INCIDENCE OF PERIOPERATIVE CARDIAC ARREST:

Analysis of anesthetics over 18-year period.

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Abstract

Objective: Several studies have surveyed perioperative cardiac arrests and their outcomes, regardless of whether patients were successfully resuscitated or died. No such studies have originated from the Kingdom of Saudi Arabia. This is a study of perioperative cardiac arrests and their outcome in a Saudi General Hospital, over an 18-year period.

Methods: Armed Forces Hospital, Wadi Al-Dawasir, Kingdom of Saudi Arabia, serves military personnel and their families, in addition to eligible civilian members of the community. Operating theaters' records were examined to collect details of patients who underwent some form of surgical procedure since the commission of the Hospital on 12.07.1992 up until 30.09.2010. Those surgical cases were traced in the Medical Records Department and the outcome of each case was reviewed. The numbers and causes of cardiac arrests and death occurring during the intraoperative and within the first postoperative 24 hours, were noted.

Results: There were 15,832 patients received anesthesia during the 18-year period. Five patients died during this period (an incidence of 0.03%), all were emergency cases and were due to non-anesthetic causes; four of them died intraoperatively and the fifth died within the first 24 hour postoperatively.

Conclusion: There were 5 non-anesthetic deaths in the perioperative period during the 18-year period. The absence of anesthesia-related cardiac arrests in such patient population has demonstrated that adopting quality improvement measures, teamwork approach and applying strict, but updated and evidence-based, guidelines are essential in the prevention of such catastrophes. A multicentre similar survey is needed to include all types of surgical operations.

Key words: anesthesia; complications, cardiac arrest; outcomes.

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Introduction

The incidence and causes of perioperative cardiac arrests related to anesthesia have been studied over the last two decades by many authors from Australia, [1] Brazil, [2] Canada, [3] France, [4,5] Japan, [6,7] Sweden, [8] Taiwan, [9] Thailand, [10] The Netherlands, [11] and the USA. [12,13,14,15] This period has seen the introduction of new anesthetic agents, improvements in anesthetic and monitoring techniques, optimization of patients' condition prior to surgery, the adoption of medical practice guidelines, and the implementation of quality standards in the healthcare service. This has led many researchers to believe that the frequency of anesthesia-related cardiac arrests have declined. [13,16,17,18] But, although the risk of death attributable to anesthesia has fallen appreciably over the years, the number of perioperative deaths remains static. [19] However, a recent review questioned if there any change has happened over the last decades. [20] There are no data on the subject in the Saudi Medical Literature. This study is looking at the incidence and outcome of cardiac arrests in a surgical population as a result of anesthesia over an 18-year period in a Saudi general hospital.

Methods

Armed Forces Hospital at Wadi Al-Dawasir, Kingdom of Saudi Arabia, provides both primary and secondary medical care to military personnel and their dependants, and receives entitled patients from the civilian population. It acts as a referral centre for other hospitals in the region including major trauma cases. It is the first hospital in the Kingdom of Saudi Arabia to obtain the ISO 9000 (International Standard Organization) Certificate in 1997. It is also the first hospital in Saudi Arabia and among all military hospitals in the Kingdom to apply Total Quality Management standards in 2003. The hospital has facilities for all types of surgery except open heart operations and major neonatal and pediatric surgery.

Following approval of the local Scientific and Ethics Committee, surgical records of the operating theater were examined since the commission of the hospital on 13.07.1992 until 30.09.2010. In addition to demographic data, the nature and type of surgery, whether elective or emergency, type of anesthetic administered (general, regional or local) was recorded in special forms. The medical records of all surgical cases during that period were traced in the Medical Records Department and the outcome of each case was observed. The causes of cardiac arrests and deaths were assigned to one of four groups: [2] (i) totally anesthesia-related when anesthesia was only or the major contributory factor; (ii) partially related to anesthesia when patient condition or surgical procedure were contributory factors, but anesthesia represented an additional factor; (iii) totally surgery-related; or (iv) totally related to patient disease or condition.

Results

There were 15,832 surgical procedures performed during that period, of which 7561 were males (47.8%) and 8271 females (52.2%), a ratio of 0.9 M: 1.0 F. Age group ranged from one day to 104 years old (average 28.1 yr-old). General anesthesia was administered to 10983 (69.4%) cases, 3769 (23.8%) received regional anesthesia (spinal, epidural or caudal), and 1080 (6.8%) plexus, nerve or regional intravenous IV (Bier's) block. There were 4 intra- and one postoperative death during this period. All 4 cases were emergencies. The first case was a 29-yr old known case of placenta previa who was admitted in labour. Due to mis-communication the locum member of staff overlooked cross matching the necessary units of blood needed in these situations. When the patient bled profusely, attempts at circulatory resuscitation were not successful. The second intraoperative death occurred in a 67-yr old patient with massive hematemesis due to advanced liver cirrhosis. The third was a victim of road traffic accident who suffered irreversible circulatory shock as a result of pelvic fracture and extended deep rectal laceration. His heart came to standstill during surgical exploration. The fourth was 73-yr old

patient who had a cardiac arrest 24 hrs following removal of chicken breast bone impacted in his hypopharynx. On admission, the patient was already showing signs of mediastinitis as a result of perforation of the pharynx. The fifth patient was a 54 yr-old male run over by a motor vehicle and suffered crush injury to the right lower limb and penetrating perineal wound. Patient developed DIC (Dissiminated Intravascular Coagulopathy), was resuscitated by massive plasma expander, blood transfusion and fresh frozen plasma, and was on maximum inotropic circulatory support, but his heart stopped during surgical exploration of the wounds.

Discussion

There are considerable differences between previous studies regarding the definition of the perioperative period. While some defined it as the intraoperative period only, [6,7,8,11,12,13] others defined it as the intraoperative and either the recovery from anesthesia period, [15] or the first 24 hr postoperatively. [14] In this study we adopted the last definition.

Perioperative cardiac arrests may be due to patient disease/condition, surgical factors, or to adverse events related to anesthesia. The rate of anesthesia related mortality has been stable over the past decade at approximately 1 death per 13000 anesthetics. [20] Anesthesia-attributale cardiac arrests are mainly the result of airway management. But also they may be due to cardiovascular depression or medication-errors. The type of the anesthetic is at the discretion of the anesthetist with patient approval if there is a choice. The vast majority of the cases in our study (69.4%) received general anesthesia,23.8% received regional anesthesia (spinal, epidural or caudal), and 6.8% plexus, nerve or regional intravenous IV (Bier's) block. Previous studies suggest that the incidence of cardiac arrest is 8.3-fold higher in general than in neuraxial (spinal and epidural) anesthesia. [15] Recent survey of cardiac arrest incidence during neuraxial anesthesia reported 2.7 cardiac arrests per 10000 anesthetics. [21] This is lower than an earlier study. [22] The improvement here is mainly due to the better knowledge of neuraxial block physiology and the use of new

local anesthetic drugs with fewer side-effects, associated with more routinely used cardiac and oxygen monitoring.

Increasing grades of surgical trauma and general anesthesia can initiate inflammatory and hypercoagulable states. [23] These factors may have a direct role in initiating plaque fissuring and acute coronary thrombosis. [24, 25]

The stress state associated with anesthesia and surgery involves increased levels of catecholamines and cortisol. Their levels increase with general anesthesia, anesthetic reversal, extubation, increasing pain scores, increasing grades of surgical trauma, anemia, fasting and hypothermia. [26] Increased stress hormone levels result in increases in blood pressure, heart rate, coronary artery sheer stress, relative insulin deficiency and free fatty acid levels. [27] Coronary artery shear stress may trigger plaque fissuring and acute coronary thrombosis. [26] The other factors increase oxygen demand and can result in perioperative myocardial ischemia, which is strongly associated with perioperative myocardial infarction. [28],[29],[30]

Factors that can initiate a hypoxic state include anemia, hypothermia (through shivering), and anesthesia and analgesia (through suppression of breathing). Perioperative hypoxia can result in myocardial ischemia in the setting of a hemodynamically significant coronary artery stenosis.

These factors were taken into consideration when planning for the anesthetic service at our hospital. We believe that the low incidence of perioperative deaths in our series is due to many factors which we are following in our hospital. International specialty standards, approved guidelines, evidence-based practices, implementation of quality improvement standards, are all meticulously applied. Members of the anesthetic staff are experienced and have continuous practice in anesthesia. Trainees are well selected and closely supervised by senior members of staff. The use of modern anesthetic equipment and monitoring systems in the perioperative period which detect changes in ST segment of the electrocardiogram, and which are regularly

checked and serviced, together with stringent measures of checking drugs and blood for transfusion before administration have all contributed to this favorable outcome. We would like also to emphasize that periodic morbidity and mortality meetings and the enforcement of the ISO and Total Quality Management roles which necessitate regular auditing of departmental activities are essential elements in persistently providing a quality patient service.

We strongly believe in good teamworking. One of the 5 principles of the Institute of Medicine's report "To Err is Human" concludes that healthcare organizations need to "promote effective team functioning." [31] It has been shown that surgical teams who exhibited good team work had better outcomes than patients of teams with poor teamwork. [32] Patients on the elective list are visited and assessed by the anesthetist at least 24 hours preoperatively. Patients with associated non-surgical findings are referred to the appropriate specialty for management and optimization of their condition before surgery. The case may be postponed until the maximum possible improvement has been reached. In emergency cases, at least 75% of patients should be seen and assessed prior to their surgery. Such cases are also assessed by the appropriate specialty teams. If there is any possibility of optimizing the co-morbid condition of the patient prior to surgery it will be initiated, otherwise the benefit/risk ratio is applied.

This study is the first of its kind in the Kingdom of Saudi Arabia and it looked at the incidence and outcome of perioperative cardiac arrests in a military general hospital. One factor which might have contributed to this favorable outcome is that military personnel tend to be younger and fitter than the general public. Similar studies need to be conducted in Saudi tertiary hospitals, but better still in multicenters to include all types of surgery and to compare results with those from other institutions. [4,6,7,9]

Acknowledgment: The authors wish to thank staff nurse Mary June Gregorio of the operating theater for her help and assistance.

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