

Pulmonary Aspiration Of Gastric Contents In Anesthesia: A review over 15-year period

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Abstract

Objective: Several studies from different countries surveyed the incidence, morbidity and mortality of pulmonary aspiration of gastric contents in anesthesia. No similar studies originated from the Kingdom of Saudi Arabia. This is a study of the incidence, morbidity and mortality of pulmonary aspiration in anesthesia in a Saudi General Hospital over a 15-year period following adoption and application of strict guidelines for the prevention of its occurrence.

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. Anesthetic records were examined to collect demographic details of patients who received a general anesthetic for a surgical procedure from the day of the commission of the hospital on 12.07.1992 until 31.10.2007. This included details of patients who regurgitated and aspirated gastric contents during the course of the anesthetic and recovery.

Results: A total of 12828 patients received general anesthetic during the 15-year period. They included all surgical, trauma, obstetrics and gynecology, and pediatric patients above 12 years. There were 451 patients regurgitated (3.5% of total), out of them 95 (21.1%) were elective and 356 (78.9%) from the emergency group. There were 80 (17.7%) regurgitated at induction and 371 (82.3%) regurgitated at extubation. Chest x-ray was requested for 12 patients and only 2 showed radiological signs of possible aspiration, one of them was admitted to ICU for observation and was discharged after 36 hrs. There was no mortality.

Conclusion: The low incidence and the absence of major morbidity of anesthesia-related pulmonary aspiration in such patient population has demonstrated that adopting quality measures and applying strict and evidence-based guidelines are essential in the prevention of such catastrophes.

INTRODUCTION

Pulmonary aspiration of gastric contents is one of the most feared complications of anesthesia. Prevention of aspiration by identification of patients at risk, preoperative fasting, drug treatment and various anesthetic maneuvers are cornerstones of safe anesthetic practice. The incidence, morbidity and mortality of pulmonary aspiration have been reported from South Africa, ¹ Finland, ² Sweden, ³ Canada, ⁴ France, ⁵ UK, ⁶ USA, ^{7,8} and Thailand. ⁹ with varying incidences, and different rates of morbidity and mortality. There are no similar reports from the Kingdom of Saudi Arabia. This study is looking at the incidence, morbidity and mortality of pulmonary aspiration in a surgical population as a result of general anesthesia over a 15-year period in a Saudi general hospital following adoption of series of approved guidelines for the prevention of pulmonary aspiration during anesthesia.

METHODS

Following approval of the Hospital Scientific and Ethics Committee, anesthetic records of patients above 12 years old admitted for surgical procedure under general anesthesia from the day of commission of the hospital on 13.07.1992 until 31.10.2007 were examined. In addition to demographic data, the nature and type of surgery, whether elective or emergency, administration of antacids in risky patients, method used to maintain the airway by cuffed tracheal tube, laryngeal airway mask (LMA) or face mask were noted. The time of regurgitation in relation to the procedure whether at induction, maintenance, or recovery from anesthesia until the patient was fully awake, was recorded.

RESULTS

A total of 12828 patients received general anesthetic during the 15-year period. They included surgical, trauma, obstetrics and gynecology, and pediatric patients above 12

year old. Their demographic details are listed in Table I, and the method of maintaining the airway during anesthesia in Table II.

Figure 1

Table 1: Demographic data of patients received General Anesthetic over 15- year period.

| | |
|---------------------------------------------|------------------------------------------------|
| Total number of patients received GA | 12828 |
| Males (%) | 6196 (48.3%) |
| Females (%) | 6632 (51.7%) |
| Age group | 12-104 years old (average 28.5 yrs) |
| No. of elective surgery | 9865 (76.9%) |
| No. of emergency surgery | 2963 (23.1%) |

Figure 2

Table 2: Method of maintaining airway in patients received general anesthetic. CTT: cuffed tracheal tube, LMA: laryngeal mask airway, FM: face mask.

| | | Method of maintaining airway |
|-----------------------------------------------|--------------|-------------------------------------|
| Number of elective cases (% of total) | 9865 (76.9%) | CTT 7712 patients |
| | | LMA 1817 patients |
| | | FM 336 patients |
| Number of emergency cases (% of total) | 2963 (23.1%) | All were intubated by CTT. |

Out of the total, 451 patients have shown signs of regurgitation of stomach contents. Their details are shown in Table III.

Figure 3

Table 3: Number and time of patients regurgitated.

| | |
|-------------------------------------------------------|--------------------|
| Number of cases regurgitated | 451 |
| % of total received GA | 3.5% |
| Number in elective surgery (%) | 95 (21.1%) |
| Number in emergency surgery (%) | 356 (78.9%) |
| Number regurgitated at induction (%) | 80 (17.7%) |
| Number regurgitated at or after extubation (%) | 371 (82.3%) |

All patients who showed signs of regurgitation were managed by oropharyngeal suction, head-down tilt and by turning them on to one side, if allowed. None of the patients

who were operated in a lateral or prone position regurgitated at extubation. More than half of the cases regurgitated in the elective group were female patients following laparoscopic cholecystectomy (46 patients), in spite of the fact that they were fasting and had orogastric tube introduced at induction and removed at end of procedure with active suction at the time of insertion and before removal, and free drainage through-out the operation. The number of patients in obstetrics and gynecology group who were operated upon under GA and showed obvious signs of regurgitation was 138; 120 patients of them were from the emergency group. Patients for emergency cesarean section constituted 74, that is 53.6% of this group. They regurgitated at or immediately after extubation and all managed by routine measures.

Out of all those regurgitated, portable chest x-ray was requested for 12 patients of them. Two patients showed signs of radiological pulmonary changes considered to be secondary to aspiration of stomach secretions. One of them was admitted to the intensive care unit for observation and was discharged 36 hrs later. None were reintubated and blood gases estimations were within normal limits. There was no mortality in this series of patients who received GA during the course of their operative intervention.

DISCUSSION

Identification of predisposing factors for pulmonary aspiration is paramount in its prevention. Risk factors include increased gastric pressure, increased tendency to regurgitate, and laryngeal incompetence.^{10,11,12,13} Contrary to vomiting, which is an active process, regurgitation is passive in nature. Pulmonary consequences of gastric aspiration fall into three groups: (i) particle-related, (ii) acid-related and (iii) bacterial. Particle-related complications may result in acute airway obstruction leading to arterial hypoxemia and may cause immediate death. The harmful effects of acid aspiration may occur in two phases: (i) immediate direct tissue injury and (ii) subsequent inflammatory response.^{14,15,16} Gastric contents are not sterile and infection with bacteria following aspiration may result in pneumonia.¹⁷ With understanding of risk factors in the surgical patient and laying down evidence-based guidelines to be strictly followed and rigorously applied by the surgical, anesthetic and nursing teams, such catastrophes could be avoided. These guidelines include: identification of patients at risk of pulmonary aspiration, period of fasting, the use of pharmacotherapy and the anesthetic technique used.

All patients for elective surgery should fast before

administration of the anesthetic. However, it is known that prolonged fasting results in increased gastric pH.^{18,19} Recommendations of well established anesthetic bodies in relation to preoperative fasting time for all age groups are applied.²⁰ Patients for emergency operations should fast the recommended period whenever possible, otherwise they have to be managed as patients at risk of pulmonary aspiration. They are given prophylactic antacid²¹ and anesthetized by rapid sequence induction with application of cricoid pressure.²² Patients admitted for elective procedures and considered at risk for regurgitation are also given prophylactic antacids as premedication.

The high incidence of regurgitation after laparoscopic cholecystectomy comes as no surprise even when patients are fasting and an orogastric tube is introduced at induction of anesthesia. This step is essential to empty the gas from the stomach to prevent gastric perforation during insertion of Verres needle. During surgery the stomach tube is kept open to drain, and at the end of procedure and before removal of tube suction is applied. In spite of all these measures, regurgitation may still occur, and this is due to the presence of pockets within the stomach far from reach of the tip of the gastric tube.

The laryngeal mask airway (LMA) is widely used nowadays in anesthetic practice, but it does not protect against pulmonary aspiration of gastric contents.^{23,24} It is recommended that LMA should not be used in morbidly obese patients, and measures should be taken to ensure that the stomach is empty.^{25,26}

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.

It is important when patient safety is considered that anesthetic staff and assistants must be properly selected, well experienced and closely trained. New members and trainees are adequately oriented and supervised before allowed to practice independently. We would like also to emphasize

that regular meetings and the enforcement of the Total Quality Management roles which necessitate regular auditing of departmental activities are essential elements in persistently providing a quality patient service. It is worth mentioning that the vast majority of cases in our study received GA in which regurgitation of stomach contents are known to happen far more than other types of anesthetic techniques, but due to the meticulous application of all the factors mentioned before that such low incidence has been achieved.

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