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Potentially preventable deaths in the Victorian Audit of Surgical Mortality

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Abstract

Background: The Victorian Audit of Surgical Mortality (VASM) seeks to peer-review all deaths associated with surgical care. This study aimed to examine the mortalities that were determined by the assessor to be potentially preventable, and identify the clinical factors associated with these cases. The assessment of preventability of death and its relationship to management issues at different stages of the admission episode, as opposed to whether the management issue(s) alone were preventable have not been reported previously.

Methods: Mortality data from the VASM audit since 2007 that completed the peer-review process were retrospectively analysed. Mortalities identified as being preventable were assessed to determine any treatment errors.

Results: A total of 6155 deaths were assessed. Of these, 14.6% (896/6155) were considered to be potentially preventable. Where a second-line assessment was requested (1113/6155, 17.5% cases), 48.3% of these deaths were considered potentially preventable. Elective patient deaths were more likely to be potentially preventable ($P < 0.001$), especially in public patients. Lack of timely involvement of senior staff, inappropriate treatment delay and failure of problem recognition were factors most frequently associated with potentially preventable mortality.

Conclusion: Overall assessment of the preventability of death is unique to VASM. This allows an additional level of analysis to be applied to the circumstances surrounding each mortality and correlation of preventability of death with clinical management issues provides important feedback to surgeons and health-care providers to further improve the safety and quality of care.

Introduction

The Victorian Audit of Surgical Mortality (VASM) is a recognized quality assurance program protected by the Commonwealth Qualified Privilege legislation.[1] Findings from cases undergoing peer-review are used purely as an educational tool; it is not a punitive process. As a retrospective observational peer-reviewed clinical audit, the VASM investigates all mortalities that occurred while under the care of a surgeon, regardless of whether or not the patient underwent a surgical procedure during hospital admission.

Previous studies have indicated that a number of clinical factors such as comorbidities, patient and hospital admission type, usage of critical care unit, urgency status, American Society of Anesthesiologists status, delay in diagnosis, surgical procedures and clinical management issues contribute to potentially avoidable mortality.[2,3] The most frequently identified clinical management issues that have been reported across all specialties were delay in definitive treatment, inappropriate operation, and management and protocol issues.[4] Medical errors have been estimated to be the third leading cause of death in the USA.[5]

VASM, unlike the other Australian and New Zealand Audit of Surgical Mortality (ANZASM) audits apart from Western Australia, also collects an opinion from the treating surgeon and assessors as to whether the mortality was potentially preventable and which individual management issues were associated with preventability. The goal of this paper was to examine these data to provide a better overall analysis of preventable deaths and the variables associated with these to provide important new information in the context of the educational role of the VASM.

Method

This study retrospectively analysed observational data from the VASM since inception from 1 November 2007 to 30 June 2015. Only the highest level of assessment of cases that had completed the audit process was analysed.

VASM methodology

Notifications of death were received from Victorian public and private hospitals, the Coroner's Office and self-reporting surgeons. This process triggers a surgical case record form (SCF) to be completed by the treating surgeon who reflects on the patient's admission to hospital and course to death, before being sent for peer-review. There were two stages of peer-review process: the first-line assessment (FLA) and/or the second-line assessment (SLA). The first-line assessor only utilized the data provided by the treating surgeon to determine whether a second more detailed review was required. If an in-depth review was necessary, the second-line assessor was provided a de-identified copy of the SCF and the patient's medical notes of the last surgical admission. To close the loop, findings from the peer-review were provided to the treating surgeon as an educational tool (Fig. S1).

The clinical data from the SCF and from the peer-review assessments were utilized for analysis. Clinical data extracted from the SCF included the patient's gender, patient status as public or private, and urgency of admission as emergency or elective. The Victorian Surgical Consultative Council introduced a detailed preventability question to VASM for the treating surgeon and both assessors to further determine whether the patient mortality was avoidable or not, and this was used as the outcome variable for this study. Additional subcategories included in the question were; *general* management issues (failure of communication, lack of timely involvement of experienced staff, inadequate resources and protocol breach), *preoperative* issues (inadequate preoperative specific condition investigation, inadequate preoperative general investigations, incorrect or untimely diagnosis, inappropriate preoperative preparation and inappropriate treatment delay), *intraoperative* issues (personnel issue, and facility/equipment issue), and *postoperative* issues (deficient postoperative care, and failure of problem recognition) as specified by assessors (Fig. S2).[6]

Statistical analysis

Quantitative analysis was conducted using GraphPad InStat statistical package (GraphPad Software, La Jolla, CA, USA). Categorical variables were compared using chi-square analysis. A two-sided P value <0.05 was considered statistically significant. The preventability rate was calculated as a percentage of preventable patient deaths of the total number of eligible patients. The concordance validity between the treating surgeon, the first-line assessor, and second-line assessor was also analysed using the Gwet's AC1 score as this provides better handling of the 'kappa paradox' where low levels of kappa occur despite high levels of agreement.[7]

Results

A total of 10 626 cases were reported. Of these deaths, 59.9% (6366/10 626) completed the peer-review assessment process and were closed. The audit pool consisted of 82.5% (5253/6366) FLAs and 17.5% (1113/6366) SLAs. Only the highest assessment level (SLA rather than FLA) was used and 211 (3.3%) of these cases were excluded from analysis due to missing data leaving 6155 cases for analysis. The breakdown of the inclusion and exclusion criteria for analysis can be seen in the flow diagram (Fig. 1). The cohort was made up of 54.9% (3382/6155) males and 45.1% (2773/6155) females. The mean age at death was 74, median 79, ranging from 1 day to 104 years old.

From the study cohort, 7.2% (365/5055) of the cases that were closed at the FLA stage were identified as death being potentially preventable with 48.3% (531/1100) of cases that required a more in-depth second-line review being considered as preventable deaths, resulting in a total of 14.6% (896/6155) preventable mortalities audited (Table 1). Of the 6155 cases, the top three surgical specialties associated with preventable mortalities were cardiothoracic surgery (31.1%, 181/582), vascular (16.2%, 82/505) and general

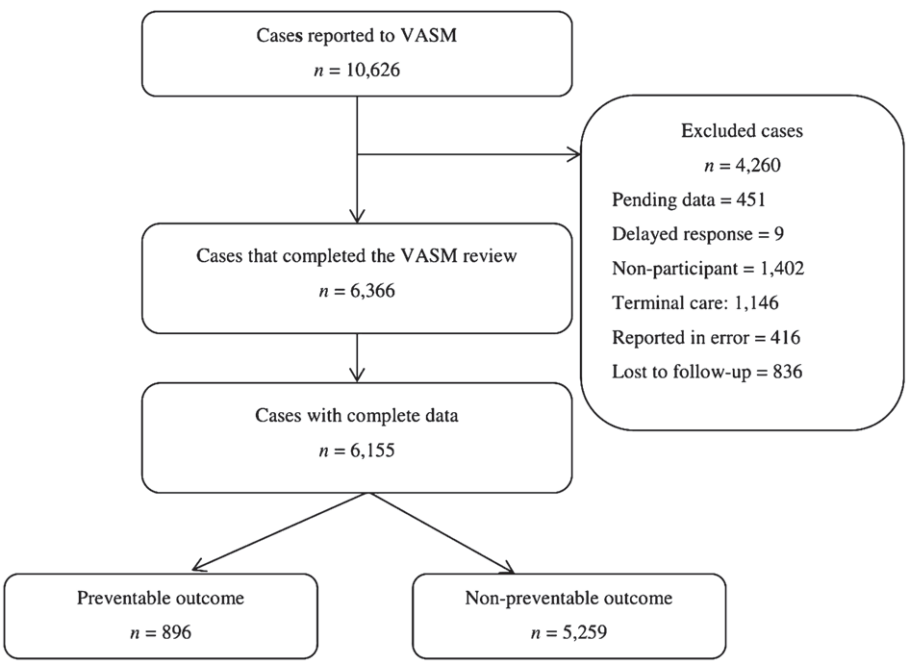

Fig. 1. Flow chart of included cases.

Table 1 Preventability of death for closed cases by highest level of assessor

Assessment type	Preventable	Non-preventable	Percentage
First-line assessment	365	4690	7.2
Second-line assessment	531	569	48.3
Total	896	5259	14.6

Missing data = 211 (3.3%).

surgery (15.6%, 411/2636) (Table 2). Of the FLA cases that went on to a SLA, 19.1% (213/1113) were assessed as being not preventable by the FLA, but were subsequently considered to be preventable in 38.6% (61/213) cases by the SLA. The comparison between elective and emergency hospital admissions and potential avoidable mortality was statistically significant ($P \leq 0.001$), with 31.6% (303/959) of patients admitted electively being assessed as preventable deaths compared to 11.4% (590/5175) of emergency admissions. When analysed by hospital status, public hospitals contained the majority of admissions (78.2%, 4497/5748), with 34.5% (203/588) of their elective deaths being preventable compared to 11.9% (464/3909) of their emergency admissions ($P \leq 0.001$). Private hospitals contributed significantly fewer patients (21.8%, 1251/5748) and the preventability of death of their elective patients was 28% (90/322), compared to 11.5% (107/929, $P \leq 0.001$) of their emergency patient pool. When the data were analysed by urgency status, there was a significant difference in preventable mortality for elective public patients (34.5%) when compared to elective private patients (28%), $P = 0.042$ (Table 2).

A total of 1343 issues were identified with preventable mortalities which were categorized as general issues (30.4%, 408/1343), preoperative issues (44.4%, 596/1343), intraoperative issues (4.2%, 56/1343), and postoperative issues (21.1%, 283/1343) (Table 3). These were identified with the same frequency by both FLA and SLA. The three most common issues identified were lack of timely involvement of senior staff (17.3%, 232/1343), inappropriate treatment delay (14.1%, 189/1343), and failure of problem recognition (12.7%, 170/1343) (Table S2). It is important to note that multiple issues can be present for one patient.

Table 3 Categories of issues associated with preventable death as identified by assessors

Preventable death	Total	Percentage
General issues	408	30.4
Preoperative issues	596	44.4
Intraoperative issues	56	4.2
Postoperative issues	283	21.1
Total	1343†	

†Greater than one issue can occur per patient ($n = 896$ preventable deaths).

The concordance validity between the treating surgeon and first-line assessor was high, but there was poor concordance between the treating surgeon and the SLA and between the FLA and SLA (Table S1).

Discussion

Preventable mortality was more likely to occur in elective admissions rather than emergencies, especially in public hospitals. In those patients subjected to a SLA, the percentage of preventability was much higher than those that just had a FLA. There is a subtle but important difference in preventability of individual management

Table 2 Specialty and admission status ($n = 6155$)

Admission factors	Preventable	Non-preventable	Percentage	*P*-value
Specialty	896	5259	14.6	
Cardiothoracic surgery	181	401	31.1	
Vascular surgery	82	423	16.2	
General surgery	411	2225	15.6	
Urology	34	195	14.8	
Other surgery†	36	229	13.6	
Neurosurgery	67	666	9.1	
Orthopaedic surgery	85	1120	7.1	
Urgency status‡	893	5241	14.6	
Elective	303	656	31.6	<0.001*
Emergency	590	4585	11.4	
Urgency status and hospital type§				
Elective patients	293	617	32.2	
Public	203	385	34.5	0.042*
Private	90	232	28.0	
Emergency patients	571	4267	11.8	
Public	464	3445	11.9	0.821
Private	107	822	11.5	
Public patients	667	3830	14.8	
Elective	203	385	34.5	<0.001*
Emergency	464	3445	11.9	
Private patients	197	1054	15.7	
Elective	90	232	28.0	<0.001*
Emergency	107	822	11.5	

*$P < 0.05$ is statistically significant. †Other includes otolaryngology head and neck, ophthalmology, paediatric surgery, obstetrics and gynaecology, plastic surgery and oral/maxillofacial surgery. ‡Missing data = 21 (<1%). §Missing data = 407 (6.6%).

issues that might be responsible for the death of a patient, which is the usual approach in the ANZASM audits, as opposed to issues identified in a mortality identified as potentially preventable. Admission status, delays in patient care, requirement for critical care, the number of operations performed during the admission and presence of clinical management issues have all been identified as preventable issues associated with surgical care in previous reports.[2–4,8–14] These studies have focussed upon the preventability of the individual clinical management issues instead of our methodology, which provides a more holistic approach to the audit of the mortality. The VASM has previously shown that assessors found that inappropriate absence of either venous thromboprophylaxis or critical care unit use were not significant issues (only 6 and 8%, respectively, would have benefited), which emphasizes the importance of clinical management issues rather than risk management issues when examining surgical mortality.[13]

Management phase

Avoidable mortalities in the VASM have been correlated with management errors at all stages of the admission episode, but this was greatest in the preoperative phase of management (44.3%, 596/1343). This emphasizes the importance of both delay in diagnosis and initiating treatment when clinical management issues are correlated with preventability of death. Deficiencies in preoperative preparation and preoperative investigation were less prominent preoperative subcategories when correlated with preventability. The lack of, or limited facilities, equipment or expertize have been associated with potentially avoidable mortalities.[12] These factors have not been prominent in this study as only 4% of preventable deaths were associated with intraoperative issues. Postoperative management issues occurred in 21% of the preventable deaths.

Admission, hospital and patient status

Most of the patients in this audit were emergency admissions and previous clinical studies and audits have recorded higher mortality in patients admitted as emergencies.[10,13] It has long been recognized that about 85% of patients in the mortality audits are elderly patients admitted as emergencies.[3] However, when data were examined from the viewpoint of preventability of the death, elective procedures were significantly associated with preventable mortality when compared to emergency procedures. Public hospitals admitted more emergency patients than private hospitals and electively admitted patients in the private sector were found to have a lower incidence of preventable deaths than their elective public counterparts. This may be explained by differences in patient and disease complexity in patients admitted in the public sector.[15]

General management issues

Poor communication between medical teams has been an issue associated with errors in patient management.[16] However, inconsistent modes of communication, such as letters, telephone and personal conversations, may also lead to information loss.[17] Lack of timely involvement of senior staff and communication issues during the admission episode were also prominent factors associated with preventability in this study. Senior staff may not be contacted because trainees are hesitant to disturb the 'boss' after hours and this should be rectified by reassurance and education of junior staff. Improvements in decision making, leadership, communication and documentation, preoperative management, postoperative management, establishing appropriate care and acting upon it, issues of shared care are all components of care identified in previous VASM publications and have been repeatedly reported in successive case note review booklets – a recurrent theme involves the substandard management of the deteriorating patient as a preventable issue.[18] Despite the clinical management challenges identified in surgical patients, the mortality rate has decreased over time.[19,20]

Assessor grade

This paper shows that although there is excellent concordance in determining preventable deaths between the treating surgeon and the FLA, this is not apparent between the FLA and SLA. This is not surprising as the FLA is influenced by the details submitted by the treating surgeon, whereas the SLA has access to the patient records. Also it is only in cases where the FLA identifies potential management issues or there is inadequate information that initiates a request for a SLA by the FLA, thus a higher incidence of preventability might be recorded after detailed scrutiny. This explains the low incidence of preventability (7.3%) in the FLA-only group compared with the high-risk SLA group (48.3%) as well as the change in preventability status to positive by the SLA from the original FLA assignment in over 1/3 of instances. These findings validate the VASM process. Regardless of the assessment stage, the top three issues identified by the first and second line assessors were the same.

Reliance on clinical data reported by the treating surgeon can produce incomplete data collection and missing data were excluded from analysis. This is a limitation of this study although this only involved a relatively small number of cases. Preventability of specific clinical management issues has been the focus of previous publications based upon the standard forms returned to each jurisdiction, but the overall classification of the preventability of the patient's death and its relationship to issues at different phases of treatment described in this paper is unique to VASM. Only the Western Australian mortality audit has a question asking the assessors to identify if the death was potentially preventable, but no further details regarding reasons for this classification as found in the VASM form are requested.[21]

Conclusion

Preventable deaths are fortunately uncommon, but in cases that have been identified by initial assessment as worthy of detailed scrutiny, the occurrence of preventable mortality remains high and correlates well with preventable clinical management issues. Preoperative preparation accounted for the majority of factors relating to preventable surgical mortalities, leading to inappropriate treatment delays and overall lack of time. Failure to recognize surgical complications postoperatively was also associated with more preventable mortalities. Elective admissions, particularly in the public sector

are more often identified as preventable deaths. The distinctive preventable mortality question provides an additional educational component of the VASM program, which allows holistic analysis of the admission episode, which has not previously been reported and which has been recommended to be adopted by the ANZASM in all states and territories.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Figure S1. Victorian Audit of Surgical Mortality (VASM) audit process.

Figure S2. Victorian Surgical Consultative Council (VSCC) questionnaire.

Table S1. Concordant validity (Gwet's AC1 score) of preventable outcome between surgeon and assessors.

Table S2. Breakdown of issues associated with preventable death as identified by assessors.