Intervertebral disc disease – overview and treatment options

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COURTENAY FREEMAN DVM, DipACVIM(Neurology), MRCVS discusses diagnostic tools, management methods and treatment recommendations for IVDD, the most common cause of acute spinal cord injury in dogs

Summary

Intervertebral disc herniation occurs in dogs, secondary to premature disc degeneration. Herniation includes extrusion or protrusion of the disc into the spinal canal causing spinal cord compression and secondary spinal cord injury. Severity of clinical signs can vary from pain only to severe neurologic dysfunction. Treatment options and prognosis also vary and are dependent on degree of neurologic dysfunction and spinal cord injury; however, overall prognosis is generally good if managed appropriately. Mildly-affected dogs – especially if only minimal spinal cord compression – can do well with conservative management.

Surgical decompression is recommended based on degree of spinal cord compression and severity of neurologic signs; it can improve the prognosis for recovery, reduce the length of recovery and reduce the likelihood of recurrence. Recommendations regarding high dose steroid administration have changed based on the increased awareness of unwanted side effects and the lack of efficacy. Additionally, the availability of MRI has improved our ability to diagnose and treat intervertebral disc diesease, while enhancing our ability to detect spinal cord injury that may affect prognosis. Our understanding of these secondary events is growing as investigators look for treatment targets to improve functional outcome.

Key words

intervertebral disc disease, **methylprednisolone sodium succinate**, **MRI**

INTERVERTEBRAL disc disease (IVDD) is a common cause of pain and neurologic signs in dogs. Fortunately, the majority of dogs affected by IVDD can be treated successfully with either conservative therapy or surgery. Successful treatment requires a correct diagnosis, proper management and owner compliance.

The intervertebral disc provides support and limited motion to the vertebral column while distributing compressive forces. It has two components – a gelatinous centre called the nucleus pulposus and a fibrous outer layer called the annulus fibrosis. The disc is composed primarily of collagenous and non-collagenous proteins, proteoglycans and glycoproteins, with a higher content of collagen fibres in the annulus and a higher content of water in the nucleus (80 per cent when healthy).

Although intervertebral disc degeneration is a normal part of ageing, dogs predisposed to IVDD undergo premature degeneration of the disc that can lead to herniation (extrusion or protrusion depending on the type of degeneration present). There are two types of intervertebral disc degeneration described in dogs – Hansen Type I and Hansen Type II.

Hansen Type I

Hansen Type I IVDD primarily affects younger (two to six years), chondrodystrophic dogs (dachshund, shih-tzu and beagle). In Type I IVDD, the nucleus pulposus undergoes chondroid degeneration, loses its water content and undergoes dystrophic calcification. These degenerative changes lead to alteration of pressure in the disc, which causes foci of mechanical stress on the annulus fibrosis and rupture of individual collagen fibres. Ultimately, the annular fibres fail and the nucleus extrudes into the spinal canal, causing spinal cord compression and concussive injury. Onset of clinical signs is typically acute.

Hansen Type II

Hansen Type II IVDD usually affects older, large breed dogs such as German shepherds. In Type II, the nucleus pulposus undergoes fibroid degeneration, causing the annulus to proliferate and protrude into the spinal canal. The clinical signs, which are typically chronic and progressive, are secondary to spinal cord compression and chronic spinal cord changes. These dogs may or may not be in pain and often have multiple sites of spinal cord compression. Ultimately, there is likely a continuum of degeneration in the disc and both types of degeneration may be present concurrently.

Signs

Neurologic signs depend on the location of the herniation, while the severity is dependent on the

degree of spinal cord compression and amount of concussive injury or chronic injury (gliosis) to the spinal cord. Importantly, prognosis is most dependent on the severity of clinical signs, which range from pain only to paralysis with loss of deep pain perception (nociception). Additionally, severity and chronicity of clinical signs affect treatment recommendations, which vary between conservative management and surgical intervention (Figure 1).

Management options

Conservative management includes activity restriction, pain medications and anti-inflammatory medications, and is an option for dogs that retain the ability to walk – especially at the first occurrence of signs (Figure 2). The majority of walking dogs managed conservatively will have a complete recovery, meaning they will be able to walk without assistance, have urinary and faecal continence, and not be in pain. However, recurrence is estimated to be approximately 50 per cent for this group of dogs.

Activity restriction is a critical component of conservative therapy and requires four to six weeks of strict crate rest. Dogs may be taken on short lead walks using a harness several times a day, but should spend the rest of the time in a crate. Pain medications, such as tramadol and gabapentin, may be used to keep dogs comfortable. Anti-inflammatory medications, including NSAIDs or steroids, are used to reduce the effects related to spinal cord compression. These medications should never be used in combination, as this will increase the risk of gastrointestinal ulceration.

Additionally, steroids should be used at anti-inflammatory doses (0.5mg/kg/day to 1mg/kg/day of prednisolone). If dexamethasone is used, the dose should be adjusted as dexamethasone is five to 10 times more potent than prednisolone (0.05mg/kg to 0.2mg/kg a day of dexamethasone). Importantly, it has been shown dogs treated with dexamethasone before surgery are more likely to have complications than dogs treated with other glucocorticoids or no glucocorticoids. Dexamethasone-treated dogs were 3.5 times more likely to have diarrhoea and 11.4 times more likely to have a urinary tract infection, which may also reflect the higher dose frequently given.

Historically, high doses of methylprednisolone sodium succinate (MPSS) have been used to treat IVDD in dogs. This form of treatment has been borrowed from human medicine, where the high dose intravenous steroid protocol has been recommended for some people with spinal cord injury if treatment is given within the first eight hours of injury. Even in people, the level of improvement is small and does not improve from a plegic to a paretic state, making a similar level improvement in dogs clinically insignificant. Additionally, evidence supporting efficacy in humans is controversial.

Treatment with high doses of steroids is thought to target the secondary effects of spinal cord injury, reducing free radical lipid peroxidation of cellular membranes. This treatment protocol is not recommended for dogs with IVDD and should not be used as a substitute for surgery. The treatment protocol not only lacks clinical value in veterinary patients, but is also associated with severe side effects including vomiting, diarrhoea, gastrointestinal ulceration and urinary tract

infections. Dogs that received high dose steroid therapy in addition to surgery have been shown to have longer hospitalisation time and higher hospitalisation costs. Additionally, studies in veterinary medicine have failed to show a benefit to MPSS administration.

Surgical decompression is the mainstay of treatment for dogs with intervertebral disc herniation and is recommended for dogs with varying levels of neurologic deficits. Surgical decompression provides a faster, more complete recovery, with a lower risk of recurrence; therefore, it may be chosen for any dog with spinal cord compression. Surgery is recommended specifically for dogs that are unable to walk or have pain that is refractory to conservative management. Because surgery requires accurate planning, preoperative imaging is vital to confirm a diagnosis and locate the site of herniation.

Diagnostic imaging

Spinal radiographs can be used to evaluate the vertebrae for bone tumours or infection and can suggest IVDD. Radiographs may be helpful to rule out these processes in dogs that will be conservatively managed. However, because the spinal cord and intervertebral disc are not radiographically visible, they do not provide enough detail to diagnose spinal cord compression or plan for surgery.

Myelography has been largely replaced by cross-sectional imaging, which provides superior information and is less invasive. CT – with or without concurrent myelography – can be used to facilitate a diagnosis of intervertebral disc herniation and plan surgery. These imaging modalities are frequently used for emergency surgery, or when MRI is not available. CT alone is particularly useful in chondrodystrophic dogs where calcified nuclear extrusions can be easily detected. CT allows rapid acquisition of images, but is less useful in dogs with non-mineralised extrusions, multiple chronic intervertebral disc protrusions and intraparenchymal changes.

Ultimately, MRI offers superior detail for imaging of the nervous system and provides early information about intervertebral disc degeneration (Figure 3). Additionally, spinal cord changes can be detected with MRI providing additional prognostic information. Extensive spinal cord hyperintensity on T2-weighted images, which may be indicative of spinal cord damage/oedema, has been associated with a worse prognosis and can be especially helpful in determining prognosis in dogs that lack deep pain perception. MRI is also helpful in distinguishing dogs with concussive spinal cord injury without a compressive component that may not require surgery.

Surgery

Surgical decompression involves removing the bone of the vertebrae to access the spinal canal and remove the extruded or protruded disc (Figure 4). The type of surgery depends on the location of the disc herniation; however, the most common procedure performed is called a hemilaminectomy. Hemilaminectomies are performed for most disc herniations in the thoracolumbar vertebral column.

Disc herniations in the neck typically require a ventral approach with a ventral slot. The majority of dogs treated surgically have a successful outcome as defined above. Additionally, surgery offers other benefits including a lower chance of recurrence, a faster recovery and a more complete recovery.

Overall, prognosis for dogs with intervertebral disc extrusion is good, but mostly depends on severity of clinical signs. Even paralysed dogs have about a 90 per cent chance of making a complete recovery with surgery, but only a 50 per cent chance with conservative management. Dogs that have lost deep pain perception have a 50 per cent chance of recovery if surgery is performed within the first 24 hours and are unlikely to recover without surgery (five per cent to 10 per cent). After 24 to 48 hours, prognosis for these severely affected dogs is extremely poor.

Additional research is always emerging to improve the understanding of prognostic predictors and the role of novel therapies to improve outcome. At this time, the most clinically useful prognostic tools are severity of neurologic dysfunction and intraparenchymal changes detected on MRI examination. Surgical intervention is the mainstay of treatment, but only addresses the compressive component of spinal cord damage, which is classified as primary injury. However, secondary injury begins soon after primary injury as a result of vascular disruption and cellular responses, and continues for the next seven days. These secondary events lead to loss of neurons and supporting cells, and are an important potential treatment target. The goal of these treatments would be to target the inflammatory events, oxidative injury, excitoxicity, among other events, to improve clinical outcome. Unfortunately, at this time there are no additional therapies targeting secondary injury that have been proven to significantly improve outcome in veterinary patients.

Because IVDD is the most common cause of acute spinal cord injury in dogs, it is essential to understand treatment recommendations and outcome. A knowledge of new recommendations for steroid administration in the treatment of IVDD is critical, as previous theories regarding efficacy in veterinary patients are unproven in dogs and are associated with unwanted side effects. Fortunately, the majority of dogs have an excellent prognosis for successful recovery and good long-term outcome – especially following surgical decompression.

• Please note some drugs mentioned in this article are not licensed for use in dogs and are used under the cascade.

References and further reading

- Boag A K, Otto C M and Drobatz K J (2001). Complications of methylprednisolone sodium succinate therapy in dachshunds with surgically treated intervertebral disc disease, *J Vet Emerg Crit Care* **11**(2): 105-110.
- Coates J R (2012). Acute disc disease. In Platt S and Garosi L (eds), *Small Animal Neurological Emergencies*, Manson Publishing, London: 399-416.
- Coates J R (2000). Intervertebral disc disease, *Vet Clin North Am Small Anim Pract* **30**(1):

77-110.
- Jeffery N D, Levine J M, Olby N J et al (2013). Intervertebral disk degeneration in dogs: consequences, diagnosis, treatment, and future directions, *J Vet Intern Med* **27**(6): 1,318-1,333.
- Levine J M, Levine G J, Boozer L et al (2008). Adverse effects and outcome associated with dexamethasone administration in dogs with acute thoracolumbar intervertebral disk herniation: 161 cases (2000 to 2006), *J Am Vet Med Assoc* **232**(3): 411-417.
- Sayer F T, Kronvall E and Nilsson O G (2006). Methylprednisolone treatment in acute spinal cord injury: the myth challenged through a structured analysis of published literature, *Spine J* **6**(3): 335-343.

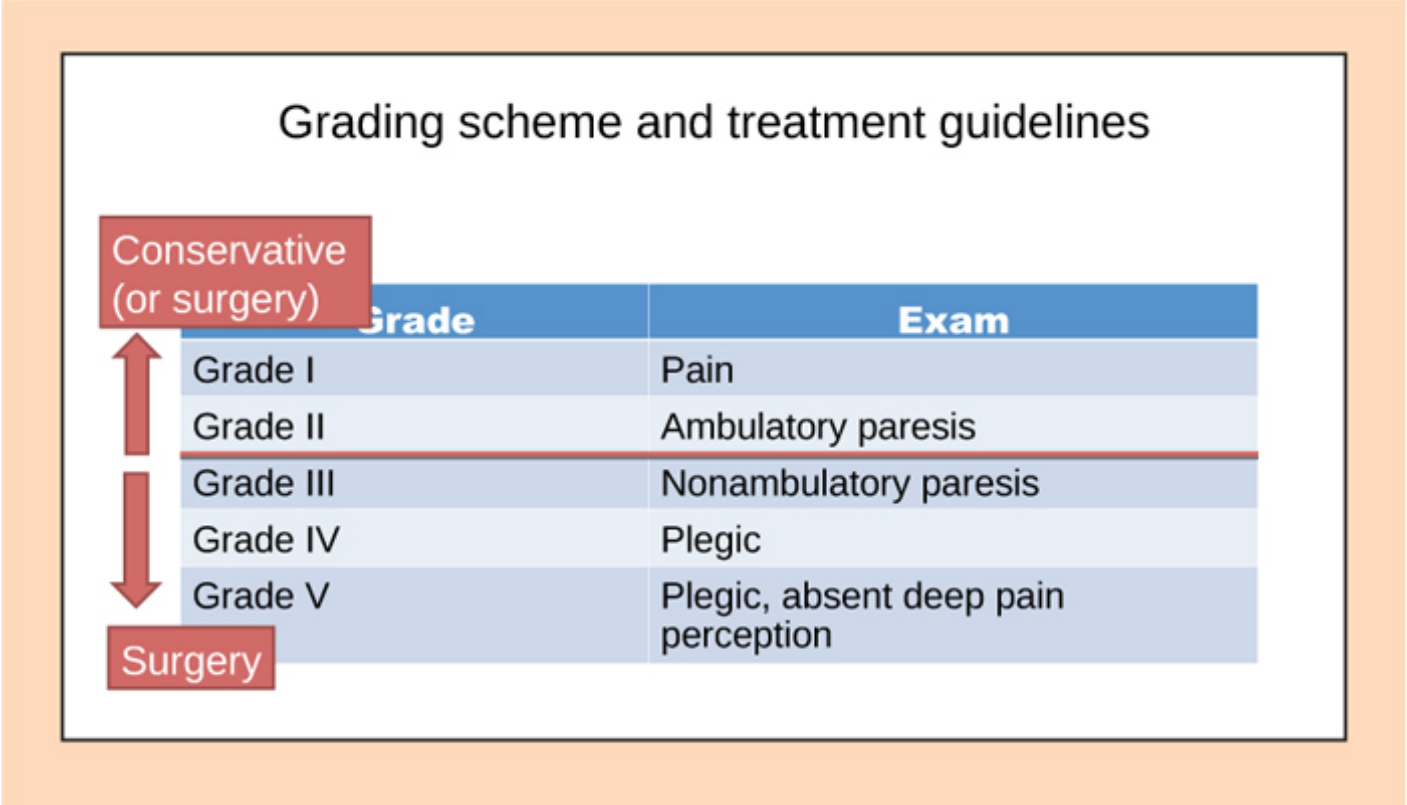

Figure 1. Outline of treatment guidelines based on neurologic grade.

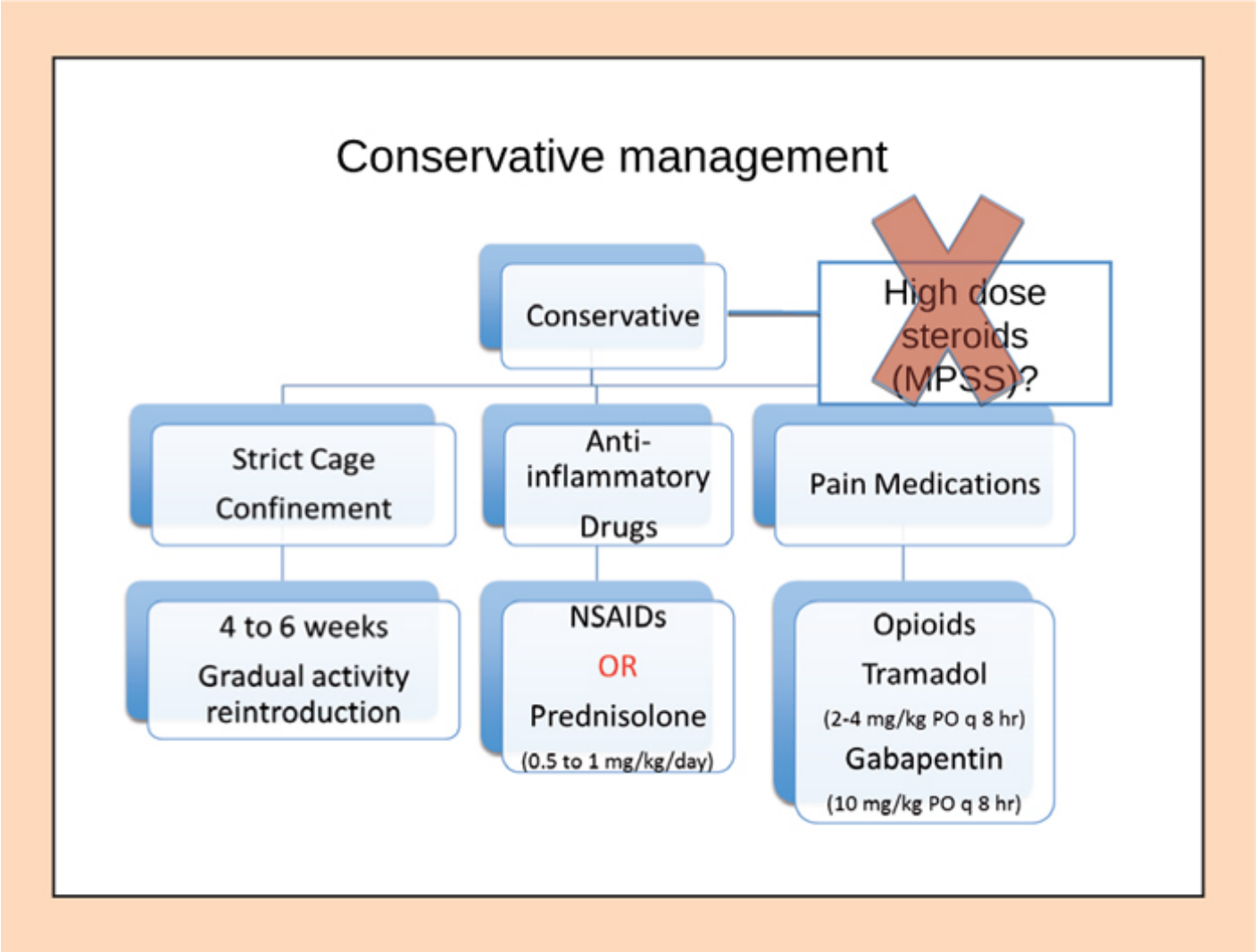

Figure 2. Conservative management recommendations for dogs with intervertebral disc disease.

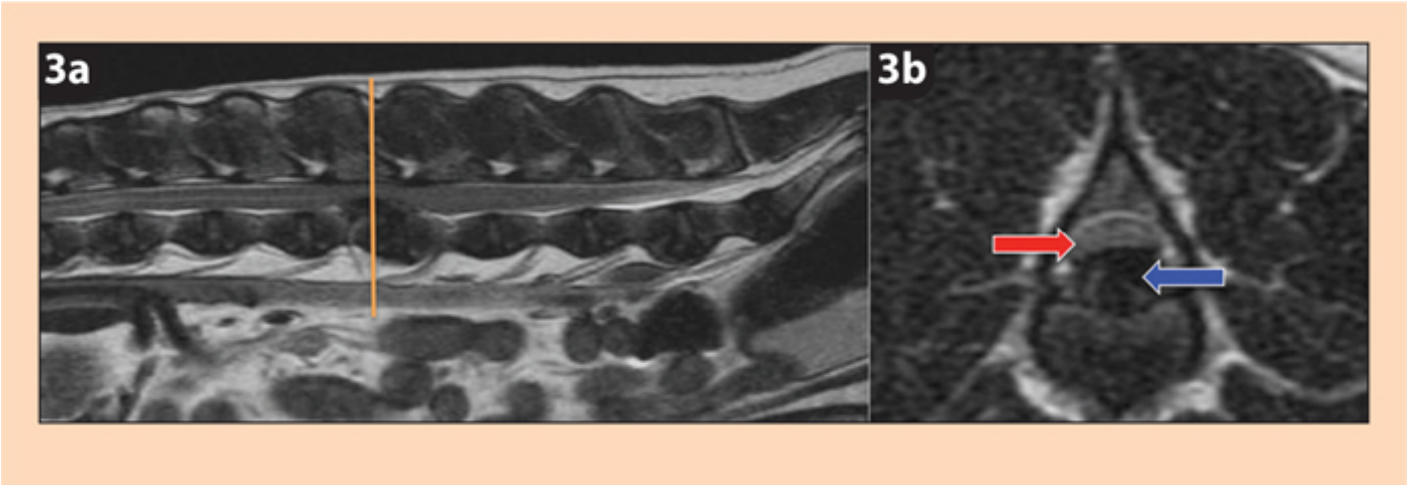

Figure 3a. T2-weighted sagittal MRI of the lumbar vertebral column. Intervertebral disc extrusion is present over the L3 to L4 disc space, causing spinal cord compression. **Figure 3b.** T2-weighted transverse MRI at the level of the yellow line indicated on the sagittal image. The spinal cord (red arrow) is severely compressed by the extruded disc material (blue arrow).

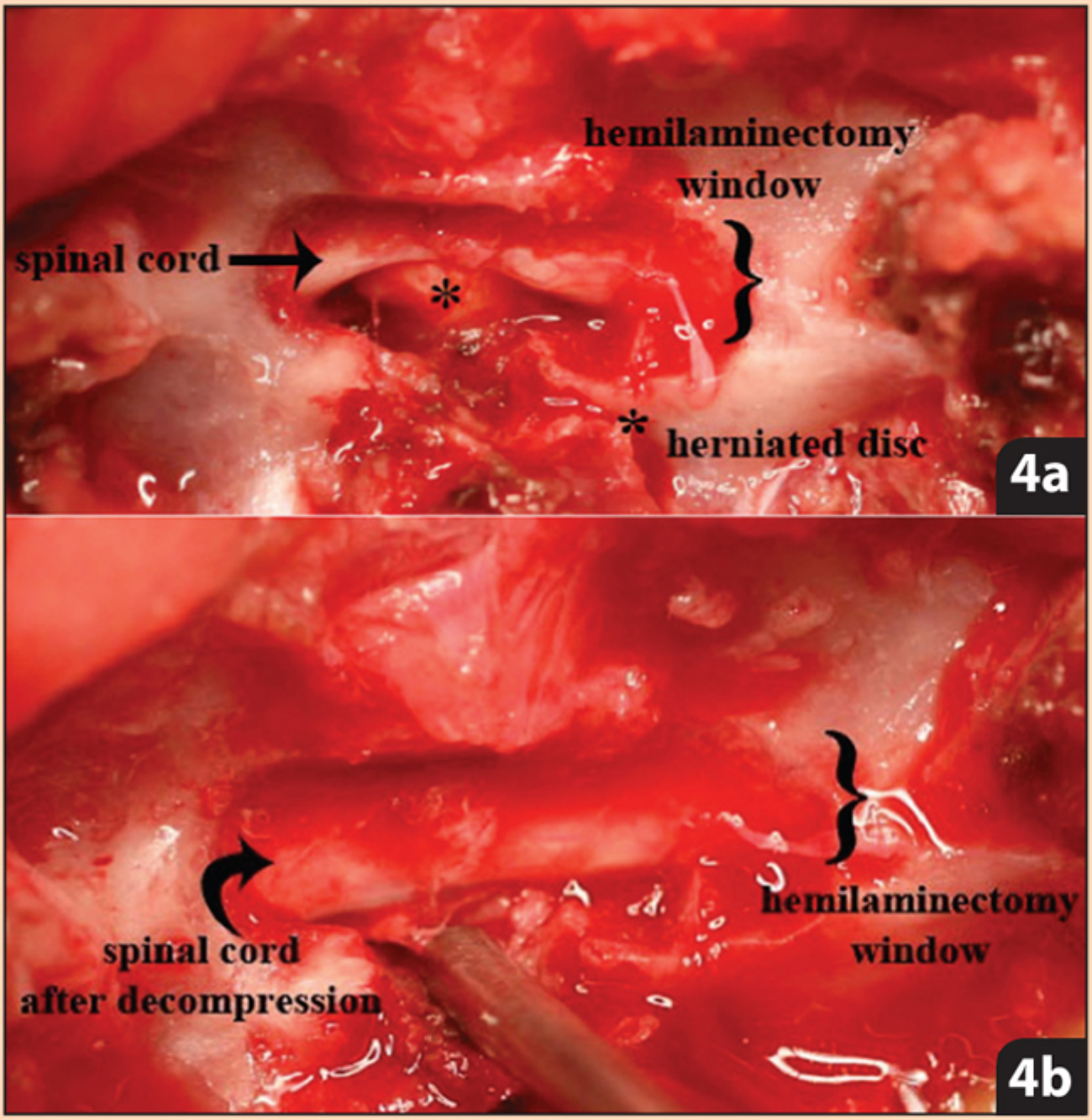

Figure 4a. Hemilaminectomy window exposing the spinal cord and extruded intervertebral disc material. **Figure 4b.** Hemilaminectomy window showing the spinal cord following decompression.