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Assessment of Cardiac Arrest among Children Due to Anesthetic Procedures: An Institutional Based Prospective Study

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Abstract

Background: Cardiac arrest requiring cardiopulmonary resuscitation (CPR) is a major public health problem. The present study was conducted to assess cardiac arrest in children due to anesthetic procedures. **Subjects and Methods:** This study was conducted on 130 children age <18 years of both genders. Parameters such as surgical procedure, personnel involved in anesthetic care, anesthetic agents, and techniques and monitors were recorded. The incidence of the cardiac arrest was also recorded. **Results:** Out of 130 patients, males were 70 and females were 60. ASA grade I was seen in 10, II in 18, III in 40, IV in 50 and V in 12 patients. The difference was significant (P< 0.05). The type of surgery was airway in 20, cardiac in 13, urology in 52, craniotomy in 15 and thoracic in 30. The difference was significant (P< 0.05). Out of 130 patients, boys had 12 and girls had 14 cases of cardiac arrest. The mechanism of cardiac arrest was medication related in 38, cardiovascular in 20, respiratory in 21, equipment related in 12, multiple event in 14, hypothermia in 15 and unclear in 10. The difference was significant (P< 0.05). **Conclusion:** Common reason for cardiac arrest in children was medication related, cardiovascular, respiratory, equipment related, multiple event, hypothermia and unclear.

Keywords: Anesthesia, Cardiac Arrest, Children.

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Introduction

Because anesthesia-related cardiac arrest is uncommon, a multi institutional database is required to more fully understand the mechanisms of cardiac arrest and to develop preventive strategies.[1] To this end, the Pediatric Perioperative Cardiac Arrest (POCA) Registry was formed in 1994 under the combined auspices of the Committee on Professional Liability of the American Society of Anesthesiologists (ASA) and the American Academy of Pediatrics Section on Anesthesiology to investigate the causes of cardiac arrest in anesthetized children.[2]

Cardiac arrest requiring cardiopulmonary resuscitation (CPR) is a major public health problem; 1 event occurs every 90 seconds. An estimated 200 000 to 750 000 cardiac arrests occur annually among hospitalized patients.[3] Not all cardiac arrests have the same origin: out-of-hospital arrest usually results from an acute onset of cardiac arrhythmia, whereas up to 14% of in-hospital arrests are preceded by complications, such as hypotension, metabolic or electrolyte disturbances, and respiratory insufficiency, and are potentially preventable or modifiable.

Studies have revealed that there is a higher perioperative mortality rate in children compared with adults.[4]

Within the pediatric population, perioperative mortality is more frequent in neonates and infants compared with older children. An analysis of overall perioperative mortality and anesthesia- related mortality in particular may help determine which children are at higher risk and may help guide planning to improve the safety profile of perioperative techniques.5 The present study was conducted to assess cardiac arrest in children due to anesthetic procedures.

Subjects and Methods

This study was conducted in the Department of Pediatrics, Gujrat Adani Institute of Medical Sciences, Bhuj (Kutch), Gujarat, India. A total of 130 pediatric patients of less than eighteen years of age were enrolled in the present study. Patients were informed regarding the study and written consent was obtained. Ethical clearance was taken prior to the study. Complete demographic and clinical details of all the patients were obtained. Exclusion criteria for the present study included:

- Subjects with history of any systemic illness,
- Subjects with any known drug allergy
- Subjects in which informed consent was not available

Parameters such as surgical procedure, personnel involved in anesthetic care, anesthetic agents, and techniques and monitors were recorded. The incidence of the cardiac arrest

was also recorded. Results thus obtained were subjected to statistical analysis using chi- square test. P value less than 0.05 was considered significant.

Results

Table 1: Distribution of subjects

Gender	Males	Females
Number	70	60
Percentage of patients	53.84	46.16

Table 2: Assessment of parameters

Parameters (ASA)	Number	P value
I	10	0.05
II	18	
III	40	
IV	50	
V	12	

Table 3: Type of surgery

Surgery	Number	P value
Airway	20	0.02
Cardiac	13	
Urology	52	
Craniotomy	15	
Thoracic	30	

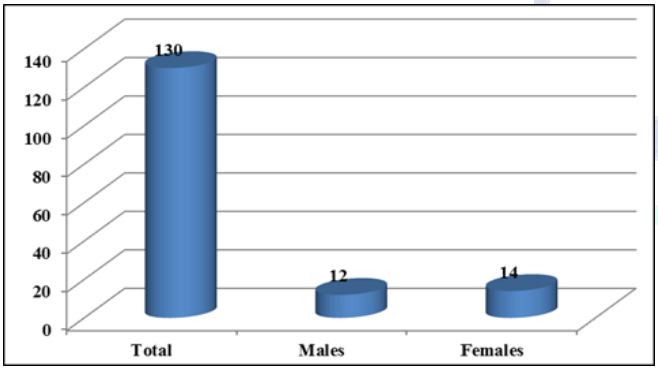

Figure 1: Prevalence of cardiac arrest

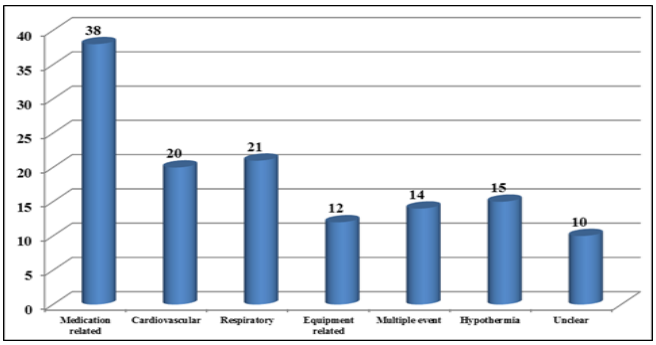

Figure 2: Mechanism of cardiac arrest

[Table 1] shows that out of 130 patients, males were 70 and females were 60. Table II shows that ASA grade I was seen in 10, II in 18, III in 40, IV in 50 and V in 12 patients. The difference was significant (P< 0.05). Table III shows that type of surgery was airway in 20, cardiac in 13, urology in 52, craniotomy in 15 and thoracic in 30. The difference was significant (P< 0.05). Graph I shows that out of 130 patients, boys had 12 and girls had 14 cases of cardiac arrest. Graph II shows that mechanism of cardiac arrest was medication related in 38, cardiovascular in 20, respiratory in 21, equipment related in 12, multiple events in 14, hypothermia in 15 and unclear in 10. The difference was significant (P< 0.05).

Discussion

Increased risk of perioperative cardiac arrest in children compared with adults has been recognized since the seminal study of Beecher and Todd.[6] A number of factors associated with perioperative cardiac arrest have been identified, including young age, comorbid conditions, and emergency surgery, although the immediate cause of cardiac arrest has at times been after to identify. Cardiac arrest was defined as the cessation of cardiac mechanical activity with loss of effective circulation determined by the absence of a palpable central pulse. The resuscitation was performed according to the interventions and protocols for Advanced Cardiovascular Life Support (ACLS) guidelines.[7] The present study was conducted to assess cardiac arrest in children due to anesthetic procedures.

In this study, out of 130 patients, males were 70 and females were 60. ASA grade I was seen in 10, II in 18, III in 40, IV in 50 and V in 12 patients. Salem et al,[8] found that during the study, patients received 18,367 anesthetics. Data collected included patient characteristics, surgical procedures, American Society of Anesthesiologists (ASA) physical status, anesthesia type, medical specialty team and outcome. All CAs were categorized by cause into one of four groups: patient's disease/condition-related, surgery related, totally anesthesia-related or partially anesthesia-related. All intraoperative CAs and deaths rates are shown per 10,000 anesthetics. There were 100 CAs and 68 deaths. The majority of CAs were patient's disease-/condition-related. There were six anesthesia-related CAs. A totally and 5 partially anesthesia-related, and three deaths, all partially anesthesia-related. ASA I-II physical status patients presented no anesthesia-related CA. Anesthesia-related CA, absent in the last five years of the study, was due to medication-/airway-related causes. ASA physical status was the most important predictor of CA followed by emergency surgery.

We found that type of surgery was airway in 20, cardiac in 13, urology in 52, craniotomy in 15 and thoracic in 30. Out of 130 patients, boys had 12 and girls had 14 cases of cardiac arrest. Murat et al9 found that in the first 4 yr of the POCA Registry, 63 institutions enrolled and submitted 289 cases of cardiac arrest. Of these, 150 arrests were judged to be related to anesthesia. Cardiac arrest related to anesthesia had an incidence of 1.4 % of anesthesia and a mortality rate of 26%. Medication-related (37O/0) and cardiovascular (32%) causes of cardiac arrest were most common, together accounting for 69010 of all arrests. Cardiovascular depression from halothane, alone or in combination with other drugs, was responsible for two thirds o all medication-

related arrests. Thirty-three per physical status 1-2; in this group, 64% of arrests were medication related, compared with 23% in American Society of Anesthesiologists physical status +5 patients ($P < 0.01$). Infants younger than 1 yr of age accounted for 55% of all anesthesia-related arrests.

We found that mechanism of cardiac arrest was medication related in 38, cardiovascular in 20, respiratory in 21, equipment related in 12, multiple events in 14, hypothermia in 15 and unclear in 10. Cohen et al,[10] found that Medication-related adverse events accounted for four (66.66%) anesthesia-related CAs, three of which were caused by cardiovascular collapse after neuroaxial anesthesia. Of these three patients, two ASA physical status IV older patients passed away in the OR during vascular surgery (lower limb amputation) while undergoing continuous epidural anesthesia. In the third patient with an ASA physical status of III who suffered a femur fracture in a motor vehicle accident, and had multiple rib fractures, the CA occurred after the administration of a spinal anesthetic with hyperbaric bupivacaine (20 mg). Immediately after anesthesia induction, he developed hypotension and bradycardia, followed by cardiovascular collapse and Cardiac arrest.

Conclusion

From the above results, the authors conclude that the most common reason for cardiac arrest in children was medication related, cardiovascular, respiratory, equipment related, multiple event, hypothermia and unclear.

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