Stab Wounds of the Cauda Equina

Case Report

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Knife wounds of the spinal canal are rarely reported in civilian practice. The vertebral column offers excellent protection to the enclosed neural elements, and therefore a knife wound inflicted only by the force of a swinging arm does not usually damage the spinal cord or roots. The few stab wounds of the spine reported in the English literature have been in the cervical or upper thoracic regions. Cauda equina lesions of a traumatic nature occur usually in association with gunshot wounds or compression fractures of the lumbar vertebrae. The case we are presenting points out that the criteria for exploration of cauda equina wounds differ from those applied to injuries of the spinal cord.

Case Report

A 15-year-old boy was admitted to the neurology service 12 hours after being stabbed in the back. His complaints were weakness and loss of sensation in the right leg. He had been attacked from the front by an assailant with whom he struggled, and who reached around and stabbed the patient in the back with a long, flexible knife. Wounds were inflicted in the left paraspinal area with the thrust toward the right heel. The patient had not voided nor had a bowel movement since the injury.

Examination. The patient, a well-developed Negro boy, had a temperature of 101°F. There were two well-defined stab wounds in his back just to the left of the midline in the area of D-12 and L-4. The lower wound was swollen and tender. Complete paralysis of dorsiflexion, eversion, and inversion of the right foot was present. The extensors and flexors of the leg were weak on the right. Sensory loss included decreased response to light touch and pinprick of the posterior aspect of the right leg, entire foot, and both buttocks. Proprioceptive and vibratory sensation were absent in the L5-S1-S2 distribution. The anocutaneous reflex and ankle jerk were absent on the right. There was moderate neck stiffness, and lumbar puncture yielded grossly bloody cerebrospinal fluid with a xanthochromic supernatant layer; no organisms could be cultured from this fluid. X-ray films of the lumbosacral spine showed no abnormalities. Catheterization yielded 800 cc of urine.

The neurosurgery service was consulted 7 days after admission. A cauda equina laceration was felt to be present at the L-4 level. The patient was started on antibiotics and given bladder and bowel care.

Operation. A laminectomy was performed 9 days after admission at the L4-5 level. After several bundles of nerve roots were freed from surrounding heavy granulation tissue within the area of the dural defect, complete transection of the right cauda equina (Fig. 1) with partial transection of the left cauda equina at the L-4 level was found. The arachnoid was nonadherent, and clear spinal fluid flowed from above. A small catheter was passed superiorly in the subarachnoid space without resistance. By extending the lumbar spine the stumps of two

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Fig. 1. Severed cauda equina roots prior to suture reanastomosis.
bundledes of the cauda could be sutured together. This was done by suturing through the perineurium between the roots, catching a portion of the roots themselves. The large rent in the dura was repaired with a graft of paraspinous fascia.

Postoperative Course. Recovery was uneventful. The catheter was permanently removed on the 12th postoperative day; there was no residual urine. The patient was discharged 19 days later with slight weakness of the hamstrings and quadriceps, and complete paralysis of dorsiflexion, eversion, and inversion of the right foot. He was able to void and have bowel movements with straining.

At 11 months postoperative, a barely detectable return of inversion and dorsiflexion of his right foot was first noted. There was a marked decrease in the amount of straining necessary to void or to have bowel movements. At 17 months postoperative, inversion was approximately 50% normal, and dorsiflexion was approximately 35% normal. Sensory findings have remained unchanged from the preoperative state.

Discussion

There is no universal agreement on the management of penetrating wounds of the spinal canal, except on local wound care and antibiotics to prevent infection as well as general measures employed in any patient with paraplegia or quadriplegia. The indications for operation enumerated by various authors have included: 1) foreign body in the spinal canal; 2) bone fragments in the spinal canal; 3) persistent spinal fluid leak; 4) intradural or extradural abscess; 5) blood in the spinal fluid; and 6) spinal subarachnoid block.

Lipschitz and Black reported their experience with 130 stab wounds of the spine treated conservatively with local wound care and antibiotics. Surgery was performed on only two patients for abscess formation, and there was only one death from meningitis due to an antibiotic-resistant organism. Of their 130 patients, only five were bedridden, 36 returned to their former occupations with or without residual deficit, and 88 were described as “up and about” and ready for occupational rehabilitation. These authors advocated conservative management unless there was sepsis, persistent sinus, or a retained foreign body. It should be noted, however, that none of these wounds involved the cauda equina.

Regeneration of the anterior roots of the spinal cord has been well documented, but that of posterior roots seldom if at all. Therefore, although sensory return may not be obtained by cauda equina repair, some motor return is feasible and reconstruction should be considered. The absence of an adequate sheath around the roots of the cauda provides a technical hurdle to suture reanastomosis. Individual nerve rootlets are surrounded by pia mater as they leave the neural axis. The trunk which is formed by the various nerve roots receives a perineurium derived from the arachnoid. There is no true epineurial covering until the root leaves the spinal canal. Thus, cauda equina roots have only endoneurial and perineurial investments. The absence of epineurium makes suture reanastomosis difficult because of the extremely delicate sheath afforded by arachnoidal and pial investments.

Tarlov attempted to reconstitute severed cauda equina roots in monkeys by means of nerve grafts with plasma clot suture. His studies indicated that regeneration does occur, but that functional restoration requires aggressive physical therapy to the involved musculature during the time needed for axon regeneration to take place from the level of the lumbosacral canal to the muscles of the leg.

Decompression of nerve roots generally is thought to provide more relief of pain and return of function than decompression of spinal cord substance. Since the cauda equina is composed entirely of nerve roots, this should influence the surgeon to undertake more aggressive surgical management in cases of injury by stabbing. Landau and Ransohoff reported a series of seven patients who had laminectomies for decompression and lysis of adhesions from 1 month to 17 years following closed injuries to the cauda equina and conus medullaris, with improvement in neurological function in all cases.

Our case illustrates the value of immediate intervention. Delay of 9 days between injury and operation resulted in a difficult dissection of the involved roots from surround-
ing granulation tissue. Procrastination in expectation of epineurial thickening affords no advantage in cauda equina root lesions, since at best there is only a thin perineurial investment. Resection of neuromatous and scar tissue formed during the waiting period with reanastomosis of the severed ends is not feasible within the spinal canal without an undue stretching of the nerve root. Another possibility in this situation would be to use a nerve graft, the results of which would probably be less favorable than that of primary reanastomosis.

Summary
A case of stab wound of the cauda equina has been reported in which severed nerve roots were reapprorximated by suture anastomosis, with partial return of motor function. Aggressive surgical therapy for immediate reconstitution has been advocated.

References