Human factors in decision making in major trauma in Camp Bastion, Afghanistan

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ABSTRACT

INTRODUCTION The concentration of major trauma experience at Camp Bastion has allowed continuous improvements to occur in the patient pathway from the point of wounding to surgical treatment. These changes have involved clinical management as well as alterations to the physical layout of the hospital, training and decision making. Consideration of the human factors has been a major part of these improvements.

METHODS We describe the Camp Bastion patient pathway with the communication template that focused decision making at various key moments during damage control resuscitation and damage control surgery (DCR–DCS). This system identifies four key stages: ‘command huddle’, ‘snap brief’, ‘sit-reps’ (situation reports) and ‘sign-out/debrief’. The attitude of staff to communication and decision making is also evaluated.

RESULTS Twenty cases admitted to Camp Bastion with battlefield injuries were studied from 6 September to 6 October 2012. Qualitative responses from 115 members of staff were collected. All patients were haemodynamically shocked with a median pH of 7.25 (range: 6.83–7.40) and a median of 18 units of mixed red cells and plasma were transfused. In 89% of instances, theatre staff were aware of what was required of them at the beginning of the case, 86% felt there were regular updates and 93% understood what was required of them as the case progressed.

CONCLUSIONS The evolution of the hospital at Camp Bastion has been a unique learning experience in the field of major trauma. The Defence Medical Services have responded with continuous innovation to optimise DCR–DCS for seriously injured patients. Together with the improvements in clinical care, a communication and decision making matrix was developed. Staff evaluation showed a high degree of satisfaction with the quality of communication.

KEYWORDS

Trauma – Military – War – Afghanistan – Battlefield injuries – Gunshot wounds – Blast injuries – Landmines

Accepted 29 July 2014

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Damage control resuscitation (DCR) and damage control surgery (DCS) are established UK military doctrine for the initial management of severely injured patients.¹ However, taking the theory and converting it into a practical, workable solution has required a continuous process of meticulous data collection, research, audit and service improvement.² The actual patient pathway has therefore evolved significantly from the early days of the tented hospital to the present layout in the purpose built hospital.³ Each step in the patient transfer on arrival to Camp Bastion has been considered carefully, from the use of tourniquets⁴ at the point of injury in order to control catastrophic haemorrhage to the medical emergency response team.⁵ These medical teams arrive by Chinook helicopter to collect patients for transfer to Camp Bastion; the purpose is to bring care as far

forwards as possible and minimise the time to reach medical treatment.

Not only has clinical practice evolved but the physical floor plan has changed in Camp Bastion to improve the ergonomics of transfer. Furthermore, there has been a concentration on human factors to optimise leadership, teamwork and the multidisciplinary approach.⁶

The need for urgent treatment in the most severely injured patients, especially in a busy trauma hospital such as at Camp Bastion where multiply injured casualties are often evacuated from the battlefield to the emergency department (ED) in a short time, meant that established communication techniques sometimes failed to keep the team adequately informed and updated while dealing with the casualty.⁷ The authors of the ‘10 seconds for 10 minutes’ principle identified

in a simulation laboratory that even in emergencies, taking time to assess the situation, which aims to teach followership and leadership among other skills, improved decision making and made the team work effectively.⁸ The newly established *European Trauma Course* teaches teamworking and leadership, uses a five-second check done by the team leader on the arrival of the casualty, prior to the team starting work.^{9,10} This allows the team leader and team members an overview of the patient, which is vital to maintaining situational awareness and forming a mental model.

Both approaches place human factors and communications at the very centre of the management of sick patients. Similar evidence is published on the need for concentrating on human factors in the operating theatre.^{11–14} Best practice assumes good communication to sequence and coordinate the processes. This is taught in detail by the Defence Medical Services with intensive training for revision just before deployment.^{15–17} The World Health Organization (WHO) surgical safety checklist, introduced in 2009,^{18–20} helps to reduce ‘never events’ and improves briefing of the team.²¹ It has also been reported to reduce hospital mortality.²¹ It was not, however, designed to optimise communication in the rapidly changing situation faced by the ED and operating room (OR) teams dealing with a severely injured patient. A discussion paper published in 2012 therefore sought to improve and streamline communication specifically during the DCR–DCS sequence.²²

The patient pathway

Figure 1 shows a diagrammatic representation of the front end of the Camp Bastion hospital footprint while Figure 2

shows the communications system, known as the ‘Trauma WHO Checklist’. Virtually all injured patients arrived by helicopter, transferred either by the British or American teams landing at the helicopter landing site approximately 200 metres from the hospital. Transfer was by ambulance to the front of the ED with triage occurring at several stages in the process. The numbers below relate to the points on Figure 1:

1. Detailed information was sent directly from the Patient Evacuation Coordination Cell to the hospital, informing them of the type of incident as well as the number and severity of casualties due to arrive. This allowed the consultant of the ED to call out the trauma teams, and to allocate relevant resources and staff to the correct number of beds in the ED and theatres.
2. The ED consultant met the ambulances on arrival and allocated them to a resuscitation bay. Although this was usually decided in advance based on the radioed information, it occasionally changed again.
 - 2.1. While the patient was being unloaded by the reception teams, the senior transferring clinician (doctor or paramedic) gave the accepting team a briefing based on the ‘ATMIST’ handover system (Table 1). It was vital that the trauma team were disciplined and remained focused and silent during the handover. Often the prehospital doctor entered the ED prior to the patient, allowing for less distraction. However, if the patient arrived at the same time, he or she would only have been looked at to confirm there

Table 1 'ATMIST' handover	
A	Age of patient
T	Time of incident
M	Mechanism of injury
I	Injuries (from top to toe)
S	vital Signs
T	Treatments given so far

was no ongoing catastrophic haemorrhage or air-way obstruction. All other treatment commenced after the handover had finished.

3. The patient arrived in the resuscitation bay on a stretcher and was transferred to the hospital trolley. A <C>ABC approach⁴ to injury identification and management was followed under the leadership of the ED team leader using a horizontal resuscitation approach.²⁵
- 3.1. Occasionally, a severely injured patient with ongoing haemorrhage may have gone straight to the operating theatre without stopping in an ED bay, known as 'right turn resuscitation'.²⁴ (The direction of patient flow has evolved over recent years so readers will note from the floorplan that at the time of writing it was actually a left turn to the theatres.) In this case, the entire ED trauma team stayed with the patient to do the primary survey and identify injuries while the surgeon/anaesthetist managed the catastrophic haemorrhage.

- 3.2. Once the initial assessment was complete, the ED team leader called a 'command huddle' in conjunction with the anaesthetist and the senior surgeon, to establish appropriate treatment (or possible futility), which was usually going either to theatre, to computed tomography or straight to the ward.²²
4. The majority of patients with penetrating battlefield injuries went to the OR. On arrival, the anaesthetist called time out for a 'snap brief', modelled on the WHO checklist but streamlined specifically for the most urgent time critical patients. It must be remembered that unlike an elective operating list, these patients may arrive in theatre within minutes of arriving in the department so the theatre team could have very little warning of the patient or what to expect. As a result, it is essential that the key information is communicated to the entire team in a set format to make sure that nothing is missed.
5. The time of the start of surgery was noted on a board in theatre and documented during the snap brief so that the importance of time was not lost.
 - 5.1. The situation changes rapidly during DCS as new injuries are discovered and the patient's physiology fluctuates in regard to his or her injuries and treatment. Furthermore, multiple surgical teams could be working on the same patient. 'Sit-reps' (situation reports) were used every 10–30 minutes to keep the team updated of progress. The mnemonic 'TBCS' helped the team leader to remember the critical information to be covered (explained in more detail in Appendix 1 – available online.) Bringing the vital physiological parameters and the surgical progress together like this regularly helps reduce the risks of tunnel vision or loss of situational awareness. It also focuses the team to review their surgical plan and change it if necessary.
6. At the end of surgery a 'sign-out' should be done. At Camp Bastion, the intensive care unit (ICU) team came to collect the patient. The sign-out is essential for both the surgeons and the anaesthetist to inform the receiving ICU team as well as all the other members of the theatre team about the patient's injuries, what has been done and what is left to do. By definition, DCS will focus on the critical injuries causing haemorrhage or contamination so many things will have been left to be dealt with at second-look surgery when the patient's physiology has improved.
 - 6.1. A debrief was done at the end before the team dispersed to other activities. This is important for clinical feedback and also to allow staff to express their feelings about the sometimes complex emotional, moral and ethical dilemmas with which they have dealt.
 - 6.2. Further analysis of the case continued over the following days, including a weekly telephone conference morbidity and mortality meeting that involved both the Queen Elizabeth Hospital in Birmingham

and the US medical facility in Landstuhl, Germany, until all learning points had been extracted and dealt with.

Methods

Approval was obtained from the director of the Joint Medical Command prior to the start of the project (RCDM/Res/Audit/1036/12/0230) as well as from the deployed medical director of the hospital. Theatre staff attitudes to communication during the management of major trauma were investigated by means of a standardised questionnaire. This was prepared with advice from experts in psychology and communication, and included 12 questions as well as a visual analogue scoring system. This was used to get information on the case and record the reactions of all members of the team associated with the case. Free text was also used to allow staff to express their personal opinions. The questionnaire was confidential. The case inclusion criteria were that the patient was severely injured and required DCS.

Although the Trauma WHO Checklist paper had already been published²² and widely distributed in predeployment training, the surgeons, anaesthetists and theatre staff were briefed again in Afghanistan prior to the start of the project on the format for communication during cases in which it was likely that DCR–DCS would be required. Posters were placed around the theatre as an aide-mémoire for the communication system proposed. Data were anonymised for both the patient and the staff, and recorded on a standard Excel® spreadsheet (Microsoft, Redmond, WA, US).

Results

Twenty cases were studied in a thirty-day period during September 2012. Responses from 115 members of staff were collected. Patients were all admitted to the hospital at Camp Bastion with either gunshot or blast injuries. They were haemodynamically shocked with a median pH of 7.25 (range: 6.85–7.40), a median base excess of -7mEq/l (range: 0–24mEq/l) and a median lactate of 4.99mmol/l (range: 1.9–14.6mmol/l). A median of 18 units of mixed packed red cells and fresh frozen plasma were transfused (9 units of each in a 1:1 ratio). The median time from arrival to the first incision in theatre was 56 minutes (range: 3–110 minutes). There was one death in this group.

The 115 responses from staff are shown in Table 2 (30 from surgeons, 23 from anaesthetists, 18 from operating department practitioners, 18 from scrub nurses, and 26 from others such as runners and transfusion staff). Overall, 88% of the theatre staff either agreed or strongly agreed that they were aware of the injuries at the beginning of the case, 91% said there were regular updates during the case and 99% understood what was required of them as the case progressed. Teamwork was found to be effective by 95% of staff members and the same proportion believed there was good communication throughout the case. Over two-thirds (69%) felt that regular sit-reps contributed to

Table 2 Results of questionnaire for optimising communications

Please answer the following questions by circling one response only, using the scale below.

0		1	2	3	4			
Disagree strongly		Disagree	Neutral	Agree	Agree strongly			
At the start (ie after the snap brief)								
				0	1	2	3	4
Q1	At the start, were you aware of the patient's injuries?			3%	6%	4%	20%	68%
Q2	At the start of the operation, did you understand the surgical plan?			1%	2%	9%	19%	69%
Q3	Did you know what was required of you at the beginning of the case?			1%	1%	2%	11%	85%
During the case								
Q4	Were there regular updates during the case?			1%	4%	4%	20%	71%
Q5	Were changes or problems during the case communicated effectively to the entire team?			0%	1%	11%	20%	68%
Q6	Did you feel that you knew what was happening during the case?			0%	2%	4%	21%	73%
Q7	Did you know what was required of you as the case progressed?			0%	0%	1%	7%	92%
Communication								
Q8	Did the team work effectively throughout the case?			0%	2%	6%	15%	78%
Q9	Was there good communication during the operation?			1%	4%	2%	20%	73%
Q10	Did you feel regular sit-reps helped to improve communication?			0%	6%	15%	20%	58%
Q11	Did you feel that you could communicate freely during the case?			0%	4%	3%	10%	83%
Q12	Were regular sit-reps helpful?			3%	7%	21%	34%	35%

improved communication with only 10% feeling that they could become annoying or unhelpful. Free text was allowed to feed back specific comments (Table 3).

Discussion

The medical treatment facility at Camp Bastion has been a unique environment for the treatment of the severely injured since it opened in 2006. A process of data collection, audit and service improvement has led to continual innovation and improvement.²⁵ DCR-DCS is now the standard of care for the severely injured patient,^{1,26} and every step in the pathway from point of wounding to the evacuation back to the UK has been considered in detail to minimise the delays and optimise treatment. With the closure of the hospital, we feel it is important to capture the logistical and clinical changes that occurred during its lifetime.

In the complex environment of managing major trauma, teamwork and non-technical skills are essential for peak performance.^{12,14,16,17,27} Training started for the entire theatre team before arrival in Camp Bastion in the form of a 72-hour whole-hospital simulation.²⁸ Care was consultant-delivered throughout the patient journey, unlike in the National Health Service where it is often only consultant-

led.²⁹ It is this relatively recent acceptance of the complexity of both medicine in general and the operating theatre environment in particular³⁰ that led to the development of the checklist. Gawande found that this produced a 36% reduction in complications and a 47% reduction in deaths.³¹ The result was the worldwide acceptance of the WHO checklist^{18,19} and the British Defence Medical Services formally introduced it to the hospital at Camp Bastion in 2010.

The original WHO checklist includes 19 questions and takes approximately 2–5 minutes to complete. Unlike most surgery, where the operation is seen as a distinct entity from the preoperative or ward phase and the operative plan is clear at the preoperative stage, severely injured patients require treatment along the DCR-DCS sequence in which resuscitation, identification of injuries, rapid surgical control of bleeding and management of life threatening injuries are integrated seamlessly and occur concurrently.¹ Human factors are essential in maintaining good teamwork.^{16,17} However, a single point checklist such as the WHO checklist is not sufficient to promote optimal intraoperative team communication because the knowledge of the injuries sustained and the dynamically changing physiological derangement requires the surgical management plan to evolve in light of this change.

Table 3 Free text comments from theatre staff**Comments**

Anaesthetist: Unstable patient. Comms very helpful to understand what was going on and how to proceed.

Anaesthetist: Feel the sit-reps formalises what is already done. Will probably become more user friendly with repetition.

Operating department practitioner: Patient's injuries were not obvious and as patient hadn't had a CT I knew what was required of me but at times I felt overwhelmed with tasks. Sit-reps worked well to tie everything together.

Surgeon: The patient had dropped systolic blood pressure down to 60 without the surgical team being informed. Poor communication but problem highlighted by the sit-reps.

Scrub nurse: The sit-reps were done at a time dictated by the anaesthetist. This made the operation and communication more smooth.

Transfusion team: This was the best case I've worked on yet. The anaesthetist was extremely professional. He discussed the plan at logical intervals, he explained his clinical decisions, plans for products and follow-up tests were talked about with enough time to react. I appreciated his teaching with me as well. I was also glad when the surgeons discussed their plans at the beginning and could gauge some of the ups and downs ahead to communicate product needs to emergency department staff. Back in the emergency department also at the beginning, the anaesthetist told us the target BP so at any given time, it was open communication to discuss a bolus. Great case. Thank you.

The fact that the hospital at Camp Bastion was probably one of the busiest major trauma units in the world provided the background against which we could trial a specific protocol of communication for trauma. Following discussions within the Defence Medical Services, it was felt that to promote good communications for severely injured patients, these would need to start in the resuscitation room, continue throughout the operation and finish with a formal sign-out; debrief should be done at this point as the trauma team will usually disperse rapidly.

All military doctors, nurses and theatre personnel involved were trained jointly in both trauma management and teamwork. This occurred using cadavers for DCS and high fidelity simulation for teamwork on the *Military Operational Surgical Training* course.¹⁵ Furthermore, to learn to how to manage casualty flow, a whole-hospital simulation in a hanger was used. Considered vital in all aspects of military activity, clear communication is confirmed by the fact that 96% of respondents had a clear understanding of their role at the beginning of the case and that 99% understood what was required of them as the case progressed reflects the fact that teamwork is already well honed in this small group of clinicians. The biggest single innovation for this project was the addition of the sit-reps, which formalised the communication during the progress of the case.

Having some flexibility in the timing of sit-reps was found to be beneficial (eg waiting for the results of the blood gases or thromboelastometry). Recognition that a key part of managing the trauma patient is at the time of transition from the OR to ICU led to the addition of the sign-out so that it could be made clear to all staff and the team accepting the patient exactly what had been performed as well as the goals for management for the next few hours and days.

By identifying just a few key moments in the management of complex trauma, we can focus minds on the importance of good communication even when the team is engrossed in performing DCS. This concept was well illustrated by the '10 seconds for 10 minutes' principle.⁸ The

major advance on the WHO checklist described in our guideline is the use of the sit-reps, which seek to continue good communication practice in the intraoperative phase and to remind the team of maintaining a dialogue.

Although this concept was already well known, it is frequently characterised by open questions such as 'how are things going?' while responses such as 'we are keeping up' are too vague to allow for meaningful dialogue and decision making. A simple protocol based on the mnemonic 'TBCS' reminds us of the importance of giving a minimum dataset of information to get a fuller picture of the patients' problems, their current physiological status and the evolving surgical plan. It does not intend, however, to reduce other forms of communication that may be considered relevant. Gawande found one unexpected result of the original WHO checklist: it seemed to improve management in areas not covered by the checklist presumably by facilitating better communication.³⁰ We had similar findings, reflected in the comments of the trauma team (Table 3).

Conclusions

This article has described the Camp Bastion system of major trauma management, in which every moment of the patient journey has been considered. Numerous improvements in clinical management have been described including DCS,¹ use of thromboelastometry³² and massive transfusion protocols.³³ In addition, human factors and good communication have been placed at the very centre of our management approach. Identifying key moments for vital communication in the DCR-DCS process and, in particular, the introduction of sit-reps has further enhanced the communication in an already good team. As with all guidelines, repeated use will encourage all the team members to become comfortable with the terms and the process. We would therefore recommend that this guideline be introduced for communication in DCR-DCS and be taught as part of the team preparations.

Acknowledgements

The authors would like to thank the staff of Herrick 16B and Colonel James Ralph (Deployed Medical Director) for their participation in this study. We are also grateful to Professor R Flin and Mr M de Rond for their advice in preparing the visual analogue questionnaire.

The views expressed in this paper are those of the authors and not of the Ministry of Defence.

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