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Abdominal aortic injury due to lumbar disc surgery: A case report

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Complications arising from lumbar intervertebral disc surgery are rare but fatal. Major vascular injury is one complication that may end in death unless it is diagnosed and treated immediately. Herein we report an abdominal aortic injury due to L3-L4 intervertebral disc surgery that was treated successfully and discuss it in light of current literature. Diagnosis and treatment of an abdominal aortic injury in a 31-year-old male patient operated on for L3-L4 intervertebral disc degeneration is discussed. Interestingly, in spite of abdominal aortic injury this particular patient was hemodynamically stable. The diagnosis was made 12 hours after disc surgery and laparotomy was performed immediately. As the injury in the aorta was large and had irregular margins, it could not be repaired with primary repair but an end-to-end anastomosis with partial resection was performed. In lumbar intervertebral disc hernia surgery, peroperative hemodynamic instability should raise suspicion of major vascular injury with high mortality and appropriate surgical treatment should be done as soon as possible. If there is any finding suggesting an intraoperative vascular injury, the patient should be kept under close monitoring in order not to delay diagnosis and treatment. It should not be forgotten that hemodynamic stability does not rule out major vascular injury.

Key Words: Intervertebral disc, discectomy, aortic injury

INTRODUCTION

The posterior approach is one of the most common procedures in lumbar disc surgery (1). Many complications due to intervertebral disc surgery have been described (1-3). Vascular injury, ureteral injury and rarely bowel and pancreatic injuries can be seen (3). Major vascular injury is one of them and it may be fatal if not noticed in time (1). This type of injury is more common especially during lumbar region intervertebral disc surgery, due to proximity of the anterior longitudinal ligament and major vascular structures located anteriorly (1-5).

CASE PRESENTATION

A 31-year-old male patient presented to the outpatient neurosurgery clinics complaining of low back pain, left lower extremity pain and numbness. He was diagnosed with L3 nerve root compression due to L3-L4 intervertebral disc degeneration. After pre-operative evaluations, an L3-L4 discectomy was applied. The patient was hemodynamically stable during the operation, and he developed abdominal pain in the 10th postoperative hour. Due to the progressive aggravation of pain within 2 hours, general surgery consultation was requested. On physical examination, there was an asymmetric distention and tenderness in the left quadrant. The pulse rate was 45 to 60 beats/min and arterial pressure was 110/70 mmHg. There was no hypotension or tachycardia in his vital signs during postoperative follow-up. The initial ultrasonography showed a heterogeneous hypoechoic lesion with anechoic areas in the left inguinal region and left lower pole of kidney, on Doppler ultrasonography an irregularly bordered lesion without vascularization was observed, and the lesion was evaluated as hematoma. A computed tomography revealed retroperitoneal hematoma and extravasation of contrast material from the abdominal aorta into the hematoma area (Figure 1). The patient's preoperative hemoglobin was 14.9 g/dL, and hematocrit level was 43.7%, while the control hemoglobin value was 11.1 g/dL, hematocrit was 31.7%. Within 2 hours, the patient's hemoglobin level dropped to 9 g/dL. The blood products were prepared and the patient was urgently operated with General Surgery and Cardiovascular Surgery teams. During the operation, a total of 4 units of packed red blood cells, and 2 units of fresh frozen plasma and fluid resuscitation was transfused. On exploration, a hematoma of about 15x20 cm

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size was observed in the left retroperitoneal space (Figure 2). The aorta proximal and distal to the injury and iliac arteries were encircled and clamped (Figure 3). A laceration with irregular borders was found at the posterior wall just above the aortic bifurcation, which was not suitable for primary repair (Figure 4). This region was excised and the defect repaired with an end-to-end anastomosis (Figure 5). The patient's postoperative course was uneventful and was discharged on the 10th postoperative day.

DISCUSSION

In patients undergoing lumbar disc surgery, major vascular injuries are rare but very serious, life-threatening complications (1-5). During the operation, in case of sudden hemodynamic instability, considering the possibility of a major vascular injury and dynamic intervention can be lifesaving (1-5). Linton and White (2-4) recorded the first vascular injury during lumbar disc surgery in 1945. In this case, development of an arterio-venous fistula (AVF) between the right iliac artery and inferior vena cava (VCI) has been reported (3). Weber reported the first VCI injury in 1950 (3). Harbison (3) reported the first intestinal injury in 1954.

De Saussure has reported 106 cases of vascular injury due to lumbar disc surgery in 1958(4). In the literature, the mechanism of injury is generally described by progression of the forceps used in disc surgery across the anterior longitudinal ligament into the retroperitoneal space (1-5). Although exact rate of vascular injuries is not known, it is usually reported in the range of 0.01 to 0.2% (1-5). Overall mortality rate ranges from 15-65% (1-3). In the acute phase and especially in aortic injury mortality rates can be as high as 20-80% (4-6). This difference in mortality rates depend on the injured vascular structures, on injury size, time of diagnosis and timing of laparotomy (2, 3, 5, 7). Prabhakar et al. (5) reported an aorta and VCI injury during L1- L2 level discectomy which was treated successfully with early diagnosis and intervention. In a survey conducted by Harbison, among 100 surgeons 4 reported a case of aortic injury and the mortality rate in these cases were given as 100% (5). De Saussure in 1959, have reported a 47% mortality rate in 106 cases, and noted that time of diagnosis and operation are the most important factors affecting mortality (3). In this study, the mortality rate was 78% for isolated aortic injury, 42% in isolated iliac artery injury, and 9% in patients with AVF (3). Venous injuries are often not life threatening as compared to arterial injuries, they may not require surgery and can cease by itself. Still, they may result in lower extremity symptoms like swelling and pain in the legs due to pelvic vein thrombosis (1). The possibility of visceral injury like bowel, ureter, bladder, and pancreas is 3.8 in 10,000 (3). According to the findings, particularly visceral injury may be diagnosed in the late period (3). Although such complications are very rare, they still can be seen and may be fatal (3).

The most common injury is related to L4-L5 and L5-S1 disc surgery (4, 5, 8). At this level the common iliac vessels emerge and injury to these vessels is more common (4). The left common iliac artery is most susceptible to injury due to its

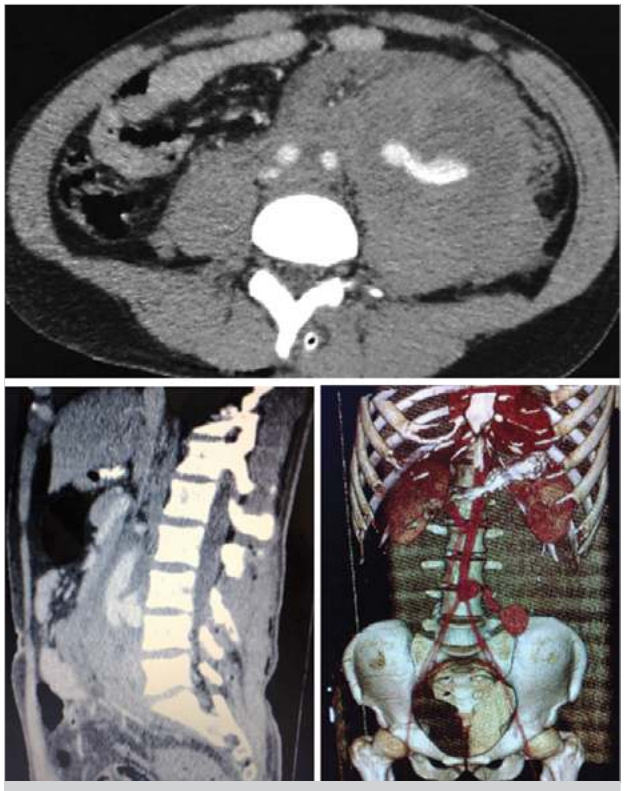

Figure 1. CT images of contrast extravasation and retroperitoneal hematoma

Figure 2. View of retroperitoneal hematoma on exploration

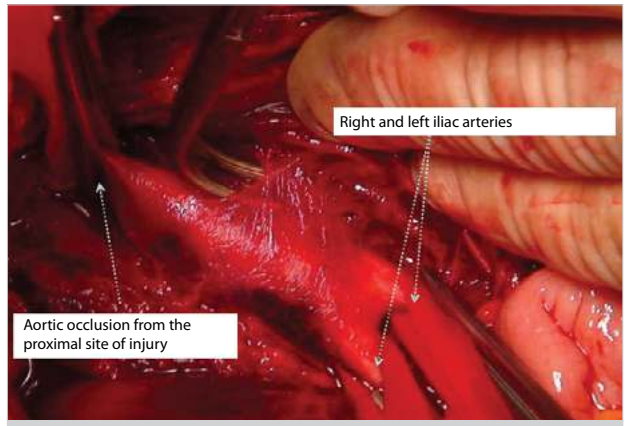

Figure 3. Aortic occlusion from the proximal site of injury

Figure 4. Site of injury at the posterior wall of abdominal aorta

more medial course and close relation with L4-L5 intervertebral disk (1, 3, 5). However, the site of injury may also vary according to the level discectomy (4, 7). The aorta and VCI are more commonly injured at the 2-4 lumbar vertebra level while the distal region of the iliac vessels are more likely to be injured at the level of the fourth lumbar vertebra (4). Lumbar arteries, internal iliac veins, median sacral artery, inferior mesenteric artery and the superior rectal artery injury are other vascular structures with possibility of injury (4).

The clinical course in patients is separated into two phases as acute and chronic and varies according to the location and shape of injury (1-5). In the acute phase, due to excessive blood loss, findings such as sudden hypotension, shock, failure to obtain femoral pulse, pallor and cold extremities occur (1, 4, 5). In the chronic phase, the symptoms occur later and depend on the development of AVF or pseudoaneurysm (1, 4, 5, 9). In case of major vascular injury, primarily and most commonly hypotension and tachycardia develop. Findings such as presence of unexplained bleeding from the disc space, sudden hypotension, vessel wall material on the forceps or specimen should suggest vascular injury (3, 4).

Due to the inhibitory effect of elastic forms of anterior longitudinal ligament and anterior annulus fibrosis, in case of vascular injury, bleeding moves back to the retroperitoneal space rather than the operative field (1). Therefore, in cases of this type of injury the likelihood of bleeding from the operation site is reported to be less than 50% (1, 3). In such a circumstance, the injury remains undiagnosed until the patient develops hypotension and other related symptoms (1). In our case, bleeding from the disc space was not observed during the operation. In some cases, early postoperative abdominal distention, discomfort, symptoms such as nausea and vomiting may occur, but these are common, nonspecific findings in the postoperative period (3). However, persistence of symptoms should raise suspicion of vascular injury (3).

Patients who are diagnosed at a later stage are usually those with pseudoaneurysm and AVF formation due to vascular injuries. In patients with pseudoaneurysm, a pulsatile abdominal mass and delayed rupture may occur (3). In patients with AVF, symptoms like high-output heart failure, leg swelling, fatigue, and classic murmur of a fistula may develop (2-4). An AVF is most frequently formed after surgery for L4-5 level and is between the common iliac artery and VCI (3). In cases of intestinal injury, acute abdomen may develop in the early postoperative period and radiologically free air can be detected in the peritoneal cavity (3). Ureteral injury is another complication that may develop, but due to lack of specific findings diagnosis is more difficult and is often diagnosed late (3). As well as abnormalities detected in urine analysis, these patients usually present with varying degrees of abdominal discomfort (3). To avoid a delay in diagnosis in such cases, careful examination of discectomy specimens is recommended (3). In his review between 1985-1998, Goodkin, reported a total of 21 cases, 18 vascular and three bowel injuries; 7 of vascular injuries were identified in the abdominal aorta while others were in the iliac artery or vein. One of bowel injuries was colonic injury and two were small bowel injuries and four of the 7 patients with aortic injury were dead (3).

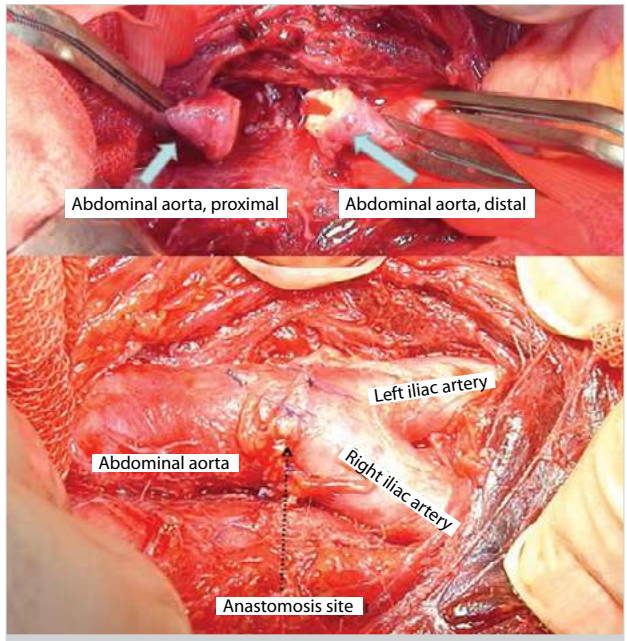

Figure 5. Views following aortic resection and end-to-end anastomosis

Leavens and Bradford suggested that the forceps used in intervertebral disc surgery damages the anterior longitudinal ligament creating a risk of entering into the abdominal cavity and causing major vascular injury (5). Annulus fibrosis and degeneration of the anterior longitudinal ligament, advanced discopathy, vertebral anomalies, adhesion of intervertebral disc to the anterior longitudinal ligament, previous disc surgery, aggressive exploration and complex patient positioning are considered as important risk factors (1, 2, 4, 5, 10). Congenital (anatomical malformation, etc.) and acquired (degeneration of the ligaments, etc.) predisposing factors associated with technical predisposing factors increase the likelihood of vascular injury (1). In 1963 Goodkin et al. (3), proposed lateral lumbar radiographs to determine the depth of the disc space, in order to prevent injury. Along with calculation of the depth, using calibrated forceps according to the depth of the intervertebral disc have been suggested (3). There are reports stating that the frequently used magnifying glasses cause the disk to be

considered more deeply than it actually is, and they advocate measurement of the disc space by radiological examination to avoid the complications arising from this error (1). The importance of careful examination of the extracted specimens in diagnosis is also emphasized (3).

According to the shape and size of injury and the patient's hemodynamic instability, the methods of treatment of the injured vessel may vary from primary suture to end-to-end anastomosis or from angio-graphic interventions to graft interposition (4). In appropriate cases, a combination of surgical and endovascular methods can be applied (1, 2). Early diagnosis and surgery of major vascular injuries may prevent potentially fatal outcomes (3). If there is gross bleeding from the disc space but the patient cannot be stabilized hemodynamically by replacement of blood products, an emergency laparotomy is recommended (1-3, 7).

The lateral injury of the aorta and VCI can be repaired with primary suture but there are technical difficulties in posteriorly localized injuries. Another treatment method is graft interposition (4). With the developing technology and when the patient's hemodynamic status is suitable, cases successfully treated with endovascular interventional procedures have also been reported (4, 11, 12). If the patient is hemodynamically stable, examinations such as ultrasound, computed tomography and angiography can be performed to confirm the diagnosis (3, 5). According to De Saussare, in case of sudden hypotension and shock, the patient should be treated as diagnosed with vascular injuries until proven otherwise (4).

In hemodynamically unstable patients, time is very valuable and a delay should not be caused with radiological examination. Otherwise, if an arterial injury is not treated with timely implementation of surgery, mortality rates reach up to 100% (1, 3). Persistent hypotension and tachycardia despite rapid transfusion is the most important finding of arterial injury (1). However, especially in young and healthy people, hypotension may not develop until 30-40% of blood volume is lost (3). Similarly, in our case, the patient's vital signs had remained stable during the early postoperative period.

Szolar et al. (13) emphasized the importance of radiology in their publication of 4 cases of vascular injury induced by lumbar discectomy. It was stated that angiography revealed the vascular anatomy and the localization of the site of injury in the preoperative period (5). It has been reported that selective vascular embolization and endovascular interventions can also provide fast and effective treatment in life-threatening injuries (4, 12). In the absence of interventional radiology or the necessary equipment, surgical treatment is accepted as the most appropriate form of treatment for massive hemorrhage control (4). In cases where injury is suspected, the intervertebral space can be filled with saline, and the retroperitoneal area assessed for leakage due to annulus fibrosis or injury to the anterior longitudinal ligament (Shelvin test) (4).

CONCLUSION

In conclusion, vascular, ureteral, and visceral injuries may occur during lumbar disc surgery. In particular, the most important point in a vascular injury that may develop is early diagnosis and timely intervention. Both the surgeon and the anesthesiologist should interpret findings like unexplained hypotension, tachycardia, loss of extremity pulse and heat loss in the intraoperative period accurately and quickly, carrying a high index of suspicion for vascular injury, thus providing a timely diagnosis and treatment with decreasing morbidity and mortality.

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