Eur Spine J (2016) 25 (Suppl 1):S124–S128
DOI 10.1007/s00586-015-4225-2

CASE REPORT

Lumbar artery injury from which the Adamkiewicz artery originated associated with lumbar spine injury: successfully treated by transcatheter arterial embolization

Tomoaki Koakutsu[1,2] · Toshimi Aizawa[2] · Hironao Yuzawa[1] · Eiji Itoi[2] · Shigeki Kushimoto[1]

Received: 19 July 2015 / Revised: 31 August 2015 / Accepted: 31 August 2015 / Published online: 5 September 2015

Abstract
Purpose Lumbar artery injury associated with lumbar spine injury can be a cause of shock leading to life-threatening condition. The Adamkiewicz artery often bifurcates from a lumbar spine or an intercostal artery at the thoracolumbar junction, where spine injury most commonly occurs. However, in emergency transcatheter arterial embolization for lumbar artery injury, hemostasis has priority and blood supply to the Adamkiewicz artery is not frequently confirmed. The aim of this report is to present the case of lumbar spine injury with lumbar artery injury from which the Adamkiewicz artery bifurcated.
Methods Retrospective description of a case.
Results A 58-year-old man was pinned under about 300-kg steel container that fell on his back. He was transported to our hospital presented with hemorrhagic shock. Contrast-enhanced computed tomography demonstrated L1–2 flexion-distraction injury and the left psoas major muscle swelling with extravasation of contrast medium, which suspected lumbar artery injury. Emergency angiography demonstrated the bilateral 2nd lumbar artery injury. Likewise, the Adamkiewicz artery originated from the distal part of the left 2nd lumbar artery. Fortunately, selective angiography of the left 1st lumbar artery depicted collateral circulation to the Adamkiewicz artery. Embolization of the bilateral 2nd lumbar artery was performed and massive hemorrhage was controlled successfully without spinal cord ischemia.
Conclusions Close attention must be paid to lumbar artery injury in the management of patients with lumbar spine injury. Once lumbar artery injury is found, transcatheter arterial embolization can be the choice of the treatment with careful attention to the Adamkiewicz artery.

Keywords Artery · Embolization · Lumbar vertebrae · Retroperitoneal space · Spinal cord

Introduction

Massive hemorrhage is the most common cause of shock in trauma patients. Retroperitoneal space is one of the major bleeding cavities, in which hemorrhage is most frequently associated with pelvic fracture [1, 2]. Lumbar artery injury (LAI) can also lead to upper retroperitoneal hemorrhage [3, 4], which can be a cause of shock leading to life-threatening condition.

Lumbar artery injury associated with lumbar spinal fracture/dislocation is relatively rare [3–6]. Once retroperitoneal hemorrhage is caused by lumbar artery injury, surgery often fails to identify bleeding sources and can cause further bleeding, limiting its use [4, 6–8]. Transcatheter arterial embolization (TAE) has been demonstrated to be safe and effective method for immediate control of active extravasation, as well as to prevent future hemorrhage from an injured lumbar artery [4, 6–9].

The Adamkiewicz artery (AKA) supplies blood to the anterior spinal artery and often bifurcates from a lumbar or an intercostal artery at the thoracolumbar junction, where spinal injury most commonly occurs [10–12]. Thus,

✉ Tomoaki Koakutsu
koakutsu@med.tohoku.ac.jp

[1] Department of Emergency and Critical Care Medicine, Tohoku University Hospital, 1-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi 980-8574, Japan

[2] Department of Orthopaedic Surgery, Tohoku University Hospital, 1-1 Seiryo-machi, Aoba-ku, Sendai, Miyagi 980-8574, Japan

embolization or ligation of the lumbar artery has a risk of spinal cord ischemia [3, 4, 6, 13]. However, in emergency TAE for retroperitoneal hemorrhagic patients, hemostasis has priority and blood supply to the AKA is not frequently confirmed, which may result in paralysis after treatment [3, 4, 6, 14].

We describe here a case of lumbar spine injury with lumbar artery injury from which the AKA was bifurcated. In this case, the collateral circulation to the AKA was carefully confirmed by selective angiography and emergency TAE was successfully conducted not only to obtain hemostasis but also to prevent spinal cord ischemia.

Case report

A 58-year-old man was pinned under about 300-kg steel container that fell on his back at a parcel delivery service distribution center. He was transported to our hospital complaining of back pain 40 min after the accident. On arrival, he presented with hemorrhagic shock. A subcutaneous hematoma was noted in the thoracolumbar junction. Neurological findings were normal.

Computed tomography (CT) demonstrated L1–2 type C injury according to the Magerl classification [15] (Fig. 1), and the left psoas major muscle swelling with extravasation of contrast medium, which suspected lumbar artery injury (Fig. 2). No other lesions related to hemodynamic instability were detected. Transfusion of red cell concentrate (4 units) was given and emergency angiography was performed.

A large amount extravasation of contrast medium was demonstrated from the proximal part of the left 2nd lumbar artery. Likewise, the AKA originated from the distal part of this artery (Fig. 3). Intra-arterial infusion of 1 % lidocaine into the proximal part of the left 2nd lumbar artery induced paralysis of both legs, suggesting the embolization of this artery may possibly cause spinal cord ischemia. Accordingly, the proximal part of this artery could not be chosen as a site of embolization.

Subsequent selective angiography of the left 1st lumbar artery depicted collateral circulation to the left 2nd lumbar artery without arterial damages (Fig. 4). Therefore, embolization of the proximal part of left 2nd lumbar artery was performed. After the embolization, the left 1st lumbar artery was confirmed to have patency of the AKA (Fig. 5). Selective angiography of the right 2nd lumbar artery showed multiple extravasations (Fig. 6). After this artery was embolized, circulation had become stable without necessity of additional blood transfusion. No paralysis occurred.

On the 7th day after injury when the general condition was stabilized, L2 spine-shortening osteotomy [16] using T12–L3 pedicle screw and rod system were conducted. The patient had a favorable postoperative course and was referred to a hospital for rehabilitation 2 weeks after surgery. On a follow-up examination 2 years after surgery, there were no subjective symptoms of back pain, and no abnormal neurological findings. Plain X-rays revealed complete bone union (Fig. 7).

Fig. 1 Computed tomography of the lumbar spine demonstrated L1–2 flexion-distraction injury

Fig. 2 Contrast-enhanced CT demonstrated swelling of the left psoas major muscle and extravasation of the contrast medium (*arrow*)

Fig. 3 Angiography of the left 2nd lumbar artery trunk demonstrated extravasation of contrast medium from the proximal part of the artery (*arrow*). The Adamkiewicz artery was originated from the distal part of the artery (*white arrow*)

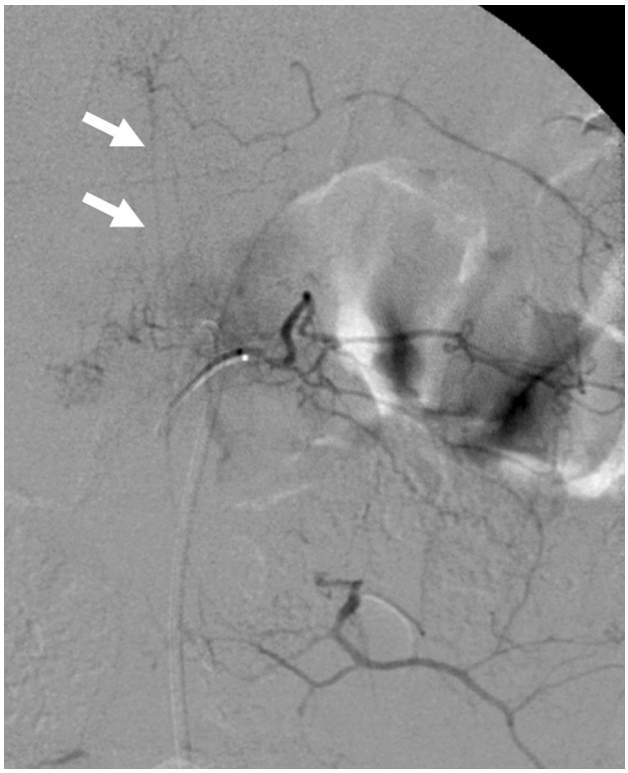

Fig. 4 Angiography of the left 1st lumbar artery depicted the Adamkiewicz artery (*white arrow*) via collateral circulation

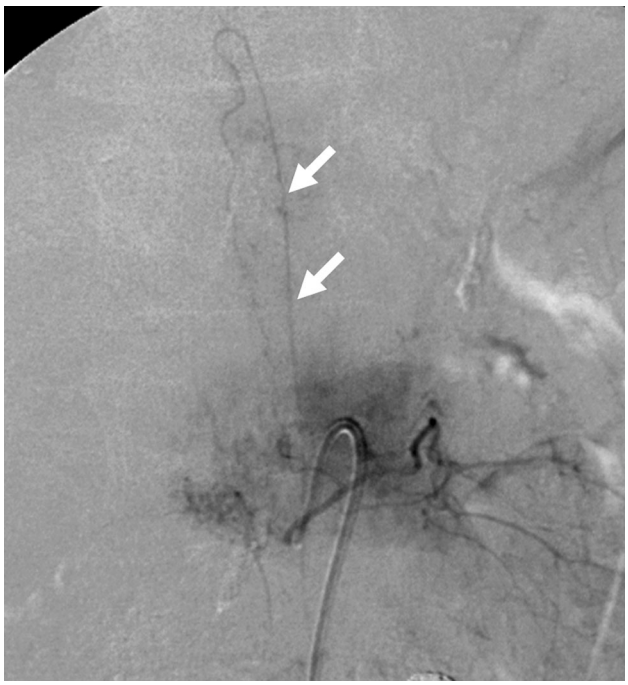

Fig. 5 Post-embolization angiography using embolization coils of the left 2nd lumbar artery demonstrated patency of the Adamkiewicz artery (*white arrow*)

Fig. 6 Angiography of the right 2nd lumbar artery demonstrated multiple extravasations (*arrow*)

Discussion

Lumbar artery injury occurs rarely, and is caused by penetrating, blunt trauma and iatrogenic injury [3–5, 17]. Lumbar arteries are less mobile and thus, they might be

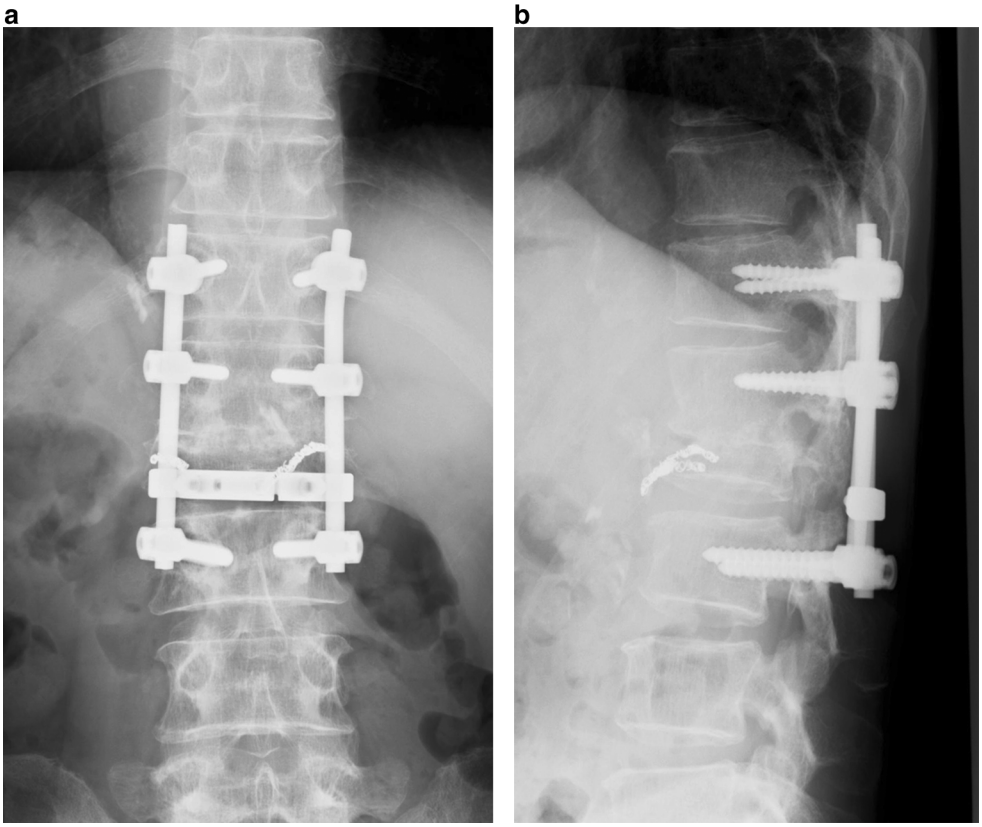

Fig. 7 Posteroanterior (**a**) and lateral (**b**) plain radiographs of the lumbar spine 2 years after the surgery revealed bone union

lacerated by the mobile aorta in high-energy trauma [3, 18]. LAI associated with spinal fracture/dislocation can be life-threatening when it is responsible for massive hemorrhage [3–6]. Since the retroperitoneal space is abundant in blood vessels, surgical hemostasis is very invasive and difficult, particularly, in cases of severe hemorrhage associated with coagulopathy. Therefore, TAE is the treatment of choice of lumbar artery injury [4, 6–9].

The AKA usually bifurcates from one of the T8–L2 intercostal or lumbar arteries on the left side, and nourishes the lower part of the spinal cord [10–12]. Since spinal injuries frequently occur in the thoracolumbar junction, the intercostal or lumbar arteries from which the AKA bifurcates can be injured. In addition, once the artery from which the AKA originates is embolized at the proximal part of the AKA bifurcation, severe paraplegia may be induced [3, 4, 6, 14]. Thus, before embolization of these vessels, the relationship between the intercostal or lumbar arteries and the AKA should be carefully confirmed [4]. The test for paraplegia by administration of a local anesthetic before TAE [19] is useful but it is actually insignificant in patients with disturbance of consciousness or serious complication of spinal cord injury [3].

In the present case, the main source of hemorrhage was the retroperitoneal space, as indicated by contrast-enhanced CT, and the main cause of bleeding was strongly suspected to be the bilateral 2nd lumbar arterial injuries, as indicated by angiography. Since the AKA was found to arise from the left 2nd lumbar artery, selective angiography was performed on the surrounding lumbar arteries to evaluate the collateral circulation. Fortunately, collateral circulation to the AKA was confirmed to come from the left 1st lumbar artery. Thus, the left 2nd lumbar artery could be embolized and massive hemorrhage could be controlled successfully.

Conclusions

Close attention must be paid to LAI in the management of patients with lumbar spine injury. Once the LAI is found, TAE can be the choice of the treatment with careful attention to the AKA. If the AKA bifurcates from the injured lumbar artery, selective angiography of the adjoining lumbar arteries to evaluate collateral circulation before execution of TAE should be performed while maintaining blood supply to the AKA.

Acknowledgments No funds were received in support of this work.

Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

Informed consent The patient was informed that data from the case would be submitted for publication, and gave his consent.

References

1. Allen RE, Eastman BA, Halter BL, Conolly WB (1969) Retroperitoneal hemorrhage secondary to blunt trauma. Am J Surg 118:558–561
2. Spahn D, Bouillon B, Cerny V, Coats TJ (2013) Management of bleeding and coagulopathy following major trauma: an European guideline. Crit Care 17(R76):1–45
3. Sclafani SJA, Florence LO, Phillips TF, Scalea T, Glanz S, Goldstein A, Duncan A, Shaftan G (1987) Lumbar arterial injury: radiologic diagnosis and management. Radiology 165:709–714
4. Sofocleous CT, Hinrichs CR, Hubbi B, Doddakashi S, Bahramipour P, Schubert J (2005) Embolization of isolated lumbar artery injuries in trauma patients. Cardiovasc Intervent Radiol 28:730–735. doi:10.1007/s00270-003-0117-7
5. Domenicucci M, Ramieri A, Lenzi J, Fontana E, Martini S (2008) Pseudo-aneurysm of a lumbar artery after flexion-distraction injury of the thoraco-lumbar spine and surgical realignment: rupture treated by endovascular embolization. Spine (Phila Pa 1976) 33:E81–E84. doi:10.1097/BRS.0b013e3181624b93
6. Yuan KC, Hsu YP, Wong YC, Fang JF, Lin BC, Chen HW (2011) Management of complicated lumbar artery injury after blunt trauma. Ann Emerg Med 58:531–535. doi:10.1016/j.annemergmed.2011.07.002
7. Marty B, Sanchez LA, Wain RA, Ohki T, Marin ML, Bakal C, Veith FJ (1998) Endovascular treatment of a ruptured lumbar artery aneurysm: case report and review of the literature. Ann Vasc Surg 12:379–383. doi:10.1007/s100169900172
8. Siablis D, Panagopoulos C, Karamessini M, Karnabatidis D, Margariti S, Tepetes K, Panagiotopoulos E (2003) Delayed diagnosis of a false aneurysm after lumbar arterial injury: treatment with endovascular embolization: a case report. Spine (Phila Pa 1976) 28:E71–E73
9. Kushimoto S, Arai M, Aiboshi J, Harada N, Tosaka N, Koido Y, Yoshida R, Yamamoto Y, Kumazaki T (2003) The role of interventional radiology in patients requiring damage control laparotomy. J Trauma 54:171–176
10. Takase K, Sawamura Y, Igarashi K, Chiba Y, Haga K, Saito H, Takahashi S (2002) Demonstration of the artery of Adamkiewicz at multi-detector row helical CT. Radiology 223:39–45
11. Biglioli P, Roberto M, Cannata A, Parolari A, Fumero A, Grillo F, Maggioni M, Coggi G, Spirito R (2004) Upper and lower spinal cord blood supply: the continuity of the anterior spinal artery and the relevance of the lumbar arteries. J Thorac Cardiovasc Surg 127:1188–1192
12. Nijenhuis RJ, Leiner T, Cornips EM, Wilmink JT, Jacobs MJ, van Engelshoven JM, Backes WH (2004) Spinal cord feeding arteries at MR angiography for thoracoscopic spinal surgery: feasibility study and implications for surgical approach. Radiology 233:541–547
13. Orchowski J, Bridwell KH, Lenke LG (2005) Neurological deficit from a purely vascular etiology after unilateral vessel ligation during anterior thoracolumbar fusion of the spine. Spine (Phila Pa 1976) 30:406–410
14. Ozoilo K, Stein M (2013) Paraplegia complicating embolization for bleeding intercostal artery in penetrating trauma. Injury Extra 44:70–73
15. Magerl F, Aebi M, Gertzbein S, Harms J, Nazarian S (1994) A comprehensive classification of thoracic and lumbar injuries. Eur Spine J 3:184–201
16. Kokubun S, Ozawa H, Aizawa T, Ly NM, Tanaka Y (2011) Spine-shortening osteotomy for patients with tethered cord syndrome caused by lipomyelomeningocele: clinical article. J Neurosurg Spine 15:21–27
17. Tummala V, Nanavati KI, Yrizarry JM, Scagnelli T (2008) Lumbar artery pseudoaneurysm following percutaneous nephrolithotripsy: treatment by transcatheter embolization. Indian J Urol 24:408–410. doi:10.4103/0970-1591.42628
18. Armstrong NN, Zarvon NP, Sproat IA, Schurr MJ (1997) Lumbar artery hemorrhage: unusual cause of shock treated by angiographic embolization. J Trauma 42:544–545
19. Doppman J, Girton M, Oldfield E (1986) Spinal Wada test. Radiology 161:319–321