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ORIGINAL ARTICLE

Approach to the vascular complications of lumbar disc surgery

Sahin Bozok*, Gokhan Ilhan*, Bugra Destan*, Orhan Gokalp† and Tefvik Gunes†

To demonstrate the role of major surgery on patients presenting with vascular complications after lumbar disc surgery. Retrospective analysis of seven cases treated surgically in two tertiary care centers between August 2001 and June 2010. The average age of patients (3 women and 4 men) was 35.8 ± 7.2 . The most common vessel injured was left common iliac artery occurring in five patients (71.4%), followed by left common iliac vein injury detected in two patients (28.5%). Transperitoneal approach was preferred in all cases and primary suturing, graft interposition and end-to-end anastomoses were the surgical methods used for the repair of vascular injury. No mortality was seen in our series during the follow-up period of two years; however the most noteworthy complication was paraplegia occurring in one patient. Vascular injury occurring at lumbar disc surgery has a considerable potential for morbidity and mortality. High index of suspicion is necessary for early diagnosis. In hemodynamically instable patients, transperitoneal approach provides better exposure and more effective control of hemorrhage, while minimal angiography and endovascular intervention should be preserved for hemodynamically stable cases.

Key words: vascular; complication; disc surgery; treatment

Introduction

During lumbar disc surgery, major vascular injury may occur due to the close anatomic relation between lumbar vertebra and major vessels. Although those injuries are rare, they have high rates of mortality and morbidity.^{1,2} The incidences of symptomatic vascular complications and mortality rate were reported to be 0.016–0.17 and 15–61%, respectively.^{3–5} In early stage, bleeding caused by major vascular injury can result in a variety of clinical pictures ranging from mild hypotension to shock. Arteriovenous fistulas (AVF) and pseudoaneurysm can be seen in late stages.⁶ Early diagnosis and urgent surgical intervention reduces

high mortality and morbidity rates especially in hemodynamically unstable patients.

In this study, we retrospectively investigated the clinical characteristics and the importance of early diagnosis and appropriate surgical therapy in seven patients with vascular complications of lumbar surgery either.

Materials and methods

This study was approved by the Institutional Review Board. Records of seven patients in whom vascular complications were encountered during lumbar surgery have been evaluated. The patients have been diagnosed and treated between August 2001 and June 2010 in two different tertiary care centers by the same surgical team. Medical records of patients have been investigated in terms of gender, age, level of lumbar disc space pathology, symptoms and preoperative diagnosis. Absence of peripheral pulses, tachycardia and hypotension were signs of preshock that favor urgent surgical intervention. Operative and postoperative data such as the type and location of vascular injury, type of approach, units of blood transfusion, duration of hospitalization and long-term outcome were extracted.

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Table 1 Clinical characteristics of seven consecutive patients

Patient	Sex/age (years)	Level	Laminectomy	Symptoms	Diagnosis for the site of vascular injury	Time of diagnosis (hours)
1	M/35	L5–S1	Conventional	Hypotension, pain	LCIA	3
2	F/48	L4–5	Conventional	Hypotension, bleeding	RCIA/V	Immediate
3	M/41	L4–5, L5–S1	Conventional	Hypotension, pain	IVC	Immediate
4	F/38	L4–5	Conventional	Hypotension, leg pain, palpitation, pallor	LCIA	8
5	M/33	L4–5	Conventional	Hypotension bleeding	LCIA/V	Immediately
6	M/29	L5–S1	Endoscopic	Hypotension	LCIA	6
7	F/27	L4–5	Conventional	Hypotension, abdominal pain	LCIA/V	1

CIA, common iliac artery; CIA/V, common iliac artery and vein; IVC, inferior vena cava; L, lumbar; S, sacral; F, female; M, male

Results

The patients consisted of three women and four men with an average age of 35.8 ± 7.2 (27–48). Physical examination findings, indicators of hemodynamic status and clinical features such as active bleeding, hypotension and tachycardia were taken into account for the diagnosis of vascular injury. Patients were urgently transferred to the operation hall after the confirmation of the diagnosis with Doppler ultrasonography, since the hemodynamic instability did not allow further diagnostic work-up such as computerized tomography (CT) angiography or digital subtraction angiography evaluation. Demographics and clinical features of patients are presented on Table 1.

In our series, the most common finding was left common iliac artery injury seen in five patients (71.4%), followed by left common iliac vein injury in two patients (28.5%). Types of vascular injury and operative interventions are demonstrated in Table 2.

Low dose acetylsalicylic acid (100 mg/day) was administered to all patients following surgery. Average amount of blood transfusion and duration of hospitalization and intensive care unit stay can be seen in Table 2. In the early post-operative period, patients with inferior vena cava (IVC) injury exhibited a slight edema in lower extremities responding well to medical treatment. Average duration of follow-up was 3.4 ± 1.2 years (2–4.5) and imaging modalities such as color duplex scanning, abdominal ultrasonography (USG) and abdominal CT were utilized during this period. Mortality rate was 0%, but one patient had paraplegia, for which the actual cause could not be fully explained.

Discussion

Abdominal aorta and IVC follow a parallel path in front of lumbar vertebrae. Iliac vessels at bifurcation are very close to vertebrae at fourth lumbar vertebrae level. Right common

Table 2 Overview of surgery-related details

Patient	Location of injury	Peritoneal approach	Treatment	Transfusion (U)	Duration of hospitalization (days)	Long-term outcome
1	LCIA	Transperitoneal	Primary suturing	7	9	Cure
2	RCIA/V	Transperitoneal	ePTFE graft interposition and primary suturing	13	16	Cure
3	IVC	Transperitoneal	Primary suturing	14	18	Deep venous thrombosis at 12th day
4	LCIA	Transperitoneal	ePTFE graft interposition	10	16	Cure
5	LCIA/V	Transperitoneal	Dacron greft interposition, primary suturing	12	15	Cure
6	LCIA	Transperitoneal	Resection; end-to-end anastomosis	6	6	Cure
7	LCIA/V	Transperitoneal	SVG interposition, primary suturing	11	14	Cure

R, right; L, left; CIA, common iliac artery; CIA/V, common iliac artery and vein; IVC, inferior vena cava; ePTFE, polytetrafluoroethylene ; SVG, saphenous vein graft

iliac artery and vein are parallel but common iliac vein crosses the aorta and common iliac artery posteriorly on the left side. The close relation of vessels and vertebrae make the patient more susceptible to injury in prone position at lumbar vertebrae surgery.⁷⁻⁹ Although rare, when vascular injury occurs mortality rate is about 15–61%.^{3,4,6} Mostly, left common iliac artery was injured since it courses just in front of L4–5 level. Left common iliac vein can be injured via the anatomic location of fibrocartilage at level L4–5 that is prone to injury.⁸ A defect in anterior longitudinal ligament makes the surgical tool to easily reach the major vessels.¹⁰ The predisposing factors that increase the risks are degeneration or defect of fibrous annulus or anterior ligament, persistent adhesions of prevertebral structures to anterior longitudinal ligament, circumstances like re-operation, aggressive exploration and inappropriate patient position.¹¹ The most common vascular injury region was detected as iliac artery course in our series. Special attention must be paid for preservation of these vessels during lumbar disc surgery.

Clinical course of vascular trauma can be classified as acute, subacute and chronic. Acute blood loss can be presented by the loss of femoral pulse, pallor, coldness of extremity and even shock. The overall mortality rate for such a situation is 80%.¹²⁻¹⁴ In early stage, persistent hypotension and local hemorrhage are the main findings alerting the surgical team for a vascular injury.^{8,15} Massive hemorrhage after vascular injury is reported in seven of 25 patients (28%), and hemorrhage can be the only significant finding during surgery.¹⁶ Great vascular injuries are hard to detect owing to their retroperitoneal location.^{11,17,18} The anesthesiologist should warn the surgeon for a possible vascular complication if hypotension cannot be relieved in spite of the volume replacement and appropriate positive inotropic medication.⁸

Lacerations usually become symptomatic intraoperatively or in the early postoperative period, while AVF were identified as late as 11 years postoperatively, on an average more than a month postoperatively. Most common late stage complications are AVF and pseudoaneurysms. Diagnosis of long-term complications (AVF and pseudoaneurysm) may be delayed owing to their occult symptomatology. Early findings of retroperitoneal hemorrhage are clues for an AVF or a pseudoaneurysm.¹⁹ Awareness for the signs and symptoms – such as swelling of the legs, shortness of breath, cardiac failure, huge pulsatile abdominal mass and machinery soufflé – aids in the correct diagnosis. Abdominal distention may ensue from an expanding retroperitoneal haematoma and/or paralytic ileus. Isolated venous injuries of great retroperitoneal veins remain dormant clinically due to the tamponade effect of a perivascular hematoma.

Non-invasive tests like color duplex USG, dynamic CT or magnetic resonance imaging can verify the diagnosis. Angiography is indicated if the symptoms are obscure. Traditionally, pseudoaneurysm and AVF are treated surgically, but endovascular stenting is an alternative to surgical treatment.¹⁹⁻²¹ We could not perform endovascular stenting in our series due to (i) technical limitations and (ii) emergency of the clinical situation.

The importance of prompt diagnosis and urgent surgical intervention for acute onset vascular complications is well documented in the literature.^{6,8,9,16} Vascular injury may not be immediately recognized at the time of surgery, since healthy and young patients may not exhibit clinical signs until a large volume of blood have been lost. 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. If vascular injury is suspected and the patient condition allows, CT may identify the extent of bleeding that has occurred. It can also differentiate between arterial and venous injury and determine the site of vascular injury and whether active bleeding is still present. Ultrasound is valuable in confirmation of the presence of intra-abdominal fluid, when transfer to a CT scanner is not appropriate, as in our series. On the other hand, angiography has the advantage of providing definitive arterial anatomy and permitting immediate endovascular treatment in selected cases.²¹ Avoidance of time-consumption can sometimes be life-saving and emergent operation can even be performed without any diagnostic examination depending on the clinical situation of the patient.

Control of the hemorrhage and stabilization of hemodynamic status from retroperitoneal approach is difficult. On the contrary, hematoma can be readily controlled with transperitoneal approach without any need for blood transfusion. Autologous graft is used for repair of the widely damaged areas. If prosthetic graft is necessary, closure of the graft and the anastomotic border with omentum may help to reduce the likelihood of graft infection. We preferred transperitoneal approach since it provides better results in terms of hemostasis. Primary suturing was our first choice for repair of the vascular injury. End-to-end anastomoses of the defect are an alternative in case of the failure of primary suturing. Materials like polytetrafluoroethylene, dacron graft or saphenous graft can be used in this purpose. Modern imaging modalities and endovascular techniques have popularized minimally invasive treatment that should be considered first line in patients who are stable. Endovascular repair has been advocated for treatment of AVF rather than the management of vessel perforation.²¹

Based on our experience, the transperitoneal approach is preferred for controlling bleeding in cases involving early onset injury. The patient's hemodynamic condition should be stabilized before the retroperitoneal space is entered. The injured vessel must be recognized by thorough assessment of the hematoma site, and the vessel should be encircled at its proximal and distal injury sites before the hematoma is treated. The hematoma can then be entered and the injury site exposed easily without the need for additional blood transfusions. Aorta was occluded with proximal aortic catheter for bleeding control and vascular repair was applied in two patients with uncontrolled bleeding. Proximal aortic catheter should not be forgotten in such cases for providing better bleeding control. Ureters should be inspected in vascular injuries due to the co-existence of urethral laceration. The first choice of surgical technique to repair vessel injury should be primary closure of the defect or end-to-end anastomosis. When the injured area is extensive, autologous graft (saphenous vein) should be used. In patients in whom a prosthetic graft is required, covering the anastomosis line and graft with omentum may be helpful to reduce the possibility of graft infection. Important factors that decrease the possibility of these complications, however, include avoiding prosthetic graft if possible, covering the disc surgery site with sterile drapes and using careful aseptic technique. A delay of a few minutes in treating the complication is less important than remaining calm and choosing the best approach.

The reason we did not have any mortality in the follow-up period may be attributed to timely diagnosis and early aggressive surgical treatment. The reason of paraplegia occurring in one patient may be either the hemorrhage to spinal channel or trauma during the surgery for discus hernia.

Conclusion

Possibility of vascular injury at lumbar disc surgery and its potential for mortality must be remembered. Clinical findings like hypotension, bleeding and tachycardia during lumbar disc surgery must alert the team for timely diagnosis and appropriate intervention in order to reduce mortality and morbidity. Transperitoneal approach provides better exposure and more effective control of hemorrhage in vascular injuries that may lead to hemodynamic instability.

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