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ORIGINAL ARTICLE

Preventative measures taken against hypothermia in selected Durban hospitals' emergency centres and operating theatres

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ABSTRACT

Introduction: Hypothermia is common in emergency general surgical patients. It is known to be associated with major complications in multiple organ systems. It is also easily preventable with the use of safe and cost-effective equipment. However, by observation, it appears that this equipment is used too infrequently thus resulting in unnecessary harm to patients.
Methods: This descriptive, observational, cross-sectional study was conducted in two arms to evaluate both emergency centres and operating theatres in the major state hospitals in Durban. It was conducted as an audit as well as a questionnaire-based study, to ascertain the availability of equipment used to prevent hypothermia and also how appropriately the equipment was being used.
Results: There was good availability of equipment in both the operating theatres and the emergency centres. However it was being used very poorly, particularly in emergency centres (41% of responses deemed not beneficial to patients versus 29% from operating theatres; 39% of answers beneficial versus 54% from operating theatres). Institutions with hypothermia-prevention protocols scored significantly better than those without a protocol (59% versus 25% beneficial; $p = 0.01$).
Conclusion: In the field of hypothermia prevention, there was sufficient equipment to result in optimal patient care. However there appears to be a lack of knowledge amongst health care providers, resulting in suboptimal use of this equipment. Protocolised management may provide a solution to this problem and improve patient outcomes.

African relevance

- South Africa has high incidence of trauma – it is therefore important to achieve optimal management.
- The study showed good availability but poor use of equipment that can maintain normothermia or address hypothermia.
- A proposed protocol for temperature monitoring and external temperature regulation is provided in the manuscript.

Introduction

Hypothermia remains one of the most preventable causes of morbidity and mortality amongst emergency surgical patients. Defined as a core temperature of less than 36 °C it is commonplace in major trauma patients: studies indicate admission hypothermia has an incidence of between 1% and 10% for all patients, but up to 36.8% for severely injured patients and an even higher incidence in patients after a prolonged extrication from scene [1–4]. Further heat loss then occurs in the emergency centres where patients are often disrobed and where cold intravenous fluids are administered. The impact of this problem is marked – even mild to moderate hypothermia is associated with major complications in multiple organ systems, including cardiovascular (depression of contractility, increased oxygen consumption, myocardial ischaemia, arrhythmias) and haematological (platelet and clotting factor dysfunction, increased blood transfusion requirements) [2,3,5]. Hypothermia increases the risk of wound infection through immune dysfunction as well as vasoconstriction and induces hyperglycaemia by suppressing insulin release. It increases the risk of gastrointestinal ileus and it results in confusion as well as central nervous system depression. Drug metabolism is also slowed [2,3,5–11]. There is now strong evidence to show a direct relationship between a decreasing core temperature and increasing mortality rates in trauma patients, and hypothermia

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forms an integral part of the "Lethal Triad" of trauma along with acidosis and coagulopathy [1,5,9,11–15]. So strong is the correlation, that a separate classification has been now developed for hypothermia in trauma patients where hypothermia is described as mild if the core temperature is below 36 °C, moderate if below 34 °C and severe if below 32 °C. Jurkovich [16] reported 100% mortality in trauma patients with admission temperatures less than 32 °C and while more recent trials [17] show some survivors, the case fatality rates remain disastrously high.

It is clear, therefore, that preventing hypothermia is a priority in trauma patients. There are several different measures which can be used to this end, including warm blankets, increased ambient temperature, forced air-warming devices and in-line fluid warmers. These devices have been shown to be effective at raising core temperature [18–20] and reducing mortality [21] and they are now recommended by the ASPAN and the NICE guidelines for the prevention of intra-operative hypothermia [22,23]. Importantly for hospitals in developing countries, the measures above have also been shown to be cost-effective, as they obviate the need to treat the numerous complications of hypothermia [24,25].

A recent South African review article made a number of recommendations concerning temperature regulation methods, based on the best available evidence [26]. These concepts have been adopted by the Trauma Society of South Africa, the Emergency Medicine Society of South Africa, the National Core Standards committee and the Netcare Group as the gold standard of care for South Africa and are a marker against which all institutions can be measured. The review stated that the ambient temperature in emergency centres and operating theatres should be between 21 and 24 degrees Celsius to minimise the risk of hypothermia, and that the use of both in-line fluid warmers and forced air warming devices should be the standard of care in South Africa, especially if the patient presents hypothermic or undergoes a surgery longer than 30 min, and for all paediatric patients.

The goals set out above are readily achievable, even in a resource- constrained setting and require no special skills or knowledge. However, by observation, these goals seem far from accomplished, especially in the emergency centres where it appears optimal care for the patients is not realised. A search of available literature revealed that no similar study has been performed in the region.

The current study aimed to evaluate how well the emergency centres and operating theatres in Durban's major teaching hospitals are performing in terms of hypothermia prevention and management in trauma patients. Specifically, the objectives were firstly to determine if the hospitals had the necessary equipment and infrastructure to ensure normothermia, and secondly to determine if the equipment was being used correctly and frequently enough. These hospitals were selected since they manage the majority of emergency surgical patients in Durban (Kwa-Zulu Natal Province, South Africa), making it important that they have the necessary equipment and staff knowledge to provide the gold standard of care. Furthermore, these hospitals serve as training hospitals for Kwa-Zulu Natal's medical students and interns, and thus practices learnt here will be applied to patients in a multitude of other locations.

Methods

A descriptive, observational, cross-sectional study was undertaken with two arms. Firstly, an audit was performed of the emergency centres and emergency operating theatres of the five major teaching hospitals in Durban. The hospitals included one quaternary hospital, one tertiary hospital and three secondary hospitals. The hospitals are moderately sized (approximately 800 beds) and the trauma burden is large [27]. The objective was to determine the availability of the items used for prevention of hypothermia, specifically: forced air-warming devices, in-line fluid warming devices and fluid warming ovens. Appendix A illustrates the audit form used.

The second arm was a questionnaire-based qualitative assessment of the practices in each area with regards to the use of the equipment as well as frequency of temperature monitoring. For this arm, two participants (one doctor and one nurse) from each venue at each hospital were asked to complete the questionnaire (a total of 20 participants by convenience sample). The study was approved by UKZN-BREC Ethics Committee (BE461/14) and permission to conduct the study in public hospitals was provided by the Department of Health, KwaZulu-Natal.

All respondents were permanent employees in their department (trainees and rotational staff were excluded) and were advised specifically to answer according to what practices were prevalent at each hospital, not according to the respondent's individual practices. This was to minimise any possibility of variation in answers within each venue and give an indication of the performance of the venue rather than the respondent. This, combined with the study being purely descriptive meant that the sample size was adequate and no power analysis was necessary. The questionnaire had two sections – one for closed-ended questions where the most accurate answer was circled by the participant, and one for more open-ended answers. The answers of the closed-ended section of questionnaire were analysed in three pre-specified groups: answers that were "beneficial", "probably not beneficial" and "not beneficial". Beneficial answers were those representing actions or knowledge in keeping with best practice; Not Beneficial answers were those that represented actions/knowledge that have been shown to be associated with poorer patient outcomes and Probably Not Beneficial answers were those where the evidence was unclear or when the answer given was so close to beneficial it was deemed unlikely to cause patient harm (for example: setting theatre temperature 1 °C too low). The data from the closed-ended questions was entered into a spreadsheet on Microsoft Excel and then analysed with Strata 13. A p value of <0.05 was considered to denote statistical significance. A thematic analysis was done for the open-ended questions. Appendix B illustrates the questionnaire.

Results

The questionnaire was hand-delivered and a 100% response rate was achieved. The data collection took place over a 60 day period between May and June 2015 and data analysis followed thereafter. The audit revealed good availability of equipment across the operating theatres. In-line fluid warmers as well as fluid-warming ovens were present in 100% of operating theatres. Forced air-warming devices were also widely available (100% of operating theatre complexes had at least one working forced air-warmer), however one hospital did not have any of the device-specific blankets available and another reported that two of the theatre complex's three devices were currently out of order and had been for some time. The recording of daily temperature logs was only done at two of the theatre complexes, although both venues consistently reported values between 21 and 24 °C.

The audit of the emergency centres also revealed good availability of equipment. All but one emergency room had a fluid-warming oven. Two venues did not have an in-line fluid warming device and two of the five did not have a forced air-warming device in the emergency room. One venue reported that although they did not have their own forced air warmer, they could borrow one from the theatre complex if they thought it necessary.

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