Amputation and the assessment of limb viability: perceptions of two hundred and thirty two orthopaedic trainees

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ABSTRACT

INTRODUCTION The management of complex extremity injury, which may require assessment of limb viability and performance of amputation, is a challenge to those involved in its emergent and definitive care. Concern exists regarding the exposure of orthopaedic trainees to such cases due both to changes in training and centralisation of trauma services.

SUBJECTS AND METHODS This is a web-based observational study by survey, investigating the confidence and perceived adequacy of training of UK orthopaedic specialist trainees in the assessment of limb viability and amputation surgery.

RESULTS Trainee confidence in dealing with the assessment of limb viability is high despite infrequent exposure to cases. The majority of trainees perceive their training in limb viability assessment as adequate. For performance of amputation, exposure is minimal, confidence is lower and 36% of trainees regard their training as inadequate.

CONCLUSIONS Limb viability assessment is an area in which trainees feel confident and well trained. There is, however, a perceived training inadequacy in amputation surgery and a corresponding lack of confidence for many trainees, irrespective of training year. This is the first study to offer an insight into specific training experiences of junior orthopaedic surgeons at a national level and it should drive the development of opportunities for trainees to develop skills in amputation surgery.

KEYWORDS Amputation – Limb salvage – Penetrating wounds – Leg injuries – Arm injuries – Education

Accepted 11 February 2010; online publication 10 May 2010

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Mutilating extremity trauma has challenged surgeons over many centuries, with amputation for limb injury and gangrene being described by Paré as early as 1564.1

Often associated with warfare,2 our understanding of such injury has advanced primarily through repeated experiences gained in the combat environment.3 Recent conflicts are no exception with considerable numbers of significant extremity injuries still being encountered.4 In peace time, road traffic accidents and industrial trauma are the main causes – particularly in the developing world.5-7

In the UK, complex limb trauma is predominantly dealt with by orthopaedic surgeons with increasing input from allied specialties including plastic surgery. Although a field reliant heavily on the apprenticeship model, orthopaedics has had to evolve alongside other surgical disciplines due to advancing technology, training legislation and restrictions on junior doctors working hours.8-11

Alterations in surgical training through diminishing working hours is not the sole factor for concern regarding junior surgeons’ exposure to cases of significant injury. There has been a growing interest in the provision of trauma care in its generality in the UK over the last 20 years.12 Trends and concerns over trauma care services have been described,13-15 culminating in a move towards recommendations for centralisation of trauma services.16 Recent evidence suggests that sub-specialist regional trauma centres have a positive impact on preventable death from significant injury.17 There is concern, however, that alongside changes in working hours, such centralisation of trauma provision will further contribute to decreasing exposure of orthopaedic trainees to limb-threatening trauma.

As a result of these changes, anecdotal concern exists in the popular press regarding surgical training.18 The capacity of orthopaedic surgeons of the future to manage competently high energy, limb-threatening extremity injury is one obvious facet of this concern. The aim of this paper is to provide an insight into current UK orthopaedic trainees perceived experiences in the management of limb-threatening trauma.
Subjects and Methods

A web-based survey was designed (Survey Monkey, Portland, OR, USA) and a sample size determined in order to establish the return rate required to provide a result representative of the population of orthopaedic surgeons in training. This was ascertained using an on-line survey sample size calculator (<www.custominsight.com>), a tool using a series of calculations written in JavaScript. This allows incorporation of population size, estimation of likely response rate and proposed confidence and error levels.

The population of orthopaedic surgeons in training is currently around 1200 in various grades. In order to gain a representative sample, a minimum of 222 returns were required. This allowed 90% confidence with a 5% error rate in reporting the survey findings. A survey return of 25% was deemed realistic and, so as to yield 222 returns, 888 junior orthopaedic surgeons were contacted. The trainees were contacted by email containing a link to the survey and all returns were anonymous.

The survey investigated a number of scenarios representative of complex trauma management including limb viability assessment and amputation.

Each question followed a uniform layout (Appendix 1), utilised a previously validated confidence assessment tool, and addressed exposure to index cases, status of operative role and perceived training need. In total, 252 trainees responded.
Results

Assessment of limb viability
Trainees were given the statement: ‘with regard to the assessment of limb viability following complex trauma’. Answer options as described in Appendix 1 with the exception of operative role were available.

Amputation for extremity trauma
Trainees were given the statement: ‘with regard to amputation following extremity trauma’. Answer options as described in Appendix 1 were available.

Overall exposure to cases, perceived confidence and adequacy of training with regards to limb viability assessment and the practical application of amputation surgery is illustrated in Figure 1A–D.

Discussion

Traditionally the realm of the war surgeon; proficiency in the management of complex trauma and extremity amputation is also required in civilian practice. This is especially apparent in the context of recent terrorist atrocities.20,21

Systems exist to aid decision making in limb viability assessment.22–26 Such ‘scoring’ should, however, be viewed with caution and certainly cannot be used in isolation.27 In the military population, in which there has been a wealth of recent experience in the management of these casualties, the use of scoring systems is unhelpful.28

The inability of scoring systems to predict functional outcome in particular is demonstrated through evidence suggesting comparable long-term functional results in both reconstructed and amputated limbs.20,30 A key distinction here must be made between viability and ultimate function in the assessment of limb trauma. Whilst a limb may be viable in terms of circulation, functional viability of the same limb in terms of catastrophic bone and muscle loss, nerve discontinuity and chronic, debilitating pain is a different matter. This is particularly challenging in lower limb fractures as sensation in the sole of the foot is not a reliable indicator of nerve injury and ultimate outcome.31

It can be seen, therefore, that assessment is multifaceted. Previously confined to absolute ischaemic viability – the long-term functional viability is now becoming increasingly recognised as a major consideration.

Acknowledging the challenging nature of these injuries, a number of guidelines have been issued to inform best management of complex extremity injuries and primary amputation for trauma.32,33 Key recommendations in terms of general management and decision making from these documents are summarised in Table 1.

Resulting both from these recommendations and the centralisation of trauma services, the care of patients with limb injuries of questionable viability will increasingly be carried out in regional centres.

There remains, however, as described, a cohort of significantly injured patients whose care will fall on those with less experience and resources as they are unable to be transferred for such specialised care. This identifies a requirement, despite sub-specialisation, for all consultant orthopaedic surgeons to be adequately trained in this field.

With scoring systems providing limited support in decision making, adequate training and exposure to cases as a trainee must form the basis of gaining those key aspects vital to decision making as a junior consultant – confidence and experience.

Limb viability assessment
Our study shows that perceived confidence in the assessment of limb viability following significant extremity trauma is high with 64.7% of all trainees either reporting themselves confident in some cases or fully confident in all cases (Fig. 1A). This perception of confidence increases with time spent in training. Exposure is sporadic, however, and most trainees report an expectancy to assess limb viability at intervals of every 6 months or longer (Fig. 1B). Overall, the perception of the majority of those responding to the survey is that their training in the assessment of limb viability is adequate (Fig. 1C). The preponderance of work regarding scoring systems in the literature may, in part, have an impact on the perceived levels of confidence despite such low case exposure.

Primary amputation for trauma
Over half of current UK orthopaedic trainees demonstrate a lack of confidence in dealing with the practical application of amputation in trauma. Although perceived confidence increases with time spent in training, over half of trainees are either not confident or lacking confidence in amputation surgery (Fig. 1A). Of note, less than one-third of trainees having completed their training reported being fully confident.

Over half of trainees report either never having been involved in such a case or, if involved, being so only once every 2 years (Fig. 1B). Over 70% of trainees would be either assisting or operating with their trainer scrubbed for such cases (Fig. 1D). Overall, a significant proportion of trainees report that their training in amputation surgery is inadequate. This perceived inadequacy is unaffected by time spent in training (Fig. 1C).

Concern over surgical training in the UK is not confined to orthopaedics. Similar problems of confidence and capability exist in surgeons dealing with vascular and thoracic trauma.34 Improvements in health and safety legislation and a decrease in high-energy trauma from road traffic accidents has affected the nature of casualties presenting to
trauma surgeons with a negative impact on training opportunities. Neither is this problem unique to the UK – trainees in Australia and Canada demonstrate similar concerns. The same issue has led to a call for restructuring of the education of trauma surgeons in the US alongside an evolution in the way that the trauma service is provided.

Study limitations
There are, of course, limitations to this study. Establishing a snapshot of current practice involves sampling the opinions of as many members of the population in question over a short period of time. An overall summary has been provided across all training years. To enable brevity of reporting, the break-down of the exposure, confidence, adequacy of training and operative role for individual groups by training year, whilst collected, is not included. As may be expected, it is seen that exposure to cases and perceived training adequacy does not change according to seniority whilst confidence and status as operating surgeon increase with time.

Previous works on issues in training have produced response rates of less than 50%. We predicted a return rate of around 25% and this allowed for efficient sampling of the population. It is appreciated that whilst does not establish the perceptions of all trainees, it does allow us to reflect on the current perceptions of the trainee body as a whole.

Conclusions
This study presents, for the first time, the experiences of UK orthopaedic trainees in the management of complex extremity injury. Exposure to cases is infrequent and, whilst a perceived confidence exists in the assessment of limb viability, there is a lack of confidence in trainees regarding the practical application of that knowledge.

The trend of decreasing trauma operative exposure is not unique to orthopaedics or UK surgical trainees in general. With the advent of increasingly stringent legislation on junior doctors’ working hours and increasing centralisation of trauma services, it is anticipated that current areas of inadequacy will not improve and focused training in the future will be required.
Acknowledgements

The opinions or assertions contained herein are the private opinions or assertions of the author(s) and do not constitute official or reflecting the views of the Ministry of Defence or Her Majesty’s Government. The authors are employees of the Ministry of Defence. No grant funding was received for this study.

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Appendix 1: Layout of responses to questions

1. I would rate my confidence in decision making and practical application as:
   - Not confident
   - Satisfactory but lacking confidence
   - Confident in some cases
   - Fully confident

2. I would expect to see a case like this:
   - Once a month
   - Every 1–3 months
   - Every 3–6 months
   - Every 6 months to 1 year
   - Once every 2 years
   - Never been involved in such a case

3. My operative role for such a case would be:
   - Assisting
   - Supervised-trainer scrubbed
   - Supervised-trainer un-scrubbed but in theatre
   - Performing (lead surgeon)
   - Training a more junior surgeon

4. I regard my training in the management of this case as:
   - Adequate for my stage of training
   - Inadequate for my stage of training