Reduction of time to definitive care in trauma patients: effectiveness of a new checklist system

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Accepted 10 August 2002

Abstract
This study evaluated the feasibility of establishing a new trauma transfer checklist and assessed its impact on trauma-related interhospital transfers.

A standard envelope with a printed checklist (N.E.W.S.) incorporating four key concepts in the care and transfer of trauma patients was used.

A prospective comparison of consecutive interhospital trauma transfers to the major trauma service between July 1999–May 2000 (pre-N.E.W.S.) and August 2000–November 2000 (post-N.E.W.S.) was made. Changes in management satisfaction were assessed by a Likert scale (1 = poor to 5 = excellent).

Pre-N.E.W.S., 88 trauma patients were transferred and 20 trauma transfers were recorded post-N.E.W.S. The time to definitive care pre-N.E.W.S. was 443 ± 322 min, and 339 ± 108 min (P = 0.014) post-N.E.W.S. The time in the referring hospital was also reduced from 343 ± 310 min pre-N.E.W.S. to 197 ± 90 min post-N.E.W.S (P = 0.0002). The checklist system prompted changes in the management of the trauma patient in 20% of the cases and there was a high level of satisfaction expressed by users of the checklist (4.6 ± 0.7).

The N.E.W.S. checklist is effective in facilitating the interhospital transfer of trauma patients by shortening the time to definitive care.

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1. Introduction

Interhospital trauma transfer is a fundamental part of all trauma systems [6,12]. Despite the wider adoption of Advanced Trauma Life Support (ATLS) [5], prolonged time to definitive care has been identified as an issue preventing optimal care of injured patients [1,8,16]. Early transfer of severely injured patients to a major trauma centre has been shown to be associated with better survival [1,18].

Errors in interhospital trauma transfers, such as inadequate airway maintenance or inadequate cervical spine immobilisation, are well recognised in Australia and overseas [1,8,13]. Checklists are commonly used in the field of medicine, and safety benefits associated with their use have been demonstrated [10,15].

Previous research in South Western Sydney Area Health Service (SWSAHS) has identified that delays in interhospital trauma transfers and prolonged times to definitive care are not uncommon [3].

The aim of this study was to evaluate the feasibility of establishing a new trauma transfer checklist and to assess its impact on both the time taken for interhospital trauma patient transfers, and on patient management and interventions by the referring hospital.

2. Materials and methods

South Western Sydney is a region of 6512 km² with a population in excess of 750,000. It has four urban and one rural hospitals [14]. Liverpool Hospital is the designated Major Trauma Service (MTS) for the region; it has 520 beds, including 22 Intensive Care Unit beds. Since 1995, the Hospital has had a dedicated direct access phone number (Trauma Hotline 02-9828-3666) for regional hospitals to access and arrange transfer of a multiply injured trauma patient. Since 1994, all patients admitted to Liverpool Hospital have been prospectively entered into a computerised trauma registry by three trauma nurses skilled in trauma data collection and trauma scoring [3].

A checklist incorporating four key concepts in the care and transfer of trauma patients was designed (Fig. 1). The checklist was chosen to enhance the existing concept and
order of the “ABC” of ATLS. It was designed to highlight four key practical principles of trauma patient management: (1) Is a procedure necessary?; (2) Is the intervention enough or sufficient for the patients needs?; (3) Has the intervention worked satisfactorily?; (4) Is everything secured for transport purposes? Hence the acronym “N.E.W.S.” (Necessary, Enough, Working, Secure).

A standard radiograph-sized envelope was used and printed with the N.E.W.S. checklist on the front cover. This allowed inclusion of all patient radiographic imaging and photocopied documentation. The envelopes were distributed to all urban and rural hospitals and educational sessions were conducted over a two month period. Every interhospital trauma patient transfer was followed up by a telephone interview with the regional trauma co-ordinator: four questions asked of the referring doctor pertained to awareness, usage, alterations in patient management as a result of the checklist, and satisfaction level of the N.E.W.S. checklist, recorded by the Likert scale (1, poor; 2, below average; 3, average; 4, above average; 5, excellent). If the checklist was not utilised, reasons for this were obtained and positive reinforcement was used to encourage future use.

Patients transferred between July 1999 and May 2000 (pre-N.E.W.S.) were compared to the first 20 patients that were transferred using N.E.W.S. (August 2000–November 2000, post-N.E.W.S.). Data collected included patient demographics, mechanism of injury, injuries sustained, injury severity score (ISS), time spent at referring hospital and time to definitive care.

The time intervals evaluated are defined and shown in Fig. 2. The pre-hospital time was the time from ambulance notification to arrival at the referring hospital. Referring hospital time was defined as the interval from patient arrival to departure at the referring hospital. Transit time was defined as the interval between leaving the referring hospital and arriving at Liverpool Hospital. Time to call the hotline was the time from patient arrival at the referring hospital to placement of a “hotline” phone call to initiate the interhospital patient transfer. The time to major trauma service is the

<table>
<thead>
<tr>
<th>Key</th>
<th>Please check each item</th>
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<tbody>
<tr>
<td>Airway</td>
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<tr>
<td>Breathing</td>
<td>Oxygen</td>
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<td>Circulation</td>
<td>Volume</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>X-Rays (Chest – C Spine – Pelvis)</td>
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<tr>
<td>Equipment</td>
<td>ECG</td>
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<tr>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Gastric Tube</td>
<td></td>
</tr>
<tr>
<td>Handover</td>
<td>MIST</td>
</tr>
</tbody>
</table>

**Fig. 1. N.E.W.S. checklist (completed by referring doctor).**

**Fig. 2. Time intervals used for analysis.**
Table 1: Demographics of interhospital trauma transfers: patients before and after introduction of N.E.W.S.

<table>
<thead>
<tr>
<th>Mechanism of injury</th>
<th>Pre-N.E.W.S. (n = 88)</th>
<th>Post-N.E.W.S. (n = 20)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road trauma</td>
<td>29 (33.0)</td>
<td>6 (30.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Falls</td>
<td>17 (19.3)</td>
<td>3 (15.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Interpersonal violence</td>
<td>24 (27.3)</td>
<td>4 (20.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Industrial</td>
<td>4 (4.5)</td>
<td>2 (10.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Recreation</td>
<td>10 (11.4)</td>
<td>3 (15.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Other</td>
<td>4 (4.5)</td>
<td>2 (10.0)</td>
<td>NS</td>
</tr>
</tbody>
</table>

The percentage values are shown in parenthesis.

Table 2: Time intervals (minutes) for interhospital trauma transfers pre- and post-N.E.W.S.

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Pre-N.E.W.S.</th>
<th>Post-N.E.W.S.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time in referring hospital</td>
<td>343 ± 310</td>
<td>197 ± 95</td>
<td>0.001</td>
</tr>
<tr>
<td>Time to call hotline</td>
<td>112 ± 80</td>
<td>122 ± 95</td>
<td>0.65</td>
</tr>
<tr>
<td>Time to definitive care</td>
<td>443 ± 322</td>
<td>399 ± 108</td>
<td>0.014</td>
</tr>
</tbody>
</table>

Between July 1999 and May 2000 (pre-N.E.W.S.), 1683 trauma patients were admitted to the Liverpool Hospital. Interhospital transfer was responsible for 88 (5.2%) admissions. Between August and November 2000 (post-N.E.W.S.), 635 trauma patients were admitted to Liverpool Hospital. Interhospital transfer was responsible for 20 (3.1%) of these admissions. There were no statistically significant (NS) differences between these two groups with respect to age, ISS, or mechanism of injury (Table 1).

Both times in referring hospital and to definitive care were significantly shorter post-N.E.W.S. (Table 2). Time to call the hotline to effect the transfer was not affected by the checklist. Of the 20 transferred patients in which the N.E.W.S. checklist was used, it prompted changes in management in 20% of cases. Examples of management changes included insertion of a naso-gastric tube for an intubated patient, determining priorities of care for a patient, placement of intravenous (i.v.) lines, and performance of a trauma series of X-rays. There was a high level of satisfaction expressed by the users of the checklist, with a mean Likert scale of 4.6 ± 0.7.

4. Discussion

This study has identified that the use of a novel trauma checklist shortened the time to definitive care in 20 consecutive interhospital trauma transfer patients. Patient management was altered and necessary procedures were prompted by the checklist prior to arrival of the transport team.

In this study, interhospital transfers accounted for 5.2% of total trauma admissions to the major trauma service before N.E.W.S. and 3.1% after N.E.W.S., which is considerably lower than the 25–34% reported by previous investigators in Australia [4,6]. These previous studies, conducted in the late 1980s, were based on state-wide surveys before establishment of a regional trauma system. The present study was based on a single Area Health Service (portion of the state only) with patients transferred to one designated major trauma service. A state-wide Trauma Plan implemented in 1991 [14], prompted changes in trauma team responses, pre-hospital triage, and transport decision making such that severely injured patients are taken directly to a major trauma service, bypassing regional hospitals. This then partly explains the low ISS of our transferred trauma patient population. If pre-hospital triage guidelines are respected, patients with life threatening injuries are brought from the scene directly to the major trauma service, therefore reducing the need for further interhospital transfer.

The implementation of a regional trauma system and improvement in pre-hospital triage had a major influence on the reduction of interhospital transfers of injured patients to the major trauma service.

Time spent in the referring hospital was significantly shorter in this series of patients after the implementation of the N.E.W.S. checklist. Ten years ago, Deane et al. [6] identified many factors contributing to delays in transferring trauma patients. These included delay in clinical assessment of the patient by inexperienced staff, as well as initiation of inappropriate and time-consuming investigations. Beddington et al. [2] as well as Ehrenwerth et al. [7] found that failure to complete necessary procedures prior to arrival of the transport team contributed to an increased time to transport. The N.E.W.S. checklist helps the referring hospital staff to focus on the essentials of a trauma patient management and sensitises staff to the need for a quick and effective interhospital transfer for trauma patients needing a higher level of care than the one that can be offered at the referring hospital.
Time to definitive care is a sum of many time intervals, as described by Spaite et al. [17]. In the process of trauma patient transfer, the longest time interval is the time spent at the referring hospital [6]. The N.E.W.S. checklist targets this specific interval to most effectively reduce the overall time to definitive care.

Previous reports indicate that vital pre-transfer procedures are often not completed by referring doctors [9,11]. These include manoeuvres, such as securing an airway and insertion of a first or second intravenous line. In our study as well, insertion of a first or second intravenous line was sometimes prompted by the checklist. These procedures can often delay transport from a referring hospital when a transport team arrives and are best performed prior to this.

5. Conclusion

Interhospital trauma transfers are necessitated by regionalised systems of trauma care and have become common practice throughout the world.

Implementation of a trauma transfer checklist reduced the time for definitive care for interhospital trauma transfer in this system and also altered management in many patients. Adaptation of a similar process may be similarly effective in other regional trauma systems striving to shorten the time to definitive care for trauma patients and achieve better overall patient care.

References