



The Newcastle upon  
Tyne Hospitals  
NHS Foundation Trust

# Low Pressure Headaches

David Butteriss, Consultant Neuroradiologist  
Royal Victoria Infirmary,  
Newcastle upon Tyne



Association  
of Anaesthetists



BRITISH SOCIETY OF NEURORADIOLOGISTS

## Introduction

- What is (spontaneous) intracranial hypotension?
  - *Loads of images*
- Radiological investigation and treatment options
- Locally developed investigation and treatment pathway
- Patient outcomes
- Summary

## (Spontaneous) intracranial hypotension

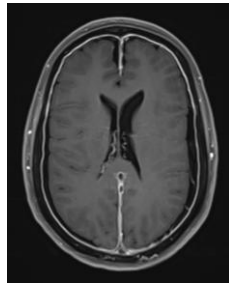
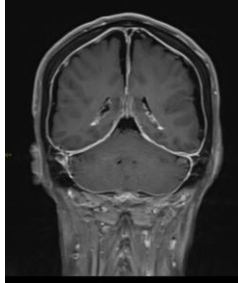
- Low CSF volume caused by **spinal CSF leak** due to:
  - **Iatrogenic** – LP/Epidural/Surgical
  - **Dural tear**
  - Meningeal diverticulum
  - CSF-venous fistula
- Presents with:
  - **Headache**
  - Cranial nerve palsies
  - Cognitive impairment
- Increasingly recognised condition

## Imaging Findings

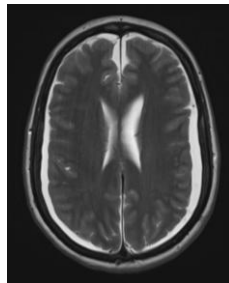
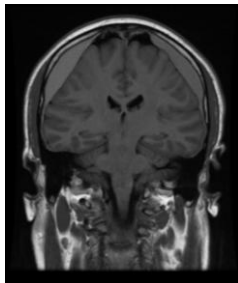
- Markedly different to cranial CSF leak via sinus/mastoid
- Effect of removal of volume (of CSF) from closed system

# Imaging Findings

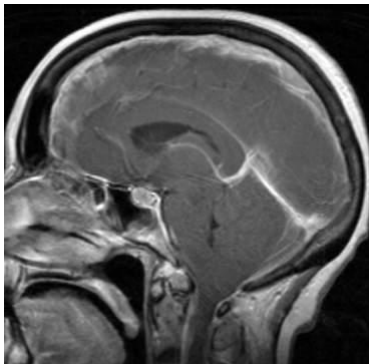
Dural enhancement



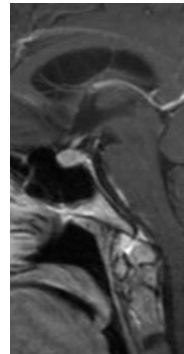
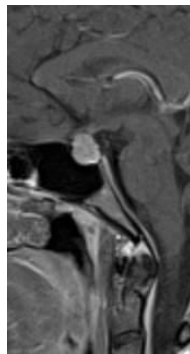
Subdural effusions



# Imaging Findings

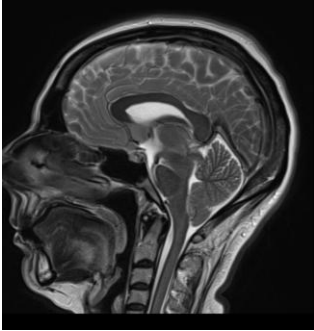


Prominent venous sinuses



Prominent pituitary

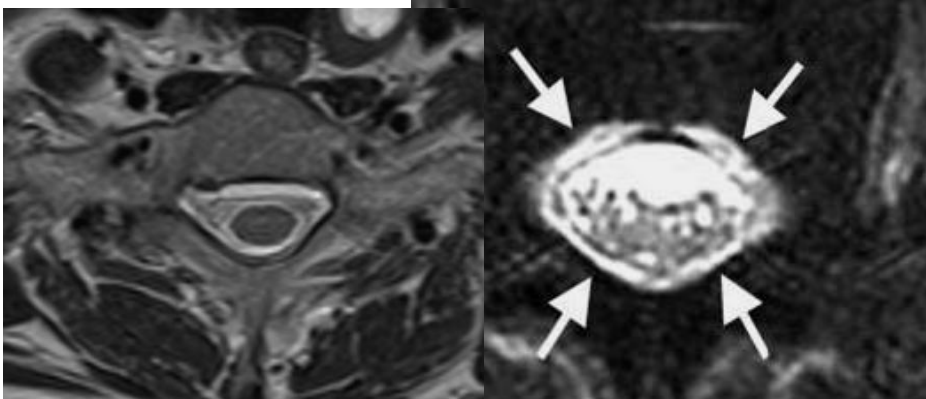
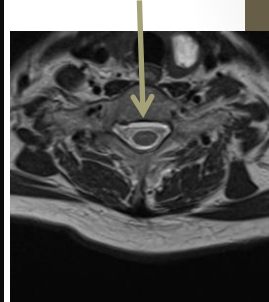
# Imaging Findings



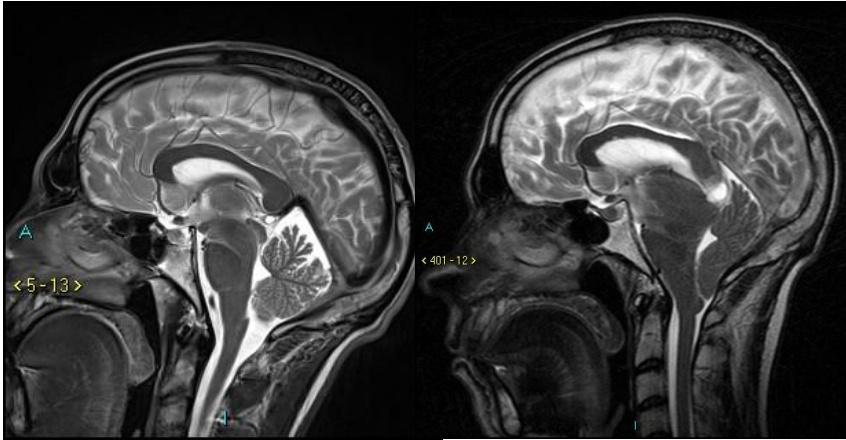
Brainstem slumping  
Cerebellar descent



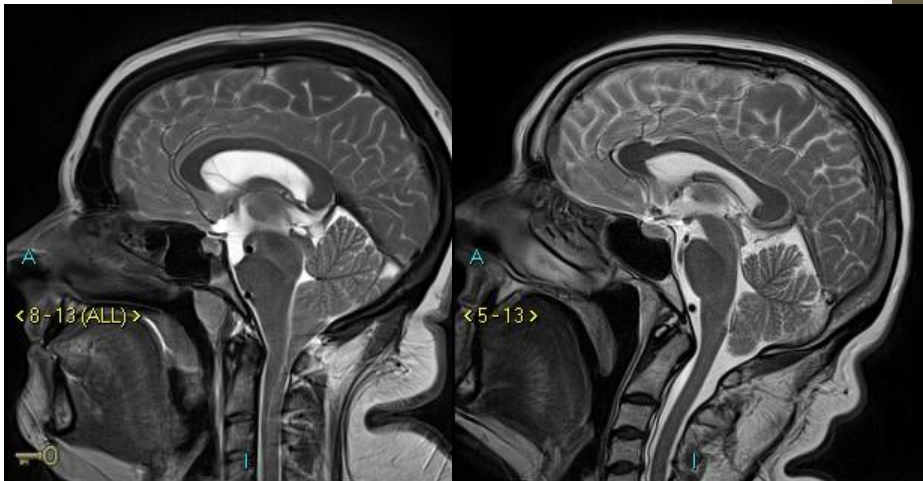
Epidural  
collections



# Imaging Findings



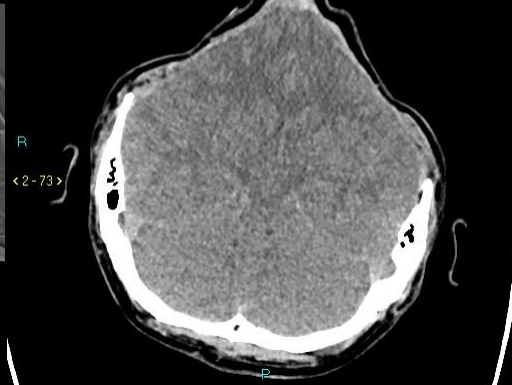
# Imaging Findings



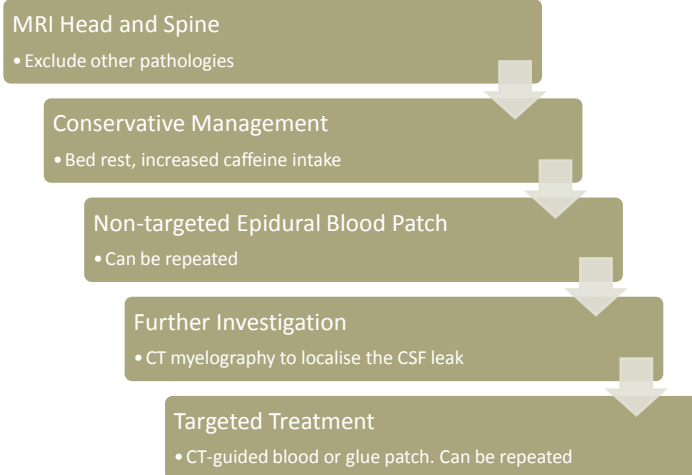
# Imaging Findings



# Imaging Findings



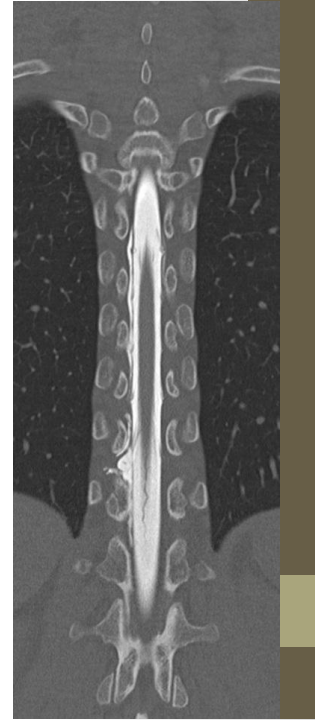
## Investigation and Treatment Pathway



## Leak-hunting options

- ~~Non-contrast MR Myelography~~
- ~~Intrathecal Gad MR Myelography~~
- ~~Conventional Myelography~~
- ~~Nuclear Medicine~~
- ~~'Standard' CT Myelography~~
- 'Dynamic' CT Myelography
- Digital subtraction myelography

## CT Myelography



## 'Dynamic' CT myelography

- Minimise time between injection of contrast and spinal imaging
- LP in CT
- 'downward dog'
- Whole spine CT
  
- Proceed to patch, or delayed scan

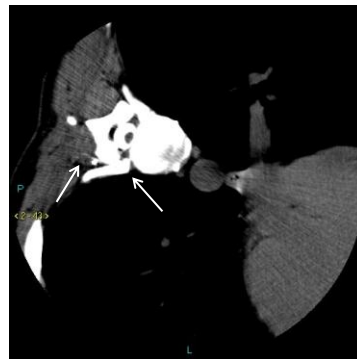
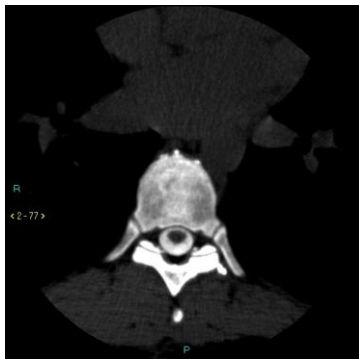


## 'Ultrafast' CT myelography

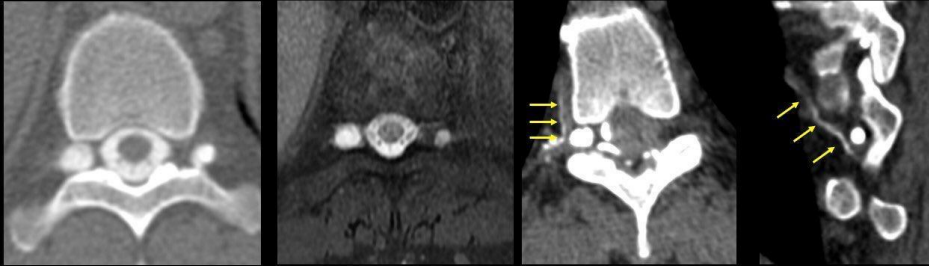
- Scanning while injecting
- Position patient over bolster
- LP in CT
- Repeat scanning of ROI while injecting contrast
- Proceed to glue patch

## Variations

- Decubitus CTM



Woman with SIH symptoms for 4 years and positive brain MRI and multiple perineural cysts on conventional CT myelogram.



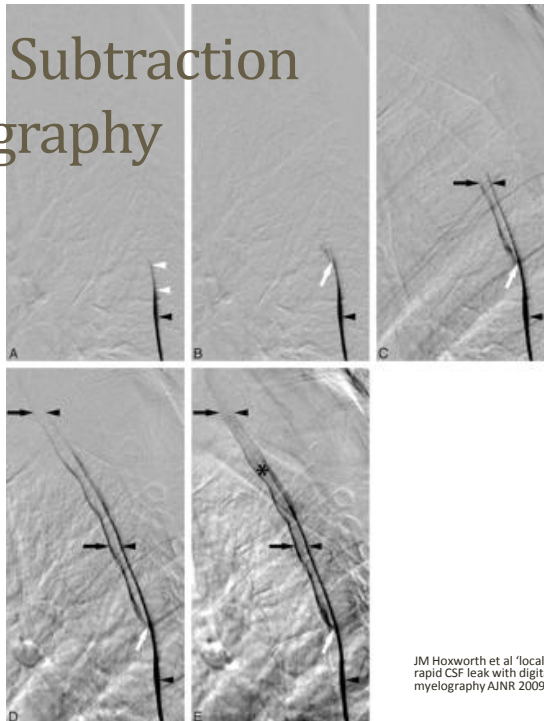
Conventional CT myelogram

MRI myelogram

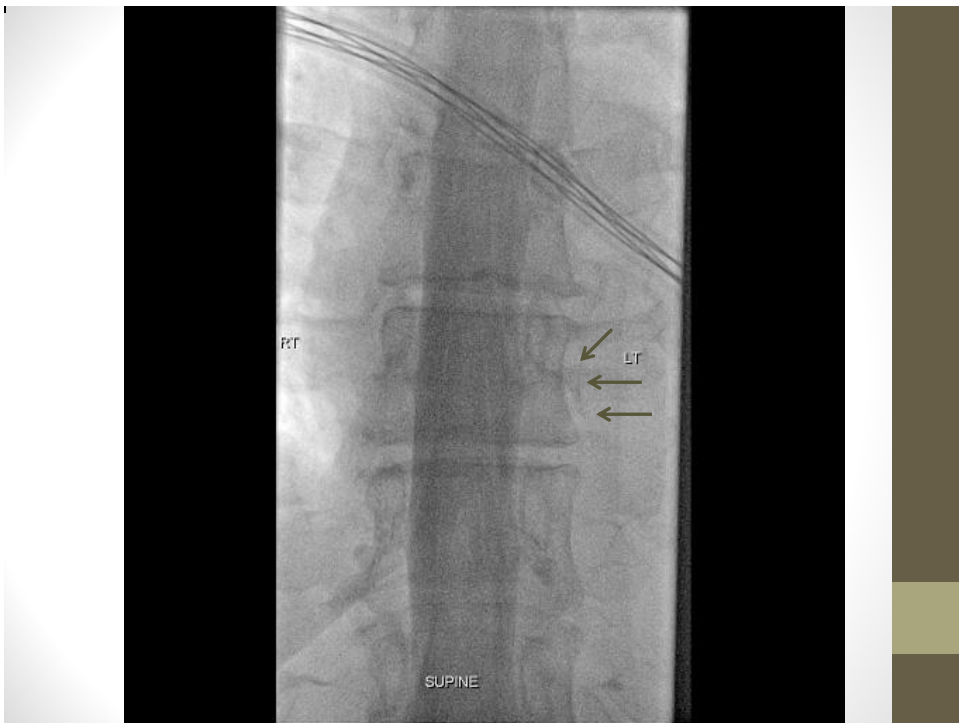
Right decubitus CT myelogram

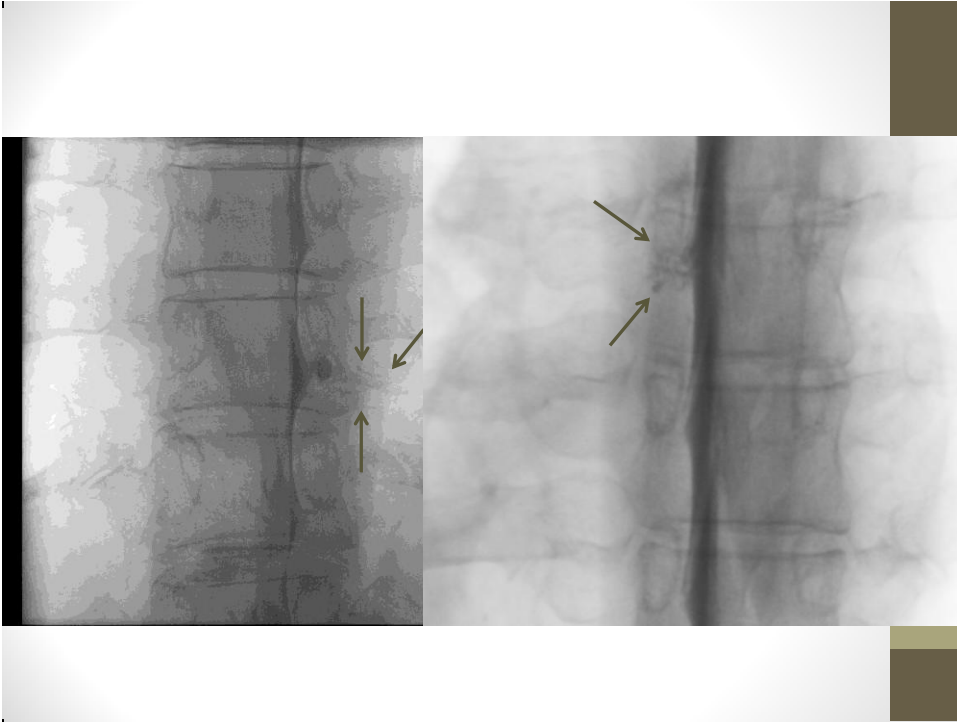
## CSF Venous Fistula

## Digital Subtraction Myelography



JM Hoxworth et al 'localization of a rapid CSF leak with digital subtraction myelography AJNR 2009 30 516-9

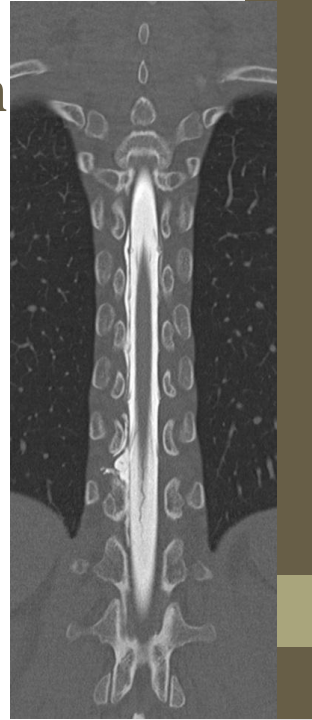




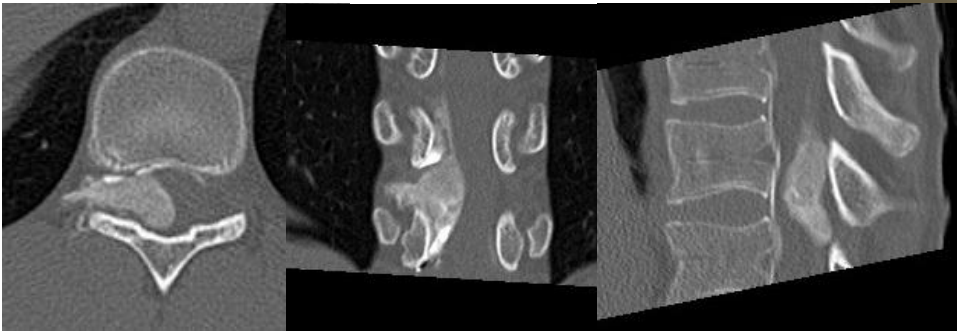
## What are we looking for?

- Lateral leak -nerve root blow-out
- Lateral leak – CSF-venous fistula
- Ventral leak – bony spicule?
- Any leak, anywhere...

## Meningeal diverticulum



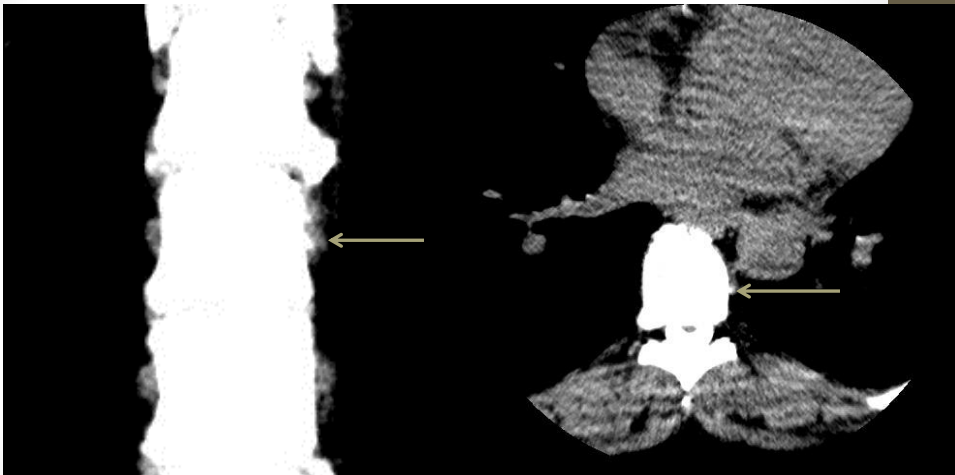
## Foraminal 'glue' patch

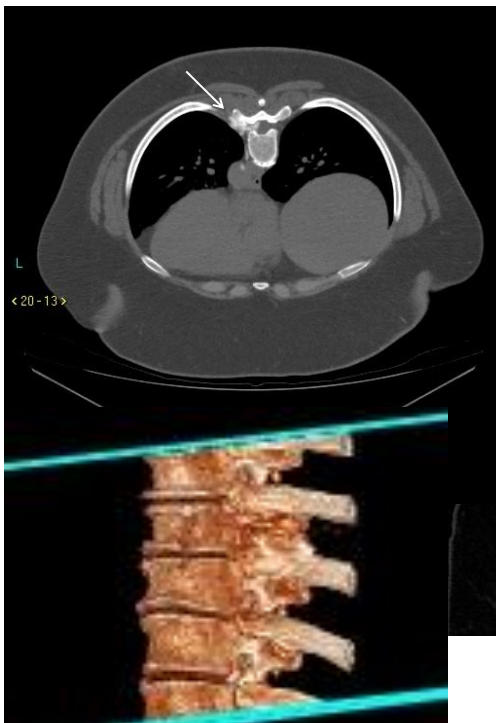
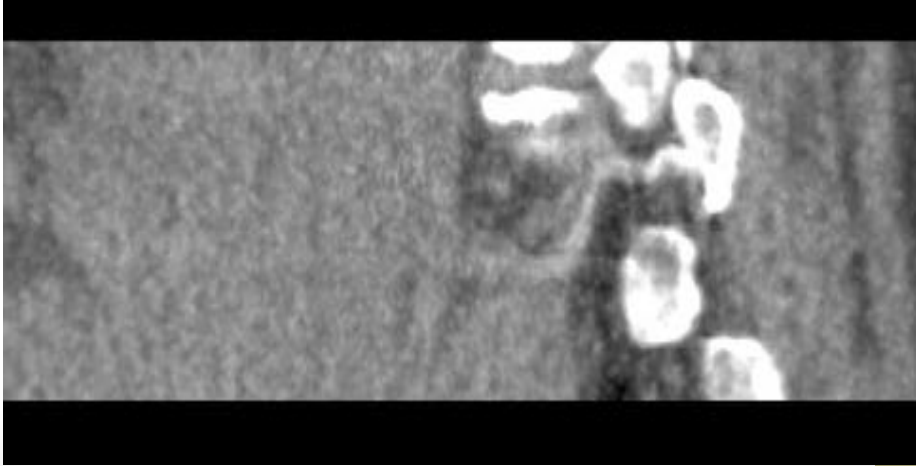


## 'Glue' patch

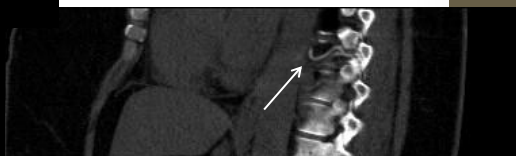
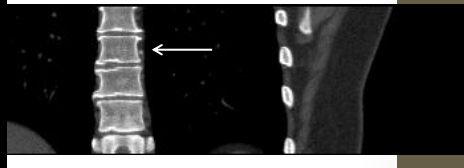
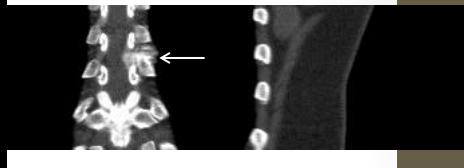
- Frozen Tisseel
- 4mls
- Tiny bit of contrast
- Asepsis
- LA
- Lateral approach to posterior neural foramen
- Warn patient of 'discomfort'
- Constant pressure injection
- Monitor/educate for CSF re-equilibration headaches

## CSF-Venous Fistula





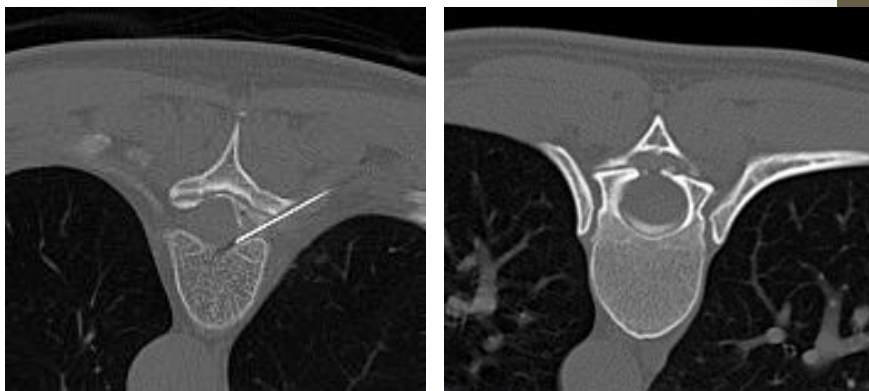
Glue patch





ANZSNR 2013

## Ventral epidural 'glue' patch





## Patient Outcomes

- Retrospective identification of patients with imaging/treatment at RVI 2010 – 2018
- Neuroradiology/anaesthetics records
- Imaging and treatments reviewed
- Electronic medical records reviewed for clinical response

## Patient Outcomes

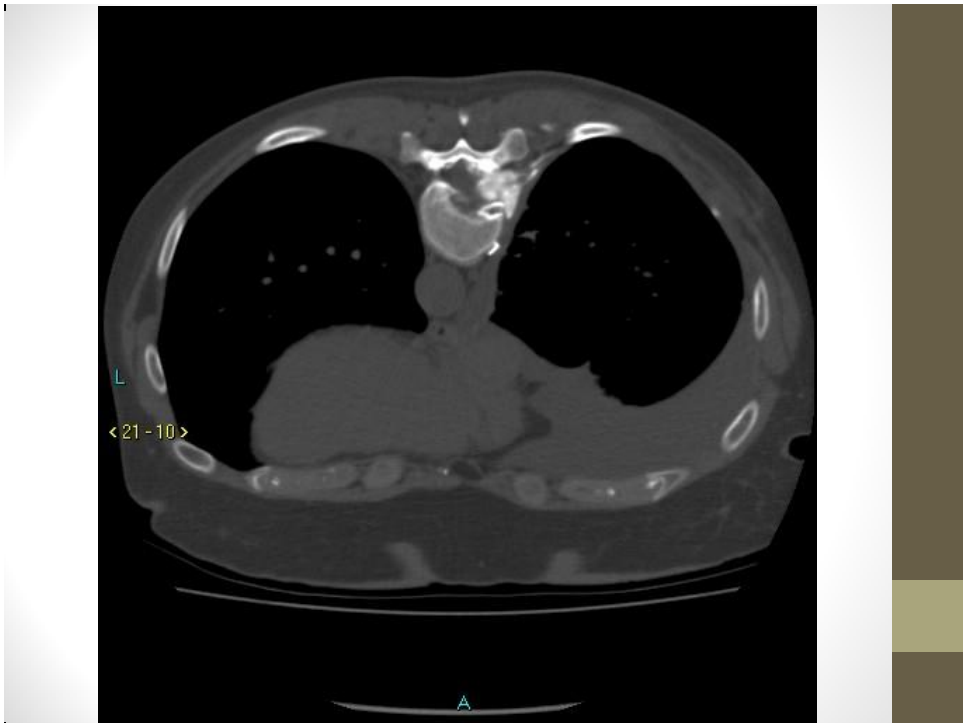
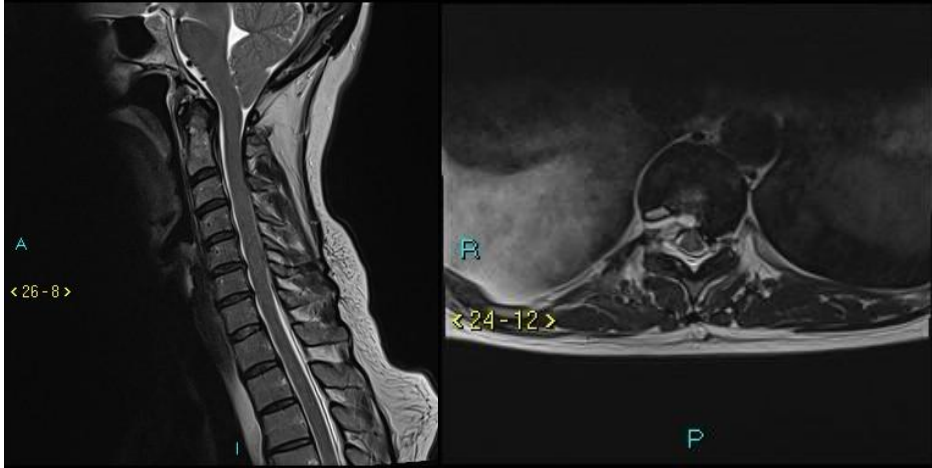
- 60 patients
  - 28 M, 32 F
  - Mean age 42 yrs
- 3 responded to conservative treatment
- 53 patients had non-targeted epidural blood patch
  - 29 responded (55%)
  - 24 did not respond (45%)
- 24 patients had targeted treatment
  - 15 responded (63%)
  - 7 did not respond\*
  - 2 awaited
- 2 patients had surgery, both responded

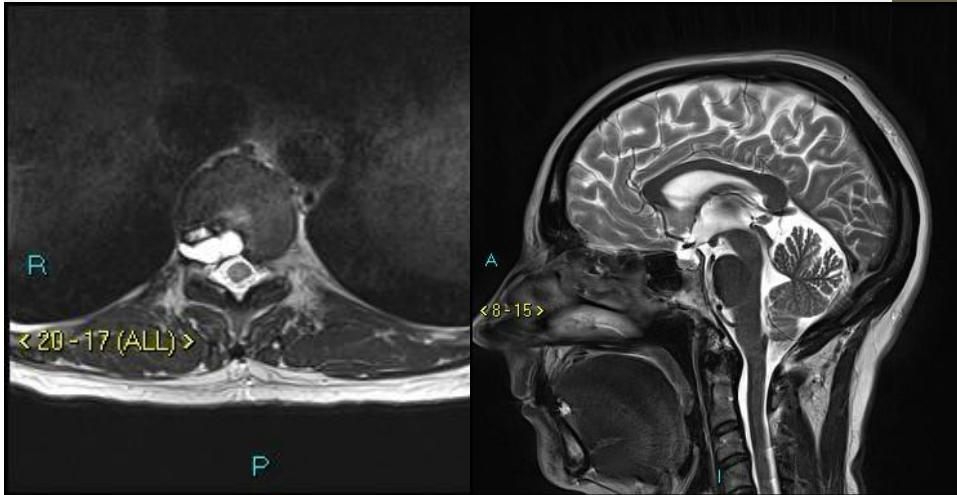
## Limitations

- Underestimation of patient population, particularly those recovering with conservative management
- Treatment responses can be difficult to assess
- Record keeping not always great

## Applications in iatrogenic spinal CSF leaks







## Summary

- (Spontaneous) intracranial hypotension
  - Under-diagnosed condition
  - Young adults, debilitating symptoms
  - Innovative radiologically guided treatments are emerging
- Investigation and treatment pathway developed locally
- **Treatments effective: 49/60 patients showed a response (82%)**
- Aim to use these data to refine treatment protocol based on clinical and/or imaging features:
  - Which patients tend to respond to which treatments?
  - Can imaging findings be used as prognostic indicators?