# Intra-operative cardiac arrest - A tropical experience

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## Summary

**In order to determine the pattern of intra-operative cardiac arrests in a developing country, we reviewed 40 consecutives cases of cardiac arrests at the Jos University Teaching Hospital between January 1993 and December 1997. During this period 15060 minor cases and 9800 medium/major surgical procedures were performed and an arrest rate of 1:15060 for minor cases and 1:251 for medium/major cases were obtained. The age ranged between one day and 65 years with a mean of 29.8 years and a male/female ratio of 1:1.3 as there were 18 males and 22 females. Twenty-five (62.5%) arrests occurred outside work hours while fifteen (37.5%) cases arrested during work hours. The surgical procedures with high arrest rates in this study were: emergency laparotomy 8 (20%), emergency caesarian sections 7 (17.5%), thoracotomy 6(15%), emergency craniotomy 5(12.5%), emergency hysterectomy 4(10%) and therapeutic bronchoscopy for foreign bodies in the airway 4(10%). The arrests occurred in 30(75%) emergency procedures as opposed to 10(25%) elective cases. Only in 3 out of the 18, 318 day case procedures did the patients arrest.**

**One patient arrested during local infiltration of lignocaine while the other 39(97.5%) arrested under general anaesthesia. There was no arrest with spinal anaesthesia. The predisposing factors for a patient to arrest on the operating table in our environment include emergency major surgery, poor risk patients with ASA 111 and above, surgery performed outside work hours, under general anaesthesia administered by nurse anaesthetists or junior anaesthetic residents. The success rate at resuscitation is highest with patients with ASA 1 & 11, operations performed during work hours and by senior surgeons and anaesthetists.**

**Key words:** ***Intra-operative cardiac arrest, Emergency surgery, Outside work hours, Junior surgeons and Anaesthetists.***

## Résumé

Pour déterminer le modèle d'intra arrestations cardiaques en vigueur dans un hôpital tertiaire dans un pays en voie de développement, nous avons examiné 40 cas consécutifs des arrestations cardiaques à l'Université Jos que Apprend l'hôpital entre janvier 1993 et décembre 1997. Pendant cette période 15060 cas mineurs et 9800 moyen/majeure les procédures chirurgicales ont été exécutées et un taux de l'arrestation de 1:15060 pour cas mineurs et 1:251 pour les cas du moyen/majeure a été obtenu. L'âge aligné entre un jour et 65 années avec une moyenne de 29.8 années et une proportion du mâle/femmes de 1:1,3 comme là soit 18 mâles et 22 femmes. Vingt-cinq (62;5%) les arrestations se sont produites à l'extérieur d'heures du travail pendant que quinze (37,5%) les cas ont arrêté pendant heures du travail. Les procédures chirurgicales avec hauts taux de l'arrestation dans cette étude étaient. l'urgence laparotomie 8(20%), le caesarian de l'urgence coupe 7(17.5%), thoracotomie 6(15%), urgence craniotomie 5(12.5%), urgence hystérectomie 4(10%) et bronchoscopie thérapeutique pour corps étrangers dans la route aérienne 4(10%). Les arrestations se sont produites en 30(75%) procédures de l'urgence comme a s'opposer à 10(25%) cas électifs. Seulement 3 des 18,318 procédures du cas du jour fait l'arrestation des malades. Un malade a arrêté pendant infiltration locale de lignocaine pendant que l'autre 39(97.5%) a arrêté sous anesthésie générale. Iln'y avait aucume arrestation avec l'anesthésie vertébrale. Les prédisposant facteurs pour un malade arrêter sur la table du fonctionnement dans notre environnement incluent l'urgence chirurgie majeure, malades du risque pauvres avec ASA III et au-dessus de, la chirurgie a exécuté à l'extérieur d'heures du travail, sous anesthésie générale administrée par anaesthetists de l'infirmière ou cadet résidents anesthésiques. Le taux du succès à réanimation est plus haut avec les malades avec ASA 1 et II, les opérations ont exécuté pendant heures du travail et par les chirurgiens aînés et les anaesthetists.

## Introduction

Anaesthetists and Surgeons dread death on the operating table. Intra-operative cardiac arrest is commonly seen in poor risk patients undergoing major surgery. However, it could occur even in apparently healthy patients undergoing minor surgery.

Cardiac arrest occurs in three main forms: ventricular fibrillation, asystole and electro-mechanical dissociation.[1] Continuous electrocardiographic (ECG) monitoring is necessary to determine the type of arrest as the modality for intervention and definitive therapy will depend on the type[2]. Unfortunately, in many developing countries, the lack of adequate monitoring equipment during anaesthesia for early detection of cardiac arrest adversely affects the outcome of resuscitation[3]. In centres where surgery is done in the absence of adequate monitoring devices, detection of intra-operative cardiac arrest depends on the vigilance of the anaesthetist and the surgeon. Without an ECG monitor, the cardinal signs of cardiac arrest include loss of consciousness, absent carotid pulses and heart sounds,

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cessation of respiration and dilated pupils[4]. However, under general anaesthesia with the patient paralyzed, only the absence of carotid pulsation and/or heart sounds may be the pointer. The surgeon may notice 'darkening' of the blood and inadequate bleeding at the operating field. Under these circumstances, detection of cardiac arrest could be late and the outcome of resuscitation poor.

## Patients and methods

All the anaesthetic records within the period January 1993 through December 1997 were analyzed and 40 cases of cardiac arrest during surgical procedures within this period were obtained. The clinical records of these patients were retrieved and entered into a proforma, which was subsequently analyzed for age, sex, diagnosis, preoperative ASA score, the type of anaesthesia, the level of seniority of the anaesthetist and surgeon and the type of surgery. The time of cardiac arrest, the day of the week it occurred, the resuscitative measures applied and outcome of resuscitation in relation to mortality and morbidity were also analyzed. The time of the arrest was obtained from the anaesthetic record while the day of the week for each arrest was obtained using the SHARP ELECTRONIC ORGANIZER Model EL-606 (Tel. & Schedule). From these, we deduced whether the arrest occured during or outside work hours.

### *Limitations*

This study was carried out in a tertiary institution at a time when the following intra operative monitoring devices were not available in the operating theatres: visual ECG display, pulse oximeter, automatic BP monitor (Dinamaps) and capnographs. None of the Boyle's anaesthetic machines had disconnect alarm and only 25% of the machines had oxygen failure alarm. There was no electrical defibrillator in any of the five operating theatres in this hospital. Being a retrospective study, some of the racords on the resuscitative measures applied at the time of cardiac arrest were incomplete. Outside work hours, occasionally the drugs needed for resuscitation were not available for emergency needs of the patients.

## Results

Over a 5-year period, a total of 40 out of 24,860 patients in the five theatres of Jos University Teaching Hospital had cardiac arrest. There were 18 males, and 22 females (M:F = 1:1.3). The age ranged between one day and 65years with a mean of 29.8 years. The highest incidence occurred mostly in the third decade of life. Thirty-nine arrests occurred during general anaesthesia while only one (2.5%) occurred under local lignocaine infiltration; there was no arrest with spinal anaesthesia which was administered on 835 patients during this period. Thirty (75%) patients arrested during emergency surgery and 10 (25%) arrests occurred during elective surgery. Emergency laparotomy was responsible for 8(20%) arrests, emergency caesarian sections 7(17.5%); thoracotomy 6(15%), emergency craniotomy 5(12.5%); emergency hysterectomy 4(10%) and therapeutic bronchoscopy 4(10%); one (2.5%) patient arrested during suturing of laceration under local anaesthesia as a result of lignocaine toxicity; one other patient arrested as a result of atropine overdose and 1(2.5%) arrest each occurred during thyroidectomy, pull-through operation for Hirschsprung's disease, orchidopexy, herniorrhaphy and repair of anterior abdominal wall defect in a neonate. One patient had emergency thoracolaparotomy as a result of polytrauma. Three patients arrested out a total of 18,318 patients who had case procedures.

Twenty-five (62.5%) patients arrested after work hours while 15(37.5%) arrested during work hours. The operations were performed by consultants in 20(50%) cases, senior registrars in 15(37.5%), registrars in 4(10%) cases and a senior house officer (SHO) in one (2.5%) case and their respective resuscitation success rates were 35%, 20%, 25% and 100%. Consultants participated only in the more severe and major cases while the only arrest in the hands of a senior house officer was during suturing of a deep laceration under lignocaine infiltration.

Anaesthesia was administered by consultants in 1(2.5%) case; senior registrars in 6 (15%) cases; registrars in 12(30%) cases and nurse anaesthetists in 20(50%) cases. Their respective salvage rates were 100%, 50%, 38% and 15%.

The type of arrests (asystole, ventricular fibrillation or electro-mechanical dissociation) could not be established in the absence of visual electro cardiographic monitor in our centre. Resuscitation was by sustained praecordial thumps, maintenance of the airway, ventilation with 100% oxygen and correction of hypovolaemic shock in all cases. Adrenaline, sodium bicarbonate and calcium gluconate were administered in 20% of the patients. The defibrillator was not applied to any of these patients. Resuscitation was considered apparently successful after resuscitation on the operating table if the patient could sustain spontaneous and adequate cardio-respiratory function; only 10(25%) patients met these criteria. All the patients who survived were transferred to the Intensive Care Unit (ICU) where visual electro-cardiographic monitors and defibrillators in good functioning state were available. However, the real success rate is determined by the percentage of the affected patients who were discharged from hospital alive and without neurological deficits; only four (10%) met these criteria.

The American Society of Anaesthetists (ASA) preoperative grading was applied for the patients under study as follows: 5(12.5%) cases were in ASA I; - 4(10%) cases

were in ASA 11; 7(17.5%) cases in ASA 111; 23(57.5%) in ASA 1V and 1(2.5%) case in ASA V. Their respective salvage rates at resuscitation were 80%, 50%, 28.6%, 13% and 0.

**ASA Grading System**

ASA Grading Description

1. A normal healthy patient
11. A patient with mild systemic disease
111. A patient with severe systemic disease that is incapacitating but not life-threatening
1V. A patient with severe systemic disease that is life-threatening
V. A patient that is moribund and is not expected to survive 24 hours with or without surgery

*For emergency operations, the letter 'E' is added e.g. 1E, 11E, etc.*

**Discussion**

Intra-operative cardiac arrest is a serious complication that requires early detection and prompt effective resuscitation to avoid death. There are numerous causes, many of which can be prevented by adequate pre-operative evaluation and intra-operative monitoring[2-5]. Unfortunately, in many developing countries there is inadequate number of trained staff, monitoring equipment and good recovery facilities to handle even the simplest of the complications.

In this study, 80% of the cases of cardiac arrest occurred with nurse anaesthetists and junior anaesthetic residents compared to 17.5% with senior residents and consultant anaesthetists. One (2.5%) arrest occurred under the care of surgical SHO during infiltration of lignocaine for suturing of wound. Following resuscitation, the success rate was also poorer with nurse anaesthetists (15%) and junior anaesthetic residents (41.6%) compared to senior residents (50%) and consultants (100%). Most of the cases of cardiac arrest occurred in patients with ASA 111 and above. These findings clearly indicate that there is need for more senior anaesthetists to handle the poor risk patients.

Adequate monitoring of patients under anaesthesia is necessary in order to detect the rapid changes in the patient's cardiorespiratory status during anaesthesia. Pollok reported a case of cardiac arrest immediately after vercuronium[6] which was detected early by a continuous ECG monitor. Due to lack of adequate monitoring equipment,many complications including hypoxia, hypotension, hypercarbia, arrhythmias, oxygen failure and circuit disconnection which could lead to cardiac arrest may go un-noticed. Moreover, without an ECG monitor during anaesthesia, clinical diagnosis of cardiac arrest could be too late for successful resuscitation especially when the anaesthetist and surgeon are not vigilant. The basic minimum monitoring devices during general anaesthesia include an ECG monitor, pulse oximeter and blood pressure monitor preferably the automatic type (Dinamap)[2] and a precordial or oesophageal stethoscope.

From the results of this study, the peak decades for cardiac arrest are the first, third, and fourth. This could be explained by the fact that infants and children withstand the stress of anaesthesia and surgery poorly and complications that could lead to cardiac arrest may be more in them. The third and fourth decades are the peak reproductive age range for females and many of the cardiac arrests within this period occurred during emergency caesarian sections. Males in this age range are more mobile and travel frequently by road in this environment, therefore, road traffic accidents were common and significantly contributed to the indications for surgery.

Spinal anaesthesia is a relatively safe procedure in areas of depressed economy as no patient arrested under spinal anaesthesia in this study. Also day case procedures were found safe in this study as only 3 arrests occurred out of 18, 318 patients who had day case procedures.

Anaesthesia for emergency surgery is associated with more adverse outcomes in anaesthetic practice[7]. Due to time constraint in emergency cases, good pre-anaesthetic assessment and preparation which are important aspects of the anaesthetic care of patients may be inadequate.

Adequate pre-anaesthetic assessment lays a good foundation for uneventful intra-operative anaesthesia and a relatively trouble-free recovery from anaesthesia. We suspect that this is why most intra-operative mishaps in anaesthetic practice occur during emergency surgery. The study also shows that emergency surgery outside work hours is another factor associated with more cardiac arrests. Out of the forty arrests in this study, 25(62.%) occurred outside work hours while 30(75%) arrests occurred during emergency surgeries. Most emergency surgeries were performed on high risk patients with life threatening conditions in which pre-operative evaluation and preparation to identify possible underlying systemic disease may be inadequate. Moreover, more senior and experienced manpower are hardly available outside work hours leaving less experienced anaesthetists to handle emergency cases. It was also observed that outside work hours, most anaesthetists worked alone without the appropriate assistants to clinically monitor the patients. Therefore, in the absence of modern monitoring devices, these patients end up being poorly monitored under anaesthesia hence the high occurrence of cardiac arrests.

Cardiac arrest is associated with very high mortality and morbidity rates. The mere return of cardio-respiratory functions after initial resuscitation on the operating table is only an apparent success feature because the real success is determined by the ability of the patient to leave the hospital without neurological deficit. Only four (10%) patients in

this study were discharged without neurological deficit. This is in keeping with the poor results recorded elsewhere[8].

In view of the above, we recommend proper pre-operative evaluation of poor risk cases with a view to identify and correct conditions that could pre-dispose to cardiac arrests. We also recommend that such operations be carried out by consultant and senior resident surgeons and anaesthetists assisted with functioning monitoring and resuscitative facilities. This will go a long way in successful prevention and management of intra-operative cardiac arrests.

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