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Case Report

Four levels pedicle fractures in a renal failure patient: A case report and literature review

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ABSTRACT

Lumbar pedicles are wider than thoracic pedicles and L5 is considered the widest, which requires high-energy trauma to fracture. It is rare to have atraumatic lumbar pedicle fractures. However, it is reported mainly in predisposed patients, like those with contralateral spondylolysis, degenerative spondylolisthesis, previous spine surgery, stressful activities, and metabolic bone disease. We are reporting a rare case of a 37-year-old renal failure male patient who is an office worker who started dialysis only 1 month before the presentation. After a fall from the bed, the patient was found to have four levels pedicle fractures. We aimed to increase the awareness that lumbar pedicle fractures can coexist in patients with renal failure and increase the suspicion index that can promote early diagnosis and effective management.

Keywords: Pedicle, Renal dialysis, Spine fractures, Spondylolisthesis, Spondylolysis

INTRODUCTION

When comparing thoracic and lumbar pedicle width in the transverse plane, the L5 is considered the widest; hence, it requires high-energy trauma to fracture.[1,2] It is rare to have an atraumatic lumbar pedicle fracture, but it is possible in predisposed patients, as mentioned in many reports. Some reported cases with pedicle fractures were predisposed by contralateral spondylolysis or degenerative spondylolisthesis[3-10] by the previous spine surgical intervention[11-19] by stressful physical activities[5,20,21] or predisposed by metabolic bone diseases.[19,22-25] However, two reported cases of one-level pedicle fracture without significant trauma, previous surgical intervention, or a bony abnormality exist.[26,27]

Patients with renal failure have abnormal bone metabolism due to hormonal imbalance and it has been found that there is rapid cortical bone loss in patients with chronic kidney disease.[28] Reports found on pedicle fracture are unilateral, bilateral, and one or two levels in predisposed patients. No cases were found in renal failure patients, in early dialysis patients and only one case was found in long-term dialysis elderly patient with one level, unilateral pedicle fracture with isthmic spondylolisthesis.[29]

We aimed to increase the awareness that lumbar pedicle fractures can coexist in patients with renal failure and increase the suspicion index that can promote early diagnosis and effective management.

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CASE REPORT

A 37-year-old non-smoker male working in an office with no significant stressful physical activity. His medical history included high-grade chronic renal failure secondary to his Grade 3 vesicoureteral reflux. He was on hemodialysis 3 times weekly, starting 1 month before the presentation. He had no history of osteoporosis. Surgical history included bladder surgery as a child and appendectomy 20 years back. The patient presented with a history of a fall from the bed. After 17 h, the family noticed his long-time sleep and tried to knock on the door, but the patient did not respond, so they broke the door to wake him up. They found the patient lying on the floor. The patient mentioned feeling thrown from one side to another while sleeping. Then, his family members tried to stand him up, but he felt dizzy with severe low back pain and right hip pain. Then, the family transferred the patient to a local health facility.

During the initial evaluation, investigations confirmed Grade 5 end-stage renal disease. A consultation with the neurology team was done and the patient was diagnosed with seizure and started on anti-seizure medications. Furthermore, consultation with the neurosurgery team was done to evaluate the patient regarding his severe low back pain. Examination showed that the patient was neurologically intact with no deficit, so their initial plan was the need for further imaging, including computed tomography (CT) and magnetic resonance imaging (MRI). After imaging, the patient was diagnosed with a right displaced neck of femur fracture, comminuted greater trochanter (GT) fracture, and lumbar spine fracture. The patient was referred to our center for a higher standard of care.

About 11 days after the trauma, the patient was transferred to our hospital, with a medical report including his CT and MRI finding, which was bilateral pedicle fractures of L4 and L5 reaching the transverse process with the possibility of instability of the spine, along with the femur neck fracture.

Our spine surgery team was consulted regarding the bilateral pedicle of L4-5 fractures. On physical examination, the patient was lying on the bed in mild pain and traction on the right lower limb, conscious, alert, and oriented, with stable vitals and Glasgow Coma Scale 15/15, no neck tenderness with a full range of motion, and mild sacral tenderness (no lumbar tenderness). The power in both upper limbs and all muscle groups was 5/5, and in the left hip, knee, and ankle, it was 5/5. His right hip and knee could not be assessed due to hip fracture pain, but his ankle was 5/5, and the sensation was intact in all limbs. In addition, the reflexes were intact in all limbs, with normal downgoing Babinski, no clonus and negative Hoffmann sign. Initial suggestions included an urgent dorsolumbar radiograph, CT, and MRI before hip surgery.

Imaging studies for the patient included a right hip anteroposterior radiograph, which showed a femoral head fracture, displaced subcapital/transcervical femoral neck fracture, and comminuted GT fracture [Figure 1]. The lumbar radiograph showed the possibility of an L4-5 pedicle fracture [Figure 2]. The lumbar spine CT scan showed three levels (L3, 4, and 5) of unclassified bilateral pedicle fractures. T12 unilateral incomplete fracture of the pedicle and lamina was also noted [Figures 3-6]. MRI of the lumbar spine showed the same fractures with maintained alignment, no ligamentous injury or associated bone edema, suggesting that the fractures were chronic [Figures 7 and 8].

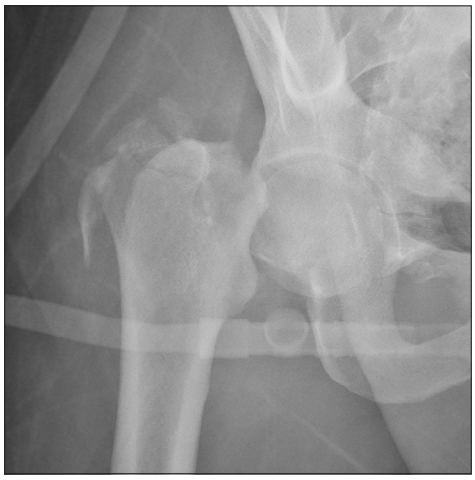

Figure 1: Anteroposterior radiograph of the patient's right hip showing the femoral head, neck, and greater trochanter fractures.

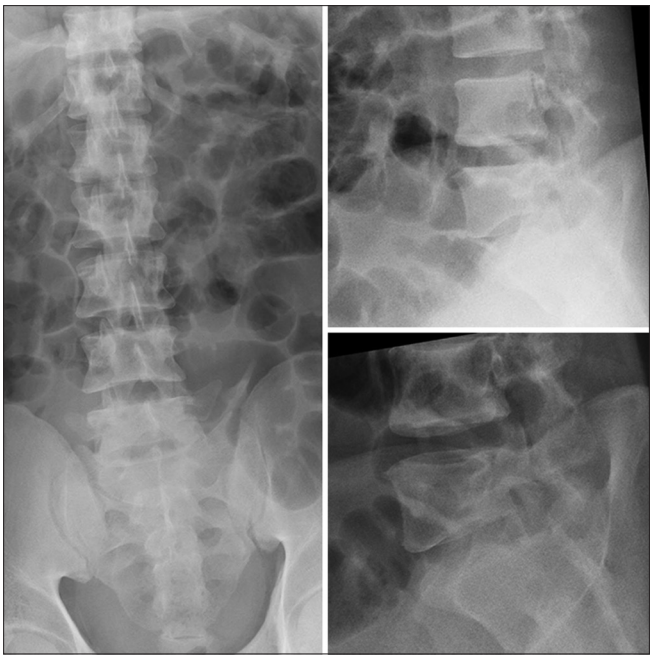

Figure 2: Anteroposterior radiograph of the patient's lower thoracic and lumbar spine (left panel) and lateral radiographs (right upper and lower panel) showing the possibility of L4-5 pedicle fractures.

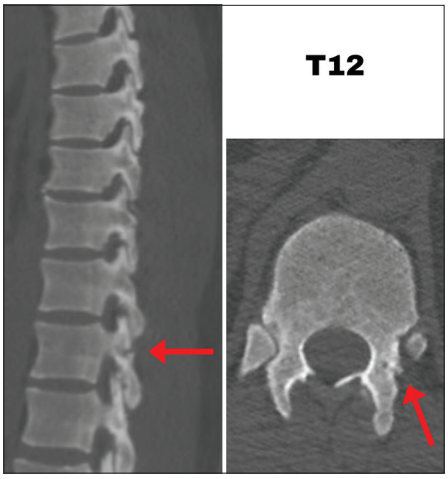

Figure 3: Computed tomography scan sagittal and axial views of the thoracic spine at the level of T12 showing left unilateral incomplete fracture of both the pedicle and lamina (Arrows).

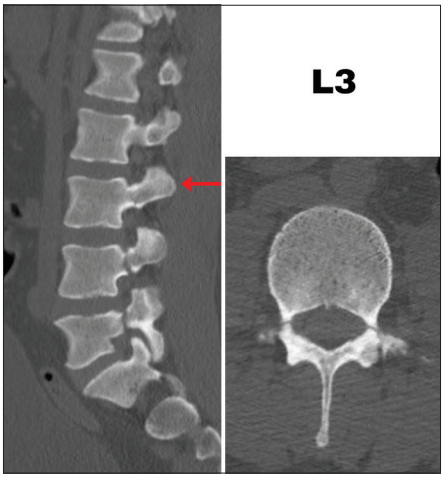

Figure 4: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L3 showing bilateral pedicle fractures (Arrow).

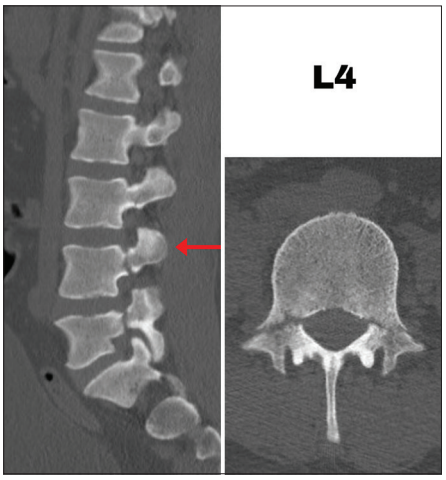

Figure 5: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L4 showing bilateral pedicle fractures (Arrow).

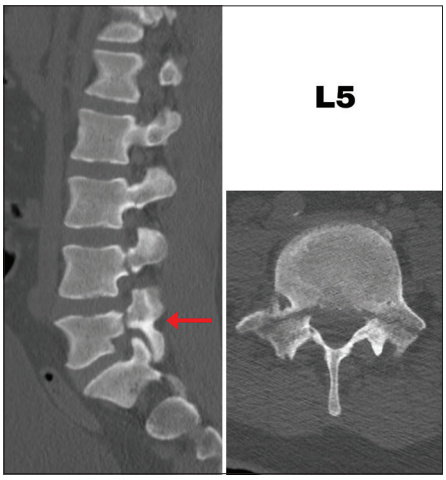

Figure 6: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L5 showing bilateral pedicle fractures (Arrow).

Furthermore, no pathological process was appreciated from history, examination, and after discussion with the radiologist. Hence, the final spine surgery team impression was that the fractures were old, as there was no tenderness on the lumbar spine examination and no bone edema on MRI. Therefore, the patient could go for the planned surgery from the orthopedic side to consider gentle manipulation of the patient's back with avoidance of extreme flexion and extension and for reassessment postoperatively. The patient was seen after the orthopedic intervention and no spine pain nor tenderness was appreciated, and there was no change in post-operative images. Our treatment protocol was analgesia as needed whenever the patient had back pain and since there was no tenderness to start weight bearing as tolerated and progress gradually and outpatient department follow-up in 2 weeks. As the patient had a total hip replacement (THR), his rehabilitation started with bed exercise, sitting at the edge of the bed with difficulty standing (first 5 days due to dizziness with standing). On the 6th day post-THR, the patient started bed-to-chair mobilization and then mobilized with non-weight bearing on the right lower limb and full-weight bearing on the left lower limb.

The patient was seen after 2, 6, and 12 weeks and he was doing fine with minimal on/off back pain that was relieved with analgesia. The patient was also seen after 6, 18, and 24 months with no further complaints of pain and unassisted

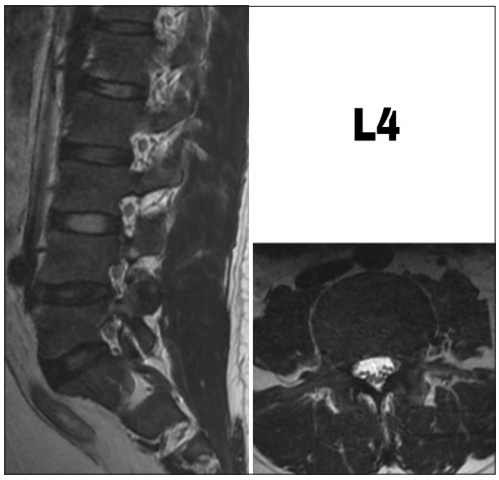

Figure 7: Magnetic resonance imaging sagittal and axial views of the lumbar spine at the level of L4 showing no bone edema.

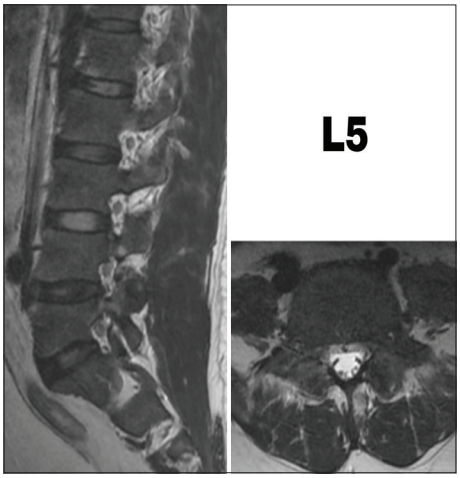

Figure 8: Magnetic resonance imaging sagittal and axial views of the lumbar spine at the level of L5 showing no bone edema.

Figure 9: Computed tomography scan sagittal and axial views of the thoracic spine at the level of T12 showing complete healing of both the pedicle and lamina.

Figure 10: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L3 showing complete healing of the pedicle fracture.

mobilization with slight limping due to weak hip abductors following THR, which improved gradually. In 2 years, a follow-up CT scan showed complete healing of the T12, L3, L4, and L5 fractures [Figures 9-12].

DISCUSSION

After our literature review on (pedicle fracture and renal failure), we found no cases reported and on (pedicle fracture and hemodialysis), we found only one case that was for an elderly male, with one-level, unilateral pedicle fracture, on long-term hemodialysis with isthmic spondylolisthesis.[29] However, there are some other reported cases of pedicle fractures but with different predisposing factors such as high energy trauma, osteoporosis, degenerative spine disease, previous spine surgical intervention, or heavy activity leading to stress fractures [Table 1].

We present this rare case with four levels of pedicle fractures in which L3, 4, 5 are bilateral fractures and in T12, unilateral and incomplete. Bilateral pedicle fractures are uncommon and extremely rare, with no history of high mechanism injury, especially in young adults. Furthermore, there is no consensus regarding the management in these rare cases; some were treated conservatively, and others were treated surgically.[2]

Compared to our treatment, we would like to shed light on the treatment done for the elderly patient.[29] He was a 65-year-old cardiac patient who complained of progressive

Table 1: Literature review for pedicle fractures laterality, level, and risk factors.

Reference	Study type	Laterality	Level	Risk factors
Araki *et al.*[3]	Case report	Unilateral	L4	Baseball player, scoliosis, contralateral spondylolysis
Garber and Wright.[4]	Case report	Unilateral	L4	Contralateral spondylosis
Guillodo *et al.*[5]	Case report	Unilateral	L5	Contralateral spondylosis
Vialle *et al.*[6]	Case report	Unilateral	L5	Contralateral spondylosis
Weatherley *et al.*[7]	Case report, review	Unilateral	L4	Contralateral spondylosis
Carr *et al.*[8]	Case report, review	Unilateral	L2-3	Spondylolisthesis, scoliosis
Kim *et al.*[9]	Case report	Unilateral	L5	Spondylolytic spondylolisthesis
Guo *et al.*[10]	Case report	Unilateral	L5	Back massage, spondylolytic spondylolisthesis
Ha and Kim[11]	Case report	Bilateral	L4	Revision spinal surgery
Knight and Chan[12]	Case report	Not mentioned	L3	Scoliosis, posterior spinal fusion
Macdessi *et al.*[13]	Case report	Bilateral	L4	Revision spinal surgery
Robertson and Grobler[14]	Case report	Bilateral	L3	Revision spinal surgery
Sheehan *et al.*[15]	Case report	Unilateral	L4	Previous spinal surgery
Stanley and Smith.[16]	Case report	Unilateral	L4	Previous spinal surgery
Tribus and Bradford[17]	Case report	Bilateral	L4	Scoliosis, posterior spinal fusion
Jorge and Carvalho[18]	Case report	Bilateral	L2-3	Previous spinal surgery
Kim *et al.*[19]	Case report	Bilateral	L4	Osteoporosis, previous spinal surgery
Parvataneni *et al.*[20]	Case report	Bilateral	L5	Athlete
Tahir and Islam[21]	Case report	Bilateral	L4	Amateur weightlifting
Mohapatra *et al.*[23]	Case report	Bilateral	L4	Osteopetrosis, spondylolysis
Doita *et al.*[24]	Case report	Bilateral	L4	Osteoporotic compression fracture of L5
Kim *et al.*[25]	Case report	Bilateral	L4	Osteoporosis, L4-5 spinal stenosis
Maruo *et al.*[29]	Case report	Unilateral	L5	Long-term hemodialysis, spondylolisthesis, degenerative scoliosis, destructive spondyloarthropathy

Figure 11: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L4 showing complete healing of the pedicle fracture.

Figure 12: Computed tomography scan sagittal and axial views of the lumbar spine at the level of L5 showing complete healing of the pedicle fracture.

neurogenic claudication and muscle weakness of the right lower limb, evidence of degenerative lumber scoliosis and Grade I isthmic spondylolisthesis at L5-S1, with later progression to destructive spondyloarthropathy and progression of the lumbar curve and slippage with resultant unilateral pedicle fracture at the concavity of L4-5. Therefore, the patient underwent gill laminectomy of the L5 with pedicle screw fixation at L4-S1 and interbody fusion using the posterior lumbar interbody fusion technique. Regarding his outcome, postoperatively, the leg pain ceased immediately, and he began walking 3 days later with the normalization of his examination. Unfortunately, at a 1-year follow-up, the patient was without leg pain but was experiencing residual low back pain secondary to pseudoarthrosis.

As there is no consensus on the management of stress fractures of the lumbar pedicle, a suggested treatment protocol explained by Liu *et al.*, "for patients with incomplete, complete, and juvenile stress fractures of the lumbar pedicle without nerve root irritation, the majority of claims preferred conservative treatment and the healing rate of fracture was high; for patients with bilateral pseudarthrosis and with nerve root irritation as well as patients who failed the conservative treatment, surgical management was advocated and the operation result is good."[30]

This patient had a femur neck fracture from a fall from standing height or less (fragility fracture), which indicate his bone is pathologic. Furthermore, since renal failure affects bone metabolism,[28] we hypothesize that renal failure is a predisposing factor not reported before for stress fractures of the lumbar spine and a strong one since it led to multiple level and bilateral fractures compared to other predisposing factors. Since he had a femur neck fracture from a simple fall, he could have had these old stress pedicle fractures from trivial daily stressful activities over time.

CONCLUSION

We must consider predisposing factors when treating a patient with multiple fractures. We also need to look carefully for associated fractures to avoid missed injuries. Pedicle fractures that are bilateral and at multiple levels can occur in renal failure patients. Furthermore, if they were chronic, they could be treated conservatively successfully, as we did with our patient.

RECOMMENDATIONS

We aimed to increase the awareness of this fracture entity and increase the index of suspicion, especially in renal failure patients. Also, we recommend reporting such cases in the literature and the future studies in more depth from different aspects.

AUTHOR'S CONTRIBUTIONS

KA contributed to patient diagnosis, evaluation and follow-up. Also, contributed to the literature review, data analysis and major role in paper writing. AT contributed to diagnosis, management, data analysis, and case supervision. IO contributed to diagnosis, evaluation, follow-up, literature review, data analysis, interpretation, and paper writing. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

Approved by Research Ethics Committee at Prince Sultan Military Medical City, Riyadh, Saudi Arabia. IRB number HP-01-R-079, dated March 24, 2021.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

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