

## ORIGINAL RESEARCH

### **A retrospective study of critical incidents during anaesthesia in a tertiary care government hospital**

**<sup>1</sup>Dr.Richa Gupta, <sup>2</sup>Dr.Devshri Raval, <sup>3</sup>Dr. Rachana Gandhi, <sup>4</sup>Dr. Aalap Shah**

<sup>1</sup>Assistant Professor, <sup>2</sup>Senior Resident, <sup>4</sup>Third year Resident, Department of Anaesthesiology, GMERS Medical College, Gandhinagar, Gujarat, India

<sup>3</sup>Associate Professor, Department of Anaesthesiology, GMERS Rajpipla, Gujarat, India

#### **Correspondence:**

Dr. Rachana Gandhi

Associate Professor, Department of Anaesthesiology, GMERS Rajpipla, Gujarat, India

#### **ABSTRACT**

**Introduction:** Patient safety is the primary objective of health care. Success and failures are part of it. Adverse events can be controlled but cannot be eliminated. They should be reported, documented, and studied. Such data is important to monitor hospital performance and also they serve as a medium for training, simulation and improvement in standards of anaesthesia care.

**Material and method:** An observational retrospective study was conducted in a teaching tertiary level government hospital from patient records who underwent adverse events or deaths related to anaesthesia over one year from October 2016 to September 2017. Type of adverse events and their relation to ASA grading, type and speciality of operation, age, sex and comorbidities of the patient, time of critical incident when occurred with relation to anaesthesia were analysed. Mortality was included as a critical event in our study and analysed.

**Results:** Critical events were documented in 50 patients (0.5%), with mortality 54%, while rest recovered completely. Highest number were documented in age group 31 to 50 years (26%) and ASA III patients(50%). Critical incidences happened more with emergency surgeries (52%), in patients with single preoperative comorbidity(35) and under general anaesthesia(78%) in maintenance phase(32.8%). Highest cause of mortality was related to cardiovascular and respiratory events.

**Conclusion:** Morbidity and critical events will always be part of anaesthesia practice. They might be prevented with proper vigilance. When they happen, it should be reported without fear of punitive results. They should be studied and analysed, and proper protocols and checklists should be developed according to local guidelines and medical practices. Such studies are important part of medical education process and improve patient care.

**Keywords:** Adverse events, documentation, patient safety, mortality, guidelines

#### **INTRODUCTION**

Patient safety is the primary objective of hospital care across the world. Yet, adverse events occur in any area of medicine, more commonly in anaesthesiology. Some adverse events are avoidable, while some cannot be avoided as consequences of health care. Although, it is must to report any adverse event which occurs in medical practice, many of them are not reported. When such events occur, analysis of such data is important to monitor hospital performance and also because they serve as a medium for training, simulation and improvement in

standards of anaesthesia care.<sup>1</sup> Also, by sharing such information, new policies are evolved which prevents recurrences.<sup>2</sup>

With modernization of medicine, despite aging population with multiple co-morbidities, more and more complex, extensive surgeries are being performed leading to perioperative morbidity with decreasing mortality. But with complex extensive surgeries, adverse events are reported, half of which are preventable. These adverse events lead to increase in hospital admission days, cost of health care and also take a toll on mental health of patient and family members.

## **MATERIALS AND METHODS**

After approval from the ethical committee, an observational retrospective study was conducted in a teaching tertiary government hospital. All patient records who underwent adverse events or death related to anaesthesia over one year, from October 2016 to September 2017 were screened retrospectively through patient records maintained in the department.

All details on pre-operative condition of patient, intraoperative events and post operative events, including death were analysed. Adverse events including deaths were analysed and studied according to age, sex, elective or emergency, anaesthesia risk, number of co-morbidities, and type of anaesthesia given. Also, time and type of critical incidents was noted down. Number of critical events including deaths, according to the surgical branches was also discussed. Data of total number of anaesthesia delivered over one year, in different surgical specialities was also noted down and was analysed. Patient records which were incomplete, psychiatric patient undergoing ECT, patients anaesthetized for radiological procedures and peripheral anaesthetic calls in hospital were excluded from the study.

Standard monitoring was used in all patients including, electrocardiogram, pulse-oximetry, end tidal carbon dioxide monitoring and non invasive blood pressure monitoring. The data was collected and subjected to analysis by using SPSS software.

## **RESULTS**

During the one year study, 10,028 patients were administered anaesthetic agents. Critical incidents were documented in 50 patients (0.5%), out of which 23 (46%) recovered completely and mortality was noted in 27(54%) patients. Age wise distribution of critical incidents amongst patients undergoing anaesthesia showed highest incidence (26%) in age group 31 to 50 years followed by 51 to 70 years (20%) with least in geriatric age group of more than 71 years (6%). Paediatric population less than one year of age showed incidence critical events (10%). Sex wise distribution showed incidence of critical events 56% (28) in males while 44% (22) in females.

Twenty six (52%) had emergency surgeries while 24 (48%) had elective procedures. Highest incidence of critical events was seen in cases posted under general surgery (32 out of 50). Majority of the critical incidents occurred in ASA grade III 25 (50%) as compared to ASA IV and V. The frequency of critical incidents (35) was maximum in patients with single pre-existing co-morbidity while 22 critical incidents were reported in both, patients with more than one comorbidity and patients with no comorbidity.

Out of 50 patients with critical incidents during the study period 27 mortalities were registered. It was seen that the highest cause of mortality was related to cardiovascular and respiratory events.

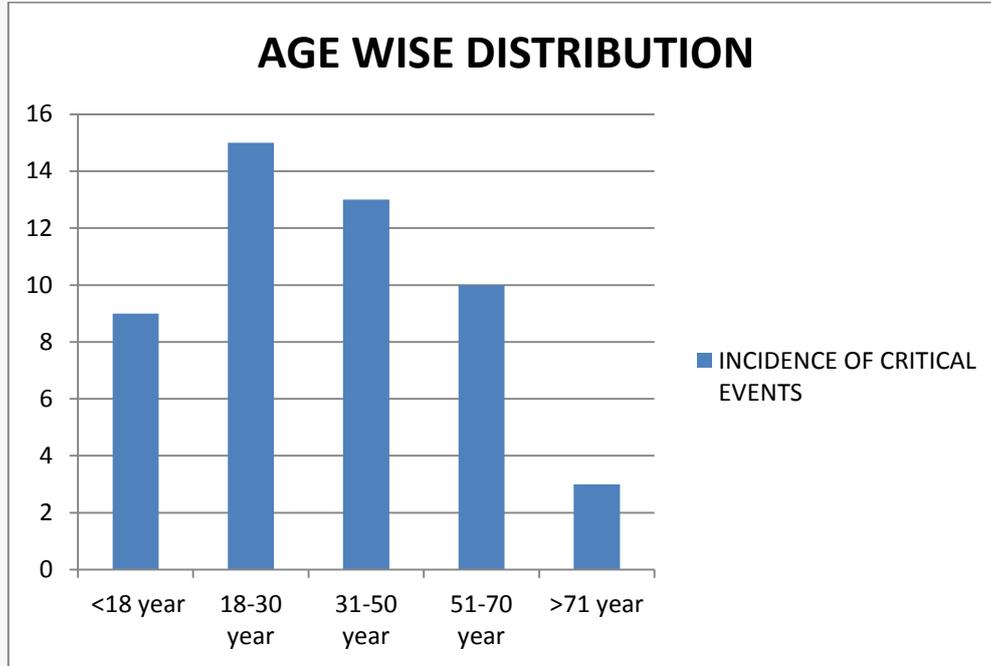
Incidents occurred more frequently in patients who received general anaesthesia 39 (78%) and occurred most commonly during maintenance phase i.e. 32.8% and least during phase of induction i.e. 7.81%.

Seventy seven incidents of critical events were documented in 50 patients in the study year, out of which maximum was death within 24hrs of giving anaesthesia which was 35%,

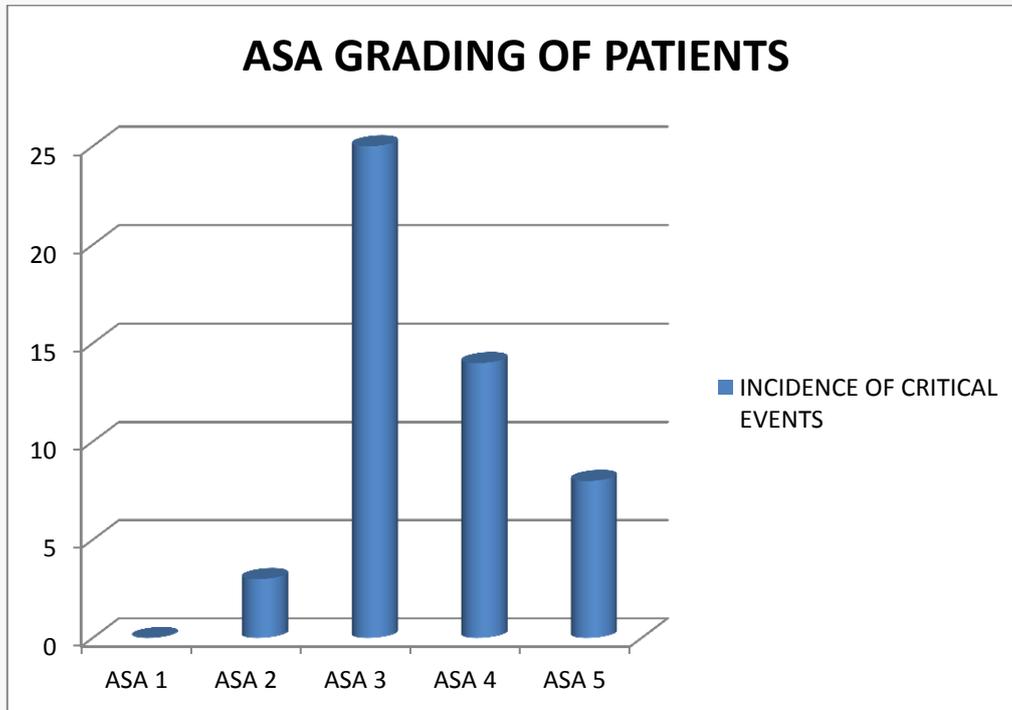
followed by cardiovascular (18%), followed by respiratory (16%). Cardiac events documented were bradycardia (1.3%), hypotension (18.2%) and arrhythmias (3.9%). Respiratory events documented were aspiration (3.9%), laryngospasm/bronchospasm (2.6%), stridor (1.3%), hypoxia (2.6%), hypercarbia (2.6%), pulmonary oedema (2.6%), respiratory distress (1.3%), failed or difficult intubation (3.9%).

Other events included delayed recovery, recurarization, faulty techniques, haemetemesis, TURP syndrome, bone cement implantation syndrome and cardiorespiratory arrest.

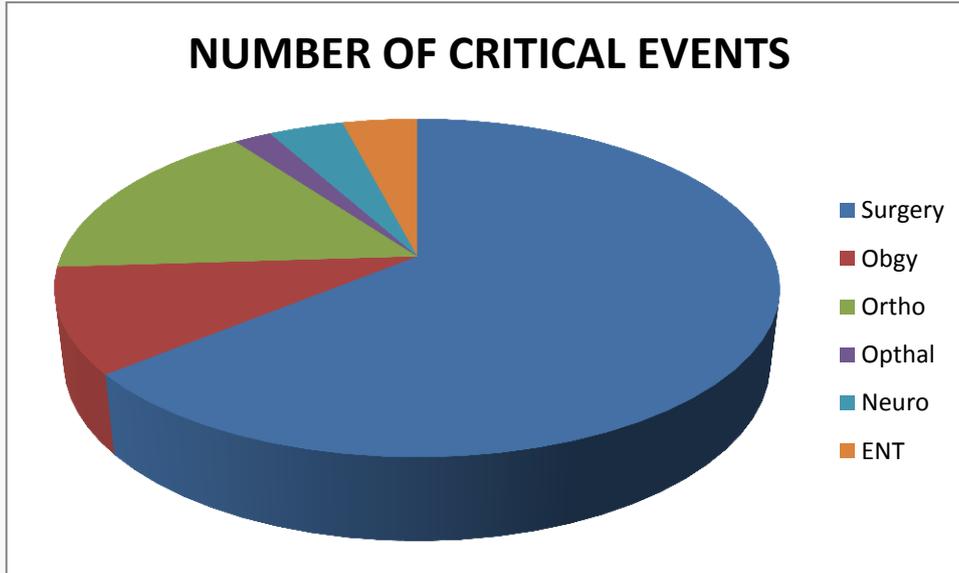
**Chart-1**



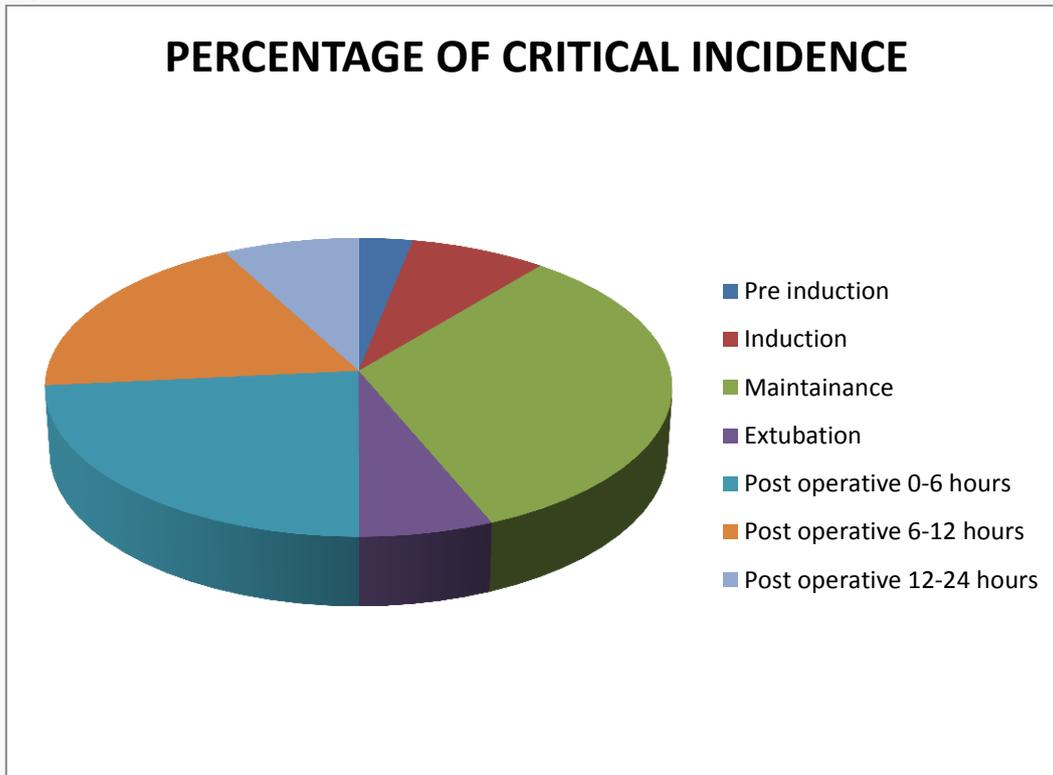
**Chart-2**



**Chart-3**



**Chart-4**



**DISCUSSION**

Success and failures are part of human work.<sup>3</sup> Failures occur in patterns which when correctly identified and timely reported and documented, can be prevented from repeating. Failures should be analyzed, classified and assessed in order to determine the cause and make effective guidelines and strategies to prevent them from repeating again<sup>4</sup>.

In respect to the major areas of risks in anaesthesia, the most valuable source of information can be obtained from the ASA Closed Claims Project Database and the National Confidential Enquiry into Perioperative Deaths (NCEPOD) reports<sup>5,6</sup>.

With new technological advances and safer drugs, anaesthesia is becoming safer in recent times with very serious incidences becoming gradually rare in the population<sup>7</sup>. The outcome of critical incidents invariably will depend on the severity of insult, timely intervention and the patient's preoperative health status.

Anaesthesia-related mortality in most developed countries is now less than 1:50,000. Anaesthesia in healthy young patients of ASA I–II physical status, it is found much lower, i.e., 1 per 250,000<sup>8,9</sup>.

Documentation and reporting of critical incidence is important to improve the standard of care under anaesthesia<sup>10</sup>. The death attributable to anaesthesia alone was only 0.05 per 10,000 anaesthetics as per 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 where perioperative deaths occurring during 12 months in three National Health Service regions were examined<sup>11-17</sup>.

The frequency of critical incidents in our study was 0.5%. There was a vast difference of critical incidents in various studies. These incidences could vary from 0.28 to 12.1%<sup>14-19</sup>. Study conducted by Warden JC et al<sup>14</sup> documented 11% incidents while in a Zimbabwean study by Madzimbamuto and Chiware reported a 0.92% of intraoperative critical incidents<sup>20</sup>. This may be due the different interpretations and guidelines followed in various regions and differences in medical practices. Also the various parameters studied and counted in these studies may differ with each other. There may be a different system of reporting of critical incidents or may be a lack of reporting minor incidents. Also, some major events go unreported for fear of retribution and lack of motivation and a formal reporting system.

Age wise distribution of critical incidents in our study showed highest incidence (26%) in age group 31 to 50 years followed by 51 to 70 years (20%) with least in geriatric age group of more than 71 years (6%). Paediatric population less than 1 year of age showed incidence critical events (10%). Also, majority of the critical incidents occurred in ASA grade III 25 out of 50 (50%). These findings are similar to study done by Ajaj and Pansalovich, where the risk was found high in the patients with ASA physical status III-V compared to ASA I or II 21 but are in contradiction to studies conducted by Gupta S<sup>22</sup> and Khan PA<sup>23</sup> where maximum critical incidents occurred in ASA I while age wise critical incidents reported highest in paediatric patients. These differences may be due to the fact that maximum number of patients undergoing anaesthesia in our setup belonged to ASA III and also patients with ASA IV and V were given anaesthesia meticulously and strictly monitored by consultant anaesthetists, while patients with ASA I, II and III were conducted by junior residents under supervision by consultant anaesthetists<sup>23,24</sup>. Also patients belonging to geriatric or paediatric age group had a presence of consultant anaesthetist throughout the operation period, which may be the cause of fewer occurrences of critical events in them as compared to the age group 31 to 50 years which were mostly conducted by resident doctors.

It was seen in our study that maximum critical events were documented in patients undergoing surgery under general surgical department (32 out of 50) as compared to gynecology, obstetrics, orthopaedics, neurology, ophthalmology and ENT department. This may be due to the fact that general surgical department has maximum patient flow in operation theatres in our setup.

We also found that the majority of critical events occurred in patients undergoing anaesthesia with single comorbidity (42%). Number of deaths was also high in patients with single comorbidity (51%). This can be explained with strict vigilance, more preoperative workup and better interdisciplinary management of patients with more than single comorbidity.

Out of all critical events, mortality rate was 54%, which is quite high. This might be due to the fact that ours is a government tertiary hospital and maximum number of patients belongs to lower socio economical class and poor health resources. Also our setup accepts all the

patients which have been rejected and referred by private setups. The patients often present late with poor optimization from the referral hospital.

The highest cause of mortality was related to cardiovascular and respiratory events as its prevalence is high in general population.

Highest number of critical incidents was noted in patients who received general anaesthesia (78%) and occurred most commonly during maintenance phase i.e. 32.8%. This is due to more vigilance during the intubation and extubation period and the anaesthetists are comparatively more relaxed and less alert in the maintenance phase.

In our study, maximum number of critical events was death within 24hrs of giving anaesthesia (35%), followed by cardiovascular (18%) and respiratory (16%). Cardiac events documented were bradycardia (1.3%), hypotension (18.2%) and arrhythmias (3.9%). Respiratory events documented were aspiration (3.9%), larygospasm/bronchospasm (2.6%), stridor (1.3%), hypoxia (2.6%), hypercarbia (2.6%), pulmonary oedema (2.6%), respiratory distress (1.3%), failed or difficult intubation (3.9%). This finding is similar to the study done by A. O. Amucheazi where most of the critical events were attributed to cardiovascular followed by respiratory morbidity<sup>25</sup> as they had not considered mortality as a different entity of critical events.

Most of the other studies have stated the major cause of critical events related to anaesthesia is human error<sup>21,26,27-32</sup> which is associated with lack of experience, lesser skills and poor judgements of the anaesthetists<sup>33</sup>. Also it depends on the economical condition of the country, availability of proper functioning modern equipments, hospital facilities, availability of anaesthetic staff and also awareness about health and personal hygiene in patients. Therefore, the critical events are more frequent in developing countries than the developed countries.

In our study, 52% of critical incidents occurred in emergency surgeries while 48% incidents occurred in elective surgeries. This result is similar to study conducted by Maaloe et al. and Braz et al. Who also found that there was a slightly higher incidence of critical incidents and mortalities in emergency surgery as compared to elective surgery<sup>34,35</sup>. Poor optimization of patient's preoperative status, nonavailability of equipments, emergency drugs, investigation facilities and poor operating conditions are all contributory factors in emergency situation in developing countries.

Our study is not free from limitations. This is a retrospective study relying on documentation done in past, so some of the findings may not be accurate as documentation was done by multiple doctors. Chances of underreporting of adverse events are high as ours is a teaching hospital and many cases are conducted by junior doctors who due to fear or ignorance might not report. Also the sample size is small to accurately generalize the results.

In conclusion, morbidity and critical events will always be part of anaesthesia practice. They might be prevented with proper vigilance. It requires prompt diagnosis and timely accurate treatment. It may only happen when critical incidents are documented and reported without any fear of punitive results<sup>36</sup>. Critical events should be studied and analyzed and proper protocols and checklists should be developed according to local guidelines and medical practices. Such studies are important part of medical education process and improve patient care.

## REFERENCES

1. Vincent CA. Analysis of critical incidents: A window on the system not a search for root causes. *Qual Safn Health Care*. 2004;13:242–3. [PMC free article] [PubMed]
2. Van der Schaaf TW. Medical applications of industrial safety science. *Qual Saf Health Care*. 2002;11:205–6. [PMC free article] [PubMed]
3. Allnutt MF. Human factors in accidents. *Br J Anaesth*. 1987;59:856–64. [PubMed]

4. Runciman WB, Sellen A, Webb RK, Williamson JA, Currie M, Morgan C, et al. The Australian Incident Monitoring Study. Errors, incidents and accidents in anaesthetic practice. *Anaesth Intensive Care*. 1993;21:506–19. [PubMed]
5. Gaba DM. Anaesthesiology as a model for patient safety in health care. *BMJ*. 2000;320:785–8. [PMC free article] [PubMed]
6. 2003/ 062 NICE responds to publication of 2003 report of National Confidential Enquiry into Perioperative Deaths. 2003
7. Robert S, Lagasse MD. American college of surgeons 90th annual clinical congress. New Orland, LA: ACS national surgical quality improvement program; 2004.
8. Hall MJ, Lawrence L. Advance Data from Vital and Health Statistics. No. 300. Hyattsville, Maryland: National Center for Health Statistics; 1998. Ambulatory Surgery in the United States, 1996. [PubMed]
9. Cheney FW. The American Society of Anesthesiologists Closed Claims Project. What have we learned, how has it affected practice, and how will it affect practice in the future? *Anesthesiology*. 1999;91:552–6. [PubMed]
10. El-Dawlatly AA, Takrouri MS, Thalaj A, Khalaf M, Hussein WR, El-Bakry A. Critical incident reports in adults: An analytical study in a teaching hospital. *Middle East J Anesthesiol*. 2004;17:1045–54. [PubMed]
11. Working party on anaesthetic mortality. Report on anaesthetic related mortality in Australia 1985-1987. NHMRC. 1990
12. Working party on anesthetic mortality. Report on deaths associated with anaesthesia in Australia 1988-1990. NHMRC. 1992
13. Eagle CC, Davis NJ. Report of the Anaesthetic Mortality Committee of Western Australia 1990-1995. *Anaesth Intens Care*. 1997;25:51–9. [PubMed]
14. Warden JC, Borton CL, Horan BF. Mortality associated with anaesthesia in New South Wales, 1984-1990. *Med J Aust*. 1994;161:585–93. [PubMed]
15. Mackay P, Connock R. 6th report of the Victorian Council on Anaesthetic Mortality and Morbidity. Cases reported during. 1989-92
16. Warden JC, Horan BF. Deaths attributable to anaesthesia in New South Wales, 1984-1990. *Anaesth Intens Care*. 1996;24:66–73. [PubMed]
17. Holland R. Anaesthetic mortality in New South Wales. *Br J Anaesth*. 1987;59:834–41. [PubMed]
18. Kumar V, Barcelos WA, Mehta MP, Carter JG. An analysis of critical incidents in a teaching department for quality assurance. *Anaesthesia*. 1988;43:879–83. [PubMed]
19. Galletly DC, Mushet NN. Anaesthesia system errors. *Anaesth Intensive Care*. 1991;19:66–73. [PubMed]
20. Madzimbamuto FD, Chiware R. A critical incident reporting system in anaesthesia. *Central African J Med*. 2001;47:243–7. [PubMed]
21. Ajaj HE. Pansalovich: How safe is anaesthesia in Libya.? *Internet J Health*. 2005;4:2.
22. Gupta S, Naithani U, Brajesh SK, Pathania VS, Gupta A. Critical Incident Reporting in Anaesthesia: A Prospective Internal Audit. *Indian J Anaesth*. 2019;53:425–433. [PMC free article] [PubMed] [Google Scholar]
23. Khan PA, Hoda MQ. A prospective survey of intra-operative critical incidents in a teaching hospital in a developing country. *Anaesth*. 2001;50:171–82. [PubMed]
24. Manghnani PK, Shinde VS, Chaudhari LS. Critical incidents during anaesthesia ‘An Audit’ *Ind J Anaesth*. 2004;48:287–94.
25. Amucheazi AO, Ajuzieogu OV. Critical incidents during anesthesia in a developing country: A retrospective audit. *Anesth Essays Res*. (2010) 4:64–8. 10.4103/0259-1162.73508 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

26. Liu EH, Koh KF. A prospective audit of critical incidents in anaesthesia in a University hospital. *Ann Acad Med Singapore*. 2003;32:814–20. [PubMed]
27. Khan FA, Hoda MQ. A prospective study of intra-operative critical incidents in a teaching hospital in a developing country. *Anaesthesia*. 2001;56:177–82. [PubMed]
28. Cooper JB, Newbower RS, Long CD, McPeck B. Preventable anaesthesia mishaps. A study of human factors. *Anesthesiol*. 1978;49:339–406. [PubMed]
29. Qadir N, Takroui MS, Seraj MA, el-Dawlatly AA, al-Satli R, al-Jasser MM, et al. Critical incident reports. *Middle East J Anesthesiol*. 1998;14:425–32. [PubMed]
30. Craig J, Wilson ME. A survey of anaesthetic misadventures. *Anaesthesia*. 1981;36:933–6. [PubMed]
31. Currie MA. Prospective survey of anaesthetic critical events in a teaching hospital. *Anaesth Intens Care*. 1989;17:403–11. [PubMed]
32. Williamson JA, Webb RK, Sellen A, Runciman WB, Van der Walt JH. The Australian Incident Monitoring Study. Human failure: An analysis of 2000 incidents reports. *Anaesth Intensive Care*. 1993;21:678–83. [PubMed]
33. Goldstein A, Jr, Keats AS. The risk of anaesthesia. *Anesthesiol*. 1970;33:130–43. [PubMed]
34. Arbous MS, Grobbee DE, van Kleef JW, de Lange JJ, Spoormans HH, Touw P, et al. Mortality associated with anaesthesia: A qualitative analysis to identify risk factors. *Anaesthesia*. 2001;5:1141–53. [PubMed]
35. Maaløe R, la Cour M, Hansen A, Hansen EG, Hansen M, Spangsberg NL, et al. Scrutinizing incident reporting in anaesthesia: Why is an incident perceived as critical? *Acta Anaesthesiol Scand*. 2006;50:1005–13. [PubMed]
36. Choy YC. Critical incident monitoring in anaesthesia. *Med J Malaysia*. 2006;61:577–85. [PubMed]