

# Surgery for Blastomycosis of the Spine

John R. Dimar II, MD, Rolando M. Puno, MD, Michael R. Nowacki, MD, and Leah Y. Carreon, MD, MSc

## Abstract

Blastomycosis is a rare fungal infection that primarily produces acute lung infections but may disseminate to multiple sites, including the spine. Once vertebral involvement occurs, an untreated infection may result in vertebral body destruction and paraspinal and epidural abscess formation followed by neurologic injury and loss of structural integrity of the spine.

We report the case of a 30-year-old man who had pulmonary blastomycosis (treated with oral itraconazole for 6 months) and presented with a 2-month history of mild thoracolumbar back pain and numbness and tingling in the lower extremities, but no neurologic deficits. Imaging revealed a destructive lesion of T11 with an extensive paravertebral and retropleural abscess tracking a spinal level above and below with extension into the spinal canal. The patient underwent incision and drainage, culture procurement and corpectomy of T11 with autogenous rib graft in a titanium cage, and, 1 week later, posterior fusion and instrumentation. Cultures were positive for *Blastomycosis dermatitidis*. Oral itraconazole was continued.

Blastomycosis that disseminates to the spine may cause serious neurologic and structural complications. In most cases, long-term use of antifungal medication eradicates the infection. Should medical treatment fail, however, surgery is a useful option.

**B**lastomycosis is a rare fungal infection that primarily produces acute lung infections but may on occasion disseminate to multiple sites, including the skin, bone, central nervous system (CNS), and oropharynx.<sup>1-30</sup> In the case of a primary infection of the lung, if there is a high index of suspicion and a thorough diagnostic workup, the diagnosis can be made from sputum or bronchoscopy.<sup>24</sup> Patients present with acute pneumonia that either resolves spontaneously or

proceeds to chronic pneumonia with extrapulmonary spread to multiple organs, including the spine. Once vertebral involvement occurs, an untreated infection may result in vertebral body destruction and paraspinal and epidural abscess formation followed by neurologic injury and loss of structural integrity of the spine.<sup>11,13,17,23,27,29</sup>

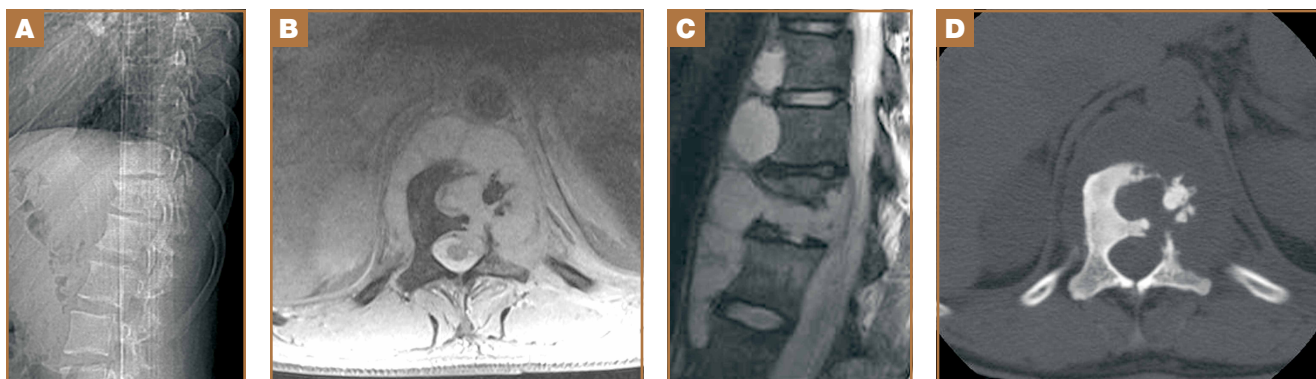
In this article, we present a case of blastomycosis of the vertebral body and provide a detailed review of the literature concerning this extremely rare infection of the spine. The patient provided written informed consent for print and electronic publication of this case report.

## Case Report

A 30-year-old African American man with known pulmonary blastomycosis, for which he had been treated with oral itraconazole 200 mg twice daily for 6 months, was admitted to the hospital with a 2-month history of mild thoracolumbar back pain. He reported transient numbness and tingling in the lower extremities but no weakness. He denied weight loss, fatigue, appetite loss, and significant night pain. On physical examination, he was alert and oriented, well nourished, and in no acute distress. Percussion revealed limited range of motion and pain. Further examination of the spine demonstrated no spasm, swelling, erythema, or drainage. The lower extremities had intact sensation, motor strength, reflexes, and pulses, and clonus was absent. White blood cell count was 8100 cells/ $\mu$ L (normal), erythrocyte sedimentation rate was 77 mm/h (normal range, 0-20 mm/h), and C-reactive protein level was 57.2 mg/L (normal,  $\leq$  10 mg/L). The patient was HIV-negative. Chest radiographs were normal except for a small pleural effusion. Radiographs showed a destructive lesion of T11 with an extensive paravertebral and retropleural abscess tracking a spinal level above and below with extension into the spinal canal (**Figure 1**).

As the patient had signs of spinal cord compression, he was taken to surgery for incision and drainage and culture procurement and corpectomy of T11 with autogenous rib graft. One week later, he was stabilized with posterior fusion and instrumentation (**Figure 2**). Gram stain of the specimen demonstrated broad-based budding yeast forms 15 to

**Authors' Disclosure Statement:** Dr. Dimar reports he is an employee of Norton Healthcare, receives consulting fees and royalties from Medtronic, is on the speaker's bureau for DePuy Synthes, and is an associate editor of *The Journal of Bone and Joint Surgery*. Dr. Puno reports he receives consulting fees from Alphatec. Dr. Nowacki reports he is an employee of Norton Healthcare. Dr. Carreon reports she is an employee of Norton Healthcare; receives research grants from Norton Healthcare, AOSpine, and the Orthopaedic Research and Education Foundation (OREF); receives travel support from OREF, the US Department of Defense, the Association for Collaborative Spine Research, the National Institutes of Health (NIH), and the University of Louisville; receives honoraria for participation in Review Panels NIH, Medtronic, and Children's Tumor Foundation; and is on the University of Louisville Institutional Review Board.



**Figure 1.** (A) Lateral radiograph of spine shows lysis and collapse of the T11 vertebral body. (B) Axial and (C) sagittal T2-weighted magnetic resonance imaging of spine shows destruction of T11 vertebral body and surrounding fluid collection from T8 to L2. (D) Computed tomography and (E) sagittal reconstruction show moth-eaten appearance of T11 vertebral body with large paraspinal fluid collection from T8 to L2.



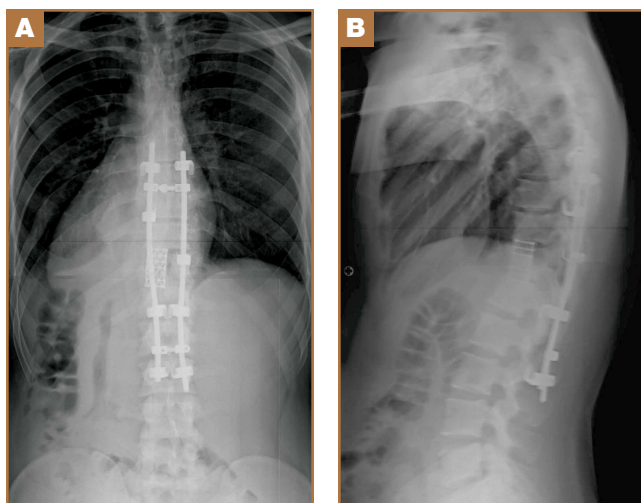
20 micrometers in size, consistent with blastomycosis. Cultures were positive for *Blastomyces dermatitidis*. Histopathologic slides (Figure 3) of the surgical pathology specimen showed granulomatous inflammation. Oral itraconazole 200 mg twice daily was continued, as it has

been found to be efficacious in treating immunocompetent patients with blastomycosis<sup>17</sup> and is considered the medication of choice for non-life-threatening, non-CNS blastomycosis. (Intravenous amphotericin B was ruled out because of its known serious side effects, such as bone marrow suppression and renal function impairment<sup>10</sup>; itraconazole was the better alternative.) The patient was placed in a thoracolumbar orthosis and discharged. As the effect of presence of instrumentation in the setting of a fungal infection is unknown, it was deemed

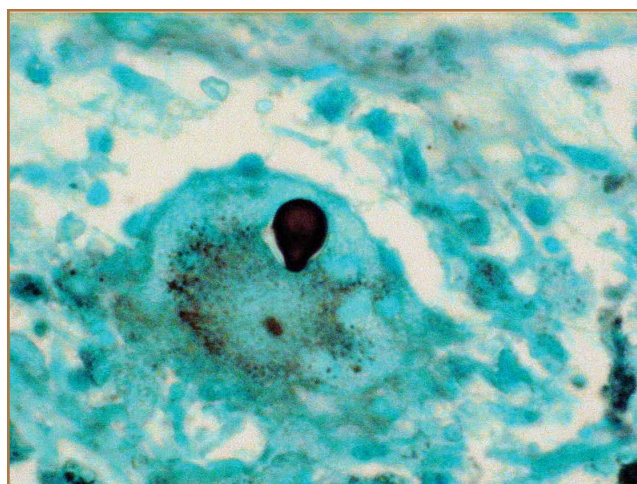
prudent to maintain the patient on chronic antifungal suppression. One year after surgery, computed tomography (CT) showed solid osseous bridging through the cage crossing the T11 vertebral body, from the inferior endplate of T10 through the superior endplate of T12 (Figure 4). In addition, there had been no recurrence of the spinal infection, and the patient was neurologically intact and doing well.

### Discussion

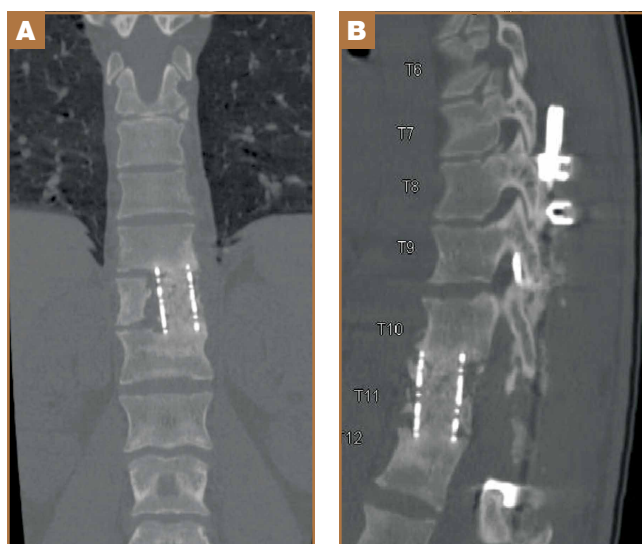
North American blastomycosis (*B dermatitidis*) is a ubiquitous dimorphic fungus that occurs worldwide and on occasion causes serious infections in humans.<sup>9,23,26,29</sup> It was first characterized in 1894 by Gilchrist and Stokes (Gilchrist disease) when they recovered the fungus from the lung tissue of a patient.<sup>3</sup> In North America, blastomycosis infections occur from central Canada to the Gulf Coast to east of the Mississippi River.<sup>2,5,7,8,13,14,17,21,22,24,27,29</sup> Additional cases of the disease have been reported in Africa,<sup>9,16,23,28</sup> Asia,<sup>12,19</sup> and South America<sup>7,8</sup> (Table [on pages E270-E271]). Recent epidemiologic studies



**Figure 2.** (A) Anteroposterior and (B) lateral radiographs immediately after surgery show corpectomy of T11 with titanium cage in place and instrumented posterolateral fusion from T8 to L1.



**Figure 3.** Histology of blastomycosis from vertebral abscess.



**Figure 4.** (A) Frontal and (B) sagittal computed tomography reconstructions 1 year after surgery show solid osseous bridging through cage crossing T11 vertebral body, from inferior endplate of T10 through superior endplate of T11.

have linked transmission of the disease to bodies of water and have questioned previous reports of male predominance and racial preference for African Americans (Table).

Blastomycosis is acquired when inhaled fungus (airborne conidia spores) causes a primary pulmonary infection or, rarely, when there is direct inoculation through the skin. The differential diagnosis includes neoplasm, tuberculosis, actinomycosis, bacterial infections, cryptococcosis, and coccidioidomycosis.<sup>3,9,12,20,25,31</sup> Blastomycosis occurs in adults and children.<sup>1-30</sup> The rate of mortality is much higher in immunocompromised patients. Initial symptoms include fever, chills, fatigue, malaise, myalgia, arthralgia, weight loss, and stigmata of chronic disease.<sup>1-30</sup> Acute pulmonary infection with blastomycosis generally resolves spontaneously but may progress to acute respiratory distress syndrome, which has a mortality rate of 50% to 89%.<sup>19</sup> With systemic dissemination, the infection may spread to other organs<sup>11</sup>—there is a particular predilection for the skin<sup>9,20,29</sup>—and to the long bones<sup>7,16</sup> and the oropharynx.<sup>16,26,28</sup>

In 50% to 64% of cases, bone involvement may be the first disease manifestation.<sup>6,7,16,22</sup> Osseous involvement with blastomycosis most commonly affects the long bones<sup>15</sup> but may include the vertebrae,<sup>1-29</sup> the ribs,<sup>26</sup> and the carpal or tarsal bones.<sup>7,16</sup> The most common vertebral involvement occurs in the thoracic or lumbar spine<sup>1,2,7-9,11-14,17,19,21-24,26</sup> and typically results in destruction of the body, development of a paraspinous abscess, and potential extension into the spinal canal, causing an epidural abscess and development of chronic draining cutaneous sinuses.<sup>2,7,9,11-13,16,17,19,22,23,26,28,29</sup> In the present case, we do not know whether the vertebral body was involved before the patient presented with mid-thoracolumbar back pain. There may have been bony involvement during initial presentation.

Diagnosis is often difficult because of a low index of sus-

picion, leading to a significant delay in treatment. Primary pulmonary infections are successfully diagnosed 86% of the time from sputum and 92% of the time from bronchoscopy.<sup>19</sup> Once the infection involves the spine, plain radiographs, CT, and magnetic resonance imaging (MRI) can be used to identify not only the bony involvement but also any adjacent soft-tissue extension.<sup>13</sup> The radiographic findings, typical of tuberculosis or a neoplasm, include disc space narrowing, vertebral body destruction and collapse, late segmental kyphotic deformity, and development of a psoas abscess or a retropleural abscess.<sup>7,26</sup> Such abscesses lend themselves well to fine-needle aspiration,<sup>7,8,11,13,14,17,19,26</sup> which, when combined with CT and MRI guidance, reliably assists in the diagnosis of blastomycosis.<sup>1,13,17</sup> If fine-needle aspiration fails, then open biopsy and surgical débridement specimens may be effective in the diagnosis.<sup>2,9,12,21,22,27</sup>

The mortality rate for systemic blastomycosis exceeded 90% before the development of antifungal medications, and these medications remain the primary treatment for most initial infections.<sup>15</sup> For severe infections in critically ill patients and for patients with CNS involvement, amphotericin B has been effective, with cure rates approaching 97%.<sup>17</sup> Itraconazole, which is well tolerated, has replaced ketoconazole as the preferred long-term oral treatment for blastomycosis. Cure rates for itraconazole approach 90% when treatment is instituted over 2 years in a compliant patient.<sup>10,19,20</sup> Nonsurgical (antifungal) treatment for blastomycosis of the spine has also proved successful in neurologically intact patients.<sup>7,9,11,26,28</sup>

A case involving the spine and requiring surgical drainage was first reported in 1908<sup>5</sup>; since then, only a few more cases have been reported.<sup>1,2,5,7-9,11-14,16,17,19,21-24,26-29</sup> Thus, the literature includes very little information that can be used to establish indications for surgery for a blastomycotic infection of the spine. However, there is enough evidence to establish that surgery is indicated for patients who have a known blastomycosis infection and are developing neurologic or structural loss of integrity of the spinal column or have an abscess that requires drainage and débridement.

Our patient had been on long-term antifungal treatment but nevertheless developed a destructive spinal lesion with a concurrent epidural and retropleural abscess. Given his risk of pathologic fracture, we performed anterior débridement and stabilization followed by posterior fusion and instrumentation. We are unaware of any other cases in which an anterior titanium cage was combined with rib autograft after anterior débridement and vertebrectomy combined with posterior instrumentation for blastomycosis. This technique proved very useful, as it allowed for immediate stabilization of the spine. Therefore, the treatment goal is similar to that for any destructive infection that fails medical treatment: preservation of neurologic function, stabilization of spinal vertebrae, débridement of abscess cavity, and definitive culture procurement.

## Conclusion

Although there is little reported information regarding surgical indications for blastomycotic vertebral osteomyelitis that

has failed medical management—in patients with a destructive lesion and compromise of both the spinal canal and the integrity of the vertebral column—anterior débridement and stabilization followed by posterior fusion and instrumentation are useful in preventing vertebral collapse, further canal compromise, and possible cord injury.

Dr. Dimar and Dr. Puno are Associate Professors, Department of Orthopaedic Surgery, University of Louisville School of Medicine, Louisville, Kentucky. Dr. Nowacki is Medical Director, Norton Hospital Laboratory, Norton Healthcare, Louisville, Kentucky. Dr. Carreon is Clinical Research Director, Norton Leatherman Spine Center, Louisville, Kentucky.

Address correspondence to: Leah Y. Carreon, MD, MSc, Norton Leatherman Spine Center, 210 E Gray St, Suite 900, Louisville, KY 40202 (tel, 502-584-7525; fax, 502-584-6851; e-mail, leah.carreon@nortonhealthcare.org).

*Am J Orthop.* 2014;43(11):E266-E271. Copyright Frontline Medical Communications Inc. 2014. All rights reserved.

## References

- Akhtar I, Flowers R, Siddiqi A, Heard K, Baliga M. Fine needle aspiration biopsy of vertebral and paravertebral lesions: retrospective study of 124 cases [published correction appears in *Acta Cytol.* 2006;50(5):600]. *Acta Cytol.* 2006;50(4):364-371.
- Arvin MC, Gehring RL, Crecelius JL, Curfman MF. Man with progressive lower back pain. *Indiana Med.* 1991;84(8):554-556.
- Baylin GJ, Wear JM. Blastomycosis and actinomycosis of the spine. *Am J Roentgenol Radium Ther Nucl Med.* 1953;69(3):395-398.
- Bradsher RW, Chapman SW, Pappas PG. Blastomycosis. *Infect Dis Clin North Am.* 2003;17(1):21-40.
- Brewer GE, Wood FC. XII. Blastomycosis of the spine: double lesion: two operations: recovery. *Ann Surg.* 1908;48(6):889-896.
- Carman WF, Frean JA, Crewe-Brown HH, Culligan GA, Young CN. Blastomycosis in Africa. A review of known cases diagnosed between 1951 and 1987. *Mycopathologica.* 1989;107(1):25-32.
- Challapalli M, Cunningham DG. North American blastomycosis of the vertebrae in an adolescent. *Clin Infect Dis.* 1996;23(4):853-854.
- Detrisac DA, Harding WG, Greiner AL, Dunn CR, Mayfield FH. Vertebral North American blastomycosis. *Surg Neurol.* 1980;13(4):311-312.
- Frean J, Blumberg L, Woolf M. Disseminated blastomycosis masquerading as tuberculosis. *J Infect.* 1993;26(2):203-206.
- Goodman LS, Brunton LL, Chabner B, Knollman BC, eds. *Goodman and Gilman's The Pharmacological Basis of Therapeutics.* New York, NY: McGraw-Hill Medical; 2011.
- Gottlieb JR, Eismont FJ. Nonoperative treatment of vertebral blastomycosis osteomyelitis associated with paraspinous abscess and cord compression. A case report. *J Bone Joint Surg Am.* 2006;88(4):854-856.
- Güler N, Palanduz A, Ones U, et al. Progressive vertebral blastomycosis mimicking tuberculosis. *Pediatr Infect Dis J.* 1995;14(9):816-818.
- Hadjipavlou AG, Mader JT, Nauta HJ, Necessary JT, Chaljub G, Adesokan A. Blastomycosis of the lumbar spine: case report and review of the literature, with emphasis on diagnostic laboratory tools and management. *Eur Spine J.* 1998;7(5):416-421.
- Hardjasudarma M, Willis B, Black-Payne C, Edwards R. Pediatric spinal blastomycosis: case report. *Neurosurgery.* 1995;37(3):534-536.
- Jahangir AA, Heck RK. Blastomycosis: case report of an isolated lesion in the distal fibula. *Am J Orthop.* 2010;39(3):E22-E24.
- Koen AF, Blumberg LH. North American blastomycosis in South Africa simulating tuberculosis. *Clin Radiol.* 1999;54(4):260-262.
- Lagging LM, Bréland CM, Kennedy DJ, Milligan TW, Sokol-Anderson ML, Westblom TU. Delayed treatment of pulmonary blastomycosis causing vertebral osteomyelitis, paraspinous abscess, and spinal cord compression. *Scand J Infect Dis.* 1994;26(1):111-115.
- MacDonald PB, Black GB, MacKenzie R. Orthopaedic manifestations of blastomycosis. *J Bone Joint Surg Am.* 1990;72(6):860-864.
- Mahiquez M, Bunton KL, Carney G, Weinstein MA, Small JM. Nonsurgical treatment of lumbosacral blastomycosis involving L2–S1: a case report. *Spine.* 2008;33(13):E442-E446.
- McKinnell JA, Pappas PG. Blastomycosis: new insights into diagnosis, prevention, and treatment. *Clin Chest Med.* 2009;30(2):227-239.
- Moore RM, Green NE. Blastomycosis of bone. A report of six cases. *J Bone Joint Surg Am.* 1982;64(7):1097-1101.
- Muñiz AE, Evans T. Chronic paronychia, osteomyelitis, and paravertebral abscess in a child with blastomycosis. *J Emerg Med.* 2000;19(3):245-248.
- Osmond JD, Schweitzer G, Dunbar JM, Villet W. Blastomycosis of the spine with paraplegia. *S Afr Med J.* 1971;45(16):431-434.
- Parr AM, Fewer D. Intramedullary blastomycosis in a child: case report. *Can J Neurol Sci.* 2004;31(2):282-285.
- Rein MF, Fischetti JL, Sande MA. Osteomyelitis caused by concurrent infection with *Mycobacterium tuberculosis* and *Blastomyces dermatitidis*. *Am Rev Respir Dis.* 1974;109(2):286-289.
- Saccante M, Abernathy RS, Pappas PG, Shah HR, Bradsher RW. Vertebral blastomycosis with paravertebral abscess: report of eight cases and review of the literature. *Clin Infect Dis.* 1998;26(2):413-418.
- Titrud LA. Blastomycosis of the cervical spine. *Minn Med.* 1975;58(10):729-732.
- Vandepitte J, Gatti F. A case of North American blastomycosis in Africa. Its existence in Republic of Zaire. *Ann Soc Belg Med Trop.* 1972;52(4):467-479.
- Voris HC, Greenwood RC. Blastomycosis of the spine with invasion of the spinal canal. *Proc Inst Med Chic.* 1947;16(17):463.
- Witorsch P, Utz JP. North American blastomycosis: a study of 40 patients. *Medicine.* 1968;47(3):169-200.
- Lucio E, Adesokan A, Hadjipavlou AG, Crow WN, Adegboyega PA. Pyogenic spondylodiskitis: a radiologic/pathologic and culture correlation study. *Arch Pathol Lab Med.* 2000;124(5):712-716.

Table on next page ➤

**Table. Summary of All Spinal Blastomycosis Case Reports in the Literature, in Chronological Order**

Author(s)/ Year Reported	Case No.	Age, y	Sex	Race	Geographic Location	Illness Duration, mo	Vertebral Involvement	Extraspinal/ Extrapulmonary Lesions	Chest Radiograph	Fever	Contiguous Abscess	HIV	Diagnosis	Surgery	Antifungal Treatment	Outcome
Brewer & Wood <sup>5</sup> (1908)	—	20	M	Caucasian	New York	3	NA	None	NA	Yes	NA	NA	Aspiration of subcutaneous abscess	Open incision and drainage, abscess wall resection	None	Wounds healed
Voris & Greenwood <sup>29</sup> (1947)	—	40	F	White	Chicago	1	T3–T8 intraspinal	Skin lesions	NA	NA	Yes	NA	Prior skin lesions	Resection of granuloma	NA	Death after recurrence of neurologic symptoms
Osmond et al <sup>23</sup> (1971)	—	39	M	Black	South Africa	2	T10	None	NA	NA	Yes	NA	Biopsy during anterolateral decompression	Laminectomy, later followed by anterolateral decompression, abscess cavity packed with bone chips and streptomycin	IV amphotericin B, NS dose <sup>a</sup>	Death
Vandepitte & Gatti <sup>28</sup> (1972)	1	36	M	Black	Zaire	NA	C5–C7	Fistulae	Diffuse infiltrates, right upper lobe	Yes	Yes	NA	Culture of discharge from fistula	None	IV amphotericin B, NS dose <sup>a</sup>	Discharged improved at 5 mo
	2	15	M	Black	Zaire	7	T7–T9	Fistulae	NA	No	Yes	NA	Aspiration of chest mass	None	IV amphotericin B 3-g dose <sup>a</sup>	Discharged at 6 mo
Titrud <sup>27</sup> (1975)	—	38	M	Caucasian	Minnesota	12	C2–C3	None	Lateral right hilar infiltrate	Yes	NA	NA	Surgical specimen	Posterior fusion, halo fixation	IV amphotericin B 2.2 g over 72 d	At 2 y, feeling well, returned to work
Detrisac et al <sup>8</sup> (1980)	—	50	F	Caucasian	Kentucky	7	T11–T12	None	NA	No	NA	NA	Needle biopsy	T11 costotransversectomy, open incision and drainage	IV amphotericin B 1728 mg over 10 wk	At 2 y, resumed normal activities
Moore & Green <sup>21</sup> (1982)	1	69	M	Caucasian	Nashville	3	T9–L1	None	Fibronodular infiltrate, left lung	Yes	NA	NA	Open incision and drainage	Costotransversectomy, corpectomy	IV amphotericin B, NS dose <sup>a</sup>	Death from perforated duodenal ulcer
	2	19	M	Caucasian	Nashville	4	T10	Skin lesion on lower back	Normal	NA	NA	NA	Craig needle biopsy	None, plaster extension jacket	IV amphotericin B, NS dose × 10 wk	Asymptomatic at 1 y
Arvin et al <sup>2</sup> (1991)	—	43	M	NA	Indiana	NA	L5	None	Left lower lobe infiltrate, mild hilar adenopathy	NA	Yes	NA	Open incision and drainage	Open incision and drainage	IV amphotericin B, NS dose <sup>a</sup>	Discharged home, improved, no neurologic sequelae
Freaan et al <sup>9</sup> (1993)	1	40	M	Black	South Africa	NA	T4–T5	NA	Miliary pattern	NA	Yes	Negative	Abscess wall biopsy	None	IV amphotericin B 30 mg/d <sup>a</sup>	Death from respiratory failure
	2	31	M	Black	South Africa	33	T9–L1	Raised erythematous skin patches	Bilateral nodular infiltrate, hilar lymphadenopathy, rib erosion	NA	Yes	Negative	Aspiration of subcutaneous abscess	None	IV amphotericin B 1.8 g over 12 wk	Well at 3 mo
Lagging et al <sup>17</sup> (1994)	—	36	F	NA	St. Louis	NA	T8	None	Cavitary lesion, posterior left upper lobe	Yes	Yes	NA	CT-guided needle aspiration	Anterior vertebrectomy rib grafting	IV amphotericin B 1 g <sup>a</sup> × 4 wk Itraconazole 400 mg/d × 6 mo	Asymptomatic
Güler et al <sup>12</sup> (1995)	—	4	M	NA	Turkey	21	T11–T12	Fistulae	No	Yes	Yes	Negative	Surgical biopsy	Anterior decompression and fusion, delayed posterior fusion	IV amphotericin B 864 mg over 72 d	Discharged healthy
Hardjasudarma et al <sup>14</sup> (1995)	—	5	M	Black	Louisiana	2	L4–L5	None	Normal	Yes	No	Negative	Ultrasonography-guided needle aspiration	Surgical drainage of paraspinal abscess	IV amphotericin B 35 mg/kg × 6 wk Itraconazole 100 mg/d × 10 mo	Marked improvement
Challapalli & Cunningham <sup>7</sup> (1996)	—	14	M	NA	Chicago	2	T12	Left ankle arthritis	Patchy infiltrate in right upper lobe, marked right apical pleural thickening	No	Yes	NA	CT-guided needle aspiration	None	IV amphotericin B 38 mg/kg <sup>a</sup> Ketoconazole 400 mg/d × 4 mo	Lost to follow-up
Hadjipavlou et al <sup>13</sup> (1998)	—	34	F	Black	Texas	10	L2	Draining sinus, left thumb	Normal	NA	Yes	Negative	CT-guided paraspinal abscess drainage	Delayed corpectomy strut grafting, thoracic-lumbar-sacral orthosis	IV amphotericin B 1.5 g <sup>a</sup> Itraconazole 200 mg/d × 1 mo	Asymptomatic

Abbreviations: HIV, human immunodeficiency virus; NA, not applicable; CT, computed tomography; FNAB, fine-needle aspiration biopsy; IV, intravenous; NS, not specified.  
<sup>a</sup>Length of administration was not specified.

Continued on page E271

Table. Summary of All Spinal Blastomycosis Case Reports in the Literature, in Chronological Order (continued)

Author(s)/ Year Reported	Case No.	Age, y	Sex	Race	Geographic Location	Illness Duration, mo	Vertebral Involvement	Extrapulmonary/ Extrapulmonary Lesions	Chest Radiograph	Fever	Contiguous Abscess	HIV	Diagnosis	Surgery	Antifungal Treatment	Outcome
Saccente et al <sup>26</sup> (1998)	1	17	F	Black	NA	15	L1	None	Normal	No	Yes	NA	Percutaneous needle biopsy	Percutaneous needle biopsy	Itraconazole 20 mg/d × 6 mo	Asymptomatic
	2	29	F	Caucasian	NA	6	T8, T9, L2	Mastitis	Opacity in right upper lobe	NA	Yes	NA	FNAB of breast abscess	None	Fluconazole 400 mg/d × 20 mo	No evidence of residual or recurrent disease
	3	14	F	Caucasian	NA	3	T7–L3	Lytic rib lesions	Right pleural effusion	Yes	Yes	NA	None	Open débridement	Ketoconazole 200 mg/d × 3 mo Then ketoconazole 400 mg/d × 8 mo Then IV amphotericin B 1 g	Status unknown
	4	50	F	Black	NA	25	T6–T9	NA	Nodular opacity in right lung apex with bilateral apical thickening	Yes	Yes	NA	NA	None	IV amphotericin B 680 mg <sup>a</sup>	Cured
	5	36	M	Black	NA	14	C2–C7, sacrum	Skin lesions	Extensive cavitation of right upper lobe	NA	Yes	NA	NA	Open débridement	IV amphotericin B 2.0 g <sup>a</sup>	Cured
	6	34	M	Black	NA	2.5	L2	NA	Bilateral nodular miliary disease	Yes	Yes	NA	NA	None	IV amphotericin B 2.0 g, then 1.0 g <sup>a</sup>	Died with relapse
	7	55	M	Black	NA	12	T2–T3	NA	Fibrotic changes in left lung with no active infiltrates	NA	Yes	NA	NA	Open débridement	IV amphotericin B 2.0 g <sup>a</sup>	Cured
	8	14	F	Black	NA	10	L2–L5	Lytic rib lesions	Haziness in left lower and right upper lung lobes	Yes	Yes	NA	NA	Open débridement	Unknown	Cured
Koen & Blumberg <sup>16</sup> (1999)	—	43	M	NA	South Africa	2	C4	Left knee, ankle, and wrist arthritis; pustular skin lesions	Diffuse bilateral miliary nodular shadowing	NA	Yes	Negative	None	Surgical drainage, corpectomy strut grafting	Fluconazole 400 mg/d × 5 wk Itraconazole 400 mg/d <sup>a</sup>	Discharged home, improved, no neurologic sequelae
Muñiz & Evans <sup>22</sup> (2000)	—	8	M	NA	Virginia	1	T8–T9	Paronychia	Normal	Yes	Yes	NA	Open incision and drainage	Open incision and drainage	IV amphotericin B, NS dose × 4 wk Ketoconazole, NS dose × 6 mo	No complications
Parr & Fewer <sup>24</sup> (2004)	—	14	F	Caucasian	Manitoba	14	T12–L1, intramedullary	NA	Unilateral pneumonia	NA	None	NA	Sputum culture	T12–L1 laminectomy, midline myelotomy, resection of abscess	Itraconazole 200 mg/d × 5 mo before spine involvement IV amphotericin B, NS dose × 7 wk	Mild weakness in right ankle dorsiflexion, but improving
Akhtar et al <sup>1</sup> (2006) <sup>a</sup>	—	28	F	NA	NA	NA	Lumbar	NA	NA	NA	NA	NA	FNAB of breast abscess	NA	NA	NA
Gottlieb & Eismont <sup>11</sup> (2006)	—	64	F	NA	South America	NA	T5–T6	None	NA	NA	Yes	NA	Large core-biopsy and FNAB	None	IV amphotericin B, NS dose × 4 wk Itraconazole 400 mg/d × 6 mo	No complaints, no spine pain; complete resolution of paraspinal abscess
Mahiquez et al <sup>19</sup> (2008)	—	37	F	Arabian	Saudi Arabia	24	L2–S1	Fistulae	NA	NA	Yes	NA	CT-guided percutaneous drainage	CT-guided percutaneous drainage	IV amphotericin B 700 mg/d <sup>a</sup> Itraconazole, NS dose <sup>a</sup>	Low-grade back pain
Present case report	—	30	M	Black	Kentucky	2	T11–T12	None	No	No	Yes	Negative	Known case of pulmonary blastomycosis	Corpectomy T11, rib grafting, posterior instrumentation and fusion	Itraconazole 200 mg/d × 6 mo	Low-grade back pain

Abbreviations: HIV, human immunodeficiency virus; NA, not applicable; CT, computed tomography; FNAB, fine-needle aspiration biopsy; IV, intravenous; NS, not specified.

<sup>a</sup>Length of administration was not specified.