

Guideline for Interventional Radiology (IR)

Issue Date	Review Date	Version
June 2020	June 2023	V1.1

Purpose

The purpose of this document is to provide guidance to clinical teams within the Peninsula Trauma Network (PTN) on what IR services are available in the region and when to consider using them in major trauma. It is also the purpose to drive forwards the improvement of major trauma care across the Southwest Peninsula.

Who should read this document?

This guideline should be read by the following members of the Peninsula Trauma Network Major Trauma clinical team:

- All Major Trauma Clinical Leads
- All Trauma Team Leaders
- All Emergency Medicine Doctors and Trauma Team Leaders
- All Trauma Nurse Co-ordinators
- Anaesthetists, ITU Doctors, General Surgeons
- All Radiologists and Radiology Clinical Directors

Key Messages

This guideline demonstrates the Interventional Radiology (IR) services available across the Southwest Peninsula and explains the processes that should be used for patients that have sustained a traumatic injury which may be amenable to IR management.

It also provides clear guidance on what to do in the event of an injury which may be amenable to IR guided treatment in children.

Core Accountabilities

Owner	Surg Cdr Philip JB Coates RN
Review	Every 3 years.
Ratification	Peninsula Trauma Network Advisory Group
Dissemination (Raising Awareness)	Major Trauma Clinical Leads All Trauma Team Leaders All Emergency Medicine Doctors Anaesthetists, ITU Doctors, General Surgeons and Clinical Radiologists.
Compliance	All clinicians involved in Major Trauma at the Peninsula Trauma Centre and the following Trauma Units: <ul style="list-style-type: none"> • Northern Devon District Hospital • Royal Cornwall Hospital • Royal Devon and Exeter Hospital • Torbay Hospital

Links to other policies and procedures

- PTN Automatic Acceptance & Secondary Transfer Policy
- PTN Blunt Abdominal Trauma Policy
- PTN Vascular Injuries SOP

Version History

V1	Surg Cdr Coates	Consultant Radiologist
V1.1	Dr Tony Hudson	Approved at NAG of 16/06/2020 for further 3 years

The Network is committed to creating a fully inclusive and accessible service. Making equality and diversity an integral part of the business will enable us to enhance the services we deliver and better meet the needs of patients and staff. We will treat people with dignity and respect, promote equality and diversity and eliminate all forms of discrimination, regardless of (but not limited to) age, disability, gender reassignment, race, religion or belief, sex, sexual orientation, marriage/civil partnership and pregnancy/maternity.

**An electronic version of this document is available on The PTN website.
Larger text, Braille and Audio versions can be made available upon
request.**

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1 Introduction

This guideline replaces all previous policies and is the overarching guideline for Interventional Radiology within the Peninsula Trauma Network. It outlines the underlying IR principles which should be used in the management of trauma patients within the PTN

2 Purpose

The purpose of this document is to provide an overarching guideline for reference by Interventional Radiology teams, Radiologists, Surgical teams, Anaesthetic teams, Emergency Medicine, and Blood Transfusion, all of which may touch on the care of IR patients.

3 Definitions

MTC: Major Trauma Centre.

TU: Trauma Unit

IR: Interventional Radiology

DCS: Damage Control Surgery

NCTH: Non compressible truncal haemorrhage

4 Duties

It is incumbent upon all staff involved in delivering care to major trauma patients within the PTN that they have an understanding of this guideline. Local Vascular Surgery Departments can use this document to develop guidance, but this document provides the overarching approach to caring for patients with vascular injuries within this network.

5 IR Guideline

5.1 Over-arching Principles

Interventional Radiology is best viewed as a type of Damage Control Surgery, using minimal access image guided treatments, which increases the proportion of patients non-operatively managed.

It is of value in treating acute haemorrhage, from major or more peripheral vessel injuries (with stent graft devices) and for organ saving focal embolization techniques (eg spleen, kidney, liver).

Not all centres can offer this service, and not all IR procedures are offered by all TUs that do have IR.

5.2 Background

Interventional Radiology has swiftly evolved as a Radiology sub-specialty, and with it the range of procedures available, many of which do have a role to play in management of the trauma patient.

IR has been shown to be highly effective for gaining control of haemorrhage in acute gastrointestinal haemorrhage, renal haemorrhage and post part haemorrhage, and the same principles are utilised in IR in trauma. It can increase the proportion of patients who are non-operatively managed, but this can sometimes be at the expense of lengthy procedure times with a not inconsiderable radiation burden.

It has great value in treating a single point of haemorrhage as part of Damage Control Surgery. This is typically in a single organ (eg spleen, kidney). Where there are multiple sites of bleeding in an unstable patient, aggressive DCS may be a better option, but cases should be reviewed by an Interventional Radiology Consultant, in conjunction with the Trauma Team Leader and Surgical team.

IR also has particular utility in major aortic injury / acute aortic syndrome. Thoracic Endovascular Stent Grafts (TEVAR) devices are deployed in the thoracic aorta for aortic transection as a life-saving procedure. This is performed only in the MTC collaboratively with the Cardiothoracics team. In the abdominal aorta, transection (although much less common) can be treated with a stent graft (EVAR device). Some TUs are able to offer this service.

It is important therefore to understand the IR capabilities, in conjunction with provision of DCS and Vascular Surgery in the TUs and MTC in the Peninsula Trauma Network. Whilst IR procedures can be safely and effectively performed as part of Damage Control Surgery in many of our TUs, some injuries (in particular thoracic aortic injury) will require transfer to the MTC for definitive treatment.

5.3 Situation

The current availability of IR, vascular, and cardiothoracic services are as follows:

- MTC (Derriford): 24/7 Interventional Radiology, Vascular Surgery
Cardiothoracic Surgery, Damage Control Surgery (General Surgeon)
- TU (Exeter): 24/7 Interventional Radiology, Vascular Surgery, Damage Control Surgery
- TU (Truro): 24/7 Interventional Radiology, Vascular Surgery, Damage Control Surgery
- TU (Barnstaple): 24 hour Damage Control Surgery (no IR service)
- TU (Torbay): 24/7 Interventional Radiology, Damage Control Surgery

5.4 Management of Injuries and MTC Referral

Isolated single organ injury

Isolated single organ injury should be managed at the MTC or IR capable TU. This excludes thoracic vascular injuries which should be managed by the cardiothoracic team at the MTC.

Isolated single organ injuries presenting to a TU without an IR capability will require referral to the MTC for definitive surgery, or alternatively may require open surgery (DCS) if the patient is too cardiovascularly unstable to transfer.

(i) Renal Trauma

Focal haemorrhage in the kidney following major trauma can usually be swiftly managed with deployment of embolic coils and soluble particles such as gelfoam or glue, to gain control of haemorrhage. This is recommended in focal active haemorrhage as an alternative to DCS, and has the massive advantage of being 'nephron sparing', and with minimal post-operative recovery. The surgical alternative would typically involve nephrectomy. Where the renal injury is part of a constellation of other injuries which would necessitate surgery, DCS is instead recommended with trauma laparotomy.

(ii) Splenic Trauma

Similarly in splenic trauma, IR can provide a swift alternative to surgery when the splenic trauma is relatively isolated. This is typically performed as a 'proximal embolisation' with coils packed into the splenic artery, when there is evidence of active splenic haemorrhage or pseudo-aneurysm formation. More superselective approaches are indicated with focal splenic haemorrhage however.

The spleen maintains some of its perfusion from short gastric arteries, and will usually maintain vascularisation despite being embolised. The clinical team should still consider appropriate immunisations against encapsulated bacteria however (as if the patient had been splenectomised) although the data to support this is limited. Again, in the setting of complex poly trauma with multiple bleeding sites, splenic packing or splenectomy as part of DCS may be necessary instead however, particularly with Grade 5 injuries (Shattered spleen).

Splenic trauma may also be managed non-operatively with bed rest and monitoring. Some cases will inevitably fail, and require delayed embolization.

(iii) Liver

The liver is sometimes embolised in trauma, but can often be managed conservatively (for instance with sub capsular haematoma or lacerations without active haemorrhage). In the event of focal haemorrhage, embolisation is suggested. This can be focal and directed, or to a wider vascular territory with particles, provided that the portal vein is patent. The alternative surgical manoeuvre would involve packing of the liver, and follow up CT, possibly with delayed embolisation. Again, the advantage of IR is that treatment can be delivered to a focal injury with de-vascularisation of a focal territory, whilst preserving vascularity to most of the organ.

(iv) Pelvic Haemorrhage

Pelvic injury provides a particular challenge to the trauma surgeon as the pelvis is relatively inaccessible surgically, and focal arterial bleeding sites can be difficult to locate. Most pelvic haemorrhage will be venous in origin, from torn bridging veins, so management will be aimed at pelvic stabilisation packing where indicated.

For the haemodynamically unstable patient with arterial extravasation from branches of the internal iliac arteries on CT, embolisation is an attractive alternative and recommended in

published guidelines. Embolisation can be performed superselectively with coils, or with particles such as gelfoam slurry (which dissolves over the next 2 to 3 weeks allowing some eventual revascularization of the territory). Associated complications following embolisation are uncommon but include non-target embolisation with resultant skin necrosis, gluteal necrosis and failure. Evidence is limited but suggests that complications are less frequent with superselective embolization. In practical terms, some of these complications are difficult to discriminate from sequelae of the original trauma in complex pelvic fractures.

(v) The Retroperitoneum

The retroperitoneum is a surgically inaccessible site, similar to the pelvis. Acute haemorrhage is often seen here from torn lumbar arteries in major trauma. When this does not rapidly settle with conservative management, these vessels can be successfully embolised, by superselective cannulation of lumbar vessels. This allows deployment of embolic coils / embolic materials (gelfoam, glue).

Role of IR in Major Vascular Injuries

Vascular injuries sustained as part of a polytrauma will normally be transferred to the MTC as per the 'PTN Automatic Transfer Policy'.³

At the receiving hospital, patients should be assessed, resuscitated and imaged in line with local guidelines. Damage control surgery may be required to arrest bleeding before imaging.

(i) Thoracic Aortic Injury

Thoracic aortic injuries must only be managed in the Major Trauma Centre with a joint Cardiothoracics / IR team. The thoracic aortic injury will be first assessed by the IR Consultant to determine suitability for TEVAR.

Current guidance recommends stent graft deployment for injuries to the thoracic aorta. The majority of these injuries are caused by blunt force trauma with sudden deceleration. The injury site is typically in the very proximal descending aorta, where the aorta is relatively fixed to as it crosses the pulmonary artery by the ligamentum arteriosum. The repair is effected from either a groin cutdown, or increasingly a percutaneous approach, to gain access to the femoral arteries. A stent graft is then manipulated into the aortic arch, where the device is typically deployed at (or sometimes covering) the left subclavian artery. The other head and neck vessels are therefore left perfused.

Where injuries are more proximal in the aortic arch and involve the thoracic aortic branch vessels, Damage Control Surgery with Cardiothoracics input may be necessary, or alternatively a joint approach with endovascular deployment of a stent graft and de-branching of the head and neck vessels. Thoracic aortic injuries can sometimes be relatively asymptomatic early on, with pseudo-aneurysm formation, so treatment in these cases is aimed at preventing complete rupture. Lesser degrees of aortic injury such as a limited intimal tear identified on CT may be managed conservatively.

In the case of a more severe aortic injury thoracic endovascular aortic repair (TEVAR) is life saving though, although it should be noted that these patients rarely have aortic injury in isolation and those other injuries will contribute to the outcome.

(ii) Abdominal Aortic Injury

In the abdominal aorta, haemorrhage control can swiftly be gained with an aortic occlusion balloon in the first instance, moving towards definitive treatment with an EVAR stent graft for suitable lesions. An EVAR is usually only possible and recommended for aortic disruption below the renal arteries. Where injury is at the level of the renal arteries or more proximal or visceral revascularisation is needed, Damage Control Surgery is instead indicated. An EVAR device is deployed in a similar manner to a TEVAR, usually from a groin approach, the difference being that it will require bilateral access to construct a bifurcated solution.

(iii) Peripheral and Branch Vessel Injury

In the event of peripheral or branch artery injury, occlusion balloons, stent grafts and embolisation all have a role to play. In an isolated injury of an artery with a difficult surgical approach (eg a dissected subclavian or iliac artery) IR will provide a simpler and swifter repair, with deployment of a covered stent graft in a vessel. This is similar to EVAR and TEVAR, and involves a metallic flexible stent (often made from nitinol) with a material component to 'seal' the vessel.

5.5 Paediatric Vascular Injuries

All paediatric Major Trauma injuries should be discussed with the Paediatric Trauma Team Leader at Bristol Children's Hospital as per the South West Paediatric Major Trauma Network Acceptance, Transfer & Repatriation Policy.

Occasionally, single organ injuries may be suitable for selective embolisation in a child who remains haemodynamically compromised despite aggressive resuscitation. It may be preferable in these circumstances (following discussion with the Paeds MTC) to undertake a focal embolisation rather than transfer a grossly unstable child with active haemorrhage. Each case should be discussed with the Paeds MTC TTL who will liaise with Paediatric surgery.

Evidence for the benefits of IR in the paediatric population is extremely poor or absent. Such cases are rare and decision made jointly, and based on local expertise, response to resuscitation, the organ injured and timelines for transfer to definitive care in a Paediatric MTC.

**Bristol Royal Hospital for Children,
Paediatric Trauma Team Leader
0300 0300 789**

[PTN Paediatric Policies](#)

5.6 Summary

Interventional Radiology in Major Trauma should be treated in TU's with an IR capability or at the MTC. Polytrauma patients should be transferred to the MTC in line with other guidelines.

Isolated organ injuries with evidence of ongoing haemorrhage and instability may be successfully treated as part of DCS in an IR capable TU, or the MTC. This should follow TTL to IR consultant discussion in the light of relevant imaging. Polytrauma patients who are grossly cardiovascularly unstable with multiple injuries are often better served by DCS.

Vascular injuries can be treated with either an endovascular approach or open surgery. Focal vascular injuries are often treated best with a stent graft, and there is a good evidence base which supports this approach. Thoracic aortic injuries are normally managed under the Cardiothoracics team in conjunction with IR in the MTC.

6 Overall Responsibility for the Document

The Peninsula Trauma Network Advisory Group is responsible for developing, implementing and reviewing this guideline.

7 Consultation and Ratification

The review period for this document is set as a default of one year from the date it was created and then every 3 years after it is last ratified, or earlier if developments within or external to the Peninsula Trauma Network (PTN) indicate the need for a significant revision to the procedures described.

This document will be reviewed by the PTN Advisory Group and ratified by the PTN Director and Clinical Governance Lead or Executive Board as deemed appropriate. Non-significant amendments to this document may be made, under delegated authority from the PTN Director, by the nominated owner. These must be ratified by the PTN Director.

Significant reviews and revisions to this document will include a consultation with named groups, or grades across the Peninsula Trauma Network. For non-significant amendments, informal consultation will be restricted to named groups or grades who are directly affected by the proposed changes.

8 Dissemination and Implementation

Following approval and ratification, this guideline will be published on the PTN website (public facing or secure as deemed appropriate) and all staff will be notified through the PTN normal notification process, currently via email to Trauma Clinical Leads.

Document control arrangements will be noted and kept current on the PTN SOP list maintained by the PTN management team.

The document owner will be responsible for agreeing the training requirements associated with the newly ratified document with the named PTN Director to arrange for the required training to be delivered.

9 Monitoring Compliance and Effectiveness

Monitoring and compliance will be reviewed via the PTN Governance form submissions and discussion at the monthly PTN Governance teleconference.

This is a requirement of the NHSE Major Trauma Quality Indicators and compliance will be reviewed via the annual Network Peer Review process and/or National QST peer review

for MTCs. If concerns are raised, these will be notified to the relevant Chief Executive and Trauma Leads will be required to provide timely action plans to resolve the concerns. These concerns will be reviewed by the PTN Management Team and fed back to relevant parties. Concerns raised by the National QST peer review for MTCs will be fed back through the appropriate channels.

This is a National Major Trauma Network standard and will be monitored via the annual Network Peer Review process directly to relevant Trauma Leads.

10 References and Associated Documentation

- 1 Peninsula Trauma Network. Automatic Acceptance and Secondary Transfer Policy V12.1. April 2017. Accessed online 24 September 2018. <http://www.peninsulatraumanetwork.nhs.uk/download.cfm?doc=docm93jjjm4n1300.pdf&ver=1553>
- 2 Standards of Practice and Guidance for Trauma Radiology in Severely Injured Patients. Royal College of Radiologists, September 2015 (BFCR(15)5).
- 3 CIRSE Guidelines: Quality Improvement Guidelines for Endovascular Treatment of Traumatic Haemorrhage: Chakraverty S et al. Cardiovasc Intervent Radiol (2012) 35: 472-482