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The implications of the patterns of error associated with acute trauma care in rural hospitals in South Africa for quality improvement programs and trauma education

D.L. Clarke [a,*], C. Aldous [b], Sandie R. Thomson [a]

[a] Department of Surgery, Nelson R. Mandela School of Medicine, University of Kwa-Zulu Natal, South Africa
[b] Research Facilitator Post Graduate Committee, Nelson R. Mandela School of Medicine, University of Kwa-Zulu Natal, South Africa

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ABSTRACT

Introduction: This audit uses error theory to analyze inappropriate trauma referrals from rural district hospitals in South Africa. The objective of the study is to inform the design of quality improvement programs and trauma educational programs.
Methods: At a weekly metropolitan morbidity and mortality meeting all trauma admissions to the Pietermaritzburg Metropolitan Trauma Service are reviewed. At the meeting problematic and inappropriate referrals and cases of error are identified. We used the (JCAHO) taxonomy to analyze these errors.
Results: During the period July 2009–2011 we received 1512 trauma referrals from our rural hospitals. Of these referrals we judged 116 (13%) to be problematic. This group sustained a total of 142 errors. This equates to 1.2 errors per patient. There were 87 males and 29 females in this group. The mechanism of injury was as follows, blunt trauma (66), stabs (32), gunshot wounds (GSW) (13) and miscellaneous five. The types of error consisted of assessment errors (85), resuscitation errors (26), logistics errors (14) and combination errors (17). The cause of the errors was planning failure in 68% of cases and execution failure in the remaining 32% of cases. The assessment errors involved the abdomen (50), chest (9), vascular system (8) and miscellaneous (18). The resuscitation errors involved airway (4), chest (11), vascular access (8) and cervical spine immobilization (3).
Conclusions: Rural areas are error prone environments. Errors of execution revolve around the resuscitation process and current trauma courses specifically address these resuscitation deficits. However planning or assessment failure is the most common cause of error with blunt trauma being more prone to error of assessment than penetrating trauma.

Introduction

The scientific study of error has developed from the work of accident investigators who have researched incidents such as the space shuttle disasters, the Chernobyl and Three Mile Island Nuclear accidents as well as aviation accidents.[1,2] Modern error theory has generated the primary insight that errors are not random and unpredictable, but follow patterns and have their roots deep within the organizations in which they manifest. The application of modern error theory to the aviation industry has resulted in an enviable safety record, which has not as yet been emulated in health care.[3,4] It has been estimated that error accounts for up to ten per cent of fatalities amongst patients with salvageable injuries in the United States.[5–7] This study focuses on the problem of error associated with rural trauma care in a developing country and uses a modified taxonomy of error to quantify and classify these errors.

Patients and methods

Setting

Edendale Hospital is a regional hospital in Pietermaritzburg in Kwa-Zulu Natal Province of South Africa. It receives patients from the urban and peri-urban areas around Pietermaritzburg as well as from the rural Sisonke Health District. Sisonke has roughly half a million inhabitants and is served by four district hospitals all staffed by non-specialist staff. None of these hospitals have advanced radiology facilities and operative capacity is limited. At the weekly morbidity and mortality meeting all trauma admissions are reviewed and inappropriately managed cases are

* Corresponding author at: Department of Surgery, Nelson R. Mandela School of Medicine, University of Kwa-Zulu Natal, Private Bag 7, Congella, 4013 Durban, South Africa. Tel.: +27 338973000; fax: +27 338450325.
E-mail address: damianclar@gmail.com (D.L. Clarke).

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identified and discussed. We have adapted the JCAHO taxonomy to analyze cases of error in our system (4). The JCAHO taxonomy breaks error down into five root nodes.

Impact

The degree of harm experienced as a result of the error.

Type

This refers to the processes of care that failed. We divide the processes of care up into three broad categories namely errors of resuscitation, errors of assessment and logistical failure. A patient may experience any number of a combination of failed processes.

Domain

The domain in which these errors occurred, was the rural hospitals of Sisonke District.

Cause

(a) Input error: Sensory input and information is incorrectly perceived, resulting in an inappropriate plan.
(b) Intention error: Sensory data and information is correctly perceived but an inappropriate plan is formulated.
(c) Execution error: Input data are correctly perceived and the correct intention is formed, but the wrong action is performed.

We find it difficult to distinguish input error from intention error as this requires detailed psychological analysis of the event and that is not always possible. We therefore simply divide the causes into errors of planning errors and errors of execution and omit the distinction of input error or intention error. Resuscitation and logistical failures are errors of execution whilst assessment failures are errors of planning.

Prevention

All error reduction programs need to develop interventions to reduce the incidence of error and to limit its effect.

Results

During the period under review there were a total 1512 trauma referrals from our rural referral hospitals. Of these referrals we judged 116 (13%) to be problematic. This group sustained a total of 142 errors. This equates to 1.2 errors per patient. There were 87 males and 29 females in this group. The mechanism of injury was as follows, blunt trauma (66), stabs (32), gunshot wounds (GSW) (13) and miscellaneous five. The types of error consisted of assessment errors (85), resuscitation errors (26), logistics errors (14) and combination errors (17) (Fig. 1). The cause of the errors was planning failure in 68% of cases and execution failure in the remaining 32% of cases. The assessment errors involved the abdomen (50), chest (9), vascular system (8) and miscellaneous (18). The resuscitation errors involved airway (4), chest (11), vascular access (8) and cervical spine immobilization (3). The overall mortality rate in this group of patients was 15% (18). Morbidity in this group was significant and included, major amputation (7), stomas (3), acute renal failure (3), untreated pneumothoraces (2), missed cervical spine injury (2), prolonged ICU admission (44) and delayed diagnosis of peritonitis (20).

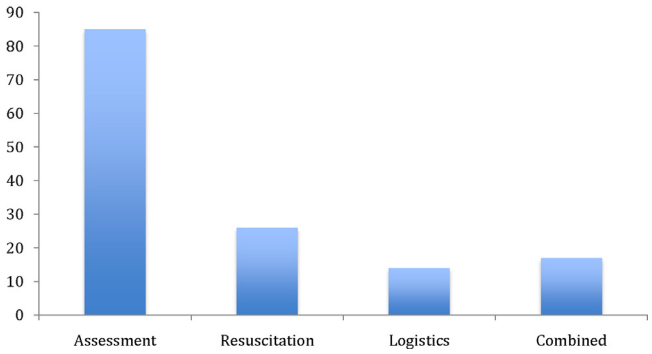

Fig. 1. Type/process error.

Resuscitation failure

The resuscitation errors involved airway (4), chest (11), vascular access (8) and cervical spine immobilization (3). The airway problems included two un-intubated head injury patients with a GCS less than nine, one patient with a failed crico-thyroidotomy and misplaced para-tracheal tracheostomy, and one esophageal intubation. In eight patients there were inadequate intravenous lines. Three patients with cervical spine injuries were transferred without any attempt at cervical spine immobilization. The errors involving the chest involved the inappropriate insertion of intercostal chest drains. One drain injured the liver, one injured the lung and two were placed in the setting of acute diaphragmatic herniation. Two intercostal drains were inserted in a low position although they did not cause any visceral injury and were considered as near misses. In two cases significant intra-pleural collections were not drained.

Assessment failures

Abdominal injuries

There were fifty cases of assessment failure which resulted in the delayed recogntion of the need for surgical exploration of abdominal injuries. The mechanism of injury was blunt trauma (23), penetrating stab (21) and penetrating GSW (6). In the blunt group the breakdown of the injuries was duodenum (4), small bowel (14), colon (2) and solid viscera (3). The injuries in the penetrating group were as follows colon (11), small bowel (8), duodenum (2), gastric (1), diaphragm (3), spleen (1). In two cases the penetrating wounds were ultimately managed conservatively in our unit. These two cases would be classified as near misses as although the management plan was ultimately the correct one this was achieved by default. The impact was significant with 10 (20%) deaths, three cases of renal failure, a duodenal fistula and prolonged ICU admission (greater than five days) in sixty percent.

Thoracic injuries

There were nine errors of assessment which involved thoracic injuries. There were four cases of blunt trauma and five stabs. All the stab wounds involved left sided thoraco-abdominal stab wounds with diaphragmatic injuries and intra-abdominal injuries. The blunt trauma cases involved the failure to recognize pneumothoraces in two and failure to realize that multiple rib fractures represent the potential for significant pulmonary contusion which will require respiratory support. The impact of these errors was significant with all the five patients with missed thoraco-abdominal injuries requiring emergency surgery. In the blunt group one patient with an unrecognized tension pneumothorax died and the remainder required urgent entubation and mechanical ventilation.