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Research Article

The outcome of anaesthesia related cardiac arrest in a Sub-Saharan tertiary hospital

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KEYWORDS

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Abstract *Background:* Anaesthesia related cardiac arrest is undesirable, and different attempts have been made to reduce the mortality associated with it through continuous specialist training, and provision of state of art equipment, combined with rigorous research.
Patients and methods: We determined the outcome of all cardiac arrests that occurred within 24 h of a surgical procedure and anaesthesia from January 2013 to May 2014.
Results: There were nine anaesthesia related cardiac arrest in 4229 cases, (incidence of 21.28 per 10,000), with a mortality of 7/4229; (16.55 per 10,000). There were 60 perioperative cardiac arrests (incidence of 141.88 per 10,000), with a mortality of 55/4229 (130.05 per 10,000). There was return of spontaneous circulation in 34 (56.67%) cases, among them only 7 (20.59%) survived to hospital discharge. The independent determinant of perioperative mortality was the duration of cardiac arrest $\geqslant$ 5 min (RR 10.50, 95% CI 2.721–40.519, $p < 0.001$), cardiac arrest in the absence of a witness (RR 9.56, 95% CI 2.486–36.752, $p < 0.001$), nonstandard time of cardiac arrest (RR 3.2, 95% CI 1.792–5.714, $p < 0.001$), ASA physical status $\geqslant$ III (RR 2.017, 95% CI 1.190–3.417, $p = 0.017$), and emergency surger (RR 2.17, 95% CI 1.151–4.049, $p = 0.011$).
Conclusion: Anaesthesia related cardiac arrest and mortality were linked to cardiovascular depression from halothane overdose in our institution. The burden can be reduced by improving on establishing standard monitoring in the perioperative period, and a team approach to patients care.

1. Introduction

Unexpected death sometimes occurs in the course of a surgical procedure or administration of an anaesthetic. This has been attributed to multiple confounding factors such as human error, anaesthesia and surgical techniques, the emergency nature of the procedure, the American Society of Anesthesiologists (ASA) physical status classification III and higher, presence of underlying medical disease, and extremes of age [1–3]. Attempts have been made to reduce the mortality during

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anaesthesia and surgery through continuous cardiopulmonary resuscitation and specialist training, improvement in surgical and anaesthetics techniques, the use of perioperative monitoring, and specific guidelines for critical incident [1–3].

The mortality related to anaesthesia has been described as death under, as a result of, or, within 24 h of an anaesthetic [2,4]. This has declined during non-cardiac surgery in recent time in the developed countries to a range from 0.5 to 1 per 10,000 in adults, and 1.4 to 4.6 per 10,000 in children.[1] The mortality following anesthesia related cardiac arrest however, is still high in developing nations with a range from 3.14 to 29.6:10,000 in a surgical population [4,5]. The high rate has been attributed to poor infrastructure, lack of adequate monitoring facilities, delay in presentation to tertiary or specialist facilities, and shortage of blood products [4–6].

The factors contributing to anaesthesia related cardiac arrest include airway or ventilation problems, medication accidents, poor preoperative evaluation, poor supervision of trainees, and infusion/transfusion mishaps [4,7].

There is a need for continuous evaluation of events which might contribute to perioperative cardiac arrest and mortality. This might give an insight into the quality of anaesthesia and surgical care, allow preventive measures to be instituted, and provide direction for future research. We investigated the outcome of anaesthesia related cardiac arrest and mortality during the 24 h period of non-cardiac surgical procedures.

1.1. Patient and methods

This was an audit of anaesthesia related cardiac arrest from January 2013 to May 2014. Institutional Human and Research Ethics Committee approval was obtained. A standard preoperative assessment was done by the attending anaesthetist the day before elective procedures, and immediately before an emergency or urgent surgical procedure.

1.2. Surgical and anaesthetic technique

All procedures were performed using standard anaesthetic and surgical techniques adapted to the individual procedures, and at the discretion of the attending physician. The monitoring instituted included a noninvasive blood pressure, pulse oximetry, electrocardiogram, capnography, anaesthetic vapour concentration, oxygen concentration, and ventilation parameters according to standard of care and the patients need.

The primary outcome of the study determined the anaesthesia related cardiac arrest and mortality. The secondary outcome determined the crude (total perioperative) cardiac arrest and mortality.

The potential predictors of mortality following cardiac arrest such as age, sex, ASA status, the urgency of surgery as defined by the ASA physical status designation of "emergency" by anaesthesia providers, witnessed cardiac arrest, and the duration of cardiac arrest were studied.

Surgical procedures were grouped according to the unit performing the operation: general surgical procedures, neurosurgical, thoracic, gynaecological, and maxillofacial procedures, as well as paediatric, Ear/Nose/Throat (ENT), trauma, orthopaedic and urological procedures.

The primary electrocardiogram rhythm during the cardiac arrest was recorded (asystole, ventricular fibrillation, ventricular tachycardia or pulseless electrical activity). If several rhythms were present, only the first one recorded was used.

The type of anaesthesia was recorded as the primary type of anaesthetic in use at the time of arrest: general, regional (peripheral neuraxial or central neuraxial) anaesthesia, or monitored anaesthesia care (MAC). If the patient received a combined general and regional technique, it was considered that the arrest occurred during general anaesthesia.

The cadre of the primary anaesthesia provider at the time of cardiac arrest was documented (junior registrar, senior registrar or consultant).

The probable cause of cardiac arrest was determined after the event by one of the researchers by reviewing the anaesthetic data. Other factors analysed included the patient's haemodynamic stability before arrest (defined as the need for infusion of vasopressors before arrest), the occurrence of more than a 10 min period of tachycardia (>120 beats/min), hypotension (systolic blood pressure <80 mmHg), or hypertension (systolic blood pressure >160 mmHg) that preceded the arrest [3].

Cardiac arrest was classified as occurring during induction, maintenance, or emergence or recovery from anaesthesia [3]. The time of arrest was documented as standard time occurred during regular working hours (07:00–16:00, Monday through Friday), or non-standard time during the night (16:01–07:59, Monday through Friday) and weekends (Friday 16:01 through Monday 06:59). This timing is based on the work schedule of the anaesthetist in our institution.

1.3. Definition of variables

Basic safety monitoring in the operating room was described during regional anaesthesia and monitored anaesthesia care to include a non-invasive blood pressure, pulse oximetry and continuous electrocardiogram display, and during general anaesthesia to include additional monitoring: capnography, delivered anaesthetic vapour concentration, oxygen concentration, and ventilation parameters [3].

The primary comorbid conditions were defined by the Hosking diagnostic criteria [8]. These criteria included cardiovascular disease, hypertension, end-stage organ failure, systemic disease, infectious disease or sepsis, cerebrovascular disease, and diabetes mellitus [3,8].

Cardiac arrest was described as an event that required cardiopulmonary resuscitation (CPR). Only cardiac arrest that occurred after anaesthesia has been initiated was included. This included cardiac arrest, which occurred during anaesthesia or surgery, transport to the recovery room or intensive care unit, and during the recovery room stay, ward transfer, or, up to a period of 24 h after an anaesthetic [3]. The crude mortality was described as combined surgical and anaesthetic mortality associated with the administration of anaesthesia within 24 h [2].

[1] The incidence is higher in infants than older children and in children with ASA physical status 3–5 than those with ASA physical status 1–2. Anesthesia related cardiac arrest is linked with respiratory impairment in children. It has been suggested that a reduction in anesthesia related cardiac arrest in pediatric patients can be achieved by improving supervision of junior doctors, encourage additional training, the use of practice guidelines, efficient blood bank services, equipment maintenance, and quality assurance monitoring [2,4].