

**UNPLANNED POST-OPERATIVE ADMISSIONS TO THE CRITICAL
CARE UNIT AT KENYATTA NATIONAL HOSPITAL**

A DISSERTATION IN PART FULFILMENT OF THE REQUIREMENTS
FOR AWARD OF THE DEGREE OF MASTER OF MEDICINE IN
ANAESTHESIA OF THE UNIVERSITY OF NAIROBI.

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Declaration

I declare that this research thesis is my original work and that it has not been submitted for a degree award in any university.

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DEDICATION

1. To my sons Sospeter and Stanley for bearing with me during this period.
2. My mentor and teacher Dr. T.M. Chokwe who has stood by me throughout the study period. God bless you.

ACKNOWLEDGEMENT

My sincere appreciation goes to my supervisor and mentor Dr. T.M. Chokwe for his guidance and supervision throughout the study period. His encouragement has been a great source of my strength.

My gratitude to all the postgraduate students of anaesthesia and the CCU personnel who assisted me in identifying my subjects in good time.

Finally my gratitude goes to the Kenyatta National Hospital Ethics and Research Committee for enabling me carry out the study.

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ABBREVIATIONS

1. ASA-American society of anaesthesiologists
2. CCU-Critical care unit
3. KNH-Kenyatta national hospital
4. RCO-Registered Clinical Officer

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SUMMARY

Patients are admitted to critical care unit from theatre in two categories; planned admissions for whom the anesthetist decided preoperatively that the critical care unit admission would be necessary and unplanned admissions for which the need for critical care unit admission was not anticipated preoperatively.

Admission to the critical care unit can be one or more of these reasons postoperatively; respiratory support by mechanical ventilation, circulatory support by inotropic support or for close observation of very sick patients secondary to other conditions.

Unplanned admission patients are those who are identified to require critical care within theatre. This can be at any time in the operating theatre room, within the post anaesthesia care unit or less than 48 hours after discharge from the post anaesthesia care unit.

No similar study had been undertaken in KNH regarding unplanned CCU admissions post operation. This study was to evaluate post-operative admission in KNH CCU that were unplanned. It involved reviewing the patients' medical records both pre-operatively, intra-operatively and post-operatively to elucidate factors that may have influenced their unplanned admission to the CCU post-operatively.

A total of 86 patients admitted to the CCU post-operatively as unplanned cases were reviewed. Their medical records were reviewed from pre-operative, intra-operative upto the post-operation period before their admission to the CCU. These records were entered into a data collecting form (appendix 3) and were later analyzed by a biostatician.

Conclusion and Recommendation.

Unplanned post-operation admissions to the Kenyatta National Hospital is relatively high.

Laparatomies dominated the cases. These were general laparatomies and obstetric laparatomies due to either antepartum or post-partum hemorrhage.

Most admission occurred after working hours and were mostly attended by resident surgeons with their counterpart anaesthesia residents or registered clinical officer anaesthetist who are on duty during those odd hours.

It is therefore necessary to foresee and plan for these admission either pre-operatively or intra-operative and inform the CCU team in good time. The residents should be free to consult their consultants and equally their consultants should be ready and willing to offer guidance during those odd hours.

INTRODUCTION AND LITERATURE REVIEW

Kenyatta National Hospital is the leading teaching and referral hospital in Kenya. It has twelve major operating theatres, two maternity theatres and several satellite theatres. To augment the functioning of these theatres and other services is a number of critical care units within the hospital. (1)

The main critical care unit has a capacity of 21 beds, each with the necessary facilities for optimum critical care to a patient. There are other auxiliary critical care facilities within KNH. These are; the acute room at the accident and emergency department, cardiothoracic and neurointensive wards and the newborn intensive care unit.

The critical care unit is an expensive resource area and should be reserved for patients with *reversible medical or surgical conditions with a reasonable prospect of substantial recovery.* (2-4)

Surgical patients with any of the following operations are candidates for admission to the critical care unit of the hospital; major cardiovascular surgery, thoracic surgery, airway surgery, craniofacial surgery, major orthopaedic and spine surgery, general surgery with major blood loss or fluid shift and neurosurgical procedures. This is so as to provide continuous haemodynamic monitoring and ventilatory support.

There are patients who may not benefit from CCU management with or without surgery. These include irreversible brain dead patients, end stage cardiac, respiratory and liver disease with no options of transplant, metastatic cancer unresponsive to chemotherapy and/or radiotherapy, brain dead non-organ donors and patients with non-traumatic coma leading to a persistent vegetative state. These patients are considered terminally ill. Palliative care is the best option with all involved being in constant consultations. This includes the patient, his relatives and the various healthcare providers involved in each particular case (5,6)

The critical care unit concept prevalent today proliferated in the 1960's(7-9).The first Consensus Conference on Critical Care Medicine led by the National Institutes of Health(NIH) in 1983 pointed out that clinical practice has led to expanded indications for admissions to critical care units (10).Most physicians are of the opinion that the benefits of CCU care are unmeasured rather than uncertain(11).Because of the utilization of expensive resources, CCUs should in general be reserved for those patients with justifiable and

reasonable outcome within the resources allocated for CCU patient care without compromising care of other needy patients.(12-14).

With recent changes in the health care environment, efficient use of CCUs has become a priority. Unfortunately, few studies have examined the indications for and outcome of CCU care post-operative (15-18).Those that have, suggest that the patients have not been categorized accurately. For example, Kraiss, et al. evaluated 196 patients undergoing carotid endarterectomy over a two-year period. There was no difference in outcome or complications between the group admitted to the CCU and those admitted to the general ward post-operation.

Guidelines from the American Critical care society advice that medical or surgical patients with any of the features below require CCU admission. (10)

Vital Signs

- * Pulse < 40 or > 150 beats/minute
- * Systolic arterial pressure < 80 mm Hg or 20 mm Hg below the patient's usual pressure
- * Mean arterial pressure < 60 mm Hg
- * Diastolic arterial pressure > 120 mm Hg
- * Respiratory rate > 35 breaths/minute

Laboratory Values

- * Serum sodium < 110 mEq/L or > 170 mEq/L
- * Serum potassium < 2.0 mEq/L or > 7.0 mEq/L
- * PaO₂ < 50 mm Hg
- * pH < 7.1 or > 7.7
- * Serum glucose > 800 mg/dl (×0.055mmol/l)
- * Serum calcium > 15 mg/dl (×0.25mmol/l)
- * Toxic level of drug or other chemical substance in a haemodynamically or neurologically compromised patient.

A study done by Manjula et al(19) at Seth G.S Medical College and K.E.M Hospital Parel Mumbai for a period of two years between 2005 and 2006 analysed various factors that lead to unplanned post-operation admissions to the critical care units.

Post-operative review was carried out to determine the cause for the unplanned admission to the CCU. These patients were further classified into four major categories:

Category 1	Related to central nervous system a)unexpected depressed level of consciousness b)new cerebrovascular accident
Category 2	Related to the cardiovascular system a)pulmonary oedema b)prolonged hypotension requiring inotropic support c)arrhythmias d)cardiac arrest
Category 3	Related to respiratory system a)respiratory depression b)low Po ₂ ,high pCO ₂ c)atelectasis, pneumonia d)airway obstruction
Category 4	Related to metabolic system a)fluid disturbances b)electrolyte imbalances

Courtesy of Indian journal of anaesthesiology (19)

In this study the main factors that served as significant predictors of critical care unit admissions were males aged more than 60 years, ASA Grading III or IV, abdominal explorations, emergency operations, history of intra-operative arrhythmias, major blood loss and hypotension requiring inotropic support. These factors were also significant in predicting an unfavourable outcome including death of patients or prolonged critical care unit stay. These factors also constituted a challenge rather than routine critical care management. (19,24,25)

A four year study in a Nigerian University Teaching hospital by Okofor et al (20) revealed that operations on the head and neck were the leading cause of unplanned post-operation admissions to CCU although the study excluded emergency operations. The study

recommended the involvement of consultants in both anaesthesia and surgery during these operations.

An earlier study by B. Osinaike with D. Aderinto (21) evaluated CCU admissions post-operation in a teaching hospital in Lagos over a three month period between June and August 2007. They characterized the patients so as to determine those pre-operation, intra-operation and the immediate post-operation risk factors that predict unplanned admissions to the CCU. In this study the unplanned CCU admissions post-operation rate was 16.7%. Risk factors identified in order of priority were; duration of anaesthesia more than 120 minutes, anaesthesia provided by a senior registrar, surgery performed by a senior registrar and increasing ASA classification. This study had also recommended the involvement of consultants in both specialties during these operations.

There various complications that can occur intra-operatively leading to unplanned admission to the CCU post-operation.. These can be both as a result of the surgery or anaesthesia. The timing of surgery and pre-operative management of the patient have a great influence on the surgical outcome. (22)

Major complications during anaesthesia requiring critical care management involve mainly the cardiovascular and respiratory systems.(23)

Cardiac complications include arrhythmias, hypotension, hypertension, myocardial ischaemia and in severe cases cardiac arrest. Perfusion of vital organs has to be maintained during and after surgery. All the above complications have to be avoided or prompt measures taken when they occur.

Arrhythmias are the most commonly encountered complications during anaesthesia (19, 23). Bradyarrhythmias can occur due to opioids used for analgesia and deep levels of anaesthesia while tachyarrhythmias might occur during intubation, extubation and stimulation of the sympathetic system during surgery. Patients with persistent arrhythmias require critical care management. This will enable continuous vital signs monitoring. Modern critical care units have continuous monitoring of all vital signs. Electrocardiogram changes can be identified in time and appropriate measures instituted. These measures include; electrolyte measurements and correction of the same, anti-arrhythmic drugs and medical or electro conversion.

Hypotension is a mean arterial pressure (MAP) of less than 60mmHg or a reduction of more than 25% of the pre-operative value. This may be due to a number of factors including poor pre-operative hydration and haemorrhage during surgery. Persistent hypotension results into under perfusion of vital organs leading to multi-organ failure. The critical care unit is best equipped to correct and monitor the patient until he is normotensive This is because invasive blood pressure monitoring is available, central venous pressure monitoring can be done with ease together with input and output comparison. Inotropic support can be instituted with the already available continuous vital signs monitoring. The continuous vital signs monitoring enables titration of the inotropic support to the blood pressure recorded.

Hypertension resistant to intra-operative management, just as with hypotension will require continuous critical care unit monitoring. This will ensure that the intravenous antihypertensives are titrated to the required blood pressure. This will involve intra-arterial cannulation for invasive blood pressure monitoring.

Myocardial ischaemia and cardiac arrest need to be promptly identified and resuscitation done intra-operatively. The patient then is transferred to the CCU for close monitoring with further resuscitation and management. The CCU plays a key role in ensuring continuous invasive monitoring of the vital organs. Respiratory support can be continued with or without intubation of the patient to secure the airway.

Respiratory complications lead to hypoxaemia which is reduced arterial oxygen tension which causes hypoxia. This needs to be corrected early enough to prevent hypoxic tissue damage. Continuous pulse oximetry will guide in detecting desaturation while arterial blood gas analysis will confirm if there is any hypoxia. Patients who cannot be extubated require continued ventilatory support until they can maintain and support their own respiration. Extubation failure, being the need for reinstatement of ventilatory support within 24 to 72 hours of planned endotracheal tube removal, occurs in 2 to 25% of extubated patients. The pathophysiologic causes of extubation failure include an imbalance between respiratory muscle capacity and work of breathing, upper airway obstruction, excess respiratory secretions, inadequate cough, encephalopathy, and cardiac dysfunction .The CCU is the best place to continue ventilating and monitoring the patient in order to release theatre for other operations. Furthermore the CCU is equipped with vents that can be set depending on the patient's level of consciousness and his own respiratory ability. Pulse oximetry in addition to other vital signs monitoring is available in the CCU. Chest physiotherapy and tracheal toiletry

can then be done by the CCU personnel. The patient can then be weaned off the vent appropriately. (23,26)

Together with the equipment installed in the CCU is a team of staff at various cadres trained and dedicated for critical care management. It is therefore important that a patient who meets the CCU admission post-operation be transferred to the unit for further management.

Therefore a patient admitted post-operation to the CCU as unplanned case implies that the anaesthetist decided during or after the operation that he will benefit from this care. This involves; continuous vital signs monitoring which might necessitate invasive blood pressure measurements via arterial cannulation, central venous pressure measurement via central venous cannulation, insertion of nasogastric tube and urethral catheter for better input output measurement.

Unplanned post-surgical admissions to CCU have various implications to the hospital, staff, patients and their relatives. (24, 25) These include;

1. Increased cost of patient care that was earlier not anticipated. This is due to the added CCU care of the patient and prolonged hospital stay. This is translated to the hospital as a care provider and the patient's relatives.
2. Due to the time taken between patient transfers from theatre to the CCU, there is a backlog of other patients who were scheduled to make use of the same theatre. CCU staff has to make unexpected reorganization for the unexpected admission.
3. The patients and relatives are emotionally affected by the unplanned post-surgical CCU admission unlike the planned admission where the patient is already counseled of what to expect post-surgery. Counseling then has to be done both for the patient and relatives to explain reasons for the admission.
4. Infections and mortality are also higher in the unplanned post-surgical patients than in the planned patients.(20)

It would therefore be important to identify the factors that predict post-surgical CCU admissions at KNH and correct them before operation or be planned for post-surgical CCU admission.

RATIONALE

The critical care unit at this institution continues to admit a sizeable number of patients from theatre who were primarily not scheduled to be admitted pre-operatively. In such circumstances the unit administration and staff have to reorganize themselves within a short time in order to receive a very sick patient from theatre and manage the same. These situations can be avoided if the risk factors for critical care admission post-operation are identified and corrected earlier.

The CCU can be alerted in advance for those cases that the anaesthetist or the surgeon feels that the risk factors already identified will necessitate CCU admission post operatively.

A formal booking system is necessary for documentation and planning of the type of patient to be received in the CCU and what the anaesthetist or surgeon feels should be the ideal management for each individual patient.

No such study has been done to assess factors leading to unplanned post-operation admissions to the KNH CCU and this review will highlight these factors.

STUDY QUESTION

What are the main factors that lead to unplanned post-operation admissions to The Kenyatta National Hospital critical care unit?

OBJECTIVES

Broad

To determine the major factors that lead to unplanned admission to the critical care unit post-operation at the Kenyatta National Hospital.

Specific Objectives

1. To determine the pre-operative risk factors that lead to unplanned admission to CCU.
2. To determine the intra-operative risk factors that lead to unplanned admission to the CCU.
3. To determine the immediate post- operative factors that lead to unplanned admission to the CCU.

STUDY DESIGN AND METHODOLOGY

Study Design

The study was designed as a prospective cross-sectional observational study .A data collection form (appendix 3) was used.

Study Site

This study was carried out at the KNH CCU and its associate auxiliary critical care areas.

Study Population

All the patients admitted to the critical care units within the study period who met the inclusion criteria were included in the study. A total of 86 patients participated in the study.

Inclusion criteria

1. All those post-surgical patients who were previously not scheduled for post-surgical critical care.
2. All those who gave consent to the informed consent certificate.

Exclusion criteria

- 1) All those patients who were admitted to the unit where the anaesthetist or the surgeon had requested admission to the unit before the operation.
- 2) Major cardiac, maxillofacial, renal and neurosurgical operation patients because most of these are routinely admitted to the unit.
- 3) Patients who were already admitted to the unit before surgery.
- 4) Patients who were admitted to the unit 48hours after the surgical procedure.
- 5) Those patients who were referred to the unit from other hospitals after any surgical procedure.
- 6) Those patients that declined the informed consent.

Sample size and sampling:

The sample size was all the patients who were admitted to the critical care unit during the study period.

This involved consecutive sampling of all patients admitted to the KNH CCU from theatre who were not earlier planned to be admitted to the CCU pre-operatively.

The fisher's formula was used to calculate the sample size (27)

$$n = z^2 pq/d^2$$

Where,

n= minimum sample size

z= units of standard normal deviation corresponding to 95% confidence interval (usually, 1.96)

p= prevalence of the characteristic being studied

q= prevalence of the population without the characteristic being studied (i.e. 1-p)

d= Error margin (usually 5/100), which is 0.05

So in this case, with a prevalence of 6%:

$$n = 1.96^2 \times 0.06 \times 0.94/0.0025$$

$$n = 86.66$$

So n was approximately 90

Data Collection and management

Anaesthetic chart and the surgeons' notes was transferred to a data collection form (appendix 3) that was later analyzed so as to interpret the pre-operative, intra-operative and post-operative state of the patient and the reason for request to admit to CCU. Transfer of data was done as soon as the patient was admitted to the CCU or as soon as was feasible.

A statistician was appointed by the principle investigator to analyze the data collected. All completed questionnaires were coded .Data was entered into a computer using Epi-info data entry programme.

Analysis was done using SPSS version 17.0.

Ethical considerations

1. The nature and purpose of the study was explained to the available next of kin of the patient to be included in the study and consent obtained (appendix 4).
2. The study had no harmful effects to the patients or the hospital.
3. Confidentiality was maintained.
4. Permission was duly sought from Kenyatta National Hospital-University of Nairobi, Ethics and Research Committee before undertaking the study (appendix?).
5. There were no cost implications to the patient or the CCU at any point during the study.
6. Findings from the study were availed to the Ethics Committee of KNH and the University of Nairobi.

RESULTS

A total of 86 patients were recruited to participate in the study. Figure 1 illustrates the gender distribution with females comprising 44 patients and the males 42 patients respectively.

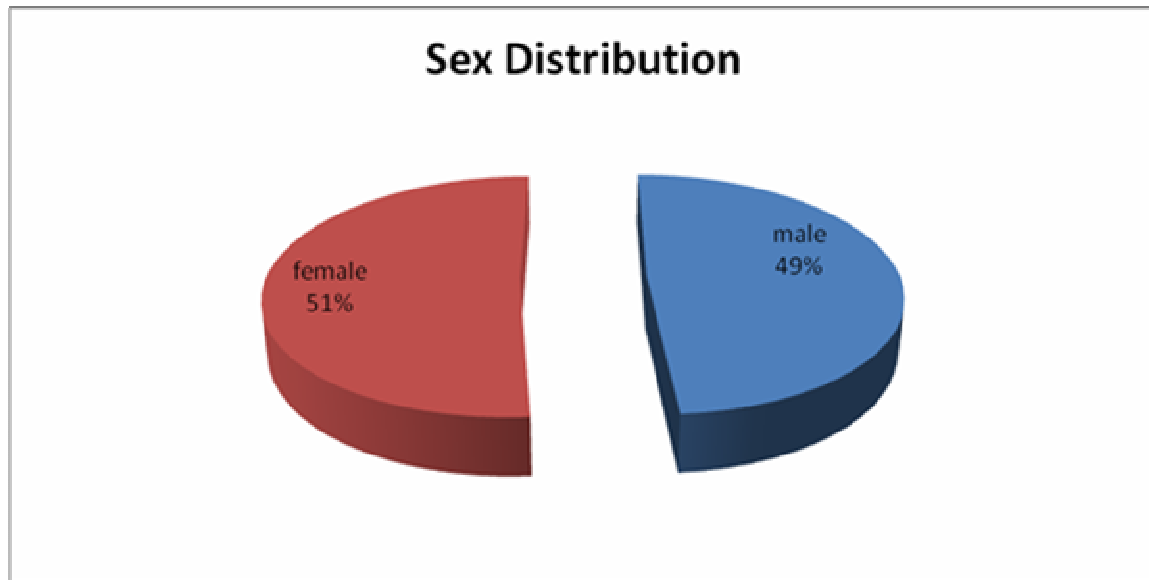


Figure 1

Table 1 illustrates age distribution with the youngest patient being 1 year and the oldest 72 years respectively.

Table 1: AGE DISTRIBUTION (Years)

Mean	33.8
Median	33.5
Std. Deviation	16.8
Minimum	1
Maximum	72

Table 2 and Figure 2 illustrates the age distribution against the kind of operations that were carried out with the paediatric age group having the least admissions while the 30 to 40 age group having the highest frequency. Among the laparatomies done 13 were obstetric in nature as they were due to either antepartum or postpartum haemorrhage.

Table 2: AGE CATEGORY AND OPERATION DONE

Age Category (Years) & Operations	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	Total
Adenoidectomy	5	0	0	0	0	0	0	0	5
Amputation	0	0	0	0	1	0	0	0	1
Caesarian Section	0	1	8	1	0	0	0	0	10
Debridement	0	0	0	0	0	0	1	0	1
Hysterectomy	0	0	1	1	1	0	0	0	3
Laparotomy	2	4	12	18	7	3	1	2	49
Laryngoscopy	0	0	0	0	1	0	0	0	1
Manual Placental Removal	0	0	0	1	0	0	0	0	1
ORIF	0	0	1	0	0	0	0	0	1
Prostatectomy	0	0	0	0	0	1	0	0	1
Thyroidectomy	0	0	0	3	1	1	1	0	6
Tracheostomy	0	0	0	1	0	0	0	0	1
VP-Shunting	0	0	1	1	0	0	0	0	2
Total	8	5	23	28	11	6	3	2	86

Table2

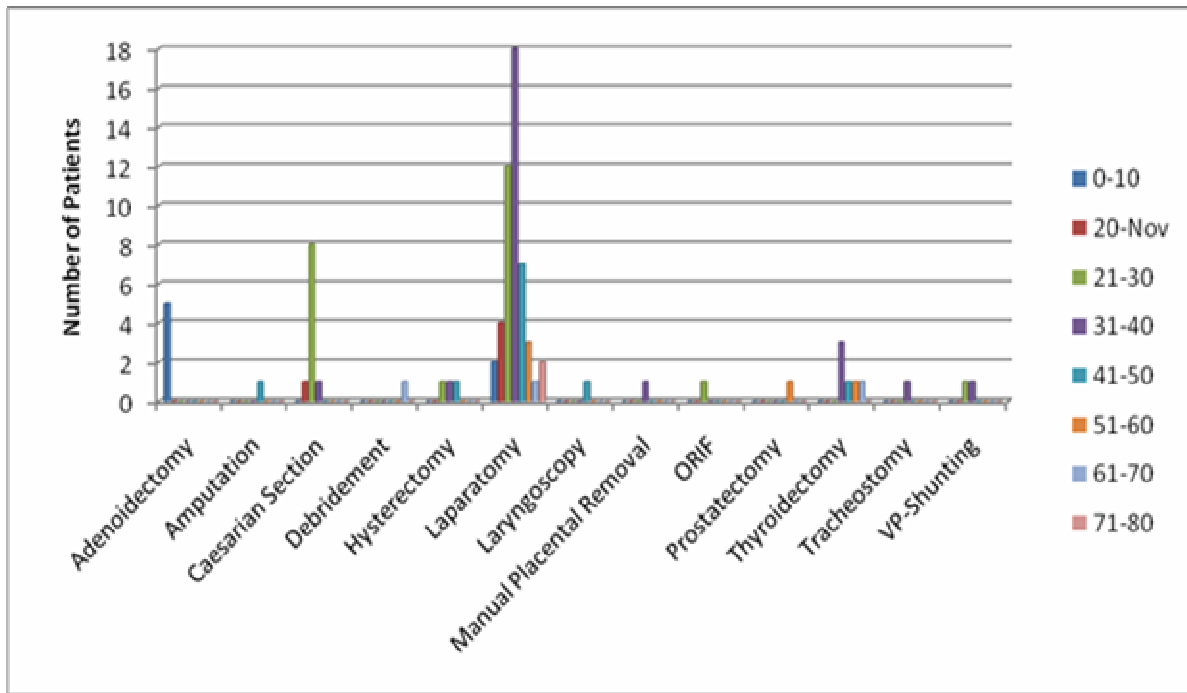


Figure 2

Table 3 and Figure 3 illustrate the nature and urgency of operation with emergency operations accounting for 55.8% and elective operations accounting for 44.2% respectively.

Table 3: URGENCY AND TYPE OF OPERATION DONE

Urgency of Operation & Operations	Elective Operation	Emergency Operation	Total
Adenoidectomy	5	0	5
Amputation	1	0	1
Caesarian Section	3	9	10
Debridement	1	0	1
Hysterectomy	0	3	3
Laparatomy	17	34	49
Laryngoscopy	1	0	1
Manual Placental Removal	0	1	1
ORIF	1	0	1
Prostatectomy	1	0	1
Thyroidectomy	6	0	6
Tracheostomy	0	1	1
VP-Shunting	2	0	2
Total	38	48	86

Table 3

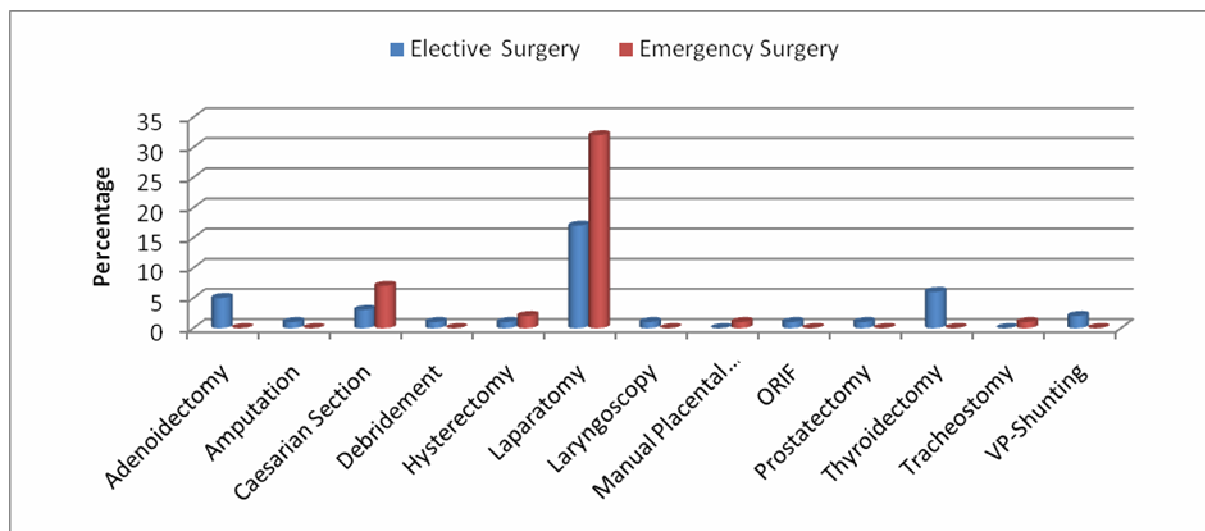


Figure 3

Figure 4 illustrates the type of anaesthesia the patients received with 7 patients having undergone spinal anaesthesia and 79 patients general anaesthesia respectively

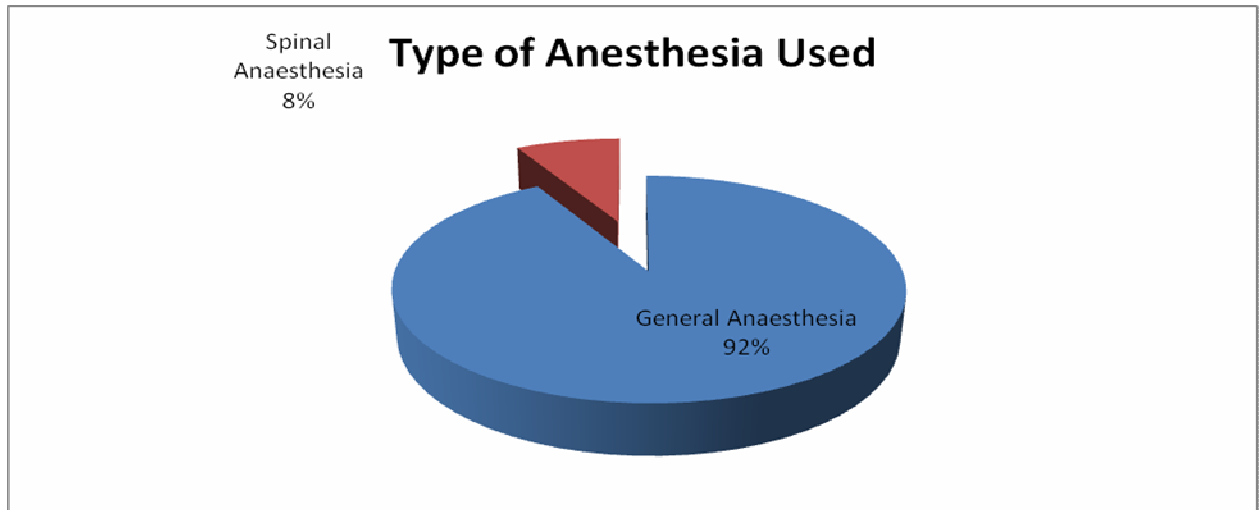


Figure 4

Figure 5 illustrates the cadre of surgeon who operated on the patients. There are residents in training and consultant surgeons at the KNH. The consultant surgeons operated on 34 patients while the residents operated on 52 patients that were admitted to the unit.

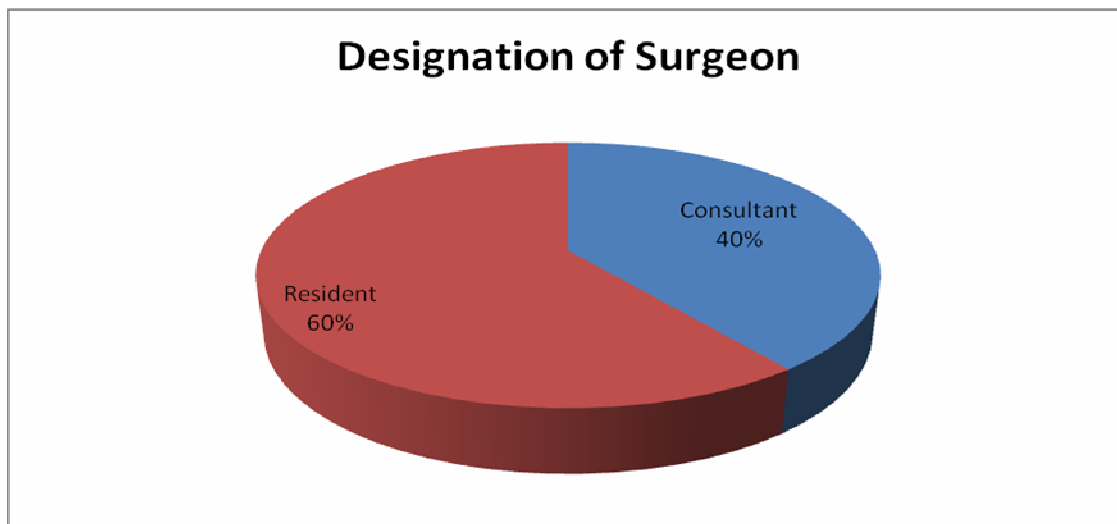


Figure 5

Figure 6 illustrates the cadre of anaesthetist during the operation. There are consultant anaesthetists, registered clinical officer anaesthetist and the resident in training anaesthetist. The consultants were present in 22 operations while both registered clinical officer and the resident were present in 64 operations respectively.

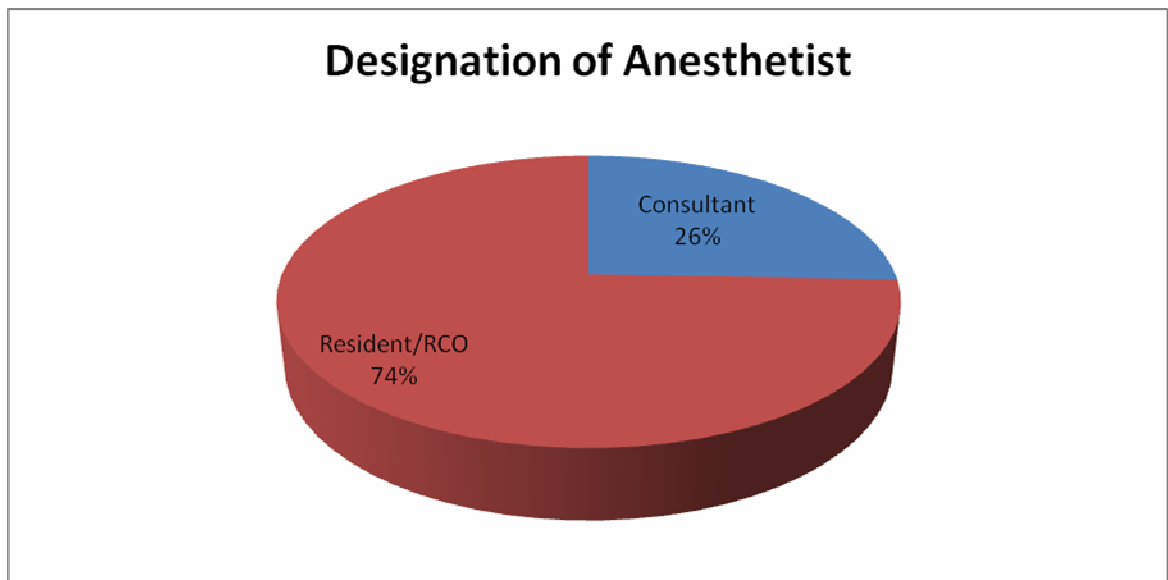


Figure 6

Figure 7 illustrates the time of operation and the cadre of surgeon who carried out the operation. Odd hours are defined as out of normal working hours. In our situation this is from 5.00 pm to 8.00 a.m. Emergency operations are done during these hours while both elective and emergency cases can be done during normal working hours. The residents operated on 42 patients against 5 patients operated by the consultant surgeons.

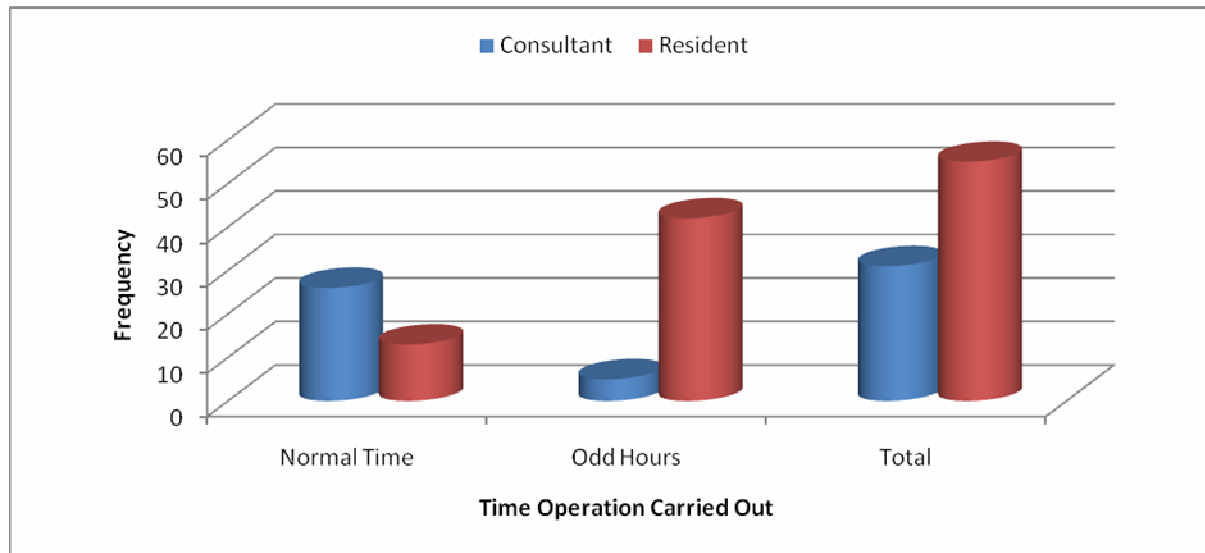


Figure 7

Figure 8 illustrates the relation between the cadre of anaesthetist and the patients operated and admitted to the unit during odd hours. The consultants attended to 5 patients whereas the RCO anaesthetists and residents attended to 47 patients.

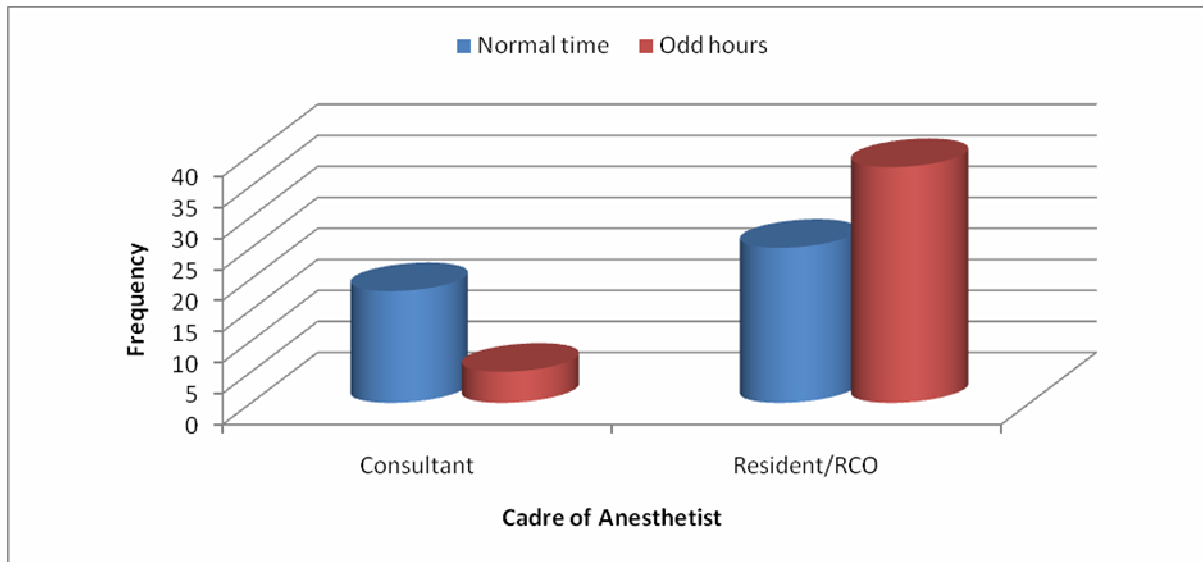


Figure 8

Patients were classified according to the ASA classification. ASA I had 36 patients while ASA II had 32 patients. ASA III and IV patients contributed to only 21% of all the admissions to the unit. The poor outcome patients were in the planned post-operation group as both the surgeon and anaesthetist are prepared for poor outcome unlike the ASA I and II who complicated requiring CCU admission.

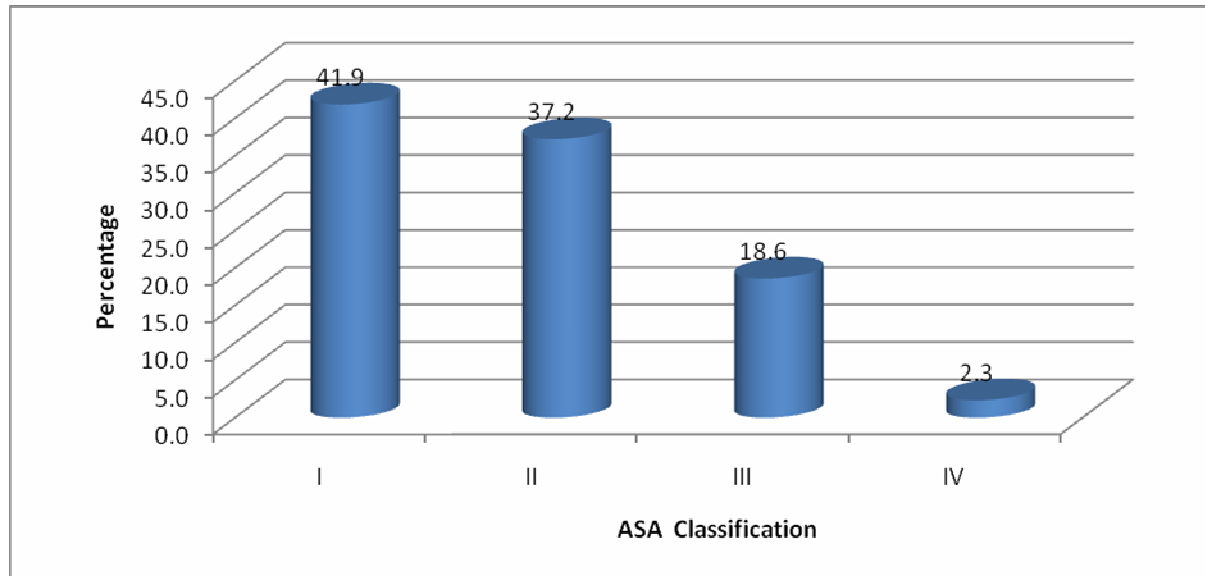


Figure 9

Figure 10 illustrates the relationship between the blood lost during surgery and the CCU admission post-operation. 20.9% had a blood loss of less than 1000mls, 25.6% had a blood loss of between 1000 and 2000 mls while 53.4% had a blood loss of more than 2000mls. All these were adult patients. 1000 mls of blood in an average adult is about 20% of his total blood volume.

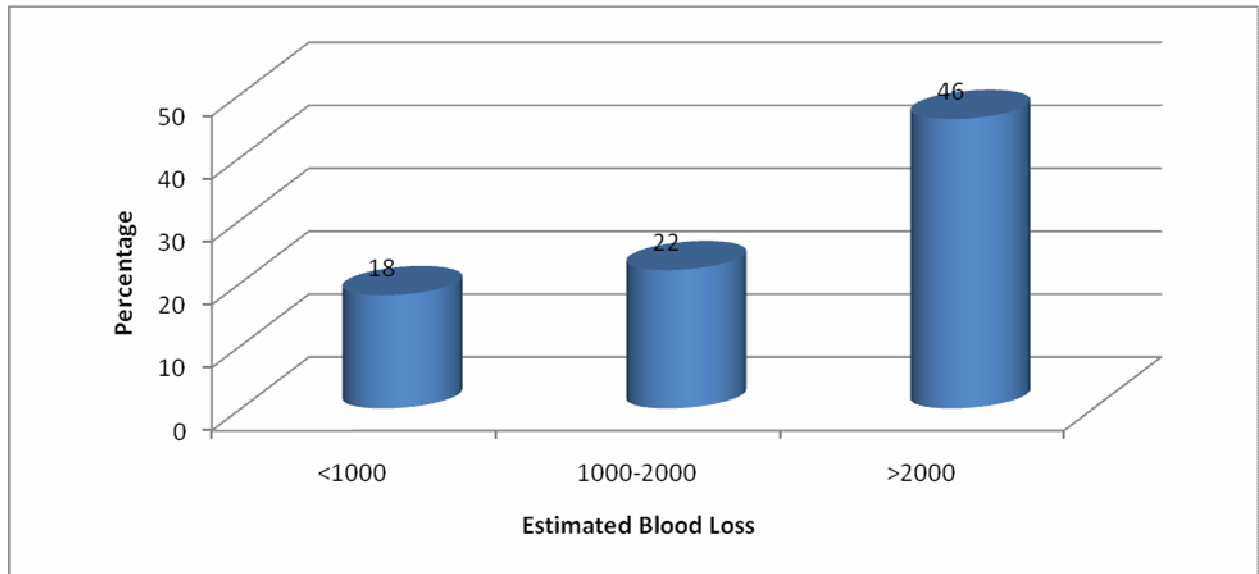


Figure 10

Figure 11 illustrates the relationship between duration of surgery and post-operation admission to the CCU. Of those admitted 19 patients lasted upto 2hours, 31 patients lasted between 2 to 3 hours and 36 patients over 3 hours.

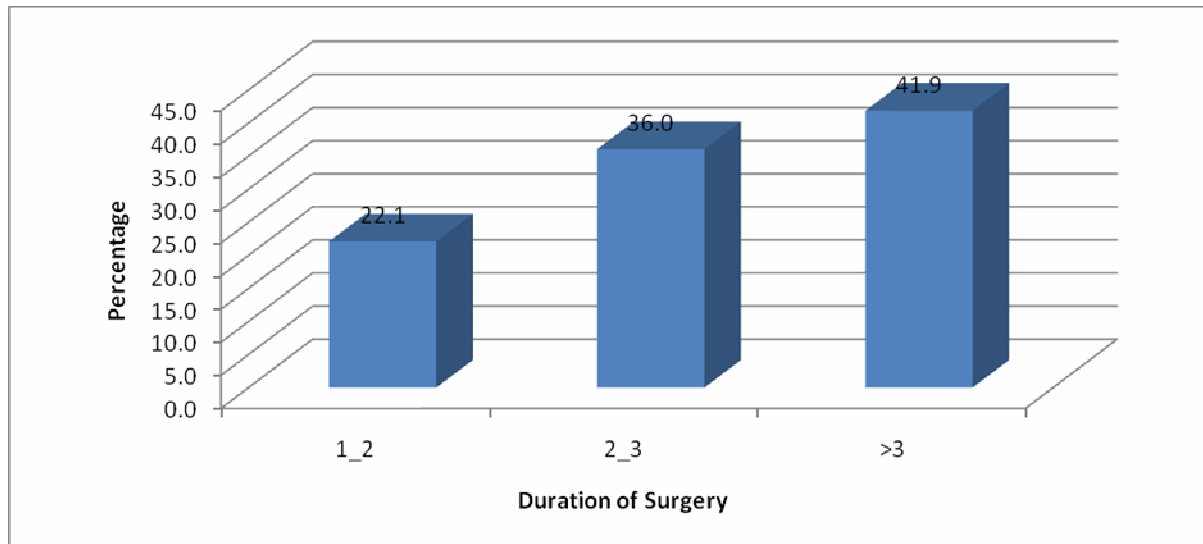


Figure 11

Figure 12 illustrates the reason for the patient's admission to the unit. Four reasons were given; respiratory support-35 patients, inotropic support- 21 patients, observation after resuscitation-14 patients and for both respiratory and inotropic support-16 patients.

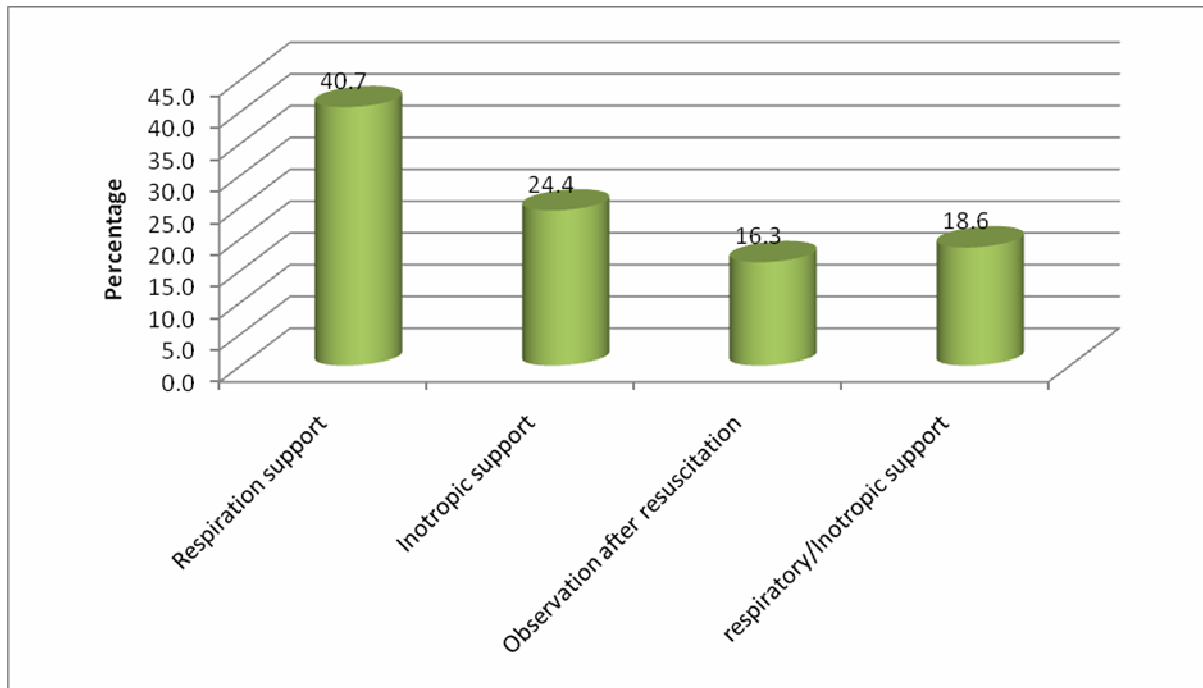


Figure 12

DISCUSSION

In this study there were more females admitted to the CCU post-operative as compared to men. Although this was the case there was a bias towards obstetric cases in the female population. Laparatomies that were done in this population tended to be secondary to obstetric cases. These were as a result of antepartum and postpartum haemorrhage. Therefore on general surgical operations on the male population would have had a higher number of post-operation admission to the CCU had the obstetric cases not been included in the study. That would have compared well with earlier studies including that of Manjula et al.

Age distribution was skewed to the category between 20 to 40 years. The minimum age was one year with the oldest being 72 years. The skewed distribution was due to the many laparatomies that were done to males between the ages of 30 to 40 years. Female caesarian sections and laparatomies occurred at the ages of 20 to 30 years. These caesarian sections were due to preeclampsia and eclampsia. Male laparatomies were mainly due to blunt and penetrating abdominal injuries. These necessitated extensive exploratory laparatomies.

The mode of anaesthesia had a great impact on the admissions to the unit. In this study general anaesthesia had a significant admission numbers to the unit. This would relate well to the type of operations that required admission post-operation. These were operations that had to be done under general anaesthesia.

Laparatomies were the major operations leading to post-operation admission to the unit. This contributed 56.9% of all admissions. This is a significant relationship ($P < 0.05$). This relationship compares well with other studies in Asia and Africa including the Manjula et al (19) and that by Okofur U.V (20). In this study the laparatomies were due to penetrating and blunt abdominal injuries in male patients and carried out as emergency operations. This also has a relationship with excessive blood loss and longer operation time. Some of these operations are done at odd hours.

The relationship between the cadre of the operating surgeon and the time of operation is very significant ($p < 0.001$). This also applies for the cadre of the attending anaesthetist and the time of operation ($p < 0.001$). This can be explained by two reasons; Emergency cases are handled initially by the resident surgeon in training and the RCO anaesthetist or resident anaesthetist unless either of them decides to call for senior backup. Two, the residents in both specialities with the RCO anaesthetists are the ones who cover during the odd hours. Therefore unless

they call their consultants for advice and guidance in the operations, then their decisions are final.

A patient was more likely to be admitted to the CCU post-operation if he was on the emergency list than if he were in an elective list. This is in line with many other studies done elsewhere in the world. It was also noted that emergency cases are first handled by the resident surgeons. This relationship needs to be studied farther to find out if this was a confounding factor.

Pre-operative and intra-operative blood loss was another contributing factor to post-operative admission to the unit. Those patients who lost more than 2000mls of blood in total whether pre-operatively or intra-operative contributed 46% of the total number of patients admitted. All these were adult patients. A blood loss of 2000 mls in an adult is about 60% of the total blood volume. In this study none of the paediatric patients was admitted to the CCU due to hypovolaemia or haemorrhage. This is more than half of the total number of patients. This compares well with studies done elsewhere (19,20,21). Pre-operative blood loss in this study included pre- and post-partum haemorrhage, retained placenta and both blunt and penetrating abdominal injuries. The majority of these patients were admitted to the CCU mainly for inotropic support or together with respiratory support. These patients also received blood transfusions.

Another factor that was explored in this study was whether the ASA classification was a factor in predicting post-operation admission to the CCU. ASA I and II patients contributed 79.1% of the patients that were admitted to the CCU post-operatively. These were patients that would have been discharged to their wards but due to other factors they complicated and had to be admitted to the CCU. Patients classified as ASA III and IV were few in this study because they are scheduled for admission to the CCU because of their pre-operation condition.

Operations that took more than three hours contributed 41.9% of the admissions to the unit. In this study it was not statistically significant ($p > 0.05$). This is in keeping with other studies that have shown that duration of surgery is significant. Operations that took shorter time and requiring CCU admissions were mainly for respiratory support. These were adenotonsillectomies and thyroidectomies.

Studies done in other institutions identified haemoglobin oxygen desaturation during the peri-operative period and intra-operative tachycardia as important markers for all admissions to critical care units post-operative(28). This study did not dwell on oxygen saturations but tachycardia was a trend seen in many patients that were admitted to the CCU post-operatively. These were mainly patients who developed hypotension due to haemorrhage either pre-operatively or intra-operatively.

Okafor et al(20) in a one year study in a Nigerian University Hospital identified head and neck surgeries as the leading cause of post-operation admissions to their critical care units. In that study they recommended careful screening of patients so that the more complex cases are handled by the most experienced surgeons and anaesthetists. Consultants who are experienced in both surgical and anaesthetic fields play a vital role in teaching the trainees. They should be available to perform and assist in the more complex operations that may arise as emergencies. In this study complicated cases in all disciplines were done as elective cases and were therefore handled by the consultants with the assistance of their trainees in respective fields.

Kaye et al(29) in their study on maternal mortality and associated near-misses among emergency intrapartum obstetric referrals in Mulago hospital had six times as many near misses as maternal deaths. Near-miss is defined using the Mantel et al definition which is the presence of acute organ/system dysfunction. This criteria uses dysfunction in cardiac, vascular, immunological(sepsis), respiratory, renal, liver, cerebral, metabolic and coagulation organ/systems. Management includes hysterectomy for any reason and critical care admission.

Unplanned post-operation admission to the critical care unit has been used as a measure of safety in surgical patients. Guy et. al.(22) validated unplanned intensive care admissions as an indicator of safety in surgical patients in a prospective cohort study of 44,130 patients admitted to their hospital. They assessed the association of UIA with intraoperative incidents and near misses, increased hospital length of stay, and 30-day mortality as three constructs of patient safety. The authors identified 201 patients with a UIA; 104 (52.2%) had at least one incident or near miss. After adjusting for confounders, these incidents were significantly associated with UIA in all categories of surgical procedures analyzed. The table below shows the types and number of incidents and near-misses that were recorded during that study.

Type of Incident and Near-Miss in Patients with an Unplanned Intensive Care Unit Admission

<u>Type of Event</u>	<u>No. of</u>
<u>Events</u>	
Incidents (n=174)	
Uncontrolled hypotension	48
Persistent oxygen desaturation	30
Technical failure and complications of central venous or arterial line insertion	22
Sudden onset of cardiac (ventricular or supraventricular) dysrhythmia	12
Uncontrolled hypertension	12
Acute Myocardial Ischaemia during procedure	10
Miscellaneous	10
Accidental upper Airway obstruction	6
Cardiac Arrest	6
Respiratory Arrest	6
Technical failures and complications of regional block techniques	4
Critically low urine output	3
Drug related incident (associated to drug error or anaphylaxis)	3
Decrease of body temperature below 35°C	1
Malignant hyperthermia	1
Near Misses (n=9)	
Difficult intubation or tracheal tube misplacement	5
Unplanned general anaesthesia after failed regional technique	2
Temporarily disconnected intravenous line	2
TOTAL	183

Compared with traditional measures such as adverse outcomes, UIA is highly specific to the safety dimension of patient care. Therefore, it does not depend on the use of complex risk-adjusted models or peer review committees to determine whether an adverse outcome is related to the patient's condition or to a patient's safety issue. It can be used in hospitals that do not record data on extensive information systems, because the information can be extracted from medical charts, if necessary. It can provide hospitals and departments with useful information about the variability of the safety dimension of patient care, on a quarterly or an annual basis. For this, the exact process leading to an unplanned admission to the ICU must be well understood to remove from the definition those patients admitted after miscommunication or organizational issues. In conclusion, these results show that UIA is a valid indicator to measure patient safety in surgical patients. It can be clearly defined and readily identified in basic hospital information systems. It provides a new perspective on the use of clinical indicators as measures of patient safety

CONCLUSION

The most significant factor isolated in this study that led to post-operation admissions to the CCU was the cadre of surgeon and anaesthetist and the time of operation. Most of the patients admitted were operated and attended to by the resident surgeon, the RCO anaesthetist in conjunction with the resident anaesthetist during the odd hours.

Both pre-operative and intra-operative blood loss in excess of 2000mls was a factor that contributed to post-operation admissions to the CCU.

Emergency operations had a higher number of admissions.

RECOMMENDATIONS

- The resident surgeons, anaesthetists and the RCO anaesthetist ought to be free to consult their seniors even during the odd hours.
- A step down recovery/CCU should be established to deal with the unplanned post-operation admissions to CCU. This will ease the burden from CCU as blood transfusions, inotropic and respiratory support can be done there as the patient is stabilized awaiting discharge to their ward. Post resuscitation patients can also be observed there.
- The planned cases should be clearly booked officially and the probable date and time specified. Any cancellation from either side to be indicated.
- A more extensive study should be carried out to determine long term determinants of unplanned post-operation admissions to Kenyatta National Hospital critical care unit.

LIMITATIONS OF THE STUDY

- Some cases were not clear whether the surgeon or the anaesthetist had requested for CCU admission post-operation. These is due to having no CCU booking records available.
- There was poor record keeping in some of the patients' files. Notes do not follow sequentially from admission to operation. Investigations were dumped anywhere within the file.
- Necessary information was lacking in some of the anaesthetist notes. Most notably were the ASA classification, estimated blood loss and the start and end of anaesthesia and surgery.

REFERENCES:

1. Kenyatta National Hospital medical records department statistics. 2008.
2. Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine: Guidelines for intensive care unit admission, discharge, and triage. *Crit Care Med* 1999;27(3):633-638
3. Society of Critical Care Medicine Ethics Committee: Consensus Statement on the Triage of Critically Ill Patients. *JAMA* 1994;271(15):1200-1203
4. Sprung CL, Geber D, Eidelman LA *et al*: Evaluation of triage decisions for intensive care admission. *Crit Care Med* 1999;27(6):1073=1079
5. Truog R.D, Brook D.W, Cook D.J *et al*: Rationing in the intensive care unit. *Crit Care Med* 2006;34(4):958-963
6. Kasvan-Gonzalez N,Souverain R,Miale S;Improving Quality of Life Through Rehabilitation in Palliative Care;*Palliative Support Care*;2010 Sep;8(3):359-69
7. Oliver M.F, Julian D. G, Donald K.W. Problems in Evaluating Coronary Units: Their Responsibilities and Their Relation to the Community. *Am J Cardiol* 1967;20:465-474
8. Bone R.C, McElwee N.E, Eubanks D.H, *et al* .Analysis of Indications for Intensive Care Unit Admission-Clinical Efficacy Project-American College of Physicians ,*Chest* 1993;104:1806-1811
9. Kalb P.E, Miller D.H Utilization Strategies for Intensive Care Units. *JAMA* 1989;261:2389-2395
10. NIH Consensus Conference-Critical Care Medicine. *JAMA* 1983;250:798 1983;250:798-804

11. Mulley AG. The Allocation of Resources for Medical Intensive Care .In: Presidents Commission for the Study of Ethical Problems in Medicine and Biomedical Research: Securing Access to Health Care .Washington, DC: Government Printing Office 1983:285-311
12. Kollef M.H, Shuster D.P .Predicting ICU Outcomes with Scoring Systems: Underlying Concepts and Principles, Crit Car Clin 1994:101-18
13. Kollef MH, Canfield DA, Zuckerman GR. Triage Considerations for Patients with Acute Gastrointestinal Haemorrhage Admitted to a Medical Intensive Care Unit. Crit Care Med 1995:23:1048-1054
14. Kraiss L.W, Kilberg L, Critch S.*et al.* Short-Stay Carotid Endarterectomy is Safe and Cost-Effective. Amer JSurg 1995:169:512-515
15. Willmitch B , Egol A ,Prager R. Outcome Equivalency for Femoral Bypass Patients Admitted to Step Down Units. Crit Care Med1997:25-43
16. Consensus Statement of the Triage of Critically Ill Patients. Society of Critical Care Medicine Ethics Committee. JAMA 1994:271:12001203
17. Accreditation Manual for Hospitals .Continuum of care 1996:155-160
18. Manthous CA Amoateng-Adjepong Y, Al-Kharrat T. Effects of a medical Intensivist on Patient Care in a Community Teaching Hospital. *Mayo Clin Proc* 1997:72:391-399
19. S. Manjula, D .Lallita, R. Shilpa: Analysis of Anaesthetic Intensive Care Unit Admissions: The anaesthesiologists' Perspective. The Indian Journal of Anaesthesiology.2007 Volume 13 Number 120.

20. Okofor U.V: An Audit of Unplanned Postoperative Intensive Care Unit Admissions in Enugu, Nigeria: Causes and Outcomes; South African Journal of Critical Care , Jul 2009,Vol 25 No1
21. B. Osinaike, D. Aderinto: Intensive Care Admissions of Patients following Surgery; African Journal of Anaesthesia and Intensive Care, Vol 9, No 2 (2009)
22. Haller G, Myles PS, Wolfe R, Weeks AM, Stoelwinder J, McNeil J. Validity of unplanned admission to an intensive care unit as a measure of patient safety in surgical patients. *Anesthesiology* 2005; 103:1121-1129.
23. Kings T.A, Adams A.P.,1990 Failed tracheal intubation. *British Journal of Anaesthesia* 65:400-414
24. Australian Council on Healthcare Standards. The ACHS accreditation guide: standards for Australian healthcare facilities, 11th. Edition. Zetland, N.S.W: Australian Council on Healthcare Standards 1992.
25. Collopy BT, Ansari MZ, Booth JL, Brosi JA. The Australian Council on Healthcare Standards Care Evaluation Program. *Med J Aust* 1995; 163: 477-480.
26. Rothaar RC, Epstein S.K.Extubation failure: magnitude of the problem, impact on outcomes, and prevention. *Curr Opin Crit Care* 2003 Feb; 9(1):59-66.
27. Fisher, Laing and Stoeckel (1983) in Mugenda OM and Mugenda AG. *Research Methods: Quantitative and Qualitative Approaches*. Acts Press, Nairobi; 2003.
- 28.Rose D.K.,Byrick R.J.,Cohen M.M.,Planned and Unplanned Post-operative admissions to Critical Care Unit for Mechanical Ventilation. *Can. J. Anaesthesiology* 1996; 333-40
29. Mantel, D.G.,Buchmann, E., Rees, H. and Pathison, R.C.,Severe Acute Maternal Morbidity; A Pilot Study of a Definition of a Near-Miss.;*Brit. J. Obstet. Gynaecol.*1998;105:985-990

Appendix 1: Budget

Item	Approximate cost (Ksh)
Biostatistician	10,000
Stationary & printing costs	15,000
KNH/UoN Research & Ethics Committee fee	1,000
Internet hours	2,000
Phone calls	2,000
Miscellaneous	2,000
TOTAL	32,000

Appendix 2: Work schedule

ASPECT OF RESEARCH	APPROXIMATE TIME NEEDED	DATES
Data collection	3 months	Feb-April
Data analysis	2 weeks	May
Report of Results	1 month	May-June
Final Adjustments	1 month	May-June

APPENDIX 3:

DATA COLLECTION TOOL

1. Serial Number..... Date.....
2. Sex: male..... Female.....
3. Age:
4. Diagnosis.....
5. ASA Classification.....
6. Operation:
 - a) Emergency..... Time.....
 - b) Elective..... Time.....
7. Anaesthesia: a) General anaesthesia..... b) Regional anaesthesia
(specify).....
8. Surgeon: Consultant.....Resident.....
9. Anaesthetist: Consultant.....Resident.....

Clinical anaesthetist.....
10. Pre-operative basic investigations: Done.....Not done.....

Haemogram..... U/E/Cr/RBS.....

Others (specify).....
11. Vital signs at pre-op: HR.....BP..... RR.....Temp.....
12. Vital signs at induction: HR.....BP.....RR.....SPO₂.....

- 13. Intra-operative events; a) Heart rate trends.....
 - b) BP trends.....
 - c) Estimated blood loose.....
 - d) Total fluids infused.....
 - e) Total blood transfused.....
- 14. Duration of surgery (induction to reversal).....
- 15. Reason for transfer to CCU.....
- 16. ABGAs on admission to CCU.....

APPENDIX 4:

Informed Consent Form

Part 1: Information

Introduction

You are invited to participate to in a study being conducted by me, Dr. Julius M. Githinji, a final year resident in Masters in Medicine in Anaesthesia.

The study is about the reasons for admission to the Critical Care Unit after an operation that has been done, but for which the patient was to have been taken to the ward after recovery room. I will do the best to my ability to answer any queries you might have.

You or your next of kin will be entered into the study at your on will. Data will be collected from the patient´s file and then analysed.

No extra cost will be incurred due to this study. Further no unauthorized interventions will be carried out to the patient including removal of blood samples.

The study is once only inclusion without follow-up for purposes of the study.

No risks will be exposed to the patient due to the study and no financial benefits either.

Confidentiality will be maintained during data analysis, presentation and publication of results. The patient will be assigned a number and not a name.

Contact Persons

In case of any questions about this study, you are welcome to contact any of the under mentioned:

Dr. Julius M. Githinji, (Researcher)-0722730166

Dr. Thomas Chokwe, (Supervisor)-0722528237

PART 2: Certificate of Consent

I understand the nature of this study as explained to me by Dr. Githinji. I give him permission to include me/my next of kin in this study.

Signed..... Date.....

I Dr. Julius M. Githinji as the principle researcher have today explained to the participant/next of kin to the participant the nature of my study. I confirm that I have not coerced him/her into consenting and that the consent has been given freely and voluntarily.

Signed..... Date.....