

Direct lesion and repair of a common iliac vein during XLIF approach

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Abstract

Purpose Description of a case of direct intraoperative lesion and repair of a major vascular injury of common iliac vein during an extreme lateral interbody fusion L4–L5 procedure.

Methods A 69-year-old female who was operated for L4–L5 spondylolisthesis suffered a major vascular injury of a vein. The high cava bifurcation and inadequate pre-operative analysis of the radiological documentation resulted in the lesion. The lesion was successfully repaired and the patient did not suffer post-operative sequelae.

Results The repair was successful although the index spine procedure was not ended. Detailed pre-operative planning, based on radiological examination of vascular structures, should be a mandatory step prior to this specific surgical approach.

Conclusion Although safer than anterior retroperitoneal approach, extreme lateral interbody fusion still bears risk for major vascular injury.

Keywords XLIF · Vascular injury · Complications · Direct repair

Introduction

Extreme lateral interbody fusion is a relatively novel technique that uses a minimally invasive approach to the thoracic and lumbar spine for the positioning of large interbody cages [1, 2]. Apart from requiring a minimized

approach, it also lowers the risk of injury to abdominal structures. However, eventual vascular injuries that do occur might be very severe due to the difficulty of direct repair based on a very limited access [3–5]. This article reports on a case of a direct lesion of a large vein and its repair.

Materials and methods

A 69-year-old female patient was admitted to the hospital due to 1 year of progressively increasing low back pain and neurogenic claudication. BMI was 31.22 and lumbar spine *T* score −2.5. The patient was previously operated in 2010 for L4–L5 micro-decompression and interspinous spacer [Device for Interspinous Assisted Motion Preservation, Medtronic (DIAM)] implant. Oswestry disability index scored 57 % and visual analogical scale showed a score of 4/10 for low back pain and 9/10 for radiating pain. Neurological examination disclosed slight right-sided L4 palsy (4/5). No urinary disturbance was reported. MRI images showed first degree degenerative spondylolisthesis of the L4 over L5 with moderate narrowing of the spinal canal at L4–L5 and L3–L4 levels (Fig. 1). X-ray images of the standing spine showed no significant sagittal and coronal misalignment (Fig. 2).

Surgical planning included an extreme lateral interbody fusion at L4–L5 level associated with L3–L5 posterior decompression and bilateral pedicle screw fixation and fusion from L3 to L5.

Surgical procedure and the complication

The surgery was done under general anesthesia. The patient was positioned on the operating table in left lateral

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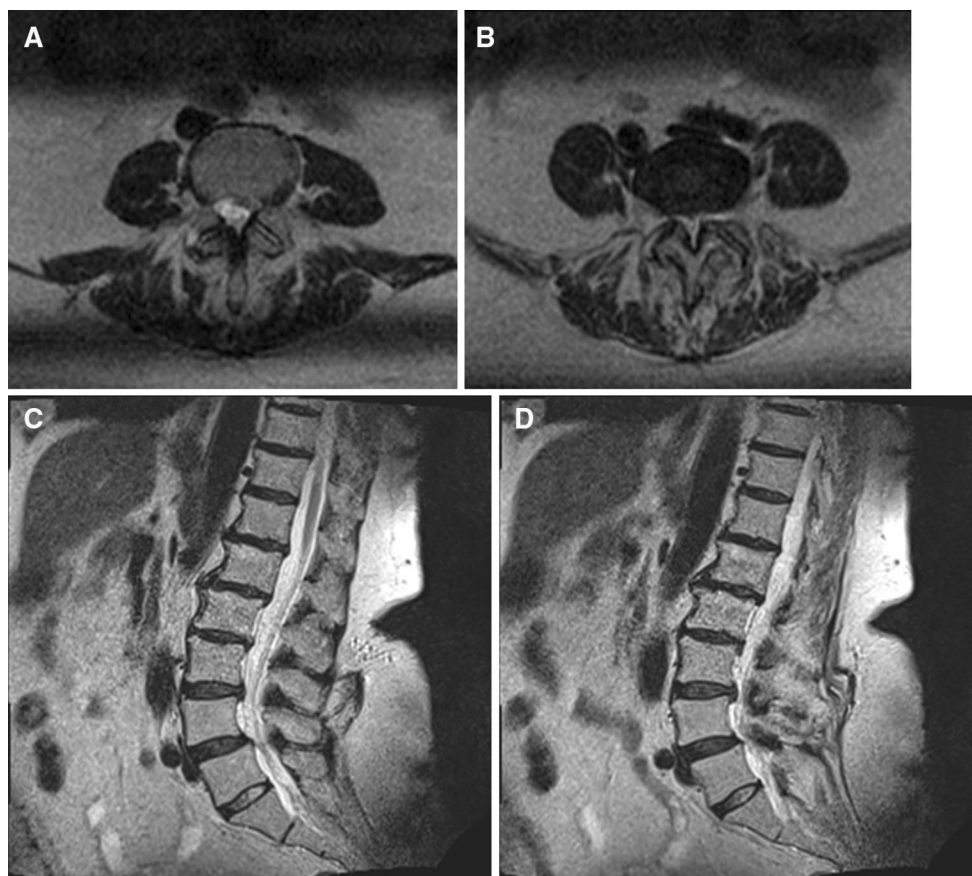


Fig. 1 T2 weighted MRI images: **a** L3–L4 level; **b** L4–L5 level; **c, d** sagittal view

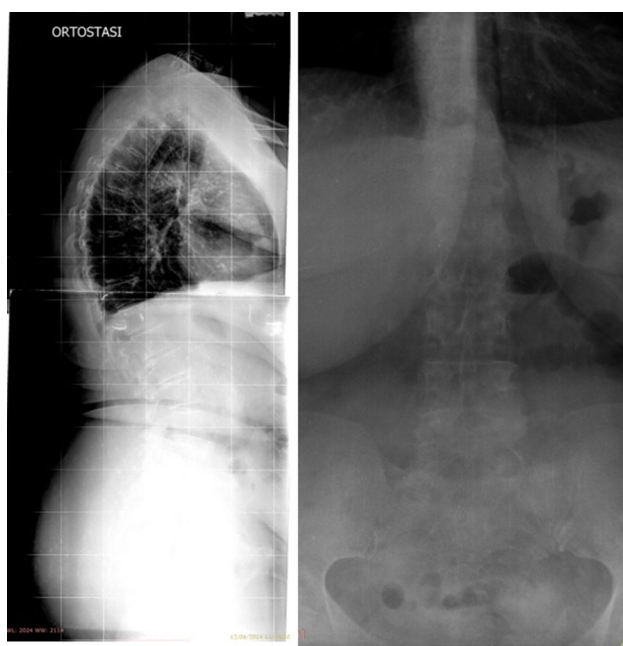


Fig. 2 Whole spine LL and lumbar AP view

decubitus with the right side facing up. She was secured to the table with bands and straps and an initial X-ray centering was done in lateral (LL) and antero-posterior (AP) views. Adjustment of the operating table was used until a desired bony alignment was matched confirming the perfect lateral position. Marking of the surgical incision was done. A two-hole approach to the retroperitoneal space was used. Three consequentially increasing diameter trocars were introduced under X-ray guidance, up to the lateral surface of the psoas muscle and centered over the mid-portion of L4–L5 intervertebral disc. The intra-operative neuro monitoring (IONM) system (Nuvasive) used to approach the psoas muscle and the lateral surface of the intervertebral disc, disclosed a minimum value of 13 mA in the posterior direction while in all the other directions the values were over 20 mA. (The IONM system evaluates the proximity of the bypassing nerve roots using active electrical impulses that are then recorded and analyzed as an algorithm and expressed as numerical values: 10–20 mA being in the safe zone, 6–10 mA being close to the nerve and <6 mA being on the nerve.) The Max-Access retractor

(Nuvasive), 130 mm of depth, was then positioned and checked for in AP and LL views. Opening of the retractor was done in the cranio-caudal and antero-posterior directions until the surgical access opening was considered to be useful (approximate values between 25×25 mm). Pin-pointing IONM device was applied to check for bypassing nerve roots of the lumbar plexus and then the dissection of the remnant soft tissue overlaying the lateral surface of the disc was done. Surgical knife was used for initial incision of the annulus. A rongeur was used initially to remove the disc material. The Cobb dissector was introduced for subperiosteal detachment of the upper and lower endplate. During the introduction of the Cobb dissector to detach the lower endplate, major bleeding initiated. The bleeding was seen coming from the antero-inferior point of the surgical field and, initially, a lesion was suspected to be of a muscular artery or a segmental vein. Initial stanching of the bleeding and haemostatic material packing did slow, but did not stop, the bleeding. After, approximately, 5 min of blind haemostasis with blood loss reaching 700 ml, the suspected bleeding point was forcefully stanching with a sponge mounted on a Foerster forceps that brought to a complete stop of bleeding. The surgical wound was enlarged posteriorly by approximately 5 cm and anteriorly by approximately 10 cm. The Max Access retractor was fully opened and a hand-hold abdominal retractor (Mikulicz) was positioned anteriorly as to keep the peritoneal sac away from the spine. Retroperitoneal dissection was done until the prevertebral space was recognized and usefully exposed. The stanch was removed and the bleeding started. This maneuver enabled the surgeon to recognize the bleeding point that was localized on a large pre-vertebral vein that was initially thought to be the cava vein. The bleeding point was stanching again and the preparation of the vein was performed proximally and distally to the bleeding point. Two curved DeBeakey vascular clamps were then applied proximally and distally on the vein and the stanch was released again. No further bleeding could be observed. Detailed inspection of the vein showed an, approximately, 1.5 cm large defect of the lateral wall of the vein. A 6-0 running suture was applied and the rupture was successfully repaired. Two more 6-0 stay sutures were applied over the running one in order to reinforce the closure of the defect. The proximal clamp was then opened and no bleeding could be seen. Then the distal clamp was opened and again, no bleeding could be observed. At that point both clamps were opened and, again, no bleeding could be seen. The wound was irrigated with 200 ml of saline solution and no blood oozing could be detected. The vein was then inspected and the lumen of the vein appeared to be reduced to approximately half of its original size. The vein size was, however, rather small as compared to the usual cava vein size. At the end of the procedure blood

collector showed 1800 ml of blood loss. The hemoglobin level dropped to 8.2 g/dl (pre-op 15 g/dl) and transfusion of two units of whole blood was done. In accordance with the anesthesia team the decision was taken to end the surgery although no useful spine procedure was done at that point. The patient was transferred in the intensive care unit and woke up promptly after a few hours. No initial neurological deficits could be seen.

Post-operative course

The following morning, the patient showed good clinical conditions. Another two units of whole blood were transfused during the night and in the morning hemoglobin level check-up showed a value of 10 g/dl. A new examination of the patient did not disclose any neurological deficit of the right lower limb. In the afternoon, the patient was moved to the ward. Long containment socks of both limbs were maintained in place and low molecular weight heparin (LMWH) (8000 iu/day) was initiated. Vascular surgeon consult was requested. Five milligrams Warfarin (Coumadin) oral therapy was suggested and added to the LMWH medication. In the third post-op day, the patient was mobilized with the help of physical therapist. The patient was able to walk for a short distance without any need for major support. Four days after the surgery, an Angio-CT scan was performed for the evaluation of the vein patency. The exam showed damaged vein to be the right common iliac vein with a high cava vein bifurcation. The vein was completely closed with the contrast medium void for a few centimeters of vein length (Fig. 3).

Then the patient was progressively mobilized and started walking alone. No neurological deficits were observed



Fig. 3 Angio CT scan showing complete closure of right common iliac vein post-operatively

specifically regarding the strength of her right thigh. The patient complained only of the pain in the area of the surgical cut and some hypoesthesia and pain in her lateral thigh but no lower than the right knee. For the last 3 days before discharge, the patient was walking alone without any type of support. On the 8 post-op day, the patient felt well and was discharged home. On discharge, the hemoglobin level was 11.5 g/dl steadily rising in the last 3 days (10, 10.5 and 11.5 g/dl, respectively) and the INR reached 1.83. Home medication was prescribed with Coumadin and LMWH for the following week until the INR values range reaches 2–2.5. The recommendation was for the patient's general practitioner to discontinue the LMWH and maintain the warfarin (Coumadin) for 6 months associated with right side pantyhose wearing. A new Angio CT scan was programmed 4 months after the discharge.

Discussion and review of literature

Iatrogenic lesions of major retroperitoneal vessels during anterior approaches to the lumbar spine are infrequent but possible complications of anterior spinal surgery. Review articles report such complications at a rate between 2 and 5 % [6–10]. Veins are most commonly injured while artery lesions are less frequent in a ratio of approximately 5–2 [6, 7]. Literature search for vascular complications and/or lesions during the extreme lateral retroperitoneal approach for interbody fusion was able to identify just a few published articles on iatrogenic vascular injury [3–5]. This case reports on direct intra-operative vein lesion and repair. The lesion of the vein took place during the initial steps of discectomy. A possible error could have been an underestimated high bifurcation of aorta and cava vein with the right common iliac vein placing itself more laterally than usually inside the field of the surgical approach. Retroperitoneal vessels do show to be highly variable in their course, orientation, number and bifurcation level. The ilio caval junction level variability is one of the most frequent [11–13]. The bleeding was managed by direct venorrhaphy although ligation was reported to be a valid option as well [14]. Postoperatively the patient developed complete occlusion of the right common iliac vein but it does not seem that this could be a major concern as most of the cases do reassess themselves in a period of few months [6, 8].

Due to extremely small incision, the extreme lateral retroperitoneal approach can become a rather difficult situation for the identification and repair of an injured vascular structure, if this event should occur. From the aforementioned complication we have learned the following lessons:

1. Pre-operative: extreme importance should be given to detailed analysis of the vessels position as seen on axial MRI images. If the position or distribution should not be clear, a contrast MRI or Angio CT scan is suggested. A high-level bifurcation may make the right common iliac vein and the left common iliac artery to be displaced far laterally inside the surgical approach, depending on the side of the approach. In such cases, a direct anterior retroperitoneal approach may, eventually, be a better surgical choice.
2. Peri-operative:
 - (a) Patient with elevated BMI might be subject to inadvertent movements of her/his spine orientation during the surgery, specifically if much table inclination is given. Therefore, frequent C-arm checking of bony landmarks becomes mandatory.
 - (b) If a major bleeding should occur, the surgeon should not lose time with blind attempts of haemostasis. This might just damage bypassing nerve roots. When 200–300 ml of blood is lost in a short period of time, with the bleeding still active and no bleeding point identified, one should compress and stanch the bleeding point as to slow or stop the bleeding and enlarge the access as much as he might need to expose the prevertebral space and identify the bleeding point.
 - (c) Once the bleeding has been controlled, and if the patient has lost significant volume of blood, the advice is to end the surgery as continuing could only increase the blood loss.

Conclusion

Extreme lateral retroperitoneal approach for interbody fusion is a less invasive surgical procedure if compared to anterior retroperitoneal approach. It is a relatively safe approach with low occurrence of complications. However, detailed pre-operative analysis of radiographic features is mandatory to properly plan the surgical access and management. Complications, particularly the vascular ones, can possibly be disastrous due to limited access space and should be incorporated in pre-operative planning.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest.

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