Extensive Erosion of Vertebral Bodies Due to a Chronic Contained Ruptured Abdominal Aortic Aneurysm

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ABSTRACT

This report describes a case of chronically ruptured abdominal aortic aneurysm contained within the lumbar vertebral bodies that presented with dull abdominal pain. Sudden, massive hemorrhage is an uncommon, yet well-known complication of an untreated abdominal aortic aneurysm. In addition, misleading clinical and radiological findings present difficult diagnostic challenges in such cases. This report emphasizes the findings obtained with multidetector computed tomography and delineates the differentiation of this condition from similar pathologies.

CASE REPORT

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Clinical History

A 66-year-old man was admitted to our emergency department with exacerbated back pain, lower left quadrant pain, and unsteady gait. He had no previous surgical history. His physical exam revealed a heart rate of 62 beats/minute, blood pressure of 160/90 mm Hg. Laboratory findings revealed a hemoglobin level of 11.4 mg/dL (normal value range: 12.1–15.1 mg/dL). The patient's medical history included hypertension, dyslipidemia, and atherosclerotic peripheral arterial disease.

Imaging Findings

The patient underwent a 64-slice multi-detector computed tomography (MDCT) examination that revealed a large infrarenal fusiform retroperitoneal abdominal aortic aneurysm (AAA), measuring approximately 10.0 x 10.0 cm at its transverse diameter and extending 10.0 cm inferiorly from the emergency of the renal arteries (Fig. 1). Heterogeneous hypodense material was seen on the lesion walls, which nearly covered its entirely circumference, compatible with mural thrombus (Fig. 1, 2), resulting in a maximum true transverse aorta luminal diameter of 7.2 cm. The aneurysm had also anteriorly displaced the celiac trunk and the superior mesenteric artery (Fig. 1).

The posterior aspect of the aneurysm wall had irregular contours and partially surrounded the spine. There was extensive erosion of the T11, T12, and L1 vertebral bodies (Fig. 1). These erosions had sharp edges, and smooth, and somewhat, sclerotic contours, suggesting a chronic process. The posterior wall of the aorta was partially identifiable, following closely the contour of the adjacent vertebral bodies to form a sign known as the "draped aorta", which is highly indicative of aortic wall deficiency and a contained leak. We noticed that some of the contrast media had indeed leaked beyond the borders of the posterior aneurysm wall (Fig. 1) and was in close contact with the vertebral bodies, thus increasing the suspicion of a chronic contained rupture (Fig. 2). The three-dimensional volume-rendered CT images show it in detail (Fig. 3).

Management

Given the tomographic findings and the patient's clinical symptoms, severe back pain was thought to result from

vertebral erosions due to a chronic ruptured, sealed aortic aneurysm. A laparotomy was performed via a transperitoneal midline approach, and the aneurysm was resected. Aortic repair was accomplished via a polytetrafluoroethylene tube graft (Fig. 4) placement and subsequent reimplantation of the celiac trunk, mesenteric, and renal arteries (Fig. 5). Microbial cultures were negative. The patient had a good postoperative outcome, with no signs of infection. He initially received a lumbar-supportive belt, and posteriorly referred to an orthopedic surgeon.

Follow-Up

A subsequent lumbar arthrodesis was performed. Unfortunately, the patient was lost to follow-up, as he did not return to any of his appointments.

DISCUSSION

Etiology & Demographics:

Vertebral body erosion due to a primary chronic ruptured aortic aneurysm is an uncommon but important cause of low back pain. A MEDLINE literature search of this condition consisted mainly of case reports. The majority of cases involved secondary aortic aneurysms, such as Behçet's disease [1], mycotic aneurysm [2], or false aneurysm [3].

Vascular lesions observed in Behçet's disease include venous thrombosis (the most common finding), arterial thrombosis, and aneurysm, although the latter is the least common complication described in the literature [1]. Mycotic aneurysms are usually more common in elderly patients with atherosclerosis, or in patients with diabetes mellitus, recurrent urinary tract infections, and immunodeficiencies [2]. False aneurysms may develop in patients who have undergone abdominal aneurysmectomy and graft replacement at the anastomotic site of the aorta [3]. Aortic grafting with silk sutures, which was a standard practice prior to the introduction of Dacron sutures, appears to increase the likelihood of this complication [3].

Aneurysms can be classified as true or false. In a true aneurysm, all three layers of the vessel wall are present (intima, media, and adventitia), whereas in a false aneurysm, or pseudoaneurysm, an opening in one of the vessel wall layers allows the leakage of blood through its wall, which is subsequently contained by scar tissue or the adventitia itself. This last type of aneurysm is usually caused by trauma or prior surgery.

They may also be classified according to its shape as fusiform, in which all sides of the vessel are bulged, or saccular, in which only one of its sides bulges. The fusiform type is remarkably more common, comprising roughly 80% of all cases.

Clinical & Imaging Findings:

Apter et al [4] published a large review of vertebral body erosion due to a primary chronic ruptured aortic aneurysm, in which he discussed the draped aorta sign, initially described by Halliday et al [5], and its utility for diagnosing this condition. This imaging finding was observed in all six patients with a contained leak, and in only one of the 68 controls [4]. Furthermore, the draped aorta sign can differentiate a contained rupture from both an uncomplicated AAA and a frank rupture. The latter may be suspected when overt contrast media leakage through the retroperitoneal tissue is observed.

In these cases, a high attenuating crescent sign is caused by blood leakage through the mural thrombus, indicating imminent rupture [6]. Unenhanced CT should be performed first, since it is able to reveal acute bleeding through the mural thrombus. It can also distinguish between an intramural thrombus of an aortic aneurysm and a chronic aortic dissection with a thrombosed false lumen, considering that in atherosclerosis-related thrombus, calcifications are typically seen on the external edge of the vessel wall, whereas in aortic dissection, these calcifications are centrally displaced.

The draped aorta sign was considered in this case because a distinct line between the posterior aorta and adjacent structures was not identifiable, additionally to the fact that the posterior aorta followed the vertebral contour. This sign is considered to be specific to a chronically ruptured aneurysm [4,5]. Another specific imaging finding observed in this case were smooth and well-corticated vertebral erosions with sclerotic borders, usually caused by aneurysms secondary to chronic repetitive arterial pulsations. Furthermore, we also observed blurring of the iliopsoas contours, which was probably caused by small vascular leaks [4].

Additional important and common imaging findings in chronic contained aneurysms, such as, soft tissue density adjacent to the aorta, discontinuity of the rim of calcification in the arterial wall, displaced abdominal structures, and lack of contrast material appearance in the mural hematoma are also helpful for the diagnosis, all of which, were observed to some extent, in the present case.

Treatment & Prognosis:

Surgery is important for the prevention of a potentially life-threatening rupture and progressive vertebral destruction. Yamamoto et al. reported a case in which a good outcome and remission of the inflammatory findings were achieved 1 month postoperatively [7]. Jones et al. reported that the postoperative survival rate associated with chronic contained rupture was similar (approximately 100%) for patients who underwent elective repair or urgent repair [8]. Notably, the mortality rates reported in the literature depended on a prompt diagnosis because frank ruptures require emergent care, whereas chronic, contained ruptures can be dealt via urgent treatment.

The clinical aspects observed in our case were also similar to those described in the literature [9-11]. Back pain, unsteady walking, arterial hypertension, and hypercholesterolemia were observed in all patients in the related studies. Other referred symptoms included lower extremity neuropathy and obstructive jaundice [12,13,14].

A possible explanation for the mechanism of this pathology is that in larger aneurysms, the sac incites a

perianeurysmal reaction along with vertebral tamponade as it increases in size [4], thus causing erosion. In our case, the aortic rupture site on the posterior wall corresponded to the site identified in most previous reports, although not as extensive as identified in our case.

Differential Diagnoses:

Several diseases could present themselves as retroperitoneal masses with vertebral erosions, including primary and metastatic retroperitoneal tumors, in which case a mass would displace retroperitoneal organs [15]. Retroperitoneal tumors may cause some adjacent structures to vanish as the mass expands, which is called the "phantom organ" sign. Enhanced-CT scan usually demonstrates the non-vascular origin of such lesions.

Vertebral fractures caused by tumors can be associated with erosion of the cortical and medullar bone, but they are also associated with soft tissue masses, expliciting the correct diagnosis.

Inflammatory conditions such as Behçet's disease, ankylosing spondylitis, and SAPHO syndrome (synovitis, acne, pustulosis, hyperostosis, osteitis) also can cause vertebral erosions, but they tend to involve only the "corners" of the vertebral bodies.

Pyogenic spondylodiscitis, and mainly, non-pyogenic spondylodiscitis, such as tuberculous spondylitis (TB; Pott's disease), may induce the formation of large abscesses and bone erosions, however, they normally present irregular and poorly defined margins, and secondly, the epicenter of the process is centered on the disc and adjacent vertebral plates [16].

Other less common infectious spondylodiscitis, like syphilitic spondylitis can also manifest with aneurysms and osseous erosions caused by syphilitic gummas, although rare. A recent publication, performed a systematic review of the English literature from 1964 to 2013, and retrieved only 37 cases of secondary syphilis with bone involvement [17]. And in this particular case, close clinical correlation and laboratory findings would be mandatory for the correct diagnosis.

Retroperitoneal abscess and psoas hematoma may also present with vertebral erosions; in such cases, unenhanced-CT scan would be helpful in differentiating these two conditions, as hyperdense fluid is usually observed in an acute hematoma.

In summary, despite the fact that numerous pathologies can come out as a retroperitoneal mass with associated vertebral body erosion, prompt identification of the aortic origin of the lesion through contrast enhanced-CT scan is of greatest importance to reach a definitive diagnosis.

TEACHING POINT

Chronically ruptured abdominal aortic aneurysm can give rise to severe erosions of the thoracic and lumbar vertebral bodies and may inadvertently be mistaken for other etiologies. For a differential diagnosis, the identification of the aortic origin of such masses using contrast MDCT and imaging findings, such as the "draped aorta sign and the sharp and well-corticated edges of the osseous erosions, is highly important.

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FIGURES

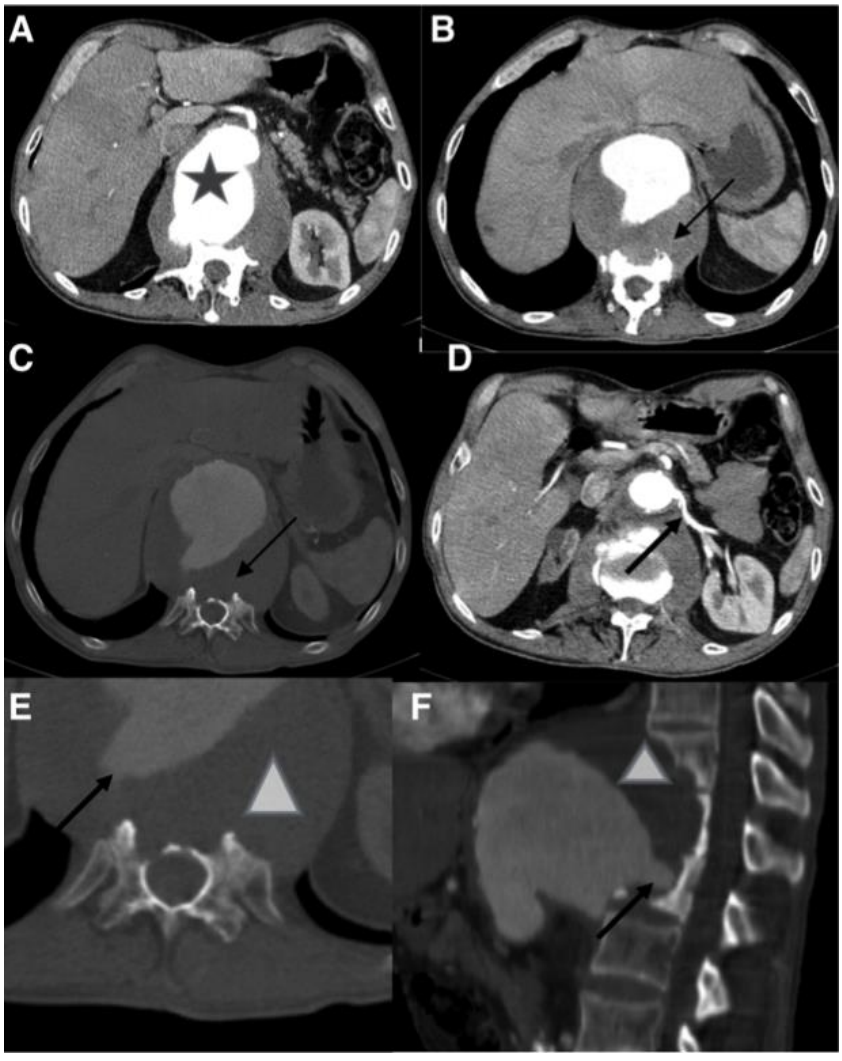

Figure 1: A 66-year-old male with a chronic ruptured abdominal aortic aneurysm.
TECHNIQUE: Axial computed tomography (CT; Philips Brilliance 64; Philips Healthcare, Best, The Netherlands) with the following parameters: 1 mAs, 120 kV, 2-mm slice thickness, 150 ml of non-ionic contrast media (Ultravist®).
FINDINGS: Axial contrast-enhanced CT at the T12 level demonstrates a large aortic aneurysm (star in A) with bone (C, E and F) and soft tissue windows (A, B and D), measuring approximately 10 x 10 x 10 cm, that extended inferiorly from the emergence of the renal arteries (arrow in D). The aneurysm has irregular posterior margins, non-noticeable posterior wall, partially encasing the vertebral body, and associated with extensive vertebral erosions (arrows in B and C). Detailed axial and sagittal reformatted contrast-enhanced CT images at the same level (E and F, respectively) shows a large area of hypodense material within the aneurysm wall (triangles in E and F) compatible with a mural thrombus. The irregular contour of the posterior aortic wall is clearly demonstrated by contrast media that had partially leaked, close to the vertebral body (arrows in E and F).

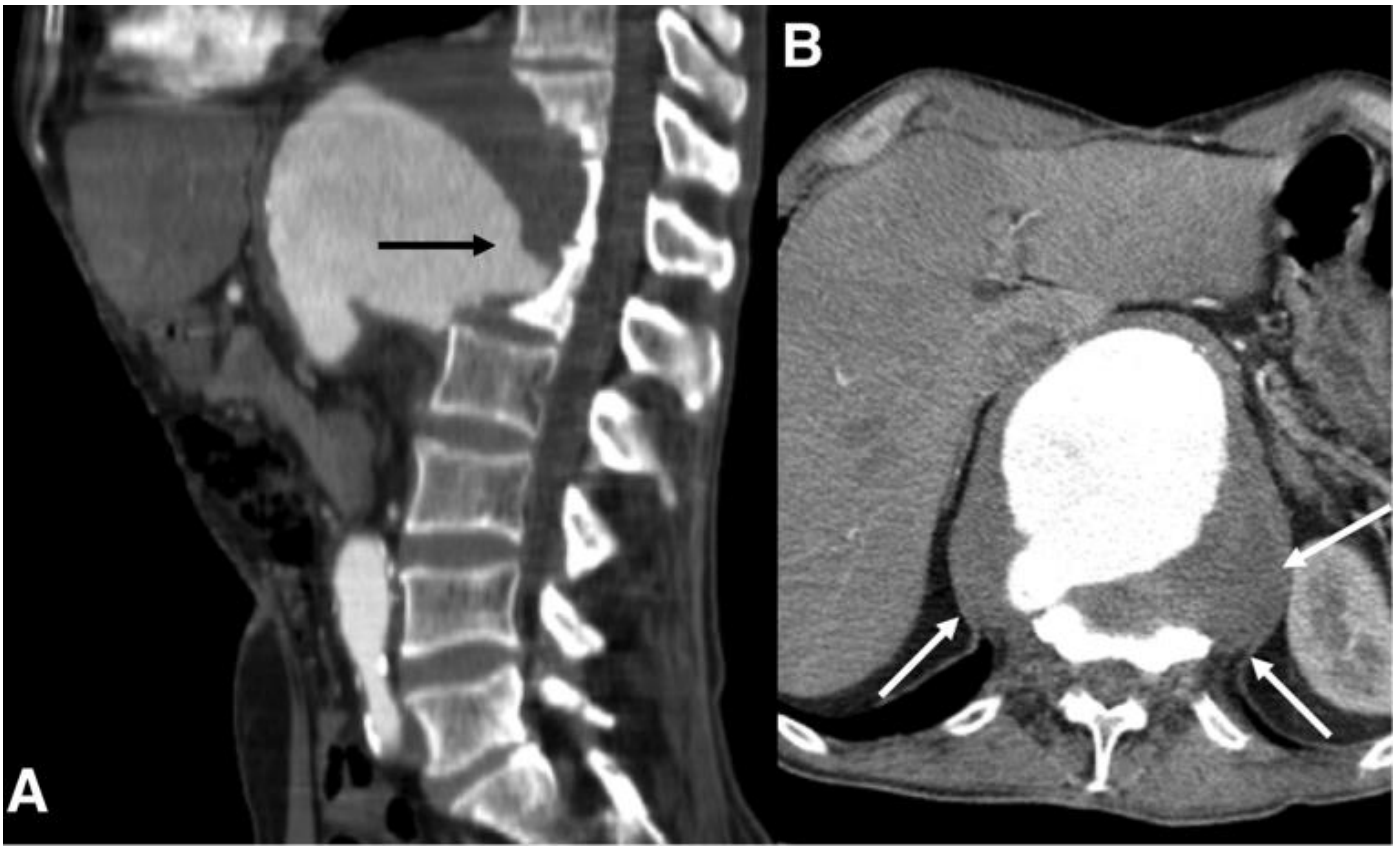

Figure 2: A 66-year-old male with a chronic ruptured abdominal aortic aneurysm.
TECHNIQUE: Contrast-enhanced computed tomography (CT; Philips Brilliance 64; Philips Healthcare, Best, The Netherlands) with the following parameters: 1 mAs, 120 kV, 2-mm slice thickness, 150 ml of non-ionic contrast media (Ultravist®).
FINDINGS: A sagittal-plane reformatted, contrast-enhanced CT scan showing the extension of the vertebral erosion (arrow in A). The posterior margin of the aorta abuts and follows the contour of the eroded vertebral body (arrows in B) to form the "draped aorta sign".

Figure 3 (left): A 66-year-old male with a chronic ruptured abdominal aortic aneurysm.
TECHNIQUE: Contrast-enhanced computed tomography (CT; Philips Brilliance 64; Philips Healthcare, Best, The Netherlands) with the following parameters: 1 mAs, 120 kV, 2-mm slice thickness, 150 ml of non-ionic contrast media (Ultravist®).
FINDINGS: Obliquely oriented three-dimensional volume-rendered CT images displaying the full extension of the aneurysm and erosion of the vertebral bodies. Note that the posterior aspect of the aneurysm partially follows the contour of the eroded vertebral bodies (arrows).

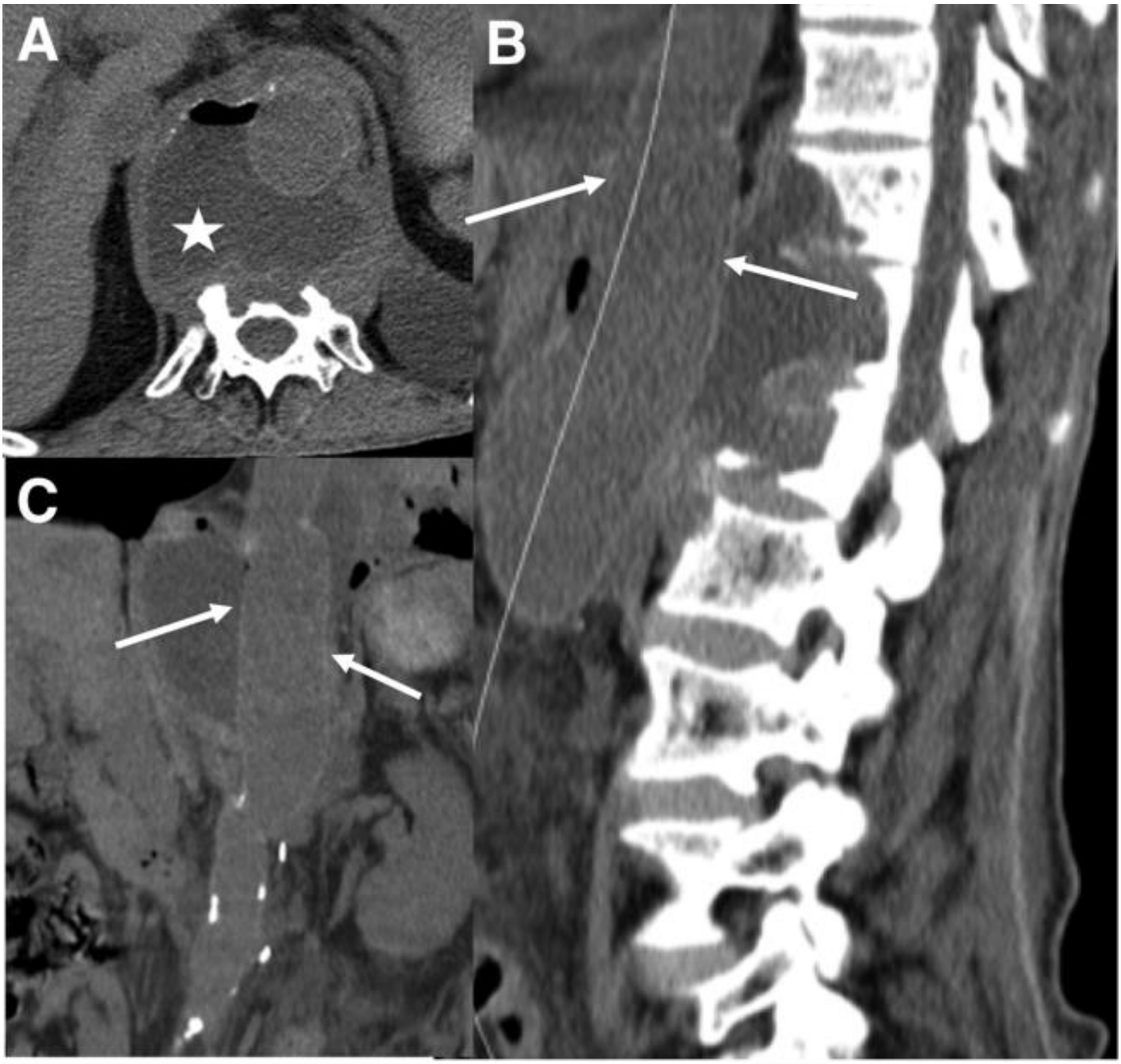

Figure 4: A 66-year-old male with a chronic ruptured abdominal aortic aneurysm.
TECHNIQUE: Unenhanced computed tomography (Philips Brilliance 64; Philips Healthcare, Best, The Netherlands) with the following parameters: 1 mAs, 120 kV, 2 mm slice thickness.
FINDINGS: An axial-plane image (A) collected in the immediate postoperative period demonstrates the reconstructed aorta with a polytetrafluoroethylene tube graft in the center, surrounded by liquid (star). Sagittal-plane (B) and coronal-plane (C) reformatted images showing the tube graft within the true lumen of the aorta (arrows).

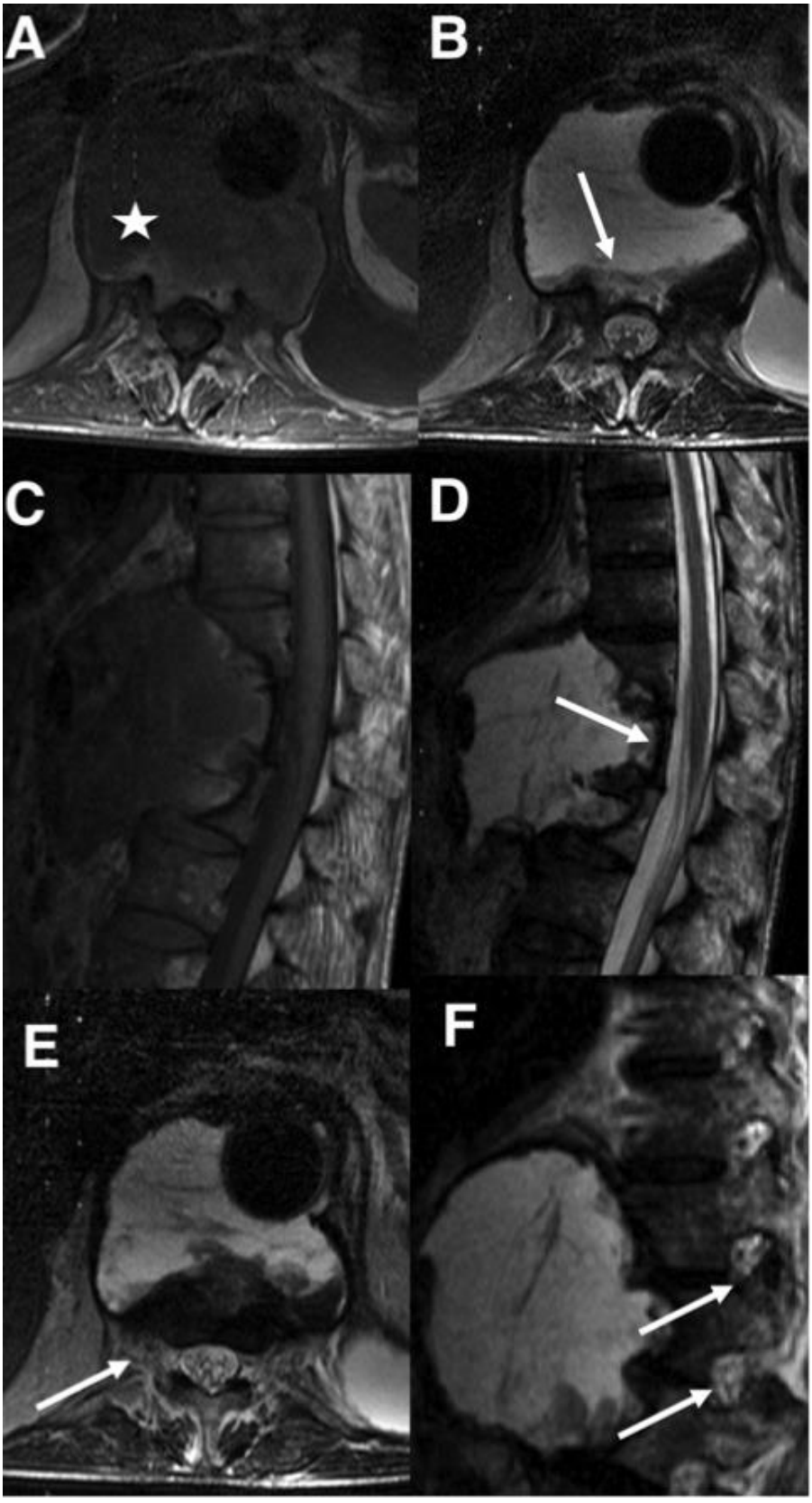

Figure 5: A 66-year-old man with a chronic ruptured abdominal aortic aneurysm.
TECHNIQUE: Magnetic resonance (MR) imaging (Magnetom; Siemens AG, Munich, Germany). Axial (A) and sagittal (B) fast-spin-echo T1- and T2-weighted 1.5-T images were obtained with the following parameters: repetition time 6000 ms/ echo time 109 ms; 20 cm × 24.3 cm field of view; matrix, 320 × 230; 4-mm slice thickness; 1-mm gap.
FINDINGS: Axial T1-weighted postoperative MR image (A) reveals the reconstructed aorta surrounded by liquid (star). Axial T2-weighted image (B) shows a high level of vertebral erosion that spared the vertebral canal and spinal cord (arrows). Sagittal T1 (C) and T2-weighted (D) postoperative magnetic resonance (MR) images shows in detail the extension of the vertebral erosion and the thin posterior remaining plate. Axial (E) and sagittal T2-weighted (F) magnetic resonance (MR) images point out the vertebral foramina (arrows) that were not affected by the erosions.

Etiology	Possible mechanism: perianeurysmal reaction and vertebral tamponade; direct contact between the vertebral body and blood; repetitive compression from the pulsatile mass
Incidence	Uncommon but not rare. A moderate number of case reports can be found in the literature.
Clinical findings	Most common: dull and chronic abdominal or back pain Less common: lower extremity neuropathy and obstructive jaundice
Risk factors	Hypertension, hypercholesterolemia
Treatment	Surgery via an open or endovascular approach
Prognosis	If detected and repaired, similar to that associated with electively repaired aortic aneurysms
Imaging findings	Draped aorta sign, vertebral erosion, mural thrombus

Table 1: Summary table for chronic contained ruptured abdominal aneurysm.

	X-Ray	CT	MRI	Contrast
Retroperitoneal tumors	Paravertebral soft tissue hyperdensity	Anterior displacement of retroperitoneal organs and retroperitoneal vessels	Variable, depends on the tumor component (fat, myxoid, necrosis, cystic)	Variable
Vertebral Fracture caused by tumor	Vertebral collapse	Associated mass	Associated mass	Heterogeneous
Behçet's disease	Small vertebral corner erosion	Small vertebral corner erosion	Vertebral corner lesion (enthesitis)	Avid in active phase
Ankylosing Spondylitis	Vertebral corner squaring, Sacroiliac erosions	Vertebral corner squaring, Sacroiliitis	Sacroiliitis, Vertebral corner lesion (enthesitis)	Avid in active phase
SAPHO syndrome	Hyperostosis, Osteitis, Vertebral corner erosion	Hyperostosis, Osteitis, Vertebral corner erosion	Vertebral corner lesion (enthesitis), nonspecific spondylodiscitis,	Variable
Spondylodiscitis	Bone erosion and loss of disc high, abscesses	Bone erosion with irregular and poorly defined margins, Periaortic gas	High T2 and low T1, abscess	Heterogeneous or peripheral (abscess)
Pott's Disease	Vertebral erosion, calcifications, preservation of disc high	Large abscesses with subligamentous extension	High T2 and low T1, paraspinal abscess,	Peripheral (abscess) or heterogeneous (bone)
Syphilis	Bone erosion with irregular and poorly defined margins	Bone erosion with irregular and poorly defined margins	Nodular spinal cord masses and sclerotic or lytic bone lesions	Heterogeneous
Retroperitoneal abscess and psoas hematoma	Bone erosion Paravertebral soft tissue hyperdensity	Unenhanced CT with hyperdensity fluid (hematoma in acute phase)	Variable	Abscess shows peripheral enhancement

Table 2: Differential diagnosis for chronic contained ruptured abdominal aneurysm.

ABBREVIATIONS

AAA = abdominal aortic aneurysm
MDCT = multi-detector computed tomography
SAPHO syndrome = synovitis, acne, pustulosis, hyperostosis, osteitis
TB = tuberculous
ER = emergency room

KEYWORDS

Abdominal aortic aneurysm; ruptured aneurysm; vertebral body erosion; MDCT

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