How safe is anaesthesia in Libya?
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Citation

Abstract
During the study period (January 1, 2004 to December 31, 2004) 17,326 anesthetics were performed. 16,313 anesthetic procedures or 94.2% of total anesthetics were performed.

9 anaesthesia intraoperative and early postoperative (24 hours) mortalities were identified. It gave the overall mortality rate of 1 per 1925 operated patients.

Despite the small number of anaesthetics that have been investigated, this study gives some insight into the incidence of perioperative mortality and major morbidity associated and not associated with anaesthesia in Libya. Our current data suggest an overall perioperative mortality rate of approximately 1/1925 anesthetics.

One fatal outcome intraoperatively (airway difficulties) was directly related to anaesthetic management (1 per 17,326), two mortalities (intraoperative hemorrhage and postoperative MI) were partially attributable to anaesthesia (1 per 8,663) and 6 perioperative mortalities were probably not attributable directly to anaesthetic management. Patient disease or other environmental factors have always been felt to be contributory. In 2-3 of 9 expired patients the deaths were considered to have been avoidable. Inadequate preparation and assessment of the patient contributed to 2 of the anaesthesia-related deaths. Mortality was greater for emergency than for elective operations as 6 to 3.

We conclude main factors determined the mortality rate were the physical status of the patient and the skill and judgment of the anaesthesiologists. Anaesthesia in Libya appears safer than ever. Nevertheless, things still go wrong and may cause significant patient harm. Anesthetic mortality is the tip of the iceberg of mortality attributable to patients condition and extent of surgery. A non-punitive approach to registration an analysis of mortality may improve safety of anaesthesia. "Responsible" does not mean "negligent".

Science is organized knowledge. Safety is organized work.

GENERAL INFORMATION
Libya, the fourth largest state in Africa, is located in the Northern part of the Continent, with a Mediterranean coastline of approximately 1,820 km in length. It is bordered by Egypt, Sudan, Chad, Niger, Algeria and Tunisia. Libya has an area of approximately 1.775 million sq. km., 3 times the surface area of France. Population of Libya is 6,431,585. Median age of population is 22.4 years. Population growth rate is 2.37%.

Gross Domestic Product (GDP) - per capita is $6,400. Libya has played host to many ancient civilizations as Phoenician, Roman, Byzantine. Libya is a country of breathtaking beauty, beginning with high mountain chains through green fields and sun-drenched Mediterranean beaches.
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HEALTH SERVICE INDICATORS

Total health expenditure per capita in Libya is $239.
Number of national physicians per 10 000 population 14.
Number of hospital beds per 10 000 population in Libya is 38.5. Infant mortality is 25.7 deaths per 1 000 of live births. Life expectancy at birth is 76.28 years.

WHAT IS IT LIKE TO PRACTICE ANESTHESIA IN LIBYA?

Anaesthesia cannot be separated from the framework of the health system. Total number of anaesthesiologists in Libya (national and foreign) is 154. Number of anaesthesiologists per 100 000 Libyan population (total) – 2.2. Number of national anaesthesiologists per 100 000 population is 0.5. Number of anaesthesiologists per 100 000 population recommended by WFSA – 10 – 15.

Anaesthetic procedures in Libya are performed by physician anaesthesiologists with assistance of an anaesthetic technician or a nurse. Standards of intraoperative monitoring include ECG, pulse oxymetry, end-tidal CO2 and noninvasive or invasive blood pressure.

In ASA 4-5 patients or in major operations, additionally
invasive blood pressure, central venous pressure, body core temperature and occasionally pulmonary artery pressure are monitored.

**Figure 6**

![Anaesthetic machines:](image)

**Anaesthetic machines:** Most commonly present are Drager ranes from Sulla 808 up to Primus. Main anaesthetic drugs are halothane, isoflurane, occasionally, enflurane and nitrous oxide, fentanyl, alfentanil, propofol, sodium-thiopentone, suxamethonium, rocuronium, vecuronium, atracurium.

**Figure 7**

![General anaesthesia is used in 75-80% of operated patients, next frequent anaesthetic technique is SA, then EA and regional blocks. Labor analgesia is practiced sporadically. Formal training of national anaesthesiologist has been commenced since 1996. Duration of residency is – 4 years. Annual "output is 3-6 licensed anaesthesiologists. The](image)

General anaesthesia is used in 75-80% of operated patients, next frequent anaesthetic technique is SA, then EA and regional blocks.

Labor analgesia is practiced sporadically.

Formal training of national anaesthesiologist has been commenced since 1996. Duration of residency is – 4 years. Annual "output is 3-6 licensed anaesthesiologists. The surgical workload at the teaching hospitals in Libya encompass most specialties except transplant and cardiac surgery. Transplant surgery is available in Tripoli Central hospital. Cardiac surgery is available in TMC and Tajura Cardiac Center. The small number of operations performed each day in peripheral training centers provided inadequate experience for the trainees.

**Figure 8**

![Training of anaesthesiologists in Libya](image)

**GOAL OF THE PRESENT STUDY**

There is a great deal of interest in safety in health care. Public concern for the health care system safety has been growing in developing countries. Fatal accident in surgical practice is treated as unacceptable not only among the patients. They become more commonly a matter of judicial practice and a matter of public interest.

Anaesthesia can be the source of danger, at the same time it has no therapeutic benefit of its own. So, anaesthesiologists tend to be risk oriented and strongly interested in patient safety. Complications and mortality associated with anaesthesia have been frequently investigated since 1954 in developed countries and recently in developing countries as well. (1, 2, 3, 4, 5, 6, 8, 13, 14, 15, 16, 17, 18, 19, 22)

The aim of the present study is to determine the incidence of perioperative morbidity and major mortality in four hospitals in Libya during a period of 2004 year and to identify risk factors.

**METHODS**

**HOSPITALS AND PATIENTS**

From January 1, 2004 to December 31, 2004, patients with an ASA I-V physical status and undergoing either general, regional or combined anaesthesia in four Libyan hospitals...
(Tripoli Medical Center, Zawia Teaching hospital, Al Butnan hospital in Tobruk and Al Afia hospital in Hun) were included in the retrospective study. Neonatal operations and patients subjected to open-heart surgery were excluded. Basic safety monitoring in all patients included: continuous electrocardiogram display, non invasive or invasive blood pressure, capnography, oxygen concentration and pulse oxymetry.

A retrospective case analysis of all intra-operative and early postoperative (24 hours) mortalities and major anaesthesia related morbidities was performed. All patients who died intra-operatively or within 24 h postoperatively were considered having a direct or indirect relationship with anaesthesia. These deaths were further analyzed to identify contributing aspects of anaesthetic procedure, operation and patient's comorbidity. For all expired patients data were obtained on patient demographics, ASA physical status classification, operation performed, emergency or elective status, length of operation, anesthetic technique, outcome and complications encountered during anesthesia and the first 24 postoperative hours.

The overall mortality rate was determined from the total number of anaesthetics and deaths. The perioperative death were assigned to one of three groups: related to anesthesia -
anesthesia was the major contributive factor, partially related to anesthesia and most probably unrelated to anesthesia. The causes of the death were classified according to the main pathologic condition.

Morbidities were included to the study if intra-operative or early postoperative (24 hours) critical incidents progress to a serious outcome.

STATISTICAL ANALYSIS

Event incidences are expressed for 10,000 anesthesias with their 95% confidence intervals. Statistical significance was retained when \( P < 0.05 \).

RESULTS

MORTALITY AND MORBIDITY

During the study period (January 1, 2004 to December 31, 2004) 17 326 anaesthetics were performed. 16313 anesthetic procedures, or 94. 2 % of total anaesthetics were performed in patients of ASA I – II physical status. 1013 anaesthetic procedures, or 5. 8 % of total anaesthetics were performed in patients of ASA IV – V physical status.. 7951 operations, or 45. 9 % of total were performed on an emergency bases and 9375 patients or 54. 1 % of total were operated as elective cases.

9 anaesthesia intraoperative and early postoperative (24 hours) mortalities were identified over 1 year period among 17326 anaesthetics. It gave the overall mortality rate of 1 per 1925 operated patients. 3 patients expired during intraoperative period (1 per 5775 ) and 6 patients ( 1 per 2887) during 24 hours period postoperatively.

Only one mortality (1 per 17326) was registered among the patients of ASA I – II physical status and 8 mortalities in the early postoperative period. Ratio of perioperative mortalities among the elective and emergency operations was 3 to 6 respectively.

Of the 9 perioperative deaths, one (11 %) was associated with hypoxic injury due to loss of airwy in pediatric patient, one (11 %) with intra-operative hemorrhage due to inability to adequately replace blood loss in obstetric patient with coagulopathy, one (11%) with intra-operative cardiac arrest due trombo- or fat embolism in elderly orthopedic patient, two (22 %) with postoperative hemodynamic instability of cardiac origin, for (44 %) with postoperative hemodynamic instability of metabolic origin in patients of ASA III-V physical status.

Over the study period, 11 major anaesthesia related major morbidities were reported out of 17 326 anaesthetics given which represents 0.06% of anaesthetics : one hypoxic brain injury, one neurological deficit after epidural anaesthesia, two pneumothorax, three dental injuries, one hepatic dysfunction, one eye injury, two persistent back pain syndromes after spinal and epidural anaesthesia.
DISCUSSION

The rarity of mortality and major anesthetic morbidity makes it difficult to study the etiology of adverse outcomes and to develop preventive strategies. Assessing the contribution of anesthesia care to perioperative mortality and morbidity is notoriously difficult. It is hindered by the lack of a standard definition, and difficulties obtaining accurate rates. It is extremely difficult to compare anesthetic mortality on a historical basis however the events that caused these deaths do not appear to have changed over the past 30 years.

Despite the small number of anesthetics that have been investigated, this study gives some insight into the incidence of perioperative mortality and major morbidity associated and not associated with anesthesia in Libya.

Nine perioperative mortalities were identified over one year period among 17326 anesthetics in four Libyan hospitals.

Our current data suggest an overall perioperative mortality rate of approximately 1/1925 anesthetics.

One fatal outcome intraoperatively (airway difficulties) was directly related to anaesthetic management (1 per 17326), two mortalities (intraoperative hemorrhage and postoperative MI) were partially attributable to anesthesia (1 per 8663) and 6 perioperative mortalities were probably not attributable directly to anesthetic management. Patient disease or other environmental factors have always been felt to be contributory. In 2-3 of 9 expired patients the deaths were considered to have been avoidable. Inadequate preparation and assessment of the patient contributed to 2 of the anesthesia-related deaths. Mortality was greater for emergency than for elective operations as 6 to 3.

Patients with ASA physical status III-V were at significantly higher risk than those with ASA physical status I or II. Of the two deaths with major contributions by the anesthetist, one occurred in a patient with an ASA Physical Status of I-II.

Main factors determined the mortality rate were the physical status of the patient and the skill and judgment of the anesthesiologists.

Epidemiological studies of the incidence of adverse events related to anesthesia have been conducted periodically from the 1950s. The most valuable source of information regarding the major areas of risks in anesthesia is derived from the ASA Closed Claims Project Database and the National Confidential Enquiry into Perioperative Deaths (NCEPOD) reports.

Today, anesthesia is measurably safer, and very serious events are becoming rarer in the population. Anaesthesia-related mortality in most developed countries is now <1:50,000 anesthetics, in healthy young patients of ASA I-II physical status it is much lower as 1 per 250 000.

The assumption by many that anesthesia-attributable mortality has declined over recent decades has recently been reviewed and challenged by Lagasse.

The medical literature review offers a wide range of values. Major reports have come from the United Kingdom, where John Lunn and associates established a confidential, anonymous system to report anesthesia deaths associated with surgery. Their initial report was published in 1982 - Anesthesia was considered partly or totally causative of
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The risk of perioperative death was 1 per 1925 operations (95% confidence interval, 0.011-1.09). The risk of perioperative mortality totally or partially attributable to anaesthesia was 1 per 5775 anesthetics.

In 2-3 of 9 expired patients the deaths were considered to have been avoidable.

Mortality was greater for emergency than for elective operations as 6 to 3.

Patients with ASA physical status III- V were at significantly higher risk than those with ASA physical status I or II.

Main factors determined the mortality rate were the physical status of the patient and the skill and judgment of the anaesthesiologists.

Anaesthesia in Libya appears safer than ever. Nevertheless, things still go wrong and may cause significant patient harm.

Anaesthetic mortality is the tip of the iceberg of mortality in one or two cases per 10,000 and to be totally causative in nearly 1 per 10,000. (11,12)

The first edition of the Confidential Enquiry into Perioperative Deaths arranged by both the Association of Anaesthetists and the Association of Surgeons of Great Britain and Ireland examined perioperative deaths occurring during 12 months in three National Health Service regions. Death attributable to anesthesia alone was only 0.05 per 10,000 anesthetics. (13,14,15,16,17,18)

Analysis of anesthesia mortality from New South Wales, Australia reported the overall death rate attributable to anaesthesia as 2 per 10,000 operations in 1960, 1 per 10,000 in 1970, and 0.5 per 10,000 in 1990. (18,19,20)

Eagle and Davis from Anaesthetic Mortality Committee of Western Australia in 1990 – 1995 reported anaesthesia related mortality rate as 1 per 40,000. (20,21)

A recent study by Arbus et al. of 869,000 anesthetics in the Netherlands during 1995-1997, reported 7 deaths solely attributable to anaesthesia, a rate of 1:124,000. (22)

Another recent study appears to be comprehensive in its collection of perioperative adverse events in a Canadian hospital from 1996-2000, reports only 1 anesthesia contributory death in 83,844 patients, including patients in all ASA classifications. (23)

In a study of 7306 patients in Denmark by Pedersen and colleagues in 1990, it was reported that one in 1800 (approximately 0.05%) died during anaesthesia. (24)

Keats suggested that ‘anesthesia mortality has not decreased because we create new mechanisms of mortality at the same rate as we solve them. (25)

Currently, patient age and physical status, surgical complexity and urgency, and experience of anaesthetic personnel appear to be important factors. In most cases, anaesthesia is an associated rather than a direct cause. Anaesthesia as the sole cause of death is extremely rare and is usually related to one or more system or human errors. (26)

Risk of anaesthesia in developing countries is poorly comparable to risk in western countries. Anaesthesiologists in developing countries deal with comorbid conditions more commonly. Poorly controlled hypertension and DM are daily routine. Number of neglected emergency patients anaesthesiologist must deal with in developing countries is un-comparatively higher. Deficiencies in facilities, shortages in anaesthetic staff, poorly developed system of health care, poor familiarity with protocols, including emergency strategies, inadequate or no supervision of junior medical staff during emergency procedures, these are factors contributing to risky anaesthesia in developing countries. Morale among local personnel is low and most staff have second jobs to supplement their non-sufficient income. The absentee rate is high, the case load is comparatively low. The supply of both drugs and equipment is not regular. Isoflurane is used sporadically; sevoflurane and desflurane are not available. Remifentanil, cisatracurium, tramadol are not available.

The anaesthesia manpower shortage in the country may be decreased by increasing the popularity of anaesthesiology among local population, improving income and life style of anaesthesiologists, increasing of available posts, increasing training capacity and capability.

Acquiring sophisticated equipment in the hospital should not impede the availability of appropriate personnel and adequate guidelines for practice. The balance between quality, cost and quantity should be found.

CONCLUSIONS

HOW SAFE IS ANAESTHESIA IN LIBYA?

- The risk of perioperative death was 1 per 1925 operations (95% confidence interval, 0.011-1.09).
- The risk of perioperative mortality totally or partially attributable to anaesthesia was 1 per 5775 anesthetics.
- In 2-3 of 9 expired patients the deaths were considered to have been avoidable.
- Mortality was greater for emergency than for elective operations as 6 to 3.
- Patients with ASA physical status III- V were at significantly higher risk than those with ASA physical status I or II.
- Main factors determined the mortality rate were the physical status of the patient and the skill and judgment of the anaesthesiologists.
- Anaesthesia in Libya appears safer than ever. Nevertheless, things still go wrong and may cause significant patient harm.
- Anaesthetic mortality is the tip of the iceberg of
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- How safe is anaesthesia in Libya?
- A non-punitive approach to registration an analysis of mortality may improve safety of anaesthesia.
- “Responsible” does not mean “negligent”.

Figure 17

LIBYA IS AN EXCITING PLACE

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