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A critical incident reporting system in anaesthesia

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Abstract

Objective: To audit the recently established Critical Incident Reporting System in the Department of Anaesthesia and Critical Care Medicine, University of Zimbabwe Medical School. The system was set up with the purpose of improving the quality of care delivered by the department.
Design: Cross sectional study. A *critical incident* was defined as 'any adverse and reversible event in theatre, during or immediately after surgery that if it persisted without correction would cause harm to the patient'. The anaesthetic or recovery room staff filled a critical incident form anonymously. Data was collected from critical incident reporting forms for analysis.
Setting: The anaesthetic service in the two teaching hospitals of Harare Central and Parirenyatwa General Hospitals.
Subjects: Between May and October 2000, 62 completed critical incident forms were collected.
Main Outcome Measures: The nature of the incident and the monitoring used were recorded, the cause was classified as human, equipment or monitoring failure and the outcome for each patient reported. There was no formal system for reminding staff to fill in their critical incident forms.
Results: A total of 14 165 operations were performed over the reporting period: 62 critical incident forms were collected, reporting 130 incidents, giving a rate of 0.92% (130/14 165). Of these, 42 patients were emergencies and 20 elective. The incidents were hypotension, hypoxia, bradycardia, ECG changes, aspiration, laryngospasm, high spinal, and cardiac arrest. Monitoring present on patients who had critical incidents was: capnography 57 %, oxymetry 90 % and ECG 100 %. Other monitors are not reported. Human error contributed in 32/62 of patients and equipment failure in 31/62 of patients. Patient outcome showed 15 % died, 23 % were unplanned admissions to HDU while 62 % were discharged to the ward with little or no adverse outcome.
Conclusion: Despite some under reporting, the critical incident rate was within the range reported in the literature. Supervision of juniors is not adequate, especially on call. The stress under which everyone has to work includes poor morale, drug shortages, poor equipment and power cuts with no backup generator. Despite this, the challenge for senior personnel is to improve quality of care. In other countries similar audits have led to change of practice and improvement in the safety features of the service provided by the hospital and staff.

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Introduction

The critical incident system is now well established as a concept and activity of a quality programme in anaesthesia. Most publications are from well resourced countries with little contribution from developing countries. When something goes wrong in the anaesthetic management of a patient, that event is the final outcome of a process that began some time before. The event may or may not be the 'fault' of the anaesthetist, but that the system (environment) in which he/she works, allows certain errors to occur without correction. Eventually, the cumulative or co-incident effect of several such errors leads to the "something going wrong". A critical incident system identifies such errors, alerts participants to the types of errors in the system, enabling corrective measures to be put in to place, rendering the environment safer.

The Department of Anaesthetics and Critical Care Medicine, University of Zimbabwe Medical School has introduced a Critical Incident Reporting System as part of their quality programme. The audit presented here is a review of that process.

Materials and Methods

Setting.

The anaesthetic environment covers 19 theatres in two teaching hospitals of about 1000 beds each (Harare Central Hospital and Parirenyatwa Hospital). These two hospitals share specialist referral responsibility for the whole country with two others 350km away in Bulawayo. Most specialities are represented with neurosurgery, cardio-thoracic surgery, head and neck and general surgery being the most complex. During the audit period the Anaesthetic Department consisted of 15 Consultants and 18 trainees on the specialist programmes of Diploma in Anaesthetics and Masters in Anaesthesia, 10 nurse anaesthetists and eight trainee nurse anaesthetists. A technical department separate from anaesthetics services the equipment. Availability of drugs and spare parts is a recurring problem. A consultant anaesthetist leads the majority of lists; others have physician or nurse trainees supported by a consultant in a nearby theatre or by the on-call consultant. The same trainees cover the 24hour call service with a consultant available from home. The on-call consultant is the responsible person for all emergency cases. An anaesthetic registrar call system exists when staffing levels permit, but was not in place during the audit. Nurse anaesthetists are on-call for obstetrics only, although they may participate, as a team member or leader, in all elective lists. During this period all junior physician anaesthetists were trainees on the DA or MMed programme. There were no service staff.

Methodology.

The process of critical incident monitoring commenced in May after several explanatory meetings within the department. The anonymous nature of the reporting was emphasised. Copies of the forms were placed in all anaesthetic rooms and recovery areas in both hospitals in specially made pockets and posted in prominent places. Boxes for receiving completed forms were also placed in all theatre suites. Staff were reminded at all opportunities to fill in their forms, including at mortality and morbidity meetings and whenever an incident occurred. At the end of October all the forms submitted were reviewed and presented at a departmental meeting for discussion.

A critical incident was defined as: *an event which led to harm, or could have led to harm, if it had been allowed to progress. It should be preventable by change of practice.* (Royal College of Anaesthetists 1996).

The data form collected information about the grade(s) of anaesthetist present, whether elective or emergency, a pre-operative assessment, monitoring equipment used, nature of the incident, comments on the cause (whether human, equipment or monitoring) and the immediate and eventual hospital outcome of the patient. There was space for further comment from the anaesthetic team about the event. No information was collected about the time of day the event took place and the ASA grading (American Society of Anaesthesiologist Grading of pre-operative health status) had been omitted from the original form. No data on age, sex or grading of the severity of the incident or of the injury was collected.

Results

A total of 130 incidents were reported in 62 forms. Twenty of the forms reported elective cases and 42 forms were on emergency cases.

Table I: Breakdown of 130 critical incidents reported May to October 2000.

Nature of Incident	Frequency (%)
Cardiac Arrest	9 (6.9)
Laryngospasm	8 (6.2)
Bradycardia	14 (10.8)
Aspiration	3 (2.3)
Abnormal ECG	18 (13.8)
High Spinal	2 (1.5)
Hypotension	44 (33.8)
Swab in patient	1 (0.7)
Cancelled	12 (9.2)
Hypoxia	20 (15.4)

In the 62 reports a consultant anaesthetist was present for 14 cases (22.6 %), of which nine (64%) were emergencies.

Monitoring was reported for those incidents as reported on the forms (Table II).

The contributory factors cited were grouped into four classes: human error, equipment failure, failure of monitoring and other or unclassified.

Table II: Monitoring conducted during critical incidents reported.

Monitoring Equipment Used	Frequency of use of equipment (%)	Comments
Electrocardiogram	60 (97)	Every theatre has an ECG machine but the electrodes and electrode jelly are not always available. Often the leads are connected directly to the patient with KY jelly or similar preparation. No comment was made on why the two cases did not have this done.
Pulse Oxymetry	54 (87)	Absent in 8 cases. Power failure affected 7 cases. Malfunctioned in 3 cases in which it was used.
Blood Pressure Measurement	60 (97)	All lists have access to automatic blood pressure machines of different makes. No comment was made why the two cases did not have this done.
Capnography	34 (55)	

Beside the assumed continuous presence of the anaesthetist, no other monitors were reported, such as central venous monitoring.

Table III: Contributory factors cited for the incidents.

Human error: 32 of 62 reports

1. Inadequate assistance quoted in 8/62 cases. There are no trained anaesthetic assistants. Any available nurse may be assigned the role. There is no intermediate cadre between junior on-call staff and consultant during the on-call service. Unavailability of consultant was cited in 4/8 times. Personal mobile phones are the main method of contact between staff since the bleep system has collapsed completely.
2. Use of the wrong drug was mentioned in 3/32 cases.
3. Failure to intubate occurred in 4 /32 cases. Two of these were obstetric patients and all four were emergencies. None were identified as potentially difficult in advance.
4. Fatigue and undue haste accounted for 6/32 cases. Mostly this led to early extubation with attendant laryngospasm, hypoxia, re-intubation or vomiting and aspirating.
5. Other factors reported as human error were inadequate preparation leading to commencement of the case before blood, or laboratory results were available or resuscitation was adequate.

Equipment failure: 31 of 62

1. A major failure was caused by a power cut for Parirenyatwa Hospital. The emergency generator failed to provide back up because it had also broken down. Four patients were affected by this incident including a child for closure of patent ductus arteriosus. All patients were manually ventilated till awake and extubated and discharged to the ward. In the recovery room the oxymeter and blood pressure machines failed. Battery supported lighting was present and manual blood pressure monitoring and a stethoscope was used. No adverse effect on the patients was reported.
2. During one anaesthetic for an emergency case the anaesthetic machine switched itself off three times. The cause of this incident could not be identified during the operation. Follow up later still could not establish the cause.
3. The oxygen sensors on all the machines were not working during this audit period. Most of the reservoir bags and breathing tubing had leaks and showed previous attempts to plug these.
4. Capnography was present for 34 cases but were not calibrated to give a numerical reading, because the calibration gas was not available.

Failure of monitoring: 3 of 62

1. A critically ill patient, post bronchoscopy, had undetected pneumothorax in recovery till patient collapsed. ICU was full. Managed in recovery.
2. An obstetric patient who had total spinal could only be monitored using NIBP.
3. A critically ill obstetric patient could only be monitored with NIBP and ECG. The oxygen gauge on the anaesthetic machine was not working.

Other: 2 of 62

1. Suction machine failed to function in a vomiting/aspiration patient.
2. Operating table could not be tilted head-down in a vomiting patient in one case.

There were 23% unplanned admissions to the high dependency unit (HDU) and ICU, and nine deaths out of the 62 cases (15%).

Table IV: Cause of deaths recorded during the audit period.

1. Failed intubation in a difficult-to-intubate patient, led to emergency tracheostomy. Patient died two weeks later due to a blocked tracheostomy tube.
2. Two obstetric haemorrhage patients post Caesarean section. Blood not available in time.
3. Ruptured aortic aneurysm: unsuccessful resuscitation.
4. Very ill paediatric patient monitored with ECG and pulse oxymeter. At end of operation developed bradycardia and asystole.
5. Very ill patient post bronchoscopy, pneumothorax, hypoxia and hypotension.
6. Two multiple injury patients. Blood not available in time.
7. Severe sepsis: died in ICU.

Discussion

For a Critical Incident Reporting System to improve an anaesthetic service, we require the participation of the whole department to first report any incidents and then to change the working environment. The purpose of this audit was to review performance of the reporting system and to identify areas of improvement in the data collection. Regular feedback keeps everyone involved and allows ownership of the improvement process.

The critical incident rate of 0.92 % (130 / 14 165) found in this study is within the range reported in the literature from well-resourced countries (range 0.28 to 2.8%).[3,5] What people may report as a critical incident may vary depending on the expectation both patient and staff may have of the anaesthetic episode. Nausea or post operative pain in recovery may be reported as a critical incident because it is preventable, may lead to further undesirable and harmful effects and can be adequately monitored. In other settings they may not be reported unless vomiting or injury occur.

The compliance for reporting in this report was not estimated but in the literature, is reported to vary from 18% to 74%.[5] Active methods of reminding colleagues such as prominent notices, regular reminders, designation as a duty for registrars to remind and collect the forms, have been reported as successful in improving compliance. As a result of this exercise, the data collection form has been redesigned. The reporting system is becoming established in the two hospitals. It is hoped that the Critical Incident Reporting System will be used in other institutions both in the private and public sector.

A consultant was present in only 22% of cases while 68% of critical incidents occurred on emergency lists. The Confidential Enquiry in Peri-operative Deaths (CEPOD) made similar observations when auditing the factors related to perioperative mortality in hospitals; poor supervision of juniors; emergency cases being done late at night when staff are tired; inappropriate decisions being taken by juniors. Closer supervision of trainees is difficult when consultant numbers are small and workloads heavy. Nevertheless, a daytime consultant-led emergency list has been advocated as a solution.

The mortality of 15% needs explaining. The unavailability of blood at the right time was responsible for four deaths. In the past the hospital blood bank made blood available within a short period of requesting it. During the study period there were several factors cited for blood not being given, despite requesting it on time, and delaying surgery. Currently, blood samples are sent to the Blood Transfusion Service outside the hospital for typing and cross-matching. Delays are often caused by administrative factors, including unavailability of transport for delivery and collection. Junior surgeons are reluctant to call for assistance early enough to avert disaster. Surgical intervention is often late due to extended ward treatment beyond the beneficial, and late patient presentation to hospital.

Unplanned admissions to the HDU are a recognised indicator of a critical incident, implying that an adverse event occurred that led to a change in post operative management for the patient. These admissions would be associated with higher morbidity, more invasive interventions, increased hospital costs, longer hospital stay, and prolonged recovery. Identifying the process that led to such unplanned admissions would have significant cost effects.

The Zimbabwe Anaesthetic Association, as well as anaesthetic opinion worldwide, has advocated for and laid down minimum standards of monitoring for different institutions and procedures. For a teaching and referral hospital, the minimum standards ought to be met in order to teach and achieve good standards of practice. The multiplicity of equipment models makes it difficult to maintain a minimum set of working devices, or bulk buy for the institution. For example, at present the many different models of non-invasive blood pressure monitors in our theatres have mutually incompatible blood pressure cuffs. In the future open platform devices may allow us to keep our present procurement practices while maintaining a mixed stable of equipment.

The Critical Incident Reporting System is being introduced as part of a quality programme of the Division of Anaesthesia in two of Zimbabwe's major referral hospitals. The health allocation in the national budget has declined from US $ 23 *per capita* in 1985 to the current less than US $ 12 *per capita*. The value of a quality programme under such severe resource restriction is not always apparent since making the required changes may not be seen to be feasible. Health professionals in rich countries build in quality programmes to ensure that the environment for patients and staff is safe and protected, even when departments have to contain costs because of escalating patient need and demand. In resource-poor conditions, striving for quality still has to drive the search for how to improve services and patient care to preserve a culture of achieving standards in good medical practice. Often the resources needed to accomplish these standards are more to do with training and attitude than actual high expenditure.

Conclusion

In conclusion, a Critical Incident Reporting System is an essential part of sustaining quality assurance in anaesthetic practice. This audit has highlighted some of the difficulties in the reporting of the Critical Incident Reporting System established by the Department of Anaesthetics. A greater effort will be made to address this by increasing methods of reminding staff members. The audit has also highlighted and quantified the lack of senior support to the trainees especially in emergencies. The system of cover has improved with the introduction of registrar supervision of junior staff and methods of increased consultant cover are being explored. The risk of morbidity and mortality that patients are exposed to through poor equipment and general working environment needs further attention.

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