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CASE REPORT

Pediatric parapharyngeal infection resulting in cervical instability and occipital-cervical fusion—case report and review of the literature

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Abstract
Parapharyngeal infection is the most common deep neck space infection in children and, in rare instances, can result in bony destruction of the cervical spine. We report one such case that required occipital to cervical fusion and halo-vest fixation. We also review the literature and discuss the etiology, diagnosis, and treatment options for managing pediatric cervical bony destruction secondary to infection.

Keywords Parapharyngeal infection · Cervical spine · Cervical fusion

Introduction

There are approximately 3400 hospital admissions per year in the USA for pediatric retropharyngel (RPA) and parapharyngeal (PPA) infections [1]. Children afflicted by these infections generally present with fever, poor oral intake, neck pain, torticollis, and cervical adenopathy. Complications of RPA and PPA infections include acute upper airway obstruction, rupture of the abscess into the pharynx or trachea resulting in asphyxiation, aspiration, lung abscess, thrombosis of the internal jugular vein, erosion into nearby arteries, sepsis, hoarseness, Horner syndrome, and osteomyelitis. Here, we present a rare case report of a 6-week-old infant with RPA resulting in bony destruction of the cervical spine.

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Case presentation

A healthy 6-week-old ex-35 week female born via caesarian section presented with torticollis, feeding difficulty, and dysphagia for 2 weeks. Her WBC was elevated at 22,000 cells per microliter and MRI of the neck revealed a 2.4 × 1.8-cm lesion with reduced diffusion and peripheral enhancement in the upper cervical prevertebral space (Fig. 1). Incision and drainage of the retropharyngeal abscess followed by fiberoptic laryngoscopy and microlaryngoscopy due to persistent stridor were performed. Cultures grew out methicillin-sensitive *Staphylococcus aureus* and thus nafcillin was started.

Initial MRI showed contrast enhancement of the C1 anterior arch and C2 dens with no epidural phlegmon. The patient's exam was intact with no evidence of weakness or long tract signs, and thus she was followed conservatively. Repeat CT imaging 1 month later showed dens erosion and a predental atlantoaxial distance (ADI, 7.5 mm), increased from 3 mm 1 month prior. MRI C-spine showed T2 signal and flexion-extension MRI showed a narrow foramen magnum that was worse with flexion (Fig. 2). Given the poor fusion rates documented in neonates and the fact that the patient remained neurologically intact with good canal caliber while neutral or extended, surgery was deferred until she was at least 3 years of age and if failure of reossification occurred through nonsurgical management. A cervical collar was placed to prevent excessive flexion (the neck motion resulting in maximal canal stenosis) and the patient was discharged. Work-up for immunodeficiency was negative.

Serial imaging was performed, and at 3 years of age, a CT scan showed a lack of ADI normalization. MRI showed

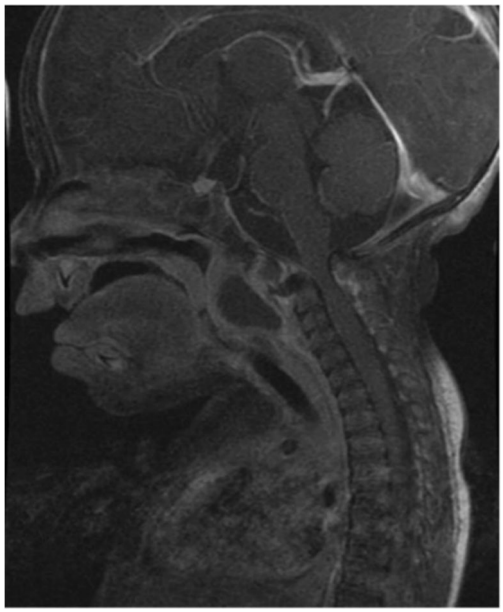

Fig. 1 Peripheral enhancement in upper cervical paravertebral space

stenosis upon flexion. The patient underwent posterior C1–C2 fusion with interposition bone allograft and fiber wiring with halo placement. Two months after the initial operation, CT showed failure of fusion. The patient was taken back to the operating room for an occiput to C3 fusion with sublaminar stainless steel wiring and reapplication of halo vest (Fig. 3). Iliac crest was harvested as bone graft, and recombinant bone morphogenetic protein (BMP) was used. On postoperative day 1, the patient had some anterior neck swelling that required a dose of decadron for airway protection. One year postoperatively, the patient showed good fusion and remained neurologically intact. The halo has been removed. Flexion extension films demonstrated stable fusion construct (Fig. 4).

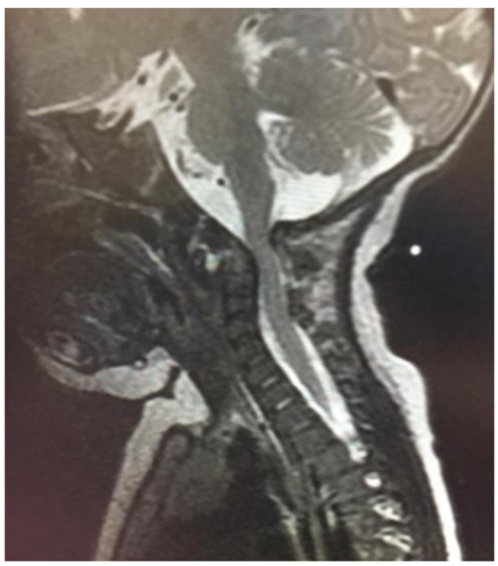

Fig. 2 Narrowed foramen magnum on MRI, T2

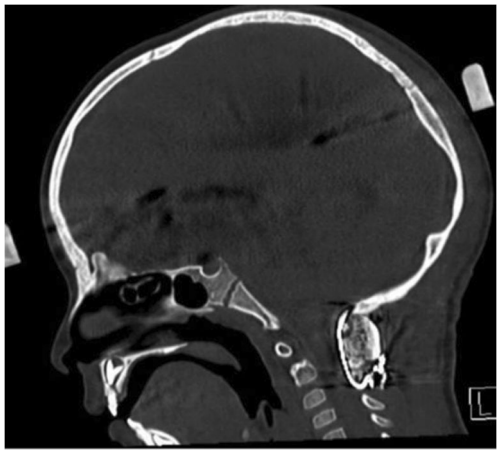

Fig. 3 Occiput to C3 fusion with sublaminar stainless steel wiring

Discussion

Infection in the cervical spine is largely due to Staph aureus (50–90% of cases in children), which reaches the cervical space hematogenously or through adjacent spread [2]. Pediatric patients with bony destruction of the cervical spine often experience pain, torticollis, fever, and dysphagia [3–5]. Contracture and spasm of the paravertebral muscles may occur, often accompanied by limited mobility of the spine [3, 6, 7]. Neurological symptoms may present in a delayed fashion and are found in 60% of patients with cervical osteomyelitis as compared with 5–20% of patients with thoracic or lumbar osteomyelitis due to the small cross-sectional diameter of cervical bone [8]. MRI with gadolinium is the gold standard for diagnosing bony destruction of the spine, with 96% sensitivity and 93% specificity [9]. Alternatively, X-ray can show end plate erosion, soft tissue edema, disk height loss, and deformity. Deformity may not be present until 2–4 weeks after infection [9]. Nonsurgical management with antibiotics and halo traction is reasonable in the absence of large epidural abscess, neurological deficit, or bony destruction [2]. Halo immobilization is generally used for 3–4 months, although in some series, fusion rates have been reported to be as low as 35% with non-operative management [10].

Operative intervention is indicated for patients with large epidural abscess, neurological deficit, spinal instability, persistent pain, or sepsis despite antibiotics [11]. Goals of surgery are to remove infected tissue, restore or preserve neurologic function, and restore sagittal and coronal balance with biomechanical stabilization. Prognosis is linked with treatment delay, degree of spinal cord compression at presentation, and presence of immunodeficiency [8]. Children's unique biomechanical properties—namely, diminutive osseous and ligamentous structures—present unique issues when considering the efficacy, safety, and route of neurosurgical intervention. Pre-operative considerations include assessment of bony height, length, width, and sagittal angle. Operative considerations suggest the anterior approach be used for lesions

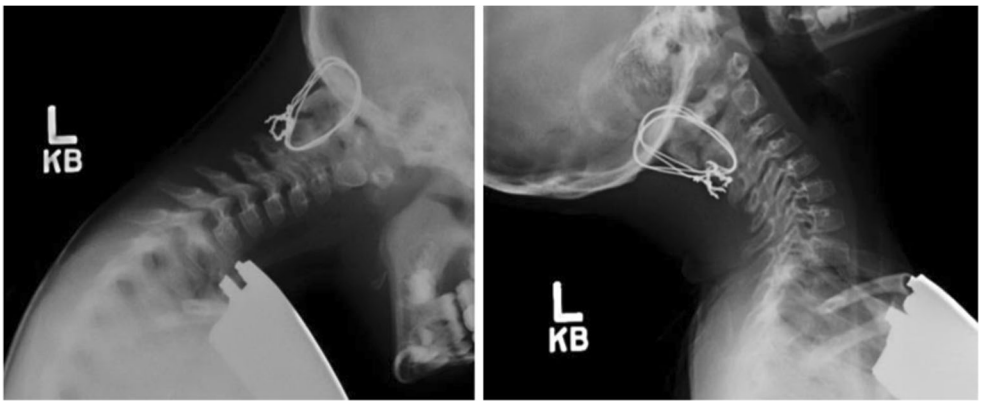

Fig. 4 Flexion-extension films show stability

causing ventral compression and a posterior approach for those causing dorsal compression. Beyond this, special considerations must be given to each case and the cervical maturity of the child; rapid periods of bone growth occur between birth and age 3–4 and so surgery after this time frame is preferable.

There are several operative techniques available for achieving fixation in the pediatric cervical spine, including transarticular screw fixation, C1–C2 fusion with C1 lateral mass and C2 pars interarticular screw fixation, occipitocervical fusion, interlaminar fixation with rib graft, and contoured loop fixation [12]. In all cases, long-term post-surgery oral antibiotic therapy (> 3 months) is usually indicated. Overall, pediatric patients that undergo spinal stabilization operations have good fusion rates. Reintjes et al. reviewed 604 pediatric patients that underwent posterior cervical fusion or occipitocervical fusion. The mean age was 9.3 with a fusion rate of 93%. Higher fusion rates were associated with occipitocervical fusion versus cervical fusion only. Interestingly, use of BMP and age were not associated with differences in fusion rates [13].

Conclusion

Pediatric parapharyngeal infections may result in destruction of the cervical spine. Conservative management may be considered in patients with no neurologic deficits and minimal bony destruction. Operative intervention is indicated for patients with large epidural abscess, neurological deficit, spinal instability, persistent pain, or sepsis despite antibiotics. Overall, pediatric patients that undergo spinal stabilization operations have good fusion rates.

Compliance with ethical standards

Conflict of interest The authors report no confilcts of interet with the information presented in this manuscript.

References

1. Adil E, Tarshish Y, Roberson D, Jang J, Licameli G, Kenna M (2015) The public health impact of pediatric deep neck space infections. Otolaryngol Head Neck Surg 153:1036–1041
2. Hadjipavlou AG, Mader JT, Necessary JT, Muffoletto AJ (2000) Hematogenous pyogenic spinal infections and their surgical management. Spine 25:1668–1679
3. Fucs PM, Meves R, Yamada HH (2012) Spinal infections in children: a review. Int Orthop 36:387–395
4. Skaf GS, Domloj NT, Fehlings MG, Bouclaous CH, Sabbagh AS, Kanafani ZA, Kanj SS (2010) Pyogenic spondylodiscitis: an overview. J Infect Public Health 3:5–16
5. Kayser R, Mahlfeld K, Greulich M, Grasshoff H (2005) Spondylodiscitis in childhood: results of a long-term study. Spine 30:318–323
6. Gouliouris T, Aliyu SH, Brown NM (2010) Spondylodiscitis: update on diagnosis and management. J Antimicrob Chemother 65: iii11–iii24
7. Early SD, Kay RM, Tolo VT (2003) Childhood diskitis. J Am Acad Orthop Surg 11:413–420
8. Acosta FL Jr, Chin CT, Quiñones-Hinojosa A, Ames CP, Weinstein PR, Chou D (2004) Diagnosis and management of adult pyogenic osteomyelitis of the cervical spine. Neurosurg Focus 17:1–9
9. Dimar JR, Glassman SD, Burkus KJ, Carreon LY (2006) Clinical outcomes and fusion success at 2 years of single-level instrumented posterolateral fusions with recombinant human bone morphogenetic protein-2/compression resistant matrix versus iliac crest bone graft. Spine 31:2534–2539
10. Frederickson B, Yuan H, Olans R (1978) Management and outcome of pyogenic vertebral osteomyelitis. Clin Orthop Relat Res:160–167
11. Jeanneret B, Magerl F (1994) Treatment of osteomyelitis of the spine using percutaneous suction/irrigation and percutaneous external spinal fixation. Clin Spine Surg 7:185–205
12. Menezes AH (2012) Craniocervical fusions in children. J Neurosurg Pediatr 9:573–585
13. Reintjes SL, Amankwah EK, Rodriguez LF, Carey CC, Tuite GF (2016) Allograft versus autograft for pediatric posterior cervical and occipito-cervical fusion: a systematic review of factors affecting fusion rates. J Neurosurg Pediatr 17:187–202