Training in the practical application of damage control and early total care operative philosophy – perceptions of UK orthopaedic specialist trainees

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ABSTRACT

INTRODUCTION Despite improvements in the outcome of individuals sustaining significant injury, the optimum management of fractures in traumatised patients remains an area of debate and publication. There is, however, a paucity of studies regarding the specifics of acquired experience and training of junior orthopaedic surgeons in the practical application of these skills. Our null hypothesis is that, despite alteration in surgical training, the perceived confidence and adequacy of training of UK orthopaedic specialist trainees in the application of damage control orthopaedics (DCO) and early total care (ETC) philosophy is unaffected.

SUBJECTS AND METHODS A web-based survey was sent to a sample of orthopaedic trainees. From 888 trainees, 222 responses were required to achieve a 5% error rate with 90% confidence.

RESULTS A total of 232 responses were received. Trainees reported a high level of perceived confidence with both external fixation and intramedullary devices. Exposure to cases was sporadic although perceived training adequacy was high. A similar pattern was seen in perceived operative role with the majority of trainees expecting to be performing such operations, albeit under varying levels of supervision. In a more complicated case of spanning external fixation for a 'floating knee', trainees reported a decreased level of perceived confidence and limited exposure. One-third of trainees reported never having been involved in such a case. In contrast to nationally collated logbook data, exposure to and perceived confidence in managing cases involving ETC and DCO were similar.

CONCLUSIONS Despite changes in the training of junior orthopaedic surgeons, trainee-reported confidence and adequacy of training in the practical application of DCO and ETC was high. Exposure to cases overall was, however, seen to be limited and there was a suggestion of disparity between current operative experiences of trainees and that recorded in the national trainee logbook.

KEYWORDS

Multiple trauma – Fracture fixation – Intramedullary – Wounds and injuries – Education – Medical – Graduate

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Advances in the care of the critically injured have led to improved outcomes in this patient group.¹ Optimum management of the injured orthopaedic patient however, in terms of technique and timing of fracture stabilization, remains a concern.² Historically, patients with long-bone fractures associated with multisystem trauma were treated non-operatively. It was thought the combination of injury and surgery produced physiological compromise – the 'double-hit' phenomenon. Patients were condemned to the complications of prolonged recumbency³ and overall prognoses were poor.

Early total care (ETC) – rapid, definitive, fracture stabilisation – evolved as a method for diminishing this morbidity and mortality.^{4–6} Improvements in implant technology, intensive care facilities and dedicated trauma teams became available. This allowed the provision of stability to fractures in those patients previously deemed too unwell to proceed to the operating room.

Although outcomes of ETC were superior to preceding methods,⁵ concerns remained over the physiological insult associated with protracted early surgery. This led to a move towards limited surgical stabilisation – unreamed nails,

Table 1 Overall perceived trainee confidence in the management of fracture stabilisation in ETC and DCO scenarios

	I would rate my confidence in decision making and practical application as (%)		
	Stabilisation of 'floating knee' with vascular compromise	External fixation and DCO	Internal fixation and ETC
Not confident	13.4	4.3	8.2
Satisfactory but lacking confidence	28.9	18.7	15.5
Confident in some cases	28.0	39.6	35.8
Fully confident	29.7	37.4	40.5

Table 2 Overall perceived trainee exposure to the management of fracture stabilisation in ETC and DCO scenarios

	I would expect to see a case like this (%)		
	Stabilisation of 'floating knee' with vascular compromise	External fixation and DCO	Internal fixation and ETC
Once a month	0.4	6.5	12.9
Every 1–3 months	1.3	20.0	21.6
Every 3–6 months	7.7	26.5	31.9
Every 6–12 months	21.6	30.0	20.7
Once every 2 years	37.5	14.8	10.3
Never involved in such a case	31.5	2.2	2.6

time-limited surgeries and greater use of external fixation.^{7–9} Damage control orthopaedics (DCO) outlines this philosophy.¹⁰ DCO includes both external fixation and unreamed intramedullary nailing as it is a concept rather than a strict operative methodology.

In the UK, stable, single-limb injured patients mostly undergo ETC. Maximally-injured patients should undergo DCO. The concept of 'the borderline patient' is problematic. Studies have attempted to identify the predictive factors contributing to an individual patient's responses to injury and subsequent surgery.¹¹ Identification of 'right procedure, right patient' is the goal. This, however, is a product of surgical training and operative experience.

Medical training in the UK is in a state of flux. Concern surrounds the training of current junior doctors in all specialities.^{12–14} While extensive debate at the molecular level surrounds ETC and DCO, there is no published work regarding the training of junior orthopaedic surgeons in the practical application of these philosophies.

This paper provides an insight into current UK orthopaedic trainees' perceived experiences in the application of the DCO and ETC philosophies.

Subjects and Methods

A web-based survey was designed (Survey Monkey,

Table 3 Overall perceived adequacy of training in the management of fracture stabilisation in ETC and DCO scenarios

	I regard my training in the management of this case as (%)		
	Stabilisation of 'floating knee' with vascular compromise	External fixation and DCO	Internal fixation and ETC
Adequate for my stage of training	78.1	90.1	88.0
Inadequate for my stage of training	21.9	9.9	12.0

Table 4 Overall perceived trainee operative role for fracture stabilisation in ETC and DCO scenarios

	My operative role for such a case would be (%)		
	Stabilisation of 'floating knee' with vascular compromise	External fixation and DCO	Internal fixation and ETC
Assisting	23.3	7.0	9.1
Supervised (trainer scrubbed)	31.0	24.3	25.9
Trainer unscrubbed	11.6	17.8	16.8
Performing	32.8	47.0	43.5
Training	1.3	3.9	4.7

Portland, OR, USA) and a survey sample size was determined in order to establish the return rate required to obtain statistical significance (survey random sample calculator <www.custominsight.com>). The population of orthopaedic surgeons in training is currently around 1200; in order to gain a representative sample, 222 returns were required. This allowed 90% confidence with a 5% error rate in reporting the survey findings. To yield 222 returns at a conservative return rate of 25%, 888 trainees were contacted by email. The returns were anonymous.

The survey investigated a number of scenarios representative of complex trauma management including application of external fixators and utilisation of intramedullary nails for limb trauma. Each question followed a uniform layout using a validated confidence assessment tool.¹⁵

Results

Trainees were given the statements:

1. 'In a patient with ipsilateral distal femur and midshaft tibia fractures with absent distal pulses, management options include rapid bridging external fixation allowing access for vessel exploration and repair. With regard to such a case.'
2. 'Damage control philosophy may utilise the rapid, accurate application of external fixators. With regards to your skill set in the execution of such surgery.'
3. 'Early total care philosophy may require the rapid and accurate implanting of single or multiple intramedullary devices. With regards to your skill set in the execution of such surgery.'

The responses to the statements above were recorded and are tabulated as: perceived confidence (Table 1); perceived exposure to cases (Table 2); perceived adequacy of training (Table 3); and perceived operative role of trainee (Table 4).

Discussion

The achievement of fracture stability in the multiply injured patient continues to be a central theme of modern orthopaedic surgery. Studies demonstrate the benefits of differing implants used on different individuals with dissimilar injuries in disparate time periods.^{16–19} Although the finer points of technique may be debated, without the required surgical skills, the prognosis is threatened regardless of which philosophy is chosen. With concerns evident regarding the training of junior doctors,^{20–25} it is timely to assess the experiences of current UK orthopaedic trainees.

Managing a 'floating knee' with associated vascular compromise is not straightforward. Overall, trainee confidence is divided with less than a third of trainees (Table 1) reporting full confidence in application of external fixation in this manner. Exposure to such cases is limited (Table 2) and is reflected in the propensity for the trainee to be recorded as assisting in these procedures (Table 4). Despite little exposure, a high percentage of trainees report that their training is adequate (Table 3).

Temporising external fixation is advocated as a rapid method of establishing bony stabilisation. It is, however, not without complications, mainly related to technical points in application and aftercare.²⁴

Overall confidence amongst trainees in the application of external fixators is high (Table 1). Exposure is sporadic. Nearly all trainees have been involved in a case involving external fixation in a DCO scenario and half of trainees would expect to see such a case at least once every 6 months (Table 2). The distribution of operative status amongst trainees demonstrates that, in contrast to the first scenario, the majority of trainees would expect to be performing the operation with varying degrees of supervision. Over 50% of trainees would expect to be performing the operation themselves or teaching a junior surgeon during the case. Over 90% of respondents regard their training in such cases as adequate (Table 3).

Intramedullary devices are used both in ETC and DCO. Our understanding of the insult to the pulmonary system is improving but, as with other fixation options, intra-operative complications associated with poor technique and incomplete understanding of the mode of support afforded by intramedullary devices remains an area of concern.

Experiences of current orthopaedic trainees in the use of intramedullary devices demonstrate a high level of confidence. Reported confidence in some cases and fully confident reports is equal to that seen in external fixation (Table 1). In a similar picture to that seen with external fixation, exposure to case-load is sporadic, although nearly all trainees report having been involved in such a case and over half would expect to be involved in their management at least once every 6 months (Table 2). Half of trainees expect to be either performing fracture fixation using intramedullary devices themselves or training a more junior surgeon (Table 4). Overall perceived training adequacy in intramedullary nailing is high (Table 3).

There is a disparity in reported training experiences in this study and the nationally gathered training logbook.²⁵ Findings from the e-logbook demonstrate that trainees are currently performing a third less external fixator applications than intramedullary nailings.²⁶ In this series, expected case-load for nailing is indeed higher, but not to the magnitude recorded in the logbook.

Data from the logbook would also suggest a disparity in the non-assistant role (as in performing the operation with varying degrees of supervision) of trainees during a procedure. In terms of trainee performing the operation, a similar percentage is seen across all years of training for nailing procedures. For external fixation, however, a more graded increase in non-assistant role is seen with less experienced trainees performing fewer procedures than their senior colleagues.²⁶ This is in contrast to that seen within this study, where both groups follow a similar pattern. The operative status for external fixation reported in this study reflects trainees performing more procedures as lead surgeon role than for nailings.

Study limitations

There are limitations to this study. As a snapshot of current practice it involves gaining the opinions of as many members of the population as possible over a short period of time. Similar work²⁷ comprised response rates of less than 50%. We predicted a return rate of around 25%, allowing efficient sampling of the population. This does allow us with the confidence levels described through freely available sample sizing techniques to reflect on current perceptions of the trainee body as a whole. More in-depth statistical analysis would be inappropriate and outwith the nature of this reflection of current experience. An overall summary

has been provided across all training years. To enable brevity of reporting the breakdown 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.

Conclusions

With changes in speciality programmes and concerns over exposure of current surgical trainees, it is encouraging to see that overall perceptions in confidence and adequacy of training are generally positive. Overall results for external fixation and intramedullary nailing are similar, whilst confidence and adequacy of training in the management of the (significantly rarer) scenario of a floating knee with vascular compromise are understandably decreased by comparison.

This survey has demonstrated the utility of an emerging resource. Improvements in assessment of trainee exposure to indicator cases and appreciation of training needs would result from a formalised web-based, trainee-centred survey of this nature in conjunction with the established logbook system. This would provide a valuable balance of subjective experience and objective activity to guide future training.

References

1. Lecky F, Woodford M, Yates DW. Trends in trauma care in England and Wales 1989–97. UK Trauma Audit and Research Network. *Lancet* 2000; **355**: 1771–5.
2. Court-Brown CM. The treatment of the multiply injured patient in the United Kingdom. *J Bone Joint Surg Br* 1990; **72**: 345–6.
3. Bose D, Tejwani NC. Evolving trends in the care of polytrauma patients. *Injury* 2006; **37**: 20–8.
4. Beckman SB, Scholten DJ, Bonnell BW, Bukrey CD. Long bone fractures in the polytrauma patient. The role of early operative fixation. *Am Surg* 1989; **55**: 356–8.
5. Bone L, Bucholz R. The management of fractures in the patient with multiple trauma. *J Bone Joint Surg Am* 1986; **68**: 945–9.
6. Ejstrud P, Sorensen JV. Early osteosynthesis of fractures of the lower extremities in patients with multiple trauma. *Ugeskr Laeger* 1993; **155**: 1202–6.
7. Weninger P, Figl M, Spitaler R, Mauritz W, Hertz H. Early unreamed intramedullary nailing of femoral fractures is safe in patients with severe thoracic trauma. *J Trauma* 2007; **62**: 692–6.
8. Pape HC, Giannoudis PV, Krettek C, Trentz O. Timing of fixation of major fractures in blunt polytrauma: role of conventional indicators in clinical decision making. *J Orthop Trauma* 2005; **19**: 551–62.
9. Kakar S, Tornetta 3rd P. Open fractures of the tibia treated by immediate intramedullary tibial nail insertion without reaming: a prospective study. *J Orthop Trauma* 2007; **21**: 153–7.
10. Giannoudis PV. When is the safest time to undertake secondary definitive fracture stabilization procedures in multiply injured patients who were initially managed using a strategy of primary temporary skeletal fixation. *J Trauma* 2002;

- 52: 811–2, author reply 812–3.
11. Giannoudis PV, Fogerty S. Initial care of the severely injured patient: predicting morbidity from sub-clinical findings and clinical proteomics. *Injury* 2007; **38**: 261–2.
 12. Bowhay AR. An investigation into how the European Working Time Directive has affected anaesthetic training. *BMC Med Educ* 2008; **8**: 41.
 13. Anwar M, Irfan S, Daly N, Amen F. EWTD has negative impact on training for surgeons. *BMJ* 2005; **331**: 1476.
 14. Hellawell GO, Kahn L, Mumtaz F. The European Working Time Directive: implications for subspecialty acute care. *Int J Clin Pract* 2005; **59**: 508–10.
 15. George JT, Warriner DA, Anthony J, Rozario KS, Xavier S, Jude EB *et al*. Training tomorrow's doctors in diabetes: self-reported confidence levels, practice and perceived training needs of post-graduate trainee doctors in the UK. A multi-centre survey. *BMC Med Educ* 2008; **8**: 22.
 16. Wenda K, Runkel M, Degreif J, Rudig L. Minimally invasive plate fixation in femoral shaft fractures. *Injury* 1997; **28** (Suppl 1): A13–9.
 17. Kuhn S, Hansen M, Rommens PM. Extending the indications of intramedullary nailing with the expert tibial nail. *Acta Chir Orthop Traumatol Cech* 2008; **75**: 77–87.
 18. Gorczyca JT, McKale J, Pugh K, Pienkowski D. Modified tibial nails for treating distal tibia fractures. *J Orthop Trauma* 2002; **16**: 18–22.
 19. Ziran BH, Smith WR, Anglen JO, Tornetta Iii P. External fixation: how to make it work. *Instr Course Lect* 2008; **57**: 37–49.
 20. Higgins R, Gallen D, Whiteman S. Meeting the non-clinical education and training needs of new consultants. *Postgrad Med J* 2005; **81**: 519–23.
 21. Higgins R, Cavendish S. Modernising Medical Careers foundation programme curriculum competencies: will all rotations allow the necessary skills to be acquired? The consultants' predictions. *Postgrad Med J* 2006; **82**: 684–7.
 22. Eaton L. MPs criticise department's handling of Modernising Medical Careers. *BMJ* 2008; **336**: 1095.
 23. Campbell D. Doctors' leader warns 48-hour week will endanger patients. *The Guardian* 2009; Top Stories (11th April 2009): 1–1.
 24. Lethaby A, Temple J, Santy J. Pin site care for preventing infections associated with external bone fixators and pins. *Cochrane Database Syst Rev* 2008; (4): CD004551.
 25. Sher JL, Reed MR, Calvert P, Wallace WA, Lamb A. Influencing the national training agenda. The UK & Ireland orthopaedic eLogbook. *J Bone Joint Surg Br* 2005; **87**: 1182–6.
 26. Jameson SS, Lamb A, Wallace WA, Sher JL, Marx C, Reed MR. Trauma experience in the UK and Ireland: analysis of orthopaedic training using the FHI eLogbook. *Injury* 2008; **39**: 844–52.
 27. Brooks A, Butcher W, Walsh M, Lambert A, Browne J, Ryan J. The experience and training of British general surgeons in trauma surgery for the abdomen, thorax and major vessels. *Ann R Coll Surg Engl* 2002; **84**: 409–13.