Femoral head traction and counter traction technique using the Starr Frame as part of the anterior intra-pelvis (A.I.P.) approach.

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INTRODUCTION

In displaced acetabular fractures, the femoral head often impacts medially into the pelvis through the quadrilateral plate/posterior column. During the anterior intra-pelvic (AIP or modified Stoppa) approach, the external iliac vessels are at risk of iatrogenic injury. Anatomical reduction of acetabular fracture can be difficult when fighting the deforming forces of the migrated femoral head.

We describe a novel technique using half of the Starr Frame, to retract the femoral head while maintaining counter traction. This technique does not require a surgical assistant to provide manual traction throughout the case. The static nature of this construct creates a reliable and constant force of distraction of the femoral head.

RATIONALE

Conventional techniques for dis-impacting the femoral head have involved in-line traction intra-operatively, provided either by fixed skeletal traction or an assistant pulling on the leg. However, these methods restrict intra-operative passive hip flexion and are subject to fatigue, respectively. Additionally, whilst traction in-line with the leg may distract the joint, the medialisation of the femoral head may not be corrected, preventing reduction and subsequent fixation of the quadrilateral plate. Whilst there are traction systems available for pelvic tables, these require the use of a perineal post and potential contamination of the sterile surgical field attaching the traction to the table through a hole in the drapes.

Poor articular congruity is associated with worse functional outcomes[1,2,3], so restoration of the bony anatomy is crucial.

INDICATIONS AND CONTRAINDICATIONS

This technique can be adopted in any fracture pattern involving medialisation of the femoral head in which the surgeon is considering an anterior intra-pelvis approach:

- Letournel[4] anterior column elementary configurations
- Letournel t-shaped, anterior column/posterior hemitransverse, associated both column associated configurations

This reduction method cannot be deployed in fracture patterns when the patient is positioned either lateral or prone, or where the femoral head remains reduced, for example for:

- Isolated posterior wall fractures
- Combined posterior wall and column fractures

If there is concomitant damage to the femoral head, primary total joint arthroplasty may be a preferred option.

STEP-BY-STEP DESCRIPTION

Pre-Operative Planning

Computed tomography (CT) imaging is now standard as part of the management of major trauma patients. 3D reconstructions allow for visualisation of fracture patterns from multiple angles and recognition of dome impaction or fragments within the joint which need to be addressed intraoperatively. Planning of the stabilisation methods (supra/infra-pectinal buttress plating/column screw fixation) is also simplified with CT imaging.

Patient Positioning & Setup

The patient is positioned supine on a radiolucent operating table. An intravesical urinary catheter is inserted in order to deflate the bladder and prevent iatrogenic damage during the approach. The patient is prepped from above the umbilicus to the ankle of the ipsilateral leg and the mid-thigh of the contralateral leg. The patient is then draped in the surgeon's preferred manner.

One sterile semi-circular carbon fibre pelvic reduction Starr Frame[5] is clamped onto the table on the same side as the acetabular fracture with the most proximal leg at the level of the hip joint.

Traction/Counter-Traction Pins

Using fluoroscopic guidance, a self-drilling 200x5mm Schanz screw is placed percutaneously into the femoral neck using power-drive, through a stab-incision inferolaterally to the greater trochanter. Care is taken not to penetrate the articular cartilage, an approximate angle of 120 degrees is preferred to penetrate but not perforate the strong femoral calcar bone as seen in figure 1.

Counter traction is applied through a second stab incision made at the supra-acetabular point of the outer table of the ilium, inline with the femur, allowing a ball spike pusher[5] to be placed onto the constant fragment superior to the acetabular dome in parallel with the neck screw.

These are each attached to the Starr Frame using a Reinert Reduction tool[5], comprising a Jacob's chuck on a threaded bolt, and a pin-to-bar clamp. A small amount of counter traction is applied to the ball spike pusher to engage the spike into the cortex only. Gradual traction under fluoroscopy can confirm the correct amount of distraction of the femoral head, approximately 2cm. With the femoral head distracted, the acetabular fracture reduction and insertion of implants is far easier than standard methods. The dissection under the ilio-pectineal fascia/external iliac vessels, over the pelvis brim is much easier and less stressful with the femoral head distracted.

Approach to the Fracture

The pelvis is approached anteriorly using either a modified Stoppa[6] or ilioinguinal approach depending on the fracture configuration, as described elsewhere. The hip can be flexed whilst traction is maintained in order to relax the iliopsoas.

Fracture Reduction and Fixation

When required, the femoral head can be disengaged from the acetabulum by winding the threads on the reduction tool, providing traction in line with the neck, most commonly at the end of the case. The patient's position is maintained by ensuring appropriate counter-traction onto the constant fragment, in a push-pull configuration.

Wound Closure

Once internal fixation has been achieved, traction can be released, and the neck pin removed using power-drive on reverse. Superficial skin closure can be achieved using 2-0 Vicryl and either 3-0 Monocryl or skin clips as per surgeon preference.

PITFALLS & CHALLENGES

Over traction of greater than 3cm of distraction of the femoral head should be avoided as the ball spike pusher counter traction will slip off the ilium. It is important to have a good understanding of where the constant normal ilium is located for the ball spike pusher counter traction as poorly positioned counter traction can create a deforming force.

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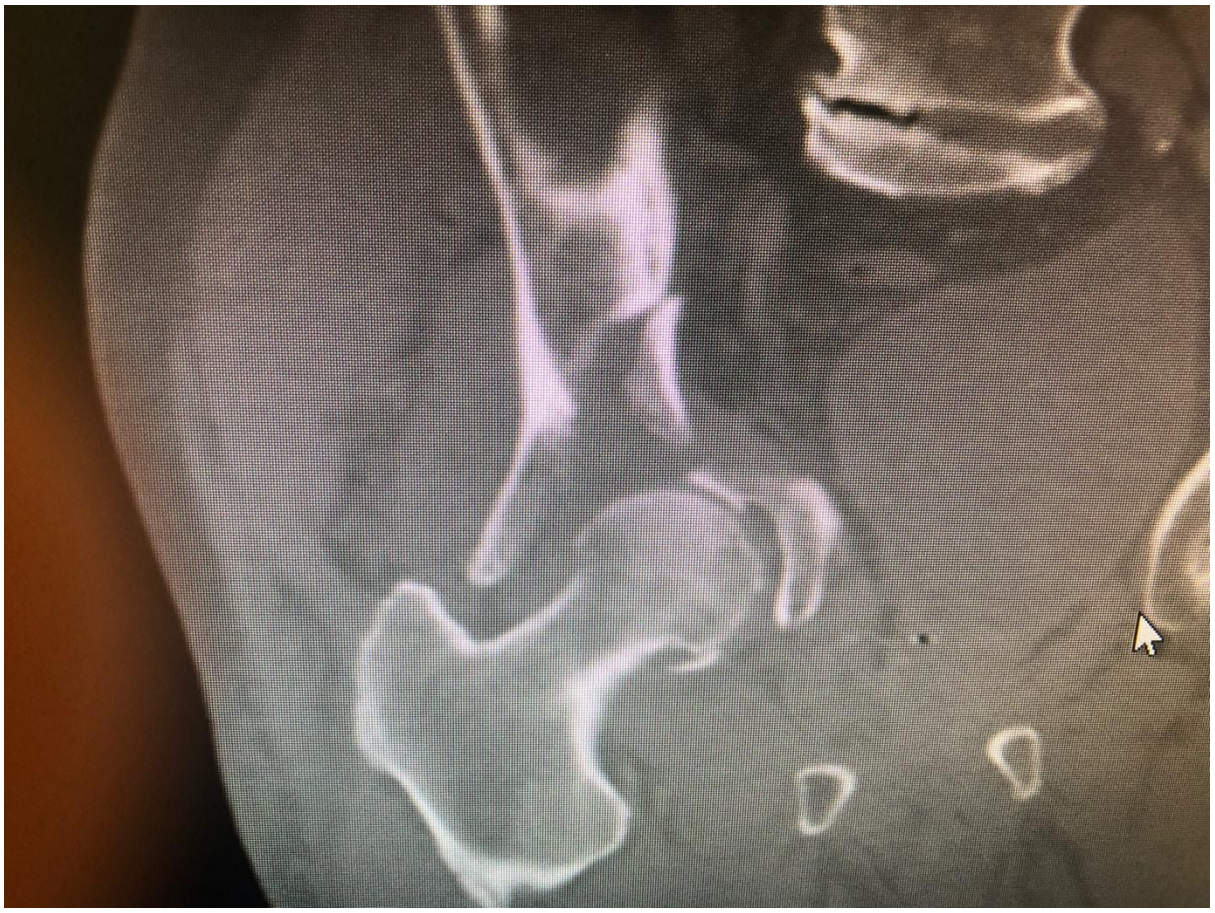

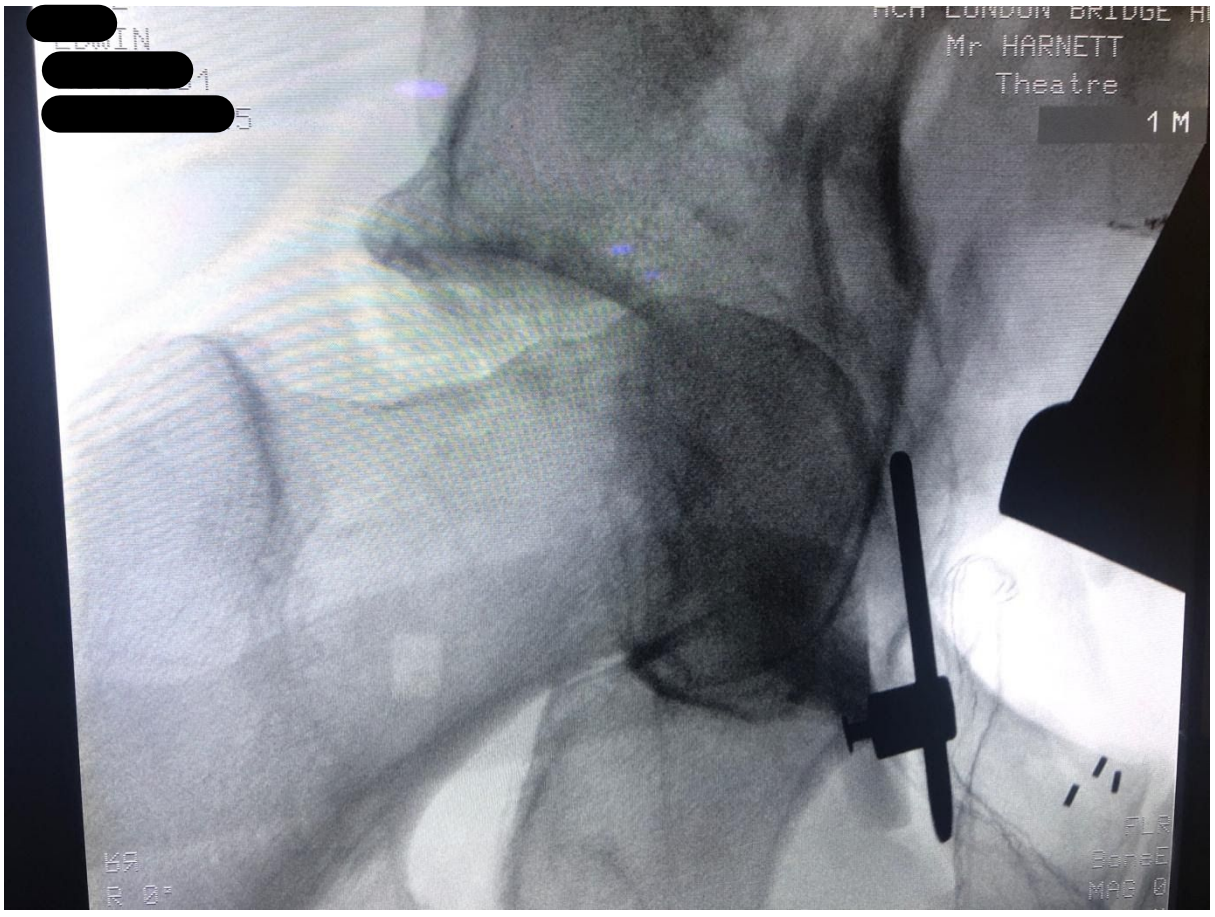
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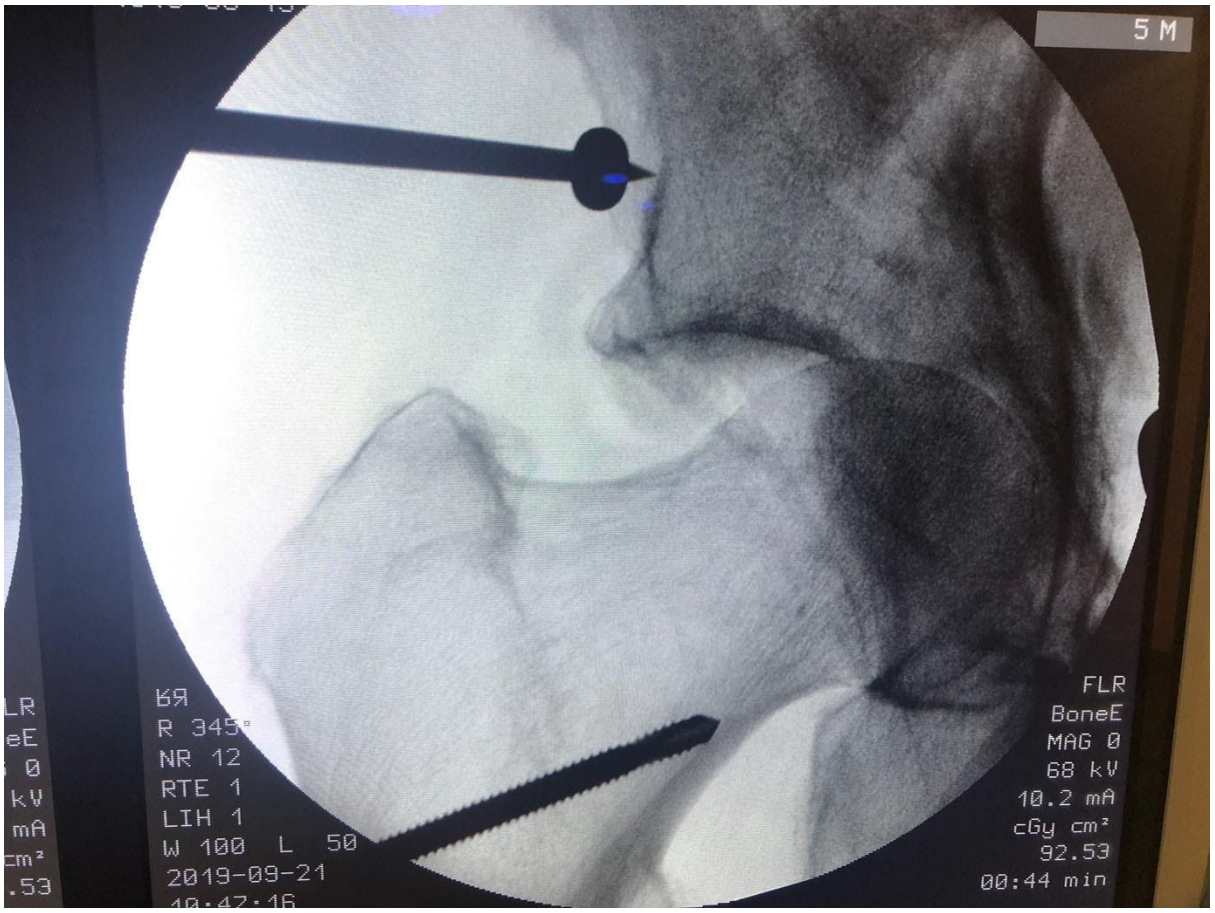
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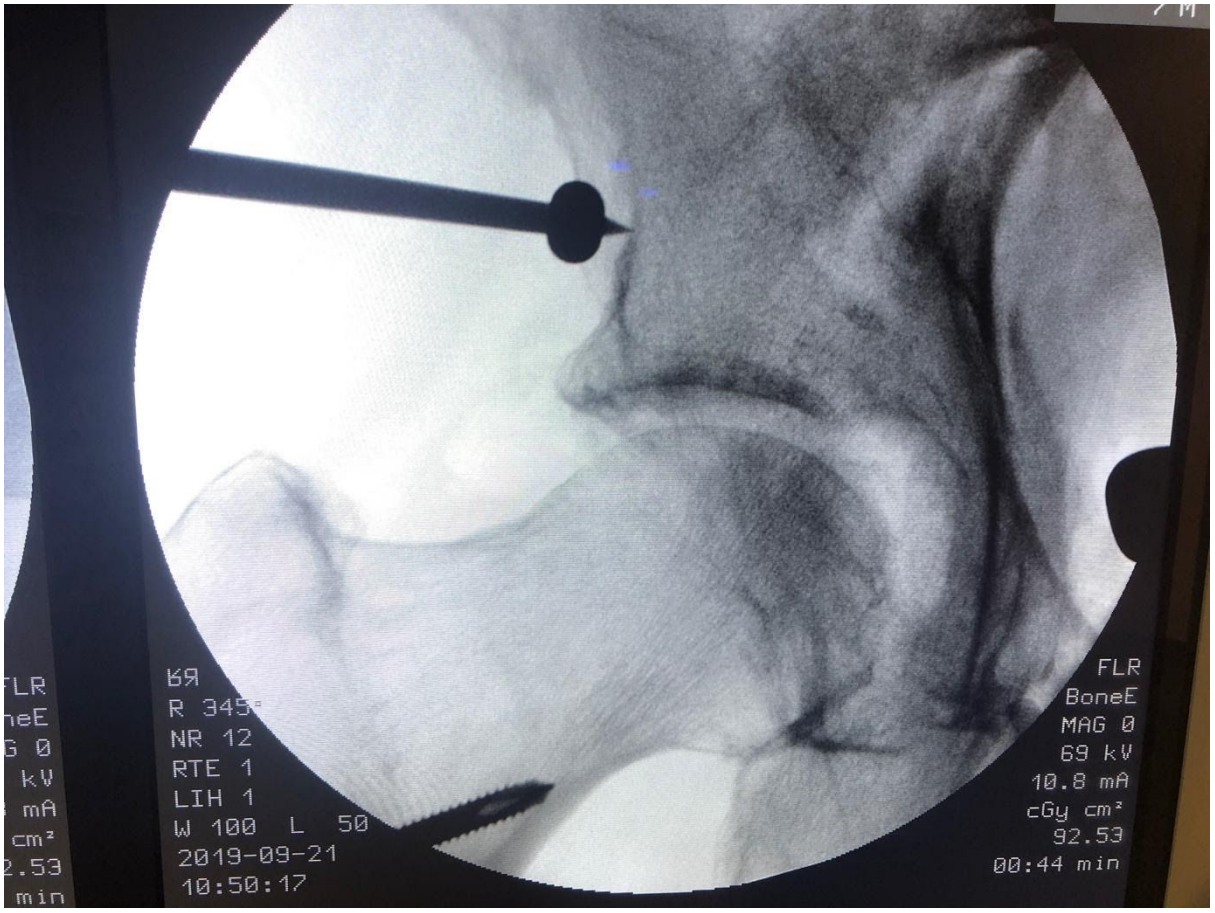
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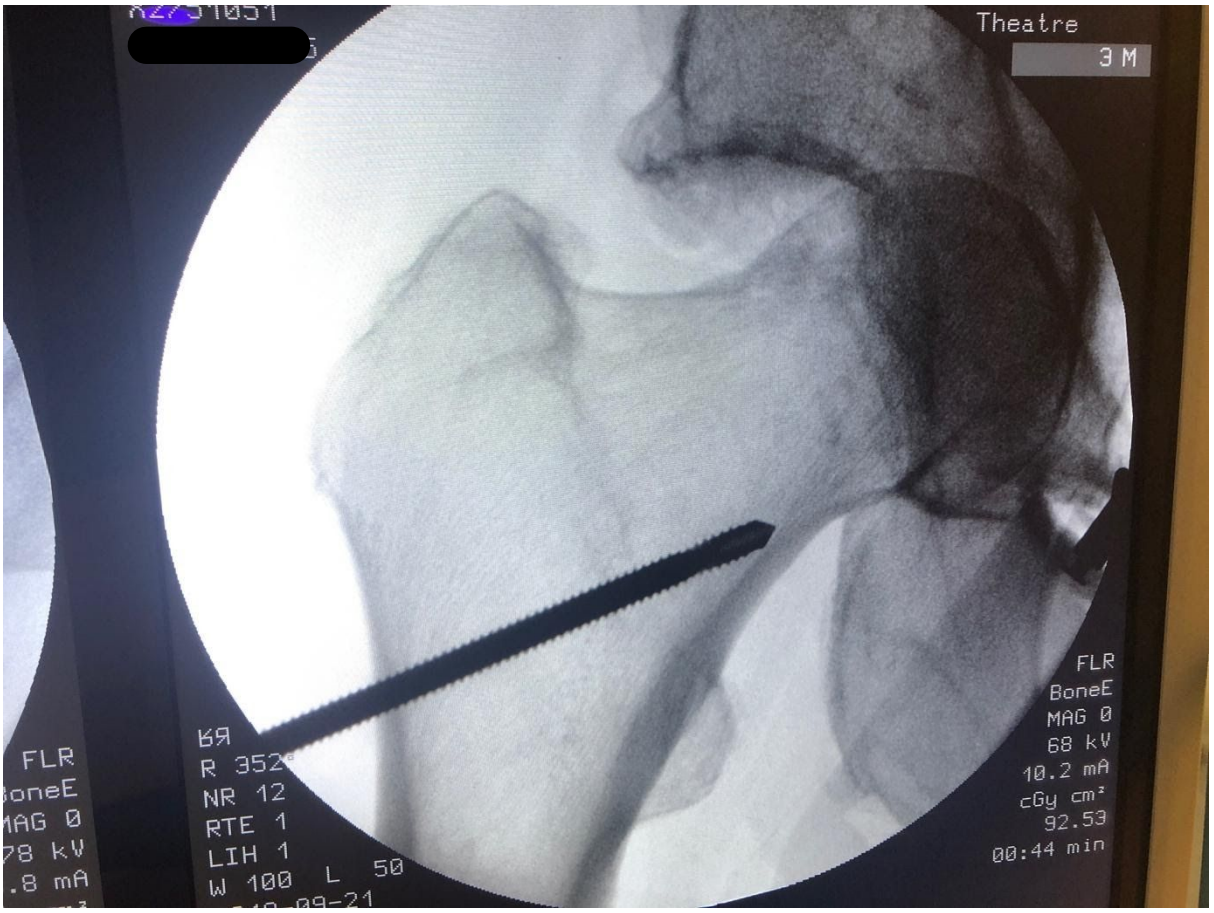
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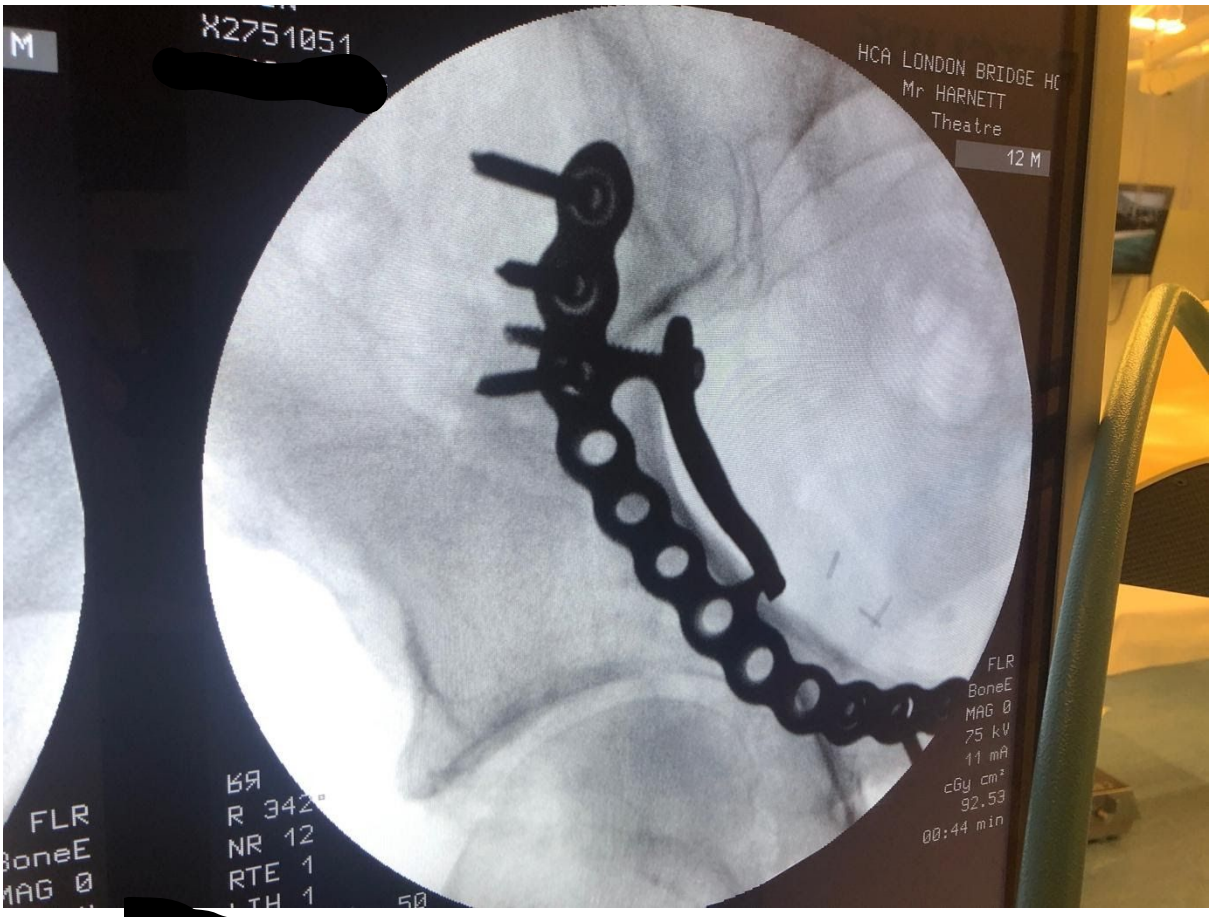
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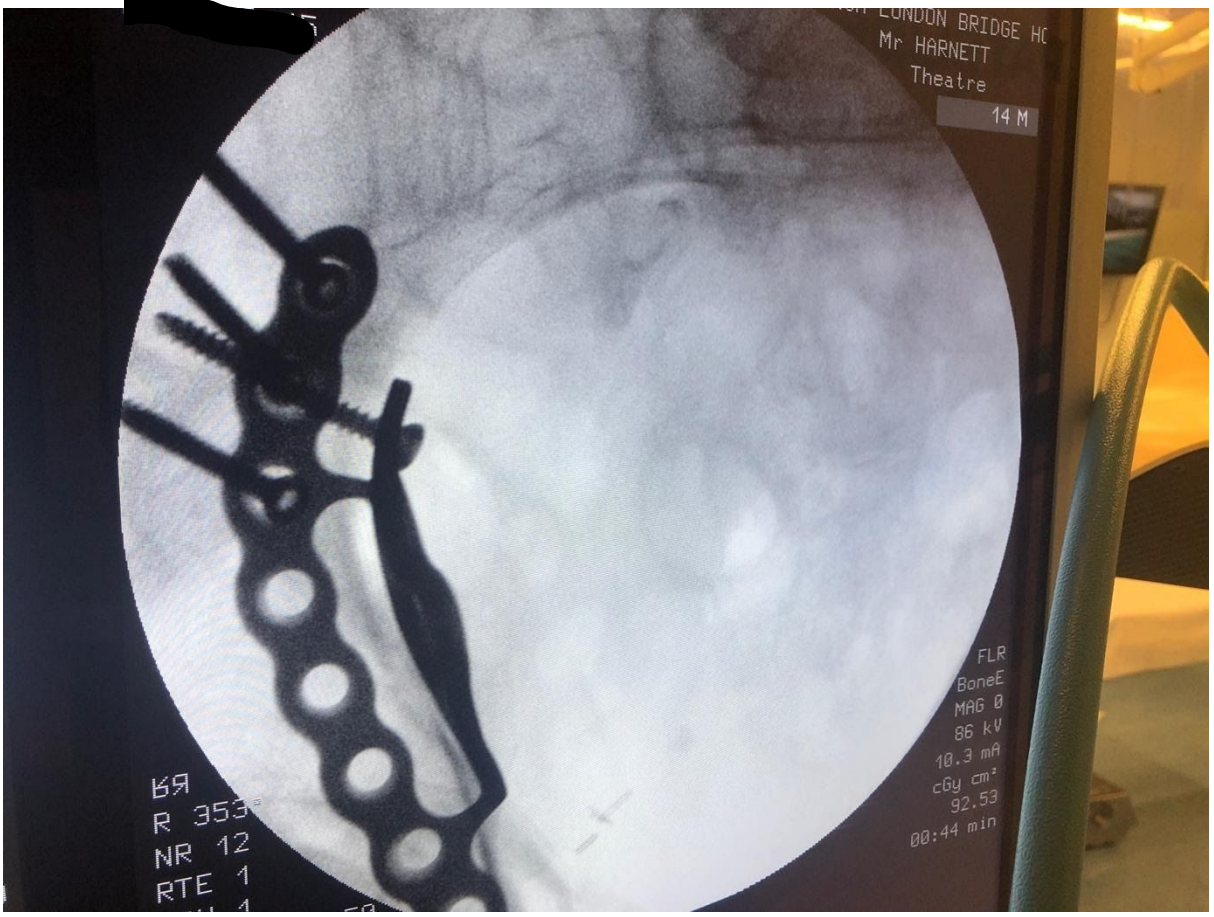
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