



Case Report

Gorham-Stout disease of the spine presenting with intracranial hypotension and cerebrospinal fluid leak: A case report and review of the literature

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ABSTRACT

Background: Gorham-Stout (GS) disease or “vanishing bone disease” is rare and characterized by progressive, spontaneous osteolysis resulting in loss of bone on imaging studies. Treatment modalities include combinations of medical and/or surgical treatment and radiation therapy.

Case Description: A 14-year-old female with GS disease presented with a 1-year history of thoracic back pain and atypical headaches consistent with intracranial hypotension. Magnetic resonance imaging and operative findings demonstrated a spontaneous thoracic cerebrospinal fluid leak (CSF) (e.g., that extended into the pleural cavity) and complete osteolysis of the T9-10 posterior bony elements (e.g., including the rib head, lamina, and transverse processes). The patient underwent repair of CSF fistula followed by a T6-11 instrumented fusion.

Conclusion: This case of GS disease, involving a thoracic CSF fistula and absence/osteolysis of the T9-T10 bony elements, could be successfully managed with direct dural repair and an instrumented T6-T11 fusion.

Keywords: Cerebrospinal fluid leak, Gorham-Stout disease, Osteolysis, Pediatric neurosurgery, Thoracic fusion, Vanishing bone disease

BACKGROUND

Gorham-Stout (GS) disease or “vanishing bone disease” is rare and characterized by progressive, spontaneous osteolysis involving multiple segments. The reduction in pH and oxygen tension results in the release of hydrolytic enzymes and phosphatases from osteoblasts which stimulate bone resorption.^[5]

Both spontaneous and posttraumatic angiomatosis result in regional osteolysis and the formation of a lymphovascular network. Periosteum, bone, and bone marrow are replaced by fibrous tissue, with subsequent direct extension of increased vascularity and lymphocytic infiltration (e.g., attributed to an abnormality of the lymphatic system).^[7]

GS disease, a diagnosis of exclusion, is based on clinical, radiographic, and histological findings. Of the 200 reported cases in the literature, 59 involve the spine; only seven presented with a

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cerebrospinal fluid leak (CSF) leak.^[2,7] GS typically involves the pelvis, humerus, axial skeleton, and mandible and often presents with dull pain, weakness, swelling, functional impairment, or fractures.^[3] There is no pattern of inheritance, no predilection for age, or race.^[3] A multimodal treatment approach may include combinations of medical management, surgery, and/or radiation therapy.^[7]

CLINICAL PRESENTATION

A 14-year-old female with a 1-year history of spontaneous mechanical thoracic back pain and atypical headaches (e.g., positional headaches for 2–3 months associated with Valsalva maneuvers). A CT brain demonstrated 1.5 cm cerebellar tonsillar ectopia, while the MR showed intracranial hypotension [Figure 1]. The thoracic magnetic resonance imaging revealed a CSF leak and signal change within the T7-10 vertebral bodies [Figure 2].

Computed tomography (CT)-guided biopsy, CSF leak repair, and instrumented fusion

Initially, she underwent a nondiagnostic T9 CT-guided biopsy. After discussion at tumor board, she was then managed with an open excision biopsy, repair of the CSF leak, and instrumented T6-T11 fusion to address the instability that resulted from osteolysis of the T9/T10 posterior elements.

Surgery

Intraoperatively, the posterior elements of the vertebral column were absent at the T9-10 levels; rib head, lamina, and

transverse processes were eroded and replaced with a thin membrane of fibrous tissue. Additional gelatinous material with a lattice pattern was noted within the epidural space, and the CSF fistula at T9-10 was repaired with Duragen and Tisseel. A microscope was utilized to inspect the dural defect. The dura was very friable, so primary closure was not successful. Next, pedicle screws were placed from T6 to T11, but only unilaterally at T8-9 given the lack of bony fixation points [Figure 3]. The postoperative course was uneventful; the headaches and back pain resolved, and she was discharged home on postoperative day 4.

Pathology

The operative specimen showed large vascular channels/lakes and reactive changes without mitotic figures, pleomorphism, or cellular atypia consistent with GS, as reported in the literature [Figure 4].

Postoperative course

She was treated with sirolimus, an immunosuppressant, and zoledronic acid, a bisphosphonate. Her positional headaches persisted, and imaging demonstrated a subtle persistent CSF leak which was treated with a blood patch [Figure 5]. At 6 months, her pleural effusion had resolved, and a CT showed improvement of her acquired Chiari malformation to 7 mm.

DISCUSSION

With GS disease, surgical intervention is generally reserved for patients with neurological impairment, significant deformity,

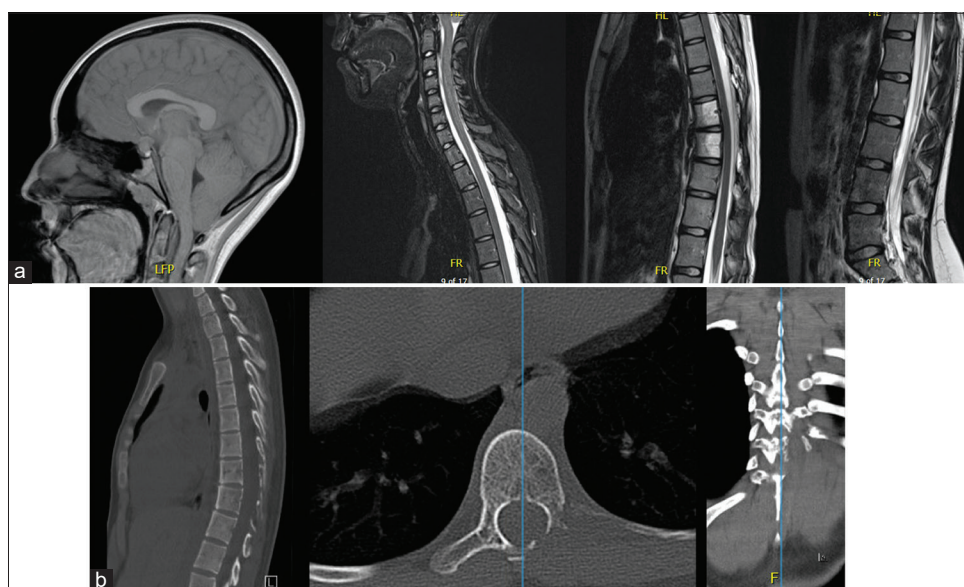


Figure 1: Preoperative imaging studies. (a) Magnetic resonance imaging neural axis demonstrating intracranial hypotension with no evidence of caudal tethered cord and contrast enhancement of T8 and T9 vertebral bodies. (b) Computed tomography thoracic spine demonstrating osseous lytic changes from T7 to T10 involving L T7-8 and T8-9 facet.

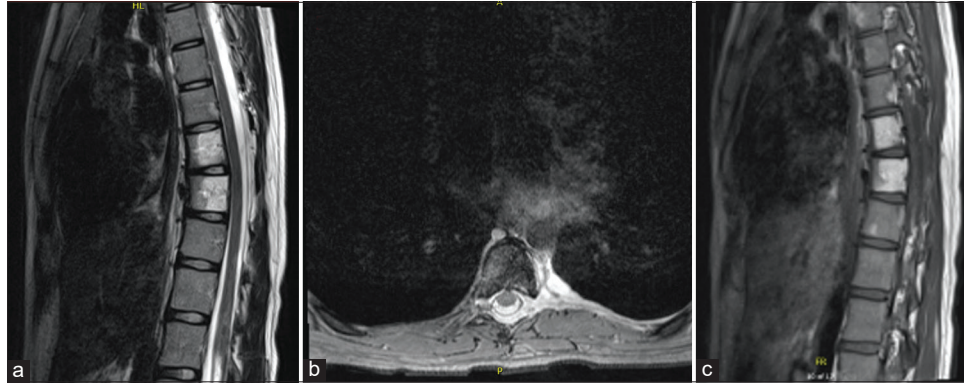


Figure 2: Preoperative imaging study. (a) Sagittal T1 post contrast. (b) Axial T2 myelography. (c) Sagittal T2 magnetic resonance imaging demonstrating contrast enhancement of T8 and T9 vertebral bodies and extravasation of cerebrospinal fluid ventrally into pleural space.

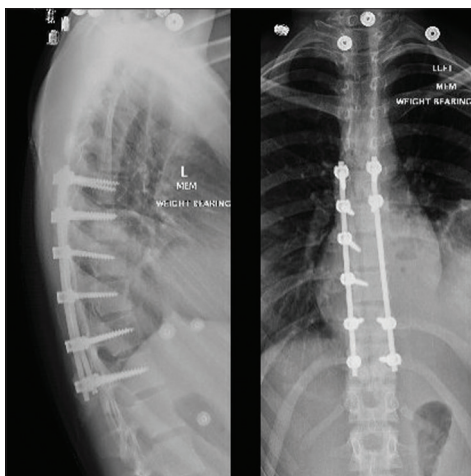


Figure 3: Postoperative X-ray thoracic spine demonstrating successful placement of instrumentation from T6 to T11.

or failure to respond to conservative treatment.^[7] Currently recommended, treatment includes initial conservative management with radiotherapy and nonoperative management for cases without spinal deformity.^[5]

In a series of Tateda *et al.*, 59 cases of spinal GS, 49% occurring in the cervical spine, and 46% in the thoracic spine, the majority of cases involved multiple vertebral levels.^[7] Spinal involvement was more prevalent in males, and patients presented at the average age of 27.4. Of the 59 patients, 20% died, and 42% presented with paralysis (e.g., they were treated surgically with instrumented fusion with a revision rate of 36% secondary to pseudoarthrosis). Notably, fusion rates were poor secondary to graft osteolysis, or insufficient bone for internal arthrodesis, external fixation, or adequate fusion surface.^[5]

Tateda *et al.* found the primary involvement of the spine in 59 cases.^[7] In the thoracic spine, the most common cause of death was pleural effusion secondary to chylothorax, due to direct invasion of the thoracic duct.^[3] The involvement of the

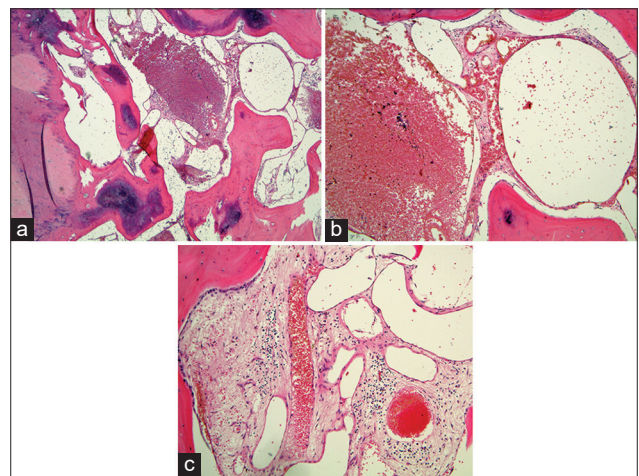


Figure 4: (a) Variably sized cystic hemorrhagic spaces have entirely replaced the intertrabecular marrow and connective tissue elements (H and E, low power). (b) The hemorrhagic cystic spaces are lined by flattened unremarkable endothelium (H and E, intermediate power). (c) Areas of fibrosis and reactive bone, with osteoblastic rimming, accompany the hemorrhagic cystic spaces, lined by flattened unremarkable endothelium (H and E, intermediate power).

cervical spine resulted in instability and subsequent paralysis. The overall mortality for GS was 13%, with spine involvement indicative of a poor prognosis and mortality of over 30%.^[3]

Medical management

Medical management targets active bone resorption with bisphosphonates (ex., Zoledronic Acid) as the mainstay of therapy. They inhibit osteoclast activity, preventing further bony lysis; furthermore, bisphosphonates reduce Interleukin-6 activity, decreasing the proliferation of GS vessels.^[2] Aizawa *et al.* describe treatments, including calcitonin and alpha 2-B interferon. Novel therapies with Denosumab, a monoclonal antibody acting as an anti-resorptive agent, warrant further investigation.^[2] An

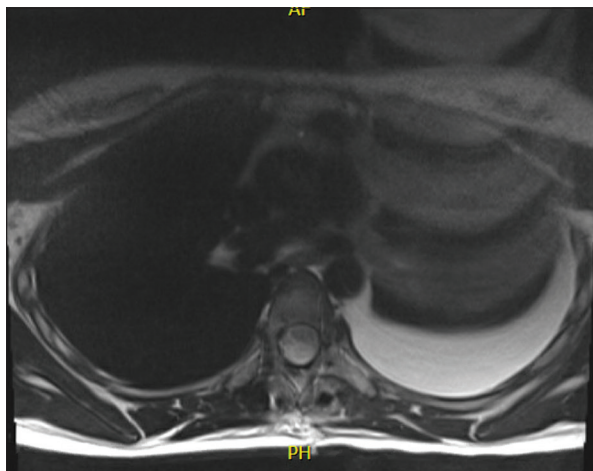


Figure 5: Postoperative imaging study. Axial T2 magnetic resonance imaging demonstrating pleural effusion, suggestive of persistent cerebrospinal fluid leak.

experimental drug, OK-432, a mixture of streptococcus pyogenes, interferon alfa, and prednisolone, were effective in treating a femoral osteolytic lesion and pleural effusion. Interferon alfa and prednisolone in conjugation effectively halted further osteolysis, showing reappearance of affected ribs at 10-month follow-up.^[6]

Other treatment modalities utilized, which included subcutaneous interferon (IFN)-alpha-2B injections, bisphosphonates, sirolimus for chylothorax development, oral Vitamin D, epidural blood patch, and/or open surgical repair with assistance of dural sealant/glue/gelatin sponge.^[1,4]

Radiotherapy

Heyd *et al.* found radiotherapy to be effective in preventing disease progression in 77–80% cases.^[3] Local radiation therapy inhibits osteolysis by destroying endothelial cells, thus limiting proliferation. Radiation monotherapy has yielded mixed results ranging from palliation to disease control and total resolution. Adjuvant moderate-dose irradiation combined with bisphosphonates and interferon has shown to halt endothelial proliferation.^[5]

Surgical intervention

Surgical intervention, reserved for patients with significant deformity, multi-level spinal involvement, or neurologic deficit, includes rigid fixation with instrumentation, decompression, or spondylectomy.^[2] However, due to lysis of bone graft, implant instability and poor fusion surface, multiple revision surgeries may be needed. The use of recombinant bone morphogenic protein-2 and fibular bone grafts has demonstrated greater resistance to graft osteolysis, offering a higher rate of success.^[5]

CONCLUSION

GS disease is rare disease that remains difficult to identify and treat. Further, prospective studies and identification of molecular and biochemical pathways will help elucidate optimal management and outcomes.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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