

**SPINAL EPIDURAL HAEMATOMA**



*DOMITIAN, issued as Caesar under Titus, (A.D. 81-96), silver denarius, Rome mint, issued A.D. 79, (3.498 grams), obv. Laureate head of Domitian to right, around CAESAR DIVI F DOMITIANVS COS VII, rev. around PRINCEPS IVVENTVTIS, garlanded and lighted altar, (S.2676, RIC T46, RSC 397), (Author's collection).*

*Emerging after Vitellius's death Domitian was hailed as Caesar and accepted an appointment as city praetor with consular powers – but in name only, because he left all judicial decisions to a junior colleague. However, the lawlessness with which he exploited his position as the Emperor's son clearly showed what might be expected of him later. I shall not discuss this subject in any detail; suffice it say that Domitian had affairs with several married women, and finally persuaded Domitia Longina to divorce her husband Aelius Lamia for his sake; and that once when he had distributed more than twenty appointments at home and abroad in the course of a single day, Vespasian murmured, "I wonder he did not name my successor while he was about it!"*

*...Vespasian had once teased him openly at dinner for refusing a dish of mushrooms, saying that it would be more in keeping with his destiny to be afraid of swords. As a result, Domitian was such a prey to anxiety that the least sign of danger unnerved him".*

*Suetonius, "The Twelve Caesars", c. 120 AD*

*In the year 69 AD Rome was torn apart by no fewer than four candidates who fought each other for the title of Emperor. It was the worst and most ferocious internal conflict*

*of the Empire since the days of Augustus and Mark Antony. Out of the four Emperors, it was Vespasian, commander of the legions in the East, who eventually emerged as the victor. Having witnessed first hand and played a leading role in the chaos of the year 69, Vespasian was determined to avoid a repeat of the same on his own death. With an eye to the future peace of Rome, in addition to establishing his own Flavian dynasty, he ensured the smooth transition of power on his demise by the elevation of his sons Titus and Domitian, should he survive Titus.*

*Having ensured the loyalty of the legions he sat back in the belief that the future peace of Rome was assured. In his son, Titus, a great general, he had every confidence, however as he watched his younger son Domitian grow up, he began to have serious doubts about him. Suetonius tells us that Domitian began to ruthlessly and shamelessly exploit his position as the Emperor's son. He had a voracious sexual appetite, seducing many married women, to the great scandal of the Empire. He did not hesitate to appoint his friends and lackeys to positions of great power throughout the Empire, so much so that Vespasian was heard to mutter "I wonder he did not name my successor while he was about it!" Vespasian came to suspect that Domitian would not make a good Emperor; indeed he was concerned that he would make a great number of enemies. At a banquet on one occasion, Domitian had refused a dish of mushrooms, prompting Vespasian to scream at him that his destiny as Emperor would be to avoid the sword rather than mushrooms! Domitian, a deeply superstitious man, would be haunted by his father's remarks for the rest of his life.*

*In 79 AD Vespasian died and was succeeded by his son Titus, who as Emperor and brilliant commander completed the war in Judea successfully. He then died, after a reign of just two years, it was said of natural causes and in 81 AD, Domitian was proclaimed Emperor. It did not take long before it became apparent that Vespasian's suspicions had proven correct. He ruled the Empire as Augustus in the same manner he had ruled it as Caesar. He was callous, cruel, spiteful, devious and malicious. His sexual appetite continued unabated, indeed it only increased as Emperor. Suetonius wrote, "Domitian was extremely lustful, and called his sexual activities "bed wrestling" as if they were a sport. Some say that he would depilate his concubines himself and go swimming with the commonest of prostitutes. He had been offered the hand of his brother's daughter Julia when she was still a virgin, but persistently refused to marry her on account of his infatuation with Domitia. Later when she was married to another, though Titus was still alive and after both her father and husband were dead he demonstrated his love for her so openly and ardently that in the end she became pregnant by him and died as the result of an abortion which he forced on her"*

*His complete disdain towards others would consistently invite disgust, Suetonius relates, "From his earliest years Domitian was consistently discourteous and presumptuous in both his speech and his actions. When Caenis, his father's former mistress, returned from Histria and, as usual, offered him her cheek to kiss, he held out his hand instead". So superstitious was Domitian and so terrified was he of assassination, that he had executed anyone whom he suspected of even the slightest degree of dissent. The merest off hand comment he took offense at would mean immediate execution for the perpetrator. He put many prominent senators to death. He had the husband of Domitia executed on the memory of what Suetonius tells us was the result of some ill advised but harmless witticism. He executed the pantomime actor Paris, seemingly for no particular reason,*

*then executed one sickly boy merely because he happened to be a pupil of the actor, and closely resembled the actor in looks and mannerisms.*

*Domitian, as did many of his predecessors, enjoyed gladiatorial combat at the Colosseum. In particular he delighted in watching female gladiators. Like Commodus before him he took pleasure in the senseless slaughter of animals, but unlike Commodus he was not actually afraid of involving himself in real combat, he did in fact lead several successful campaigns against the Alani. Whilst at the games Suetonius says that he overheard a chance remark of someone in the crowd who made a seemingly harmless remark he considered insulting to himself. This was enough to have the games halted, the poor unfortunate dragged from his seat and thrown into the arena with a placard tied around his neck, declaring, "A Thracian supporter, who spoke ill of his Emperor", whereupon he was torn to shreds by a pack of wild dogs. Some of his executions were not so spontaneous, but were planned with malicious delight. Suetonius again - "Domitian was not merely cruel but devious and cunning into the bargain. He summoned a bookkeeper into his bedroom, invited him to share his couch, made him feel perfectly secure and happy, condescended to offer him portions of his dinner – yet had already given orders for his crucifixion the following day!"*

*Domitian came to be greatly hated and feared, yet the great anomaly of his reign was its astonishing longevity - fourteen years. This was an astounding length of time given the life expectancy of most Roman Emperors of the imperial period. His reign was the longest since Augustus. Many Emperors lasted only a period of months. In an age where an Emperor would be quickly assassinated as soon as he had accumulated enough enemies, it remains an enigma that such a hated Emperor could last so long. The answer seems to lie in the degree of suspicion he harboured against all. His willingness to execute anyone he suspected probably accounted for a number of real potential assassins as well as imagined. One shudders to think of Domitian in the context of the Twentieth century, with the technology of that century available to him perhaps he would have surpassed even Stalin or Hitler in ruthlessness toward his enemies. So paranoid had he become near the end of his reign, that Suetonius tells us he lined the portico, where he took his daily walking exercises, with highly polished moonstone, which reflected everything that happened behind his back, in order to detect a potential hiding assassin. In the end, like Commodus, he was indeed assassinated by those servants closest to him when they themselves began to fear for their own lives. His great "success" where many others failed both before and after him, laid in his almost paranoid suspicion, fostered perhaps by his prescient father Vespasian, which allowed him to survive for as long as he did.*

*In the medical field, lurk many potential deadly dangers, and many of these trap us merely because our index of suspicion is low. Whilst not for one minute recommending the behaviour of Domitian, he can nonetheless teach us a valuable lesson. By always maintaining a high index of suspicion for the "worst case scenario" we will avoid many deadly dangers to our patients. No better example is seen in the rare case of the epidural haematoma, where textbook clinical signs and symptoms will not be reliable; rather it is a high index of suspicion in these cases which will lead us to the correct diagnosis.*

## SPINAL EPIDURAL HAEMATOMA

### Introduction

**Spinal epidural haematoma** is a rare condition, but has potentially devastating consequences if missed.

It may be due to trauma, or it can be spontaneous in those with coagulation diseases, including those taking **warfarin** or **DOACs**

Diagnosis is problematic, due to the rarity of the condition as well as the non-specific nature of the signs and symptoms before neurological impairment develops.

Although neurological impairment makes the diagnosis far more apparent, this will be a **late** sign, and the condition is ideally diagnosed *before* this occurs.

**A high index of suspicion and an MRI scan are required to make the diagnosis.**

### Pathology

Causes of spinal epidural haematoma include:

1. Trauma:

In one impressively large study of over 27,000 trauma patients admitted to the Alfred Hospital, a major trauma center in Melbourne, <sup>1</sup> the incidence of cervical spine traumatic epidural haematomas was:

- 0.6% among *all* trauma patients
- 9.1% among patients with *any cervical spine injury* (a surprisingly high percentage compared to previous reports)

Of this group just over 50% had neurological deficits consistent with the anatomical location of the epidural haematoma.

Among the patients diagnosed with cervical spine traumatic epidural haematomas 7% died and 45% required cervical spine surgical decompressions.

Of note, the majority of patients with cervical spine traumatic epidural haematomas were neither on antiplatelet therapy nor anticoagulant therapy, nor had a coagulopathy on laboratory testing at the time of injury.

2. Coagulopathic disease

3. Drug induced:

- **Warfarin**
  - **DOACs**
  - **Heparin / LMW heparins**
4. Secondary to pathological lesions:
- Malignant disease
  - Vascular disease

### Clinical features

The earliest features of spinal epidural haematoma will usually be **midline back pain**.

Examination and initial investigation will not reveal a diagnosis.

**In spontaneous cases the only clue to the diagnosis will be that patient is taking warfarin or a DOAC**

**As a general rule, any pain must be carefully assessed with a high index of suspicion in any patient who is coagulopathic.**

Other important differential diagnoses of **back pain** in patients with a coagulopathy include:

1. Retroperitoneal haematoma
2. Aortic dissection
3. Acute coronary syndrome and pulmonary embolism must always be considered even if they are on anticoagulants.

*Note that all the above are far more common than spinal epidural haematoma, adding to the diagnostic difficulty in this condition.*

It will usually be at the point when other serious diagnoses have been ruled out that the possibility of spinal epidural haematoma is the considered.

**Midline** back pain/ tenderness without obvious cause may be the only clue to early diagnosis.

When **neurological symptoms** have developed diagnosis of course becomes far easier, however these are unfortunately **late signs**, and confirmation with MRI becomes extremely urgent, if the patient is to hope for any degree of recovery.

## Investigations

### Blood tests:

Blood test results should not delay definitive MRI imaging, but the following may be considered:

1. FBE
2. CRP
3. U&Es/ glucose
4. Clotting profile:
  - INR, in particular for patients who are taking warfarin.
5. Troponin
  - To assist in ruling out ACS.

### ECG:

This should be done to help rule out acute coronary syndrome as a differential to spinal pain in non-trauma cases.

### Plain radiography:

CXR and spinal x-rays may assist in ruling out alternative differential diagnoses of spinal pain in non-traumatic cases but cannot make a diagnosis of epidural haematoma.

### MRI Scan:

#### **MRI is the definitive investigation.**

MRI also allows for the differentiation between other potential traumatic causes of neurological deficits such as spinal cord oedema or contusion and traumatic disc ruptures.

**It is important to note that a lack of neurological signs (the presence of which is unfortunately usually the first clue to the diagnosis) does not negate the need for an MRI scan when clinical suspicion is high.**

**In the Alfred study one-third of patients diagnosed with cervical spine traumatic epidural haematomas did *not* have any neurological deficit clinically identified.**

**The diagnosis of epidural haematoma is best made before the development of neurological signs!**

In the Alfred Hospital study the cervical spine traumatic epidural haematomas were diagnosed by MRI in 75% cases, of whom 13% had *normal* CT scans. Of note therefore, about one quarter of cases were diagnosed on CT scan, (though whether these were contrast scans was not reported).

### CT Scan:

Increasingly patients have cardiac pacemakers / defibrillator devices or other metallic devices.

Older models contraindicate MRI.

Newer models may be *provisionally* MRI compatible, however extremely strict protocols exist regarding the performance of an MRI scan. In “out of hours” situations, these protocols, are virtually impossible to apply from a logistics point of view.

A CT scan with contrast (soft tissue and bone algorithms) offers a next best alternative to MRI. Although not nearly as good as MRI, CT with contrast is a better option than no imaging whatsoever.

A suggestive scan, together with the clinical picture and index of suspicion, may be enough to at least raise or lower suspicion, if not in some cases to intervene.

CT myelogram is absolutely contraindicated in coagulopathic patients

If the CT scan is negative then epidural haematoma *cannot* be excluded.

CT may also assist in ruling out alternative differential diagnoses, (such as retroperitoneal haematoma or aortic dissection).

### Management

1. Analgesia:

- Give as clinically indicated.

2. Anticoagulant reversal:

#### Warfarin reversal:

- If the patient is on warfarin this should be fully reversed, immediately following diagnosis, with **Prothrombin X, FFP** and **IV vitamin K**

#### Dabigatran reversal:

- If the patient is on dabigatran this should be fully reversed, immediately following diagnosis, with **Idarucizumab**.

#### Direct Factor Xa Inhibitor, agents reversal:

- Rivaroxaban, Apixaban may be reversed with **Andexanet Alfa** (if available).

3. Steroids:

- Steroids may provide some benefit. This should be discussed with the neurosurgeon.

4. Surgery:

- Once the diagnosis has been made, there should be *urgent* referral to neurosurgery for consideration of surgical decompression.

The decision to undertake decompression will in general terms depend on the extent of the bleed, as well as the duration of any neurological symptoms.

In the setting of **trauma**, adverse outcomes are associated with protracted time intervals between symptom development and definitive surgical interventions.

Epidural haematomas within the **cervical spine** are of particular clinical significance given the potential extent for neurological deficits involving both upper and lower sensory/motor function if early treatment is not instituted.

5. Anticoagulation:

- Anticoagulation reflects a particular management conundrum in patients with traumatic spinal epidural haematomas.

Early LMWH thromboembolism chemoprophylaxis carries the risk of potentially causing an increase in the epidural haematoma.

However, withholding LMWH thromboembolism chemoprophylaxis may place spinally immobilized patients at increased risk of thromboembolic events, (although the risk in the Alfred study was not high)

Clinicians in this situation may choose to use mechanical thromboembolism prophylaxis with graduated compression stockings and/or intermittent pneumatic compression devices.

## Appendix 1



*MRI scan of a 72 year old woman with a spontaneous large epidural haematoma, (C4-T4). She was on warfarin medication. She presented initially with non-descript back pain and no clear diagnosis could be made with initial investigations; the diagnosis of epidural haematoma only became apparent when she developed leg paralysis whilst under ongoing observation in the Emergency Department. (MRI image courtesy Dr. Riyadh Abdul-Ridha).*



*Domitian, as Emperor, in marble, first century AD, Vatican Museums*

References

1. Lisa Brichko, Birinder Giddey, Jin Tee, Louise Niggemeyer, Mark Fitzgerald. Cervical spine traumatic epidural haematomas: Incidence and characteristics. *Emergency Medicine Australasia* (2017) doi: 10.1111/1742-6723.12920.

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