Two Tiered Trauma Call Activation System

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Two Tiered Trauma Team Activation

**Background**

- Trauma Team Activation (TTA) plays a role in the timely and efficient management for selected trauma patients.
- East Surrey Hospital is a Trauma Unit (TU) with an important role in the regional trauma network and received 1759 trauma patients in 2017 out of which 1001 had TTA [1].
- Patients who had not received TTA were seen in the routine queue in the Emergency Department (ED) and consequently some of them suffered delays in assessment, CT and longer length of stay [1].
- Literature agrees that patients who are undertriaged and do not receive TTA may suffer in terms of increased mortality and morbidity [2].
- Our own TARN audit also identified two important shortcomings:
  (i) a significant proportion of severely injured patients have not received TTA (undertriage) and
  (ii) the quality of care provided to the highest acuity of patients was under the expected level.
  (iii)
- Our departmental audit has also investigated the current TTA criteria to establish the under- and overtriage ratio and concluded that the sensitivity and specificity for ISS>15+ patients were 46% and 1.4% respectively [3]. This suggests a considerable safety concern as well as a significant burden on the Trust.

In the past we have tried to increase safety by increasing the number of TTAs: implementing wider TTA criteria and excluding the possibility of involving senior clinical decision. All patients who fitted into any criteria for TTA had a TTA response. 82% of TTA was activated purely on the basis of perceived mechanism of injury [3]. The result was an increased TTA (currently an average of 3 TTA per day) which has increased the overtriage ratio above 90% while the undertriage has remained around 53%. The American College of Surgeons College on Trauma (ACS-COT) maintains that acceptable rate of over- and undertriage is 25-50% and 2-5% respectively. [4]

In order to increase safety (reduce undertriage) and at the same time reduce waste (overtriage) and save considerable resources for the Trust a new two tiered trauma team activation system was modelled onto the existing trauma audit data. The result suggests that the two tiered TTA would be able to capture most of the severely injured patients but would reduce the burden of a hospital wide trauma team response significantly [3].

The main concept of the two tiered system is based on the assumption that the Emergency Department is able to respond and manage trauma patients adequately provided that the patient does not need the specific interventions necessitating the involvement of other specialist skills. Evidence suggests that these patients are managed equally well in the ED as long as the ED response is structured and prioritised and supported by the appropriately prioritised diagnostics (Tier1 TTA) [5]. Patients who would likely need multi-specialty intervention would receive hospital wide trauma team activation (Tier 2 TTA).
**Aim of the new system**

Provide safe clinical care for trauma patients

- Identify patients with potential severe injuries for Trauma Team Activation (TTA)
- Provide a priority assessment by trained and skilled professionals
- Expedite the diagnostic processes including radiology imaging
- Provide emergency interventions as necessary by the appropriately skilled professionals
- Create and maintain a sustainable system in terms of resources and human factors
- Increase Trust compliance with Network and TARN objectives

**Identifying patients for Tier 1 and Tier 2 TTA**

Information received from the prehospital providers (Ambulance, HEMS) or obtained on arrival (triage) will determine the level of TTA needed

The information collected will be

- Vital signs (RR, SpO2, Heart rate, Systolic Blood pressure, GCS)
- Anatomical signs (Visible injuries: amputation, penetrating injury, burn, high suspicion of pelvic or long bone injuries/deformities; neurological deficits)
- Mechanism of injury (history, suspected energy)
- Individual factors (age, anticoagulant use)

In general, patients with signs or high risk of clinical deterioration potentially need emergency intervention to resuscitate, stabilize or damage control. These patients will benefit from multi-specialty team input and will need a Tier 2 TTA (Hospital Trauma Call). [6]

Patients who are in risk of suffering severe injury due to the known mechanism of injury or specific individual risk factors but does not show signs of clinical deterioration or high likelihood of the need for emergency interventions (like penetrating injuries, significant amputation, significant burns - these would need Tier 2 Hospital TTA) would benefit from a priority assessment and Tier 1 TTA (ED Trauma Priority).

There is evidence in the medical literature that a tier 1 TTA provided by ED clinicians would be equally effective to reduce the mortality and morbidity of this patient group [7] [5] [8]. The Tier 1 (ED Trauma Priority) can be escalated to Tier 2 TTA at any time when needed and evidence suggests that the delay of tier 2 TTA in these cases does not have negative effect on mortality or morbidity [9] [10].

Patients who has no clinical or anatomical signs of severe injury, suffered only minor mechanism of injuries and has no individual high risk factors (age, anticoagulant use) would be seen and triaged as the routine on arrival to the ED. No TTA is needed but keep the options open to escalate to either Tier1 or Tier2 TTA on arrival upon the results of a detailed triage.
TTA will be initiated by the nurse or practitioner who takes the call from the ambulance or performs the triage on arrival (Figure 1). The level of TTA tier will be determined by strict but simple guidelines (see Tables 1 and 2) and need no further input from any clinician. In the rare cases of uncertainty the senior shop floor leader should be asked (consultant or in absence the nurse in charge) and their advice followed - general rule is to err on the safe side.

The two-tiered TTA is not new; it has been widely used both in the UK and elsewhere and evidence suggests it is a safe and efficient system as long as the activation criteria audited and tailored to the individual population characteristics [11] [12] [13] [14] [15] [16].

**Figure 1: Two Tiered Trauma Team Activation**

**Tier 1 TTA: ED Trauma Call Priority**

Goal of the Tier 1 TTA is to

- Provide priority assessment of selected trauma patients with a potential severe injury (tier 1) by ED senior trauma provider
- Escalate to tier 2 TTA as and when necessary in order to provide multi-specialty input for interventions, diagnostics or decision making
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- Provide high quality care for patients who could be safely and efficiently managed within the ED (including diagnostics, interventions, decision making, disposition)

Patients selected for Tier1 TTA (See Table 2)

- Presents with stable vital signs on triage (RR, SpO2, Heart rate, Systolic Blood pressure, GCS)
- Has no anatomical injury which warrants immediate multi-specialty input: no penetrating torso injury; no severe burn; no clinical signs of airway obstruction; no amputation proximal of fingers/toes.
- Suffered a mechanism of injury which suggests high energy impact within 6 hrs
- Individually high risk of suffering severe injury (age > 65; anticoagulant use) and had a fall from own height

Tier 1 TTA Providers (Team)

- ED senior clinician (ST3 above) who has been signed off on the Tier 1 Trauma Care Provider skills course (in house training) which is additional of ATLS / ETC. – will provide the primary survey and further management as necessary.
- ED nursing staff trained in ED resuscitation care – will provide assistance and nursing care
- Radiology to provide priority imaging and consultation as necessary
- Porter to provide patient transfer for imaging and for de-escalation when necessary (to move patients out from Resus when primary survey completed and de-escalation decided).

Supervision and escalation

- Tier 1 TTA is supervised by the shop floor lead ED Consultant. De-escalation will be discussed and implemented upon his approval.
- Escalation to Tier 2 TTA is necessary when patient’s vital signs or newly discovered anatomical features (injuries) warrant Tier 2 TTA. This could be initiated by any ED provider directly involved in the care (Tier 1 TTA doctor, nurse or lead consultant).

Tier 2 TTA: Hospital Trauma Call

Goal of the Tier 2 TTA is to

- Provide priority assessment and complex management of patients with potentially severe injury by a multi-specialty team of highly skilled and experienced clinicians and led by a senior Trauma Team Leader (TTL) - including diagnostics, interventions, decision making, disposition
- De-Escalate to tier 1 TTA or no TTA as and when necessary in order to free up resources for the Trust – only when the primary survey concluded and no further emergency intervention is deemed necessary. This must be the decision of the Trauma Team Leader (TTL).

Patients selected for Tier2 TTA (see Table 1)

- Presents with unstable or deteriorating vital signs on triage
- Has anatomical injury which warrants immediate multi-specialty input: penetrating torso injury, severe burn; clinical signs of airway obstruction; amputation proximal of fingers/toes, more than two long bones are broken

Tier 2 TTA Providers

- Trauma Team Leader (TTL) should be ED Consultant or trained (ATLS/ETC) and skilled senior provider (ST4 or above or specifically trained TTL practitioner). It is our aim to provide a consultant led trauma team as much as possible but we acknowledge the finite resources which are competing for other needs within the ED at the same time. Evidence suggests that not designation or seniority but adequate training and skills are needed for the efficient TTL [17] [18].
- Multi-specialty team of adequately skilled senior members (at least ST2 or above):
  - Anaesthetist
  - Surgeon
  - Trauma & Orthopaedic Surgeon
  - Paediatrician in case of paediatric emergency
  - Obstetrician in case of pregnant trauma victim
  - Other specialties might be involved as necessary (ENT, Ophthalmology) upon the decision of the TTL and based on triage or results of primary survey.

Most important is that the team members should have both procedural skills for the relatively simple procedures necessary within the ED (airway skills; chest drain; limb manipulations; pelvic immobilisation; haemorrhage control; etc) and also the decision making capability for specialty related issues (sedation; intubation; surgical airway; damage control surgery; critical transfer; emergency caesarean section; etc). Evidence suggests that efficient trauma care requires senior (at least registrar) involvement not just at the TTL level but also in key members (anaesthetist and surgeon). [18]

- ED nursing staff trained in ED resuscitation care – will provide assistance and nursing care
- Additional nursing staff (Trauma nurse, OT, etc) to provide assistance as necessary
- Radiology to provide priority imaging and consultation as necessary
- Porter to provide patient transfer for imaging and for de-escalation when necessary and to assist with transporting blood samples and blood products as necessary.

**Training**

Majority of patients presenting in the ED after a trauma can be managed safely within the ED and does not need an early multi-specialty input [1] [3]. Therefore the number of Tier1 TTA will exceed the Tier2 TTA cases. However, to provide the high quality and safe care for these patients there is a need to ascertain the necessary skill acquisition and retention among the senior ED staff.

In fact these skills are needed to provide the safe and efficient care for both tiers of TTA and the current TARN audit results suggests that our performance is lagging behind the expectations [1]. This will unlikely be addressed successfully by simply increasing the TTA numbers and so a targeted training for all providers (but at least the ED senior provider level) will be necessary.

Currently valid ATLS certificates are mandatory requirement for the ED seniors who are supposed to be TTL however we must accept the fact that the skills learned during ATLS courses will not necessarily and completely cover the needs of the patients seen during the tier 1 TTA. Therefore a specific and more tailored training is needed which addresses the specific need for Tier1 TTA providers:

- Work in a smaller team
- Provide efficient and safe primary survey
- Identify the need for escalation (and de-escalation)
- Skills to perform simple interventions and management for patients safely manageable in ED
- Decision making, communication

Aim is that all senior ED clinicians who would provide the Tier1 TTA care (ST3 and above; senior ACP tier) should have ATLS/ETC and also obtain the sign off from the in-house training addressing the above needs. The training and the sign off process should be repeated in every 2 - 4 years (TBD).

Obviously this in-house training is not a substitute for ATLS or ETC but merely an additional practice based course tailored to the specific needs of Tier 1 TTA in ESH.

**Audit**

The Two Tiered TTA criteria should be validated to the particular patient population served by the Trust. There are changing characteristics in both the population and the mechanism of injuries and these must be followed up.

We are already running a continuous audit on our trauma management (TARN). This audit process should only be very slightly extended in order to provide adequate data for a continuous validation of our two tiered TTA. The system should be reviewed initially in 6 months and then yearly. Aim is to adjust the TTA triage categories as necessary and keep the undertriage level less than 2% and the overtriage ratio less than 50% for Tier2 TTA [4].
SUMMARY: the Trauma Team Activation Process

- Call from the prehospital team will be taken and assessed against the given TTA criteria (see Table 1). Decision made if a Tier2 TTA (Hospital Trauma Call) is necessary.

- When Tier2 TTA is not necessary the given details will be assessed if a Tier1 TTA is needed (Table 2)

- The appropriate TTA should be initiated (via switchboard). Normally there is no need for senior clinician input.

- When in doubt, discuss with the senior team leader (first call is the duty consultant, if unable than nurse in charge). Err on the safe side.

- When neither Tier1 nor Tier2 TTA is deemed necessary the patient will be accepted in ED as usual. Upon the first triage the assessment for the possible need for TTA must be repeated.

Table 1: ACTIVATION CRITERIA FOR TIER2 TTA (HOSPITAL TRAUMA CALL)

| Vitals | - Airway compromised  
|        | - RR > 30/min or RR <12  
|        | - SpO2 < 95% on air (or <85% on COPD)  
|        | - Patient needs O2 to maintain Saturation >95% (or >90% in COPD)  
|        | - HR > 120/min (adult) – paediatric needs age adjusted limit  
|        | - SBP < 90 mmHg  
|        | - GCS < 14 (or baseline -1)  
| Anatomical | - Penetrating torso or neck injuries  
|        | - Amputation proximal to fingers / toes  
|        | - Burns > 15% BSA or facial burn with possible airway involvement  
|        | - 2 or more long bone fracture  
|        | - Pelvic ring fracture highly suspected  
|        | - Spinal injury with demonstrated neurology  
| Mechanism of Injury | Unless the anatomical or vital signs suggest deteriorating clinical condition (as described above) the mechanism of injury alone should not trigger a Tier2 Trauma Team Activation [7] [19] [20] [21] [22]  
|        | Check the Tier1 TTA Criteria for actions in response to mechanism of injury |
Table 2: ACTIVATION CRITERIA FOR TIER1 TTA (ED TRAUMA PRIORITY)

| Vitals                          | - Vitals (RR, SpO2, HR, SBP, GCS) should be above the Tier2 TTA criteria  
|                                | - SBP < 110 and >90 mmHg in patients above the age 65                  |
| Anatomical                     | - Suspected spinal injury without obvious neurology                |
|                                | - Distal amputations (fingers, toes)                              |
|                                | - Burns < 15% without airway involvement                         |
| Mechanism of Injury            | - Fall from > 3 m                                               |
| (only when arriving from scene or when within 6 hrs) | - Ejection from vehicle                                       |
|                                | - Pedestrian hit and thrown by a motor vehicle                    |
|                                | - Bike / cyclist thrown over or collision with motor vehicle      |
|                                | - High energy RTC where individual speed > 30 Mph. (There is no combined speed.) High energy impact can also be determined when airbags deployed or patient was entrapped in vehicle due to structural damage. |
| Individual factors             | - Patients over the age of 65 with a fall (from any height)       |
|                                | - Patients on anticoagulant and head or blunt torso injury (Warfarin and rivaroxabane and derivate only: aspirin and clopidogrel are not anticoagulants) |
|                                | - Pregnant patient (> 20/40) with blunt torso injury              |

**Silver Trauma**

The initiative of “silver trauma” call system provides safety for a specific patient group who have often previously been undertriaged [23]. The Tier 1 TTA would cover this population and therefore mitigate the need to create an additional “silver trauma call”.

**Timing of injury:**

It is important to remember that slowly deteriorating injury can manifest life threatening complications many hours or days after injury. However, when the vital signs and anatomical signs are all within the normal and the individual risk factors (age, anticoagulant use) are low the delayed presentation suggests that the need for emergency intervention is unlikely. There is no hard evidence for any time limit; we believe that a cautious 6 hrs is very conservative. Therefore we
suggest to activate the Trauma Team only when vital signs suggests deterioration in the cases of delayed presentations (>6hr).

Bibliography


