

CASE REPORT

Abdominal Vascular Injury During Posterior Lumbar Discectomy, Experience from Three Cases and Review of Literature

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Study Design. Case series and review of literature.

Objective. To report three cases of vascular injury during posterior lumbar disc surgery, two of these occurred during open discectomy, and one during an endoscopic surgery. Aim is to highlight importance of early diagnosis and prompt steps taken to prevent morbidity and mortality.

Summary of Background Data. Vascular injury during lumbar discectomy is rare injury. Also no case has been reported so far occurring during an endoscopic discectomy.

Methods. Three patients were treated for lumbar intervertebral disc prolapse, two had undergone open posterior discectomy while the third patient underwent endoscopic discectomy and all of them were diagnosed to have suffered an abdominal vascular injury.

Results. In two cases pseudo-aneurysm was found while third case was diagnosed as an arterio-venous fistula. All the three cases were managed with endovascular stenting and followed for a minimum period of 2 years. No further complications were detected.

Conclusion. Vascular injury during a disc surgery is difficult to diagnose due to the rarity of occurrence and subtle signs which need to be recognized to start early management.

Key words: aneurysm, discectomy, endoscopic, spine, vascular injury.

Level of Evidence: 5

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Open and endoscopic discectomy is usually considered a safe procedure. Still many complications like wound infection, urinary retention, leakage of cerebrospinal fluid, cauda equina syndrome, subdural hematoma, small bowel perforation, and rupture of the ureter have been reported.^{1–4} Abdominal vascular injury during posterior lumbar disc surgery was first reported by Linton and White in 1945.⁵ Although sparsely reported, it may have a rapid downhill course unless diagnosed early and treated emergently. Left untreated, it has a mortality ranging from 15% to 61%. Injury may cause laceration of the major abdominal vessels with early signs of acute blood loss, or may result in the formation of a false aneurysm or an arteriovenous fistula that may often escape detection for long periods.⁶ In all, the total number of cases reported so far being less than 200, but none occurring during an endoscopic discectomy. We present here two cases of abdominal vascular injury during an open discectomy and one during an endoscopic discectomy. Whereas in two cases vascular injury was identified postoperatively in the third case it was diagnosed intraoperatively. All the three cases were operated upon by an experienced eminent spine surgeon (R.B.) with over 15,000 discectomies to his credit at a tertiary care spine center over a period of more than 30 years.

Our aim lies in propagating the knowledge about the complication amongst the surgeons and enabling them to make an early diagnosis and mitigate the damages. Also, a simple procedure called endovascular stenting done by the vascular surgeons have been very useful in all the three of our cases.

CASE REPORTS

Case 1

A 34-year-old man presented with low backache radiating to left lower limb for past 1 year. Magnetic resonance imaging (MRI) revealed sequestered disc at L4–L5 vertebral level. Failing conservative treatment, endoscopic discectomy was planned. Intraoperatively,

while clearing disc space, there was a sudden welling out of blood from the disc space and fall in blood pressure. Hemostasis could be attained with sustained pressure. Twelve hours postoperatively, patient developed hypotension and tachycardia which responded to blood transfusion and vasopressors. After 48 hours, his hemoglobin was found to be 6 gm%. Blood transfusion was given with partial recovery. Subsequently, abdominal girth increased with paralytic ileus. Thigh girth also increased and pedal edema was observed. Patient became icteric by seventh postoperative day and developed jaundice. On abdominal computerised tomography (CT) scan a fluid collection was noted and CT angiogram showed an Arterio-Venous fistula between the right common iliac vein and artery. An endovascular stenting was done. Her anemia and jaundice improved subsequently. At 7 years follow up she had no complications.

Case 2

A 28-year-old woman was diagnosed with prolapsed L4–L5 disc, with cauda equina syndrome. She had a history of abdominal surgery during childhood the records of which were not available. She was planned for open posterior discectomy. Intraoperatively, there was resistance to deeper penetration by the pituitary rongeur, with a sudden giving away followed by acute hemorrhage and fall in blood pressure. Transmitted pulsations could be visualized, bleeding was stopped with pressure. There was no further bleeding and discectomy was completed without any further drop in blood pressure. On turning supine, a bruit could be auscultated in the right iliac fossa; abdominal girth, and thigh girth were increasing. Ankle brachial index was 0.6 on the right side and distal pulses were feeble as compared with the opposite side. The blood pressure was fluctuating with persistent tachycardia. Computed tomography (CT) angiography done on second post op day, showed a pseudo-aneurysm in the common iliac artery at its origin. Endovascular stenting was done. At 3-year follow up there were no complications.

Case 3

A 31-year man presented with low backache with bilateral radiculopathy for past 3 years. MRI suggested a central extruded disc at L4–L5. There was no history of prior abdominal surgery. An open posterior discectomy was planned. Patient was placed prone on operating table with bolsters under shoulders and the hips leaving the abdomen free. During discectomy, there was some obstruction for deeper penetration. In attempting to clear the obstruction, there was a brief giving way of the pituitary rongeur anteriorly with sudden gush of bright red blood, transmitted pulsations could be seen. There was a sudden fall in blood pressure, the disc space was packed with cotton patties and pressure was applied with mops. Based on surgeon's (RB) past experiences with similar situations a diagnosis of injury to the major vessels was made

intraoperatively. The ankle brachial index was 0.7 on the right side; a bruit could be auscultated over right suprapubic area and the femoral vessels. Patient was hemodynamically unstable. Peripheral pulses on right were feeble. Ultrasoundogram of abdomen revealed fluid in the paracolic gutters. CT abdomen confirmed the presence of blood. CT angiogram was conclusive of a pseudo-aneurysm in the internal iliac artery on the right just adjacent to the bifurcation. Endovascular stenting was performed; post procedure contrast flow was good. At 2 years follow up there were no complications.

DISCUSSION

Abdominal vascular injuries secondary to posterior lumbo-sacral disc surgery are serious complications with high morbidity and mortality. Incidence during conventional discectomies ranges from 0.01% to 0.05%. Surprisingly, the incidence has not reduced over the past 50 years.⁷ Overall mortality varies from 15% to 61%.⁸ The broad anterior longitudinal ligament separates the disc spaces from the great vessels and branches.⁹ The most common affected vessels are the left common iliac artery (76.9%) because it lies just in front of the L4–5 disc space followed by left common iliac vein (30.8%).¹⁰ In contrast, in all three of our cases the right sided vessels were involved.

Most reported cases of abdominal vascular injury were caused by the pituitary rongeur pushed too far ventrally as to perforate the annulus fibrosus and anterior longitudinal ligament.^{11–13} The pituitary rongeur and curette when used together are the second most common cause, curette alone is the third most common instrument causing anterior vascular injury.¹⁴ In all three of our cases pituitary rongeur perforating anteriorly was the main cause. In posterior lumbar approaches to the intervertebral discs, instruments should not be inserted further than 3 cm into the disc space.¹⁵ This is of particular importance in endoscopic discectomies wherein the spatial orientation is of paramount importance.

The most common type of injury is arteriovenous fistula (AVF) (67%), second most common being laceration (30%), and pseudo-aneurysm in 3% of the cases. L3–L4 level is associated with injuries predominantly to the aorta and the inferior vena cava, iliac vessel injuries are seen mainly with L4–L5 and L5–S1 space surgery. Arteriovenous fistula may be formed immediately, if the laceration includes both arterial and venous tear.¹⁶ Pseudo-aneurysms originate from a localized arterial wall disruption. Two of our patients had a pseudo-aneurysm whereas one patient had an arterio-venous fistula.

The factors that increase the risks are degeneration or defect of the fibrous annulus or anterior longitudinal ligament, persistent adhesions of prevertebral structures to the anterior longitudinal ligament, and circumstances like reoperation, aggressive exploration, and inappropriate patient positioning.¹⁷ In two of our patients there was a history of previous abdominal surgery, aggressive clearance of disc space was attempted in all the three cases, in the two cases of

open discectomy small incisions were used which might have contributed to the injury.

These vascular injuries can be divided into three groups based on the time of their recognition: intraoperative, immediate postoperative, and late postoperative.¹⁸ Early presentation is usually in form of hemodynamic shock due to rupture of a major retroperitoneal vessel. Late complications include development of pseudo-aneurysms and arterio-venous fistulas, which may sometimes present years after the index surgery.^{14,19} Arteriovenous fistula is rarely diagnosed in the first 24 hours after discectomy and may manifest many years later as high-output congestive heart failure.^{20,21} A pseudo-aneurysm has been diagnosed in a patient after an interval of 13 years.²⁰ The most common signs and symptoms of vascular injuries are hypotension with tachycardia (77%), bleeding (53%), wide pulse pressure, and abdominal distention (20%) during or shortly after the operation accompanied by an abdominal bruit and pedal edema.^{22,23} In more than half of the cases, bleeding is absent or mild; the first sign is usually bleeding and progressive drop in blood pressure because of hypovolemia. In cases where there is a period of sudden hypotension bright red bleeding is associated. According to Ganesan *et al*,¹¹ the characteristic “collapsing pulsation” of dural sac is the first alarming sign. In our experience this is a difficult sign to appreciate partly because of the blood pool. We however could appreciate the welling out of blood from the disc space and transmitted pulsations in all of our cases.

According to Postacchini *et al*,²⁴ a greater reliability should be conferred to an unexpected, even if not copious, bleeding from the disc space. The abnormal bleeding rapidly stops. A possible explanation for the arrest may be that a valve mechanism is set up by the elastic properties of the operated disc that prevent blood leakage, this may also be the cause for small rates of trauma bleeding.²² Some authors advise to use the Shevlin test (Shevlin *et al*²³). We however found that this is a difficult test to perform and interpret. Tests which we found of significant value were ankle brachial index and presence of soufflé/bruit. There is a broad range of mortality (15–61%) which largely depends on the diameter of the injured vessel, size of the tear, rapidity of diagnosis, laparotomy, and rate of control of bleeding. Fortunately there was no mortality in our series because we could early diagnose the vascular injury postoperatively in two cases and successfully predict intraoperatively in one patient.

Early detection of major vascular damage is essential. If such an injury is suspected, CT angiography is the first-line investigation to assess the extent of bleeding and to localize it. In our patients, the CT scan immediately provided the diagnostic clue, and further angiography studies, helped us establish the final diagnosis. The lower risk compared with conventional repair of an AV fistula, makes endovascular management the preferred option.^{25,26} All three of the patients in our series underwent endovascular stenting without any further complications and all of them were doing very well at the last follow up.

CONCLUSION

Abdominal vascular complications of posterior lumbar disc surgery are associated with high rates of mortality and morbidity. The tenets of this type of surgery are careful preparation, microscopic dissection techniques, and healthy respect for the structures anterior to the disc. Placement of any tool into the disc space is a “blind approach” requiring the greatest degree of care with an understanding of the potential to harm vasculature and neural structures.

The prone operative position may confer a degree of vascular compression during surgery and may temporarily tamponade vascular tears. Therefore, a high index of suspicion is necessary in the postoperative period.

The main findings that should alert the surgical team to the abdominal vascular injuries are local hemorrhage with transmitted pulsations and refractory hypotension during the intraoperative period. When the patient is turned supine: auscultation of a bruit, decreased ankle brachial index, and increasing thigh girth warrant further work up. We feel that this complication can be kept to a minimum by the use of a curette to loosen the disc fragments and using pituitary rongeur only to pick the loose fragments from the disc space. Control of the hemorrhage with packing is the life saving and time-gaining step as a bridge to definitive vascular surgery.

Any bleeding which is associated with intraoperative hemodynamic instability requiring packing should be assumed to be potentially life threatening and should trigger the appropriate intraoperative or immediate postoperative angiography for early diagnosis. This logic should also follow for endoscopic procedures. CT angiography remains the diagnostic tool of choice, which proves the presence of vascular injury and delineates the definitive site of vascular injury. The endovascular stenting procedure is a less invasive option to treat vascular injury and has a lower rate of mortality and morbidity than open surgery.

➤ Key Points

- Pituitary rongeur should be used only to pick the loose fragments from the disc space and curette should be used to loosen the disc fragments.
- Control of the hemorrhage with packing is the life saving and time-gaining step as a bridge to definitive vascular surgery.
- CT angiography is the diagnostic tool of choice to diagnose the injury.
- Endovascular stenting procedure is a less invasive option to treat vascular injury and has a lower rate of mortality and morbidity than open surgery.

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