Cross-sectional Study

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Prevalence, impact and associated factors of abnormal preoperative investigation result in patients undergoing surgery in Dilla University referral hospital: cross-sectional study

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Background: As one domain of preoperative assessment, preoperative investigations are often ordered to evaluate patient's medical condition for risk stratification and assessing patient status to undergoing surgery. Despite the fact that laboratory testing can assist in ensuring the best possible preoperative condition, routine screening examinations have a number of drawbacks. Although there are evidence-based recommendations for which investigations should be done, the tradition of routine preoperative testing is still prevalent and clinical practice with abnormal results detected varies.

Method: Institution-based cross-sectional study design was conducted from 1 November to January at Dilla University Referral Hospital. Data was collected from complete pre-anaesthesia check-up sheets, investigations already done. It was collected at the individual level by using, closed-ended self-guided questionnaire. The collected data was entered, cleaned, edited and checked using SPSS version 26 for data processing and analysis. Logistic regression was performed to examine the impacts of abnormal preoperative investigation results and summarised by using tables and figures. An Adjusted odds ratio with 95% CI was computed to determine the level of significance.

Result: Data of 208 patients (65.9 female) with mean ± standard deviation age 30.83 ± 15.340 years and 22.59 ± 2.99 BMI were analysed. Patients were mostly American Society of Anaesthesiologists I and II underwent National Institute of Clinical and Health Excellence Grade 2 surgeries and surgical shape class 3. Totally, 178 (44.5%) test results were abnormal. CBC is the most detected abnormal result. Only 15 (3.75%) abnormalities had an impact in terms of delay, further investigations, and surgical technique. Comorbidity (AOR 7.982, 95% CI, $P = 0.041$), medication history (AOR 1.463, 95% CI, $P = 0.013$), ASA physical status II (AOR 3.287, 95% CI, $P = 0.029$) and history of smoking (AOR 1.577, 95% CI, $P = 0.049$) were factors which was significantly associated with abnormal preoperative investigation result.

Conclusion: Only 0.6% of all tests had a significant impact in terms of changing perioperative anaesthetic management. The significant impact of abnormal investigation result noticed was delayed surgery

Keywords: abnormal results, anaesthesia, anaesthesia plan, Dilla University, ASA physical status, comorbidity, cross-sectional, delay, further investigation, impact, laboratory tests, magnitude, outcome, preoperative, referral, routine testes, surgery, surgery grade

Introduction

The idea that early and frequent testing could identify diseases in their pre-clinical stage gave rise to preoperative evaluation[1,2].

HIGHLIGHTS

- In this study, the majority of the patients had at least one abnormal test result on routine preoperative tests.
- Only a few of all tests performed had any impact in terms of delayed surgery, further testing, and surgical technique change.
- The significant impact of abnormal investigation result noticed was delayed surgery.

Pre-anaesthetic evaluation or pre-anaesthesia check-up (PAC) is the initial step in preparing a patient for surgery and is described as the clinical evaluation phase that comes before the administration of anaesthetics for both surgical and non-surgical procedures. The PAC must take into account data from many sources, preoperative investigations included[3,4].

American Society of Anaesthesiologists (ASA) Task Force on PAC defined routine tests as those done in the absence of any specific clinical indication or purpose. Traditionally include a panel of

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complete blood count (CBC), urine analysis (U/A) and chest X-ray (CXR), electrocardiogram (ECG). Indicated tests are tests done for a specific clinical indication or purpose, for example to confirm a clinical diagnosis or assess the severity and progress of disease[1,5].

Abnormal investigation results are the values outside the laboratory reference ranges; however, various factors affect the tests. Users and patients must be made aware of these limitations so that laboratory testing remains a supporting piece of evidence in the clinical context and does not cause undue concern[3,6].

Knowing the incidence of abnormal findings helps anaesthesia professionals better stratify patients based on their risk for perioperative complications. Abnormal preoperative testes have an impact ranging from change of management to delay of the surgeries[7]. Despite the fact that laboratory testing can assist in ensuring the best possible preoperative condition, routine screening examinations have a number of drawbacks. Tests ordered in the absence of clinical indication, while frequently abnormal, fail to predict perioperative complication. Healthcare management is now advocating cost-effective and safe healthcare delivery[1,8]

Selected tests would be useful to diagnose diseases that require treatment before non-urgent surgery knowing the impact of abnormal investigations is essential because its incidence is high in developing countries and Ethiopia is one of them. The abnormal result from investigations commonly reported from different African countries particularly in Ivory Coast done on the usefulness of routine preoperative testing in a developing country showed abnormal results up to 35% of cases[7].

In Ethiopia there are limited studies that shows the prevalence of abnormal preoperative investigation in surgical patients one study showed that the prevalence of abnormal preoperative investigation result is 4.2%[9], but the impact of this abnormal investigation is not well confirmed in the surgical patients. So ours study aimed in determining the prevalence and showing the impact of abnormal preoperative investigation.

During the past years, routine perioperative investigations have been challenged by several guidelines and academic challenges because these results in significant costs without much benefit[1,10]. Preoperative tests are done to know the progress of a known disease, but Routine they have an unfavourable cost-benefit ratio. Although not acceptable or without controversy, it is also done to detect hidden co-morbid conditions[11–13]

However, the value of such testing is seriously questioned, especially in resource-limited areas like Ethiopia. Knowing the impact of abnormal investigation and associated factors is crucial for cost reduction. Preoperative laboratory investigations add to the cost with a large amount[4]. This problem exists in our study area and gave rise to do this thesis. The study will enhance the capacity to look for possible alternative solutions to health service delivery in addition to contributing to an increase in the knowledge and awareness of the problem areas by concerned bodies including the hospital staffs.

This research plays a crucial role in this case as foot step for the next researches to be done in this area, and also it can be used as a data to resolve the problems of unwanted impact of abnormal preoperative investigation results in patients undergoing surgery.

Method and material

Study design and period

Institution-based, cross-sectional study design was conducted from November to January, 2022 G.C. The study is registered in the Research Registry with Unique Identification Number. The methodology in this study has been reported according to **STROCSS** guidelines 2021[13].

Population

Source population

All surgical patients who underwent surgery under anaesthesia.

Study population

All surgical patients who underwent surgery under anaesthesia during the study period who fulfils the inclusion criteria were included in the study.

Eligibility criteria

Inclusion criteria

Patients who underwent surgery under anaesthesia during the study period.

Exclusion criteria

Patients admitted without investigations

Patients scheduled for minor surgery

Sampling technique and sample size determination:

The actual sample size for the study is determined by using single population proportion

$n = (Z\ a/2)\ 2\ pq.\ /d\ 2$ Where:

n = Initial estimation sample size

Z = Confidence level at 95% (alpha, α), 1.96

P = prevalence of problem from previous study done in India in which a more suitable population is found (0.572)[14]

d = marginal error (0.05)

$n = (1.96)2\ *\ 0.57*0.43/\ (0.05)2 = 376$

By using correction formula for finite population since source population are less than 10,000.

$nf = n/1 + (n - 1)/N = 376/1 + (376 - 1)/470 = 208.$

Where: $n =$ is number of sample size,

nf = final sample size = 208

N = Total number of patients who were present to undergo surgery at DUH within three months study period during similar months last year, which is 470.

Sampling method

Study variables

Dependent variables

Abnormal preoperative investigation result.

Independent variables

Age, sex, ASA class, surgery grade, type of surgery, surgical speciality, comorbidity, number of comorbidities, types of comorbidity, investigation types and number of investigations.

Operational definition

Investigation: The action of investigating something or someone; formal or systematic examination or research. (Late Middle English).

Preoperative laboratory testing: Any laboratory test obtained within 30 days of surgery[15].

Routine test: A test ordered in the absence of a specific clinical indication or purpose.

Instrumental testes: Imaging modalities which used to identify or diagnose a disease entity.

ASA physical status: Classification system of a patient fitness for surgery based on systemic disease severity irrespective of age and surgery type.

An abnormal test result was said to be impactful if the abnormal test resulted in:

Referral
Delay
Further investigations
Retesting
changes in plan of anaesthetic management.

Change in the perioperative anaesthetic management (i.e. postponing the elective case for further optimisation, changes in the ongoing management, altering the anaesthetic procedure and monitoring plan.).

Data collection tool and procedure

Data were collected at DUH by using a Structured Questionnaire which includes socio-demographic characteristics, surgical grade and speciality type, ASA class, shape classification, number and types of comorbidities, procedure to be done, number of investigations which are done with the respective cost and investigation which has abnormal result and its impact. The response was encircled or written in the space provided. On this basis, the investigation result was divided into two groups: normal and abnormal. The results of the normal group were within the standard hospital reference range, whereas values outside the hospital reference ranges considered as abnormal group. The data are collected by 4th year anaesthesia students and MSc students in collaboration with principal investigators after orienting about the aim of the study to collect data and reduce bias.

Data quality control

Data collectors and supervisors were trained for 30 min on each items included in the study tools, objective, relevant of study, right of respondents, confidentiality of information obtained. During data collection, regular supervision and follow-up was made. The investigator was checked for completeness, consistency, accuracy, and correctness accordingly of data every day. Pre-test was done on the 5% of the sample size on the patients who wasn't included in actual data collection. During data collection each questioner revised by the investigator for being complete and appropriate. Data clean up and cross checking was done before analysis on SPSS. There was no data loss or inappropriate data.

Data analysing

The collected data was entered and analysed by statistical software using SPSS window version 26, then the prevalence and impact by the frequency, percentage and cross tabulation with different variables is determined and associated factor analysed by binary logistic regression with adjusted odds ratio (AOR) with the corresponding 95% CI was calculated to show the strength of association, based on the study finding.

Ethical issue

Ethical consent was obtained from Department of Anaesthesiology, DUH. The data collector was conducted after explaining the aim and benefit of the study to study subjects to avoid ambiguity and misunderstanding. Moreover the individual is asked to respond accordingly after getting verbal consent and their confidentiality was guaranteed throughout the study.

Result

Socio-demographic characteristics

In total, 208 patients were included. Table 1 provides an overview of the patient demographics. The mean age was 31.1 ± 15.1 years (1–90 years), and 59 (32.8%) and 121 (67.2%) of the participants were male and female, respectively; out of 208 participants 71 (34.1%) were male and 137 (65.9%) were females. The median age is 28.

Among these 66 (31.7%) undergone elective surgery and 142 (68.2%) was emergency surgery ($N = 180$). Caesarean section was the most frequently performed procedure (41.3%) followed by laparatomy (12.7%). (Table 1).

Characteristics of cases based on surgical filed speciality, surgery grade, ASA class, comorbidity type and number of comorbidities

Among the total sample collected, 86 (41.3%) were obstetrics patients, 82 (39.4%) general surgery, 29 (13.9%) orthopaedic surgery, and gynaecologic surgery, 11 (5.3%) (Table 2).

The majority of the patients were ASA class I and II accounting for 93 (44.7%) and 89(42.8%), respectively. Most patients 131 (63%) underwent the surgery was shape 3 surgical classification. Twenty-two (10.6%%) of the cases were ASA class III and the rest 1.9% were ASA class V. One hundred twenty-four (59.6%) patients undergo moderate surgery, while 56 (26.9%) and 28 (13.5%%) undergo major and minor surgery, respectively.

Out of the total patients, 22 (11.1%) had comorbidities, of which CVS 9 (4.3%) and endocrine 7 (3.4%) are the commonest. The rest of the patients have HIV/AIDS, respiratory co-morbid diseases and others. (Fig. 1).

Out of these, the majority of the patients had one comorbidity 10.6%, the rest only 0.5% had two comorbidities. From these 18

Table 1

Socio-demographic characteristics of the patients in Dilla University Referral Hospital, underwent elective and emergency surgery ($n = 208$), 2022

Variable	Number
Sex, *n* (%)	
Male	71 (34.1)
Female	137 (65.9)
Age	
Mean(SD)	30.83 (15.340)
Median (min–max)	28.00 (1–90)
Age, *n* (%)	
< 20	43 (20.7)
20–45	133 (63.9)
45–59	19 (9.1)
≥ 60	13 (6.3)

Table 2

Case distribution by surgical speciality of patients undergoing surgery at DUH ($n=208$), 2022

Types of comorbidity	Frequency (percent), *n* (%)
Obstetrics	86 (41.3)
Gynaecology	11 (5.3)
General surgery	82 (39.4)
Orthopaedic surgery	29 (13.9)
Total	208 (100)

(8.7%) was an old comorbidity while 5 (2.4%) was newly identified comorbidity.

Prevalence of abnormal preoperative investigation result

A total of more than 400 investigations were done for 208 patients who underwent surgeries during study period, out of these the prevalence of abnormal investigation results was 178 (44.5%). (Fig. 2).

From the detected abnormalities CBC are 107 (59.1%),others are 27 (14.9%) like TFT, U/S, etc, LFT are 16 (8.8%), ECG 12 (6.6%), U/A 5 (2.8%), CXR 5 (2.8%), ECHO 2 (1.1%), RBS, and FBS 1 (0.6%) according to their frequency.

Factor associated with abnormal preoperative investigation result

Results of binary logistic regression analysis

Binary logistic regression was performed to ascertain how the age, BMI, ASA status, history of medication, history of smoking, surgical shape classification, and comorbidity affect the patient's probability of getting abnormal investigation results. A total of 208 patients were used in the analysis (Table 3).

Results from multi-variable analysis

Based on these regression demonstrated that the predisposing factors of abnormal investigation result are comorbidity (AOR 7.982, 95% CI, $P=0.092$) patients in ASA II groups are approximately three times more likely to have abnormal investigation than ASA I patients. ASA physical status II (AOR 3.287, 95% CI, $P=0.049$) and history of smoking (AOR 1.577, 95% CI, $P=0.728$) in 208 patients).

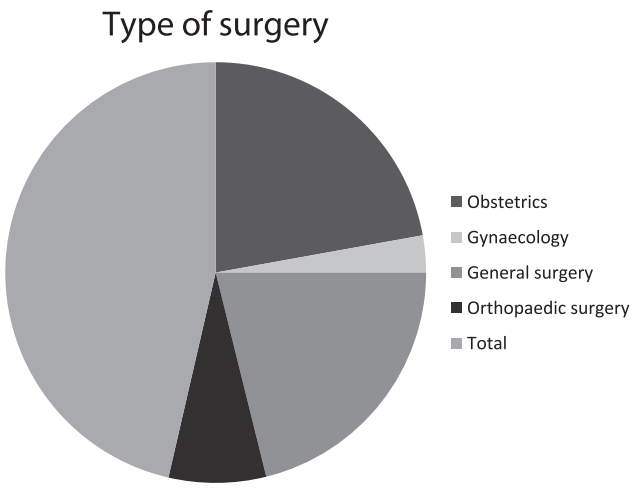

Figure 1. Type of surgery in patients undergoing surgery at DUH, Dilla, Ethiopia ($n=219$), 2022.

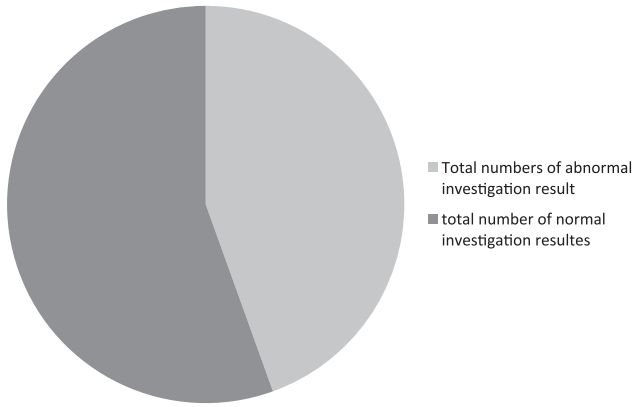

Figure 2. Prevalence of abnormal preoperative investigation result at DURH, ($N=208$), 2022.

Impacts of abnormal preoperative investigation result on intended surgery

Ordered investigation revealed abnormalities in 122 (58.7%) patients. Only 7 (3.4%) out of these patients influenced by an abnormal investigation result, 4(2.2%) patients were delayed from surgery due to impacts of abnormal test results had a delayed surgery before the patients final evaluation and risk stratification was completed, in 2(1.1%) patients surgical techniques was changed, in 1 (0.6%) anaesthesia technique was changed and in 1 (0.6%) further test was considered on the same day of surgery. Whereas 163 (40.75%) patients with an abnormal preoperative investigation result underwent surgery without change the perioperative management. A total of 15 out of more than 178 investigations abnormal test results could be regarded as test with significant impact. From these the common are 4 (2.25%) CBC, 2 (1.12%) CXR, and 2 (1.12%) ECG. (Table 4).

Table 3

Binary logistic regression analysis of factor associated with preoperative abnormal investigation result in surgical patients presented to be operated in DURH, Dilla, Ethiopia from 1 November to 30 January, 2022 ($n=208$)

Independent variables	Probability of having abnormal Ix result (*P* value)	COR (95% CI)
Comorbidity	0.041**	7.982
History of smoking	0.049**	1.303
BMI	0.482	1.039
Age	0.747	1.004
History of medication	0.013**	0.188
ASA physical status	0.070	
ASA class I	0.518	0.730
ASA class II	0.029**	3.540

ASA, American Society of Anaesthesiologist; BMI, Body mass index; COR, crudes odds ratio.

Table 4

Magnitude of impacts on the intended surgery and abnormal preoperative investigation results that has an impact on patients in DUH, 2022 ($n = 208$)

Variables	Number, *n* (%)
Total numbers of abnormal investigation result	178 (44.5)
Impacts of abnormal preoperative investigation result	
Yes (patients influenced by an abnormal investigation result).	15 (3.75)
No impacts (patients not influenced by abnormal investigation result (underwent surgery with abnormal result).	163 (40.75)
Patient underwent surgery with normal investigation results	222 (55.5)
Impacts of abnormal preoperative investigation result on the intended surgery	
Delay surgery	4 (2.2)
Change surgical techniques	2 (1.1)
Anaesthesia techniques	1 (0.6)
Further test considered	1 (0.6)
Preoperative investigation that leads impacts on intended surgery	
CBC	4 (2.25)
CXR	2 (1.12)
ECG	2 (1.12)
RFT, LFT, FBS, U/A and others	1 (0.56)

CBC, complete blood count; CXR, chest X-ray; FBS, fasting blood sugar; ECG, electrocardiogram; LFT, liver function test; RFT, renal function test; U/A, urine analysis.

Discussion

Among more than 400 investigations had done, out of these 178 (44.5%) were investigations that have abnormal result. The preoperative abnormal test result that were not influence the patients are 163 (40.75%), but notably only fifteen (3.75%) abnormal results had an impact on the perioperative management in terms of delay of surgery, changing anaesthesia and surgical technique and further testing reporting, etc. These results strongly question the necessity for routine preoperative tests.

In the present study, 178 (44.5%) of the patients had at least one abnormality in the tests done, which is higher than the 4.37% tests incidence of abnormal results in study which was done by Ashis and colleagues. This is probably because of the difference in the population studied and the investigation which was studied by the previous study was only routine laboratory investigations[16].

Again it is higher than 4.2% incidence of unexpected abnormal results in a previous study done by Berhanetsehay and colleagues in Addis Ababa. This is probably due to the selection of tests that have unexpected abnormal results proposed to report accidental abnormal test results during routine preoperative tests[9].

The current study finding is lower than the previous study done in India by Reazaul Karim HM *et al.*[14] revealed the incidence of 57.2%.This probably of difference in results might be due to the higher sample size included than ours.

In this study the detected abnormalities are CBC 94 (59.5%), others 23 (14.6%) like TFT, U/S and LFT 14 (8.9%) were the major. When compared with the finding reported by Virintorn Prapakornkovit and colleagues, the rates of abnormal investigation results were 40.2% for EKG, 15.5% for CXR, 12.7% for Hb were top three identified in individuals undergoing elective cataract surgeries. The probable justification for different results with our study is that it is a case-specific evaluation[17].

When it came to detecting/indicating comorbidity (disease), it detected a total 20 comorbidities; 8 (4.4%) of these were cardiovascular disease. Only 5 cases were significant new comorbidity out of 208 patients. In this context, we have to remember that the use of the preoperative tests as screening tool for detecting new hidden asymptomatic diseases is also not advised by experts[18] Again, cost-effectiveness for detecting one such significant case which will change perioperative anaesthetic management and outcome in terms of mortality reduction have to be considered.

The importance to train the surgical staff so that inappropriate preoperative laboratory tests are not requested for healthy paediatric patients is emphasised in the study which was done Naiyana Aroonpruksaku *et al.*[19] in Thailand because unnecessary test have their own impact like overtreatment of borderline or false positive results and increased in coast burden .this results are in line with our study.

The traditional practice of routine preoperative tests before surgery is still very much prevalent both among anaesthesiologists and surgeons. This leads a huge cost burden this is showed in the study which is done by tekelemariam *et al.*[9] in elective surgical patient at a tertiary care institution. Our study also found similar results. The average cost per patient was 146.2birr with 18 patients didn't know the cost they paid.

All these indicate that routine preoperative testing is not at all cost-effective in changing perioperative anaesthetic management and outcome.

Conclusion and recommendation

Conclusion

Majority 122 (58.7%) of the patients had at least one abnormal test results on routine preoperative tests, but only 15 (3.75%) of all tests performed had any impact in terms of delayed surgery, further testing, and surgical technique change. Eighty-six (70.49%) of the patients are emergency surgery, whereas 36 (29.51%) are those underwent elective surgery with an abnormal preoperative investigation result. Only 0.6% of all tests had a significant impact in terms of changing perioperative anaesthetic management. The significant impact of abnormal investigation results noticed was delayed surgery (2.2%).

Recommendation

Routine preoperative investigations should be sent based on guideline and as per the standards to eliminate abnormal test result, cost burden and associated factors. To take appropriate precaution during intraoperative management since most of patients underwent surgery without influenced by abnormal investigation result. Further researches have to be done with a large sample size.

Strengths and limitation of the study

Strength of study

Study includes different fields of surgical specialty unit in DUH.

First study in our setup to our awareness, it can be used as source of data for further work and development of institutional guidelines.

The sample size was somehow enough to decrease the confounding factor.

Limitation of study

Institution-based laboratory reference range difference.

Study does not include treatment for false positives of unwanted investigations and its burden.

Ethical approval

Ethical approval was secured from the Dilla University, college of health science institutional review board.

Consent

No individual or sensitive data is available on request.

Source of funding

Not applicable.

Author contribution

A.T.: conceptualization, design, drafting, manuscript writing. R.M.: editing. G.M.: editing. Z.B.: editing and manuscript writing.

Conflicts of interest disclosure

The authors declare no conflicts of interest.

Research registration unique identifying number (UIN)

1. Registry used = researchregistry.
2. Registration, ID = 10342.
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Data availability statement

Data are available on request.

Provenance and peer review

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