

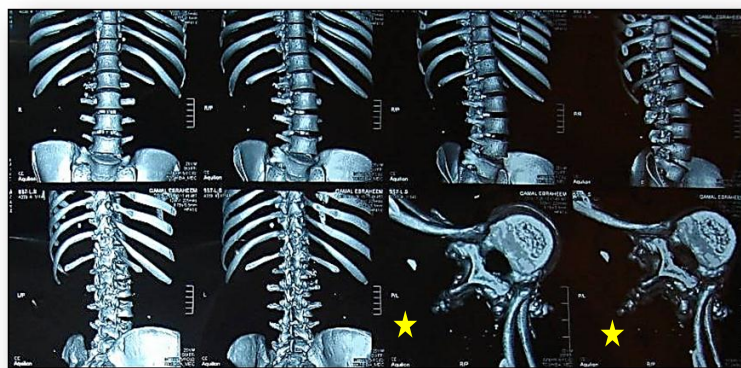
Cauda Equina Injury New Surgical Approach

In the management of ignored or old traumatic caudal injuries, one expects dealing with the posterior arch of the lumbar column (i.e. laminectomy, stabilization,), removing the induced protrusion of the inter-vertebral disc, and eliminating any other invasion into the vertebral canal.

All are correct but are not comprehensive. Herein, I present an additional concept to that strategy: " Releasing each root of the Cauda Equina, at the level of the inter-vertebral foramen in particular, could have a tremendous benefit for the patient". Previously, no one has ever thought of exploring the exit-port of the roots while treating the caudal injuries. Fortunately, unusual unique clinical case could make the difference, drawing attention to this troublesome factor.

26-year old male patient came to my clinic with potential traumatic injuries to the 9th and 10th thoracic vertebrae. Spastic palsy was expected, but flaccid palsy was quite present. Why and how it could be? The rest came as follow.

26-year- old male patient was a victim of a gunshot. The projectile smashes the transverse and the spinous process of his 9th and 10th dorsal vertebrae. The patient awoke to complete loss of sensation and active motion from the level of the costal edge down. He lost control on urination – defecation activities. Supra-pubic catheter was in place. While, pampers are still in use for personal hygiene. Sexual activity was the most troubling figure in the clinical picture as well as the saddle anesthesia. One year passed without any clinical improvement; [Figure \(1\)](#).



*[Figure \(1\)](#)
CT- Scan of Vertebral Column*

The projectile smashes the transverse and the spinous process of 9th and 10th dorsal vertebrae of the patient (The yellow stars). However, the vertebral canal per se is free of any invasion nor direct penetration.

Physical examination showed a clear contradiction between the requirements of potential spine injury and the clinical reality. The absence of active movement with the absence of tendon reflexes (patellar reflex, ankle jerk reflex) as well as skin reflexes (such as cremasteric reflex) made the difference between the expected and the reality. The clinical examination imposes flaccid paraplegia whereas the logic of things suggested spastic paraplegia.

In front of low neuron injury, surgical intervention on Cauda Equina was decided. The target was to release any potential intra-dural sac fibrous adhesions. Adhesions might fix neural roots to each other, or fix each one to the corresponding inter-vertebral foramen.

The begin was by removing the posterior arch (i.e. laminectomy). Dural sac was incised longitudinally for 12 cm. Roots were inspected for any adhesions. As preoperatively imagined, roots were only fixed at the level of inter-vertebral foramens. Only the quite exposed second and third lumbar roots were liberated from their adhesions. Because of technical reasons, the liberation of the other roots of Cauda Equina was postponed to second time; [Figure \(2\)](#).

Early results are promising. 2-month postoperatively, we find the return of some reflexes such as the cremasteric reflex (L2). The adductors muscles gained power (M3), the quadriceps femoris muscle (M2).

Discussion

Faced with this contradiction between the site of potential spine injury (D9- D10) suggesting spastic paraplegia, and the clinical picture imposing flaccid paraplegia, I assumed the presence of another damage; but at the level of Cauda Equina and/or conus medullaris.

I excluded any penetration injury to Cauda Equina for the absence of any breach of the spinal canal at this level. Thus, the only remaining mechanism to explain the damage was to suppose the presence of constricting adhesions blocking the roots of Cauda Equina.

Fibrosis can occur by one of two mechanisms; either bleeding inside the spinal canal, and is more likely, or as a result of trauma-induced inflammatory changes in cerebrospinal fluid. The induced inflammatory process, absorption of blood effusion, and the liquidation of the cerebrospinal fluid of turbid, randomly make up fibrosis in several places.

The random distribution of the fibrous adhesions may explain this great diversity in the spectrum of clinical symptoms. Fibrosis may be located within the dural sac embracing the roots to each other, or at the outlet of each root; [Figure \(2\)](#).

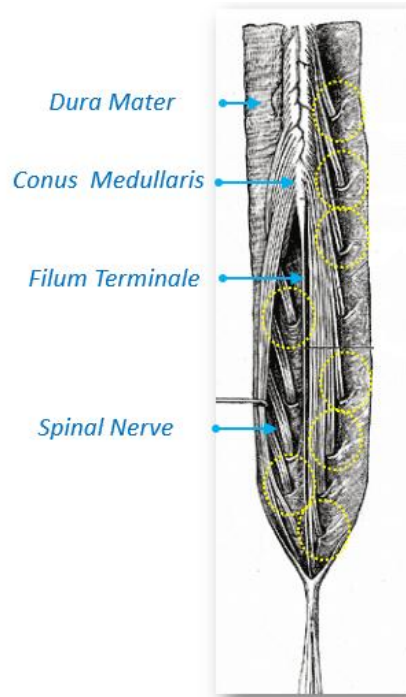


Figure (2)
Cauda Equina, Condemned Sites of Pathology

The Yellow Circles indicate the sites of fibrosis at the outlets of the roots.
The root traverses the inter-vertebral foramen with a narrow sleeve of dura mater.

Each root, with elongation of dura mater, traverse the space between two vertebrae. This passage is the most critical site in the path of the root. Minimal fibrosis or adhesion could block total action of the root; Figure (3).

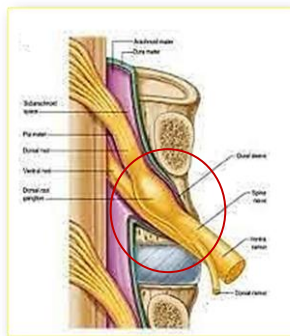


Figure (3- a)

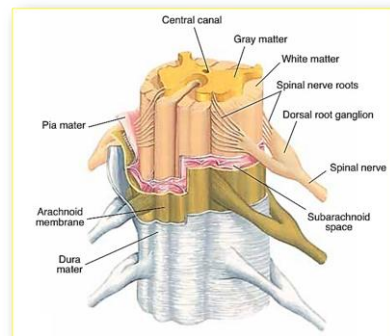


Figure (3- b)

Figure (3)
Cauda Equina.
Meningeal Sleeve is the Risk Factor

Figure (3- a): The Red circle indicates the site of fibrosis concerned in this pathology.
Note the narrow dural sleeve enveloping the root when traversing the corresponding inter-vertebral foramen.

Figure (3- b): Each root leaves the dural sac with an elongation of both the dural mater and arachnoid membrane. This elongation is the small meningeal sleeve, which in combination with the other sleeve of the second root, forms the bigger meningeal sleeve of the spinal nerve.


Traditionally, in the management of caudal injuries, therapists prefer monitor-strategy, which I do believe of its uselessness. Moreover, the surgical intervention, if done, is to raise the posterior arch of the vertebral column (laminectomy) +/- remove any protruding part of the inter-vertebral disc. Nobody has ever thought of exploring the outlet of roots in caudal injuries.

Indeed, liberating Cauda Equina roots requires extensive exposure of dural sac, at least at the level of the five lumbar and the first sacral vertebrae. After opening the dural sac, each root is followed from the origin to exit-port. Be sure of the continuity of each root (in case of penetrating traumatic injuries at this level), and of its liberty from any adhesion or fibrosis.

Finally, I will not refute the other points of view in this area. But I will strongly recommend surgical intervention in Cauda Equina injuries in the following cases:

- 1- In every traumatic injury to the spine when we find some contradictory elements; such as reported in this case.*
- 2- In penetrating injury at this level; directly by the projectile itself or by some of its consequences (i.e. bony or metal sequestration into the vertebral column).*
- 3- In old caudal injuries, traditional strategy of treatment (laminectomy+/- removal of protruding inter-vertebral disc) does not suffice. It is recommended to explore the exit-port of Cauda Equina roots.*

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