# INTERVENTIONAL RADIOLOGY IN TRAUMA MANAGEMENT

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# Introduction

- Role of radiology has become more prominent in modern trauma management
- Diagnostic radiology provides rapid and comprehensive assessment of trauma patients with rapid full body scanning
- Interventional radiology has been rising up as a major team player in multi-disciplinary management of trauma
- Comparatively less invasive

# Facets of Interventional Radiology in Trauma

- ***Trans-arterial embolization***
  - Targeted selective arterial embolization provides rapid minimal invasive method for hemostasis in poly-trauma patients
- Stent graft placement
  - Endovascular stent-graft placement is an alternative to open surgery in traumatic vascular injuries
- IVC filter placement

# Trans-arterial Embolization

- Rapid loss of blood from solid organs or intraabdominal arteries is a major cause of morbidity and mortality in poly-trauma patients
- Target embolization can be applied to potentially many organs or arteries such as liver, spleen, kidneys, pelvis…etc.

- Advantages
  - Organ and function preservation: may avoid splenectomy in splenic trauma patients.
  - Speed: Faster (maybe) than surgical approach
  - Damage control:rapid damage control in liver and pelvic trauma

# Trans-arterial Embolization

- In pelvic trauma:
  - External fixators help decrease bone surface bleeding
  - Surgical packing provides tamponade effect
  - Embolisation occludes blood vessel
  - Allow rapid hemostasis in haemodynamically unstable patients

- Solid organ injuries
  - Embolisation occludes the vessel temporary or at a proximal location to either occlude or decreased flow to focus of haemorrhage

# Trans-arterial Embolization

- Different catheters shapes and guidewires allow cannulation of different arteries in the body.
- Identification of bleeding can then be obtained with angiogram to see bleeding in real time (c.f. CT shows a snapshot of the haemorrhage)

# Embolisation

- Aim of embolisation:
  - More distal (selective and targeted) occlusion to slow or cause blood flow stasis
    - But if too distal embolisation: stop bleeding but also cause tissue ischemia and thrombosis by embolising capillary bed
  - Allow thrombus formation at bleeding site
  - Temporary agents favored if possible

# Embolisation

- Different agents at our disposal
  - Gelfoam
  - Glue
  - Coils
  - Vascular Plugs

# Gelfoam

- Temporary agent
  - Disappears in 4-6 weeks
  - Vessel recannulisation from 2 weeks to 4 months
- Induces thrombosis
- Readily available
- Cheap
- Can provide proximal or distal embolisation depending on cut size

- Not useful if coagulopathy present

# Gelfoam

- Favored by many interventionists
- Come in several forms
  - Gelfoam pledget / torpedo
    - Whole pieces of gelfoam
    - Proximal embolisation
  - Gelfoam slurry
    - Gelfoam pieces pixed with contrast through 3-way stopcock
    - Further downstream embolisation
  - Gelfoam powder
    - Off the shelf product, not a/v in QEH
    - Possible capillary bed embolisation

# Gelfoam

- Best used in
  - No obvious extravasation seen on angiogram
  - Diffuse/multiple points of extravasation
  - Gelfoam slurry is preferred
    - Fast preparation
    - Embolise large field
    - Without sacrificing capillary bed

- Shotgun embolization

# Glue

- Liquid embolic agent
- Permanent
- Readily available
- Cost
- Not dependent on coagulation pathway
  - Can be used in instances of DIC
- Can provide proximal or distal occlusion depending on concentration used
- More technically demanding
  - Not for novices

# Glue

- Favored when a single target vessel is identified
- Preparation
  - Use a separate glue cart
  - Use D5 for everything
  - Change gloves
  - Mix glue with lipiodol at different concentrations
    - Usually 1:2, 1:3, 1:4, 1:5
    - 1:2 for more proximal targets
    - 1:5 if want glue to travel more distally
    - If too distal, can still damage capillary bed

# Coils

- Permanent
- Available
- ***Cost***
- Dependent on coagulation pathway
- Provide proximal occlusion
- More technically demanding
  - Not for novices

# Coils

- Favored when a single target vessel is identified
- And the vessels is large
- May also be used in cases of pseudoaneurysm

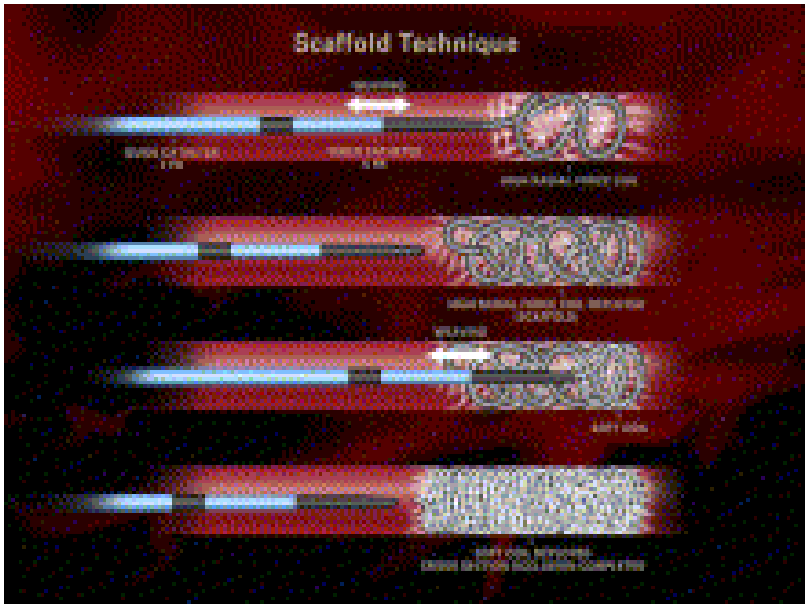
- Comes in different shapes and sizes
- Most QEH coils are helical
  - And are best used to embolise long vessels
- Have thrombogenic “hairs”

# Coils

- Pushable vs detachable
  - Detachables have more control
  - But also increased cost
- Sizing is important
  - Too large: act like a guidewire
  - Too small: distal migration of coil
  - Usually upsize ~20% of target vessel diameter

# Coils

- Need a few large coils at first to establish a scaffold
- Then use smaller coils to fill in the holes
- Alternatively, can use some dense glue as filler



# Vascular Plugs

- Large plugs
- Aim is to slow arterial flow and decreased distal haemorrhage
- Allow slow collateral flow to continue perfuse end organ
- Commonly used in splenic trauma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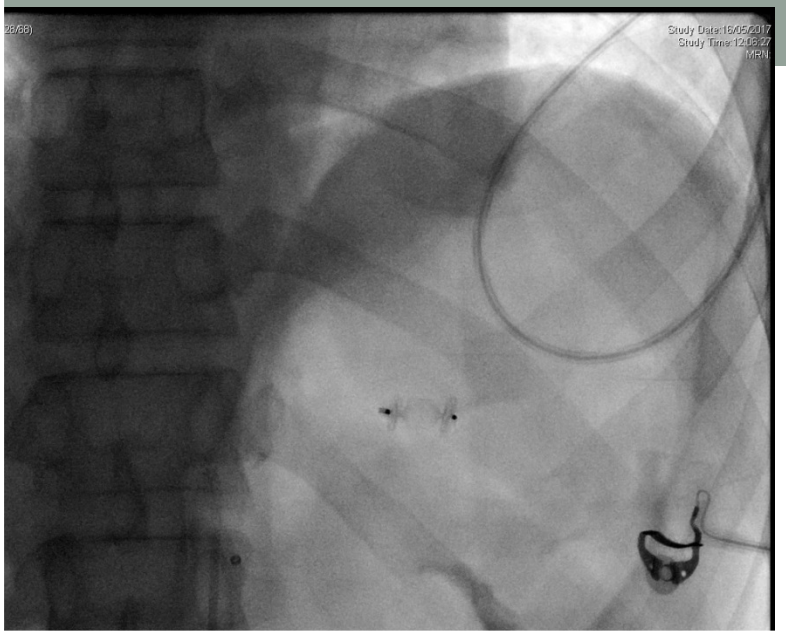
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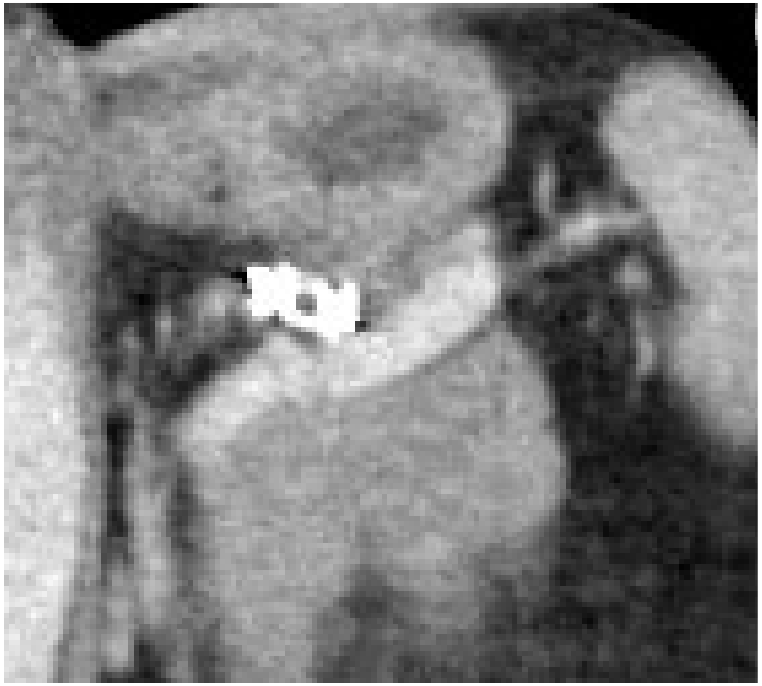
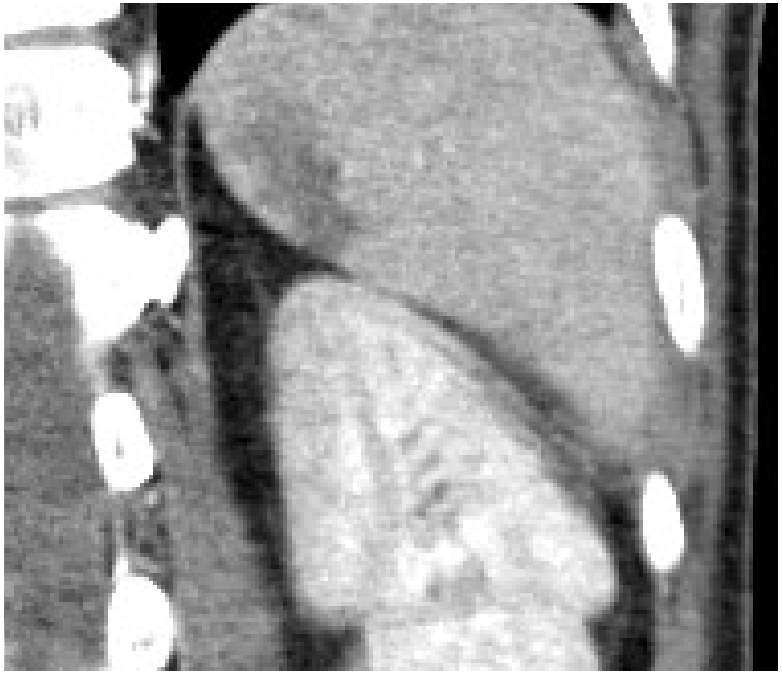




# Complications

- Uncommon
- Bleeding
- Dissection
- Reflux of material into external iliac to cause lower limb ischaemia
- Reflux or inadvertent embolisation of distal arteries
  - gluteal arteries to cause buttock ischaemic or necrosis
  - Bladder necrosis from vesicle arteries
  - Impotence from pudendal arteries

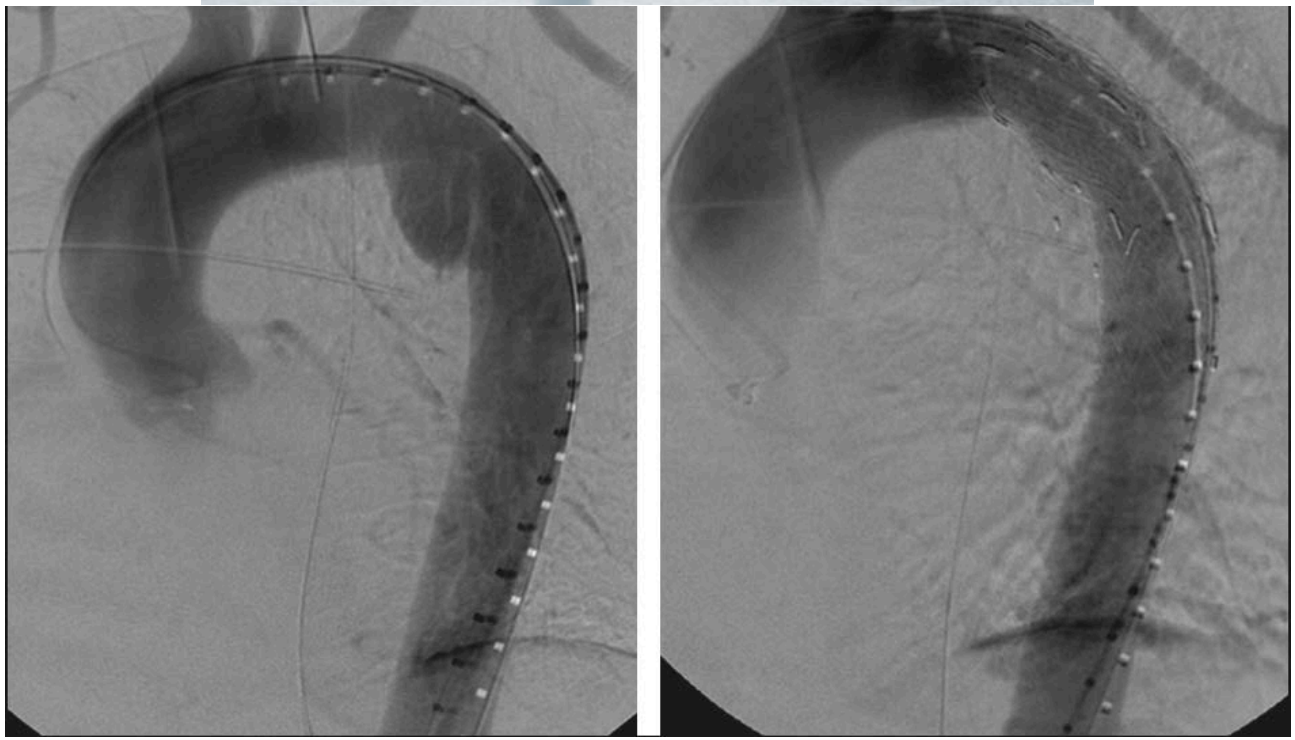
# Stent Graft Placement

- Arterial transections are often rapidly fatal
- Most patients die on site/or during transport
- But minority fortunate and younger patients can survive to the hospital
- Transected arteries include aorta at the aortic isthmus and iliac arteries.

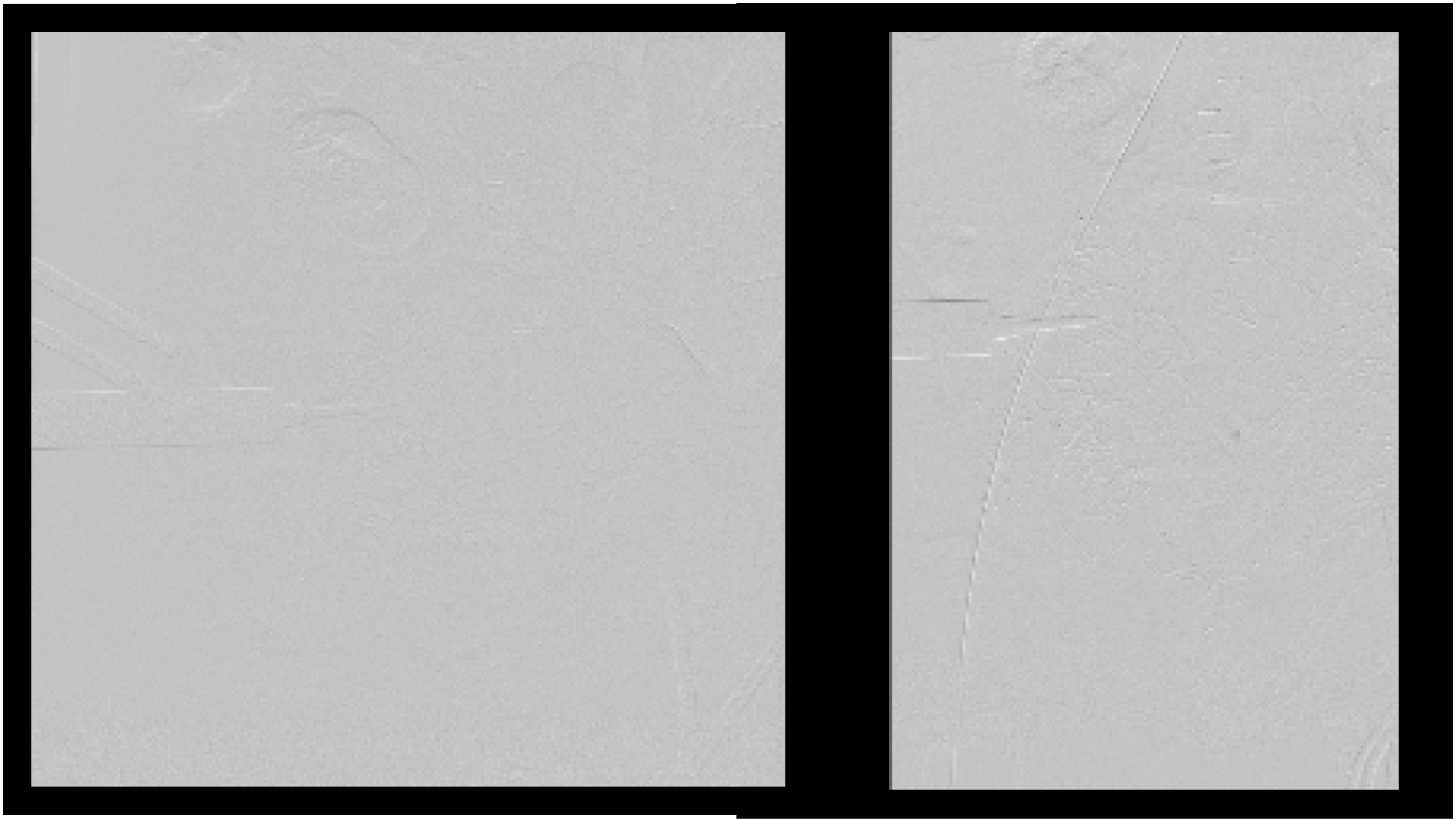
# Stent Graft Placement

- Stent graft placement offers a rapid and minimally invasive method to exclude the transected segment from circulation
- This decreases haemorrhage into perivascular space
- Stent grafts can be placed from femoral arteries and guided into area of injury with different guidewires and catheters

# Stent Graft Placement

# Stent Placement in Iliac Artery Injury



# Prophylactic IVC Filter Insertion

- No definite international consensus
- Eastern Association for the Surgery of Trauma (EAST) Guidelines give some directions on indications for insertion
- Not routinely practiced in our center

Prophylactic IVC filter insertion should be considered in very high-risk trauma patients:

1. Who cannot receive anticoagulation because of increased bleeding risk

and

2. Who have an injury pattern rendering them immobilized for a prolonged period of time, including the following:

a. Severe closed head injury (GCS < 8)

b. Incomplete spinal cord injury with paraplegia or quadriplegia

c. Complex pelvic fractures with associated long bone fractures

d. Multiple long bone fractures

# Summary

- Interventional radiology is a major player in multidisciplinary trauma management
- Different technological advances and tools allows arterial embolization for hemostasis or stent grafts for vascular injury repair

# THANK YOU