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Original article:

Perioperative critical incidents in anesthesiology –prospective observational study

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Abstract:

Introduction: In recent years anaesthesia has become very safe by the use of excellent monitoring and life saving devices, but , in spite of this critical incidents are very common. We had conducted one year prospective analysis of perioperative critical incidents in our hospital.

Aim: Evaluation of Critical incidents assigned to factors attributable to either patient or anaesthesia or surgery.

Method: We had analysed (1) Anaesthesia related critical incidents and mortality which further analyzed for factors responsible like Equipment error- Failure/ non functional/unavailable/ Malfunction, type of anaesthesia, timings, anaesthesiologist experience, human error, Wrong drug/Wrong dose/wrong route/adverse reaction., (2) Patient related-age ,sex, ASA grading, associated co-morbid conditions, (3) Surgery related-nature of surgery and type of surgery, Number of patient shifted to ICU/HDU/Ward, Number of mortality, Number of Critical incidents related to patient/anaesthesia/surgery factor.

Result: We had reported 125 critical incidents, among which complete recovery reported in 58 cases (46.40%). Mortality in 40 patients (32%) due to surgery/anaesthesia/patient related factors and 85% patient recovered from effects of critical incident. Eleven patients had cardiac arrest (8.80%) out of which one case recovered completely and mortality reported in 10 cases . In our study maximum critical incidents occurred due to factors related to patients 61.60%(n=77) as compared to those related to surgical factors 20% and anaesthesia related factors 18.4%(n=23). In our study we found no anaesthetic death.

Conclusion: Thus, we observed that death solely attributable to anaesthesia is rare now a days rather, patients' pre-existing disease along with co-morbid conditions and the nature and extent of surgery have a greater effect on overall outcome than the risks attributable to the anaesthesia.

Key words: Perioperative , Anaesthesia, Surgery, Patients, Critical incidents

INTRODUCTION

Critical incidents are very common in anaesthesiology which may be due to surgery, anaesthesia or due to patient related factor. A critical incident is defined as "An event under anaesthesia which will have the potential to lead to substantial negative outcome (which ranging from admission to intensive care, increased length of hospital stay to death or permanent disability or cancelled operative procedure) if left to progress"[1,2]. In last few years anaesthesia has become very safe with the development of authentic monitoring and life saving devices. Despite of this critical incidents are very common which can be associated with mortality and morbidity. In recent

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years with the rapid increase in establishment of ICUs, there is increased number of patients admitted to ICUs in their postoperative period. But, still today, we have lack of a standard definition, data, and assessment of critical incidents.[3] Patient safety learning system(critical incident reporting system) is defined in Ontario legislation as "any unintended event that occurs when a patient receives treatment in the hospital that -

(a) Can results in death, serious disability, injury, or harm to the patient

(b) which does not result primarily from the patient's underlying medical condition or from comorbid condition.[4]

A patient safety learning system means structured reporting, and analysis of such adverse incidents.[5] Benefits of this are following:

A. Lesson from adverse events.

B. Improve Monitoring to allow early detection of future adverse events.

C. Timely investigations and detailed documentation of adverse event in view of possible claims in future.

D. Correct information to the patients or families about the adverse event.[5]

So, we planned to conduct a prospective observational study on this subject over a period of one year. As there was no critical incident reporting regarding perioperative mortality in our department of anaesthaesiology.

AIM:

To study the critical incidents attributable to anaesthesia and analyze factors or events responsible for that.

OBJECTIVES:

(1) Anaesthesia related critical incidents and mortality further analyzed for factors responsible like Equipment error- Failure/ non functional/unavailable/ Malfunction, type of anaesthesia, timings, anaesthesiologist experience, human error Wrong drug/Wrong dose/wrong route/adverse reaction.

(2) Patient related-age, sex, ASA grading, associated co-morbid conditions.

(3) Surgery related-nature of surgery and type of surgery

(4) Number of patient shifted to ICU/HDU/Wards

(5) Number of mortality **:** mortality is defined as-death of a patient within 24 hours of receiving anaesthesia.

MATERIALS AND METHODS:

After obtaining approval from the Institutional ethics committee, one year prospective analysis of perioperative critical incidents had been conducted in STGH Haldwani, Uttarakhand, tertiary care teaching hospital. Since it was an observational study without any intervention, consent from patients was not required.

All members of the department of anesthesia and intensive care/HDU/Postoperative wards were informed to report peri-operative critical incidents within 24 hours occurring in patients subjected to anaesthesia. Indigenous "Critical Incident Reporting Form" was developed by us and made available in all the operation theatres, post-operative wards , Intensive Care Units and High Dependency Units. It was the regular duty of the Anaesthesiologists, engaging in this work, to motivate and remind to report critical incidents on an voluntary basis and care was taken to maintain complete confidentiality.

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Inclusion criteria: General surgery, Obstetrics & Gynaecology, Orthopaedic, Plastic, ENT, Eye, Paediatric surgery, burn ,neurosurgery, ASA grade of the patient, Type of surgery: elective or emergencey, all age groups and sex of patient included. We observed the patient in the study till their statisfactory condition and for ICU/HDU patients their discharge from ICUs/HDU.

Exclusion criteria: Surgeries not being conducted in our institute.

PARAMETERS TO BE STUDIED: They were the same as we used for objectives of the study.

RESULTS & OBSERVATION:

In our study over one year period 14,729 patients received anaesthesia and 125(0.84%) critical incidents were reported.

We observed critical incidents were found mostly in 15-60 year age group 77.6% [n=97].We had divided the age groups in neonate (0-1yr), pediatric (2-14), adult (15-60yrs) and geriatric population(>60 yrs). The maximum number of cases operated in our institution were between 15-60 yrs which included maximum number of LSCS and laprotomies.**[Figure-1]** Our study showed the higher rate of critical incidents in female population. In our study, critical incident were reported more in cases conducted by resident doctors , <3 years experience (55.2%) than under supervision of consultants with experience of 3-6 years (34.4%) and experience of >6years (10.4%). We found that maximum number of critical incidents occurred in ASA II [40%] and there was high number of critical incidents in ASA III and IV than ASA I & II**.[Table -1]**

Figure- 1: Critical incidents among different age groups

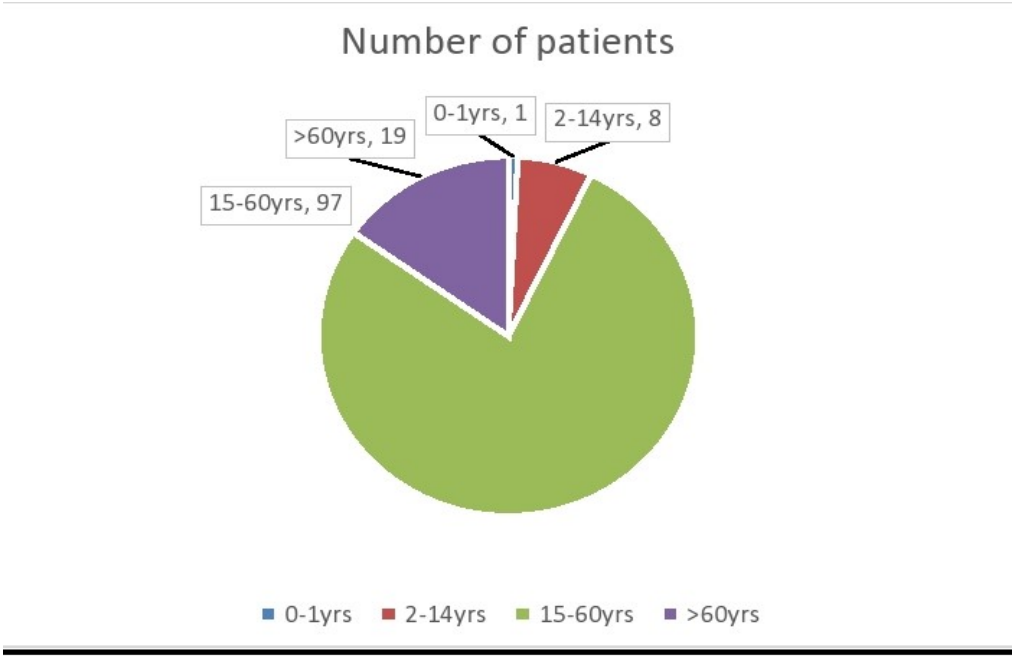

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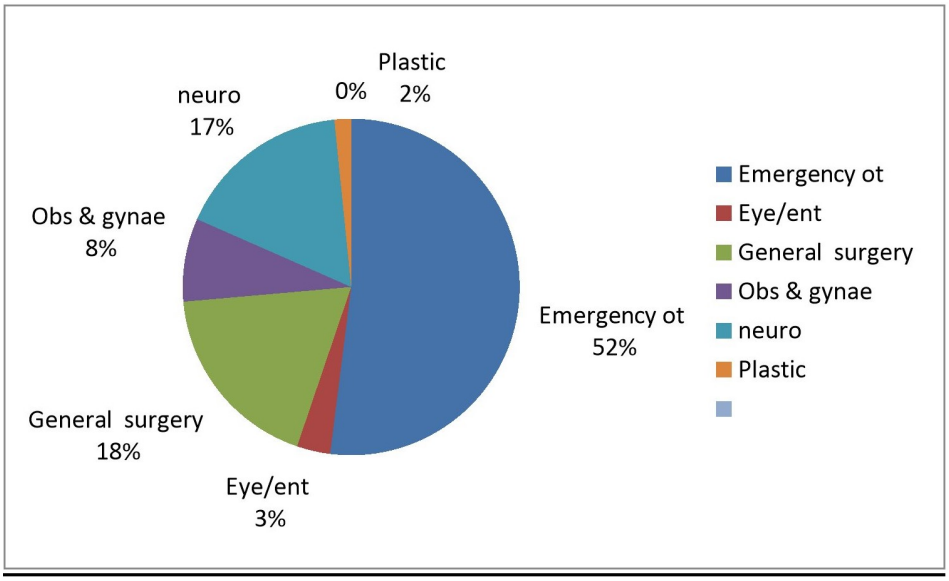
Table -1: Distribution of critical incidents among different ASA grading

ASA Grading	NUMBER OF PATIENTS
I	5
II	50
III	40
IV	30

In our study we found that number of critical incidents were maximum in patients with pre-existing systemic involvement (n=86 68.8%); maximum of which have cardiovascular (n=28) and respiratory (n=25). Only one patient had history of CNS related co -morbidity. Hematological co morbid condition seen in 15 patients maximum of which had predominance of anemia. Thirteen patients had sepsis as a co morbid condition. We found maximum critical incidents reported in emergency (n=65, 52.2%) than elective (n=60, 48%) surgery & the maximum number of critical incidence in elective OT occurred in general surgery OT (n=23) **.[figure- 2]**

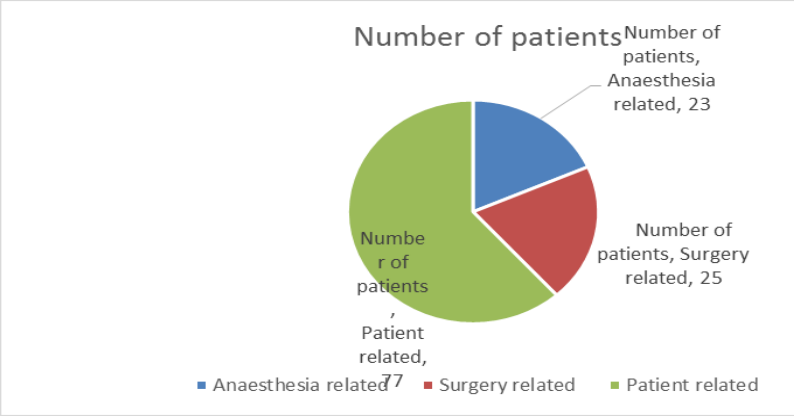
FIGURE 2: DISTRIBUTION OF CRITICAL INCIDENTS AMONG SURGICAL SPECIALITIES



We noted maximum incidents occurred in patients who received general anaesthesia in our study (n=90, 72%).We found critical incidents were detected immediately in 99 cases (n=121 96.8%) and delayed in 4 cases . Most of the critical incidents found in our study were due to events involving cardiovascular system (n=43 33.6%) followed by respiratory system (airway + pulmonary) (n=28 22.4%). Among the respiratory events, incidence of cannot intubate was only one(8%). Incidence of bronchospasm was 5.6% (n=7). In airway events, incidence of laryngospasm were n=3(2.4%). Due to all of these reasons and others the incidence of hypoxia was seen in 50 patients(40%). CVS events are usually more than respiratory events in which hypotension was commonest (n=67,53.6%). Incidence of bradycardia was 11.2% while the incidence of tachycardia was 12% myocardial infraction seen in five patients.

Mortality in 40 patients (32%) due to surgery/anaesthesia/patient related factors and 85% patient recovered from effects of critical incident. Eleven patients had cardiac arrest (8.80%) out of which one case recovered completely and mortality reported in 10 cases.

FIGURE -3: CRITICAL INCIDENTS ATTRIBUTED TO PATIENTS/ANAESTHESIA/ SURGERY RELATED FACTORS



DISCUSSION:

In this one year prospective observational analysis , we had made an effort to find possible critical incidents attributable to anaesthesia or events leading to anaesthetic mortality within 24 hours of perioperative period of receiving anaesthesia at STGH Haldwani, a tertiary care teaching hospital of Kumaon region Uttarakhand.

Peri-operative risk is multifactorial and depends on the interaction of anaesthesia, patient, and surgery-specific factors. Anaesthesia-related contributions can include issues of judgment and mishaps, as well as

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characteristics of the provider. The surgical procedure itself affects outcome, as does the location of intra-operative and postoperative care.

The term 'critical incident' was first brought to anaesthesia by Ludwig Blum in 1971.[6] Cooper and colleagues (1978 and1984)[1,2] extensively applied the technique to anaesthesia. The Australian Incident Monitoring Study (AIMS) was established with the purpose to provide a database to allow identification of commonly occurring errors and other potentially hazardous incidents in daily anaesthetic practice.[7]

Critical incidents were assessed on the basis of age of patients, gender, experience of anaesthetist, ASA grading, previous systemic involvement, surgical speciality, emergency/elective surgery, surgical factors, time of surgery, type of anaesthesia, place and phase of occurrence, time of detection, type and details of systemic events, equipment, drugs and human factors attributable to critical incidents and substantial outcome.

Zeng, Shin Yi Ng, et al reported a total of 441 incidents, out of 98,502 anaesthetics performed during a study period of 4 years in a tertiary hospital.[8] Tiret L, Desmonts JM, Hatton F, et al carried out a prospective survey in representative sample of 198,103 and found 268 major complications associated with anaesthesia occurring during or within 24 hours of anaesthesia.[9] Gupta et al in their study, reported 112 (0.79%) critical incidents among 14,134 patients who received anaesthesia during their one year study period.[10] Manghnani et al in their study over a period of one year, reported a total of 109 critical incidents out of 23,406 patients.[11]

In our study over one year period 14,729 patients received anaesthesia and 125(0.84%) critical incidents were reported. Incidents reported in the above mentioned studies ranged from 0.46% - 24.8%. In our study critical incidents were found mostly in 15-60 year age group 77.6% [n=97] As, maximum number of cases operated in our institution were between 15-60 years which included maximum number of LSCS and laprotomies. That's why this age group had highest exposure to anaesthesia and surgery , resulting in highest number of critical incidents in this age group.**[Figure 1]** Being the first Government medical college of Uttarakhand, there is lack of complex paediatric and other super-speciality surgeries. So, we have less exposure to these surgeries which in turn is responsible for small number of critical incidents in this age group in comparison to other studies.

Amucheazi A O et al found in their study, distribution of critical incidents was quite different between male and female patients (46.3% and 53.7% respectively), [12] which was in favor of our study (females,n=85 > males,n=40). As we know Maternal Mortality rate(MMR) is higher in developing countries including India(167) and in our state Uttarakhand (285).[13] So, in order to overcome this health hazard, our Central Government has implemented the Janani-Shishu Suraksha Karyakram (JSSK) all over the country which has led to drastic increase in Institutional deliveries. Being the only tertiary care hospital of Kumaon region, increasing number of patients for surgical deliveries are being referred to our Institute. So, number of Caesarean sections are more than other surgeries which in turn is responsible for higher incidence of critical incidents among females(28%).

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In our institution, surgical cases including emergency surgical cases are conducted by residents doctors under the direct supervision of senior anaesthesiologists/faculties, rest all other cases conducted by residents independently by the guidance of their senior anaesthesiologists/faculties. In our study also critical incident were reported more in cases conducted by resident doctors , <3 years experience(n=69 <3 yrs versus n=13 >6 yrs experience) .

The outcome of critical incidents invariably depends on the degree of insult, timely intervention and the patient's baseline health status. Anaesthesia-related mortality in most developed countries is now <1:50,000 anaesthetics; in healthy young patients of ASA I–II physical status, it is much lower, i.e., 1 per 250,000. Wangles Pignaton, José Reinaldo C Braz et al revealed in 2006 study that major risks of perioperative mortality were patients with poor ASA physical status (III–V).[14.] A R Aitkenhead found that the number of complications attributable to anaesthesia was almost eight times higher in patients in ASA grades III–V than in those with ASA grade I or II, and the incidences of a negative outcome and preventable errors were also much higher in patients with a high ASA grade.[15] This might be explained on the basis of that while dealing with higher grade of ASA, we take extra precautions and follow strict monitoring protocol for these patients and usually they get operated under the presence of senior , experienced anaesthesiologist. Manghnani et al also found in his study that critical incidents maximally belonged to ASA grade I (51%), followed by ASA grade II (21.5%), ASA grade III (17.4%), ASA grade IV (9.2%) and ASA grade V only 1 (0.9%)[11.] In our study we found that maximum number of critical incidents occurred in ASA II [40%] and there was high number of critical incidents in ASAIII and IV than ASA I & II.**[Table 1]** As we discussed previously that our institute had high number of pregnant females who comes under ASA II. So, the reason for higher incidence of critical events in patients with ASA II grade could be because of the more number of surgeries were performed in these patients.

In our study equipment related factors which causes critical incidents were reported, only one case (0.8%) was reported under this category. Equipment failure in above studies ranged from 4-14% and the reason could probably be because of different level of maintenance of equipments, non familiarity with equipments and non availability of proper equipments. In our institute one critical incident occurs due to the non availability of proper and advanced equipment required for difficult intubation due to which that case could not be intubated and postponed.

In this study human related factors reported is 6.40% and the incidence is lower than similar studies and the reason could be either because of non reporting of critical incidents by residents, who are usually responsible to increase the occurrence of critical incidents. Residents has usually a tendency to hide the occurrence of critical incidents due to human error in order to prevent themselves to be blamed. Another reason could be that maximum incidents occurred during day time under supervision of expert anaesthetists, so human errors were less.

We had reported maximum critical incidents related to patient factors. The difference could be due to the fact that which was discussed above as our institution is a single tertiary care hospital of kumaon region

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and is draining patients from remote hilly areas of Kumaon as well as Garhwal regions who are poor, uneducated , unaware of their health related issues. Their access to the health services is further limited due to poor transport services and natural calamities. As compared to other studies our hospital deals with patient who come to hospital in very bad general conditions along with various complications, which make their prognosis grave.

CONCLUSION:

Anaesthesia continues to be associated with mortality and morbidity despite improvements in drugs and equipments. More emphasis should be given to the strategies and protocols for increasing and updating knowledge base to avoid errors of judgment. There is evidence that the use of checklists, protocols and unproved awareness of the relevance of critical incidents can improve safety. Thus critical incident reporting should be introduced in all anaesthesia departments as part of quality assurance programmes to ensure improved patient care.

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