[0] PATTERN OF BLOOD ORDERING, CROSS MATCHING AND UTILIZATION IN THE SURGICAL SUITES OF KENYATTA NATIONAL HOSPITAL (KNH)

BY:

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2005

DECLARATION

This dissertation is my original work, and has not been presented for a degree in any other University.

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My thanks also goes to my dear wife Khaltuma and my children Hamisa, Neima and Abdul for their patience as I burnt the midnight oil.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

K.N.H. . . . . Kenyatta National Hospital

BTU. . . . . Blood Transfusion Unit

MSOBS. . . . . Maximum Surgical Ordering Blood Schedule

WBC. . . . . White Blood Cells

RBC. . . . . Red Blood Cells

Hg. . . . . Haemoglobin

g/dl. . . . . grams per deciliter

C/T. . . . . Crossmatch to Transfusion

T/P. . . . . Transfusion Probability

TI. . . . . Transfusion Index

PDA. . . . . Patent Ductus Arteriosus

VP SHUNT. . . . . Ventriculo Peritoneal Shunt

AP RESECTION... Abdominal Perineal Resection

ICU. . . . . Intensive Care Unit.

SUMMARY

This was a 3 months prospective study carried out at KNH on pattern of blood ordering, cross matching and utilization. Patients who satisfied the study criteria were recruited from elective theatre list of surgical suites of KNH that include: general Surgery, orthopaedic surgery. Paediatric surgery, plastic surgery , cardiothoracic surgery and neurosurgery units.

The following details were recorded for every patient; age, sex, occupation, religion, level of formal education, duration of illness resulting in admission for surgery, duration of waiting for admission after the patient was booked for elective operation, planned surgery type, patient ABO blood group and Rhesus D status and amount of blood requested for that particular operation .

Subsequent follow up of patient's blood request was done at BTU and amount of blood crossmatched and its ABO blood group and Rhesus D for that particular operation were recorded.

After the operation, details of blood transfused or not transfused were recorded. Between the third and fifth postoperative day, blood was drawn from the patients and analyzed for haemoglobin, white blood cell count, platelets, sodium and potassium levels.

On discharge of the patients, duration of hospital stay was recorded.

Only 119 patients whose age ranged between two weeks and 87 years were studied. The results revealed that:-

- The peak age group range was 21 - 30 years (20%)
- The male (68) to female 51 ratio was 1.3:1
- The ratio of Christians (107) 51% to Muslims (12) 9:1
- Education level in the study population was in the order of, no formal education 29.4%, Primary 31.9%, Secondary 29.4%, College 9.2% of the study population.
- Majority of the study patients (62.2%) were unemployed. Duration of illness that patients waited before seeking medical attention ranged from 0 - 1 0 weeks with a peak duration of > 8 weeks(53%).
- Duration of waiting for surgery after diagnosis was made ranged from 0 to greater than 8 weeks. Majority of the patients (72%) waited for 2 weeks or less before being operated on.
- Majority of the study patients had ABO Blood group O

  Rhesus D^+ (66.1%)
- Majority of the surgical procedures done were in the general

  surgical unit (28%)followed by orthopaedic surgical unit (24%)
- The main cause of rescheduled operations was due to lack of

  appropriate ABO Rhesus D Blood (96%).
- The mean preoperative haemoglobin levels ranged from 11.6- 14.5 g/dl (55%)
- Blood transfusion in the elective procedures that were performed in this study were mainly intra operative (88%)

The mean post operative haemoglobin levels for transfused patients and patients not transfused was (11.6 - 14.5) g/dl

Elective surgical procedures performed were predominated by craniotomy and excition of brain tumor (10.9%)

The crossmatch to transfusion ratio (C/T) was <2.5:1 in 16 (39%) of the elective surgical Proedures done, with 15 (36.6%) as having a transfusion probability (T/P) of >30%.

Maximum surgical ordering blood schedule for total hip replacement is one unit of blood.

Majority of the blood from BTU to the surgical units were utilized in the cardiothoracic unit (41.4%)

Mean duration of hospital stay for transfused patients was 27 days and for not transfused patients 29 days.

It is concluded from this study that it is possible to designate MSOBS for elective surgical procedures in KNH.

LITERATURE REVIEW

INTRODUCTION

Despite active blood conservation techniques during surgery, availability of donor blood is still an important prerequisite for surgery[111].

In the United Kingdom, transfusion of donor blood remains the mainstay for the management of patients who are considered to be at risk of major surgical bleeding Use of allogenic blood/blood components in elective surgical procedures varies from specialty to specialty, the incidence of appropriate use of blood transfusion in elective surgery varies widely from 60 - 99% . [3,4,5]

The percentage of cross matched patients receiving transfusion for general surgical procedures range from 5 to 40%[161]

Blood is a scarce resource a critical approach to its use is needed. Various studies have shown that blood transfusion in surgery is over used and the reason for it rarely recorded[7].

Preoperative over ordering of blood, leads to holding up of blood bank reserves, ageing of blood bank unit and wastage of blood bank resources.[18J]

Yet we have operations being differed in elective surgical lists due to non-availability of blood. This can be decreased by means of changing the blood cross matching and ordering schedule depending upon the type of surgery to be performed.

HISTORY OF BLOOD TRANSFUSION

The era of blood transfusion started a century ago with the discovery of the ABO system by Land Steiner [9]. It was not until four decades later with the description of the Rhesus system and perhaps even more critically with the introduction of safe and effective anticoagulant preservative solution, and the development of the antiglobulin test by Coombs that the clinical practice of transfusion as we know it began [10, 11, 12, 13]. Extensive experience with transfusion therapy in surgery accumulated during world war two [14].

AIDS TO EFFECTIVE BLOOD ORDERING

BLOOD ORDERING EQUATION

There has been a growing demand for blood and blood products [15]. This demand has often exceeded the resources of local blood bank and thereby disrupted both the planning and nature of surgical lists [16].

Elective surgery by demanding large quantities of blood each day, of which little is ultimately used, commits valuable supplies and resources both in technician time and reagents. The criteria for ordering blood are often vague and established policies non-existent[7].

This made clinicians to coin the blood ordering equations[17]

The intention of blood ordering schedules is to relate the ordering of blood to the likelihood that a transfusion will be required[18].

MAXIMUM SURGICAL ORDERING BLOOD SCHEDULE

This is a list of number of blood components/units that should be cross matched before most common elective surgical procedures [19\ Each surgical operation is allocated a tariff of transfusion, which is influenced by national & hospital practice but locally agreed by clinicians and blood providers (7,15,18,20). The number of blood units crossmatched before the operation should match the intraoperative transfusion requirement in 90% of patients[21].

The ratio of the number of units of cross-matched red cells for a given operation to the number of units actually transfused crossmatch to transfusion ratio (C: T ratio) should not exceed 2:1 (22,23).

C:T ratio was first suggested by Boral (18) in 1975 subsequently a number of authors used the C:T ratio for evaluating blood transfusion practices[24]

LAROQUE BLOOD ORDERING EQUATION

Laroque used risk factors to allocate points for pre-operative haemoglobin, weight in Kilogram (Kg) and type of surgery, whether primary or revision surgery [251.

JFLPRCURIALI'S BLOOD ORDERING EQUATION

Mercuriali produced an algorithm based on accurate calculation of patient's pre-operative red cell volume, as depicted in the following equation;

(pre-operative Red cell volume) _ (Post operative red Cell volume)

= Operative blood loss - extra transfusion support/demand

Using the same data and a threshold haematocrit, the lowest red cell volume acceptable to the surgical team for that operation can be established [1261].

NUTTAL SURGICAL BLOOD ORDERING EQUATION

Nuttal developed a surgical ordering equation, which accounted for haemoglobin levels. Allowing blood provision to be tailored more closely to the individual patient[27].

TRIGGERS OF BLOOD TRANSFUSION

Risk factors, which predict the need for allogenic transfusions need to be defined. The Traditional 'haemoglobin 10 grams per deciliter/Haematocrit 30%' transfusion trigger has long been challenged in surgical transfusion practice [28,29,30]

The haemoglobin 10 mg per deciliter suggestion was based on clinical experience of the physiology of the transport and release of oxygen but not on successful studies [31,32,33].

Blood is transfused to increase oxygen content and improve oxygen delivery, thereby preventing tissue hypoxia. In the absence clinically reliable direct measurements of adequate tissue oxygenation, haemoglobin concentration is commonly used as a surrogate [34].

In the presence of adequate cardiorespiratory function, haemoglobin concentration of 9 to 10 grams per deciliter improves capillary perfusion, reduces viscosity and improves tissue oxygenation[1281].

A haemolobin level of 8 grams per deciliter is an appropriate threshold for transfusion in surgical patients with no risk of ischaemia, where as a threshold of 10 grams per deciliter can be justified for patients with compromised cardio respiratory function [35].

It has been found that the factors that determine the risk of allogenic transfusion are:(36)

Low pre-operative Haemoglobin/Haematocrit, age over 65 years, availability of pre-operative autologus blood donation, estimated surgical blood loss, type of surgery whether primary or revision surgery.

TRANSFUSION GUIDELINES

Transfusion guidelines have been shown to reduce the number of allogenic transfusion(37)

In a study conducted by Mallet et al [381 They audited prospectively the perioperative transfusion practice in elective surgical patients over a three month period in 1996. Transfusion guidelines that required the haemoglobin level to be measured immediately after surgery were introduced.

The audit was repeated in 1998, transfusion 'triggers' and the number of transfusion of the two periods compared. In the second audit, the total number of transfusions decreased by 43%, the estimated haemoglobin for transfusion decreased from 12.4 to 9.9 grams per deciliter. The study suggested that transfusion guidelines have a significant input on transfusion practice.

The formation of a special hospital committee to develop transfusion guidelines adapted to local clinical situation and conducting blood utilization reviews to monitor effective blood use, has also been shown to reduce the number of aMogenic transfusion [36].

UTILIZATION

Transfusion of red blood cells is used to increase the oxygen carrying capacity of blood in patients who have anemia, packed red blood cells should not be used as a volume expander, a haemostatic agent or as enhancer of wound healing, surgeons have other options in theire armamentarium when dealing with such problems [39]. preoperative anaemia increases the likelihood of allogenic transfusion [40]. When a patient refuses blood transfusion preoperative haemoglobin is an important determinant of operation outcome [41,421. The use of intraoperative transfusion should reflect the ongoing rate of surgical blood loss continued haemodynamic instability and anticipated postoperative bleeding [43] Intraoperative bleeding using near patient testing improves safety margins by avoiding unnecessary transfusion [43,441.

Postoperative transfusion should be a threshold range, 7 to 10 grams per deciliter with clinical indications further defining the need of alllogenic transfusion in between[145,461.

Blood Haemoglobin level as low as seven grammes per decilitre (7g/dl) or less ttiay meet physiological requirements in patients who have adequate intravascular volume for adequate tissue perfusion[38].

OBJECTIVES

1) BROAD OBJECTIVE

To determine the pattern of blood ordering, cross matching and utilization in the surgical suites of Kenyatta National Hospital.

(2) SPECIFIC OBJECTIVES

a) To document the age, gender, of the patient for elective surgery of which blood is required.

b) To determine the amount/units of blood requested, cross matched and transfused per specific surgical procedure.

c) To determine the maximum blood ordering schedule of surgical suites of Kenyatta National Hospital.

RATIONALE

The study will establish the appropriate number of units to be ordered and cross-matched, to the likelihood of being used, in the surgical suites of KNH hence , improve blood utilization and reduce wastage. This will enable the formulation of appropriate transfusion guidelines in KNH which will result in improved transfusion practices.

METHODOLOGY:

A) STUDY AREA

The study was conducted in the Blood Transfusion Unit and surgical suites of Kenyatta National Hospital, specifically the suites in level four, five and six covering general and Orthopaedic surgery as well as speciality units - namely Plastic surgery, Paediatric surgery, Cardiothoracic surgery and Neurosurgery.

B) STUDY POPULATION

All patients who had undergone elective surgical procedures that required blood to be processed.

INCLUSION CRITERIA

The patients who were included in the study satisfied the following criteria:

- Patients scheduled for a surgical procedure and blood is requested for from blood transfusion unit [KNH] for that particular procedure.
- The requested blood unit/s whether cross matched, used or not used within five days of surgery.

EXCLUSION CRITERIA

- Blood used in acute trauma/emergency cases
- Blood transfusion after five days of surgery
- Blood already being transfused on patient referred/transferred to Kenyatta National Hospital, or blood that accompanied that particular patient.
- Blood transfused prior to surgery.
- Patient with documented blood coagulation disorder.
- Patient admitted for more than one planned type of surgery.

C) STUDY DESIGN

This was a prospective cross-sectional study on blood usage on elective surgical operations in Kenyatta National Hospital.

D) SAMPLE SIZE

Sample size was based on patients who satisfy the study criteria and worked out as follows.

$$n = \frac{Z^2 P (T-P)}{d^2}$$

Calculated at a prevalence (P) of 9.06% and a degree of precision (d) of 0.05, this gives a sample size of **119 cases**

KEY

n = Sample size

Z = 1.96

P = proportion of blood utilized in surgical suites for elective surgical cases 9.06% [6].

d = degree of precision (set at + 5% i.e. 95% certainty)

> E) DATA COLLECTION AND HANDLING

The principal investigator collected data with guidance and clarification from the supervisors.

F) MATERIALS

Writing material

Computer for data entry and analysis

G) DATA ANALYSIS

Data was collected on structured questionnaires and transferred to a matching computer database for statistical derivation and calculations done by a qualified statistician. Computer generated spreadsheets were prepared from the database and then transferred to SPSS® statistical software for analysis. The descriptive summary statistics were presented as proportions and percentages in form of tabulations, charts and graphs using SPSS®.

The various data elements such as demographics and clinical data were correlated to the amount of blood ordered, cross-matched and utilized. Various statistical derivations were made and compared to recommend ordering equations, so as to determine the MSOBS in KNH. The ratio of the number of blood units of cross-matched to the number of units actually transfused were also determined.

ETHICAL CONSIDERATION

Permission to carry out the study was sought and obtained from the ethical research committee Kenyatta National Hospital before embarking on the study.

The collected information will be kept in a confidential manner.

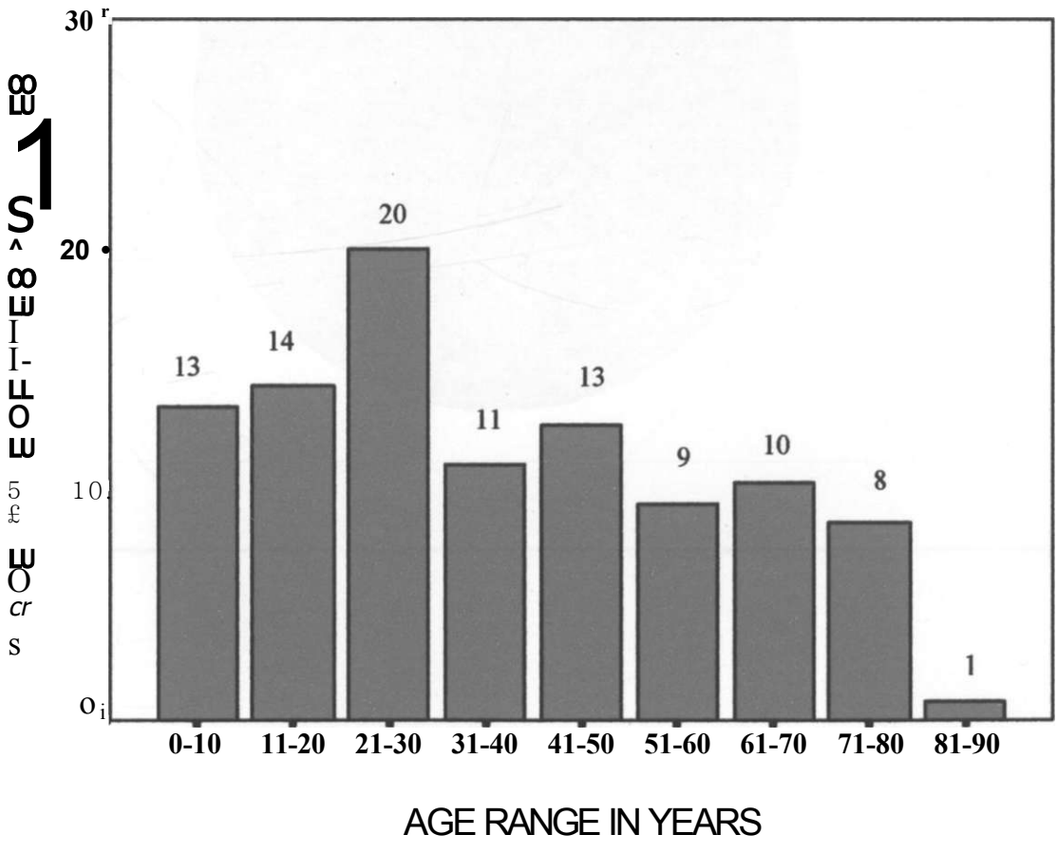
All patients recruited into the study signed an informed consent.

RESULTS

119 patients were involved in the study and 41 elective surgical procedures performed. The data was entered and analyzed using the SPSS version 10.0 computer data analysis package.

These 119 patients had an age range of between 2 weeks to 87 years with a mean age of 36.0 years with a standard deviation of ±27 years, with a peak age group of 21 to 30 years (20%) as shown in figl below.

FIG 1: AGE GROUP RANGE AND PROPORTION OF THE STUDIED CASES

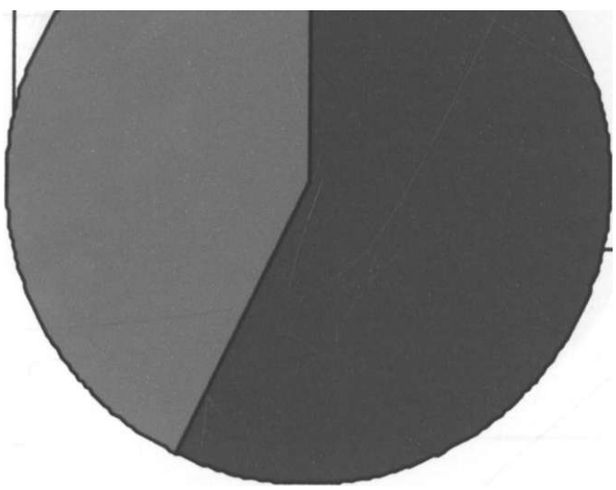


The studied cases were 68 (57.1%) males and 51 (42.9%) females

with a male: female ratio of 1.3:1 as summarized in the pie chart below (fig2).

FIG 2. SEX DISTRIBUTION

Female
42.9% (51)

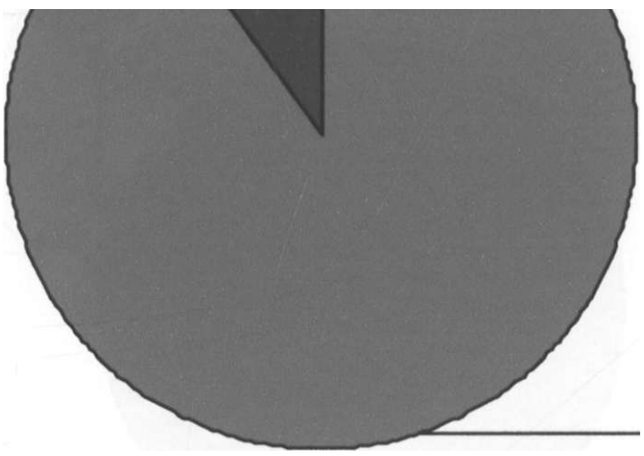


Male
57.1% (68)

Religion distribution showed 99.1% of the study population were Christians and 10.1% Muslims. This is illustrated in the pie chart below (fig 3).

FIG 3: RELIGION DISTRIBUTION

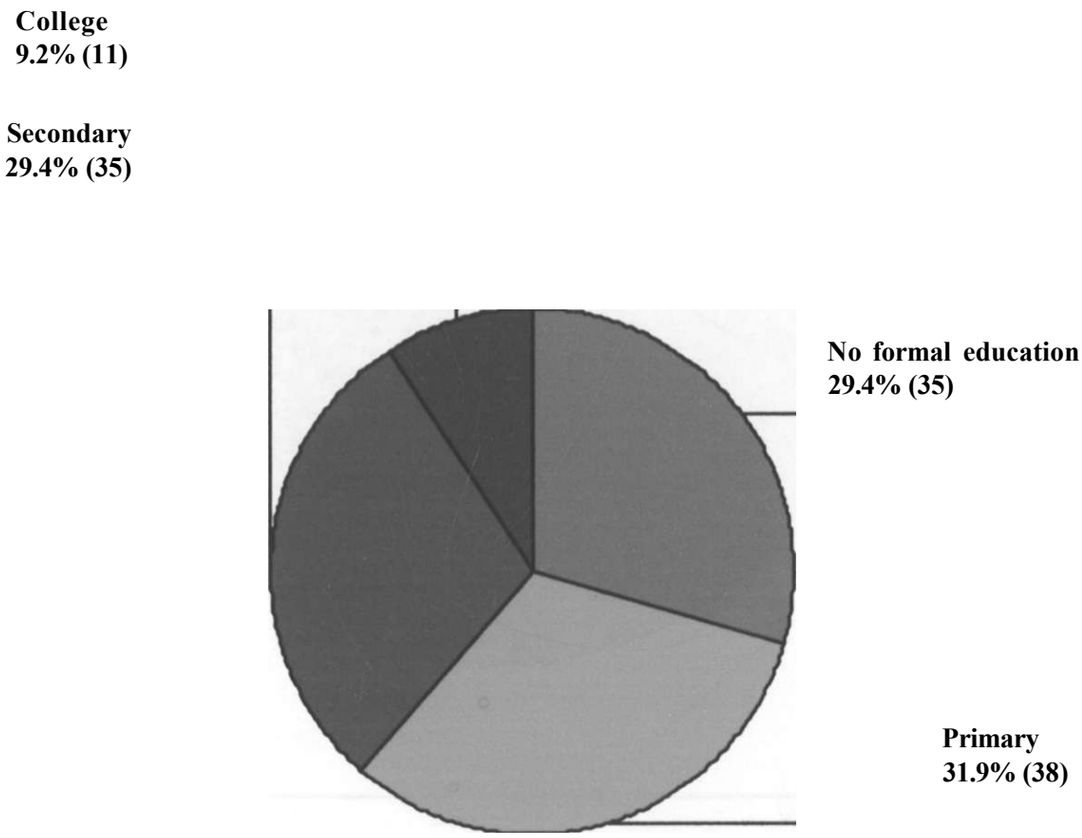
Muslims
10.1% (12)



Christians
89.9% (107)

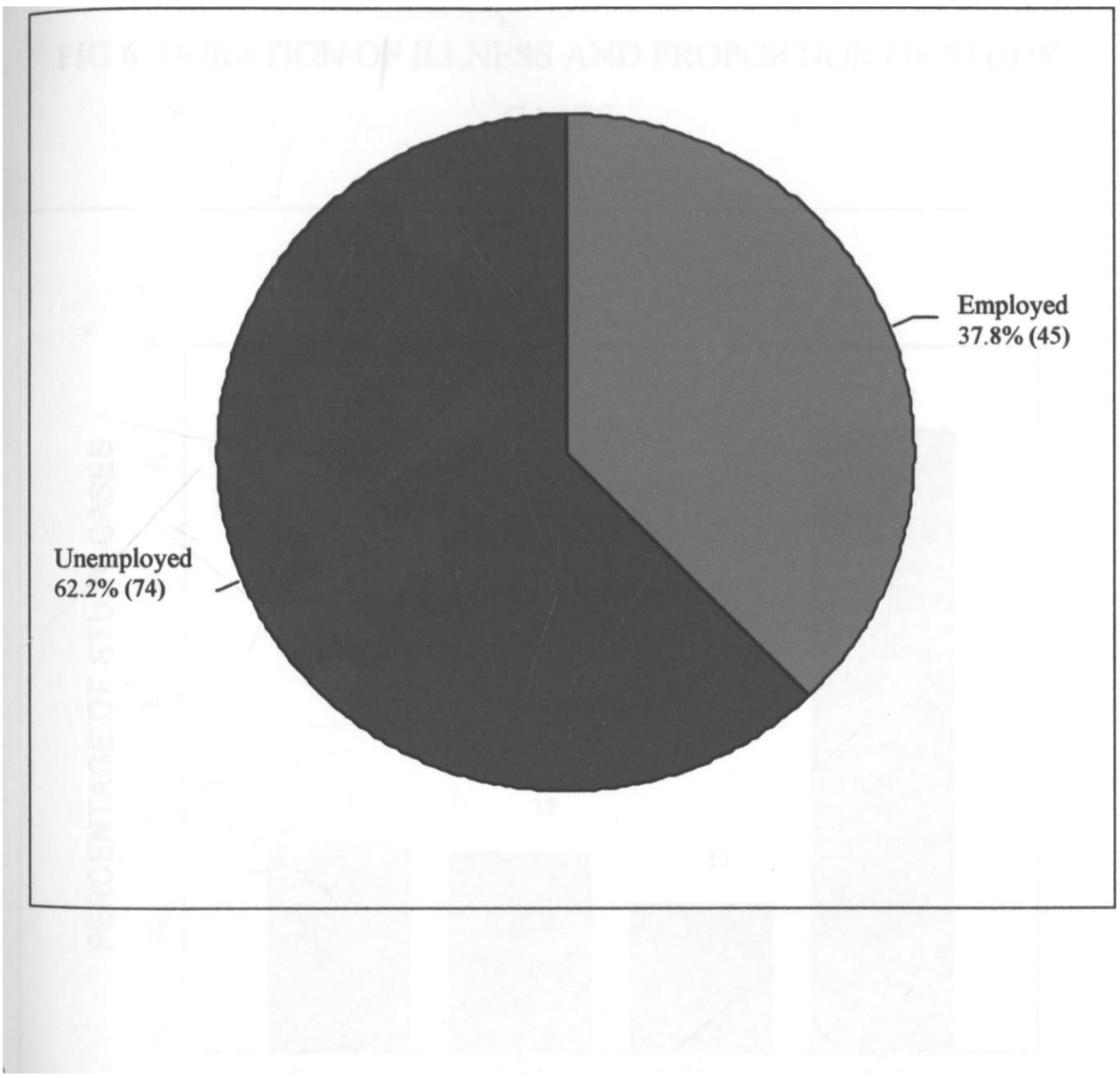
The formal education background revealed that the majority were of primary school level (31.9%) while 29.4% of the patients had no formal education. The rest were distributed as shown in the pie chart below (fig4).

FIG 4. LEVEL OF EDUCATION



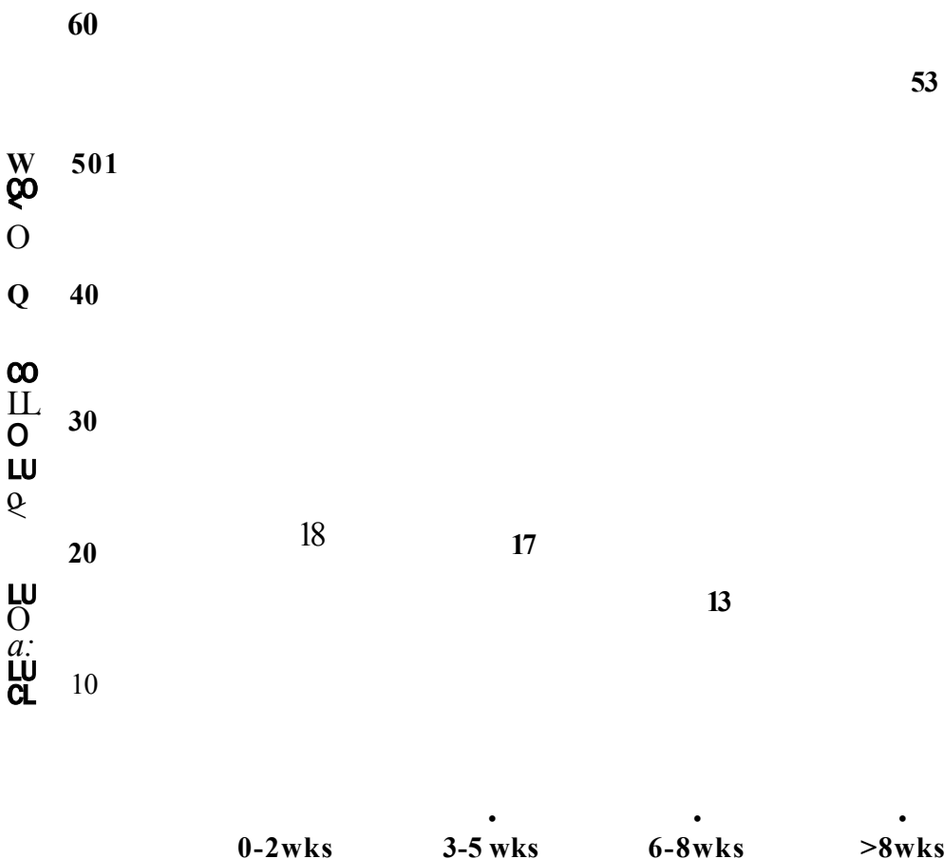
The ratio of employed (37.8%) to unemployed (62.2%) was 0.6:1. This is as shown in the pie chart below (fig 5).

FIG 5. OCCUPATION



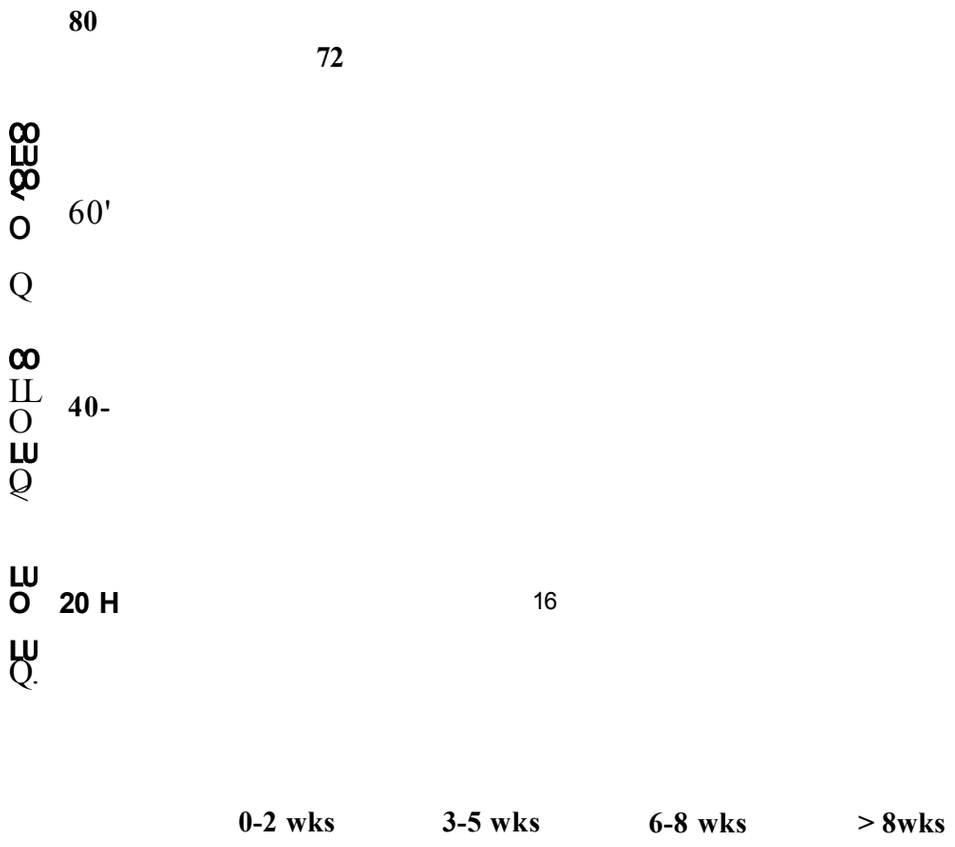
The pattern of scheduling for medical review showed that 53% of the study patients waited for 8 weeks or more before seeking medical attention. Only 18% of the study patients sought medical attention within 0-2 weeks of the illness of the onset of illness as shown in fig 6 below.

FIG 6. DURATION OF ILLNESS AND PROPORTION OF STUDY CASES



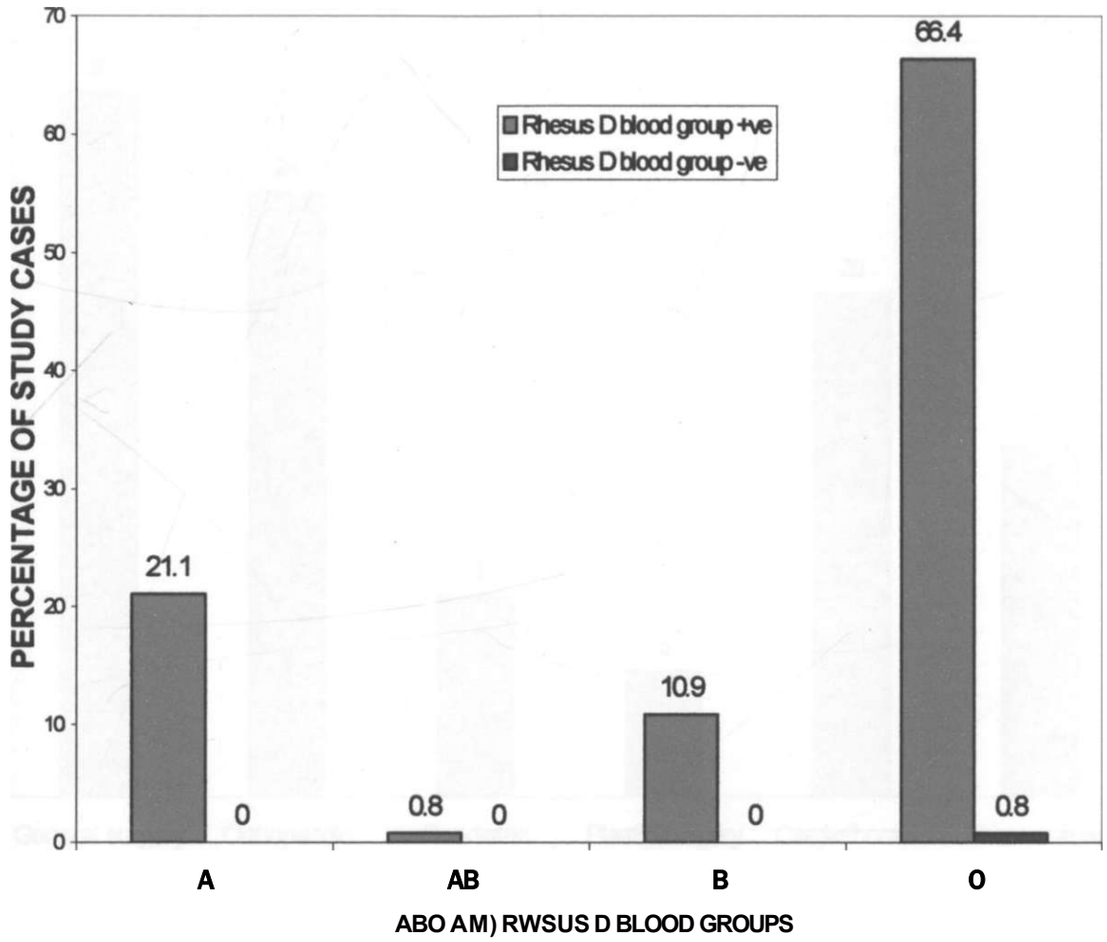
The short listing for surgery revealed that most of the study cases (72%) were admitted for surgery within 2 weeks of being booked for that particular type of surgical procedure. The rest were distributed as shown in fig 7 below.

FIG 7. DURATION OF WAITING FOR ADMISSION FOR SURGERY



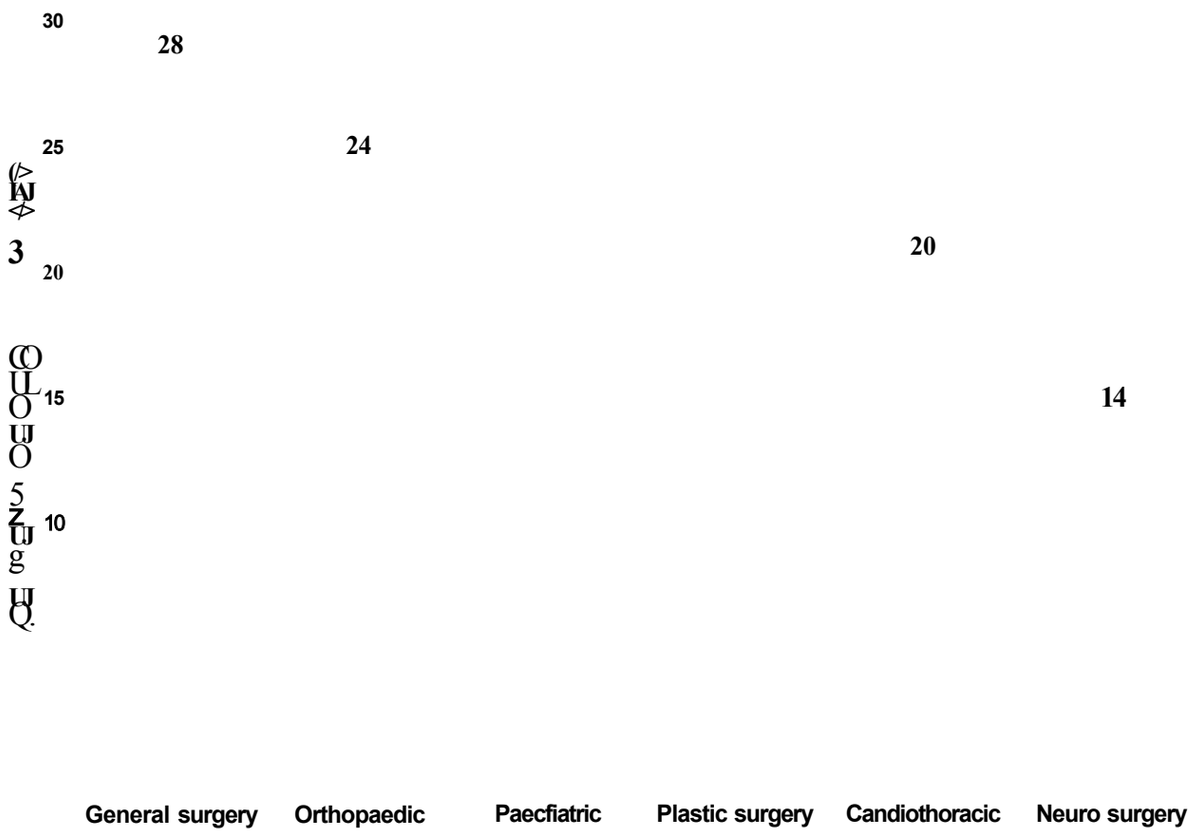
Since the ABO and Rhesus D blood group is an important determinant of blood being made available, their evaluation showed that 66.4% of the study patients were in blood group 0+. The rest were distributed as shown in fig 8 below.

FIG 8. ABO AND RHESUS BLOOD GROUP OF THE STUDY CASES



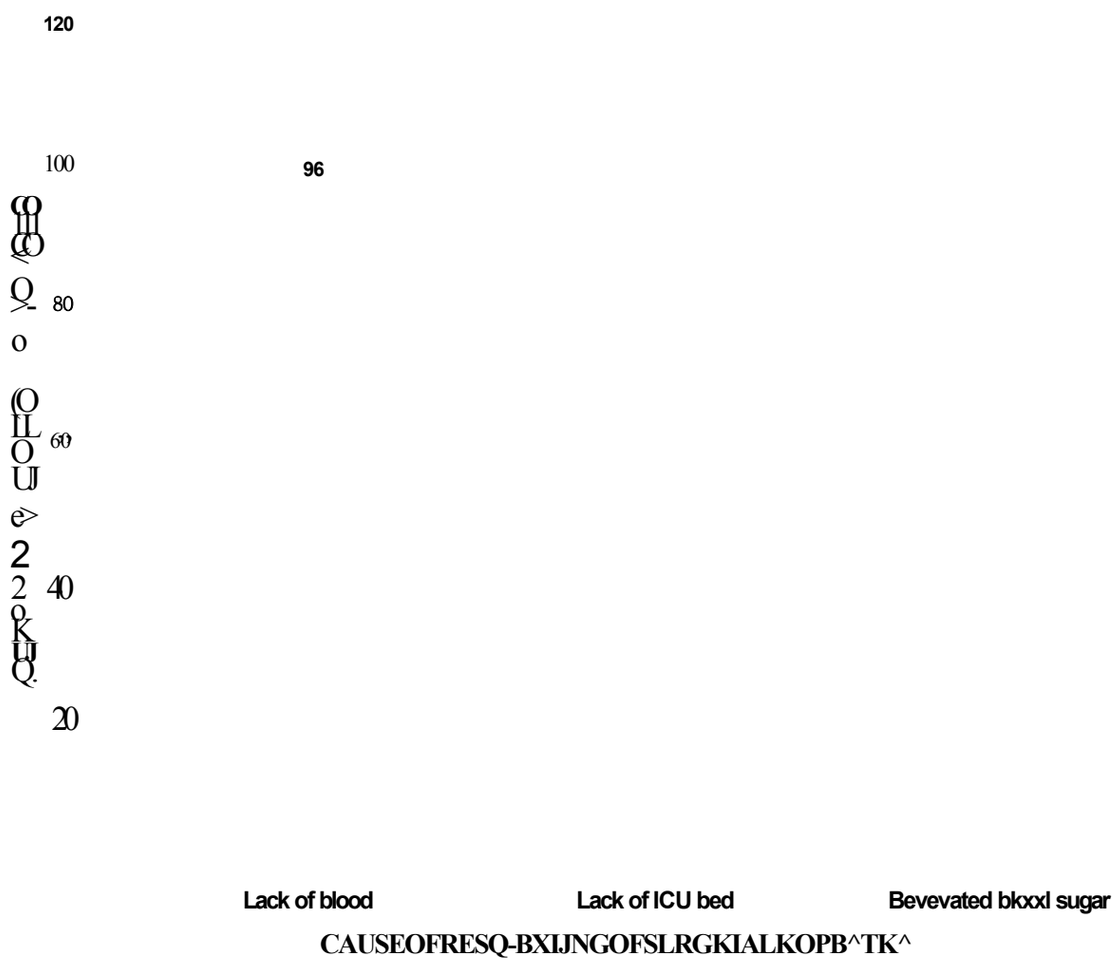
There are several surgical units within the department of surgery, 28% of the surgical procedures were performed in the general surgical unit and 24% in the orthopedic unit. The rest of the distributions are as shown in fig 9 below.

FIG 9. PROPORTION OF SURGICAL CASES PERFORMED PER SURGICAL UNIT



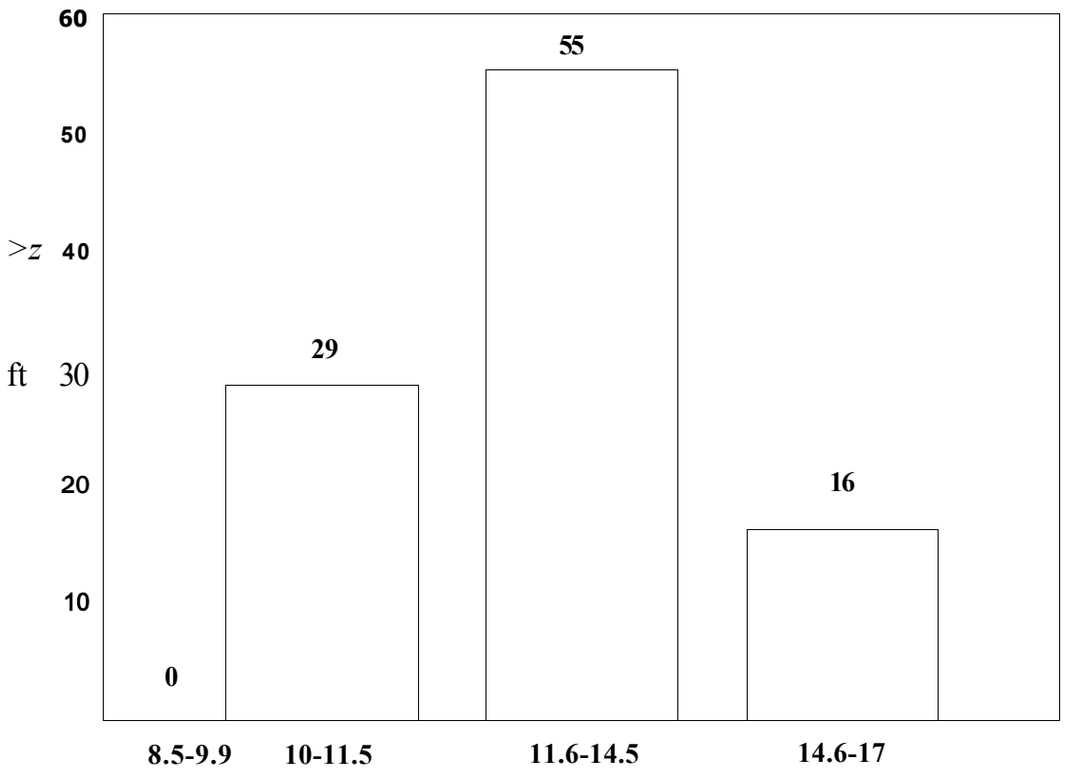
There appeared to be three reasons for rescheduling of operations in the study cases and 42 surgical operations (36%) were rescheduled. The main cause of rescheduling of surgical operations was due to lack of appropriate ABO and Rhesus D blood (36%) as shown in fig 10 below.

FIG 10. CAUSES OF RESCHEDULING OF SURGICAL OPERATIONS.



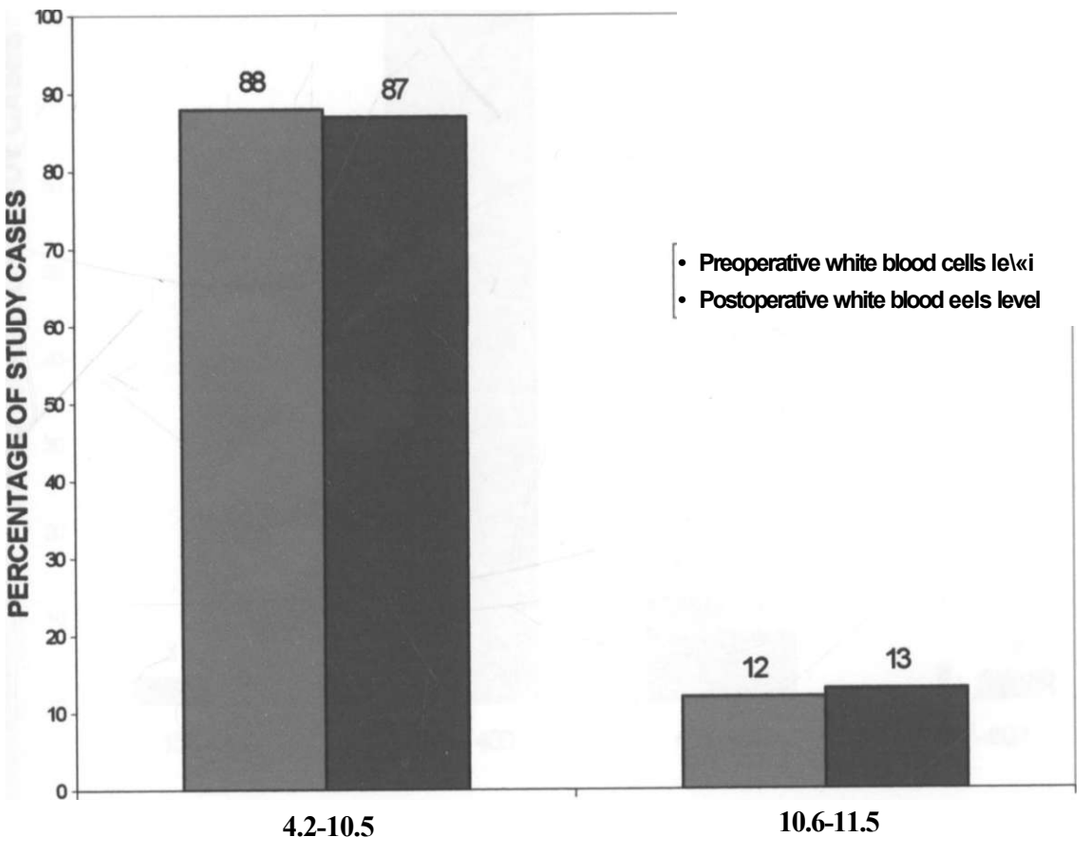
The preoperative haemoglobin levels were distributed as shown. 55% had haemoglobin levels between 11.6-14.5 g/dl as shown in fig 11 below.

FIG 11. PREOPERATIVE HAEMOGLOBIN LEVELS



Laboratory results on the preoperative and postoperative levels of white blood cells, platelets, sodium and potassium were as shown in figl2, figl3, figl4 and fig 15 respectively.

FIG 12. PREOPERATIVE AND 3rd DAY TO 5™ DAY POSTOPERATIVE WHITE BLOOD CELLS LEVELS



WHITE BLOOD CELL COUNT (x 10^9/Litre)

FIG 13. PREOPERATIVE AND 3rd DAY TO 5th DAY POSTOPERATIVE PLATELETS LEVELS

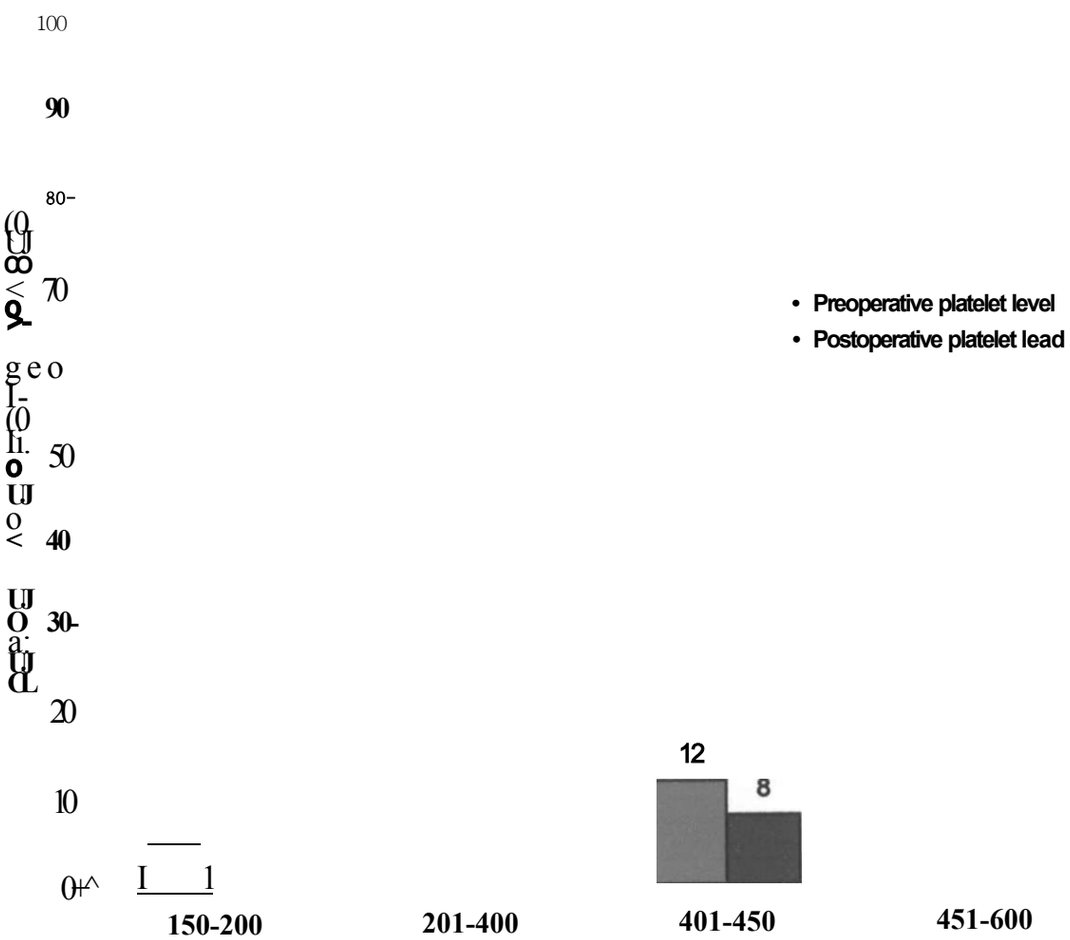


FIG 14. PREOPERATIVE AND 3rd DAY TO 5th DAY POSTOPERATIVE SODIUM LEVELS

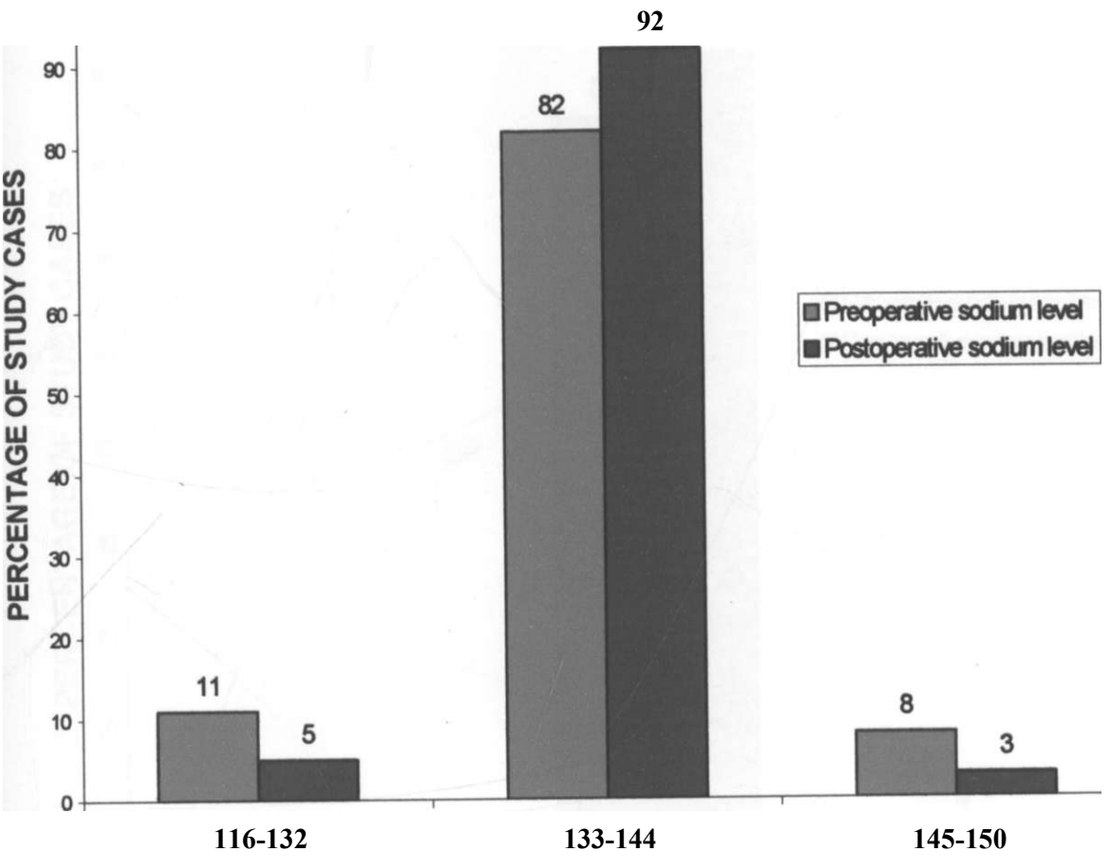
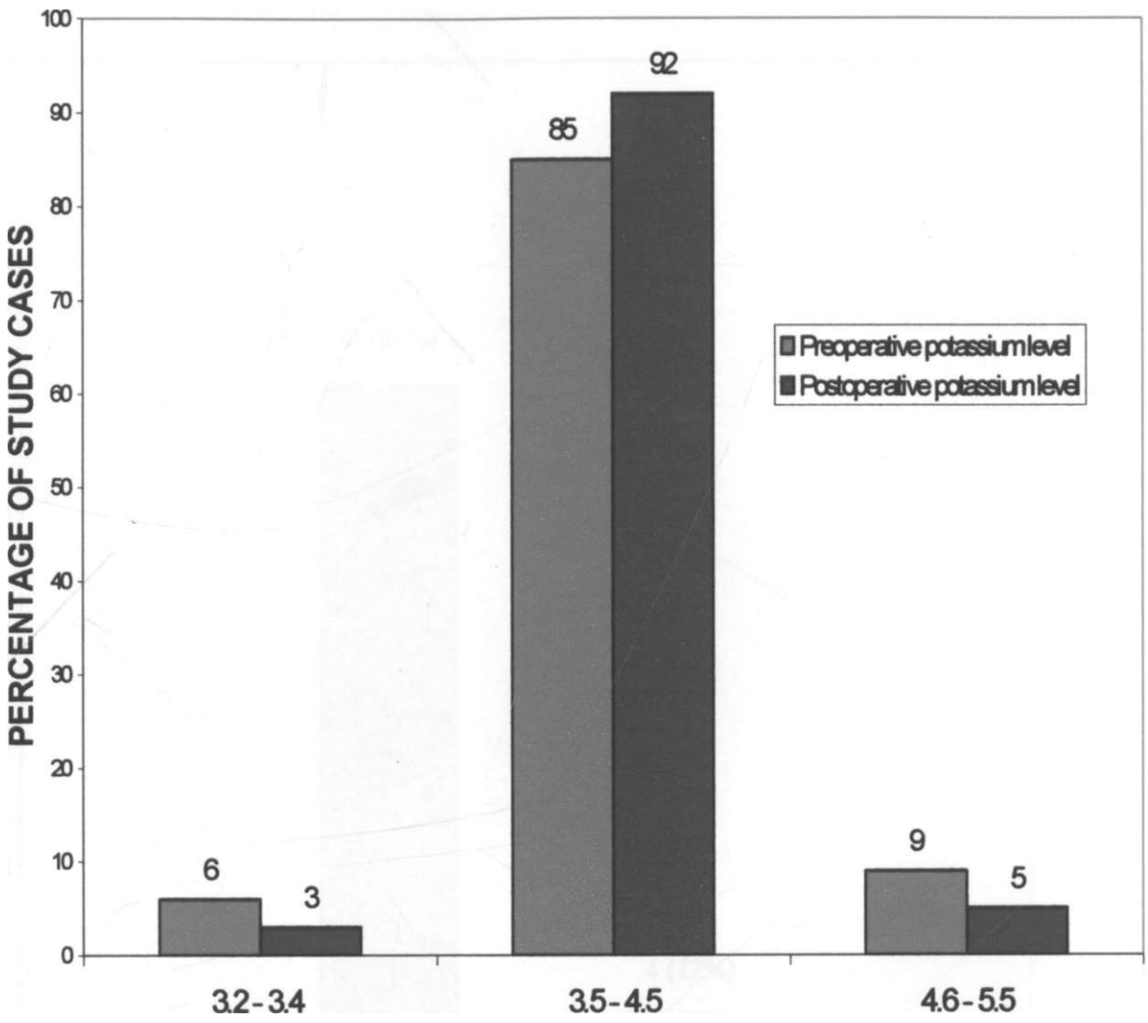


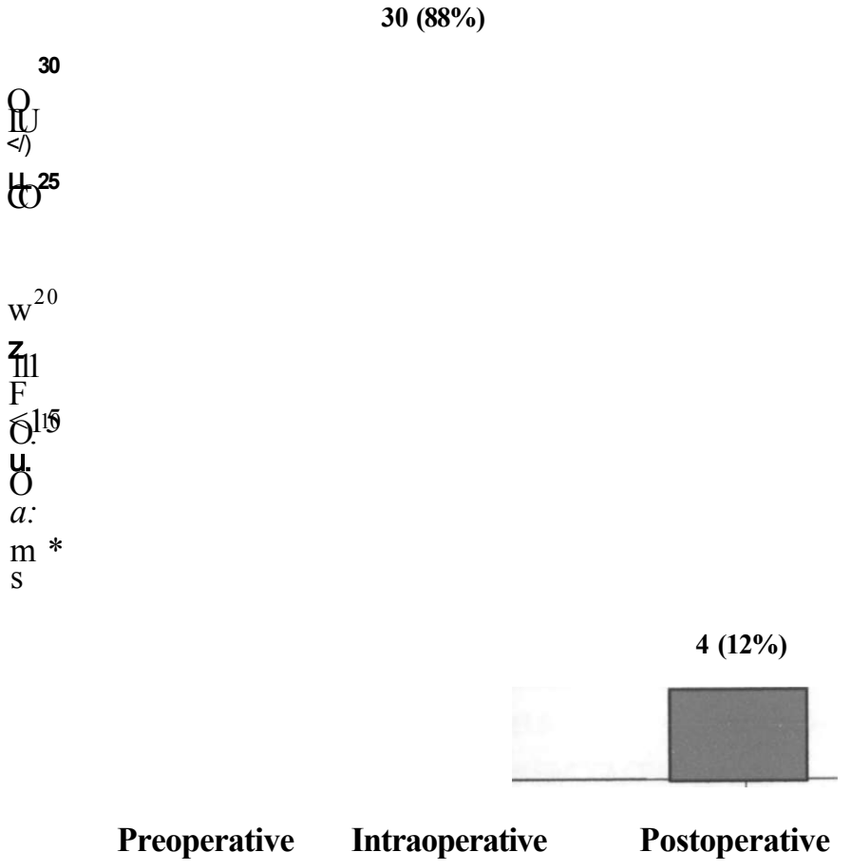
FIG 15. PREOPERATIVE AND 3rd DAY TO 5TM DAY POSTOPERATIVE POTASSIUM LEVELS



POTASSIUM LEVELS (Mmol / L)

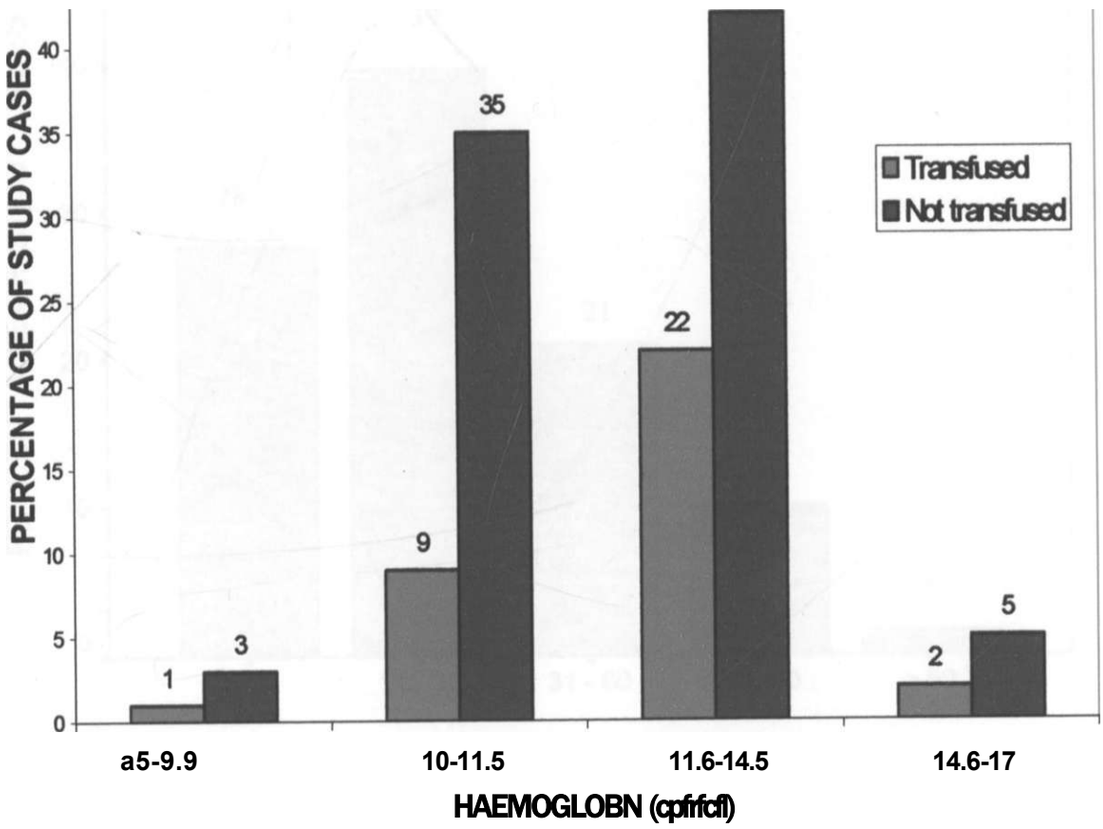
of the 34 patients who were transfused, 30 (88%) were transfused intraoperatively as shown in fig 16 below.

FIG 16. TIMING OF TRANSFUSION



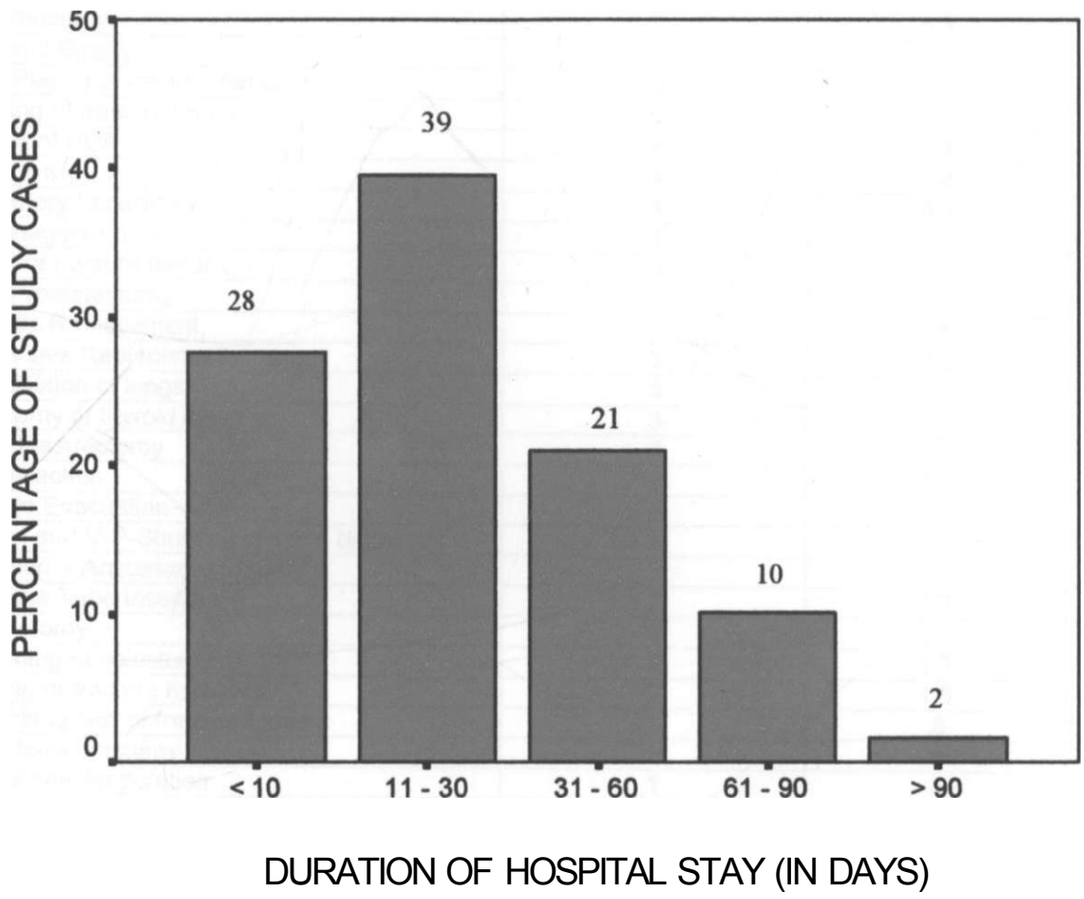
Mean postoperative hemoglobin level was 11.6-14.5 gm/dl (54%) as illustrated in Fig 17 below.

FIG 17. PRORPOTION ON 3rd DAY TO 5th DAY POSTOPERATIVE HAEMOGLOBIN LEVELS



39% of the study patients had a hospital stay of 11-30 days as shown in fig 18 below.

FIG 18. DURATION IN DAYS OF HOSPITAL STAY



Surgical procedures performed were predominated by Craniotomy + Excition of brain tumor (10.9%), colostomy closure (6.7%), skin grafting (5.9%) and thyroidectomy (5.9%). The rest of the surgical procedures were distributed as shown in table 1 below.

TABLE 1. OPERATIVE PROCEDURES

Surgery Performed	Number	%
Craniotomy + Excition of brain tumor	13	10.9
Colostomy Closure	8	6.7
Skin Grafting	7	5.9
Thyroidectomy	7	5.9
Exertional Biopsy	6	5.0
Angle Plating of fracture femur	6	5.0
K-Nailing of fracture femur	5	4.2
Ligation of PDA	4	3.4
Mastectomy	4	3.4
Explaratory Laparatory	4	3.4
Oesophagectomy	4	3.4
Plating of fracture femur	3	2.5
Open Prostatectomy	3	2.5
Total Hip Replacement	3	2.5
Mitral Valve Replacement	3	2.5
Decortication of lungs	3	2.5
Lobectomy of thyroid gland	3	2.5
Partial Gastrectomy	2	
A-P-Resection	2	
Burrhole Evacuation	2	
Excition and V-P-Shunting of spina bifida	2	
Resection + Anatamosis of gut	2	
Cellestine Tube Insertion	2	
Thoracotomy	2	\./
Fashioning of colostomy	2	
K-Wiring of fracture humerus	2	1.6
Interlocking Nail of fracture femur	1	.8
Right Hemicolectomy	1	.8
[Below Knee Amputation	1	.8
Above Knee Amputaion	1	.8
.Laminectomy of the spinal vertebrae	1	.8
fistulectomy of large gut	1	.8
Multiple Screws for fracture neck of femur	1	.8
__Repair of Atrial Septal Defect	1	.8
Cardiomyotomy	1	.8
^Feeding Gastrostomy	1	.8
pneumonectomy	1	.8
^Adrenolectomy	1	.8
^Correction of Tetriallogy of Fallot	1	.8
_Aortic Valve Replacement	1	.8
.Repair of Abdominal Aortic Aneurysm	1	.8
Jotal	119	100.0

16 (39%) of the 41 elective surgical procedures performed had a crossmatch to transfusion ratio of below 2.5 to the ratio of 1 as shown in table 2 below.

TABLE 2: CROSS-MATCH AND ACTUAL TRANSFUSION RATIO

Surgery performed	Units of blood cross -matched	Units of blood transfused	Cross-match / Transfusion ratio
Skin Grafting	9	2	4.5:1
Ligation of PDA	6	1	6:1
Mastectomy	4	3	1.3:1
Partial Gstrectomy	3	2	1.5:1
K-Wiring of fracture humerus	1	0	0
A-P-Resection	2	2	1:1
Craniotomy + Excition of brain tumor	20	12	1.7:1
Interlocking Nail of fracture femur	2	0	0
Plating of fracture femur	4	0	0
Burrhole Evacuation	2	0	0
Open Prostatectomy	5	0	0
Right Hemicolectomy	2	1	2:1
Exertional Biopsy	9	5	1.8:1
Thyroidectomy	7	0	0
Angle Plating of fracture femur	7	1	7:1
Total Hip Replacement	4	3	1.3:1
Colostomy Closure	8	1	8:1
Excition and V-P-Shunting of spinal bifida	2	0	0
Below Knee Amputation	1	0	0
Above Knee Amputation	1	0	0
Laminectomy of spinal vertebrae	2	2	1:1
Mitral Valve Replacement	11	11	1:1
Decortication of lungs	4	1	4:1
Lobectomy of thyroid gland	3	0	0
Explaratory Laparatory	6	0	0
K-Nailing of fracture femur	5	1	5:1
Resection + Anatamosis of gut	3	1	3:1
Fistulectomy of large gut	1	1	1:1
Multiple Screws of fracture femur	1	0	0
Cellestine Tube Insertion	4	0	0
Thoracotomy	5	2	2.5:1
Repair of Atnal Septal Defect	3	3	1:1
Cardiomyotomy	1	0	0
Feeding Gastrostomy	2	0	0
^Pneumonectomy	2	2	1:1
Adrenolectomy	3	1	3:1
.Correction of Tetralogy of Fallot	1	0	0
^Fashioning of colostomy	2	1	2:1
_Oesophagectomy	6	5	1.2:1
_Aotic Valve Replacement	4	5	0.8:1
^Repair of Abdominal Aotic Aneurysm	3	3	1:1

15 (36.6%) of the 41 surgical procedures done had a transfusion probability of 30% or more as shown in table 3 below.

TABLE 3: TRANSFUSION PROBABILITY

Surgery performed	No of patients transfused	No of Patients cross-matched	Transfusion Probability (%)
Skin Grafting	2	7	28
Ligation of PDA	1	4	25
Mastectomy	2	4	50
Partial Gstrectomy	0	2	0
K-Wiring of fracture humerus	0	1	0
A-P-Resection	1	2	50
Craniotomy + Excition of brain tumor	4	12	33.3
Interlocking Nail of fracture femur	0	1	0
Plating of fracture femur	0	3	0
Bunrtiole Evacuation	1	2	50
Open Prostatectomy	0	3	0
Right Hemicolectomy	1	1	100
Exertional Biopsy	2	6	33.3
Thyroidectomy	0	7	0
Angle Plating of fracture femur	2	6	33.3
Total Hip Replacement	1	3	33.3
Colostomy Closure	1	8	12.5
Excition and V-P-Shunting of spinal bifida	0	2	0
Below Knee Amputation	0	'1	0
Above Knee Amputation	1	1	100
Laminectomy of spinal vertebrae	0	1	0
Mitral Valve Replacement	2	3	66.7
Decortication of lungs	2	3	66.7
Lobectomy of thyroid gland	0	3	0
Explaratory Laparatory	1	4	25
K-Nailing of fracture femur	1	4	25
Resection + Anatamosis of gut	1	2	50
Fistulectomy of large gut	1	1	100
Multiple Screws of fracture femur	0	1	0
Cellestine Tube Insertion	0	2	0
Thoracotomy	0	2	0
Repair of Atrial Septal Defect	1	1	100
^Cardiomyotomy	0	1	0
Feeding Gastrostomy	0	1	0
Pneumonectomy	0	1	0
_Adrenolectomy	1	1	100
.Correction of Tetralogy of Fallot	0	1	0
^Fashioning of colostomy	1	2	50
^esophagectomy	4	4	100
.Aotic Valve Replacement	0	1	0
iRepair of Abdominal Aotic Aneurysm	0	1	0

19 (46.3%) had a transfusion index of 0.5 or more as shown in table 4 below.

TABLE 4: TRANSFUSION INDEX

Surgery performed	Units transfused	No of Patients cross-matched	Transfusion index
"Skin Grafting	2	7	0.3
Ligation of PDA	1	4	0.3
Mastectomy	3	4	0.8
Partial Gstrectomy	2	2	1
K-Wiring of fracture humerus	0	1	0
A-P-Resection	2	2	1
Craniotomy + Excition of brain tumor	12	12	1
Interlocking Nail of fracture femur	0	1	0
Plating of fracture femur	0	3	0
Burrhole Evacuation	0	2	0
Open Prostatectomy	0	3	0
Right Hemicolectomy	1	1	1
Exertional Biopsy	5	6	0.8
Thyroidectomy	0	7	0
Angle Plating of fracture femur	1	6	0.2
Total Hip Replacement	3	3	1
Colostomy Closure	1	8	0.1
Excition and V-P-Shunting of spinal bifida	0	2	0
Below Knee Amputation	0	1	0
Above Knee Amputation	0	1	0
Laminectomy of spinal vertebrae	2	1	2
Mitral Valve Replacement	11	3	3.7
Decortication of lungs	1	3	0.3
Lobectomy of thyroid gland	0	3	0
Explaratory Laparatory	0	4	0
K-Nailing of fracture femur	1	4	0.3
Resection + Anatamosis of gut	1	2	0.5
Fistulectomy of large gut	1	1	1
Multiple Screws of fracture femur	0	1	0
Cellestine Tube Insertion	0	2	0
Thoracotomy	2	2	1
Repair of Atrial Septal Defect	3	1	3
Cardiomyotomy	0	1	0
Feeding Gastrostomy	0	1	0
Pneumonectomy	2	1	2
Adrenolectomy	1	1	1
.Correction of Tetralogy of Fallot	0	1	0
_Fashioning of colostomy	1	2	0.5
_Oesophagectomy	5	4	1.3
_Aotic Valve Replacement	5	1	5
Repair of Abdominal Aotic Aneurysm	3	1	3

Transfusion index of operative procedures that were frequently performed (3 or more times) with a transfusion probability of 30% or more was used as the number of units to be requested in MSOBS in the study patients as shown in table 5 below.

TABLE 5: MAXIMUM SURGICAL ORDERING BLOOD SCHEDULE (MSOBS)

Surgery performed	MSOBS
Craniotomy + Excision of brain tumor	1
Exertional Biopsy	0.8
Angle Plating of fracture femur	0.2
©esophagectomy	1.3
Total Hip Replacement	1
Mitral Valve Replacement	3.7
Decortication of lungs	0.3

Cardiothoracic surgery unit had the highest amount of blood utilization (41.4%) as in table 6 below.

TABLE 6 : BLOOD UTILIZATION

Surgery performed	No of units Requested	No of units cross-matched	No of units used	% Blood utilized	C/T Ratio
General surgery	49	42	11	15.7	3.8
Orthopaedic surgery	44	35	11	15.7	3.1
Paediatric surgery	10	10	4	5.7	2.6
Plastic surgery	8	7	1	1.4	7.0
Cardiothoracic surgery	57	51	29	41.4	1.8
Neuro surgery	35	30	14	20	2.1
[Total	203	175	70	100	

Total number of units crossmatched =175

Total number of units used = 70

Utilization rate in all the surgical departments is 40%. Average C/T ratio for all the surgical units = 2.5 : 1

DISCUSSION

This was a prospective study of one hundred and nineteen (119) patients who were admitted for elective surgical procedures in the surgical suites of KNH. It is the first kind of study in this institution. There being no other studies in this area to compare with, it will form a baseline for future reference.

Age group distribution with a peak age group of 21 to 30 years accounted for 20% of the patients in the study population. Age group (21-30years) is an active age group who are prone to trauma or trauma related injuries.

This is a reflection of the majority of elective procedures in this study population (31%) which were trauma or trauma related. Wabomba on his study of surgical delivery services at KNH and Afiilo on pattern of autologus blood use in surgical cases in surgery in KNH had similar peak age group.[47,48]

The sex distribution in this study was 68 (57.1%) Male 51(42.9%) Female with a M: F of 1.3: 1. This sex ratio defers with the sex ratio of other studies carried outatKNH[147,481]. This can be explained by the fact that the studies involved different surgical conditions with different sex distribution patterns.

Studies in other centres also showed variation in sex distribution [32>49,51J

The religion distribution is a reflection of the predominant Christian community in the study area, 89.9% of the study population being Christians.

This is in keeping with the study done by Afulo,[47] which found a Christian to Muslim ratio of 10:1.

From the level of education, 29.4% of the study population did not have any formal education but with the current free education in Kenya, subsequent studies will show a different pattern of level of education. Previously, primary education was not free in Kenya. Afulo, on pattern of pre-operative autologus blood deposit in surgical practice at the KNH in 1998, found that 11% of the study population did not have any formal education.

Analysis of the employment status of the study population indicates 62.2% being unemployed. This being an urban centre, we expected that the majority of the residents of Nairobi to be involved in one form of employment or another hence the 62.2% of the study population being unemployed does not reflect on this. This study involved a wide age group range of 2 weeks to 87 years. Therefore, the issue of employment will not arise in the extreme of ages. And since this being a public health institution, we expect employed people to have access to health cover and hence attend private hospitals. Similar findings were also found in other studies in the same institution[47,48]

Majority of the study patients (53%) waiting for 8 weeks or more before seeking medical attention. This implies that most patients are ignorant of symptoms until they develop complications and advanced disease. This infer on the majority of the study population 29.4%, with no formal education hence the ignorance.

Hospital treatment in this institution where the study was conducted is not free and 62.5% of the study population were not employed hence lack of money could be a contributing factor for patient waiting for 8 or more weeks before seeking medical attention. A study done in the same institution had similar findings [47]"

General surgical unit accounted for 28% of surgeries performed followed by orthopaedic surgical unit with 24% of surgeries performed. Both orthopaedic and general surgical units accounted for 52% of all elective surgical procedures done compared to 48% in the remaining four surgical units. This is because the two units i.e. general surgical and orthopaedic units have a greater number of theatre allocations per week than the other surgical units. Orthopaedic unit has nine theatre allocations compared to two in the plastic surgical unit. No wonder, plastic surgery unit, accounted for only 8% of the surgical procedures done. In the study by Maxwell on the use of red blood cell in surgery conducted at royal Melbourne Hospital, similar findings were found.[1521]

There were 119 elective surgical operation done in these study, 42(36%)of the operation performed, were done after a reschedule, the reasons for the rescheduling were:

- Lack of appropriate ABO and Rhesus D blood [96%]
- Lack of ICU bed [2%] and
- Elevated blood sugars [2%]

This shows that blood is a major prerequisite for surgery[12,29,511]. Blood is a scarce resource, the demand of blood has often exceeded the resources of the blood bank there by disrupting both the nature and planning of elective surgical lists.[151]

The preoperative haemoglobin of all the patients in this study was above 10 s/dl. This shows that the traditional practice of haemoglobin 10\haematocrit 30% is still used in this institution. A multicentre survey of hospitals in Finland on transfusion threshold in common elective surgical procedures showed a similar pattern [321 .Other studies found the rule is still widely practiced.[149,53].

This rule was based on clinical experience and retrospective studies in which surgery with low haemogobin resulted in poor out come[131,32,331 .This value was based on physiological knowledge at the time and may have been appropriate.

A large retrospective study of surgical patients confirmed that allowing confounding factors there was no difference in mortality using a low threshold haemoglobin of between 6 and 10g/dl[351

Further studies have shown that in association with surgery in a patient refusing blood transfusion with a preoperative haemoglobin of between 6 and lOg/dl there is no increase in mortality provided that the blood loss is less than 500mls[46]

Majority of the patients in the study[88%] were transfused intraoperatively. This is similar to other studies done f[21_28,32_42^

r

Though in these studies intraoperative and postoperative transfusions were based on measured haemoglobin levels. This is unlike in our study where the transfusions were not based on any measured haemoglobin levels.

The reasons for the transfusions were more likely based on the anaesthetists estimate of blood loss and or at the surgeons discretion.

Postoperative haemoglobin of 1 lg/dl or more in an elective surgical patient is considered as an inappropriate transfusion.[f28]

Majority of the elective surgical procedures [77%] in this study that were transfused were inappropriate transfusions. This does not relate to the study by Niraj whereby the rate of inappropriate transfusion in which the intraoperative haemoglobin was based on estimated blood loss was 32.4%.[42]Inthe same study, patients in whom intraoperative haemoglobin measurement was used as a transfusion trigger, the rate of inappropriate transfusion was only 10.3%. Intraoperative blood loss estimate is subjective and unreliable, because of the inaccuracies in measurements from drains, swabs , intercompartmental fluid shifts during surgery and the dilutional effects of crystalloid therapy. This can result in an overestimation of blood loss thereby provoking an excessive response[42, The incidence of appropriate use of blood varies widely [21,421.

Crossmatch to transfusion ratio[C/T] and transfusion probability[T/P] are indices that are used as a measure of efficiency of blood ordering practices in elective surgery[16,18,22,23,24,521]

Only 39% of the elective surgical procedures done in the study population had acceptable C/T ratios. Normally,50-100% of elective surgical procedures done should have acceptable C/T ratios[1241],14.2% of the elective procedures performed had acceptable T/P values, nomally 50-100% of elective surgical procedures should have acceptable T/P values[2A].

Transfusion index for operative procedures that are frequently performed [greater than three times] with a transfusion probability of greater than 30% is indicative of the number of units to be designated for a particular type of procedure included in a maximum surgical ordering schedule.'[8,16,321]
Lowery reviewed 35 elective surgical procedures after the introduction of MSOBS, their C/T ratios decreased from 5:1 to 2:1[19] Similar findings were reported in other studies[16,55,561]

The utilization rate in this study 40%, compares well with other studies[6,8]

CONCLUSION

This study has been an overview of pattern of blood ordering and utilization in the surgical suites of Kenyatta National Hospital. The findings were that the male to female ratio was 1.3: 1, the predominant age group being between 21 to 30 years with majority of patients (89.9%) being Christians and 10.1% Muslims with a Christian to Muslim ratio of 9: 1.

General surgical and orthopaedic departments accounted for 52% of the total operative procedures done. The main cause of operation reschedulement in the study group was due to lack of blood (96%).

The preoperative hemoglobin of all the operated patients was above lOgldl which shows the traditional practice of hemoglobin 10/hematocrit 30% is still used in Kenyatta National Hospital. Majority of the patients (80%) transfused intra operatively, with 40% of the blood cross matched being utilized.

From the results of this study, the maximum blood ordering schedule for craniotomy and excision of brain tumor is 1.0 units of blood.

UJv

M EC

RECOMMENDATION

In the absence of an explicit maximum blood order policy, ordering for blood transfusion in our institution is based on subjective anticipation of blood loss instead of evidence based estimates of average requirements in a particular procedure.

In vast majority of elective surgical procedures in this institution routine crossmatch is not necessary as shown in this study. This study proposes a draft of maximum surgical blood ordering schedule in KNH. This will provide a guideline for frequently performed elective surgical procedures by recommending the maximum number of units of blood to be crossmatched preoperatively.

KNH should be given authority to source for blood instead of depending on the blood from the Kenya National Blood Transfusion Services and those donated by sympathetic relatives of affected patient. This will reduce the number of elective surgical operation which are rescheduled because of lack of blood (96% as shown in this study).

Although this study is based on KNH, it should serve as a guide to other public health institution and the private health sector.

This study will serve as a baseline for other studies in the use of blood in surgical practice.

Intraoperative haemoglobin and immediate postoperative haemoglobin should be in future used as a transfusion trigger in operative surgical patients.

CONSENT INFORMATION FOR PARTICIPATING PATIENT

INTRODUCTION

O Pattern of blood ordering cross-matching and utilization in the surgical suites of Kenyatta National Hospital

CONSENT EXPLANATION

O My name is Dr. .Mohamed a postgraduate student in the Department of Surgery University of Nairobi. I am carrying out a research to determine the maximum blood-ordering schedule of surgical suites of Kenyatta National Hospital. This study will help the surgical units to be more effective in blood ordering and utilization.

O You are not obliged to either accept or refuse to be involved in this study and your decision shall in no way affect any treatment you may receive in this institution.

O You will be enrolled upon giving consent and allocated a study number and undergo the normal process of history taking and physical examination. This information will be documented in a questionnaire.

O Apart from the normal risks of any patient undergoing your type of surgery there are no extra risks you are exposed to by participating in this study. Incase you are transfused intraoperatively or within 24 hours of surgery a blood sample will be drawn from you and analysed for ; full haemogram, urea and electrolytes.

O Please feel free to ask any questions that may not be clear to you or that may arise from my explanation above. Please sign the consent form below if you wish your self or dependant to be part of the study.

Thank you.

DR MOHAMED

CONSENT FORM

I have understood the explanation by DR MOHAMED and here by give informed consent to participate in the study:

- **I accept to participate in the study on my own free will.**
- **I accept to be interviewed and examined by DR MOHAMED and answers recorded in a questionnaire. And if need be blood sample drawn from me and analysed as per his earlier explanation.**
- **I understand that my participation is strictly voluntary and 1 can withdraw my consent at any point of the study, and that such withdrawal will not affect my treatment in any way.**
- **I understand that the information I give will be treated with utmost confidence and that my name will not be published in the results.**
- **I understand that I may raise any issues relating to the study through the contact number given by DR MOHAMED.**

PARTICIPANT'S NAME

(RELATIVE/ GUARDIANS NAME)

SIGNATURE

WITNESS

SIGNATURE / THUMB PRINT

INVESTIGATOR: DR MOHAMED MUSA ***Telephone mimber 0722650364***

CHETI CHA KUKUBALI

Nimeelewa maelezo yote kutoka kwa daktari Mohamed na nina toa kibali kuhusishwa kwenye utaflti.

1. **Kwa hiari yangu binafsi bila kulazimishwa.**
2. **Nakubali kutoa habari kuhusu ugonjwa wangu na majibu yake kwa Daktari Mohamed.**
3. **Na kubali kupimwa kuthibitisha ugonjwa wangu.**
4. **Nimelewa kwamba kuhusishwa kwangu ni kwa hiari yangu na naweza kujiondoa wakati wowote bila masharti, na kujiondoa kwangu hauta dhuru matibabu yangu kwa njia yoyote.**
5. **Nimeelewa kwamba habari yoyote nitakayo toa kuhusu ugonjwa wangu itahifadhiwa kwa siri , na kwamba jina langu halitachapishwa hadharani.**
6. **Nimeelewa kwamba naweza kuuliza swali lolote kuhusiana na utafiti kupitia nambari ya simu ya Daktari MOHAMED atakayo nipa hapo chini.**

Jina la mgonjwa

Shahidi/Kidole

Shahidi

Shahidi/Kidole

MTAFITI: **DAKTARI MOHAMED Nambari ya simu 0722 650364.**

QUESTIONNAIRE

TITLE: PATTERN OF BLOOD ORDERING, CROSS MATCHING AND UTILIZATION IN THE SURGICAL SUITES OF KNH

Study Serial Number • • •

I n Patient Number • • • • • • •

A. PERSONAL HISTORY

1. SEX **(a) Male** • **(b) Female** •

2. AGE (IN YEARS)

3. OCCUPATION

(a) Skilled labour • **(b) Unskilled labour** •

(c) Unemployed •

4. RELIGION

(a) Muslim • **(b) Christian** • **(c) Others** •

5. LEVEL OF EDUCATION

(a) No formal education Q

(b) Primary or Secondary

(c) Colleges + University •

CLINICAL INFORMATION

(1) Chief complaint

(2) Duration of Illness resulting in surgery

(3) Duration of waiting for admission for this operation

(4) Past medical history.

(5) Systemic enquiry....

CONSTITUTIONAL SYMPTOMS/SIGNS

(1) Pallor **Present** • **Absent**

If Present:

(i) Mild • **(ii) Moderate** • **(iii) Severe**

(2) Cyanosis **Present** • **Absent**

If Present :

(i) Mild • **(ii) Moderate** • **(iii) Severe**

(3) Jaundice **Present** • **Absent**

If Present:

(i) Mild • **(ii) Moderate** • **(iii) Severe**

(4) Oedema (Bipedal) Present • Absent •

If Present:

(i) Mild • (ii) Moderate • (iii) Severe •

(5) lymphadenopathy

(a) Present

(b) Absent

If present specify location

D. VITAL SIGNS (24 hours before surgery)

- Blood Pressure
- * Respiratory Rate.
- Pulse Rate
- Temperature (degrees Celsius).

E SYSTEMIC EXAMINATION

1. Musculoskeletal system
2. Genitourinary system
3. Gastrointestinal system
4. Central nervous system
5. Respiratory system
6. Cardiovascular system

1. Other systems

F. PREOPERATIVE LABORATORY FINDINGS(within two weeks of operation)

1. Full Haemogram
    a. Haemoglobin
    b. White Blood Cell Count
    c. Platelets
2. Blood, Urea and Electrolytes
    a. Potassium
    b. Sodium
    c. Urea
3. Any other investigations done

G. WORKING DIAGNOSIS

1. Diagnosis
2. Other associated conditions
3. Planned surgery (type)

H. BLOOD TRANSFUSION INFORMATION

1.	Patients ABO Blood Group	(a) A	•
		(b) AB	•
		(c) B	•
		(d) O	•
2.	Patients Rhesus	(a) Rh+	•
		(b) Rh-	•

3. Previous transfusion **(a) Yes** **Q**

Date of transfusion

(b) No •

5. Total number of units previously transfused

6. Reason for previous transfusion

7. Blood request from which department * „„ " 4 •

'-'•*Any*

A - General surgery **Q**

B - Orthopaedic surgery **CH**

C - Paediatric surgery **EH**

D - Plastic surgery •

E - Cardiothoracic surgery **O**

F - Neurosurgery **O**

8. Specific type of surgery to be performed

9. When was surgery performed from time of blood request

10. No of units of blood and time involved

[r.]od in relation to	Actual number of units Requested	Actual number of units X-matched	Actual number of units Used	Actual number of units Returned
Jdays before rgery				
raoperative				
e days after surgery				

I. WHEN FIRST SCHEDULED FOR SURGERY

J CAUSE OF RESCHEDULING OF SURGERY

K POST OPERATIVE ASSESSMENT

1. Operative diagnosis

2. Surgery performed

Transfused

3. (i) Transfused ABO blood group **(a) A** •

(b) AB • •

(c) B • •

(d) O • •

(ii) Transfused blood Rhesus **(a) Rh+** •

(b) Rh- •

(iii) Laboratory findings (Within 3-5 days postoperatively)

Haemogram

(a) Haemoglobin (gldl)

(b) WBC

Total ($X10^9$/L)

Differential

(c) Platelets ($XI0^9$/L)

(iv) Other laboratory investigations

(v) Duration of hospital stay

f

KENYATTA NATIONAL HOSPITAL ETHICAL AND RESEARCH COMMITTEE APPROVAL

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.

Tel: 726300-9
Fax: 725272
Telegrams: "MEDSUP", Nairobi.

Ref: KNH-ERC/01/2434 **Date: 4th November 2004**

Dr. Musa Muhamed
Dept.of Surgery
University of Nairobi

Dear Dr. Mohamed,

RE: PATTERN OF BLOOD ORDERING, CROSS MATCHING AND UTILIZATION IN THE SURGICAL SUITES OF KENYATTA NATIONAL HOSPITAL (PI07/8/2004)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** the revised version of your above cited research proposal for the period 4th November 2004 - 3rd November 2005. You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research Findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely.

PROF. A N GUANTAI
< R£!,\m RNH-ERC

Cc Prof. K Bhatt, Chairperson, KNH-ERC
The Deputy Director (C/S), KNH
The Dean, Faculty of Medicine, UON
The Chairman, Dept. of Surgery, UON
CMRO
Supervisors: Dr. G A 0 Magoha, Dept.of Surgery, UON
Dr. Mwanda, Dept. of Hematology & Blood Transfusion, UON

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