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Can residents be effective trauma team leaders in a major trauma centre?

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ABSTRACT

Objective: The overall objective of this study was to compare senior Emergency Department (ED) trainees (residents) with consultant trauma team leaders, assessing their influence on trauma team performance and patient outcomes. We aimed to identify the effect of seniority of leader on time-based performance measures and clinical outcomes.

Methods: This retrospective study of prospectively collected data was conducted in an urban Major Trauma Centre which has a well-established trauma team. For the period covered by this study the trauma team was led by either an ED consultant or specialist registrar having completed a local trauma team leader development programme. Data from all adult trauma team activations for seriously injured trauma patients (ISS – Injury Severity Score >15) presenting between 1st January 2008 and 31st October 2009 were included. Performance measures included time to FAST, time to CT scan and time to haemorrhage control. Patient outcomes were mortality, critical care and hospital length of stay.

Results: There were 579 patients seriously injured in the study period. Trainees led 126 (22%) of the trauma teams. Significant differences in times to diagnostics or haemorrhage control between trainees and consultants were only seen in patients presenting with shock. Compared with trainees, consultant team leaders were significantly more likely to achieve targets for diagnostic imaging (FAST <15 min: consultants 97% vs. 33% trainees, $p < 0.01$; CT scan <60 min: 76% vs. 50%, $p < 0.01$) and haemorrhage control (surgery or angiography <60 min: 82% vs. 54%, $p < 0.001$). There was no significant difference in overall mortality between consultants and trainees (consultants 25% vs. trainees 27%, p 1.00). Critical care length of stay was also the same for both (consultants median 5 days vs. trainees median 5 days).

Conclusions: Consultant team leaders improve team performance, resulting in shorter times to diagnostic imaging, and faster transfer to haemorrhage control. The greatest benefit seems to be for bleeding patients. Clinical outcomes were similar for trainees and consultants in our major trauma centre.

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Introduction

The acute management of trauma patients is conducted by a multidisciplinary team working in parallel for rapid diagnosis and management.[1] Effective leadership is important for team organisation and efficiency.[2] Many regional trauma systems around the world specify that the trauma team should be led by a senior doctor (consultant or attending grade).[3–6] Despite this, evidence suggests that residents (senior trainee doctors) are expected to lead trauma teams,[7–9] due to staff rota restrictions and financial issues.

The evidence analysing the seniority of trauma team leaders is limited and conflicting. Only one historic study has identified seniority as a factor influencing the time taken in patient assessment, although team leaders had on average only 4 postgraduate years of training.[1] A subsequent study from the same group found experienced team leaders to have longer resuscitation times.[10] A comparison between consultant and very junior (intern grade) trauma team leaders (TTL) demonstrated step-wise improvement in patient outcome with seniority.[11] A more recent report on the care of major trauma care in the UK incidentally noted significantly worse outcomes with trainee team leaders but did not account for trainee grade, hospital type or case mix.[12] There has been little research into whether senior trainees can deliver optimal trauma care through effective trauma team leadership.

The overall objective of this study therefore was to compare our senior ED residents with consultant trauma team leaders,

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assessing their influence on trauma team performance and patient outcomes. We aimed to identify the effect of grade of trauma team leader on time based measures of the process of care. We specifically chose to examine the subgroup of shocked patients as these are known to be the most time critical patients and likely to benefit from improved processes of care.[13–17] Second, we wished to determine whether any identified process improvements translated into better clinical outcomes in terms of mortality or hospital stay. We also wished to examine whether preventable mortality was altered by the presence of a resident. We conducted a retrospective study of severely injured trauma patients before implementation of a regional trauma system that mandates consultant trauma team leaders.

Methods

Study setting

The Royal London Hospital Major Trauma Centre has a well-established trauma team. For the period covered by this study the trauma team was led by either an Emergency Department (ED) consultant or specialist registrar (resident or trainee doctor of between 5 and 8 years of postgraduate training). The criterion for choice of team leader was dictated by consultant availability rather than severity of patient injury. The consultants' rota covers ED clinical shifts 24 h a day, Monday to Friday, and 6 h on Saturday and Sunday. Subsequent inpatient trauma care is managed by surgical and anaesthetic teams. Irrespective of grade of team leader, trauma team composition and resources, such as access to diagnostic imaging or surgery do not alter across weekday or weekend hours.

Trainees and newly appointed consultants are orientated to the role of TTL on induction to the ED. This is followed by a local TTL training programme comprising clinical, behavioural and leadership skills taught via didactic lecture, group discussion and simulation. Prior to independently undertaking the role of TTL, trainees and new consultants are observed and assessed by an experienced ED consultant.

Sample

We included all adult trauma team activations (patient age $\geq$16 years), with an ISS $>$ 15 presenting between 1st January 2008 and 31st October 2009. Based on preliminary data from 100 patients we calculated a sample size of 550 patients to identify a 12% increased mortality with trainees as trauma team leaders compared to consultants (uncorrected χ^2 test; power 0.8; α 0.05; 4:1 consultant to trainee team leader ratio). The study was approved by the internal ethics board.

Data collection

Demographic data collected included age, gender, mechanism of injury, injury severity score (ISS), day and time of arrival (Day: 08:00–20:00; Night: 20:01–07:59), base deficit (BD) and systolic blood pressure (SBP). Shock was defined as SBP of $\leq$90 mmHg or BD $>$6 mmol/l on first measurement in the ED. Process measures used as threshold values in trauma system design[4,5,7] were chosen: time to FAST, time to CT scan and time to haemorrhage control (operative intervention or angio-embolisation). Patient outcomes included: mortality, critical care unit (ICU), length of stay (LOS) and hospital LOS.

All trauma deaths are reviewed in our trauma performance improvement programme to identify opportunities for improvement. The American College of Surgeons' (ACS) performance improvement model[16] was used to classify by consensus each death as non-preventable, possibly preventable, probably preventable or preventable. Although a subjective process, this has been shown to produce robust and consistent analysis of clinical and system failures and a standardised process in trauma care.[17–20]

Data analysis

Statistical analysis was performed using GraphPad PRISM v5 (GraphPad Software Inc., San Diego, CA, USA). Percentages were analysed using chi squared or Fisher's exact tests and medians using Mann Whitney *U* test. Multivariable analysis was used to assess impact of the day and time on process of care measures. Variables with $p < 0.10$ on univariate analysis were included in multivariable analyses. A p value of <0.05 was considered statistically significant.

Results

In the twenty-two month study period, there were a total of 2839 adult trauma team activations, of which 579 patients had an ISS $>$ 15. Consultants led 453 trauma teams (78% – Table 1). There was no difference in penetrating injury rates or ISS for both groups, but patients seen by consultants were slightly older (36 vs. 31 years, $p = 0.01$). Consultants were more likely to lead the team in normal working hours (52% vs. 21%, $p \leq 0.01$) and less likely to lead the team at night on weekends (8% vs. 43%, $p \leq 0.01$).

Performance measures

For all patients, FAST scans were completed 2 min faster ($p = 0.04$) when consultants were team leaders, and 8 min faster for shocked patients ($p = 0.07$, Fig. 1A). More nonshocked patients had a FAST scan within 15 min with consultants than trainees (consultants vs. trainees: 78% vs. 64% – Fig. 1B) but this did not achieve significance. When managing a shocked patient only one-third of trainee-led teams achieved this target compared to almost all consultant-led teams (consultants vs. trainees: 97% vs. 33%, $p < 0.01$ – Fig. 1B). Overall there was no difference in time to CT scan between consultant and trainee TTLs (Fig. 1C), however consultants were more likely to obtain a CT scan within an hour for shocked patients (consultants vs. trainees: 76% vs. 50%, $p < 0.01$ – Fig. 1D). Multivariable analyses including day (week or weekend) and time of arrival with seniority of team leader did not reveal any confounding effect of ease of access to diagnostics for both time to FAST and time to CT.

In both all cases and in shocked cases, consultants transferred patients to definitive haemorrhage control 20 min faster than trainees (Fig. 1E). Patients presenting in shock were significantly more likely to be transferred to haemorrhage control within an hour if the trauma team was consultant led (consultants vs. trainees: 82% vs. 54%, $p < 0.01$ – Fig. 1F).

Outcomes

Mortality was not significantly different between groups for all severely injured patients or those presenting with shock (Fig. 2). Consultant led trauma teams were associated with a 6% lower absolute mortality for critically injured patients (ISS $>$ 24 – consultants vs. trainees 28% vs. 33%, p 0.39) and an 8% mortality reduction for those requiring haemorrhage control (consultants vs. trainees 44% vs. 52%, p 0.30), but neither achieved statistical significance. In a multivariable analysis of seniority of team leader, time of day, day of week and including admission physiology, mechanism of injury and age, there was no effect of seniority of team leader on mortality. There was no significant difference in the proportion deaths with an element of preventability (either

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