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OPIS PRZYPADKU
CASE REPORT

Transforaminal lumbar interbody fusion L4/L5 in a 72-year-old Jehovah's Witness with a history of prostate cancer: A case report following patient blood management standards

Przezotworowa lędźwiowa stabilizacja międzytrzonowa L4/L5 u 72-letniego świadka Jehowy z rakiem prostaty w wywiadzie – opis przypadku zgodny ze standardami zarządzania krwią pacjenta

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ABSTRACT

Lumbar spinal stenosis (LSS) is a common degenerative condition in older adults, leading to chronic low back pain, neurogenic claudication, reduced functional capacity, and impaired quality of life. It most frequently affects the L4/L5 and L5/S1 levels. Surgical intervention improves patient outcomes when conservative treatment fails. Coexisting conditions, such as prostate cancer with spinal metastases, increase the risk of fractures and bleeding. Refusal of blood transfusions by Jehovah's Witnesses requires comprehensive patient blood management (PBM), including preoperative optimization, meticulous intraoperative hemostasis, and postoperative support. A 72-year-old man with chronic low back pain, neurogenic claudication, and progressive neurological deficits, with a history of prostate cancer and complete refusal of blood transfusions, presented for treatment. Magnetic resonance imaging (MRI) revealed critical stenosis at L4/L5 and degenerative changes at L2–L4. Conservative therapy was ineffective. The patient underwent transforaminal lumbar interbody fusion (TLIF) with pedicle screw fixation and a biopsy of L3. Recovery was uneventful, neurological deficits resolved, and follow-up MRI confirmed adequate decompression of neural structures. Histopathology demonstrated prostate cancer metastases. The procedure provided decompression and spinal stabilization while minimizing blood loss through PBM measures, including optimization of erythropoiesis, tranexamic acid administration, precise hemostasis, and monitoring of hidden blood loss. TLIF with PBM is safe and effective in older patients with severe lumbar stenosis, coexisting malignancy, and transfusion restrictions. Multidisciplinary

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planning and meticulous surgical technique support neurological recovery and allow continuation of oncological treatment.

KEYWORDS

lumbar spinal stenosis, discectomy, transforaminal lumbar interbody fusion, patient blood management, neurogenic claudication, spine surgery

STRESZCZENIE

Stenoza kanału kręgowego odcinka lędźwiowego (*lumbar spinal stenosis* – LSS) jest częstym schorzeniem zwyrodnieniowym u osób starszych, prowadzącym do przewlekłego bólu dolnego odcinka pleców, chromania neurogennego, ograniczenia sprawności i pogorszenia jakości życia. Najczęściej dotyczy poziomów L4/L5 i L5/S1. Leczenie chirurgiczne poprawia stan pacjenta, gdy terapia zachowawcza zawodzi. Choroby współistniejące, np. rak prostaty z przerzutami do kręgosłupa, zwiększają ryzyko złamań i krwawienia. Odmowa przetoczeń krwi przez świadków Jehowy wymaga kompleksowego zarządzania krwią (*patient blood management* – PBM), obejmującego optymalizację przedoperacyjną, precyzyjną hemostazę oraz wsparcie pooperacyjne. Do leczenia zgłosił się 72-letni mężczyzna z przewlekłym bólem lędźwiowym, chromaniem neurogennym i postępującymi deficytami neurologicznymi, z historią raka prostaty i całkowitą odmową transfuzji krwi. Obrazowanie za pomocą rezonansu magnetycznego (*magnetic resonance imaging* – MRI) wykazało krytyczną stenozę L4/L5 oraz zmiany w kręgach L2–L4. Leczenie zachowawcze było nieskuteczne. U pacjenta wykonano przezotworową lędźwiową stabilizację międzytrzonową (*transforaminal lumbar interbody fusion* – TLIF) z zespoleniem śrubami pedikularnymi i biopsją trzonu kręgu L3. Rekonwalescencja przebiegła bez powikłań, deficyty neurologiczne ustąpiły, a kontrolne badania MRI potwierdziły prawidłowe odbarczenie struktur nerwowych. Badanie histopatologiczne wykazało przerzuty raka prostaty. Zabieg zapewnił odbarczenie i stabilizację kręgosłupa przy minimalnej utracie krwi dzięki PBM, w tym optymalizacji erytropoezy, podawaniu kwasu traneksamowego, precyzyjnej hemostazie i monitorowaniu utraty krwi. TLIF z PBM jest bezpieczny i skuteczny u starszych pacjentów z ciężką stenozą, współistniejącym nowotworem oraz ograniczeniami dotyczącymi przetoczeń. Wielodyscyplinarne planowanie i precyzyjna technika chirurgiczna pomagają w odzyskaniu funkcji neurologicznych i umożliwiają kontynuację leczenia onkologicznego.

SŁOWA KLUCZOWE

stenoza kanału kręgowego odcinka lędźwiowego, discektomia, przezotworowa lędźwiowa stabilizacja międzytrzonowa, zarządzanie krwią pacjenta, chromanie neurogenne, chirurgia kręgosłupa

INTRODUCTION

Lumbar spinal stenosis (LSS) is a common disorder in the elderly, causing chronic low back pain, reduced function, and impaired quality of life [1]. It results from narrowing of the spinal canal or intervertebral foramina, compressing neural structures such as the cauda equina or nerve roots [2]. Degenerative stenosis, arising from age-related disc and facet joint changes, is most frequent [3]. Pathophysiology includes reduced disc height, disc bulging, ligamentum flavum thickening, and facet joint hypertrophy, often causing osteophytes and facet cysts that significantly reduce space for neural structures [3]. Severe stenosis most commonly affects L4/L5 centrally and laterally, while foraminal stenosis peaks at L5/S1 [4]. Prevalence rises with age, from 16.0% and 4.0% under 40 to 38.8% and 14.3% in patients ≥60 years [5].

When conservative treatment fails, surgical decompression improves function, quality of life, and pain [6]. Techniques include laminectomy and facetectomy with transpedicular and interbody stabilization. Transforaminal lumbar interbody fusion (TLIF) allows intervertebral access via a posterolateral approach with pedicle screw stabilization [7,8,9].

Coexisting malignancy, especially prostate cancer, complicates management. Hematogenous metastases occur in 35% of patients, with 90.1% involving bone – mostly the spine from lumbar to cervical segments [10]. Bone metastases can cause pathological fractures, cord compression, and hypercalcemia, limiting mobility and quality of life [11]. Markers such as N-terminal telopeptide (NTX) and bone alkaline phosphatase (BALP) help predict skeletal-related events, though further study is needed [12]. Surgery aims to improve quality of life, preserve neurological function, relieve pain, and provide spinal stabilization [13].

Religious beliefs, such as those of Jehovah's Witnesses, require avoidance of allogeneic blood products, though most surgical procedures and IV fluids are accepted [14]. Comprehensive patient blood management (PBM) is essential, including preoperative hematopoiesis optimization, meticulous intraoperative hemostasis, blood salvage, and postoperative support [15,16].

Planning spinal decompression with stabilization in elderly patients with LSS, prostate cancer, and transfusion restrictions requires careful interdisciplinary preparation, integrating neurosurgery, oncology, hematology, and perioperative care to minimize complications and maximize therapeutic benefit.

CASE REPORT

The patient was a 72-year-old man in good general condition presenting with severe chronic lumbosacral pain radiating to both lower extremities. Pain intensity was 8/10 on the Visual Analogue Scale (VAS), worsened by axial loading and walking, limiting ambulation to less than 100 meters, consistent with neurogenic claudication. Neurological examination revealed bilateral L5 sensory impairment and ankle dorsiflexion weakness (4/5 Lovett scale), with negative stretch tests but pronounced paraspinal stiffness. Notably, the patient had a history of prostate cancer with imaging suggestive of spinal metastases and, as a Jehovah's Witness, absolutely refused blood transfusion, classifying him as high-risk for surgery.

Conservative treatment – including pharmacotherapy, targeted rehabilitation, and physical therapy – was ineffective, and neurological deficits were slowly progressing. Lumbar magnetic resonance imaging (MRI) revealed advanced L4/L5 degenerative changes, central-right lateral disc protrusion, ligamentum flavum hypertrophy, facet arthrosis causing critical stenosis, and heterogeneous signals in L2–L4 vertebral bodies consistent with metastases (Figures 1 and 2).

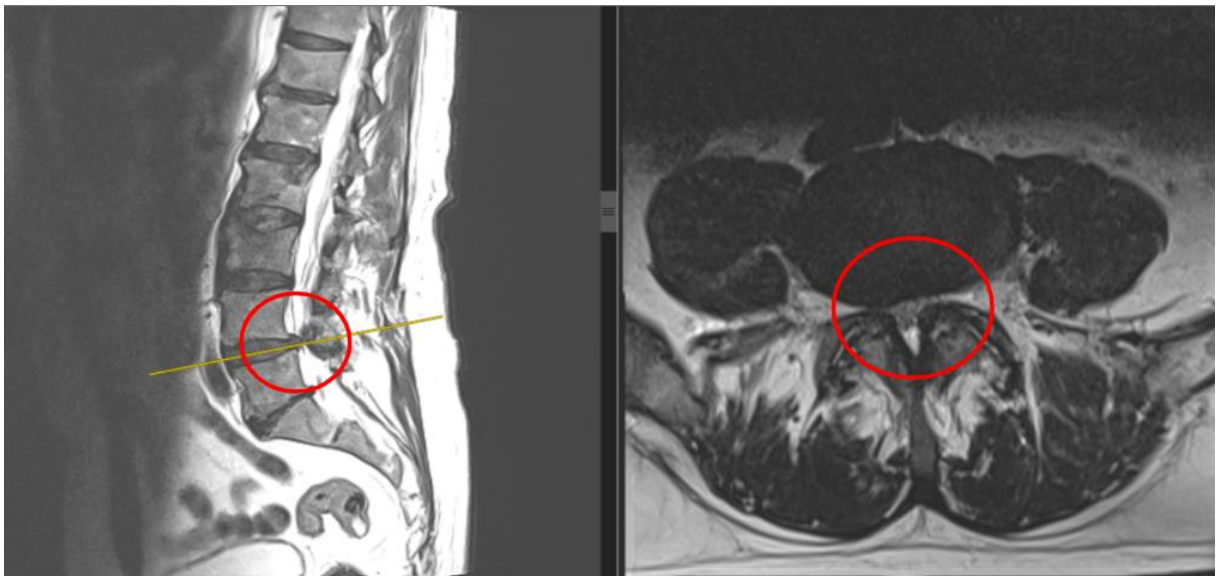

Fig. 1. Preoperative magnetic resonance imaging of the lumbosacral spine. Features of lumbar spinal canal stenosis at L4/L5, including a central-right lateral disc protrusion, hypertrophied ligamentum flavum, and degenerative changes of the facet joints

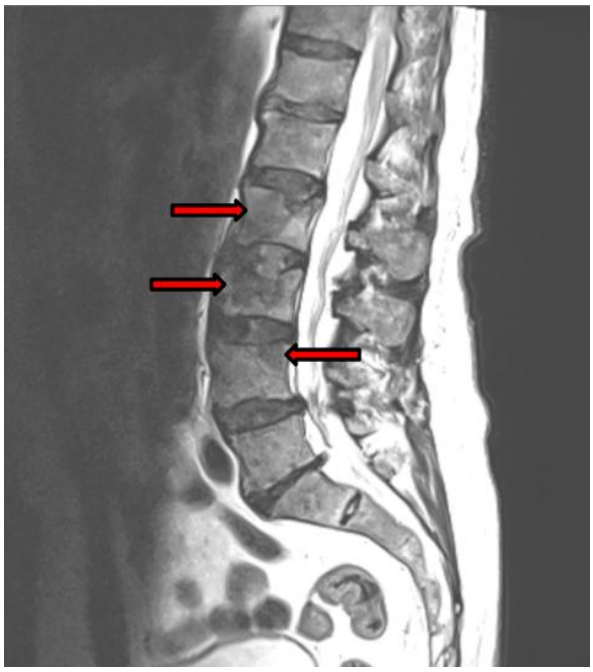

Fig. 2. Preoperative magnetic resonance imaging of the lumbosacral spine. Arrows indicate areas with imaging features consistent with spinal bone metastases

Due to the failure of conservative treatment and risk of permanent neural injury, the patient was qualified for surgery despite advanced age, malignancy, and absolute refusal of blood transfusion. Decision-making was multidisciplinary, accounting for religious and oncological considerations, with management guided by the PBM protocol to optimize erythrocyte mass and physiological reserve.

Preoperative assessment included complete blood count, vitamin B12, folate, and iron parameters (ferritin, transferrin saturation – TSAT) to exclude deficiencies. Medications affecting hemostasis were discontinued, and hemoglobin on the day of surgery was 13.8 g/dl.

Given critical stenosis and risk of instability, isolated decompression was abandoned in favor of interbody stabilization. Wide bilateral facetectomy (>50% of the facet joint) and disruption of the posterior column increased the risk of iatrogenic instability. In addition, the L2–L4 vertebral lesions were evaluated using the Spinal Instability Neoplastic Score (SINS), which was calculated as 8 points, indicating indeterminate stability. In this setting, particularly in the presence of mechanical pain, stabilization is generally recommended, thereby supporting the decision to perform

interbody stabilization rather than isolated decompression.

Surgery employed TLIF with pedicle screw fixation, providing 360-degree stabilization via a single posterior approach while minimizing dural sac retraction, epidural bleeding, tissue trauma, and operative time. Additionally, an L3 vertebral body biopsy was performed to confirm suspected metastatic lesions. Figures 3 and 4 illustrate the procedure: red – bilateral L4/L5 facetectomy, black – L4 laminectomy, green – pedicle screw fixation, blue arrow – TLIF implant trajectory.

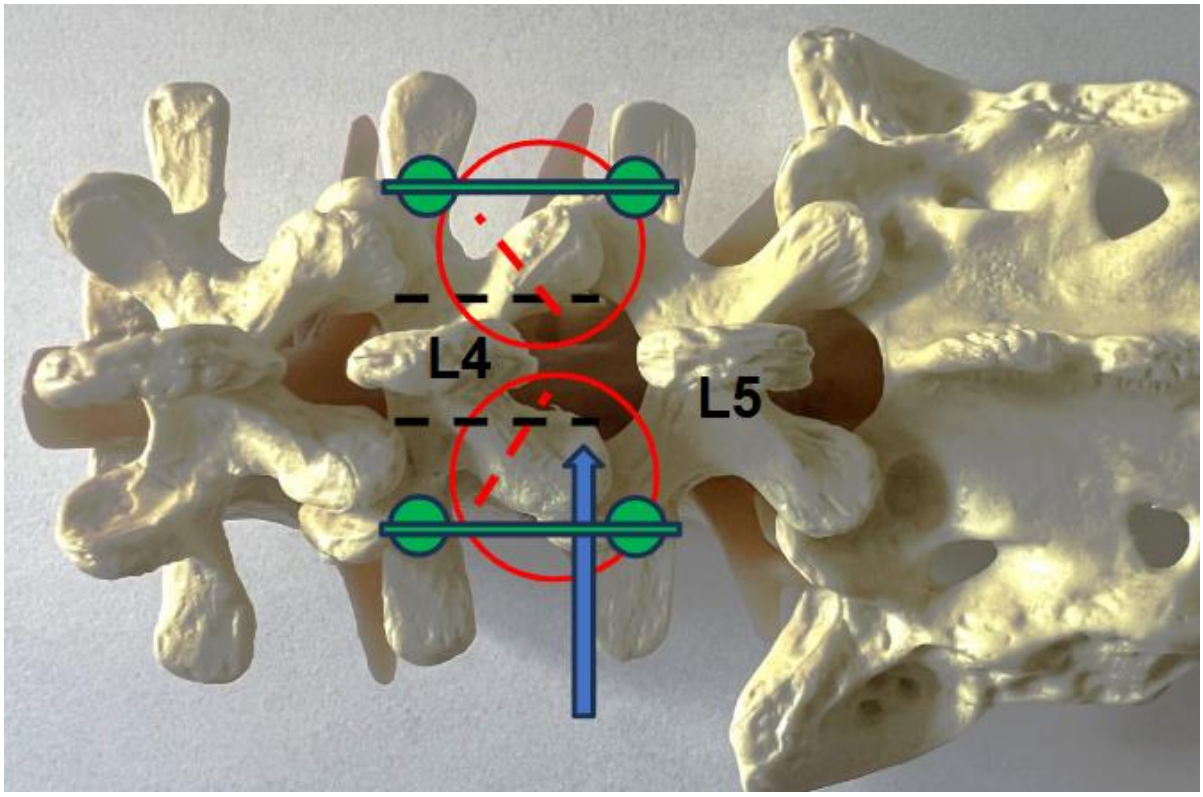

Fig. 3. Surgical procedure planning – posterior view of the lumbar spine; explanations in the text

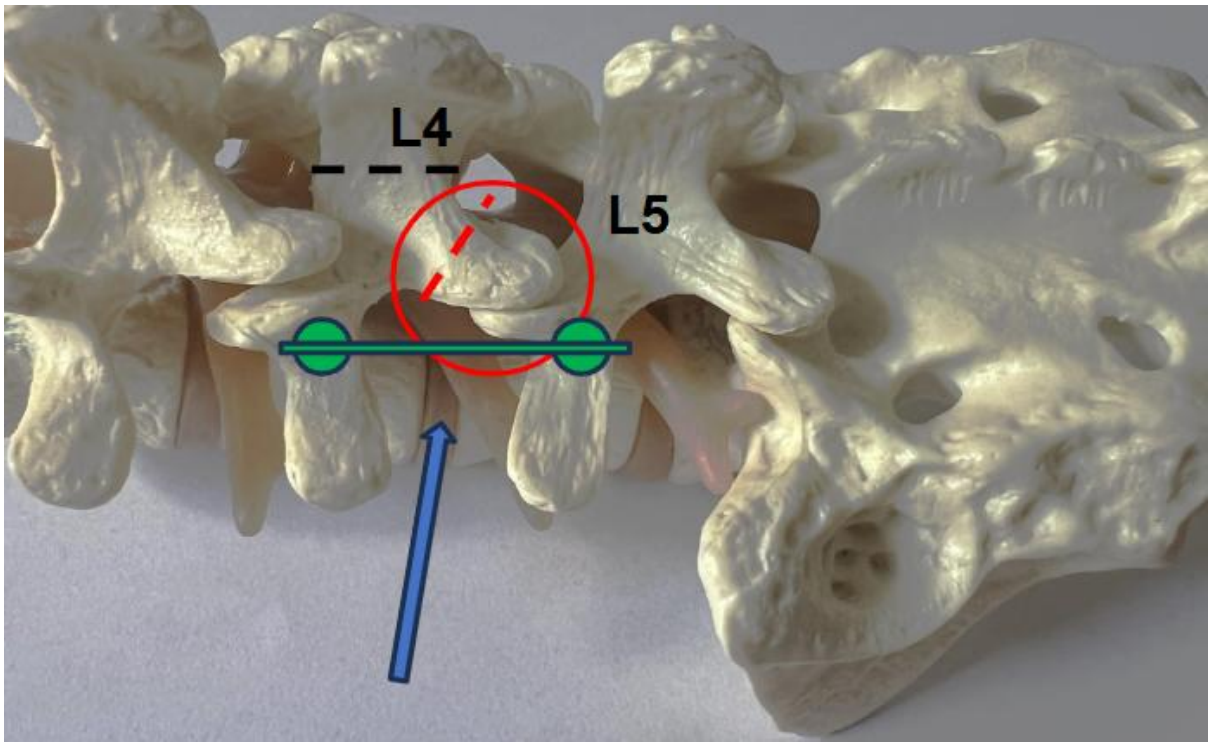

Fig. 4. Surgical procedure planning – lateral view; explanations in the text

On the first postoperative day, a control computed tomography scan was performed, confirming proper placement of the construct in the pedicles and vertebral bodies, as well as decompression of the neural structures (Figure 5). The patient was mobilized under the supervision of a physiotherapist, reporting no pain or neurological deficits.

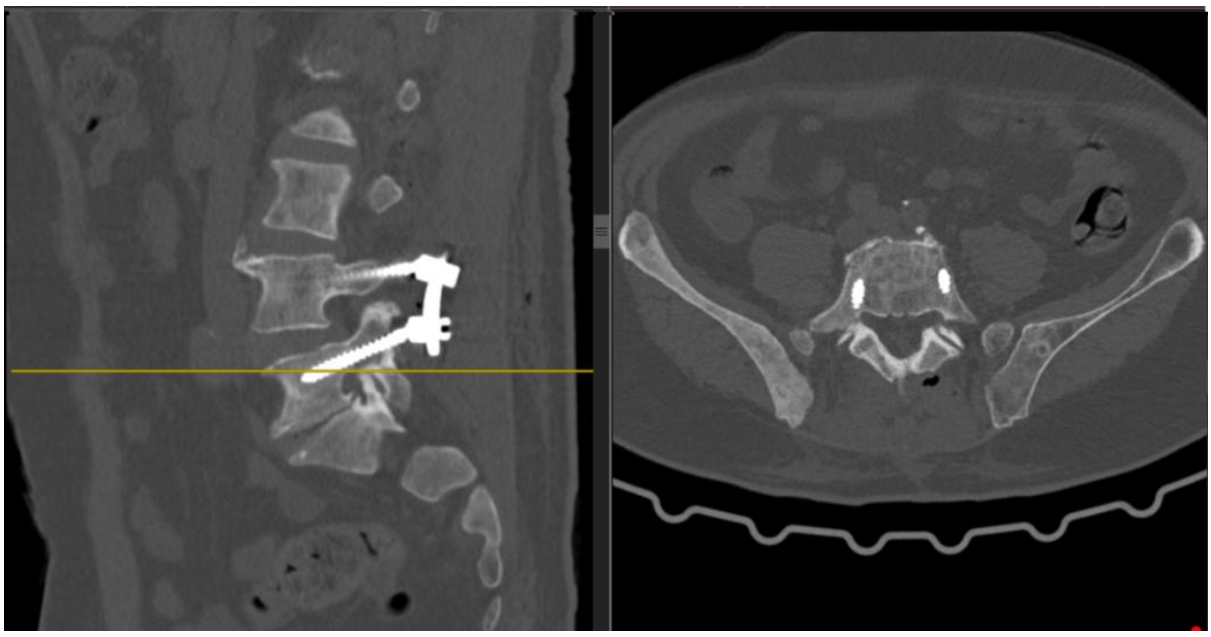

Fig. 5. Computed tomography imaging on the first postoperative day

The postoperative period was uneventful. Histopathological examination of the L3 vertebral body biopsy confirmed the presence of a prostate cancer metastasis. The patient was referred for further oncological treatment.

At the 3-month follow-up visit, the patient demonstrated improved functional status compared with baseline, as evidenced by complete resolution of neurogenic claudication and lower limb paresthesia, which translated into a marked improvement in daily functioning and overall quality of life. Follow-up MRI revealed a widely patent spinal canal without evidence of stenosis (Figure 6). The surgical strategy employed – combining decompression, stabilization, and oncological diagnostics while rigorously minimizing blood loss – enabled achievement of the desired therapeutic outcomes despite the presence of additional limiting factors.

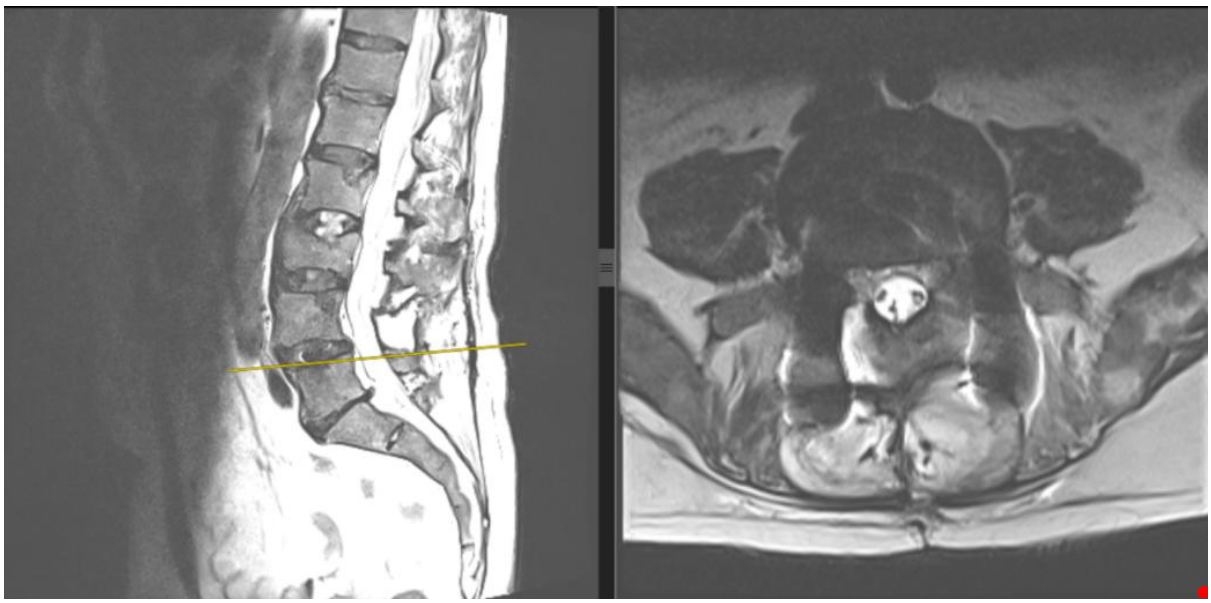

Fig. 6. Magnetic resonance imaging at the follow-up visit – 3 months postoperatively

DISCUSSION

Progressive neurological symptoms, including worsening neurogenic claudication and exercise intolerance with walking distance limited to ~100 meters, alongside radiological findings, neurological deficits, and medical history, constituted absolute indications for neurosurgical intervention. The pathophysiology involved critical L4/L5 spinal canal stenosis, causing dynamic and static compression of cauda equina nerve roots and ischemia from edema and nutrient vessel compression during axial loading. In advanced degenerative disease with massive ligamentum flavum hypertrophy, facet joint arthropathy, and large disc herniation, conservative treatment fails, and delay can result in irreversible deficits, such as impaired bladder function or permanent sensorimotor deficits [6,17,18].

Effective decompression required extensive resection of bony and ligamentous structures, including bilateral facetectomy and laminectomy [19,20], which compromises posterior column integrity and increases iatrogenic instability risk. Removal of >50% of facet surfaces can cause immediate or delayed spondylolisthesis, necessitating stabilization [21,22].

Open TLIF with interbody cage implantation at L4/L5 provided 360-degree fusion, stabilizing the segment in sagittal and coronal planes while fully decompressing neural structures. TLIF enables indirect decompression by restoring disc and foraminal height, reducing nerve root compression [23,24]. Compared to posterior lumbar interbody fusion (PLIF), TLIF minimizes dural sac and nerve root retraction, reducing neural injury and blood loss [25,26]. Given elevated perioperative risk and absolute transfusion refusal, the surgical plan balanced tissue-sparing with radical stenosis treatment.

The patient's Jehovah's Witness status required modification of perioperative protocols via a multidisciplinary PBM program. PBM maximizes preoperative red cell mass, minimizes intraoperative blood loss, and optimizes postoperative blood use [27]. For patients refusing allogeneic transfusion, PBM is the only safe pathway for major surgery [15,27,28]. Evidence shows preoperative hemoglobin >13 g/dl allows tolerance of lumbar fusion blood loss without symptomatic anemia [15,27].

Minimizing intraoperative blood loss – the second PBM pillar – was achieved with TLIF and pharmacologic measures such as tranexamic acid (TXA). TXA, a synthetic lysine analog, blocks plasminogen binding on fibrin, preventing clot lysis. Meta-analyses show IV TXA before incision and during surgery significantly reduces blood loss and drainage without increasing thromboembolic risk [15,29,30]. In spinal surgery, precise bipolar coagulation and hemostatic matrices targeting the epidural venous plexus are essential for safe hemostasis in transfusion-refusing patients.

Hidden blood loss (HBL), often underestimated, represents the difference between total blood loss and volume collected in drains, resulting from diffusion into soft tissues and hematoma hemolysis [31,32]. HBL manifests as hemoglobin drop postoperatively. Strict monitoring of hematologic parameters, including hemoglobin and hematocrit every 6–12 hours for 48 hours, is vital for optimizing anemia tolerance – the third PBM pillar. Hemoglobin levels at discharge correlate with functional recovery, emphasizing that even non-critical anemia affects healing after lumbar fusion [31,33,34]. Outcomes should be evaluated using neurological status scales and quality-of-life measures [35].

Geriatric factors, such as frailty and nutritional status, influenced risk. Aging reduces physiological reserve, limiting compensation for major surgery [28]. Subclinical malnutrition impairs regeneration, delays healing, and weakens muscles essential for spinal stability. Preoperative nutritional optimization is protective even in relatively fit patients [28,36].

The patient's history of prostate cancer added complexity. T1-weighted MRI showed hypointense lesions in L2–L4 vertebrae. Osteoblastic metastases can mimic degenerative changes [37,38], but stable clinical status, absence of systemic symptoms, and predominance of neurogenic claudication supported a degenerative etiology.

Literature on spinal surgery in patients with cancer history and transfusion refusal is limited [39]. Reports emphasize surgical planning prioritizing bleeding minimization and oncological safety. Microscopic metastases are highly vascular; manipulating them can cause uncontrolled hemorrhage. TLIF provides access to the interbody space without deep vertebral body intervention, reducing bleeding risk while allowing prophylactic stabilization to prevent potential instability (SINS) [40].

In summary, critical stenosis and progressive deficits made surgery inevitable. TLIF provided optimal outcomes under constraints of age, cancer history, and transfusion refusal. Comprehensive PBM, including preoperative erythropoiesis stimulation, intraoperative TXA, and rigorous hemostasis, enabled safe surgery. Awareness of HBL and frailty monitoring (e.g., Geriatric Nutritional Risk Index – GNRI) is essential. Despite limited literature, this strategy allowed the patient to regain function and resume treatment, demonstrating the feasibility of complex neurosurgical procedures under extreme blood management restrictions.

CONCLUSIONS

Decompression and spinal stabilization using TLIF at the L4/L5 level can be safely and effectively performed in elderly patients with critical spinal canal stenosis, even in the presence of concomitant prostate cancer and restrictions due to refusal of blood transfusion.

Implementation of a comprehensive PBM program, including optimization of erythropoiesis, minimization of intraoperative blood loss, and monitoring of HBL, is essential for reducing perioperative risk in Jehovah's Witness patients.

An interdisciplinary approach, integrating neurosurgical, oncological, and hematological considerations, enables safe execution of complex surgical procedures in patients with multiple risk factors.

The combination of precise surgical technique, rigorous hemostasis, and careful monitoring of hematologic parameters facilitates rapid rehabilitation, improvement of neurological function, and continuation of treatment for the underlying disease.

Authors' contribution

Study design – J. Mikołajczyk, A. Joniec, B. Pietrzyk

Manuscript preparation – J. Mikołajczyk, T. Fajferek, A. Joniec, B. Godlewski

Literature research – E. Mażul-Kulesza, W. Pierzchała

Final approval of the version to be published – J. Mikołajczyk, T. Fajferek, A. Joniec, E. Mażul-Kulesza, B. Pietrzyk, B. Godlewski

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