduce economic burden on the patient and enhance patient care. The aim of this study was to determine the economic burden of preoperative laboratory tests on pre-surgical patients in Komfo Anokye Teaching Hospital with a view to making appropriate recommendations that will reduce costs for the patients. **Methodology:** This was a prospective, cross-sectional study of patients undergoing elective surgery at K.A.T.H from 1st to 31st March 2014. A quantitative technique was used to effectively quantify laboratory results that were contained in a patient's folder before an elective surgical procedure. Close and open ended questionnaire was developed and answered by reviewing patient's folders during the pre-anaesthesia assessment. Cost of various laboratory investigations was obtained on request from one private laboratory and the KATH main laboratory. Data were analyzed using Statistical Package of Social Sciences (SSPS) version 22 and Microsoft Excel 2010. **Results:** The total cost of preoperative laboratory investigations in the study population was GHC 15, 321.19 (GHC 92.85 per individual); and for tests that were not indicated, GHC 3, 266.83 (GHC19.80 per individual). **Conclusion:** Routine preoperative laboratory tests ordered by Surgeons in Komfo Anokye Teaching Hospital impose an economic burden on the patients. The development of a comprehensive guideline that will help in the ordering of preoperative laboratory investigation will reduce costs for the patients.

Keywords

Preoperative, Laboratory Investigations, Economic Burden

1. Introduction

In the assessment and preparation of patients for surgery, preoperative laboratory investigations play a crucial role to ensure that the patient goes through anaesthesia and surgery with little or no complications [1] [2]. Even though preoperative laboratory investigation is important its request should be based on a sound clinical examination. Any test that is ordered before surgery should be based on the history of the patient, his or her co morbidities and the type of surgery to be done. Before a test is ordered, one should ask whether it can identify any abnormalities, change the diagnosis or influence the anaesthetic plan or the outcome of the patient [3] [4] [5]. Request for preoperative laboratory investigations should not be done simply because the patient is going to have surgery. It should rather be requested for specific clinical indications that can lead to increase perioperative risk.

At many health institutions, the practice has been that all preoperative tests and diagnostic studies be ordered by the surgeon or primary care physician. Mostly these tests are requested without specific indication based on history or physical examination but rather on speculations that the anaesthetist may “require them” to proceed with the surgery and thus avoid delays and cancellations [5] [6].

A study conducted by Alison W. Vogt *et al.* concluded that an average of 72.5% of tests ordered by surgeons were considered not indicated by the anaesthesiologists and that their hospital could have saved \$80,000 by eliminating un-indicated preoperative tests for the 5100 patients seen in preoperative clinic annually [7].

Routine pre-operative test results in significant cost to the hospital and expense for the patient. The cost of a single laboratory test may be negligible but too many tests have increased cost for many national health schemes [8] [9]. An unnecessary preoperative investigation adds a lot of cost to both the patient and insurance schemes, some of these laboratory investigations are not covered under the health insurance scheme thereby adding to the cost of surgery even if the patient is insured. Most of these patients cannot afford this extra cost thereby delaying surgery and adding up to emergencies. Implementation of change is necessary to reduce economic burden on the patient and enhance patient care. The aim of this study was to determine the economic burden of preoperative laboratory tests on pre-surgical patients in Komfo Anokye Teaching Hospital with a view to making appropriate recommendations that will reduce costs for the patients.

2. Methods

This was a cross-sectional survey which involved patients undergoing elective surgical procedures at the KomfoAnokye Teaching Hospital, Kumasi, Ghana. After ethical clearance from the Committee for human research publication and ethics, a census from 1st - 31st March 2014 was done to collect data from folders of patients presenting for various surgical procedures that met the inclusion cri-

teria, and the anaesthetist who anaesthetized the patients filled the final part of the questionnaire. The folders of all the patients presenting for elective surgery during the study period was reviewed. A quantitative technique was used to effectively quantify laboratory results that were contained in a patient's folder before an elective surgical procedure. Close and open ended questionnaire was developed and answered by reviewing patient's folders during the pre-anaesthesia assessment. Part of the questionnaire was answered by the attending anaesthetist immediately after the surgical procedure had been performed. In all a total of one hundred and sixty five patients were enrolled in the study. Cost of various laboratory investigations was obtained on request from one private laboratory and the KATH main laboratory. The data was analyzed using Statistical Package of Social Sciences SPSS version 22 and Microsoft Excel 2010. The results were presented in the form of frequency tables.

3. Results

The study population was 165 candidates with a mean age of 50 years and a male to female ration of 1:1.1. At the time of pre-anaesthetic review, all the candidates had at least one laboratory result. 98.8% of the laboratory tests were ordered by the surgical team while the anaesthetist was responsible for only 1.2% of all laboratory requests (**Table 1**).

Table 2 shows that Complete blood count (CBC) is the most frequently ordered Laboratory test for patients coming for elective surgical procedure at KATH. Out of the 165 folders reviewed, 163 representing 98.8% had a request for CBC, followed by Renal function test (75.8%), Grouping and cross-matching (63.6%), Serum electrolyte (57.0%), Liver function test (29.1%), Urinalysis (11.5%), Blood Glucose (10.9%), Coagulation studies (7.9%), Thyroid function test (5.5%), Haemoglobin and Haematocrit are ordered as part of another test. In none of the female patients was pregnancy test ordered. Most laboratory investigations were ordered within two weeks of surgery in 76.4% of the study population, within one month in 10.3%, within 2 months in 4.2%, within three months in 7.3%, above three months in 0.6% and above six months in 1.2% respectively.

Table 1. Demographic and pre-surgical characteristics.

Characteristics	Value	Percentage
Number of patients	165	
Mean age (years) +- SD	50	
Male to female ratio	1:1.1	
Who orders Lab Investigations? And frequency of pre-anaesthetic lab results		
Surgeons	163	98.8
Anaesthetists	2	1.2
Pre-anaesthetic lab results	165	100

When the tests requested were compared with the Canadian Anesthesiology Society (**Table 3**), it was found that out of the 163 request for complete blood count, 124 (76.1%) were indicated while 39 (23.9%) were not indicated. For serum electrolytes, 56/94 (59.6%) were indicated while 30/94 (40.4%) were not indicated; for renal function test, 57/125 (46.6%) were indicated while 68/125 (54.6%) were not indicated; for coagulation studies, 8/13 (61.5%) were indicated while 5/13 (39.5%) were not indicated.

Table 4 shows that in 79.4% of the study population, laboratory investigations

Table 2. Frequency of tests ordered.

Lab test	Requested	Not requested
Complete blood count	163 (98.8%)	2 (1.2%)
Renal function test	125 (75.8%)	40 (24.2%)
Blood grouping and matching	105 (63.6%)	60 (36.4%)
Serum electrolytes	94 (57.0%)	71 (43.0%)
Liver function test (LFT)	48 (29.1%)	117 (70.9%)
Urinalysis	19 (11.5%)	146 (88.5%)
Blood glucose	18 (10.9%)	147 (89.1%)
Coagulation studies	13 (7.9%)	152 (92.1%)
Thyroid function test (TFT)	9 (5.5%)	156 (94.5%)
Haemoglobin	0 (0.0%)	165 (100%)
Haematocrit	0 (0.0%)	165 (100%)
Pregnancy evaluation	0 (0.0%)	165 (100%)

Table 3. Number of investigations that were indicated or not indicated according to the Canadian Anesthesiology Society guidelines for preoperative laboratory testing.

Laboratory test	Indicated	Not indicated
Complete blood count (%)	124/163 (76.1)	39/163 (23.9)
Serum electrolytes (%)	56/94 (59.6)	30/94 (40.4)
Renal function test (%)	57/125 (46.6)	68/125 (54.6)
Coagulation studies (%)	8/13 (61.5)	5/13 (39.5)

Table 4. Frequency of repeat laboratory investigations.

Characteristics	Value	Percentage
Not repeated	131	79.4
Repeated	34	20.6
Frequency of repeated lab investigations		
Two times	31	91.1
Three times	2	5.9
Four times	1	3.0

were not repeated whereas in 20.6% of cases, laboratory investigations were repeated due to abnormal values; of the 20.6%, CBC only was the most repeated laboratory investigation representing 15.2%, CBC and Renal function test 0.6%, CBC, Renal function test, Serum electrolyte 1.2%, CBC, Renal function test, Liver function test 0.6%, Random blood sugar 1.8%, Renal function test only 0.6% and Thyroid function test 0.6%. Furthermore, it was observed that same tests were repeated two times in 18.8% of the study population, three times in 1.2% and four times in 0.6%.

Table 5 shows that the average cost of laboratory investigations ordered in the study population using two laboratories was GHC 10,666.55. Thus the average cost per person was GHC 64.65. However, some tests were repeated (**Table 5**) leading to an additional cost of $72 \times 64.65/165 = \text{GHC } 28.21$. Adding this to GHC 64.65, the total average cost of laboratory investigation per person was GHC 92.86. Thus, total cost of laboratory tests was GHC 15, 321.9. Total laboratory request = $594 + 72 = 666$. Total laboratory request not indicated = 142. Therefore cost of laboratory tests not indicated = $142/666 \times 15,321.19 = \text{GHC } 3266.83$ (GHC 19.80).

4. Discussions

Our study shows that the total cost of preoperative laboratory investigations in the study population was GHC 15, 321.19 (GHC 92.85 per individual) and that

Table 5. Costs of laboratory investigations from two laboratories.

Labs	Frequency	Cost (KATH)	Total cost (KATH)	Cost (private lab)	Total cost (private lab)
Haemoglobin	0	GHC 4.00	GHC 0.00	GHC 7.00	GHC 0.00
Haematocrit	0	GHC 4.00	GHC 0.00	GHC 7.00	GHC 0.00
CBC	163	GHC 10.00	GHC 1630.00	GHC 20.00	GHC 3260.00
CS	13		GHC 0.00	GHC 30.00	GHC 390.00
SE	94	GHC 10.00	GHC 940.00	GHC 20.00	GHC 1880.00
RFT	125	GHC 24.00	GHC 3000.00	GHC 25.00	GHC 3125.00
LFT	48	GHC 28.00	GHC 1344.00	GHC 40.00	GHC 1920.00
TFT	9	GHC 56.70	GHC 510.30	GHC 86.00	GHC 774.00
Bld G	18	GHC 9.10	GHC 163.80	GHC 7.00	GHC 126.00
Urinalysis	49	GHC 5.00	GHC 95.00	GHC 15.00	GHC 285.00
BGXM	105	GHC 8.00	GHC 840.00	GHC 10.00	GHC 1050.00
PT	0	GHC 5.00	GHC 0.00	GHC 5.00	GHC 0.00
Total cost			GHC 8523.10		GHC 12,810.00

GHC Ghana cedis, Labs Laboratory tests, lab Laboratory, KATH KomfoAnokye Teaching Hospital, CBC Complete blood count, CS Coagulation studies, SE Serum electrolytes, RFT Renal function test, LFT Liver function test, TFT Thyroid function test, Bld G Blood glucose, BGXM Blood grouping and cross match, PT Pregnancy test.

GHC 3, 266.83 (GHC 19.80 per individual) could have been saved if routine laboratory testing was not done.

The national institute for clinical excellence (NICE) has published an evidence based guidelines on the use of preoperative test before surgery. There are other guidelines published by other institutions like the American Society of Anaesthesiologists (ASA), and the Canadian Anaesthesiologist society (CAS). The ultimate aim of these guidelines is to assist in judicious preoperative testing, to reduce cost whilst at the same time improve care effectiveness. use of there are clinical indications for laboratory [10].

In the early 1940 when preoperative assessment evolved, preoperative investigations were based on thorough history and physical examination during preoperative visit. Laboratory test ordered were done selectively to confirm diagnosis [10]. However in the late 1960 when test ordering became easier because of the introduction of biochemical auto-analyzers routine testing became common without recourse to the economic burden on patients. The idea of routine testing was equated to efficient care [2].

This practice of requesting a series of laboratory test before surgery was adopted by a lot of hospitals with the assumption that the more investigations you do, the safer it is for the patient [2]. The practice continued without any scientific evidence until Kaplan *et al.* published an academic paper to debunk the practice. Their study was a retrospective one involving 2000 elective patients. These patients had a battery of investigations such as complete blood cell count, differential blood count, prothrombin time, glucose level, serum electrolyte, renal function test and platelet count. Their results showed that only 96 (22%) of the tests revealed abnormalities. They also demonstrated that out of the 96 abnormal results only 10 could not be determined by history and examination. Another revealing aspect was that out of these 10 only 4 were of actual clinical significance [11]. A lot of academic publications has challenged the practice of routine preoperative laboratory investigations in the past three decades. This practice leads to an increased cost of surgery without any benefit to the many surgical patients who underwent these investigations [2] [12] [13] [14].

A study at San Giovanni Battista Hospital in Turin found that if guidelines are applied it will decrease the mean number of tests prescribed from 20 to 3 per patient. They further stated that tests deemed inappropriate by guidelines did not add any relevant clinical information to their study. In economic terms they estimated a reduction of 63% in cost per patient (€69 to €26) for preoperative tests by introducing guideline criteria. As regards the cost per patient for preoperative evaluation and hospital stay (€115 considering only variable costs, €580 including all costs), the application of the guidelines would reduce costs by 41% - 52% according to different cost evaluation approaches for hospital stay [10].

A study at Siriraj Hospital's also revealed that over investigation is common in their institutions and estimated US 200,000 dollars as the cost of over investigation. They concluded that utilizing preoperative guidelines will decrease unnecessary testing and the consequential financial burden on patients [15].

A study by Macuso *et al.* also demonstrated that the introduction of guidelines lead to a decrease in pre-operative laboratory test ordering by surgeons by 23% - 44%. Economically the guidelines also lead to a cost savings of over \$650,000 during the first 2 years for ambulatory surgery alone. It is worth noting that this decrease in test ordering did not lead to an increase adverse patient outcome either in the intra or post operative period [16].

In Stanford university, researchers studied retrospectively the ordering of preoperative laboratory investigations six months before the setting up of a pre-operative anaesthesia evaluation clinic. Now, comparing the preoperative ordering of laboratory investigations 1 year after the setting up of the anaesthesia clinic to six months before the clinic, there was a reduction of 55%. This also translated in to cost saving of the hospital's expenses in preoperative laboratory investigations by 41% yielding \$112 in cost savings per patient [3]. The preoperative anaesthesia clinic and the ordering of laboratory investigations by Anaesthesiologists instead of surgeons also prevented operating room cancellations, delays and adverse patient events.

5. Conclusion

The total cost of preoperative laboratory investigations in the study population was GHC 15, 321.19 (GHC 92.85 per individual) and that GHC 3, 266.83 (GHC 19.80 per individual) could have been saved if routine laboratory testing was not practiced. It is recommended that a comprehensive guideline be developed to help in the ordering of preoperative laboratory investigation. Ordering of preoperative investigation should be the responsibility of the anaesthetist during preoperative assessment; the practice of surgeons ordering preoperative laboratory investigations for the anaesthetist should be minimised.

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