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CASE REPORT

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Blastomycosis of the lumbar spine: case report and review of the literature, with emphasis on diagnostic laboratory tools and management

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Abstract We report on the conservative and surgical management of a patient with blastomycosis of the lumbar spine, causing severe and crippling deformity. The diagnosis was made through biopsy. Curative removal, reconstruction and realignment of the spine were achieved. Imaging modalities were highlighted, with a detailed discussion of the histology and conservative and surgical management. We emphasize the importance of early, aggressive treatment of blastomycosis to prevent deformity and disability, and to enable identification of the best management of a destructive lesion with deformity. This case demonstrates that empirical treatment should not be used in cases of unusual sinus and abscess locations. Specific diagnosis and early treatment are indicated to prevent dreadful complications and spinal deformity resulting from blastomycosis. Aggressive antifungal therapy can cure the disease but does not control complications related to deformity. The latter can only be addressed by surgical reconstruction. We review the literature of surgical treatment, focusing on abscess drainage, bone fusion and posterior instrumentation in the absence of addressing the deformity component.

Key words Antifungal · Blastomycosis · Spine · Surgery

Introduction

Blastomyces dermatitides is a dimorphic fungus that is endemic in southern, midwestern and eastern parts of the United States, especially the Mississippi and Ohio river valleys [2]. Blastomycosis has also been reported as a rare condition in southern Canada, South America, Africa, and Asia [5, 14, 23]. The incidence of blastomycosis is much lower than that of either histoplasmosis or coccidioidomycosis [31]. The disease may be asymptomatic to life threatening. Blastomycosis is almost exclusively acquired by inhalation of airborne spores resulting in a primary lung infection. The infection in the lungs, which is the most common form of the disease, may disseminate to other organs. Various organ systems may be involved. However, the usual course of pulmonary blastomycosis, which may or may not be symptomatic, is spontaneous

resolution. The skin and the bones are among the most common extrapulmonary sites, followed by the genito-urinary tract (prostate), central nervous system, and the oropharynx [2, 20, 34]. Skin involvement is either secondary to systemic spread or more rarely by direct inoculation [33]. Osseous involvement ranges from 14% to 60% of the disseminated form of the disease [28, 29]. The spine is the most common site of skeletal involvement, followed by the skull, ribs, tibia, the bones of the foot, and wrist [7, 12, 34]. The clinical course of blastomycosis is variable. The disease may remain asymptomatic or become fulminant with life-threatening forms. Reported surgical treatments deal with drainage of spinal abscesses and spinal fusion [1, 18]. However, spinal deformity may be crippling, and surgical options tailored specifically to reconstructing blastomycotic spinal deformities have not been established. This report presents a case of spinal blastomycosis, describes its medical management and surgical reconstructive procedure and reviews the pertinent literature.

Case report

A 34-year-old black woman, a Texas Correction Center guard, with no prior medical complaints, presented with a history of a boil appearance on her back in March 1995. This was treated with incision and drainage (I&D) and empirical administration of oral antibiotics. She remained well for a few months, but in September 1995 she developed a recurrence of boils on her mid-back region. This was again managed with I&D and oral administration of antibiotics. In January 1996, the patient developed draining sinuses on her left thumb and mid-back. She also started to complain of backaches, which were progressive in severity, associated with a claudicant type of weakness in the lower extremities.

In this phase of the illness, the patient was investigated and spinal radiograph showed a lytic lesion at the second lumbar vertebra (L2) with unilateral collapse of the vertebra. CT scan showed a lytic lesion in the L2 vertebra. *Blastomyces dermatitides* was isolated from the pus in the thumb wound. The patient was referred to the spine division of the Department of Orthopaedic Surgery of The University of Texas Medical Branch at Galveston and was hospitalized. Past medical and surgical history was unremarkable. The patient denied any use of tobacco, alcohol, or recreational drugs, and had not received any transfusions. She also gave a history of being HIV negative and there was no evidence that she was an immunocompromised host.

Physical examination revealed a young well-nourished female. Eyes, ears, nose, and throat were normal, neck was supple, cardiovascular, respiratory, gastrointestinal, and genito-urinary examination were unremarkable. Examination of the back showed two draining sinuses in the midline at lumbar vertebrae two (L2) and four (L4) levels. There was no evidence of cellulitis nor any fluctuant mass in the back. The left thumb showed a post surgical incision draining sinus. The central and peripheral nervous system examination were within normal limits, except for some mild weakness of the hip flexors and abductors.

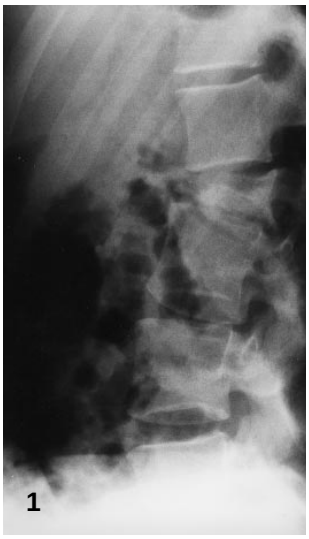
Bone and gallium scans showed increased uptake in the left thumb and upper lumbar spine. A lateral plain radiograph revealed a kyphoscoliotic deformity, and moderate to severe compression deformity of L2 with posterior subluxation (Fig. 1) without significant adjacent endplate destruction. A CT scan was performed and showed extensive patchy destruction of the L2 vertebral body posteriorly (Fig. 2). The chest plain radiograph and MR images of the brain were found to be normal. Enhanced gadolinium MR imaging of the spine on a 1.5-T unit revealed abnormal signal replacing the entire vertebral body of L2 (Fig. 3). The adjacent discs were not involved with the infection, which was traveling via the left psoas muscle. Blood samples at admission showed a sedimentation rate (Westergren) of 60 mm/h and a white blood cell (WBC) count of $9{,}800 \times 10^3/mm^3$.

At this stage, the goal of the treatment was to control the infection, drain the abscess and maintain correct alignment of the lumbar spine by means of thoracolumbar orthosis. The patient underwent a CT-guided paraspinal abscess drainage with a 9 French catheter. Smears and sections made from the biopsy material showed numerous neutrophils, scattered multinucleated giant cells, and necrotic cellular debris. This constellation is characteristic of a suppurative granulomatous inflammation. Scattered within the inflammation were large intra- and extracellular spherical to oval, single and budding yeast form of fungi with thick, refractile walls. The budding yeasts had broad bases at the points of budding (Figs. 4, 5). These findings are diagnostic of *Blastomyces dermatitides*. Gomori methenamine silver (GMS) stain better highlighted the organisms (Fig. 6). In addition, germ tubes, pseudohyphae, and hyphae forms were seen on GMS stain. Organisms morphologically consistent with *Blastomyces dermatitides* were also present intra- and extracellularly. Special stains for acid fast bacilli (AFB) revealed no mycobacteria or acid fast organisms. Bacteriologic culture revealed growth of *Blastomyces dermatitides.* No other organism was isolated (aerobes, anaerobes or acid fast bacillus). The diagnosis of disseminated blastomycosis was made and the patient was treated with intravenous amphotericin B (1.5 g). The spine was immobilized with a thoracolumbar spine orthosis (TLSO). After amphotericin B treatment was complete, she received 4 weeks of oral itraconazole (200 mg daily).

The patient was readmitted after 6 months because of progressive deformity of the spine and disabling back pain. A follow-up MRI examination revealed significant decreased enhancement in the abnormal vertebral body compared to the previous gadolinium-enhanced MRI scan, and the psoas muscle abscess showed good healing (Fig. 7). Bone scan with ^{67}Ga was not suggestive of any active infectious process in the skeleton. The Westergren sedimentation rate was 7 mm/h and WBC count was $5{,}700 \times 10^3/mm^3$. A transpedicle biopsy using the appropriate technique that was published elsewhere [15] failed to isolate any *blastomyces*.

At this stage, the patient underwent surgery. This consisted of total excision of the second lumbar vertebral body, the anterior half of the pedicles, and discectomies at the L1-L2 and L2-L3 levels. The approach was through an anterior retroperitoneal flank incision. The L2 vertebra was found wedged, and there was a cavity in the middle of the vertebral body filled with dense fibrous tissue. There was no evidence of suppuration. The fibrous tissue extended vertically into the adjacent disc spaces, and posteriorly was adherent to the posterior longitudinal ligament. By means of sharp and blunt dissection, the scar tissue was excised in toto, and the posterior longitudinal ligament was excised as well. The dura was exposed and thus decompressed. There was no evidence of any granulation tissue invading the spinal canal. The defect created by the vertebrectomy and discectomies was bridged with a femoral ring allograft. The kyphoscoliotic deformity was corrected and the spine was stabilized using the Kaneda instrumentation from L1 to L3 (Fig. 8). Multiple biopsies at the time of surgery were negative for any acute inflammation, and the tissue cultures were negative for aerobic, anaerobic, and fungal organisms.

The patient was immobilized in a TLSO for 3 months. Six weeks later the patient was asymptomatic and resumed her regular work as a guard in the Texas Correction Center. Seven months after surgery she was doing very well, and was free of pain and disease activity.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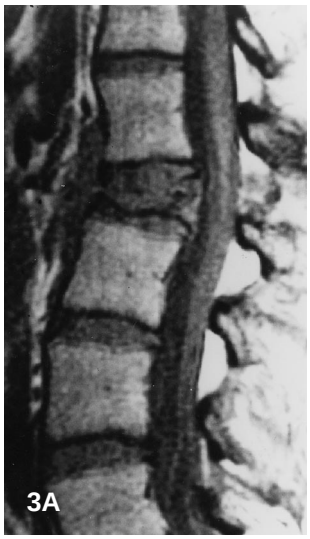
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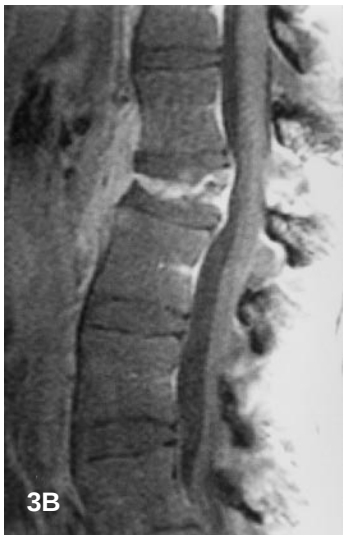
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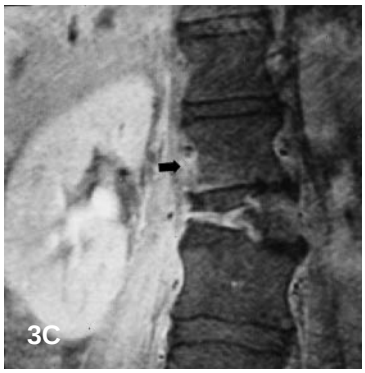
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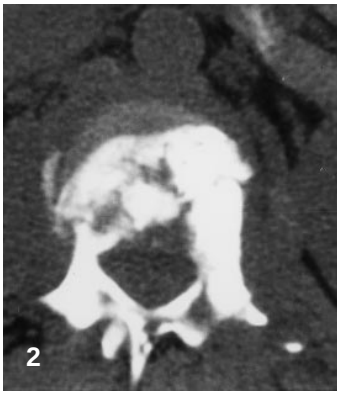
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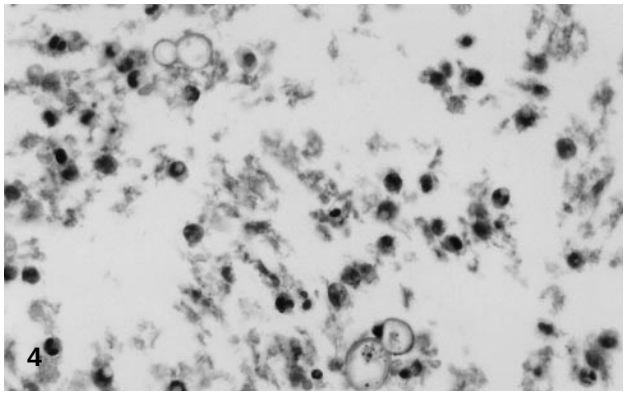
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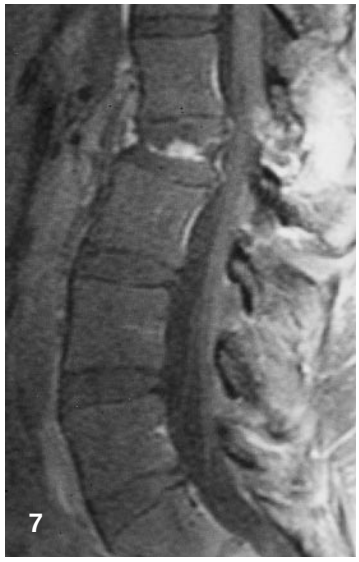
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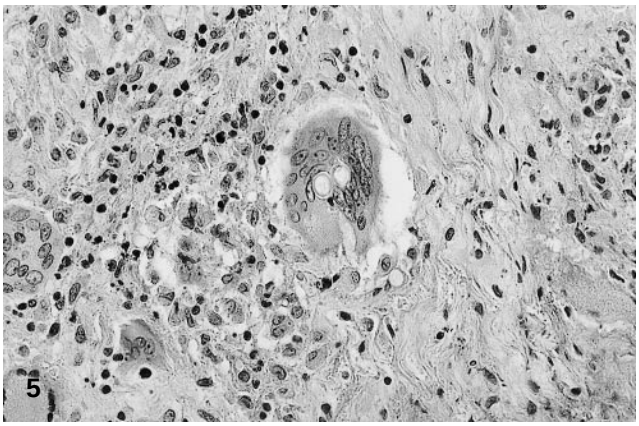
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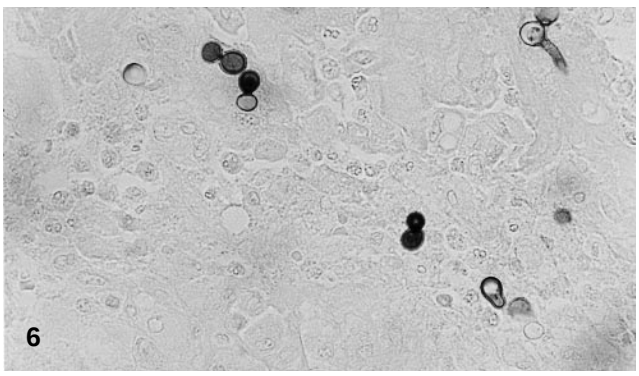
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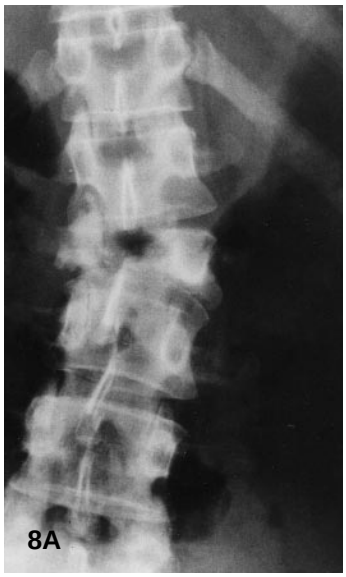
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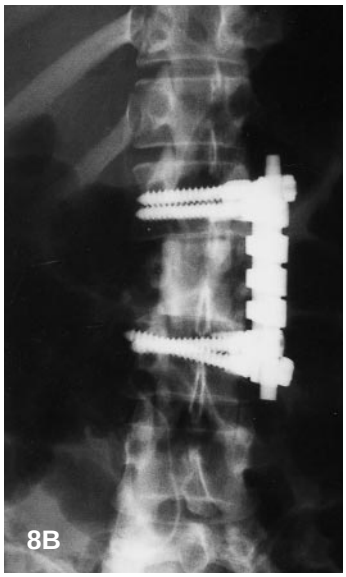
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◀ **Fig. 1** Lateral view of the lumbosacral spine reveals moderate to marked compression deformity of L2 with posterior subluxation

Fig. 2 Axial CT scan shows destructive lesion in the vertebral body

Fig. 3A–C MR images of the lumbar spine pre- and post-gadolinium. **A** Sagittal T1-weighted image reveals replacement of the normal fatty signal of L2. **B, C** Sagittal and coronal post-gadolinium with fat saturation images reveal abnormal enhancement of the L2 vertebral body with spread via both psoas muscles (right greater than left, depicted to better advantage on the coronal view). The discs were relatively spared with involvement of the L1 vertebral body laterally (*arrow*)

Fig. 4 Aspirated material from the spine showing double contour, thick-walled budding yeasts with surrounding acute inflammatory cells

Fig. 5 Histologic section of bone showing double contour, thick-walled budding yeast in multinucleated giant cells and adjacent inflammation with extracellular organism

Fig. 6 Budding yeast highlighted by gomori methenamine silver stain with germ tube form (*right upper corner*)

Fig. 7 MRI 5 months following therapy reveals decreased enhancement on gadolinium T1-weighted image with fat saturation

Fig. 8A, B Anteroposterior radiographs before (**A**) and after (**B**) instrumentation

Discussion

The most common area for spine involvement in blastomycosis is the lumbar and thoracic vertebrae. Whether the route of spread of infection to the spine is via the Batsons valveless venous plexus system or the arterial blood supply is debatable [16].

MRI and CT are valuable in determining the presence and extent of involvement by the granulomatous disease. The advantage of CT is its ability to show bone architecture better than MRI. MRI, on the other hand, can depict pathologic changes of the soft tissue, spinal canal, and cord in much more detail than other imaging modalities. The appearance of granulomatous lesions on non-enhanced MR images can be variable. Most lesions are hyperintense on T2-weighted images. Intravenous gadolinium on T1-weighted images will show marked solid enhancement of granulomatous lesions, as opposed to the ring enhancement by the abscess. Gadolinium-enhanced MR images are valuable indicators of the disease activity, and response to therapy [25, 30], as shown in the post-treatment images (Fig. 6). T1- and T2-weighted images do not always distinguish between burnt-out infection and an ongoing one, since the abnormal changes of the infection process tend to remain somewhat permanent. ^{67}Ga-enhanced bone scan can reliably monitor the disease activity and the response to treatment, as advocated by Lisbona et al. [19].

The clinical and imaging picture can be confused with other destructive bone lesions caused by coccidioidomycosis, actinomycosis, cryptococcosis, tuberculosis, bacterial infections, and metastatic carcinomas [8, 9]. In blastomycosis, as in coccidioidomycosis and tuberculosis, there is an indiscriminate involvement of the vertebral bodies. In tuberculosis the posterior elements of the vertebral body are not affected [11], except in the unusual form of the disease, whereas in coccidioidomycosis [8, 22] and blastomycosis [1] all the bone elements of the spine are affected. In coccidioidomycosis, there is a relative sparing of the disc space [8, 22, 24]; in blastomycosis, this effect is variable. Some reports have shown that the disc space may be involved in the early stages of the disease [9, 12]. However, this observation is not universal [16] and was not observed in our case; the disc space was spared.

A spontaneous spinal fusion occurs in a significant proportion of cases of tuberculosis that have been treated with a full course of anti-tuberculous therapy, but has not been observed in blastomycosis or coccidioidomycosis. Soft tissue extension with formation of fluctuating paraspinal abscesses and ulceration [26] is common in all three types of infection. However, blastomycosis has a greater tendency to produce fistulae, as exemplified in our patient.

No clinical syndromes or imaging modalities are characteristic for blastomycosis. A diagnosis can be made only by visualization of the yeast in pus, sputum and secretions and on the basis of the histological examination. A diagnostic biopsy should be done in patients with mass lesions. It can be done as a needle biopsy or excision biopsy. It is our opinion that percutaneous transpedicular biopsy is the best approach for diagnosing spinal lesions [15]. The biopsy usually has a good yield and can be visualized with potassium hydroxide and hemotoxylin and eosin stains. The gamori methanine-silver stain is best used for screening tissues for fungal infection. When typical budding forms are present, *Blastomyces dermatitides* can be identified with confidence.

One should always suspect fungal infection when the presenting abscess (on the back, in our patient) or draining sinus (on the thumb, PIP joint) have an unusual manifestation. Some are of the opinion that in immunocompetent patients with uncomplicated pulmonary forms of the disease, therapy may not be necessary [6, 27, 32]. Considering the complication of blastomycosis and the relative safety of oral antifungal medication, we tend to agree with others [3, 10, 18], that when blastomycosis is suspected, even in its mildest form (as in the case of our healthy patient), antifungal therapy should be instituted.

Before the advent of chemotherapy, blastomycosis had a progressive course and mortality rates as high as 78% [21] were reported. Amphotericin B was previously considered as the treatment of choice for all forms of blastomycosis, but it is a drug with serious side effects, such as bone marrow suppression and renal function impairment [13]. Itraconazole and ketoconazole have fewer side effects and are effective alternatives in immunocompetent patients with mild to moderate forms of this disease. Ke-

toconazole is to be used for at least 6 months at doses of 600–800 mg/day for 81–100% cure rates. Itraconazole is an oral triazole which has excellent in vitro and in vivo activity against *Blastomyces dermatitides*. It has an efficacy rate of 90% at doses of 200–400 mg daily and the patient needs to be treated for 6 months [18]. Itraconazole has superior efficacy and lower side effects, so it should be used as the drug of choice in immunocompetent patients with blastomycosis. Amphotericin B remains the drug of choice in patients who are severely immunocompromised, and have a disseminated form of the disease in a life-threatening situation. The recommended total dose of Amphotericin B is 1.5–2.5 g [9, 18]. The cure rate of Amphotericin B was reported to be 87% when a 1-g course therapy was used, and 97% when a 2-g course treatment was used.

Local debridement with abscess drainage may be necessary for spinal or skin involvement [1, 9, 16]. Drainage and antifungal treatment can cure the disease, but certainly cannot control the pain and neurological deficit caused by deformity and osseous element neurocompression. In our case, the disease was brought under control with aggressive antifungal treatment and drainage of the abscess. However, because of progressive deformity (kyphoscoliosis) and spinal canal compromise, reconstructive surgery was indicated to decompress the spinal canal, eradicate pockets of any residual infection, and reconstruct and align the spine. Because blastomycosis is not a glycocalyx-producing infection, there were no contra-indications to the use of anterior device instrumentation for spinal stabilization. Biomechanically it has been shown that the Kaneda instrumentation is rigid enough and can be used as the sole device (Fig. 8B), without further supplementation with posterior instrumentation [17]. The patient's pain responded promptly after this type of surgical intervention and she was able to resume her regular work 6 weeks after this type of surgical reconstruction.

Conclusion

In conclusion, medical antifungal treatment can successfully eradicate the infectious process in blastomycosis as was observed in our case. The disease activity and response to treatment can reliably be monitored by gadolinium-enhanced MRI and ^{67}Ga-enhanced bone scan. We concluded that blastomycosis, even in its minor form, should be adequately treated in order to prevent its dreadful complications. Pain caused by severe bone destruction that results in instability and deformity (kyphoscoliosis) or neurological deficit by bony intrusion into the spinal canal cannot be controlled by conservative treatment alone. Anterior spinal surgical approach proved to be an excellent surgical option, because it provides adequate access for radical excision of pathological tissue, and simultaneously allows a one-stage rigid reconstructive procedure. It should be noted that instrumentation can only be used when antifungal therapy has controlled the infection. Proper surgical techniques may restore spinal stability without the need for implants.

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