Neonatal Vertebral Osteomyelitis: Case Report and Literature Review

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ABSTRACT

Introduction: Neonatal vertebral osteomyelitis is a severe and extremely rare condition that is challenging to treat and rarely requires open surgery during the acute phase. We present a case of a 25-day-old neonate who was admitted to the Neonatal Intensive Care Unit due to a respiratory infection with poor progression and no response to conventional treatment. The patient subsequently developed lower cervical and upper thoracic spondylodiscitis, with progressive deterioration and worsening general condition. Open surgical debridement and anterior reconstruction were performed, along with prolonged sequential antibiotic therapy (intravenous to oral). In selected cases, neonatal vertebral osteomyelitis may require open surgical treatment for the resolution of acute infection. However, this approach does not eliminate the risk of residual deformities.

Keywords: Neonatal; vertebral osteomyelitis; pyogenic spondylodiscitis; infant.
Level of Evidence: IV

Osteomielitis vertebral neonatal. Presentación de un caso y revisión bibliográfica

RESUMEN

La osteomielitis vertebral neonatal es una enfermedad grave, muy infrecuente, de tratamiento difícil, que excepcionalmente requiere de cirugía a cielo abierto en la etapa aguda. Se presenta el caso de un recién nacido de 25 días que ingresó en la Unidad de Cuidados Intensivos Neonatales por una infección respiratoria con mala evolución, sin respuesta al tratamiento convencional y que desarrolló una espondilodiscitis cervical inferior y torácica alta con empeoramiento progresivo y mal estado general. Requirió una limpieza quirúrgica a cielo abierto y reconstrucción por vía anterior, además de antibioticoterapia secuencial (por vía intravenosa-oral) prolongada. En casos seleccionados, las osteomielitis vertebrales neonatales pueden requerir un tratamiento a cielo abierto para curar la infección aguda. Esto no protege, sin embargo, de la posibilidad de deformidades como secuelas.

Palabras clave: Neonatal; lactante; osteomielitis vertebral; espondilodiscitis cervical.
Nivel de Evidencia: IV

INTRODUCTION

Neonatal spondylodiscitis, or neonatal vertebral osteomyelitis, is a severe and rare condition. Its treatment is technically and ethically challenging, with a high incidence of sequelae and complications.[1] It is exceptionally rare for surgical treatment to be required in the acute stage, particularly at the cervical or cervico-thoracic level.[2,3] This report presents and describes a case of neonatal cervico-thoracic spondylodiscitis treated surgically during the acute stage. The diagnostic and therapeutic options at such a young age are discussed, and relevant literature is reviewed.

CLINICAL CASE

A 25-day-old male neonate with no significant prenatal or perinatal history was admitted for febrile symptoms related to a respiratory infection, for which conventional antibiotic treatment was initiated. During his stay in the Neonatal Intensive Care Unit, he progressively deteriorated, presenting with dyspnea, sepsis, and a palpable left supraclavicular soft-tissue mass. Plain radiographs revealed this mass (Figure 1A), along with alignment abnormalities in the cervico-thoracic spine (Figure 1B).

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How to cite this article: Manzone P, Ovejero MP. Neonatal Vertebral Osteomyelitis: Case Report and Literature Review. *Rev Asoc Argent Ortop Traumatol* 2025;90(1):80-89. https://doi.org/10.15417/issn.1852-7434.2025.90.1.2037

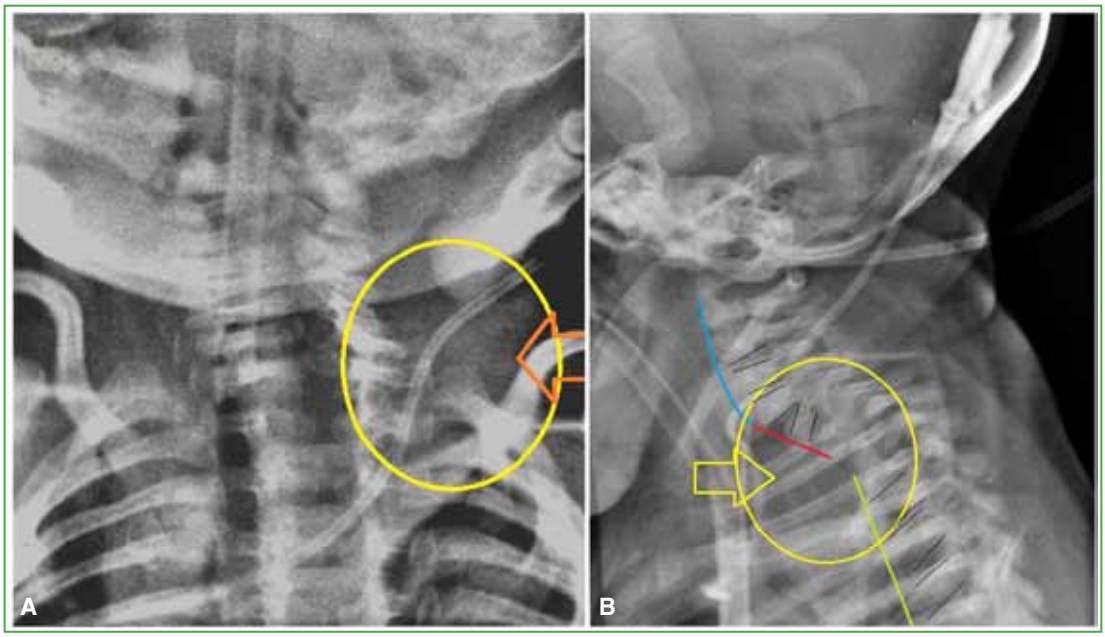

Figure 1. A. Anteroposterior thorax radiograph. Note the supraclavicular soft tissue mass (yellow circle, red arrow). **B.** Lateral cervical spine radiograph. Note the break in the alignment of the cervico-thoracic passage (red and green lines, circle and yellow arrow).

The patient required intubation, and aspiration of the supraclavicular mass revealed methicillin-sensitive *Staphylococcus aureus*. Additionally, *Klebsiella pneumoniae* was identified in secretions from the endotracheal tube.

Despite treatment, the respiratory condition continued to worsen. Helical computed tomography with reconstruction (Figure 2) showed a significant retropharyngeal and retrotracheal abscess, accompanied by osteolysis of the lower cervical vertebral bodies and infectious lesions in the lower cervical and upper thoracic spine.

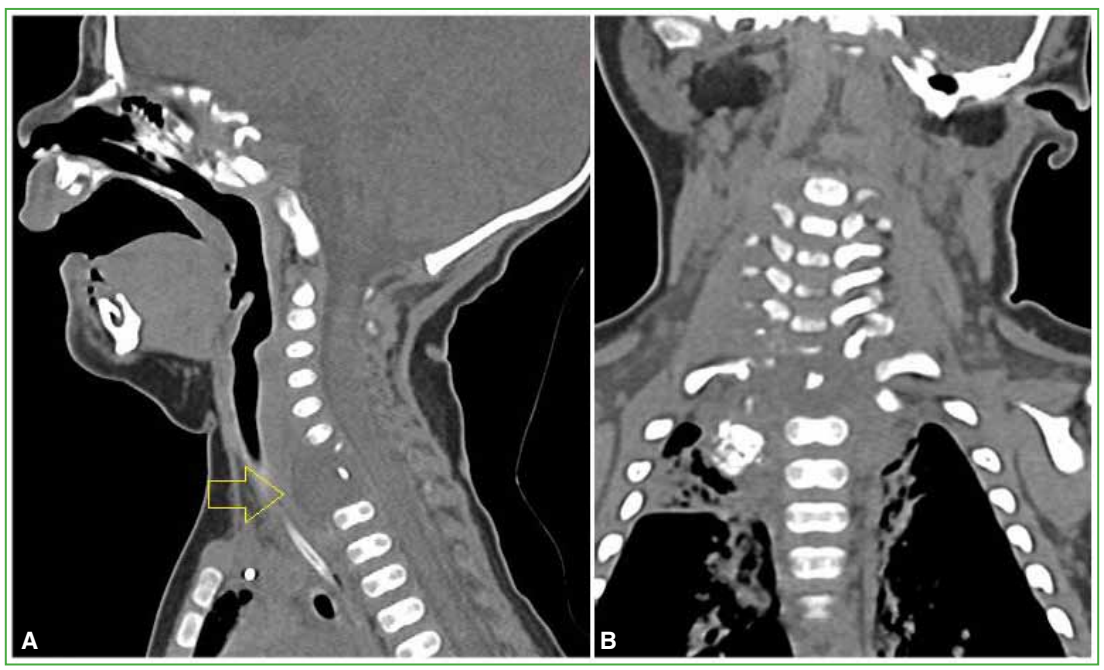

Figure 2. Computed tomography of the neck. **A.** Sagittal view; note the destruction/disappearance of vertebral bodies and the soft tissue mass of the abscess (yellow arrow). **B.** Coronal section.

Magnetic resonance imaging (MRI) further confirmed the abscess and infectious destruction of the vertebral bodies of T1, C7, and partial destruction of C6 (Figure 3).

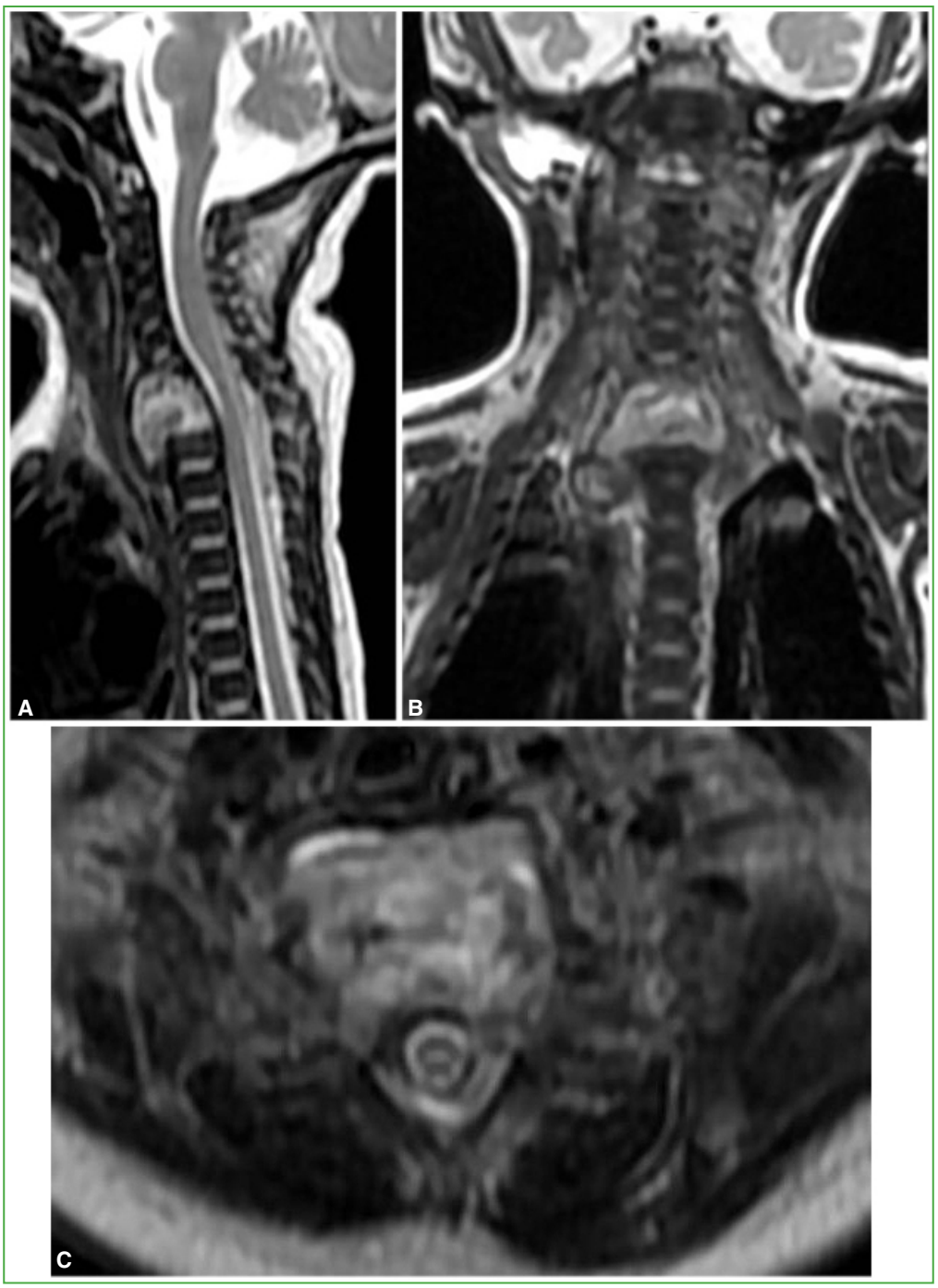

Figure 3. Magnetic resonance imaging of the neck. The abscess and the disappearance/destruction of vertebral bodies can be appreciated with greater fidelity. **A.** Sagittal view. **B.** Coronal view. **C.** Axial view.

The clinical scenario was diagnosed as severe neonatal vertebral osteomyelitis in the context of sepsis, with progressive respiratory deterioration unresponsive to antibiotic therapy. Surgical intervention was therefore indicated to address the infectious focus. An extended left anterolateral cervical approach was selected, given the elasticity of neonatal tissues, allowing adequate distal access with appropriate retraction. In case of difficulties, the surgical plan included possible resection of the left lateral portion of the sternal manubrium and the medial extremity of the left clavicle, but this was ultimately unnecessary. The procedure was performed at eight weeks of age, achieving ample visualization of the operative area for successful debridement, which resulted in a significant cavity.

Intraoperative continuous multimodal neurophysiological monitoring was employed. Initially, motor evoked potentials were abnormal, while sensory evoked potentials remained unaffected (Figure 4).

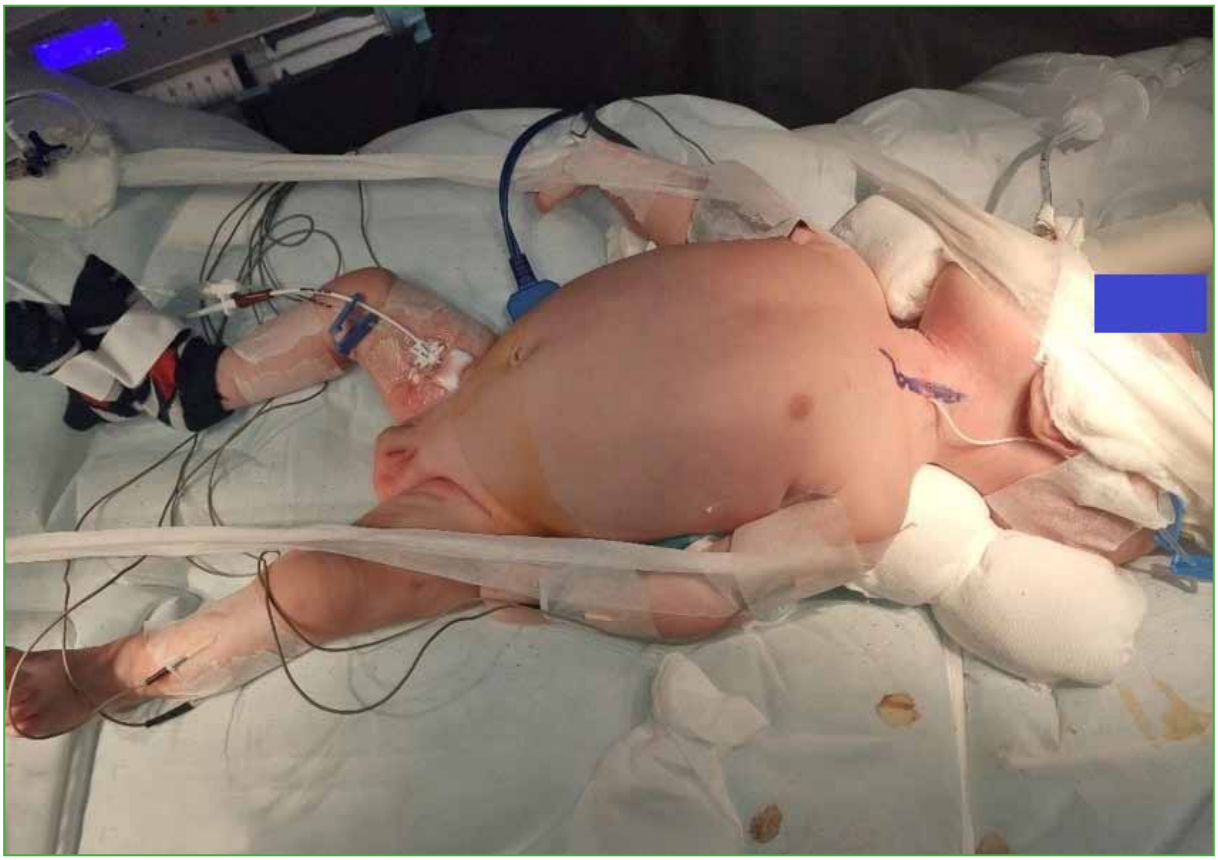

Figure 4. Intraoperative positioning. Note the use of neurophysiological monitoring.

However, the monitoring limited the use of a fibula graft for stabilization; instead, a rib graft was used for structural support, supplemented with bone chips and two titanium mini-plates for additional stability. Postoperative imaging, including C-arm fluoroscopy and radiographs, confirmed satisfactory results (Figure 5).

Following surgery, the patient was fitted with a soft cervical collar, which was replaced on the third postoperative day with a custom-made cervico-thoracic orthosis featuring a soft frontal cephalic component (Figure 6).

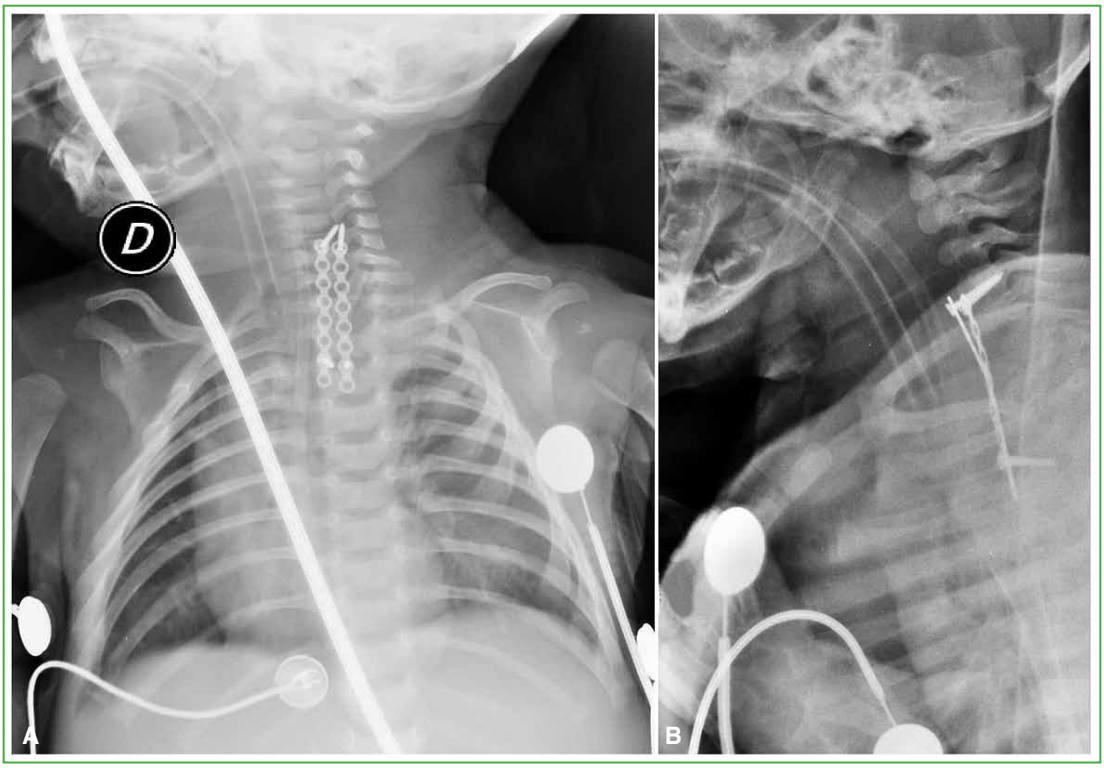

Figure 5. Anteroposterior (**A**) and lateral (**B**) radiographs of the cervico-thoracic spine in the immediate postoperative period in the Neonatal Intensive Care Unit. Note the adequate placement of the osteosynthesis elements.

Figure 6. Patient fitted with custom-made, soft cervico-thoracic orthosis prior to discharge.

During surgery, meropenem and vancomycin were initiated after obtaining culture samples. These cultures grew methicillin-resistant *Staphylococcus aureus* (MRSA) sensitive to vancomycin. Consequently, vancomycin was continued alongside parenteral amikacin for four weeks, followed by oral trimethoprim-sulfamethoxazole and rifampin for eight weeks.

Three months postoperatively, the patient exhibited normal weight gain, psychomotor development, and no visible spinal deformities. Follow-up imaging was normal, and the orthosis was used consistently.

Eight months post-surgery, radiographic evaluation revealed disassembly of the osteosynthesis without significant kyphosis. The patient remained asymptomatic, with normal development and no neurological deficits, despite continued use of the orthosis (Figure 7).

The patient achieved independent walking at one year and three months of age.

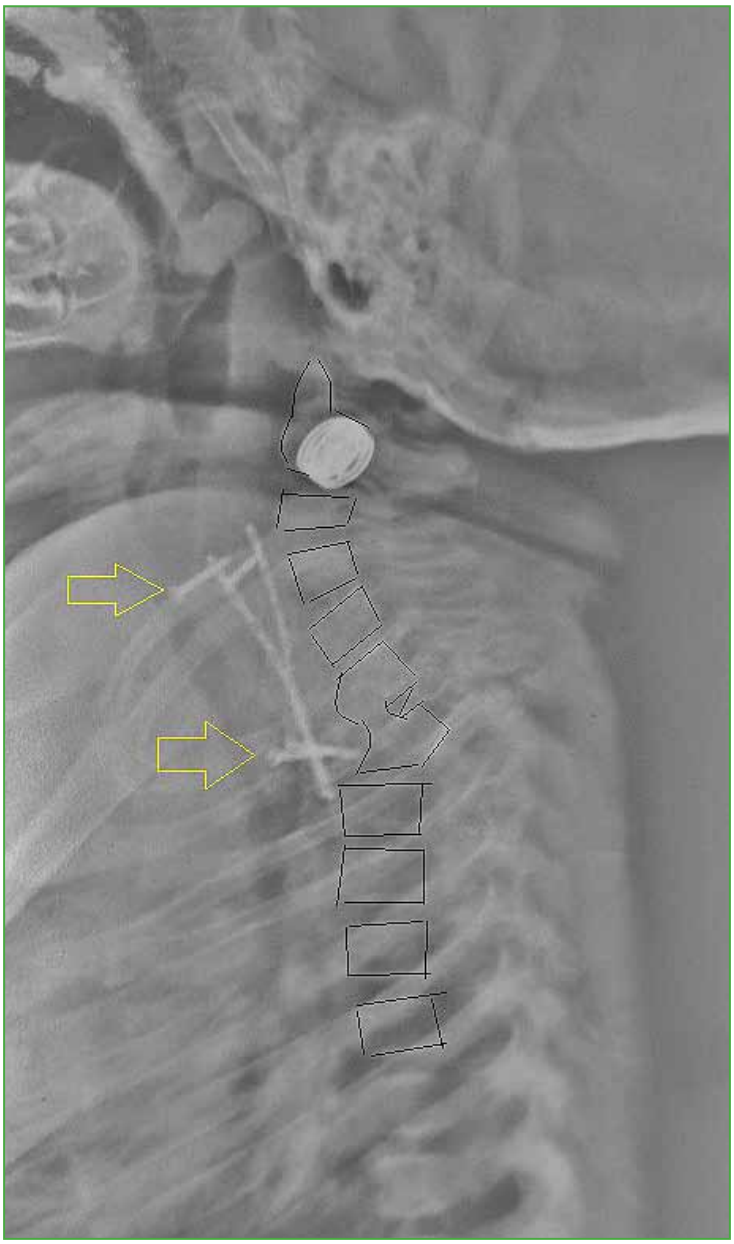

Figure 7. Lateral radiograph of the cervico-thoracic spine 8 months after surgery. Note the partial disassembly of the osteosynthesis (yellow arrows), with slight kyphosis of the focus.

At one year and ten months postoperatively (two years of age), the patient maintained normal development with no evidence of neurological impairment or visible deformities. A follow-up computed tomography scan (Figure 8) showed intersomatic fusion with robust anterior bony bridging. However, segmental kyphosis was noted, associated with mild compensatory hyperlordosis. Instrumentation disassembly remained unchanged, with no related complications or symptoms such as dysphagia, cough, cervical pain, or dysphonia.

To prevent progression of the kyphosis during remaining growth, a revision and complementary surgery was scheduled.

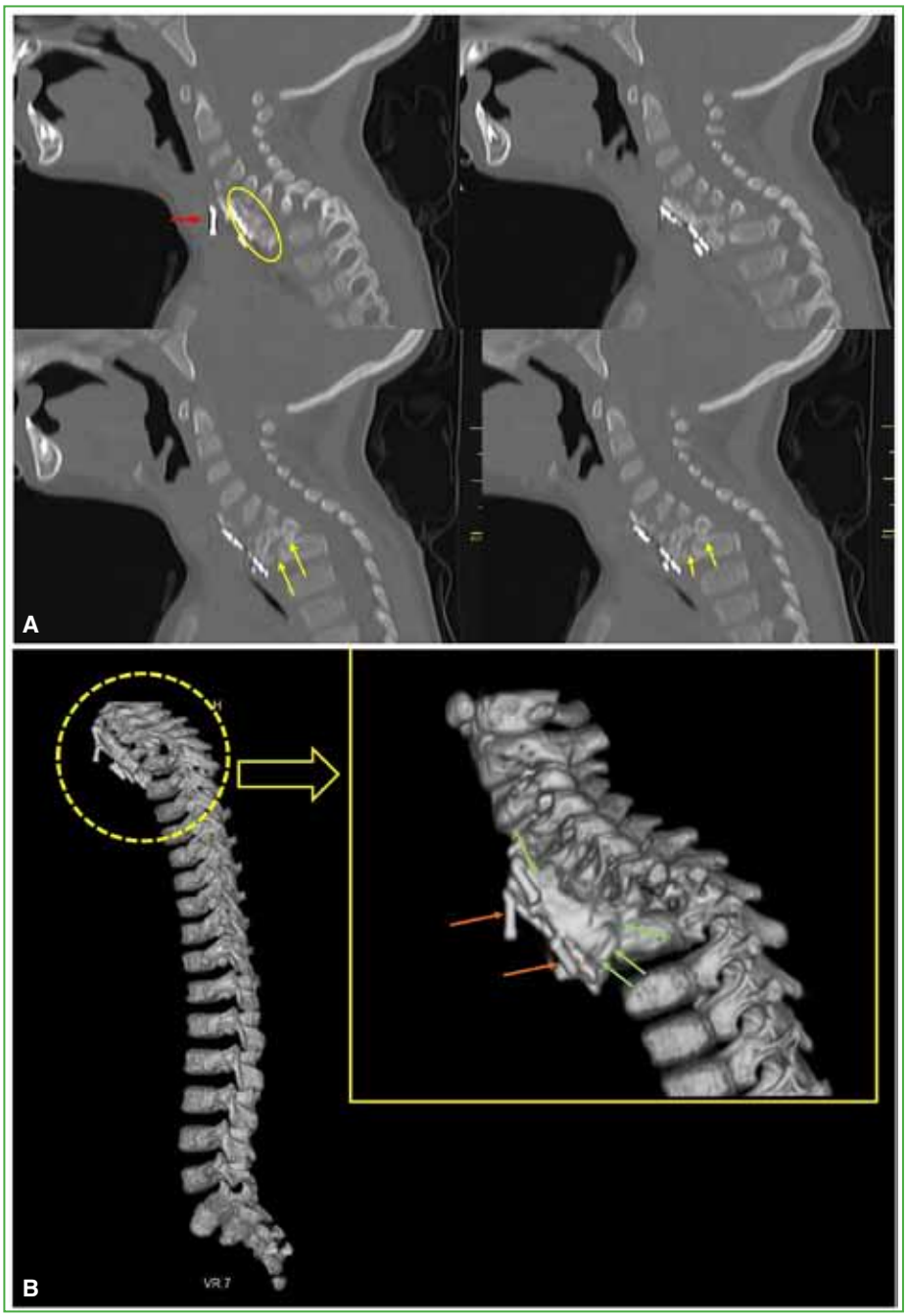

Figure 8. Control CT scan of the cervico-thoracic spine at 1 year and 10 months after surgery. **A.** Note intersomatic fusion (yellow arrows), significant anterior bony bridging (yellow oval), instrumentation disassembly (red arrow), and segmental kyphosis. **B.** 3D reconstruction. In the inset, the important fusion mass stabilizing the region can be seen.

DISCUSSION

The prevalence of neonatal spondylodiscitis is extremely low; in referral centers, it accounts for only 7 out of every 1000 admissions to the Neonatal Intensive Care Unit.[4] The incidence is approximately 0.40% in live newborns.[5] Although preterm infants are typically at higher risk, it has also been described in healthy newborns, usually occurring between 2 and 4 weeks of life,[6] as in our case.

Forty-five years ago, Ogden[7] described the pathogenesis of neonatal vertebral osteomyelitis: in newborns, small capillaries pass through the vertebral growth plates, facilitating the spread of infection and contamination of both the disc and the vertebral body. The cortical bone of neonates and infants is thin, weak, and lax, predominantly composed of immature bone tissue. While this allows for the release of pressure caused by the accumulation of infectious material, it also promotes rapid dissemination to the subperiosteal region. Consequently, large sequestra do not typically form because extensive cortical infarction, if present, is quickly resorbed due to the significant vascularization in neonates.[6] However, necrosis of the vertebral endplates may occur due to capillary obstruction caused by septic emboli, potentially leading to the formation of large subperiosteal abscesses.

Retropharyngeal abscesses have been reported in neonates and infants, sometimes presenting as soft tissue masses in the neck,[8] as in our case. On CT scans, additional associated lesions are often identified,[9] which may be complicated by nearby spondylodiscitis, potentially causing neurological deficits.[8]

The clinical presentation of spondylodiscitis in neonates and infants often includes high fever, signs of sepsis, irritability or pain—especially during mobilization or breastfeeding—and developmental delay.[10] In preterm, low-birth-weight neonates with prolonged Neonatal Intensive Care Unit stays, sepsis, and irritability or pain during trunk movements, pyogenic vertebral osteomyelitis should be suspected.[4,10-13]

The severity of both acute and chronic injury caused by this condition has been aptly described by Pershin and Mushkin as "a ticking time bomb." [1]

Although ultrasound and conventional radiography may aid in the diagnosis, spinal MRI is the diagnostic method of choice due to its superior sensitivity and specificity. MRI enables evaluation and differentiation of bone and disc destruction and delineation of paravertebral abscesses.[12] In our case, the use of CT before MRI was due to institutional availability; however, it proved very useful in identifying the lesion and evaluating bone destruction (Figure 2).

There are few published reports on the treatment of neonatal spondylodiscitis in the acute stage, with various approaches described: antibiotic therapy combined with immobilization using orthoses;[14,15] abscess evacuation via aspiration followed by orthopedic treatment;[16-18] drainage and open debridement;[2] or surgical treatment in the chronic phase after infection resolution, typically involving double approaches or repeated posterior fusions with anterior approaches.[1,18,19] Most of the published cases involve older infants or children aged 1–2 years. Our case is noteworthy because the patient underwent surgery during the acute stage at just 8 weeks of age. Drainage with cleansing and debridement, along with anterior reconstruction, enabled rapid healing and improvement. Sequential treatment with intravenous antibiotics, followed by a switch to oral antibiotics—a proven approach in this patient group—ensured complete resolution.[20]

Instrumentation of the cervical and upper thoracic spine in young children is generally associated with complications, especially in younger patients.[21] While successful outcomes have been reported in the upper thoracic spine in children under 2 years of age,[22] reports of successful instrumentation in children younger than 1 year are rare,[3] and we found no reports of anterior-approach implants in neonates. In our case, the use of an anterior implant added intraoperative stability (Figure 5). Although partial disassembly occurred postoperatively (Figure 7), the plates ensured the grafts remained in place until consolidation of the lesion (Figure 8).

The most common complication of this condition, aside from neurological deficits, is the dissolution of the vertebral bodies, leading to kyphosis. This deformity is often angular and can resemble congenital kyphosis due to vertebral body aplasia. Reconstructive surgeries, usually involving double approaches, are often required.[1,23] While there are limited long-term studies following growth completion, the severity of this deformity and the young age of affected patients—who have significant growth potential—make it comparable to the progression of pediatric Pott's kyphosis.[24] Similar criteria can guide decisions regarding additional procedures. In our case,

the residual deformity poses a risk of progression, with potential neurological deterioration due to its location (the cervico-thoracic junction and high thoracic spine).[25] Additionally, the marked growth deficit in the anterior segment of the affected region (secondary to vertebral body and physis destruction) led us to schedule a second intervention (Figure 8).

CONCLUSION

Neonatal vertebral osteomyelitis, in selected cases, may require open surgery to resolve acute infection. However, such interventions do not eliminate the risk of deformity as a sequela, necessitating long-term follow-up until growth is complete.

Conflict of interests: The authors declare no conflicts of interest

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