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Case Report

Retroperitoneal arterial bleeding caused by an undisplaced conservatively treated hyperextension injury of the lumbar spine – A case report

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ABSTRACT

Background: Hyperextension fractures of the thoracolumbar spine are commonly seen in ankylotic disorders due to the rigidity of the spine. The known complications include instability, neurological deficits and posttraumatic deformity but there is no report of a hemodynamic relevant arterial bleeding in undisplaced hyperextension fractures. An arterial bleeding poses a life-threatening complication and may be difficult to recognize in an ambulatory or clinical setting.
Case presentation: A 78-year-old male was brought to the emergency department after suffering a domestic fall with incapacitating lower back pain. X-rays and a CT scan revealed an undisplaced L2 hyperextension fracture which was treated conservatively. 9 days after admission, the patient complained about unprecedented abdominal pain with a CT scan disclosing a 12 × 9 × 20 cm retroperitoneal hematoma on grounds of an active arterial bleeding from a branch of the L2 lumbar artery. Subsequently, access via lumbotomy, evacuation of the hematoma and insertion of a hemostatic agent was performed. The therapy concept of the L2 fracture remained conservatively.
Conclusions: A secondary, retroperitoneal arterial bleeding after a conservatively treated undisplaced hyperextension fracture of the lumbar spine is a rare and severe complication that has not been described in literature yet and may be difficult to recognize. An early CT scan is recommended in case of a sudden onset of abdominal pain in these fractures to fasten treatment and hence decrease morbidity and mortality. Thus, this case report contributes to the awareness of this complication in a spine fracture type with increasing incidence and clinical relevance.

Background

Injuries of the thoracolumbar spine are mostly due to hyperflexion, compression and shearing forces like rotation and distraction [1]. Whereas in younger patients, a high energy trauma like a fall from a greater height or a motor bicycle accident is the main cause for a thoracolumbar vertebral fracture, a low energy trauma, like a domestic fall, is often sufficient for the older population to sustain a

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vertebral fracture [2].

Hyperextension fractures (AO Spine-B3) are a rare entity which can be classified through the AO Spine classification [1] and are mainly seen in ankylotic disorders like ankylosing spondylitis and disseminated idiopathic skeletal hyperostosis (DISH) [3]. The morphology can be transosseus or transdiscal [3]. The known and frequent complications of vertebral fractures include neurological deficits in up to 40 % of the cases [4,5] and around 23 % in thoracolumbar hyperextension injuries [3]. Further complications are kyphosis, persisting pain [6] and secondary deep venous thrombosis with possible pulmonary embolism [7].

A retroperitoneal arterial bleeding after a conservatively treated hyperextension fracture of the lumbar spine is a severe and life-threating complication and may be difficult to recognize in an ambulatory or clinical setting. As the mentioned complication has not been described in literature yet, our case report contributes to its knowledge. This might be relevant to all disciplines, as patients with this fracture type often stay as outpatients. Moreover, hyperextension injuries appear in rigid spines and as there is an undisputed correlation between DISH, metabolic disorders and age [8], hyperextension fractures are continuously increasing in the aging population of the western world and so must our knowledge of their complications.

Case presentation

A 78-year-old male was brought to the emergency department suffering incapacitating lower back pain after he had tripped and fallen in his domestic bathroom. The physical examination including a body check was unremarkable, showing no tenderness upon percussion on the whole spine and no signs of sensomotoric deficits of the lower extremities.

Past medical history included an ICD implantation as a consequence of atrial fibrillation with absolute bradyarrythmia, an evacuation of a hematoma 6 days after the ICD implantation, anticoagulation with Warfarin®, a former bone mineral density measurement with the result of an osteopenia and a wedged L1 due to a former fracture.

Initial conducted radiographs displayed a suspected superior endplate impression of T12 and L1 along with a listhesis of L3/L4 (Fig. 1). As there were no clear diagnostic findings for the patient's symptoms, a CT-scan was carried out revealing a transosseus hyperextension fracture of L2 (Fig. 2a). Two horizontal fracture lines could be distinguished in the axial slices: The first line went from right lateral through the vertebral body towards the neuroforamen and pedicle ending at the posterior edge (Fig. 2b). The second line went from left lateral caudal through the vertebral body towards the superior endplate (Fig. 2c). Overall, the fracture lines went from ventral caudal to dorsal cranial through the vertebral body without displacement of the posterior edge. Secondary findings were degenerative changes affecting the whole spine in terms of a spondylosis deformans: syndesmophytes, calcification of the anterior longitudinal vertebral ligament, multiple endplate depressions, calcification and vacuum phenomenon in multiple disc spaces, listhesis of L3 against L4 and a bland colon diverticulosis.

Subsequently, the patient was admitted to the ward to execute a conservative therapy plan including mobilization, physiotherapy and pain therapy under periodic X-ray control of the affected vertebrae. Anticoagulation with Warfarin® was paused and bridged with

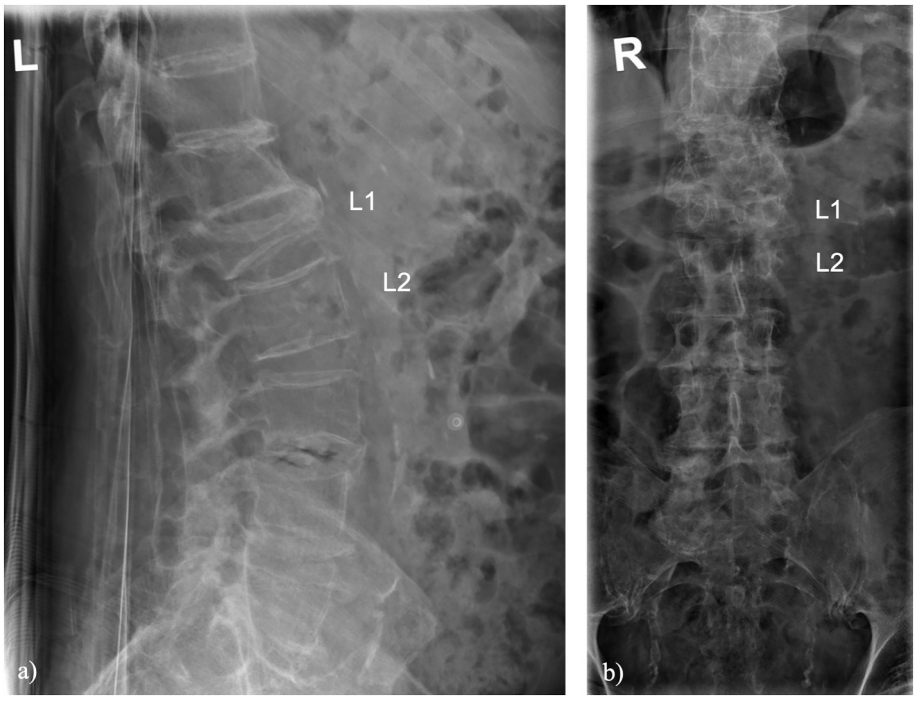

Fig. 1. Initial radiographs of the lumbar spine as the patient presented in the emergency department. a) Lateral radiograph of the lumbar spine which revealed a wedged L1 and a listhesis of L3 against L4. b) Corresponding a.p. radiograph.

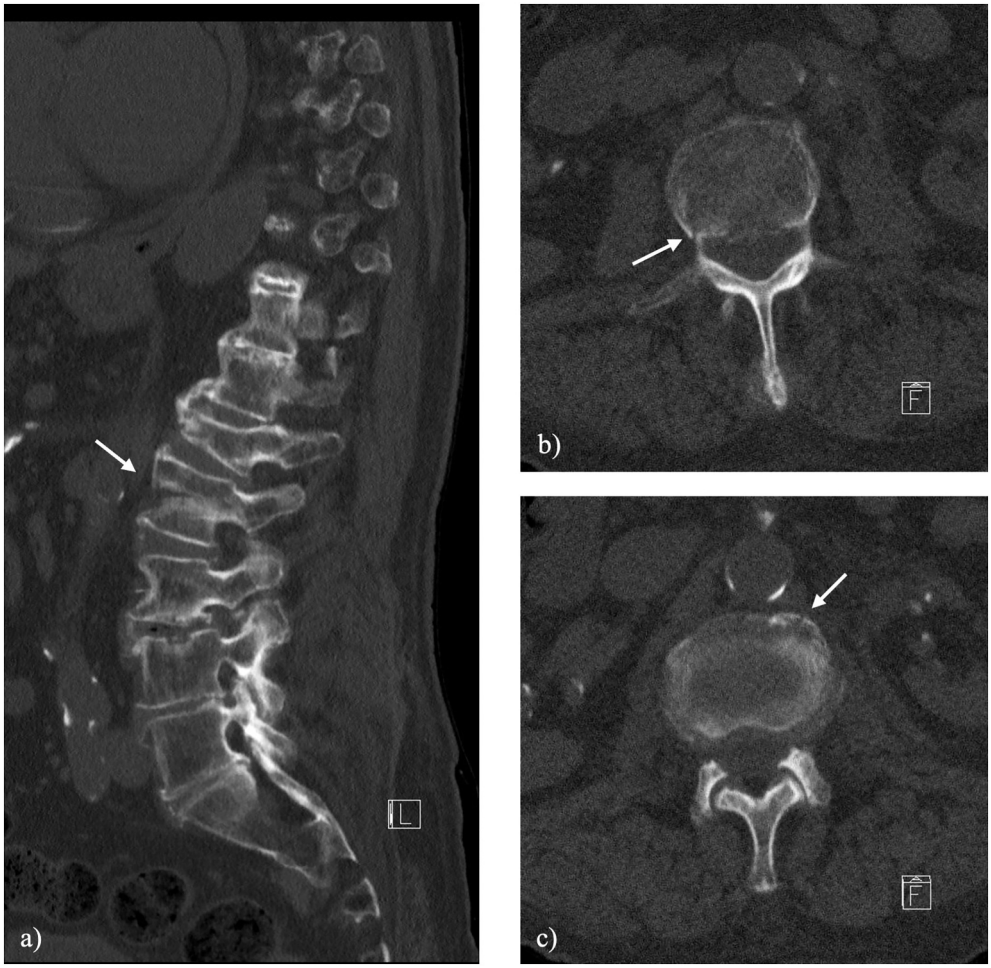

Fig. 2. a) Sagittal slice of the initial CT scan of the lumbar spine. A transosseus gap of L2 is visible, consistent with a hyperextension fracture (arrow). Additionally, a bony bridging of T11-L1 is revealed. b), c) Axial slices of the superior endplate of L2 in the initial CT scan. Two fracture lines can be distinguished, one running from right lateral to the pedicle and neuroforamen (arrow in b), the other running from left lateral caudal to the superior endplate (arrow in c).

Enoxaparin®.

In the night of the 9th day after admission, the patient complained about new severe pain in his left lower abdomen. The conducted abdominal ultrasound showed no free abdominal fluid and a diverticulosis of the sigmoid colon without any proof of inflammatory changes in the visible ventral colon parts. An abdominal CT-scan was recommended in case of symptom progression. The next morning, the patient had collapsed on the ward. The emergency laboratory values showed a decrease of the hemoglobin from 9.9 mg/dl (the day before) to 7.7 mg/dl, an INR of 1.76, a Partial Thromboplastin Time (PTT) of 42.6 s and thrombocytes of 208,000/µl. An emergency abdominal CT scan demonstrated a retroperitoneal hematoma mainly on the left side dorsal of the left kidney. The arterial contrast phase showed an active bleeding, presumably from a branch of a lumbar artery at the level of the L2 superior endplate (Fig. 3a). The left kidney was compressed and ventrally dislocated by the hematoma (Fig. 3b), whose axial dimensions were approximately 12 × 8.5 cm and from cranial to caudal approximately 20 cm. Compared with the initial CT scan at admission (Fig. 2a), the posterior edge of L2 was depressed from 3 to 2.5 cm without any stenosis of the spinal canal (Fig. 3c).

As an angiographic intervention with embolization or coiling was technically not possible, access to the hematoma was gained via lumbotomy. Next, evacuation of the hematoma, which presented intraoperatively partially liquid and partially solid at a volume of approximately 1.5 l, was performed and diffuse bleeders were coagulated with the bipolar forceps. TABOTAMP® hemostat (Ethicon, Somerville, NJ, USA), one retroperitoneal Robinson's drainage and one subcutaneous redon drainage were inserted. Blood clotting values were adjusted postoperatively by giving Prothrombin Complex Concentrate resulting in an INR of 1.20 and a PTT of 37.3 s. Unfractionated heparin was given continuously with an infusion pump adjusted to body weight while Enoxaparin® and Warfarin® remained paused. Therapy of the L2 hyperextension fracture was continued conservatively.

Postoperative sonographic controls showed no hematoma relapse and lateral X-rays demonstrated a stable impacted L2 with a constant height of approximately 2.5 cm. The Patient could be discharged 15 days postoperatively being pain controlled and mobile on

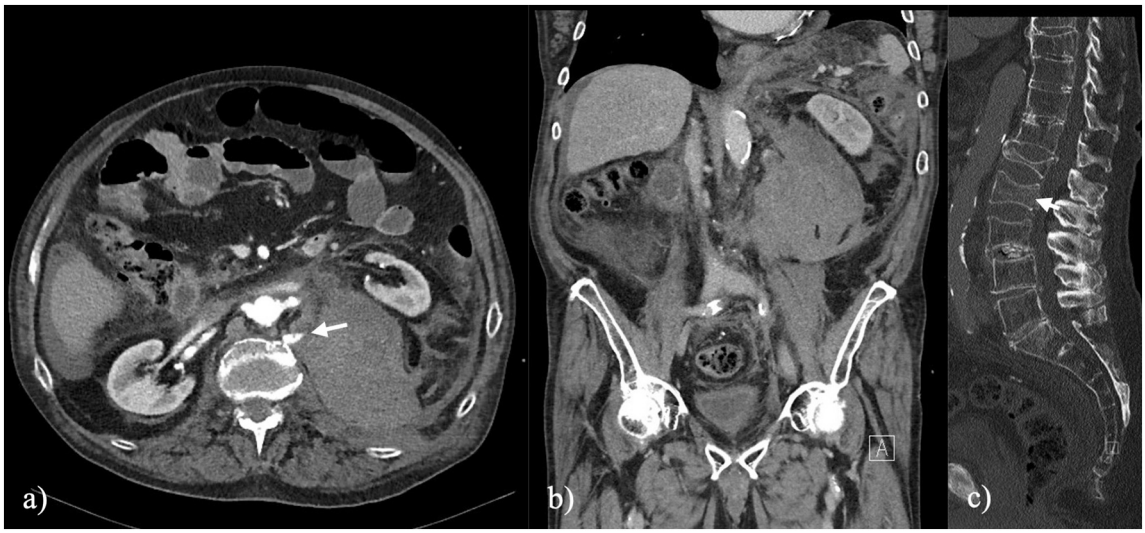

Fig. 3. CT scan after the patient's hemoglobin had decreased by 2.2 mg/dl revealing a retroperitoneal hematoma. a) Active arterial bleeding at the height of the L2 superior endplate (arrow). Axial dimensions of the hematoma were approximately 12 × 8.5 cm with ventral dislocation of the left kidney. b) Craniocaudal dimensions of approximately 20 cm with compression of the left kidney. c) The further height loss of the posterior edge of L2 from 3 cm (compare Fig. 2a) to 2.5 cm (arrow) could be measured together with a closing of the hyperextension gap.

the ward without any further complications.

Discussion

Regardless of the fracture morphology, common complications after thoracolumbar vertebral fractures include transient or persistent neurological deficits due to compression of the spinal canal. Hsu et al. described this type of complication with an incidence

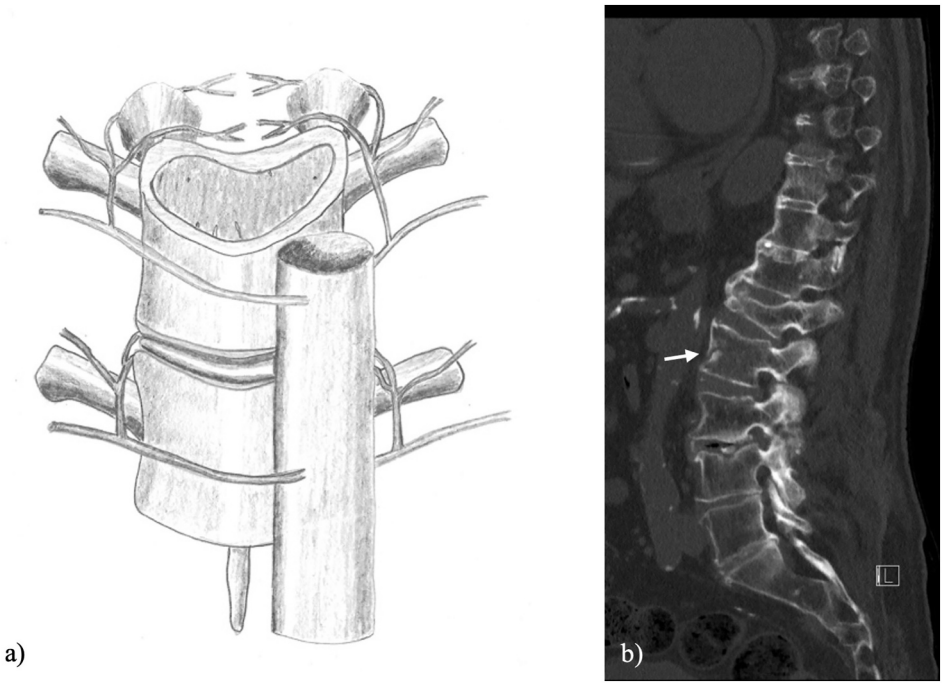

Fig. 4. a) For each lumbar vertebrae, a pair of lumbar arteries occur directly from the abdominal aorta to ensure the blood supply of L1 to L4. Every lumbar artery runs along the ventral vertebral body and divides at the height of the intervertebral foramen into a lateral and dorsal ramus. The latter divides further into a medial and spinal ramus. b) As the arterial bleeding was primarily on the left side, it could be possible that the left fracture line (arrow) damaged the left dorsal ramus or a more distal part of it.

of 21 % to 42 % [4] and Balling et al. in a series of 23 thoracolumbar hyperextension injuries with 23 % [3]. Further complications include radiculopathy [9], vertebral height loss with subsequent kyphosis [6], persisting pain [10], quality of life reduction [11] and secondary deep vein thrombosis, pulmonary embolism, pneumonia and decubitus [7].

Rare complications already described in literature include arterial bleeding after kyphoplasty [12], ureteral impingement after a hyperextension injury of the lower lumbar spine [13] and epidural hematoma after a hyperextension injury of C6–C7 [14]. To the best of our knowledge, a retroperitoneal arterial bleeding with a subsequent hematoma after a conservatively treated undisplaced hyperextension injury of the lumbar spine has not been described in literature yet.

Anatomically, four pairs of lumbar arteries from the abdominal aorta pass horizontally around the vertebral body of L1 to L4 and divide into several branches at the intervertebral foramen (Fig. 4a). Each lumbar artery divides into a dorsal ramus, which further divides into a spinal ramus. That spinal ramus enters the spinal channel for the blood supply of the spinal ganglion and the spinal cord. A medial ramus passes backwards, closely to the lamina and spinous process, supplying the paraspinal muscles in which it ascends and descends. A lateral ramus passes along ventrally to the transversus process of the vertebrae supplying paravertebral muscles.

As the emergency CT scan showed, the bleeding seemed to be not directly from a lumbar artery but from a more distal branch of it (Fig. 3a). We can only hypothesize that the left fracture line, which seemed to be located near the bleeding in the axial CT slices (Figs. 2c, 3a), damaged the arterial wall of a medial or lateral ramus and caused the bleeding.

Oh et al. described a L4 hyperextension fracture in which the right ureter was impinged in the transosseus fracture gap [13]. Therefore, an alternative explanation could be that a branch of the lumbar artery was impinged in the fracture gap and started bleeding as the gap closed during mobilization of the patient. Consequently, orthopedic trauma surgeons and other disciplines should be aware that a transosseus or transdiscal gap emerges in hyperextension injuries which can impinge retroperitoneal structures like blood vessels or ureters.

Complicating matters further, the retroperitoneal hematoma was at first not recognized during the night as the symptoms were supposed to originate from a colon diverticulosis. For this very reason, knowledge of this rare complication is crucial to all medical disciplines to promote its rapid diagnosis and treatment. Retrospectively, the history of a former bleeding after an ICD implantation might have played a role, indicating a higher bleeding diathesis of the patient. However, as the laboratory results demonstrated, a dysregulated blood clotting seemed not to be the cause at the time of bleeding.

Conclusions

Based on the assumption that hyperextension injuries are mainly seen in ankylotic disorders, which will increase in the western world due to their correlation with higher age and metabolic disorders [8], the incidence of hyperextension injuries will increase as well.

Consequently, our awareness for possible complications in multimorbid patients and especially in cases where those complications are not easy to recognize must rise.

Not only the described fracture morphology, but all hyperextension injuries may bear the risk of an arterial bleeding or impingement of retroperitoneal structures. One should therefore be generous with early abdominal CT scans in patients with sudden abdominal pain after lumbar hyperextension fractures and a history of a bleeding diathesis. Knowledge of this severe complication is necessary to allow its early recognition and treatment to decrease morbidity and mortality.

Credit authorship contribution statement

RH and KF were the primary providers at patient's admission and at treatment of the described complication. RH shaped and designed the manuscript and PH and MH made the most significant contribution in writing the manuscript. SHD, RH and TH reviewed, edited and added specific clinical insights to the manuscript and correlated this case with other cases in literature and daily clinical practice. KF acquired, processed and edited the medical images. PH and MH draw the illustrations. All authors read and approved the final manuscript.

Declaration of competing interest

None.

Acknowledgements

None.

Ethics approval and consent to participate

Ethics approval was waived for this study being a case report by local ethics committee of the Faculty of Medicine of the University of Würzburg. An official statement is available upon request.

Consent for publication

Written informed consent was obtained from the patient for publication of the anonymized case report and any accompanying anonymized medical images. A copy of the written consent form is available for review upon request.

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Availability of data and materials

Only relevant excerpts of the patient's medical images (x-ray and CT-scans) and laboratory results were shown in this case report. Access to the full image series (x-ray, ultrasound and CT-scans) and laboratory results is not possible according to German law as the patient did not give permission to share his full medical records beyond this case report neither publicly nor under other health care professionals.

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