ORIGINAL ARTICLE

Pattern of Perioperative Cardiac Arrests at University of Maiduguri Teaching Hospital

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Abstract

Background: *Perioperative cardiac arrests and death on the table represent the most serious complications of surgery and anaesthesia. This paper was designed to study their pattern, causes and outcomes following cardiopulmonary resuscitation (CPR) and intensive care unit (ICU) management in our institution.*

Methodology*: Three year retrospective review of perioperative cardiac arrests and death on operating table following surgical procedure under anaesthesia. For each cardiac arrest or death on the table the sequence of events leading to the arrest was evaluated using case notes, anaesthetic chart and ICU records. Study variables which include demographic data, ASA score, anaesthetic technique, causes and outcome were analysed and discussed.*

Results*: Fourteen perioperative cardiac arrests were encountered following 4051 anaesthetics administered over the three year study period. Twelve out of the fourteen cardiac arrests occurred following general anaesthesia, while the remaining two occurred following spinal anaesthesia. There was no cardiac arrest following local anaesthesia. Children suffered more cardiac arrest than adults. ASA class III and IV risk status suffered more arrests than ASA I and II. Hypoxia from airway problems was the commonest cause of cardiac arrest followed by septic shock. Monitoring with pulse oximeter was done in only 4 out of the 14 cardiac arrests. Only 2(14%) out of 14 cardiac arrests recovered to home discharge, one of them with significant neurological deficit.*

Conclusion: *Majority of arrests were due to hypoxia from airway problems that were not detected early. There is need to improve on patient monitoring, knowledge of CPR and intensive care so as to improve the outcome of perioperative cardiac arrest.*

Key words: *Cardiac arrest, Perioperative period, Anaesthesia.*

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Introduction

Surgery without anaesthesia was associated with significant risk of death and suffering[1,2]. Perioperative cardiac arrests represent the most serious complication of anaesthesia and surgery[1]. Earlier reports[2,3] of perioperative cardiac arrests showed that significant mortality occurred even in healthy patients undergoing minor procedures suggesting that anaesthesia was a principal causal factor. However, subsequent studies[2,4] reported death mainly in patients with significant co-morbidities undergoing major surgeries suggesting that other causal factors like patient and surgical factors also contribute to perioperative cardiac arrests. Anaesthesia is now said to be five times safer than it was forty years ago[2,]. Mortality rate have decreased from 1 in 5000 to 1 in 300,000 anaesthetics due to improvement in anaesthetic drugs, patient monitoring and anaesthetic equipment[4]. This study was designed to assess the pattern of perioperative cardiac arrest in our institution with a view to identifying the causes and proffer solutions.

Methods

All patients who suffered cardiac arrest or death on operating table (DOT) in the perioperative period were studied retrospectively over a three year period. The perioperative period in this study was defined as the time spent in surgical operation, recovery room and intensive care unit. Only patients with American Society of Anesthesiologist (ASA) risk classes I to IV were included in the study. ASA risk class V patients were excluded due to their small chances of survival with or without surgery and anaesthesia. Cardiac arrest is considered when there is an absence of arterial or cardiac pulsation on palpation of femoral/carotid arteries or auscultation of the precordium necessitating external cardiac massage. Recovery from cardiac arrest is considered when there is full return of cardiac and respiratory activity following resuscitation. Failure to resume cardiorespiratory activity after CPR was considered as DOT when arrest occurs on operating

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table. The sources of data include anaesthetic record charts, surgical operation registers, ICU record book, patients' case notes and morbidity/mortality meetings. A data form was filled for each cardiac arrest where details of preoperative co-morbid condition and ASA risk classification of patient were recorded. Other information includes age, sex, and type of surgery, anaesthetic technique (general, regional or local anaesthesia), intraoperative critical incidents such as difficult intubation, hypoxia, airway obstruction, aspiration, hypoventilation, hypotension and cardiac arrests. The outcome of cardiac arrest was classified as successful CPR and ICU admission, death on table, death on transportation, death in ICU, discharge with neurological deficit and discharge without neurological deficit. The data obtained were analyzed using Microsoft excel and result presented as proportion and frequencies in tables and charts

Results

Over the three year period of study, there were 14 perioperative cardiac arrests out of 4051 anaesthetics administered. Twelve (86%) were cardiac arrest following general anaesthesia (n=2984), while 2(14%) followed spinal anaesthesia (n=489). No cardiac arrest followed local anaesthesia (n= 578) fig 1. Age distribution of cardiac arrest shows paediatric age group < 14yrs were 9(64%) while adult > 15yrs were 5(36%). Sex distribution showed 7(50%) males and 7(50%) females. The frequency of cardiac arrest was highest among ASA III (n=5) and IV (n=4) patients constituting 36% and 29% respectively (details in table 1). Analysis of the causes of cardiac arrest shows hypoxia from airway problems constitute 4(29%), refractory shock from sepsis 3(21%), uncontrolled bleeding 2(14%), drug error 2(14%) and pulmonary embolism 2(14%), see details in table 2. Ten patients did not receive continuous monitoring with pulse oximeter until after cardiac arrest. Out of the 14 cardiac arrests, 7(50%) were successfully resuscitated following CPR and subsequently managed in the intensive care unit, while 6(43%) were death on the table and 1(7%) death during transportation. Out of the seven cardiac arrests that were successfully resuscitated and admitted into ICU, only two were discharged home, one of whom had significant neurological deficit (table III).

Table I. Distribution of perioperative cardiac arrests by age, sex and ASA status.

Variables	Number of cardiac arrests (%)
AGE	
≤1 month	2(14)
1month to 1yr	4(28)
1 to 14yrs	3(21)
≥15yrs	5(35)
SEX	
Male	7(50)
Female	7(50)
ASA status	
I	2(14)
II	3(21)
III	5(35)
1V	4(28)

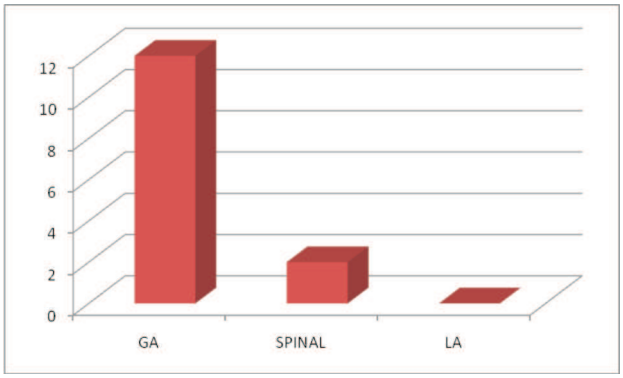

Fig 1. Relationship of perioperative cardiac arrests to Anaesthesia techniques.

Table II. Causes of perioperative Cardiac arrests

Causes of Cardiac Arrest	NO (%)
Hypoxia:	5(35)
Airway problems	3(14)
Aspiration of gastric content	1(7)
Hypoventilation	1(7)
Septic shock	3(21)
Uncontrolled bleeding	2(14)
Drug errors	2(14)
Pulmonary embolism	2(14)
Total	14(100)

Table III. Outcome of perioperative cardiac arrests.

Outcome	NO (%)
*Successful CPR and ICU transfer	7(50)
Death on the table(DOT)	6(42)
Death on transportation	1(1)
Total	14(100)

*Of the seven patients transferred to ICU, 5 later demised. Two discharged home of whom one had significant residual neurological deficit.

Discussion

The study provides insight into the pattern of fourteen perioperative cardiac arrest from 4051 anaesthetics giving an incidence of 3/1000 anaesthetics. This is lower than the findings of Desalu et al[5] at Lagos University Teaching Hospital in their audit of adult perioperative cardiac arrest. Majority of cardiac arrests in this study occurred following general anaesthesia. Few studies[3,4,6] have associated general anaesthesia with greater anaesthetic morbidities and mortalities than regional or local anaesthesia. Harkins et al[6] found that regional anaesthesia is 16 times safer than general anaesthesia in obstetric patients. The reason for the high morbidity and mortality associated with general anaesthesia may be because high risk patients are usually done under general anaesthesia because of their unstable cardiorespiratory systems. In addition, recent advances in the knowledge of physiology and pharmacology of regional blocks have resulted in fewer complications during regional blocks[7].

This study also showed that hypoxia from airway problems is the commonest cause of perioperative cardiac arrest in our hospital. This is in contrast to the study in Lagos University Teaching Hospital which found hypotension from hypovolemia to be the commonest cause of perioperative cardiac arrest[5]. Airway problems that are usually encountered during conduct of anaesthesia include difficult or failed intubation, esophageal intubation, and aspiration of gastric content and inadequate ventilation. All these have been shown to cause hypoxia and cardiac arrest if they are not corrected promptly[8]. The ASA claim study[9] reported hypoxia as the cause of 57% of perioperative cardiac arrest which can be prevented by monitoring patients routinely with pulse oximeter in the perioperative period. Only four out of the fourteen patients that suffered cardiac arrest were monitored with pulse oximeter. This could explain why hypoxia was the commonest cause of arrest in this study.

Paediatric surgical patients suffered more perioperative cardiac arrest than adult surgical patients during the study period. This may be due to the fact that paediatric patients are more prone to hypoxic cardiac arrest because of their low oxygen reserves[10]. Similarly, high risk patients of ASA classes III and IV also suffered more cardiac arrest than those in classes I and II probably because of associated co- morbidities which included anemia, infection, hypertension, diabetes mellitus and obesity This is consistent with other studies[5,11].

Another rare cause of perioperative cardiac arrest documented in this study is drug error from misidentification of drug ampoules and inadvertent intravenous injection of adrenaline. Two patients suffered these errors which are rare but recognized cause of anaesthetic mishaps. Similarities in the ampoules of atropine and adrenaline resulted in the administration of adrenaline instead of atropine to a hypertensive patient with ischaemic heart disease resulting in cardiac arrest. The other anaesthetic mishap was an inadvertent intravascular injection of adrenaline solution following local infiltration of the perineum with adrenaline to reduce bleeding during repair of third degree perineal tear under general anaesthesia. Drug administration error during anaesthesia has been identified as a significant cause of iatrogenic harm to patients[12]. Reported incidents of drug error in anaesthesia are believed to underestimate the true number of event due to fear of blame and litigation. Drug error can be minimized by being vigilant always, supervising every drug that is administered to patient, and by practicing and teaching the reading of labels on drug ampoules before administration.

Pulmonary embolism is difficult to diagnose clinically in the perioperative period. Peer review during mortality meeting helped in the diagnosis of pulmonary embolism as the cause of cardiac arrest in this study. The two patients who suffered this complication were both orthopedic patients with risk factors for pulmonary embolism. Pulmonary embolism can be prevented by appropriate thromboprophylaxis in patients at risk. Refractory shock from sepsis following laparotomy for intestinal obstruction was the cause of three perioperative cardiac arrests. Sepsis can be treated by resuscitation and use of appropriate antibiotics before surgery. Uncontrolled bleeding at operation site despite effort at replacement with appropriate fluid was the cause of arrest in two patients. This can also be prevented by careful patient selection to avoid those with inoperable disease or tumours and meticulous surgical techniques.

The outcome of cardiac arrests in this study is poor. Only 2 (14%) out of 14 cardiac arrests survived to home discharge. Several factors such as age, co morbid state, type of surgery, duration of arrest, knowledge of CPR, and level of intensive care are known to affect outcome[5,8,11] . Predictors of survival show that extremes of ages, prolonged arrests and co morbid conditions usually give poor outcome[13]. However, this study being a retrospective study did not address these factors. A prospective study is required to study these factors that affect outcome more comprehensively.

Conclusion

Hypoxia from airway problems and refractory hypotension from septic shock are the leading cause of perioperative cardiac arrests in this study. Measures should be taken to prevent hypoxia by early detection using pulse oximeter. There is need to improve on the knowledge of CPR and intensive care so as to improve the outcome.

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