Journal of Vascular Medicine & Surgery
ISSN: 2329-6925

Certík et al., Vasc Med Surg 2015, 3:3
DOI: 10.4172/2329-6925.1000201

Case Report Open Access

Flank Incision Laparotomy Approach for Repair of Traumatic Left Renal Artery Thrombosis, Small Bowel and Transverse Colon Injury

Certík B[1]*, Treska V[1], Bierhanzlova J[1], Matejka J[2], Zeman J[2] and Matejka T[2]

[1]Department of Surgery, University Hospital Plzen, Czech Republic
[2]Department of Orthopaedics and Traumatology of Locomotive Organs, University Hospital Plzen, Czech Republic

Abstract

Renal artery thrombosis is a less common complication of blunt abdominal injuries. The most common cause is car crash where, due to sudden deceleration, numerous internal injuries may develop. In our case report, we describe traumatic occlusion of the left renal artery with complete ischemia of the left kidney in a circulatory stable young female patient with ambiguous finding in the abdominal cavity in a Computer Tomography (CT) scan requiring abdominal cavity revision. Due to short delay after the injury, we attempted to perform revascularisation of the left kidney. We have used the left side retroperitoneal approach for this procedure.

Keywords: Renal artery thrombosis; Seat belt injury; Computer tomography

Introduction

Seat belts decrease the severity of injuries in car crashes by preventing the passengers in the vehicle from an intensive impact with surrounding objects or even from launching through the broken front windscreen. It is estimated that up to 80% of deaths in car crashes could be prevented by correct usage of seat belts [1]. Nevertheless, in certain circumstances (collision of motor vehicles at high speed), these seat belts may cause even serious injuries [2,3]. Kulowski and Rost [4] were the first ones to describe the injuries caused by seat belts in 1956. Garrett and Braunstein [5] described the "seat belt syndrome" in 1962 and Doersch and Dozier [6] discussed the term "seat belt sign" in 1968. The seat belt sign is characterised by bruises and excoriations on the chest and abdominal wall corresponding with the position of the seat belt (diagonal or horizontal). They may even spread to the neck of the patient [7]. Many studies have proven association of this sign with severe neck injuries, injuries of intrathoracic and intra-abdominal organs and lumbar spine [8-10]. The presence of the seat belt sign should always alert the physician about the high probability of specific internal injuries.

Renal artery thrombosis is a less common complication of blunt abdominal injuries. The most common cause is car crash where, due to sudden deceleration, numerous internal injuries may develop. Renal artery occlusion is very rare as an isolated blunt injury.

The first description of traumatic renal artery occlusion comes from Von Recklinghausen in 1861 [11]. Rohl published the first successful revascularisation of renal artery thrombosis about 100 years later [12]. In the last century, the biggest summary review of blunt renovascular injuries was performed by Clard et al. In 1981 he reported a total of 250 patients collected from all articles in the English literature [13]. Currently, the biggest study is a US study from 2006 analysing 517 blunt injuries of renal arteries. This study has shown that incidence of this injury in blunt abdominal injuries is only 0.05 % [14].

Discussion about the management of blunt renovascular injuries is affected by numerous factors.

Firstly – experiences of every traumacentre with this injury type are limited due to rarity incidence. Secondly – revascularisation rarely leads to normal renal function return, even if the perioperation procedure is successful. Thirdly – prolonged renal ischemia is associated with low probability of renal function renewal.

In our case report, we describe traumatic occlusion of the left renal artery with complete ischemia of the left kidney in a circulatory stable young female patient with ambiguous finding in the abdominal cavity in a Computer Tomography (CT) scan requiring abdominal cavity revision. Due to short delay after the injury, we attempted to perform revascularisation of the left kidney. After this procedure, stabilisation of seat belt fracture in the lumbar spine (L2/3) was scheduled.

Case Report

A 7-year-old female patient, weight 30 kg, height 135 cm, was in a car crash on 22/9/2013 at 3:15 pm in a passenger car (frontal impact – bus). She was sitting on the rear seat on a booster seat and she was wearing a seat belt. The mother, driver, died on the spot and the girl had to be extricated from the car. She arrived at the Emergency Department of the University Hospital in Plzeň at 4:30 pm. Her circulation was stable, she was fully conscious, without dyspnoea. She did not remember the exact cause of the injury. She complained about abdominal pain localised in the strip with excoriations and haematomas passing through the abdomen obliquely from the left side up to the right side (in accordance with the course of the seat belt). She did not have any other complaints; no neurological deficit was found. There were no clear clinical signs of intra-abdominal injury. After inserting a urinary catheter, the urine was clear. On the head, chest and extremities, there were no signs of severe injuries.

Due to the mechanism of the injury – undoubtedly a seat belt injury – a CT scan was performed.

***Corresponding author:** Bohuslav Certík, Vascular Surgeon, Department of Surgery, University Hospital Plzen, Alej Svobody 80, Plzen, 30460, Czech Republic, Tel: +420-377104275; E-mail: certik@fnplzen.cz

Received April 17, 2015; **Accepted** May 12, 2015; **Published** May 14, 2015

Citation: Certík B, Treska V, Bierhanzlova J, Matejka J, Zeman J, et al. (2015) Flank Incision Laparotomy Approach for Repair of Traumatic Left Renal Artery Thrombosis, Small Bowel and Transverse Colon Injury. J Vasc Med Surg 3: 201. doi:10.4172/2329-6925.1000201

The CT scan showed an occlusion of the left renal artery with ischemia of the left kidney (Figure 1), slight lacerations of the right liver lobe, intestinal contusion with mesenterial bleeding and small hemoperitoneum. Skeletal images showed a seat belt fracture in the L2/3 segment with complete ligamentous injury and significant segmental kyphotisation.

In the laboratory tests, there were no signs of massive bleeding (haemoglobin 112 g/L, white blood cell 31 × 10^9/L), slight elevation of liver enzymes.

Due to the CT finding, surgical revision of the left kidney and abdominal cavity was performed at 5:20 pm. Interventional management of the finding in the lumbar spine was scheduled for further course of the treatment due to negative neurological finding.

Due to dominant injury of the renal artery, the surgery was led by a vascular surgeon.

Using the left side retroperitoneal approach, we freed the capsules of the left kidney with a significant amount of blood. The kidney itself was solid, uninjured, but completely ischemic with purple colour (Figure 2). The renal vein was intact, the renal artery was very gracile, without pulse. In the middle of its course, there was a thrombus (Figure 3). Due to the gracile condition of the artery, replacement was not possible. After dissecting the whole course of this renal artery, we clamped its origin from the aorta and performed slight transversal arteriotomy above the visible thrombus. Direct thrombectomia was associated with backward bleeding from the kidney. Application of diluted Heparine solution was completely free. The arterial wall was not dissected. However, there were significant spasms. Therefore, the artery was slightly dilated using the Fogarty catheter after the recanalisation. Afterwards, the arteriotomy was closed using a transversal suture with Premilen 8/0. After removing the clamp, the blood support in all of the kidney renewed and it quickly reached good turgor (Figure 4).

Abdominal cavity revision was performed using the original retroperitoneal approach after opening the peritoneum. Slight haemoperitoneum was found with up to 200 ml of darker blood. During revision of intestinal loops, we found segmentary mesenterial separation from the respective intestinal part in 2 places. Its wall was contused and ischemic (Figure 5). Therefore, 2 partial intestinal resections about 10 cm were performed using the E-E anastomosis with absorbable suture (Maxon) in one layer. There were no severe traumatic changes in the liver; stomach, ascendent colon and descendent colon were uninjured. After removing the transversal colon from the omentum, we found a long laceration in the middle part of the mesotransversum. At the top of the injured mesotransversum, the respective part of the transversal colon was contused with signs of wall ischemia. The finding was treated with partial resection of the transversal colon (about 10 cm) using E-E anastomosis with absorbable suture in one layer. After cleaning the abdominal cavity, internal organs were covered by the omentum and the cavum Douglassi was drained using a soft drain. The left retroperitoneum was closed with active drainage.

Further post-operative course did not bring any severe

Figure 1: Post-traumatic CT scan showing complete ischemia of the left kidney in traumatic renal artery thrombosis.

Figure 2: Peri-operative finding of complete ischemia of the left kidney.

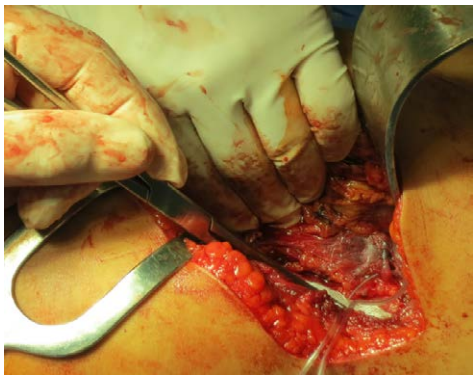

Figure 3: Perioperative finding of segmental thrombosis of gracile renal artery at the left side.

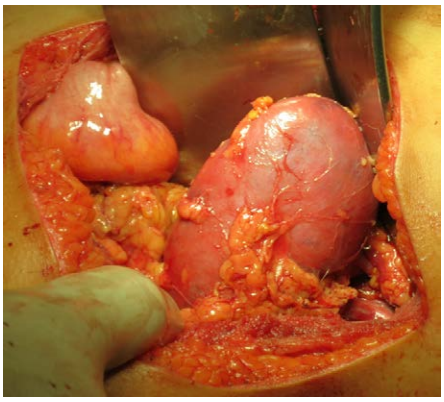

Figure 4: Good blood supply of the left kidney after revascularisation.

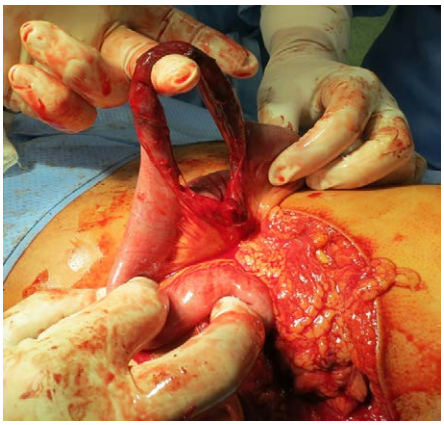

Figure 5: Two areas of segmental intestinal injury.

complications. The circulation of the injured patient was stable, no intra-abdominal complications appeared. In the laboratory tests, elevated myoglobin level was found (3,500) as a sign of vast injury. With good renal function, the myoglobin was quickly eliminated.

On the second day after the injury, spinal magnetic resonance imaging was performed. Orthopaedist indicated the stabilisation of the seat belt fracture of lumbar vertebrae (L2-3). The MRI and ultrasonography examination showed good blood support of the left kidney.

Due to high risk of possible inflammatory complications after severe injury in the abdominal cavity requiring 3 intestinal resections and due to myoglobin blood level associated with the muscle tissue contusion, spine stabilisation was scheduled for later. The patient was resting on her bed (Figure 6).

After normalizing of the laboratory parameters and with clinically undisturbed finding in the abdomen, orthopaedic surgery was performed on 7/10/2013. An incision over L1-L3 was performed to access the subcutaneous tissue. Severe bleeding results were found, muscles were torn. After skeletization, a completely torn and luxated L2/3 joint at the right side was found. At the left side, the finding was not as severe, the joint was only sub-luxated. The supra and infraspinous L2/3 ligaments were completely interrupted. The rupture continued up to the ligamentum flavum, which was torn as well. The dural sac was not injured. The finding was treated with stabilisation – posterolateral instrumented L2/3 spondylodesis was performed.

Post-operative course after spinal stabilisation was not complicated at first, the patient underwent gradual physiotherapy. Up to that time, the completely afebrile course was complicated with high fever (about 40°C) and vomiting on 13/10/2014. The CT examination did not show any severe abdominal pathology. Left kidney blood circulation was good, no complications were found in the wounds. The cause of the fever in the patient was a viral infection with labial herpes.

After disappearance of the acute symptoms of the herpetic infection, further course was not complicated and the injured patient was released to go home on 1/11/2013.

The girl is regularly monitored by a paediatrician, her general condition is excellent. Renal laboratory tests are normal, the blood pressure is 90/50. She continued with compulsory school attendance and she finished her 2nd year of primary school without any delays.

At a check-up after half a year, the girl did not have any problems, the abdomen was healed without complications, passage through the gastrointestinal tract was free.

The control CT examination half a year after the injury showed good blood support of both the kidneys (Figure 7). Abdominal cavity was without post-operative complications. The spine was healed in spondylodesis of high quality. For future we plan use contrast-enhanced ultrasound in the evaluation of renal artery also to avoid radiation dose [15].

Discussion

The diagnostics of blunt injuries of renal artery are complicated. Physical examination and ultrasonography usually are not able to determine this injury. CT examination has high sensitivity, up to 98%. Therefore, due to a more liberal approach in CT usage in blunt abdominal injuries in the last two decades, incidence of renal arteries injuries is increasing [16].

Optimal management of blunt renal arteries injuries is still a matter of discussion. In general, renal artery avulsion requires immediate revision and bleeding management. In renal artery thrombosis, the decision is very complicated. There are three options – immediate surgical revascularisation, prophylactic nephrectomy or conservative

Figure 6: Postoperative picture of the healed wound, still visible seat belt sign on the abdomen.

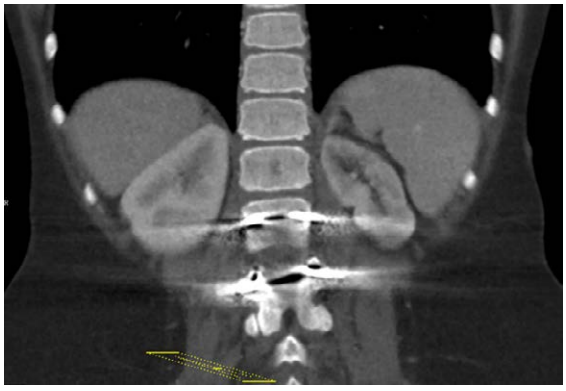

Figure 7: Check-up CT scan of kidneys, half a year after the injury.

treatment. In a US study from 2006, in 517 diagnosed blunt injuries of renal artery, revascularisation was performed in only 9%, nephrectomy in 18% and conservative treatment in good function of the contralateral kidney was preferred in 73% of injured patients (in this group, angiographic intervention in occluded artery was performed in 3% of patients) [14].

Revascularisation with the intention to maintain renal function has been one of the major interests of surgeons since the first reports of the successful revascularisation by Rohl in 1971 and Skinner in 1973 [17]. Successful reconstruction results in thrombosed renal arteries were reported mainly in institutions with extensive experience in elective renovascularisation surgeries. In the majority of the other cases, only very bad early and late results were reported. Haas and Sprinak presented a group of 139 patients with unilateral renal artery injury with initial good revascularisation in only 26% [18]. Long-term results of reconstruction procedures with renewal and maintaining of normal renal function were presented in less than 25% of injured patients.

Revascularisation success rate in occluded renal artery is limited by time. Generally, it is supposed that the kidney is able to tolerate warm ischemia for only 1 hour. In reality, successful revascularisation cases have been presented even 12 hours after the injury. We can conclude that the kidney is able to withstand even longer ischemia than supposed. On the other hand, the duration of renal ischemia does not necessarily correspond to the time since the injury – the arterial occlusion may not be complete at first. In case of polar artery, perfusion may be maintained using the collateral circulation. The critical time threshold to rescue an ischemic kidney is currently less than 2 to 3 hours. In the majority of cases, this time frame has elapsed before revascularisation [19].

The reasons for the low number of revascularizations traumatic renal artery closures are numerous. Technical requirements of the procedure and increasing risks in complex, life threatening injuries. The main aspects are statistically tested bad results, both early and long-term. Long-term results after successful revascularisation in insufficient renal function renewal are associated with arterial hypertension leading to late nephrectomy.

Haas and Sprinak show decreased renal function in 67% of patients after successful revascularisation. Incidence of late nephrectomy due to renovascular hypertension is in the range of 12 to 35% [13,16,18,19]. Therefore, some authors recommend revascularisation only in optimal cases with very short kidney ischemia duration (less than 2 hours) and in the absence of associated life-threatening injuries. On the contrary, a clear indication and revascularisation attempts are recommended in cases of bilateral renal occlusion or in injured patients with one kidney [20,21].

Sporadic case reports describe successful endovascular recanalisation of the renal artery after an injury. Endovascular intervention is a prospect mainly in patients with polytrauma, as surgical intervention significantly increases the risk for the patient. In these cases, the rule "life over the organ" applies.

In summary, conservative therapy is recommended in unilateral post-traumatic thrombosis of the renal artery. In this group of injured patients, long-term monitoring of arterial pressure is necessary due to the risk of renovascular hypertension. This complication is described in 25-50% of cases and it requires nephrectomy. Immediate nephrectomy is not recommended in patients with conservative treatment. On the contrary, in case of complex injuries requiring laparotomy, immediate nephrectomy may be performed to prevent renovascular hypertension.

Conclusion

Complex injuries in seat belt injury are severe. If the seat belt sign is found, even in very clinically favourable condition of the patient, it is necessary to consider a high probability of specific internal injuries. The quickest and most contributive examination is a CT scan. In our case, early diagnostics and interesting approach, particular the laparotomy via a flank incision saved the left kidney of the injured girl and prevented perforation peritonitis development.

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