

## Retrospective Audit of Critical Events under Anesthesia at Tertiary Care Nephro-Urology Set Up

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### Abstract

**Introduction:** Critical events under anesthesia can cause sudden and dramatic complications. Recognition and analysis of such events helps to improve OR practices (in order to prevent recurrence of the same); thereby improving the overall quality of anesthetic practice. Unlike other countries which have national registries to capture such incidents, India relies on a voluntary and non-standard reporting of critical incidents under anesthesia. None of these papers have studied anesthesia-related complications in patients who have predominant renal dysfunction. **Materials and Methods:** A retrospective audit was performed of all critical incident reports filed in our department from 01/01/2015 to 31/12/2015. The data was analyzed to identify the incidence, causes and outcomes of these events. **Results:** Of 1217 anaesthetics administered, 2.54% of patients had reported adverse events during surgery. Most complications occurred in the elderly patients (41.9%) and those who were ASA grade III or above (45.1%). More than half (54.8%) of the complications involved the cardiovascular system. There were two deaths during this period (mortality=0.16%). **Conclusions:** Though anesthesia related complications have declined dramatically with the use of advanced monitoring and safer drugs, there is still potential for improvement. Use of checklists and standard protocols can help mitigate much of the human error associated with these critical events. The larger proportion of cardiovascular complications in our patients is probably a reflection of the higher incidence of cardiovascular complications in patients who have renal dysfunction.

**Keywords:** Critical Events; Critical Incident Reporting; Anaesthesia; Anaesthesia Mortality; Critical Incident Reporting Form; Renal Insufficiency Chronic.

### Introduction

Patient safety is of prime importance for good patient care. This is especially important in areas which are vulnerable for adverse events like the operating room setup. In anesthesia there is interaction at three levels- human (anesthesiologist, patient), machines(monitors and workstations) and environment (operating room, surgeons and OR nurses)[1]. An error in one of these can tilt the balance leading to adverse event. Cooper et al in 1978 adopted the critical events recording in anesthesia similar to US Air force analysis of critical events [2,3].

Over the years with improvements in drugs available, newer monitoring devices and development of newer techniques, there is significant drop in anesthesia related mortality but it is still associated with significant morbidity and is concern for public health and can be significantly brought down [4,5]. The errors could be because of judgemental errors in patient management, deviation from set protocols or lack of help available [6]. Therefore critical incident monitoring in anesthesiology is an important tool to assess mishaps in the OR, recognise 'near-misses' and to identify areas for improvement in existing OR practices.

Most of the developed nations have national registry of critical incidents like American Quality

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Institute (AQI), Australian incident monitoring system (Australia), and National learning and reporting system (UK) but in India there is no such reporting system either at national and state levels. There are various studies published on critical incident reporting in anesthesia but there is no study of critical events in a nephro-urology setup.

With this in mind, we conducted a retrospective audit of our Critical Incident Forms (CIR) from January 1 to December 31, 2015. The data was analysed to identify incidence, predisposing factors and outcome of critical incidents in the OR.

## Methods

As a part of our quality assurance programme Critical Incident reporting Forms (CIR) were filled and discussed in our monthly departmental meetings. We conducted a retrospective audit of our CIR forms from January 1<sup>st</sup> 2015 to December 31<sup>st</sup> 2015. As this was retrospective analysis and an observational study, consent from patient for study was waived.

A critical event was defined as "An event under anesthesia care which had the potential to lead to substantial negative outcome (ranging from increased length of hospital stay to death or permanent disability or cancelled operative procedure) if left to progress" [4,7].

Our hospital is a tertiary care referral centre catering to patients in nephrology and urology departments only; hence most patients coming to our OR have some degree of pre-existing renal impairment and may be categorised as ASA grade 3 and above.

Reporting of anesthesia adverse events is purely voluntary and reported by the anesthesiologist himself. As a part of our departmental quality assurance programme we have developed a Critical incident reporting Form (CIR) which includes demographic parameters age and sex of the patients. Other study parameters included are co morbidities, ASA grade, surgery planned, technique of anesthesia used, phase of occurrence of the complication, grade of severity of the complication, whether the complication was a result of anesthesia/surgery/patient factors or multifactorial, management and outcome of the cases and strategies to prevent future occurrence.

The data was analysed to identify incidence, predisposing factors and outcome of critical incidents in the OR.

## Results

During one year audit period from Jan 2015- Dec 2015, 1217 anesthetics were administered. The details of patient characteristics are listed in Table 1 and Figure 1.

Most of the critical events occurred in elective surgeries as compared to emergency surgery. Of a total of 1217 patients, 31 (2.54%) critical events were reported, with complete recovery in 28 (90.32%), permanent disability in 1 (3.22%) (Above knee amputation following graft thrombosis) and mortality in 2 (6.54%) patients. The severity of harm was graded according to Table 2. Both the patients who died in this period had been taken for emergency surgery. The critical events were seen predominantly in male patients (n=27, 87.09%) vs female patients (n=4, 12.09%). Maximum incidence was in the age group above 60 years (n=13, 41.93%); followed by those between 40-60 years (n=11, 35.48%) and then in the 0-20 age group (6.54%). Most of the critical events occurred in patients with ASA Grade 3 and above 45.16% (14/31), where as 32.25% (10/31) were ASA Grade 2 and 22.58% (7/31) were ASA Grade 1. Most of the events occurred in patients with pre-existing illness and who had multiple co morbidities, including type 2 diabetes mellitus (DM), essential hypertension, chronic kidney disease (CKD) on maintenance hemodialysis, ischemic heart disease with or without Percutaneous transcoronary Angioplasty (PTCA), patients on anticoagulant therapy etc.

Maximum number of complications were related to the cardiovascular system-54.83% (17/31). The cardiovascular complications most frequently seen were hypotension, hypertension, bradycardia and arrhythmias. The others included airway related complications, pulmonary complications such as respiratory depression, pulmonary edema, laryngospasm. Other complications seen were disseminated intravascular coagulopathy (DIC) and drug reactions. These are tabulated in Figure 2.

One surgery had to be postponed—a patient who needed a biopsy of oral tumour could not be intubated as there was extension of growth in tonsillar fossa and vallecula. Laryngeal Mask Airway (LMA) was placed and patient was ventilated, later he was reversed from anesthesia and was referred to higher centre for further management.

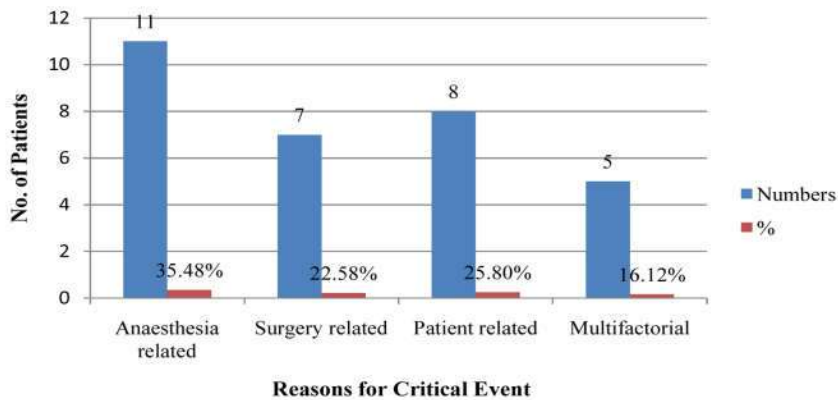
Incidents occurred more frequently in patients who received general anesthetic 58.06% (18/31) as compared to 41.93% (13/31) in patients who received regional anesthesia.

According to phase of occurrence of critical events, maximum events 45.16% occurred in intra-operative phase, 25.80% occurred during induction while 16.12% were seen in post-operative period (Figure 3). Critical events and mortality were correlated with factors attributable to patient or anesthesia, surgery or multifactorial. Out of 31

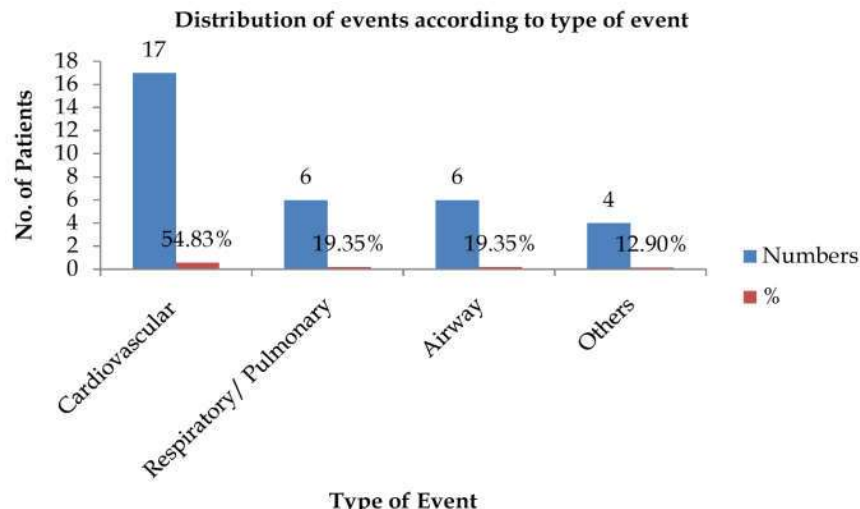
events maximum 45.16% were attributable to anesthesia, 22.58% were due to surgery related while 25.80% events were due to patients pre-existing condition while 16.12% were due to more than one factor. 90.32% critical events occurred in elective surgeries as compared to 9.67% in emergency surgery.

**Table 1:** Characteristics of Critical Event

		No. of Patients	Percentage (%)
Age	0-20	2	6.45%
	21-40	5	16.12%
	41-60	11	35.48%
	60 and above	13	41.93%
Gender	Male	27	87.09%
	Female	4	12.90%
ASA Grading	ASA Gr 1	7	22.58%
	ASA Gr 2	10	32.25%
	ASA Gr 3 & above	14	45.16%
Type of Surgery	Elective	28	90.32%
	Emergency	3	9.67%



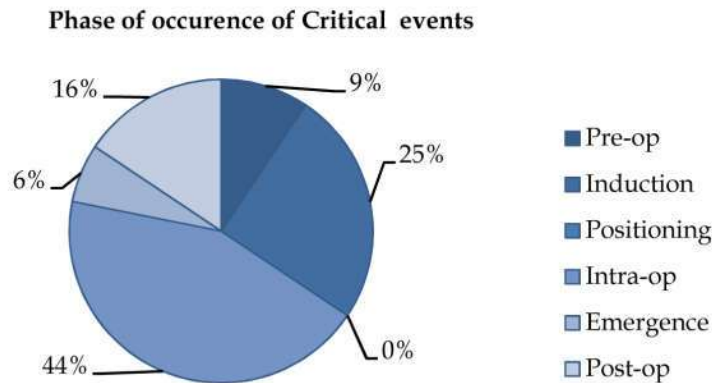
**Fig. 1:** Analysis of Critical events



**Fig. 2:** Type of critical events

**Table 2:** Severity of Harm

Grading	Description	No. of Patients	Percentage (%)
Grade 1	Transient abnormality unnoticed by patient	2	6.40%
Grade 2	Transient abnormality with full recovery	24	77.41%
Grade 3	Potentially permanent not disabling	1	3.22%
Grade 4	Potentially permanent disabling damage	1	3.22%
Grade 5	Death	2	6.40%

**Fig. 3:** Phase of occurrence of Critical events

## Discussion

One of the important components of patient safety movement is to analyse and learn from adverse events and near misses [8]. Anesthesia draws a parallel with aviation industry in adapting its incident reporting system (Cooper et al 1978). Recording and audit of critical incidents in anesthesia department helps in bringing out changes in prevalent practice and protocols, to improve the standards of anesthesia care and thus helping in designing policies to prevent their recurrences [8-11].

Anesthesia related critical events get obscured by various factors like skill of the operating surgeons, complexity of surgery and the patient condition.

The total complications in our hospital were 2.54%. The incidents reported from different institutions varies from 0.28% to 2.8% [12,13], while higher incidence of 12.1% [14] and 10.6% [15] have been also reported. Our centre being a tertiary care and a standalone nephro-urology set up, we deal with patients with multiple co morbidities and most of our patients are ASA Grade 3 [14,16] and above, which may in itself explain the higher incidence of critical events.

Slightly higher incidence of critical events [14] and mortality [9,16] is seen in emergency surgeries as

compared to elective surgeries. In our audit 58.06% of critical events were seen in general anesthesia as compared to regional techniques which is similar to most of the studies published [15,16]. Interestingly, however, both the mortalities occurred in patients who were taken up for emergency surgeries and had received regional anesthesia/IV sedation. This could be because of the fact that they were ASA grade 4 & 5 respectively, with multiple co morbidities; hence regional techniques were preferred in them.

Critical events mostly occurred during day time in our hospital similar to other study [16].

Operating room is observed as a vulnerable site for occurrence of critical events [7,16]. Like aviation industry, take off and landing are considered as critical time period similarly in anesthesia induction and reversal periods are considered to be incident rich [5,16] but we found higher events in intra-operative period as compared to induction and post-operative phase which is similar to other studies [12,13,16]. Factors responsible for critical events were analysed and were categorised as anesthesia related, surgery related, patient related or multifactorial. We found anesthesia related critical events were 35.48% and more seen in induction and emergence phase which are similar to other studies [2,3,7]. Surgery related factors were mostly bleeding and in one case of pheochromocytoma, tumor handling lead to hemodynamic disturbances.

Critical events related to airway management have been found to be 17-34% [12,13,14]. A quarter of anesthesia related deaths have been associated with airway management. The airway and respiratory complications seen in our institute were pulmonary edema (as CKD patients are prone for fluid overload), respiratory depression due to morphine, LMA slippage, laryngospasm and difficult airway. But in our institute we found higher incidence of cardiovascular complications as similar to Manghani et al in their article in 2004 [7]. This is likely because most of our patient population has CKD associated morbidity [17].

Independent predictors of operative mortality cited in literature include advanced and pediatric age group as well as male gender. This should be correlated to the fact that in audit period; of total anesthetics administered, 71.73% (873/1217) were in male patients [11,18].

Many variables (patient status, surgical procedure, and surgical expertise) make the delineation of anesthesia related factors obscure. Of the total critical events, 35.48% (11/31) of the complications were purely anesthesia related; 22.58% (7/31) events were surgery related while 25.80% were due to patient related complications.

Recent studies define anesthesia mortality as death under, as a result of, or within 24 hours of anesthetic administration. In literature, crude anesthesia mortality (i.e. combined anesthetic and surgical mortality) ranges between 10-30/10,000 [19,20] anesthetics. In our audit we found crude anesthesia mortality as 16.4 per 10,000 anesthetic. In most developed countries, anesthesia mortality ranges between 0.12-1.4 per 10,000 anesthetics [21] while in our institution the anesthesia mortality was 8.2 per 10,000 anesthetics which is higher than the developed countries. The reasons for higher mortality rates is likely because most of our patients have CKD associated comorbidities and are sicker.

## Conclusion

Complications related to anesthesia have reduced dramatically over the decades from 1978; when Cooper et al introduced the first critical incident analysis of preventable anesthesia related mishaps but still anesthesia remains to be associated with morbidity and mortality. Use of checklists in OR, protocols and increased awareness among anesthesiologists about critical incidents and their reporting can improve the quality of anesthesia

care delivered. As reporting of critical events is voluntary, under reporting of critical events can be of concern.

In our institution, majority of critical events were related to cardiovascular system, preoperative optimization and risk stratification of all these patients prior to surgery is very important.

In view of the fact that human error is the single most important factor in the majority of these incidents, we suggest that policies and protocols be adhered to and updating knowledge base to avoid errors. That however is not a reason for complacency. Such incidents continue to occur as the specialty now caters to sicker patients who require more complicated surgeries. The complications which occurred purely due to anesthesia are preventable with the use of thorough preoperative optimization and better equipment for monitoring and airway management. Safety does not happen by accident it requires teamwork.

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