Managing the multiply injured patient: the impact of multidisciplinary teams

ABSTRACT

Management of trauma has been tackled at a national level to improve patient care and mortality. Decision making through a multidisciplinary team approach has resulted in improved patient outcomes through a complex combination of changes. While the focus of trauma care delivery has been towards establishing an effective multidisciplinary trauma service, there are still improvements which can be made. This article reviews the history of trauma care in the UK, and the impact that multidisciplinary teams have had on the management of the multiply injured patient.

Major trauma is the leading cause of mortality in those under 40 years of age. In the UK the incidence is estimated to be 20 000 cases per year, resulting in 5400 deaths (National Audit Office, 2010). This is associated with substantial morbidity; for each trauma fatality there are two survivors with serious or permanent disability (National Confidential Enquiry into Perioperative Deaths, 2007). In the UK blunt trauma is by far the most common, with road traffic accidents and falls the predominant mechanisms of injury. Data from the Trauma Audit and Research Network suggest that each trauma death costs the nation £750 000, and every major injury costs £50 000 (National Audit Office, 2010). The estimated lost output from the economy as a result of deaths and serious injuries from major trauma is £3.3–3.7 billion per year (National Audit Office, 2010).

Major trauma usually refers to a life-threatening injury or injuries requiring a coordinated multidisciplinary approach to their care. It is most commonly classified as an injury severity score of ≥16 (Baker et al, 1974), calculated from the severity codes of the three most severely injured body systems of a trauma patient.

Trauma care in England is organized into 27 regional trauma networks using a 'hub and spoke' model (Moran et al, 2018). Three levels of trauma care are provided: major trauma centres, trauma units and local emergency hospitals (McCullough et al, 2014). Major trauma centres have dedicated, round-the-clock facilities to provide resuscitation, imaging, emergency surgery and critical care. Patients are received by dedicated consultant-led multidisciplinary trauma teams. The full array of surgical specialties are employed on site allowing comprehensive definitive care. A standardised pre-hospital triage system is used to identify patients with major trauma, who are then taken straight to major trauma centres, bypassing trauma units and smaller centres which may be closer.

The regional major trauma networks across England were established in 2012. In the 5 years following their establishment there was a 19% overall decrease in mortality after severe injury (Moran et al, 2018). Changes were made in response to reports over a number of years which found trauma care in the UK to be unacceptably varied, with poor outcomes compared to other countries, and lacking progress in the preceding 20 years (Royal College of Surgeons, 1988, 2000; Lecky et al, 2002; Darzi, 2008). This article reviews these issues and the subsequent changes which occurred as a result of the recognition of these in order to examine the importance of a multidisciplinary approach to trauma care.

History

Historically patients who suffered acute injuries were taken to the nearest hospital, irrespective of the hospital's resources or capabilities of their staff to provide appropriate care. They would be received by individual physicians who would subsequently involve the necessary specialties depending on the pattern of injury. Reports from the USA in the 1970s and the UK in the 1980s found that under this system, a third of trauma deaths which occurred were preventable (Kreis et al, 1986; Anderson et al, 1988). The main causes of preventable death were unrecognized haemorrhage, delay to surgery, or lack of appropriate surgical intervention on site. Inter-specialty communication was often delegated to junior medical staff who lacked the understanding and experience to coordinate trauma care. Poor coordination of care has a higher risk of problems for trauma patients because of the complex nature of their injuries and presentations.

In response, the Committee on Trauma, American College of Surgeons (2014) recommended the systematic approach to major trauma that is used today:

- Coordinated prehospital care to allow bypass of local hospitals to major trauma centres when indicated
- Multidisciplinary inpatient services providing definitive management in specialist centres
- System quality improvement.

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Subsequently a large number of population-based studies have showed significant reduction in mortality (in the order of 15–20%) as a result of these new trauma systems (Mann et al, 1999; Celso et al, 2006; MacKenzie et al, 2006). These results were reproduced in Canada (Liberman et al, 2005), Australia (Cameron et al, 2008; Gabbe et al, 2012), and Europe (Meisler et al, 2010; Ruchholtz et al, 2012).

The multidisciplinary trauma team

The multidisciplinary trauma team typically comprises six to ten members from emergency medicine, anaesthetics, nursing, radiography, orthopaedic, general surgery and/or other surgical specialties (Mercer et al, 2018). They are pre-alerted to the arrival of a major trauma patient by the prehospital team. Primary involvement of multiple specialties assists with early diagnosis and integrates care, as does the proximity of computed tomography scanners. These factors minimize delay and therefore reduce mortality.

In the recovery phase a multidisciplinary approach provides continuity of care, rehabilitation, discharge planning and addresses the often-underestimated psychosocial needs of these patients. Trauma teams also bring improvements in governance with improvement in training, development of guidelines and audit.

Deficiencies in multidisciplinary trauma care in England

For various reasons the UK was slow to update its trauma system. The influential National Confidential Enquiry into Perioperative Deaths (2007) report *Trauma – Who Cares?* identified deficiencies in both the organizational and clinical aspects of trauma management, finding that 52% of patients received sub-optimal care. Despite previous recommendations from the Royal College of Surgeons of England (2000) that all hospitals receiving major trauma patients should have dedicated multidisciplinary trauma teams available at all times, they were absent in 22% of treating institutions.

Three years on from the National Confidential Enquiry into Perioperative Deaths report, the 2010 National Audit Office report *Major Trauma Care in England* concluded that there was still unacceptable variation in major trauma care in England, and services were not being delivered efficiently or effectively. Some of the failings are discussed below. These demonstrate the issues with patients requiring care by a range of medical and surgical specialists within a relatively short period of time.

Surgical specialties

Only 17 of the 183 hospitals had out-of-hours access to cardiothoracic surgery, vascular surgery and neurosurgery. Delays to definitive surgery, which as previously discussed are detrimental to outcomes, were common. Delays in cardiothoracic surgery have been found elsewhere to account for 9% of preventable deaths (Gruen et al, 2006). The average time to fixation of a pelvic fracture was 10–20 days – a delay of more than 7 days significantly increases morbidity (Moran et al, 2018). Hospitals with dedicated trauma consultants and wards had improved coordination of care leading to a reduction in the delay to the patient having definitive intervention. This has changed radically over the last decade. There are 27 major trauma centres at the hub of each regional trauma network in England. These have the full complement of surgical specialties on site. Patients who require multi-speciality treatment are triaged by the prehospital team and taken to centres which have the appropriate specialist services available.

Radiology

Despite the evidence from Huber-Wagner et al (2009) which showed a 25% relative reduction in mortality in major trauma patients imaged with whole-body computed tomography, 23% of patients who needed a computed tomography scan were not receiving one. One reason for this was the physical location of the computed tomography scanner and delays reaching this. The computed tomography scanners were sometimes not located adjacent to the emergency department. Computed tomography scanner proximity has since been correlated with increased odds of survival (Huber-Wagner et al, 2014). This has been factored into the design of receiving emergency rooms in major trauma centres and computed tomography scanners are now a standard feature of the layout of the emergency department in major trauma centres.

Critical care

It was found that 82% of patients with an injury severity score of between 16 and 25 needed critical care, but only 45% were placed in critical care beds (National Audit Office, 2010). Access to critical care is improved by the consistent presence of an anaesthetist in a trauma team, who will often provide continuity of care through the start of a patient's admission.

Rehabilitation

Rehabilitation is one of the most important facets of care in the multiply injured patient. This is usually the step which helps to integrate the patient back into his/her normal environment and society as a whole. There was an overall lack of capacity on rehabilitation wards for major trauma patients. They tended to remain on general acute medical wards and so were cared for by non-specialist staff. There has been significant progress in coordination and engagement as a result of the trauma network but ongoing issues include capacity, insufficient rehabilitation medicine consultant input, lack of dedicated facilities, and lack of community-based and vocational rehabilitation (Cornell, 2017).

What is the evidence for the benefit of multidisciplinary trauma teams?

The specific benefit of a multidisciplinary team in managing trauma patients is difficult to quantify. There is a vast array of data internationally showing the effectiveness of trauma systems as a whole, but improvements in outcome

are secondary to a complex combination of changes. This article examines some observational studies of smaller, intra-institutional changes in order to focus specifically on the effect that dedicated team can have.

Davenport et al (2010) published a UK study 2 years before the introduction of regional trauma networks which retrospectively analysed mortality in their London hospital before and after the establishment of a multidisciplinary trauma service. The hospital had previously been made a pilot major trauma centre and therefore already had all the relevant specialties and facilities on site. In response to stagnant mortality rates, a multidisciplinary trauma service and ward were formed with overall responsibility for all trauma patients. In the 5-year period immediately following this change, mortality rates from severe injury fell by 16%. This was well above the national average and equivalent to American data. The biggest improvements in mortality were seen in patients arriving in shock, and those with traumatic brain injury. There were significant decreases in time to computed tomography, laparotomy and craniotomy. There were also significant reductions in average length of stay on the ward – from 20 to 13 days. Therefore, using a multidisciplinary team approach from the outset reduced mortality through better coordination and access leading to faster definitive management. It also facilitated a performance improvement programme.

A comparable Australian study was done by Ursic et al (2009). Their centre was similarly a fully-equipped receiving hospital for trauma, but without a dedicated multidisciplinary trauma team or ward. Trauma patients were originally received by an emergency medicine team. They implemented a full-time trauma team and ward, trauma director, hospital trauma committee, trauma practice guidelines and protocols, a quality assurance audit programme and trauma case managers. They reported an 8% reduction in mortality among major trauma patients within 18 months of the change. Unlike the previous study, subgroup analysis did not reach statistical significance. There was also a significant reduction in length of stay for patients presenting with multisystem trauma.

These reductions in length of stay provide evidence that the benefits of a multidisciplinary approach to trauma continue after definitive management. Length of stay data take on increased significance in context of the strain on hospital bed capacity. Evidence has suggested that hospital capacity strain is associated with increased mortality and worsened health outcomes (Eriksson et al, 2017). In the UK this has been addressed at the national level. Guidelines from the National Institute for Health and Care Excellence (2016) recommended allocation of a trauma coordinator for each patient, a role that has also been shown to reduce length of stay and reduce time to allied health intervention.

A Norwegian study by Groven et al (2011) spanned the formalisation of a dedicated multidisciplinary trauma team, trauma medical director and trauma coordinator, again at a centre where all specialties were already present before the change. They reported an improved relative survival rate of 33% over the 3 years after the change. Benefits were attributed to staffing, education, governance and performance improvement changes.

It has been argued that improvements in outcomes with trauma teams are because experienced consultants, who are now required to head the team, are simply seeing more patients. This was explored in an American retrospective cohort study comparing mortality data for 13 894 patients admitted under experienced *vs* inexperienced consultants over a 10-year period. There was no difference between the two, suggesting that benefit is occurring on a system-wide rather than an individual clinician level (Haut et al, 2009).

The rising numbers of geriatric trauma patients

As the population ages data show that the UK major trauma cohort is becoming increasingly more elderly and frail, with a fall from <2 m rather than road traffic accidents the predominant mechanism of injury in this group (Kehoe et al, 2015; Moran et al, 2018). These patients have significantly higher mortality rates as they are often undertriaged, carrying occult injuries in the context of limited physiological reserves, comorbidities and taking multiple medications (Nakamura et al, 2012; Brown et al, 2016). With an ageing UK population, their management poses a significant potential challenge to the delivery of trauma care.

One American centre aimed to address this with a protocol of mandatory highest level trauma team activation for all injured patients >70 years of age (Hammer et al, 2016). They showed a significant decrease in relative risk of death with this approach, as well as decreased length of stay in the emergency department. The generalisability of such an approach, especially to an already financially and resource stretched NHS, remains to be seen. A recent study from Norway found secondary improvements in geriatric trauma mortality after the formation of a general multidisciplinary trauma team at their centre (Ringen et al, 2019). It is expected that the best way to manage rising complex trauma in these already complex patients will be with a multidisciplinary approach.

Conclusions

Management of trauma is about 'getting the right treatment to the patient at the right time'. This has been tackled on a national level through the reorganization of services into cooperative networks. It extends inside the hospital and is embodied by the multidisciplinary team, bringing early specialty involvement, rapid access to appropriate imaging and shorter time to definitive management. These combined changes have contributed to a remarkable reduction in mortality from major trauma in the last few years. Challenges remain such as the provision of rehabilitation services and delivery of this type of care in a resource limited environment. In the future, the importance of a multidisciplinary approach is likely to increase in order to meet the rising demand of geriatric trauma. **BJHM**

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KEY POINTS

- The introduction of multidisciplinary teams has led to decreased mortality in trauma patients, but mortality rates remain high.
- These reductions in mortality are the result of care being provided by the correct individuals being in the same place at the same time to address the complex needs of these patients.
- The incidence of complex trauma particular in elderly patients is expected to grow over the coming years.
- The importance of a well-structured multidisciplinary approach is likely to increase in order to meet this demand.
- There is room for improvement with access to rehabilitation services for the multi-trauma patient.

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