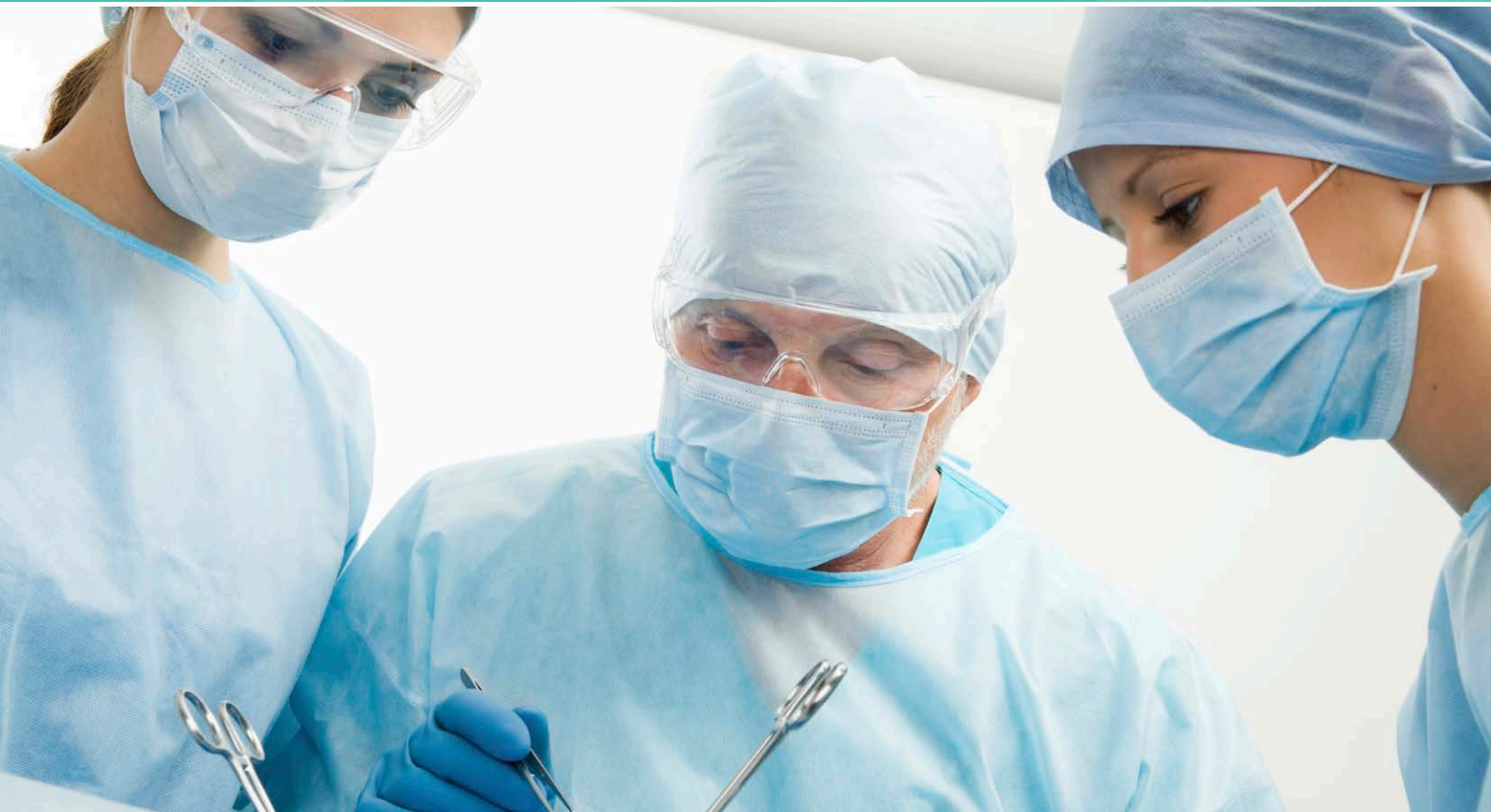




Royal College  
of Surgeons

ADVANCING SURGICAL CARE



# Major Trauma Workforce Sustainability

Outcomes of the RCS Major Trauma Workgroup



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## Outcomes of the RCS Major Trauma Workgroup

### Abstract

To build on the improvements that the introduction of the introduction of the regional major trauma networks has had on patient outcomes it is essential that a highly skilled sustainable medical workforce is developed to service the needs of tomorrow's patients. This paper outlines the vision of the Royal College of Surgeons of England for the establishment of high quality training to deliver the knowledge and skills required to provide the highest possible standard of patient care.

**Martin Bircher, Adam Brooks, Tim Ong and Nigel Tai**

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# Executive Summary

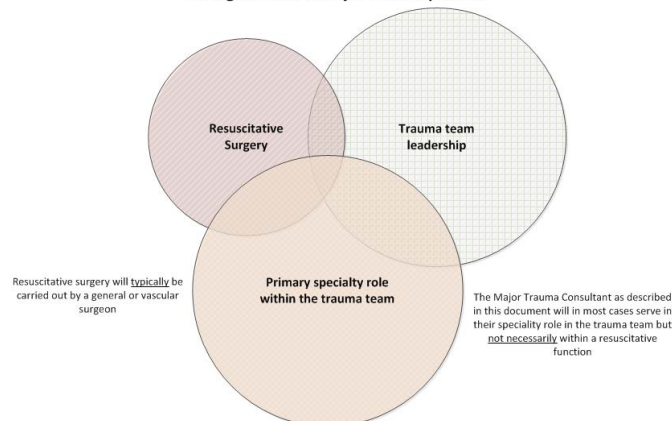
The introduction of the regional major trauma networks in England has driven a significant improvement in patient outcomes.<sup>1</sup> To ensure that this success is built upon it is essential that the service is developed to meet the needs of future patients. This document details the findings of the RCS Major Trauma Workforce Project, outlining a framework to deliver a sustainable major trauma workforce. Surgeons involved in the reconstructive aspects of trauma care benefit from established training pathways and defined areas of practice. Services reliant upon a reconstructive model are already maturely organised and include provision of trauma and orthopaedic, plastic, and oro-maxillofacial care. Beyond this it is apparent that there are significant gaps in the training for two key areas of trauma service provision:

1. **Major trauma consultant:** The role of coordinator, orchestrator and clinical leader of ongoing care for poly-trauma patients is ill-defined and poorly-trained. This function is vital if all elements of the wider hospital response are to be deployed effectively throughout the patient's journey.
2. **The resuscitative surgeon:** There is an absence of training for surgeons to undertake the key surgical decisions and management of life threatening torso haemorrhage and visceral trauma. This function is essential regardless of need for surgery, interventional radiology or conservative management.

Training pathways for these roles are set out with relevant competencies for each given. Surgical trainees of any acute specialty would be able to gain training equipping them for the major trauma consultant role. Specialties mapping to the resuscitative surgeon function would include general and vascular surgery. These pathways would enable career flexibility to work in an area of elective practice alongside major trauma service commitments, and to match commitment to a demanding trauma rota by stage of consultant career.

The composition and organisation of the surgical trauma workforce needs to be tailored for the individual characteristics of the network they serve. Educating and training surgeons to fulfil the newly defined roles of major trauma consultant and resuscitative surgeon will assist major trauma networks in delivering quality care.

## The three key components required within the major trauma team for the initial surgical management of a major trauma patient



<sup>1</sup> Independent review of Major Trauma Networks [www.england.nhs.uk/2013/06/25/incr-pati-survi-rts/](http://www.england.nhs.uk/2013/06/25/incr-pati-survi-rts/)

# Recommendations

To ensure a highly skilled, sustainable surgical workforce able to deliver care to major trauma patients in the future, the following actions are recommended:

- For MTCs hiring consultants to work within the MTC consultant and resuscitative surgeon roles to ensure competency in the areas and to the levels set out in this paper are present on appointment and are maintained to this minimum standard thereafter
- The development of training rotations to deliver competencies as set out in this document for resuscitation surgeons managing initial control of haemorrhage in torso trauma patients
- The development of a major trauma TPD to oversee the training of surgeons with an interest in major trauma surgery
- Development of major trauma consultant training courses and fellowships to deliver the multi-disciplinary leadership competencies as set out in this document for the coordination of care throughout the patient pathway
- Career pathways involving major trauma aspects are publicised and adopted by employers to empower trainees to pursue careers in major trauma
- Pilots for training to deliver major trauma resuscitative surgeon competencies are initiated immediately

# 1. Introduction

In April 2012 a system of regional trauma networks was introduced across England. Significant improvements in mortality rates have followed.<sup>2</sup> These and further improvements in outcome and experience must be secured by developing a major trauma centre medical workforce that can service the needs of major trauma patients from admission to discharge and beyond.

Surgeons are well placed to provide leadership to the multi-disciplinary trauma team – not only through the delivery of resuscitative and reconstructive surgical interventions – but also by guaranteeing continuity-of-care and assuring a ‘whole patient’ approach. As such, the surgical workforce is a key resource for safe delivery of emergency care beyond the operating theatre and throughout the patient pathway. However, appropriate training paths that endow the key skills required to delivery resuscitative surgery, or to run and contribute to in-patient major trauma services, or to lead major trauma networks, have yet to be developed. The implementation of specific training schemes designed to generate trauma-proficient surgical cadres will be instrumental in reducing the number of avoidable deaths and raising quality.

This paper sets out the vision of the College with regard to the development of surgeons who wish to provide safe, effective care within the setting of a major trauma centre within a regional trauma network. Structures for flexible, fulfilling and defined career pathways are provided. Recommendations are set out for training pathways that deliver the competencies for resuscitative surgeons tasked with the initial stages of patient care, continuing-care for those providing on-going management, and system administration competencies for consultants managing an MTC trauma service or regional trauma network.

## The RCS Major Trauma Workforce Project

In September 2014 College Council initiated the Major Trauma Workforce Project in order to scrutinise workforce gaps and to explore how surgical training could be improved to sustain major trauma centres and regional trauma networks. This followed a College briefing note that set out the gaps in surgical workforce provision concerning care of major trauma patients.<sup>3</sup>

Two key areas of concern were identified relating to workforce generation.

1. The lack of training provision for major trauma centre consultants to provide safe and effective clinical leadership and orchestration of multi-disciplinary care for seriously injured patients.
2. The lack of a dedicated training pathway for surgeons acting as the resuscitative surgeon in higher volume major trauma centres (MTCs), and the lack of appropriate training for surgeons working in lower volume Trauma Units (TUs) – ie surgeons responsible for the resuscitation and stabilisation of complex major trauma patients.

Having confirmed these workforce gaps, the project group sought to define the competencies

<sup>2</sup> Analysis of outcome data from the Trauma Audit and Research Network suggests that patient survival has improved by 20% since the NHS implemented regional trauma networks - Professor Chris Moran, National Clinical Director for Trauma. Major Trauma Forum Meeting, Nottingham, 29 January 2014 and NHS England. Independent review of major trauma networks reveals increase in patient survival rates; Available from: <http://www.england.nhs.uk/2013/06/25/incr-pati-survivals/>. Accessed 13 February 2015.

<sup>3</sup> N Tai and M Bircher, Trauma Systems in England-a strategy for Major Trauma Workforce Generation and Sustainability, March 2014, Royal College of Surgeons of England Briefing Note

required for safe practice as a Resuscitative Surgeon and for the effective coordination and leadership of multi-disciplinary care for trauma patients for the entire duration of their care pathway. Existing models and educational programmes were outlined, and career pathways for major trauma surgeons were investigated.

## Consultant roles and major trauma care

All major trauma patients require initial assessment of their injury burden, physiological stabilisation and restoration of function. The technical, interventional roles afforded to surgeons caring for major trauma patients include 1) initial lifesaving intervention (to stem bleeding and control contamination) 2) evacuation of intracranial haematoma, 3) limb salvage (restoration of perfusion and skeletal stabilisation) and 4) restoration of function (soft tissue and bony reconstruction).

The project group recognise that, so far as British surgical practice is concerned, roles 2–4 are already mapped to defined specialty training pathways, leading to well described areas of consultant responsibility. For example, trauma and orthopaedic surgery, plastic and reconstructive surgery, and oro-maxillo facial surgery have established areas of sub-specialist interest related to the management of injury. However, the decision to deploy and then deliver initial lifesaving interventions (role 1) may fall ad-hoc to a general, vascular or cardiothoracic surgeon, depending on injury pattern and local circumstances. Currently there is no standardised programme of trauma training that assures and equips such surgeons for this ‘resuscitative’ role. The concentration of training upon elective surgical outputs, and sub-speciality fragmentation of general surgery has exacerbated this problem.

Furthermore, the project group acknowledge that the fifth role ascribed to surgeons looking after Major Trauma patients – that of daily ward rounds, identification of on-going care needs, liaison with other surgical and non-surgical services, assuring of safe discharge and follow-up – is not defined at all. Similarly, there is no training programme or definition of the competencies needed for this ‘major trauma consultant’ role. This role does not need to map to a particular surgical speciality, but could be undertaken by any appropriately trained surgeon, emergency medicine consultant, or other clinician from an acute speciality (Figure 1).

The College’s pilot document<sup>4</sup> and previous published work on the experience of general surgeons in the UK to major trauma provide accounts of the requirement to address the ‘resuscitative’ and ‘major trauma consultant’ skill shortage.<sup>5,6</sup> The current (2013) ISCP curricula set out training routes which define the skills that general surgeons require to deliver major trauma care, although the gap between curriculum and provision of training path is stark. The curriculum is comprehensive but fragmented by surgical sub-speciality. A defined pathway through the curricula for each sub-speciality, which offers a route into major trauma provision, whilst providing the trainee with a range of career options has not been articulated to date.

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4 Ibid.

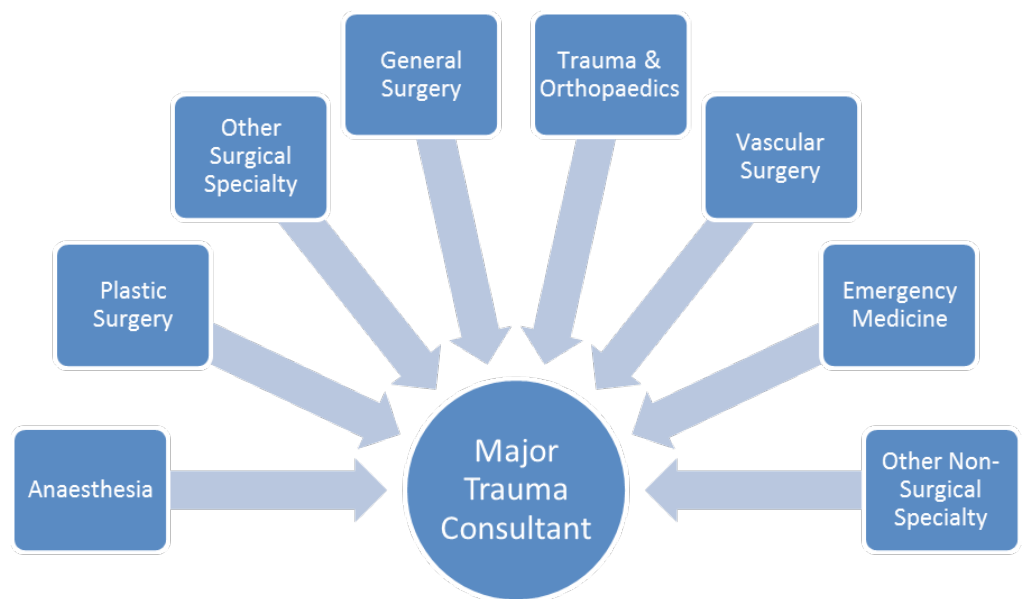
5 A Brooks et al. Experience and Training of British General Surgeons in Trauma Surgery for the Abdomen, Thorax and Major Vessels. . Ann R Coll Surg Engl 2002; 84: 409–413.

6 NRM Tai, JM Ryan, AJ Brooks. The Neglect of Trauma Surgery BMJ 2006; 332: 805–806



**Figure 1.**

Major trauma consultant core skills for on-going care of the major trauma patient in hospital and the overlap with specialities (not exclusive) that have major trauma relevant skills and may also deliver the MT consultant role.



## 2. The major trauma consultant

### Major trauma consultant role

The key role of the major trauma consultant is to lead the multi-disciplinary team (MDT) caring for seriously injured patients. However, the project group identified that the competencies embodied within the role are poorly defined and that no training pathway exists to systematically educate surgeons (or other trauma clinicians) in the ongoing care of major trauma patients. This broad range of professional knowledge is required so that major trauma consultants can:

- Lead and co-ordinate the multi-disciplinary team response until patient discharge.
- Effectively contribute to the clinical management within the major trauma centre and trauma network.
- Undertake ward rounds on major trauma patients; perform clinical reviews; examine relevant systems; check relevant imaging; ensure that there are no missed injuries or gaps in the treatment plan; answer initial questions from patients and relatives as to the injuries, sequelae, likely management plan and possible outcomes.
- Recognise when to call for earlier review from associated elements of the multi-disciplinary team in order to refresh, re-prioritise, challenge or de-conflict parts of the management plan.
- Lead the placement and discharge arrangements for community care and on-going rehabilitation
- Initiate or perform all ward-based measures required to save life in the acutely deteriorating trauma patient (airway control, IV access and blood administration, chest decompression, application of tourniquet, accurate application of haemostatic pressure, ACLS resuscitation) whilst setting in place definitive arrangements for patient stabilisation

Major trauma consultants could come from any relevant surgical or non-surgical acute specialty, including receiver trauma surgeons. Major trauma consultants who are surgeons may contribute to ongoing surgical care of trauma patients relevant to their training and experience (figure 3). However, the key clinical output of the major trauma consultant is to drive the delivery of excellent care for the complex polytrauma patient, based upon a global understanding of patient needs and mature decision-making.

### Major trauma consultant training

Appendix A provides a list of the necessary competencies required for safe and effective practice as a Major Trauma Consultant. The knowledge and clinical skills are derived from across the various surgical curricula of the ISCP, in accordance with the need for Major Trauma Consultants to have a thorough understanding of the full spectrum of trauma management.

The unifying aim is to deliver an appropriately skilled and flexible workforce, possessing a broad clinical skill set, capable of delivering safe care in a range of different settings, managing patients with multiple co-morbidities, who can adapt to the needs of a changing population demographic and address issues of health inequality.

For general or vascular surgeons undertaking receiver trauma surgeon training, opportunities for acquiring major trauma consultant skills should be embedded within the training pathway. Bespoke fellowship periods and post-graduate courses, linked to placements in well supervised positions in high volume MTCs are other options for the delivery of training.

### **Paediatric and childhood major trauma care**

All staff caring for children within major trauma services must have key paediatric competences in recognition and resuscitation of a critically ill or deteriorating child, as well as up to date training in safeguarding and pain management, as required by their role. Consultants managing children must ensure that their paediatric caseload and related outcomes are included within annual appraisal and that their CPD activities are reflective of their whole practice. All care provided should give regard to guidance set out in *Standards for non-specialist emergency surgical care of children* (RCS, Children's Surgical Forum, November 2015).

# 3. The resuscitative surgeon

## The resuscitative surgeon role and elective surgical practice

The project group examined a variety of resuscitative surgery models used in English MTCs and noted that this cadre came from a variety of general surgery and vascular surgery backgrounds. It was noted that none of the surgeons identified confined their practice to trauma, with elective practice accounting for around 50–80% of programmed activities. Career sustainability, insufficient trauma volumes, the contribution of elective practice to trauma skill technical retention, and the desire to retain elective practice for its own sake were amongst the reasons offered as to the desirability of a mixed job plan.

This model of consultant surgical practice informs the training pathway. As such, training paths must encompass a rounded approach that delivers both resuscitative surgical competencies and an elective skillset that foster job plans that are attractive, fulfilling and sustainable over the full span of a consultant career. High standards of patient care denote that the provision of learning opportunities must encompass the broad range of surgical practice in order to perform safely and effectively in emergency and trauma care. Grounding resuscitative trauma surgeon training alongside elective surgical practice ensures that the surgical workforce is sufficiently flexible to match provision to the requirements of an evolving patient population.

## Training pathways for the resuscitative surgeon role

The project group set out a pathway offering a training route for surgeons wishing to attain competency in the surgical and non-surgical management of the physiologically unstable acutely injured major trauma patient. Figure 2 illustrates an example of a training rotation from Foundation Training through to consultant appointment. It will offer a range of opportunities for trainees, adaptive to differing service requirements and personal aspirations of each stage of professional life.

The guiding principles by which any trauma training path should be developed include:

- Supplementary and complementary to elective training schedules.
- Delivers the technical and non-technical skill-sets (as defined in ISCP) for safe practice as a consultant surgeon in a surgical specialty
- Delivers the competencies for surgeons working within English major trauma centres, including multi-cavity and extremity haemorrhage control skills
- Consistent with future anticipated training objectives

## Recommendations for the improvement of surgical training

Training in major trauma surgery will further benefit from improvements to current training processes. These could include:

- Dedicated training time
- Reduction of non-educationally valuable 'service provision' activities for trainees
- Set curriculum/syllabus for each stage of training to be agreed and monitored for progress by educational supervisor
- Commitment to working within the set parameters for trainee support for out-of-hours cover and routine service provision: 'Trainees should be training'.
- Support in attendance of training courses (eg DSTS, DSTC, ASSET)

- Appointment of MTC training programme director(s)
- Formal training and certification of surgical trainers
- Development of dedicated training in the management of paediatric care

## MTC training programme director (TPD)

Major trauma networks will benefit from the appointment of designated, appropriately skilled major trauma TPDs, responsible for ensuring that the training and education of surgeons is sufficient for the acquisition and retention of the trauma skills needed for optimal patient care.

The major trauma TPD will lead educational activities to ensure that training is provided to meet local demand given the respective region's trauma case mix. The major trauma TPD would be responsible for:

- Administration and management of the training programme(s) for major trauma.
- Co-ordination between trainees, consultants, medical directors, educational providers, service providers, employers and commissioners.
- Participation in the recruitment and appointment process.
- Assessment of trainee learning needs and the most appropriate placements for each trainee throughout training to ensure that relevant competency levels are attained and maintained.
- Overseeing the delivery of the training.
- Monitoring and inspection of training placements.
- Overseeing the selection, delivery and assessment of major trauma fellowships and out-of-programme attachments.

## Training paths and rotations

Appendix B, taken from the 2013 curriculum, details all the competencies specific to major trauma for surgeons to provide the acute resuscitative treatment required of the resuscitative surgeon.

**Figure 2.**  
Example training path



## Core surgical training

Core surgical training should encompass a solid foundation in general surgery, with the option to undertake a four-month attachment in a major trauma service for trainees interested in a career that includes major trauma.

## Intermediate (ST3–4)

Trainees wishing to pursue a career in major trauma surgery would meet with educational supervisors and TPDs to arrange a rotation configured for their learning requirements and to address specific gaps, with trainees undertaking 6 month (6/12) rotations in colorectal, upper GI/HPB and vascular surgery.

A six-month major trauma placement within a high volume MTC would supplement this development, providing exposure to blunt and penetrating mechanisms of injury and the management of the severely injured patient (Figure 2). This would instil the competencies as laid out in the intermediate syllabus of the 2013 ISCP general surgery for advanced trauma.

Full competency list in Appendix B – Table 1

## Final I (ST5–6)

Following the intermediate stage of training the trainee would be expected to have a sufficiently wide range of experience to focus training toward their desired elective area of sub-specialty practice. This may centre on development in major trauma leadership or be directed towards a traditional subspecialty area within colorectal or upper GI surgery. Through training in a chosen subspecialty, trainees should be given the opportunity to undertake major trauma on-call duties to continue to develop their skills and maturity in the management of seriously injured patients. The drive to regional centralisation of subspecialty services, and co-location in MTCs will facilitate this. For instance, a trainee with an interest in HPB surgery will be able to pursue this electively while undertaking trauma on-call in the co-located MTC (Figure 2).

Full competency list below Appendix B – Table 2

## Final II (ST7–8)

A further six-month rotation in a high volume MTC in major trauma would be undertaken combined with a further six-month attachment in a trauma related specialty that would offer acquisition of skills related to vascular exposure and control. The final year would offer training in the trainee's desired subspecialist area of elective interest, mirroring the eventual desired practice setting. By the end of this stage the trainee would be competent in damage control surgery and resuscitation, and sufficiently competent in an elective subspecialty to attain a Certificate of Completion of Training (Figure 2).

Full competency list below Appendix B – Table 2

## Post-CCT training and fellowships

Obtaining a post-CCT position in an area of specialist interest is a popular choice for many surgeons wishing to consolidate or add to their training. The project group propose that surgeons interested in trauma use this period flexibly and according to their personal requirements. Some will wish to pursue fellowships germane to their elective sub-specialty interests. Others will use this period within high-volume trauma centres within the UK or abroad. While these fellowships can offer highly effective training opportunities to surgeons, it is essential that the educational opportunities provide relevant skills and knowledge for the provision of safe and effective care for patients in the UK after the completion of the post.

Adequate management and monitoring of fellowships (ideally by the Major Trauma TPD where UK-based fellowships are concerned) is essential to ensure that the skills acquired therein will contribute to the local trauma service. The TPD role pertains to selection of a relevant post for candidacy of approved fellowship status, identification of required educational outcomes and monitoring and assessment of the impact of training.

Fellowship posts should deliver a structured educational experience designed to deliver training objectives that are not attainable through local training and will be of value to patients in the respective region. They should have a predefined set of specific, measurable, attainable, relevant and time-bound (SMART) learning outcomes, agreed with local service providers and employers as well as the providers of the fellowship prior to commencement. Furthermore sufficient logging to evidence achievements is required.

The RCS Quality Assurance Committee is in the process of developing standards for accreditation of fellowships, which will inform this area.

## Academic training and out-of-programme attachment

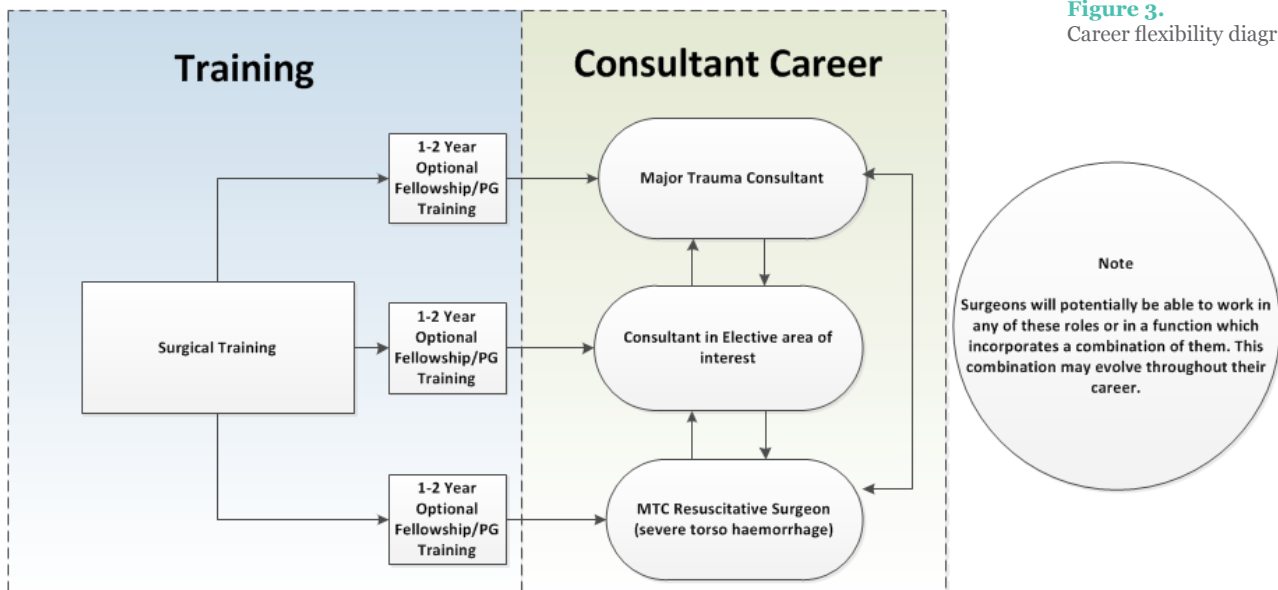
Academic pathways relevant to major trauma should be available to surgical trainees. The early years' training schedule should be flexible enough to allow trainees to devote the required time for teaching or research whilst undertaking surgical training. Academic trainees, academic and educational supervisors, and TPDs should collaborate to ensure that the required academic and clinical competencies are gained. It is understood that academic trainees will need to demonstrate competence in all areas of their speciality syllabus in order to be awarded a CCT, reaching the same level of competence in surgery required of non-academic trainees in the curriculum. The consequence of this is that – as is the case with other fields of academic surgical training – major trauma academic trainees may take longer to complete training.

Trainees with an interest in major trauma surgery can benefit from the opportunity to undertake out-of-programme (OOP) attachments in related medical disciplines. The service can value greatly from the additional expertise surgeons are able to develop in these rotations and opportunities to undertake OOP attachments should be considered where value can be shown to be added.

# 4. Career pathways for surgeons with an interest in major trauma

On gaining their CCT surgeons who have trained in major trauma would be able to pursue a number of roles depending on appointment, local need, and personal aspiration (Figure 3). Some general surgeons, having undertaken resuscitative trauma surgeon and major trauma consultant training, will be able to play a full part in the initial and ongoing care of trauma patients. This role should be combined with contribution to an elective, or elective and emergency surgery service according to job-plan, as volumes of trauma surgery within the UK are unlikely to sustain a practice based purely on trauma. Some surgeons with receiver trauma surgeon training will decide to concentrate more on developing their chosen elective practice and not to contribute to the ongoing major trauma service. Others will look to take on wider leadership roles leading to clinical director appointment within their major trauma service or major trauma network. Not all surgeons with trauma training need be based in the MTC. Depending on local need, models of employment where TU surgeons undertake regular on-call or duty periods within their local MTC will become established.

**Figure 3.**  
Career flexibility diagram



## Job plans and skills maintenance

To ensure maintenance of skills in major trauma and the chosen specialty surgery, a suitable job-plan should as a minimum include:

- 1 in 8 MTC call
- 1 in 8 surgical specialty on call
- 2 operating surgical lists – (eg 3 PAs for elective specialty plus 1PA for MTC surgery)
- 1 outpatient clinic
- Ward rounds - MTC and surgical specialty
- Appropriate SPA allowances

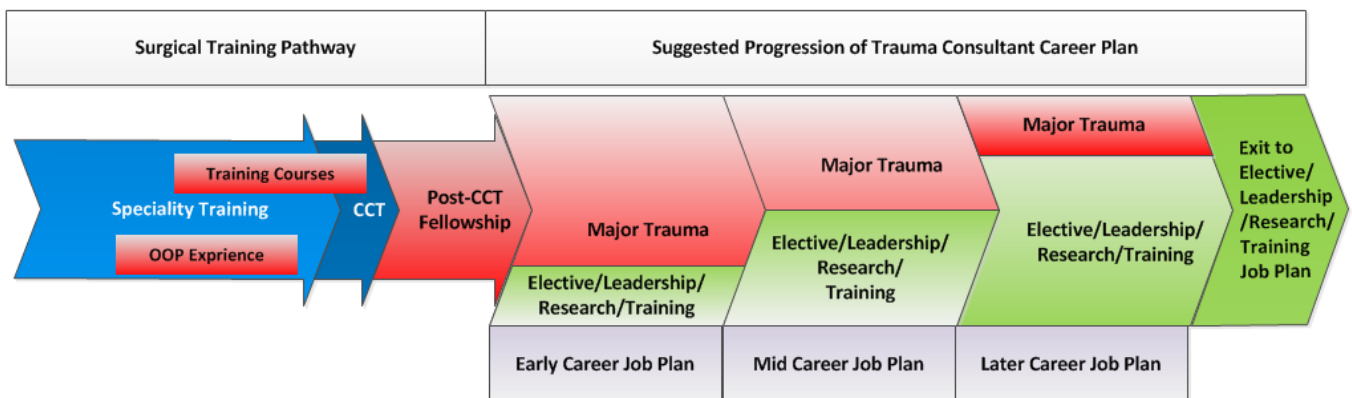
A 'Surgeon of the Week' or similar model is likely to be helpful. Job plans may be configured around blocks of duty dedicated to major trauma, emergency surgery and elective services in order to ensure continuity of case.



## Flexibility and surgical careers

Consultant surgeons take on different roles as their careers progress, and major trauma career paths should reflect this reality. It is anticipated that the demands of acute, out-of-hours on-call for major trauma are more readily borne during the first half of a consultant career than the latter half. A pathway that allows consultants to broaden their elective, academic, educational or managerial responsibilities, and to diminish the frequency of on-call duties, would be beneficial to patients, surgeons and hospitals (Figure 4). Trainees entering the major trauma training pipeline would be assured of a career structure that was flexible, fulfilling and motivating. This will contribute to an effective and responsive workforce that can sustain the clinical outputs of major trauma centres and regional trauma networks.

**Figure 4.**  
Example career plan



# 5. The future MTC workforce

## Resuscitative surgeon workforce

The project group undertook initial workforce modelling in order to understand the number of resuscitative surgeon roles required to staff an MTC on-call rota.

Key assumptions used to model potential numbers were as follows:

- 22 English major trauma centres
- Each MTC requires a resuscitative trauma surgical cadre sufficient to populate an on-call rota.
- A minimum of 8 consultants is required to staff the rota

Using this model, the upper ceiling of resuscitative trauma surgeon consultants required for England is 176 (whole time equivalence). This function, however, requires the skills set present at all times not necessarily in a single individual so potential for alternative models for providing this is not ruled out. assuming that the steady state is reached in 6 years and that a 10% loss of trainees occurs over the period.

## Major trauma consultant surgeon workforce

The project group undertook further workforce modelling in order to understand the number of surgeons required to fulfil the major trauma consultant role and staff MTC trauma services. These surgeons could come from the resuscitative trauma surgeon cadre as well as from any trauma-relevant surgical specialty – aggregated as a ‘reconstructive’ major trauma surgeon cadre for the purposes of modelling.

Key assumptions used to model potential numbers were as follows:

- 22 English major trauma centres
- Each MTC has an established major trauma service
- A minimum of 8 consultant whole time equivalents is required to staff the service
- Each major trauma service can constitute its service with resuscitative trauma surgeons, reconstructive trauma surgeons, and non-surgically trained trauma consultants (emergency medicine or critical care physicians)
- Major trauma services will base their constitution according to local epidemiology.

Four simple models of MTC Major Trauma Service are considered:

- **Resuscitative** model: high burden of penetrating trauma burden – 8 resuscitative surgeon model
- **RECON(STRUCTIVE)** model: Low burden of penetrating trauma- 8 Reconstructive Surgeon model
- **RESUS/RECON mix** model: Intermediate burden of penetrating trauma – 4 Hybrid Resuscitative Surgeon & 4 Reconstructive Surgeon model
- **MULTI-DISCIPLINARY** model: (2 Resuscitative Surgeon, 2 Reconstructive Surgeon, 4 non-surgically trained Trauma Consultants)

Five scenarios, varying by the number of MTCs subscribing to each model, are depicted in Figure 5. This shows the number of NTN surgical trainees who would be recruited and trained in major trauma consultant competencies (alongside their elective specialisms per year to produce a steady state in major trauma consultant surgeon provision).<sup>7,8</sup>

Scenario	No of MTC services on RESUS model	No of MTC services on RECON model	No of MTC services on RESUS/RECON model	No of MTC services on MULTI-DISCIPLINARY model	RESUS Trauma Surgeon Total	RECON Trauma Surgeon Total	Trauma Surgeon Total	NTN per year total	NTN per year (resilience)
1	5	5	0	12	62	62	124	21	23
2	5	5	5	7	74	74	148	25	27
3	5	11	0	6	52	100	152	25	28
4	4	4	11	3	82	82	164	24	30
5	11	11	0	0	88	88	176	30	32

Using this approach, the upper ceiling of surgeons needed to train in the MTC trauma consultant role is 176 surgeons (scenario 5). A more realistic number, which takes in to account the contribution of non-surgically trained trauma consultants, is scenario 2, which requires 148 surgeons, or training/recruitment of 27 NTN per year.

<sup>7</sup> Assuming steady state is reached in six years following identification of first tranche of trauma trainees at ST3 level

<sup>8</sup> Assuming 10% loss of trainees over six years

## 6. Conclusion

This paper summarises the views of the Royal College of Surgeons of England Major Trauma Workforce Project group, and sets out solutions to issues that threaten the sustainability of Major Trauma Services in England and Wales.

It is imperative that sufficient numbers of suitably trained major trauma specialists are produced, through provision of better defined training pathways that foster excellence in initial and on-going care. These pathways must provide for fulfilling surgical careers that incorporate the development and maintenance of elective, academic or managerial interests.

Most surgical specialties afford some training and career options in trauma care, but notable exceptions include General Surgery and Vascular Surgery – the specialties that have most to offer in the immediate surgical resuscitation of polytrauma patients. By incorporating formalised trauma training and allowing motivated trainees to acquire the Resuscitative Surgeon competencies, the quality of initial and care can be maintained and improved. Beyond the first 24hrs of care, outcomes and patient experience can be optimised by staffing Major Trauma Services with trauma-trained Major Trauma Consultants who have an excellent understanding of the generality of trauma, who can navigate the complex treatment paths available and can act as champions for their patients.

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# Appendix A

## Competencies for MTC consultants (mapped to respective ISCP)

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The chart overleaf outlines the required skills to become a major trauma centre consultant, responsible for the ongoing care and coordination of the severely injured patient in the MTC and to map out an appropriate career pathway to deliver this.

The MTC consultant skill set lies in understanding the major trauma patient and their injuries from a holistic perspective with sufficient knowledge and understanding of the management of these injuries from across the speciality divides to coordinate their care from resuscitation to rehabilitation.

This appeals to a multidisciplinary approach bringing the best skills from a number of speciality backgrounds in-order to capture the recent advances in major trauma management and deliver the best care for the patient both in mortality and functional outcome.

The competencies are linked to the ISCP; however, owing to the multi-disciplinary nature of the MTC consultant role the required competencies span a number of the specialty curricula. For this reason bespoke training opportunities will be required for the delivery of the inter-specialty disciplines.

The levels of competency given correspond to the ISCP competency descriptors which can be viewed below in Appendix F.

Table 1 – MTC consultant competencies

TOPIC	COMPETENCY
<b>Generic Competency Trauma Principles</b>	<p><b>Objective</b></p> <p>Identify and manage the majority of seriously injured patients</p> <p><b>Knowledge</b></p> <p>4 Anatomy of abdomen 4 Aetiology and Epidemiology 4 Pathophysiology of shock 4 Recognition of the possibility of non-accidental injury</p> <p><b>4 Differences in children and the elderly</b></p> <p>4 Principles of management of severely injured patients 4 Importance of mechanism of injury – gun shot, stabbing, seat belt 4 Indications for uncross matched blood 4 Coagulopathy 4 Pathophysiology of peritonitis and sepsis 4 Trauma Scoring Systems</p> <p><b>Clinical Skills</b></p> <p>2 Triage 4 History and examination 4 Resuscitation 4 Investigations 4 Appropriate use of radiographs, CT and ultrasound 3 Indications for intervention 3 Recognition of injuries requiring other specialties 3 Management of hollow organ injury 3 Understand indications for Damage Control vs Definitive Surgery 4 Assessment and initial management of multiply injured patient</p>
<b>Clinical Decision Making</b>	<p>Ability to rapidly assimilate clinical information in order to ensure correct decision making with regard to:</p> <ul style="list-style-type: none"> <li>• Initiating or undertaking the best investigations, including imaging, physiology and information gathering</li> <li>• Initiating or performing the most appropriate interventions, including conservative, operative or interventional radiology</li> <li>• Sequencing and prioritisation of interventions (immediate, short term and long term)</li> <li>• Generation of a care disposition pathway</li> <li>• Anticipation and mitigation of likely complications and mustering and coordination of wider trauma clinical services to address these concerns</li> </ul>
<b>Central Nervous System/ Brain Injury Head and Neck</b>	<p><b>Objective</b></p> <p>Identification, assessment and initial management of trauma to the head and neck</p> <p><b>Knowledge</b></p> <p>4 Assessment of the unconscious patient 4 Ability to advise on management of secondary complications and further surgical intervention 4 Anatomy of the head and neck 4 Pathophysiology of head injury and of multiple trauma 4 Pathophysiology of SAH 4 Indications for operative intervention 4 Medical management of acutely raised intracranial pressure 4 Complications of surgery and their management 4 The role of post-traumatic neurological rehabilitation 4 Indications for decompressive craniectomy in management of intractable increases in ICP</p> <p><b>Clinical Skills</b></p> <p>3 Interpretation of CT scans including assessment of intracranial blood load, haematomas and hydrocephalus 3 Observation of patients with head injury 2 Interpretation of CT brain/skull 3 Decision to refer to neurosurgeon</p>

TOPIC	COMPETENCY
<b>Management of the spinal injury patient</b>	<p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>4 Pathophysiology of spinal cord injury</li> <li>4 Classification of spinal fracture dislocations</li> <li>4 Biomechanics of spinal instability</li> <li>4 Indications for halo traction and external stabilisation</li> <li>4 Indications for and principles of open reduction and stabilisation</li> <li>3 Anatomy of the spine, spinal cord and nerve roots</li> <li>3 Anatomy and principles of surgical approaches: anterior and posterior at each level and endoscopic access</li> <li>4 The acute fracture and dislocation</li> <li>4 Spinal shock and cord syndromes</li> </ul> <p><b>Clinical Skills</b></p> <ul style="list-style-type: none"> <li>2 Interpretation of plain radiographs and CT scans of cervical spine</li> <li>4 Immobilisation of patients with suspected cervical spine injury</li> <li>4 Clinical assessment of the spinal injury patient</li> <li>4 Management of spinal shock</li> <li>4 Interpretation of plain radiology, CT and MRI scans</li> <li>4 Liaison with spinal injury units</li> </ul>
<b>Peripheral Nervous System Injury</b>	Principles of management of peripheral nerve injury and post-operative management
<b>Pelvic Injury</b>	<p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>4 Anatomy of the hip and pelvic region and related structures</li> <li>4 Initial clinical assessment of the injured patient</li> <li>4 Priorities of treatment and identification of life/limb-threatening injuries</li> </ul> <p><b>Clinical Skills</b></p> <ul style="list-style-type: none"> <li>4 Non-operative management of fractures</li> <li>4 Rehabilitation of the injured patient</li> <li>4 Principles of pelvic/acetabular fracture stabilisation</li> <li>4 Recognition of visceral/neurovascular damage</li> <li>4 Rehabilitation of the injured patient</li> </ul>
<b>Urological Injury</b>	<p><b>Trauma to the urinary tract</b></p> <p><b>Objective</b></p> <p>To assess and manage patients who present with genitourinary trauma, including onward referral when necessary</p> <p><b>Knowledge</b></p> <p><a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=jmE92GS8JytegbE7ZOGTwc9Bz054HYROhW9MuE2sUctkj9qi4akzePuyDaqzfmymo6+97e7u7R/vErUv+g6KNxLlgmlUXCFavk78A66iLvNqJFFJeouDA0ItWwhzruB9nX4vNk50GNOxLi9LUGOjBQ==">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=jmE92GS8JytegbE7ZOGTwc9Bz054HYROhW9MuE2sUctkj9qi4akzePuyDaqzfmymo6+97e7u7R/vErUv+g6KNxLlgmlUXCFavk78A66iLvNqJFFJeouDA0ItWwhzruB9nX4vNk50GNOxLi9LUGOjBQ==</a></p> <ul style="list-style-type: none"> <li>3 Anatomy of kidneys, ureters, bladder and male/female urethra</li> <li>3 Causes, pathophysiology classification and management of renal, ureteric, bladder, urethral, testicular, and genital trauma</li> <li>4 Differences In children</li> </ul> <p><b>Clinical Skills</b></p> <ul style="list-style-type: none"> <li>3 Assessment and management of renal, ureteric, bladder, urethral, testicular, and genital trauma. Recognition of complications including urinary collection, urinary retention, blocked outflow tract and fistula</li> <li>3 Principles of late reconstruction</li> <li>3 Principles of management of post-operative patients following nephrectomy, renal repair, ureteric stenting, bladder repair, supra-pubic or peri-urethral urinary drainage.</li> <li>3 Principles of operative and conservative management of urological injury</li> </ul>

TOPIC	COMPETENCY
Soft Tissue Injury Extremity and Soft Tissue	<p><b>Objective</b></p> <p>Assessment and management of blunt and penetrating injury of the soft tissues and skeleton.</p> <p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>4 Anatomy of the limbs</li> <li>4 Initial clinical assessment of the injured patient</li> <li>4 Priorities of treatment and identification of life/limb-threatening injuries</li> <li>3 Concept of low energy, high energy transfer injury</li> <li>3 Pathogenesis of shock</li> <li>2 Principles of soft tissue coverage and simple flaps</li> <li>3 Principles of topical negative pressure dressings</li> <li>4 Understanding of wound contamination/infection</li> <li>4 Fracture management (closed, open and pathological)</li> <li>4 Reconstructive surgery in non-unions/mal-unions</li> <li>4 Principles of open reduction and internal fixation/external fixation of fractures</li> <li>4 Splintage and traction</li> <li>4 Principles of casting</li> <li>4 Non-operative management of fractures</li> <li>4 Rehabilitation of the injured patient principles of management of open fractures and BOAST 4 guidelines</li> <li>4 Compartment syndrome</li> </ul> <p><b>Clinical Skills</b></p> <p><b>Blunt and penetrating soft tissue and skeletal injury</b></p> <ul style="list-style-type: none"> <li>4 Arrest haemorrhage by pressure and tourniquet</li> <li>4 Appropriate immobilisation during assessment</li> <li>2 Assessment of ischaemic limb</li> <li>2 Recognition and treatment of acute compartment syndrome</li> <li>3 Postoperative management and recognition of complications</li> </ul>
Maxillo-facial, Ophthalmic and ENT Injury	<p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>3 Anatomy of facial skeleton, scalp, face, nose, ears, eyelids, orbit and contents</li> <li>3 priorities of management</li> <li>3 Classification of condylar, dental trauma and dento-alveolar, frontal bone, facial fractures</li> <li>4 Understanding the benefits and indications of both open and closed treatments</li> </ul> <p><b>Clinical Skills</b></p> <ul style="list-style-type: none"> <li>4 assessment and examination of patient with facial trauma</li> <li>3 awareness of additional factors affecting timing of surgery</li> <li>3 Assessment of head injury and cranial nerve function</li> <li>4 Selection and interpretation of relevant imaging</li> <li>4 Potential complications long and short term</li> <li>3 Ability to formulate a treatment plan and prioritise management</li> </ul>



TOPIC	COMPETENCY
Abdomen and Thorax	<p><b>Objective</b></p> <p>Assessment and management of blunt and penetrating injury.            Closed thoracic injury: Assessment and emergency management of blunt injury of the thorax            Penetrating thoracic injury: Assessment and emergency management of penetrating injury of the thorax.            Closed and penetrating abdominal injury: Assessment and management of blunt and penetrating abdominal injury.</p> <p><b>Knowledge</b></p> <p><b>Closed and penetrating thoracic/abdominal injury</b>            4 Anatomy            2 Concept of low energy, high energy transfer injury            4 Pathogenesis of shock</p> <p><b>Clinical Skills</b></p> <p><b>Closed and penetrating thoracic injury</b>            2 Recognise need for operative intervention and organise            2 Understand indications for ER thoracotomy            3 Recognise and treat sucking chest wound            3 Postoperative management and recognition of complications</p> <p><b>Closed and penetrating abdominal injury</b>            2 Recognise need for laparotomy and organise            2 Arrest haemorrhage by suture/ligation/packing            2 Indication for pelvic fixator            2 Drains for biliary / pancreatic injury            2 Management of retroperitoneal haematoma            3 Postoperative management and recognition of complications            4 Early postoperative management of conventional stoma            2 Assessment of the post-operative GI surgical patient with emergency complications</p>
Vascular Trauma	<p><b>Objective</b></p> <p>Identification, assessment and management of injuries to blood vessels</p> <p><b>Knowledge</b></p> <p>3 Surgical anatomy relative to fractures, nerves and associated structures            4 Mechanisms of vascular injury (penetrating, blunt and iatrogenic)            4 Low energy and high energy transfer injury            3 Pathophysiology of trauma, muscle ischaemia and shock lung            4 Investigations for bleeding/ischaemia (duplex, CTA, on-table arteriography)            2 Pathophysiology of trauma and muscle ischaemia            2 Pathophysiology of A-V fistula            4 Principles and indications for primary amputation            Principles of post-operative management of the residual limb (stump)            Principles of management of fasciotomies</p> <p><b>Investigations</b>            2 Indications            2 Invasive            2 Non-invasive</p> <p><b>Operative approach to specific injuries</b>            2 Arterial or venous            2 Open surgery            2 Endovascular            2 Combined arterial and venous            2 Orthopaedic / neurological            2 Technical options for repair            3 Fasciotomy</p> <p><b>Clinical Skills</b></p> <p>2 Symptoms and signs of acute arterial / venous injury            2 Manage systemic effects of arterial trauma - rhabdomyolysis</p>

TOPIC	COMPETENCY
Care of the elderly trauma patient	Principles of recognition and management of: <ul style="list-style-type: none"> <li>• Agitation, dementia, delirium and post-admission confusion</li> <li>• Mobility, cognitive and swallowing/speech dysfunction and role of therapies</li> <li>• URTI, LRTI, UTI</li> <li>• The post-fall from standing patient</li> <li>• Exacerbation of chronic conditions (COPD, DM and mobility disorders)</li> <li>• Principles of rehabilitation</li> <li>• Principles of End of life care</li> </ul>
Care of patient groups for whom special considerations apply	Principles of adult and child safeguarding Principles of managing patients who are deprived of liberty Principles of managing alcohol and drug dependency in trauma in-patients Principles of managing trauma in-patients who have self-harmed Principles of managing trauma in-patients with acute mental health crises and psychological disorders Principles of managing trauma in-patients with learning difficulties
Management of common complications	Principles of management of: <ul style="list-style-type: none"> <li>• Pain (Oral, IV, PCA, regional techniques)</li> <li>• Infection (SIRS, SEPSIS)</li> <li>• Nutritional dysfunction</li> <li>• Metabolic and endocrine dysfunction</li> <li>• Common electrolyte disturbances</li> <li>• Prevention and treatment of Thromboembolism</li> </ul>
<b>Acknowledgement and link to ISCP</b>	
The above competence descriptors have been taken from the following ISCP Curricular: <b>General Surgery (2013):</b> <a href="https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf">https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf</a> <b>Neurosurgery (2010):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtg8MFxqvSHpsYROinig2TCs=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtg8MFxqvSHpsYROinig2TCs=</a> <b>Cardiothoracic Surgery (2014):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtjh0PDzDI4dLQM1+ua3hrN4=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtjh0PDzDI4dLQM1+ua3hrN4=</a> <b>Trauma and Orthopaedic Surgery (2014):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtqx93tr8r1WBZgcwKrWYh68=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtqx93tr8r1WBZgcwKrWYh68=</a> <b>Oral and Maxillofacial Surgery (2010):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtkzLubS2292nsVFYUURMf8A=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtkzLubS2292nsVFYUURMf8A=</a> <b>Vascular Surgery (2014):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtukUkeQKq7gpbftet5HQypc=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtukUkeQKq7gpbftet5HQypc=</a> <b>Urology (2010):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtuCOpSN6UVIgpG3hs2JL4tM=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtuCOpSN6UVIgpG3hs2JL4tM=</a> <b>Plastic Surgery (2013):</b> <a href="https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtmsQfnon4Mt7U0vLMhrjto=">https://www.iscp.ac.uk/surgical/SpecialtySyllabus.aspx?enc=j4VfyFXq6Hwh0loAlHujtmsQfnon4Mt7U0vLMhrjto=</a>	

# Appendix B

## Resuscitative surgeon competencies (mapped to ISCP general surgery 2013)

The tables below list the competencies, both technical and non-technical, for surgeons working in an MTC in a resuscitative surgeon role, managing the initial haemodynamic stabilisation of trauma patients.

Surgeons in this function will typically be ‘torso’ surgeons whose work involves access to the thoracic, peritoneal and retroperitoneal domains, ie general, vascular or cardiothoracic surgery backgrounds. Surgeons working within other surgical specialities (eg transplant, urology) could potentially be credentialed with the required competencies thereby enabling them to undertake such positions, subject to demonstration of maintenance of competency.

The levels of competency given correspond to the ISCP competency descriptors which can be viewed below in Appendix C.

**Table 2 – Resuscitative surgeon competencies Intermediate ST3–4 and Final I ST5–6**

Competence Levels for Major Trauma Resuscitative Surgeons	
ISCP General Surgery 2013 Major Trauma Competencies for Resuscitative Surgeons, Intermediate level Competency and Final I level Competency	
Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
Trauma Principles	<p><b>Objective</b></p> <p>Identify and manage the majority of abdominal injuries</p> <p><b>Knowledge</b></p> <p>4 Anatomy of abdomen 4 Aetiology and epidemiology 4 Pathophysiology of shock 4 Recognition of the possibility of non-accidental injury 4 Differences in children and the elderly 4 Principles of management of severely injured patients 4 Importance of mechanism of injury – gunshot, stabbing, seat belt 4 Indications for uncross matched blood 4 Coagulopathy 4 Pathophysiology of peritonitis and sepsis 4 Trauma scoring systems</p> <p><b>Clinical Skills</b></p> <p>2 Triage 4 History and examination 4 Resuscitation 4 Investigations 4 Appropriate use of radiographs, CT and ultrasound 3 Indications for intervention 3 Recognition of injuries requiring other specialities 3 Management of hollow organ injury 3 Understand indications for damage control vs. definitive surgery</p>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
Abdomen And Thorax	<p><b>Objective</b></p> <p>Assessment and management of blunt and penetrating injury.            Closed thoracic injury: Assessment and emergency management of blunt injury of the thorax            Penetrating thoracic injury: Assessment and emergency management of penetrating injury of the thorax.            Closed and penetrating abdominal injury: Assessment and management of blunt and penetrating abdominal injury.</p> <p><b>Knowledge</b></p> <p><b>Closed and penetrating thoracic injury</b>            4 Anatomy            2 Concept of low energy, high energy transfer injury            4 Pathogenesis of shock</p> <p><b>Closed and penetrating abdominal injury</b>            4 Anatomy            2 Concept of energy, low high energy transfer injury            4 Pathogenesis of shock</p> <p><b>Clinical Skills</b></p> <p>2 Indications for and interpretation of CT            2 Indications for radiological intervention for haemorrhage control</p> <p><b>Closed thoracic injury</b>            4 Assessment and initial management of multiply injured patient            2 Recognise need for operative intervention and organise            2 Understand indications for ER thoracotomy            3 Postoperative management and recognition of complications</p> <p><b>Penetrating thoracic injury</b>            4 Assessment and initial management of multiply injured patient            2 Recognise need for operative intervention and organise            3 Recognise and treat sucking chest wound            2 Understand indications for ER thoracotomy            3 Postoperative management and recognition of complications</p> <p><b>Closed and penetrating abdominal injury</b>            4 Assessment and initial management of multiply injured patient            2 Recognise need for laparotomy and organise            2 Arrest haemorrhage by suture/ligation/packing            2 Indication for pelvic fixator            2 Drains for biliary / pancreatic injury            2 Management of retroperitoneal haematoma            3 Postoperative management and recognition of complications</p> <p><b>Technical Skills</b></p> <p><b>Closed and Penetrating thoracic injury</b>            4 Chest drain insertion            1 Lateral thoracotomy            1 Median sternotomy            1 Clamshell thoracotomy            1 Hilar control of massive pulmonary haemorrhage            1 Non-segmental lung resection            1 Pulmonary tractotomy using staplers            1 Pericardotomy            1 Control and suture of myocardial laceration</p> <p><b>Closed and penetrating abdominal injury</b>            2 Laparotomy - trauma            2 Packing / debridement of liver trauma            2 Splenectomy            1 Splenic repair            2 Small bowel resection            2 Distal pancreatectomy            2 Pancreatic debridement and drainage            2 Mobilisation and repair of the duodenum            2 Medial rotation of left hemicolon and colectomy when appropriate            2 Medial rotation of right hemicolon and colectomy when appropriate            2 Hartmann's Procedure            1 Nephrectomy            1 Bladder repair            2 Ileostomy - construction            2 Colostomy - construction            2 Temporary abdominal closure bogota bag or topical negative pressure dressing</p>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
Head and neck	<p><b>Objective</b></p> <p>Identification, assessment and initial management of trauma to the head and neck</p> <p><b>Knowledge</b></p> <p>4 Anatomy of the head and neck</p> <p><b>Clinical Skills</b></p> <p>4 Immobilisation of patients with suspected cervical spine injury</p> <p>3 Observation of patients with head injury</p> <p>2 Interpretation of plain radiographs and CT scans of cervical spine</p> <p>2 Interpretation of CT brain/skull</p> <p>3 Decision to refer to Neurosurgeon</p> <p><b>Technical Skills</b></p> <p>1 Exposure, control and repair of vascular, airway or GI tract structures in the neck</p> <p>3 Cryothyroidotomy</p> <p>1 Formal tracheostomy</p> <p>1 Burr holes</p> <p>1 Craniotomy/Craniotomy</p> <p>1 Evacuation of Extradural/Subdural haematoma</p> <p>1 Debridement of injured brain</p> <p>1 Lateral canthotomy for orbital decompression</p>
Extremity and soft tissue	<p><b>Objective</b></p> <p>Assessment and management of blunt and penetrating injury of the soft tissues and skeleton.</p> <p><b>Knowledge</b></p> <p>4 Anatomy of the limbs</p> <p><b>Blunt and penetrating soft tissue and skeletal injury</b></p> <p>4 Anatomy</p> <p>3 Concept of low energy, high energy transfer injury</p> <p>3 Pathogenesis of shock</p> <p>2 Principles of soft tissue coverage and simple flaps</p> <p>3 Principles of Topical Negative Pressure Dressings</p> <p>4 Understanding of wound contamination/infection</p> <p><b>Clinical Skills</b></p> <p><b>Blunt and penetrating soft tissue and skeletal injury</b></p> <p>4 Assessment and initial management of multiply injured patient</p> <p>4 Arrest haemorrhage by pressure and tourniquet</p> <p>4 Appropriate immobilisation during assessment</p> <p>2 Recognition of major vascular trauma</p> <p>2 Assessment of ischaemic limb</p> <p>2 Recognition and treatment of acute compartment syndrome</p> <p>3 Postoperative management and recognition of complications</p> <p><b>Technical Skills</b></p> <p><b>Proximal arterial control</b></p> <p>1 Femoral</p> <p>1 Brachial</p> <p>1 Subclavian</p> <p><b>Soft Tissue Management</b></p> <p>2 Wound debridement and lavage</p> <p>2 Fasciotomy – lower leg</p> <p>2 Fasciotomy – thigh</p> <p>2 Fasciotomy – upper limb</p> <p>3 Application of dressings</p> <p>2 Application of topical negative pressure dressings</p> <p>2 Split skin grafting</p>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Vascular trauma</b>	<p><b>Objective</b></p> <p>Identification, assessment and management of injuries to blood vessels</p> <p><b>Knowledge</b></p> <p><b>Surgical anatomy</b></p> <p>2 Relationship of vascular structures to fractures, nerves, associated structures</p> <p><b>Mechanisms of vascular injury</b></p> <p>2 Traumatic</p> <p>2 Iatrogenic</p> <p>2 Pathophysiology of trauma and muscle ischaemia</p> <p>2 Pathophysiology of A-V fistula</p> <p><b>Investigations</b></p> <p>2 Indications</p> <p>2 Invasive</p> <p>2 Non-invasive</p> <p><b>Operative approach to specific injuries</b></p> <p>2 Arterial or venous</p> <p>2 Open surgery</p> <p>2 Endovascular</p> <p>2 Combined arterial and venous</p> <p>2 Orthopaedic / neurological</p> <p>2 Technical options for repair</p> <p>3 Fasciotomy</p> <p><b>Clinical Skills</b></p> <p>2 Symptoms and signs of acute arterial / venous injury</p> <p><b>Investigation :</b></p> <p>3 Ankle / brachial pressure index</p> <p>3 Duplex</p> <p>3 CT angiogram</p> <p>3 DSA</p> <p>3 Manage multiply injured patient</p> <p>2 Manage systemic effects of arterial trauma - rhabdomyolysis</p> <p><b>Technical Skills</b></p> <p>4 Control with compression</p> <p><b>Surgical options:</b></p> <p>1 Exposure and control of major vessels</p> <p>1 Thoracic aorta</p> <p>1 Abdominal aorta (infra and supra renal)</p> <p>1 Subclavian and axillary arteries</p> <p>1 Femoral and popliteal arteries</p> <p>1 Use of shunts</p> <p>2 Ligation</p> <p>1 Direct suture repair</p> <p>1 End to end anastomosis</p> <p>1 Interposition vein / prosthetic graft</p> <p>1 Panel / spiral grafts</p> <p>2 Fasciotomy</p> <p><b>Radiological</b></p> <p>1 Intra-operative imaging techniques</p> <p>1 Options for control of bleeding</p>
<b>ACKNOWLEDGEMENT AND LINK TO ISCP</b>	
Taken from the ISCP 2013 Syllabus for General Surgery available here: <a href="https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf">https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf</a>	

Table 3 – Resuscitative surgeon competencies Final II ST7–8

Description of Competence Levels for Major Trauma Resuscitative Surgeons	
ISCP General Surgery 2013 Major Trauma Competencies for Resuscitative Surgeons, Final II level Competency	
Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Key Skills</b>	
<b>Manage the patient with multiple injuries</b>	<ul style="list-style-type: none"> <li>• Assess and resuscitate the patient (including children) with multiple injuries in accordance with the ATLS standards current at the time</li> <li>• Trainees should have a valid ATLS certificate when they apply for CCT</li> <li>• Work appropriately as part of the trauma team, participating at a level appropriate to the situation either as member or leader.</li> <li>• Conduct the initial management of blunt and penetrating injuries (including gunshot and knife) calling in other expertise as necessary.</li> <li>• Participate as an effective member of the major incident team as required.</li> </ul>
<b>Manage trauma of specific areas</b>	<ul style="list-style-type: none"> <li>• Diagnose and manage patients (including children) with abdominal trauma including bowel, splenic, hepatic and pancreatic injuries.</li> <li>• Competent to recognise the indications for and to perform exploratory and damage limitation laparotomy</li> <li>• Diagnose and initially manage vascular trauma, controlling haemorrhage with pressure and referring on for definitive management</li> <li>• Initial management of soft tissue extremity injury, referring on when necessary for definitive management</li> <li>• Initial management of head and neck injury, referring on when necessary for definitive management</li> <li>• Diagnose and initiate management of the patient with possible injury to the uro-genital tract, involving other specialists appropriately.</li> <li>• Initial management of thoracic injury; ability to carry out damage control thoracotomy when this is required as an emergency; onward referral to more specialised surgeons when appropriate</li> </ul>
<b>Trauma principles</b>	
<b>Damage control surgery</b>	<ul style="list-style-type: none"> <li>3 Management of the postoperative patient in difficult circumstances eg acidosis, coagulopathy, rewarming</li> <li>4 Difficult peripheral haemorrhage: safe control of major vessels</li> <li>4 Severely traumatised ischaemic limbs: safe control of major vessels</li> <li>3 Repair of vessels</li> <li>3 Use of temporary shunts</li> <li>4 Fasciotomy</li> <li>3 Decision to amputate</li> <li>4 Amputation AK</li> <li>4 Amputation BK</li> <li>4 Amputation upper limb</li> <li>n/a Pregnant woman with severe abdominal trauma: Caesarean section</li> <li>3 Burns: escharotomy</li> <li>4 Fluid replacement</li> <li>4 Surgical airway management in severe head and neck injury: cricothyroidotomy</li> <li>3 Tracheostomy</li> </ul>
<b>Generic knowledge requirements</b>	<ul style="list-style-type: none"> <li>4 Anatomy of abdomen</li> <li>4 Aetiology and epidemiology</li> <li>4 Pathophysiology of shock</li> <li>4 Recognition of the possibility of non-accidental injury</li> <li>4 Differences in children and the elderly</li> <li>4 Principles of management of severely injured patients</li> <li>4 Importance of mechanism of injury - gun shot, stabbing, seat belt</li> <li>4 Indications for uncross matched blood</li> <li>4 Coagulopathy</li> <li>4 Pathophysiology of peritonitis and sepsis</li> <li>4 Trauma scoring systems</li> </ul>
<b>Generic clinical skill requirements</b>	<ul style="list-style-type: none"> <li>4 Triage</li> <li>4 History and examination</li> <li>4 Resuscitation</li> <li>4 Investigations</li> <li>4 Appropriate use of radiographs, CT and ultrasound</li> <li>4 Indications for intervention</li> <li>4 Recognition of injuries requiring other specialties</li> <li>4 Management of hollow organ injury</li> <li>4 Understand indications for damage control vs. definitive surgery</li> </ul>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Advanced trauma – general principles (for those intending to work in a trauma centre)</b>	
<b>Objective</b>	
<p><b>Pathophysiology of trauma:</b> Knowledge of the pathophysiology of different types of trauma</p> <p><b>Trauma laparotomy:</b> Ability to perform trauma laparotomy.</p> <p><b>Paediatric trauma laparotomy:</b> Ability to perform paediatric trauma laparotomy.</p> <p><b>Trauma thoracotomy:</b> Ability to perform trauma thoracotomy.</p> <p><b>Damage control surgery:</b> Judgement in performing damage control surgery if definitive laparotomy inappropriate.</p> <p><b>Difficult peripheral haemorrhage:</b> Ability to manage difficult peripheral haemorrhage</p> <p><b>Severely traumatised ischaemic limbs:</b> Appropriate urgent management of severely traumatised ischaemic limbs.</p> <p><b>Head injury:</b> Urgent management of head injury.</p> <p><b>Pregnant woman with severe abdominal trauma:</b> Urgent management of pregnant woman with abdominal trauma.</p> <p><b>Burns:</b> Management of burns in the first 48 hours.</p> <p><b>Surgical airway management in severe head and neck injury:</b> Safe management of the airway in severe head and neck injury.</p> <p><b>Stabilisation of the jaw after severe facial injury:</b> Stabilise the jaw after severe facial injury</p>	
<b>Knowledge</b>	
<b>Pathophysiology of trauma</b>	<ul style="list-style-type: none"> <li>4 Pathophysiology of blunt trauma</li> <li>4 Penetrating injury (low and high energy trauma)</li> <li>3 Blast injury</li> <li>3 Burns</li> <li>4 Trauma laparotomy</li> <li>4 Indications for laparotomy</li> </ul>
<b>Paediatric trauma</b>	<ul style="list-style-type: none"> <li>4 Paediatric physiology</li> <li>3 Paediatric trauma laparotomy</li> <li>4 Trauma thoracotomy: Indications for thoracotomy</li> <li>4 Incisions used in particular circumstances</li> <li>4 Damage control surgery: damage control vs. definitive laparotomy</li> <li>4 Difficult peripheral haemorrhage: Anatomical approach to major vessels</li> <li>4 Severely traumatised ischaemic limbs: Anatomical approach to major vessels</li> <li>3 Pregnant woman with severe abdominal trauma: Indications for Caesarean section</li> </ul>
<b>Burns</b>	<ul style="list-style-type: none"> <li>4 Knowledge of fluid replacement regimes for burns patients</li> </ul>
<b>Clinical skills</b>	
<b>Trauma laparotomy</b>	<ul style="list-style-type: none"> <li>4 Use of focussed abdominal sonography for trauma FAST</li> <li>4 Exposure of retroperitoneal structures</li> <li>4 Techniques for arresting haemorrhage including liver packing</li> <li>4 Safe anastomotic techniques for gut and blood vessels</li> <li>4 Appropriate formation of stomas</li> <li>3 Trauma thoracotomy: lung resection</li> <li>3 Cardiac repair without bypass</li> </ul>
<b>Damage control surgery</b>	<ul style="list-style-type: none"> <li>3 Management of the postoperative patient in difficult circumstances eg acidosis, coagulopathy, rewarming</li> <li>4 Difficult peripheral haemorrhage: safe control of major vessels</li> <li>4 Severely traumatised ischaemic limbs: safe control of major vessels</li> <li>3 Repair of vessels</li> <li>3 Use of temporary shunts</li> <li>4 Fasciotomy</li> <li>3 Decision to amputate</li> <li>4 Amputation AK</li> <li>4 Amputation BK</li> <li>4 Amputation upper limb</li> <li>3 Burns: escharotomy</li> <li>4 Fluid replacement</li> <li>4 Surgical airway management in severe head and neck injury: cricothyroidotomy</li> <li>3 Tracheostomy</li> </ul>



Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Technical skills</b>	
<b>General</b>	<ul style="list-style-type: none"> <li>4 Trauma Laparotomy: laparotomy-trauma</li> <li>4 Trauma thoracotomy: thoracotomy-trans-sternal</li> <li>4 Thoracotomy-lateral</li> <li>4 Thoracotomy-clamshell</li> <li>4 Severely traumatised ischaemic limbs amputation-ak</li> <li>4 Amputation-BK</li> <li>4 Amputation-upper limb</li> <li>4 Surgical airway management in severe head and neck injury: cricothyroidotomy (percutaneous tracheostomy)</li> </ul>
<b>Military only – additional requirements</b>	<ul style="list-style-type: none"> <li>4 Safe patient transfer: Awareness of evacuation assets</li> <li>4 Interventional surgery only if the patient cannot be transferred safely within the relevant timeframe</li> </ul>
<b>Abdomen and thorax</b>	
<b>Objective</b>	
<p>Assessment and management of blunt and penetrating injury</p> <p>Closed thoracic injury: Assessment and emergency management of blunt injury of the thorax</p> <p>Penetrating thoracic injury: Assessment and emergency management of penetrating injury of the thorax</p> <p>Closed and penetrating abdominal injury: Assessment and management of blunt and penetrating abdominal injury</p>	
<b>Closed and penetrating thoracic injury</b>	<ul style="list-style-type: none"> <li>4 Anatomy</li> <li>4 Concept of low energy, high energy transfer injury</li> <li>4 Pathogenesis of shock</li> </ul>
<b>Closed and penetrating abdominal injury</b>	<ul style="list-style-type: none"> <li>4 Anatomy</li> <li>4 Concept of energy, low high energy transfer injury</li> <li>4 Pathogenesis of shock</li> </ul>
<b>Clinical skills</b>	
	<ul style="list-style-type: none"> <li>4 Indications for and interpretation of CT</li> <li>4 Indications for radiological intervention for haemorrhage control</li> </ul>
<b>Closed thoracic injury</b>	<ul style="list-style-type: none"> <li>4 Assessment and initial management of multiply injured patient</li> <li>4 Recognise need for operative intervention and organise</li> <li>4 Understand indications for ER thoracotomy</li> <li>4 Postoperative management and recognition of complications</li> </ul>
<b>Penetrating thoracic injury</b>	<ul style="list-style-type: none"> <li>4 Assessment and initial management of multiply injured patient</li> <li>4 Recognise need for operative intervention and organise</li> <li>4 Recognise and treat sucking chest wound</li> <li>4 Understand indications for ER thoracotomy</li> <li>4 Postoperative management and recognition of complications</li> </ul>
<b>Closed and penetrating abdominal injury</b>	<ul style="list-style-type: none"> <li>4 Assessment and initial management of multiply injured patient</li> <li>4 Recognise need for laparotomy and organise</li> <li>4 Arrest haemorrhage by suture/ligation/packing</li> <li>4 Indication for pelvic fixator</li> <li>4 Drains for biliary / pancreatic injury</li> <li>4 Management of retroperitoneal haematoma</li> <li>4 Postoperative management and recognition of complications</li> </ul>
<b>Technical skills</b>	
<b>Closed and Penetrating thoracic injury</b>	<ul style="list-style-type: none"> <li>4 Chest drain insertion</li> <li>4 Lateral thoracotomy</li> <li>4 Median sternotomy</li> <li>4 Clamshell thoracotomy</li> <li>4 Hilar control of massive pulmonary haemorrhage</li> <li>4 Non-segmental lung resection</li> <li>4 Pulmonary tractotomy using staplers</li> <li>4 Pericardotomy</li> <li>4 Control and suture of myocardial laceration</li> </ul>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Closed and penetrating abdominal injury</b>	<ul style="list-style-type: none"> <li>4 Laparotomy - trauma</li> <li>4 Packing / debridement of liver trauma</li> <li>4 Splenectomy</li> <li>4 Splenic repair</li> <li>4 Small bowel resection</li> <li>4 Distal pancreatectomy</li> <li>4 Pancreatic debridement and drainage</li> <li>4 Mobilisation and repair of the duodenum</li> <li>4 Medial rotation of left hemicolon and colectomy when appropriate</li> <li>4 Medial rotation of right hemicolon and colectomy when appropriate</li> <li>4 Hartmann's procedure</li> <li>4 Nephrectomy</li> <li>4 Bladder repair</li> <li>4 Ileostomy – construction</li> <li>4 Colostomy – construction</li> <li>4 Temporary abdominal closure Bogota bag or topical negative pressure dressing</li> </ul>
<b>Head and neck</b>	
<b>Objective</b>	
Identification, assessment and initial management of trauma to the head and neck	
<b>Knowledge</b>	
<b>Basic science</b>	4 Anatomy of the head and neck
<b>Clinical skills</b>	
	<ul style="list-style-type: none"> <li>4 Immobilisation of patients with suspected cervical spine injury</li> <li>4 Observation of patients with head injury</li> <li>4 Interpretation of plain radiographs and CT scans of cervical spine</li> <li>4 Interpretation of CT brain/skull</li> <li>4 Decision to refer to Neurosurgeon</li> </ul>
<b>Technical skills</b>	
	<ul style="list-style-type: none"> <li>4 Exposure, control and repair of vascular, airway or GI tract structures in the neck</li> <li>4 Cryothyroidotomy</li> <li>4 Formal tracheostomy</li> <li>4 Burr holes</li> <li>4 Craniotomy/craniectomy</li> <li>4 Evacuation of extradural/subdural haematoma</li> <li>4 Debridement of injured brain</li> <li>4 Lateral canthotomy for orbital decompression</li> </ul>
<b>Extremity and soft tissue</b>	
<b>Objective</b>	
Assessment and management of blunt and penetrating injury of the soft tissues and skeleton	
<b>Knowledge</b>	
<b>Basic science</b>	4 Anatomy of the limbs
<b>Blunt and penetrating soft tissue and skeletal injury</b>	<ul style="list-style-type: none"> <li>4 Anatomy</li> <li>4 Concept of low energy, high energy transfer injury</li> <li>4 Pathogenesis of shock</li> <li>4 Principles of soft tissue coverage and simple flaps</li> <li>4 Principles of topical negative pressure dressings</li> <li>4 Understanding of wound contamination/infection</li> </ul>
<b>Clinical skills</b>	
<b>Blunt and penetrating soft tissue and skeletal injury</b>	<ul style="list-style-type: none"> <li>4 Assessment and initial management of multiply injured patient</li> <li>4 Arrest haemorrhage by pressure and tourniquet</li> <li>4 Appropriate immobilisation during assessment</li> <li>4 Recognition of major vascular trauma</li> <li>4 Assessment of ischaemic limb</li> <li>4 Recognition and treatment of acute compartment syndrome</li> <li>4 Postoperative management and recognition of complications</li> </ul>

Area of competency	Procedure and level of competency (See ISCP description of competency levels below, Appendix C)
<b>Technical skills</b>	
<b>Proximal arterial control</b>	<ul style="list-style-type: none"> <li>4 Femoral</li> <li>4 Brachial</li> <li>4 Subclavian</li> </ul>
<b>Soft tissue management</b>	<ul style="list-style-type: none"> <li>4 Wound debridement and lavage</li> <li>4 Fasciotomy – lower leg</li> <li>4 Fasciotomy – thigh</li> <li>4 Fasciotomy – upper limb</li> <li>4 Application of dressings</li> <li>4 Application of topical negative pressure dressings</li> <li>4 Split skin grafting</li> </ul>
<b>Vascular trauma</b>	
<b>Objective</b>	
Identification, assessment and management of injuries to blood vessels	
<b>Knowledge</b>	
<b>Surgical anatomy</b>	4 Relationship of vascular structures to fractures, nerves, associated structures
<b>Mechanisms of vascular injury</b>	<ul style="list-style-type: none"> <li>4 Traumatic</li> <li>4 Iatrogenic</li> <li>4 Pathophysiology of trauma and muscle ischaemia</li> <li>4 Pathophysiology of A-V fistula</li> </ul>
<b>Investigations</b>	<ul style="list-style-type: none"> <li>4 Indications</li> <li>4 Invasive</li> <li>4 Non-invasive</li> </ul>
<b>Operative approach to specific injuries</b>	<ul style="list-style-type: none"> <li>4 Arterial or venous</li> <li>4 Open surgery</li> <li>4 Endovascular</li> <li>4 Combined arterial and venous</li> <li>4 Orthopaedic / neurological</li> <li>4 Technical options for repair</li> <li>4 Fasciotomy</li> </ul>
<b>Clinical skills</b>	
<b>General</b>	4 Symptoms and signs of acute arterial / venous injury
<b>Investigation</b>	<ul style="list-style-type: none"> <li>4 Ankle / brachial pressure index</li> <li>4 Duplex</li> <li>4 CT angiogram</li> <li>4 DSA</li> <li>4 Manage multiply injured patient</li> <li>4 Manage systemic effects of arterial trauma – rhabdomyolysis</li> </ul>
<b>Technical skills</b>	
<b>General</b>	4 Control with compression
<b>Surgical options</b>	<ul style="list-style-type: none"> <li>4 Exposure and control of major vessels</li> <li>4 Thoracic aorta</li> <li>4 Abdominal aorta (infra and supra renal)</li> <li>4 Subclavian and axillary arteries</li> <li>4 Femoral and popliteal arteries</li> <li>4 Use of shunts</li> <li>4 Ligation</li> <li>4 Direct suture repair</li> <li>4 End to end anastomosis</li> <li>4 Interposition vein / prosthetic graft</li> <li>4 Panel / spiral grafts</li> <li>4 Fasciotomy</li> </ul>
<b>Radiological</b>	<ul style="list-style-type: none"> <li>3 Intra-operative imaging techniques</li> <li>3 Options for control of bleeding</li> </ul>
<b>ACKNOWLEDGEMENT AND LINK TO ISCP</b>	
All the above have been taken from the ISCP 2013 syllabus for general surgery available here: <a href="https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf">https://www.iscp.ac.uk/documents/syllabus_GS_2013.pdf</a>	

# Appendix C

## ISCP: description of competence levels

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### Knowledge

- 1: knows of
- 2: knows basic concepts
- 3: knows generally
- 4: knows specifically and broadly

### Clinical and Technical Skills

- 1: Has observed – the trainee acts as an ‘assistant’
- 2: Can do with assistance - a trainee is able to carry out the procedure ‘directly supervised’
- 3: Can do whole but may need assistance – a trainee is able to do the procedure ‘indirectly supervised’
- 4: Competent to do without assistance, including complications – a trainee is at CCT level and ‘finishing’ for the common procedures in a specialty

### T&O Only

The skills and procedures have 6 defined levels:

- 0 No experience expected
- 1 Has observed or knows of
- 2 Can manage with assistance
- 3 Can manage whole but may need assistance
- 4 Able to manage without assistance including potential common complications
- 5 Able to manage complex cases and their associated potential complications

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