Acute celiac artery occlusion secondary to blunt trauma: Two case reports

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Case Report

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Abstract

Background

Blunt celiac artery injury is extremely rare, but it is easy to ignore. The clinical manifestation of celiac artery injuries is usually atypical, so it is easy to fail to diagnose them.

Case presentation:

We report two cases of celiac artery occlusion after multiple trauma admitted, its mechanisms were motor vehicle collision and fall from height, respectively. The first patient was combined with severe liver injury, and the right hepatic arterial was embolized with coil assisted by the operation through the superior mesenteric artery. Both patients were managed with non-operation treatment, and no complications occurred during hospitalization.

Conclusions

For patients with celiac artery injury, conservative treatment is an important choice, but successful treatment still needs to be individualized based on the patient's condition.

Background

Acute celiac artery (CA) injuries are rare but potentially life-threatening and are more often caused by a penetrating injury rather than a blunt injury [1, 2]. The CA is located just below the diaphragm at the T12 level, originate from the anterior wall of the abdominal aorta and is usually between 1.0 and 1.5 cm in length. CA artery further divides into the common hepatic artery, the left gastric artery, and the splenic artery. Blunt abdominal vascular injuries account for 5% of abdominal vascular injuries, and CA injuries are the rarest type of abdominal vascular injuries[2]. The clinical manifestation of CA injuries is usually atypical, so it is easy to fail to diagnose them[3], early detection and treatment are importation. We report two cases of patients with CA occlusion secondary to blunt injuries, both of whom recovered after conservative treatment.

Case Presentation

Case 1

A 19-year-old male without protective clothing was injured while driving a motorcycle after hitting the rear-end of a car at a speed of approximately 60 km/h. Upon presentation to our institution, the patient had shortness of breath, and a physical examination and ultrasound assessment indicated right hemopneumothorax. Closed thoracic drainage was urgently performed, and a large amount of gas and approximately 600 ml blood were evacuated. Afterward, his vital signs were stable. Under the protection

of cervical gear, a whole-body Computed tomography (CT) scan was performed and showed right hemopneumothorax, multiple rib fractures and comminuted fractures of the scapula on the right side, liver contusion but no perihepatic hemorrhage. Twelve hours after admission, an abdominal contrast-enhanced CT showed that the liver injury was severe, and the perihepatic hemorrhage had significantly increased. Therefore, the patient was directly transferred to an interventional radiology chamber for hepatic artery angiography and embolization.

The beginning of the interventional operation was not smooth because the opening of the CA could not be found. Instead, the catheter entered the superior mesenteric artery (SMA) on each attempt. By carefully rereading the abdominal contrast-enhanced CT, it was found that the root of the CA was occluded (Fig. 1). As a result, hepatic artery interventional embolization and hemostasis could not be achieved by the routine procedure. Therefore, angiography of the hepatic artery through the SMA was attempted, which showed that collateral circulation between the SMA and the celiac trunk had developed and that there was retrograde contrast media in the initial segment of the splenic artery and occlusion of the CA. Due to the distortion and stenosis of the anastomotic branch, after repeated attempts, the microcatheter was inserted into the hepatic artery. Angiography showed that there was contrast medium leakage in the branch of the right hepatic artery, and active bleeding was still being considered. Given the tiny diameter of the collateral branch, the coil could not be smoothly released. Therefore, the CA was retrogradely opened with a microwire through the SMA (Fig. 2A), and then, the right hepatic artery was embolized with coils successfully through the CA (Fig. 2B). Stent implantation was not performed at this site. After the operation, the hemoglobin did not decrease further; the blood pressure returned to normal; and there were no complaints of abdominal distension, abdominal pain, nausea or vomiting.

During hospitalization, the patient was in good spirits, and his appetite was even better than before. The laboratory examination showed that the liver function was normal. Approximately 1 week later, the risk of bleeding decreased, and anticoagulant therapy with enoxaparin sodium was initiated. A re-examination approximately 2 weeks after the injury showed that the CA was still not recanalized. Thereafter, internal fixation of the scapula was performed. A biloma formed in the right liver and was drained with a pigtail tube. The patient was discharged 6 weeks post-injury. A follow-up CT scan 3 months later showed the origin of CA remained occluded.

Case 2

A 37-year-old male was admitted to the emergency department after falling from a height of 15 m. On admission, his blood pressure was 88/47 mmHg, and rapid fluid resuscitation was performed. After his vital signs were stable, a contrast-enhanced CT scan of the chest and abdomen showed that there was a small high-density mass in a lesser peritoneal sac and in front of the abdominal aorta. Furthermore, bilateral pneumothorax, sternum and bilateral multiple rib fractures, an L4 vertebral burst fracture, iliac wing and acetabular fractures were also discovered. Right calcaneus debridement was emergently performed after admission. The chest and abdominal cavity were assessed by ultrasound 6 hours after admission and showed no bleeding or solid organ injuries. Fourteen hours later, the chest and abdomen

were evaluated by a contrast-enhanced CT scan, and vascular injury with thrombosis at the initial segment of the CA was confirmed (Fig. 3). Furthermore, hemorrhage in the abdominal and retroperitoneal spaces and renal contusion were also found. The patient complained of abdominal distension and occasional nausea, but there was no obvious abdominal pain or any other symptoms. Due to the lack of obvious abdominal tenderness and the presence of bowel sounds, the patient was conservatively treated. No thrombolysis, stent implantation or other treatment was performed. The abdominal Computed tomography angiography (CTA) on the 5th day showed that the CA thrombus was not recanalized. Ten days after admission, internal fixation of the lumbar vertebrae, pelvis and left calcaneus was performed, and anticoagulant therapy with enoxaparin sodium was initiated after the operation. The symptoms of nausea after meals disappeared approximately 4 weeks later, and abdominal distension was significantly relieved after 6 weeks. At 60 days, abdominal CTA showed that the CA thrombus was still not recanalized, and the patient was then discharged. At 3 months follow-up, the patient had no abdominal symptoms.

Discussion

CA injuries account for 0.01%-0.1% of all vascular injuries with a high mortality rate[2, 4], which has been reported as high as 38%-75% in the literature [5]. However, there are no mortality data for blunt CA injuries. Currently, only a few cases of blunt CA injury have been published in the literature, after considering the 2 patients in this paper, the mortality rate is about 10%[6–9]. As CA injuries are prone to being missed, it is estimated that the actual mortality rate is lower. Patients with blunt CA injury often have multiple injuries, and the ISS of the two cases we reported were 36 and 27, respectively. The first case is the first report of CA occlusion with severe hepatic trauma thus far and the first case in which hepatic artery embolization was performed. The two patients were consecutively admitted within one week, suggesting the incidence of CA injury may be underestimated.

Studies have speculated that CA injury is related to the compression of or shear force from the median arcuate ligament. The data indicated that arcuate ligament compression exists in approximately 34% of the CA injury population. Therefore, the anatomical basis of this injury is not uncommon. This injury process can lead to intimal tears, occlusions, dissection flaps and avulsions[4]. In the above two cases, one was due to drastic compression of the chest and downward movement of the diaphragm, and the other was due to the shear force from deceleration of the diaphragm caused by falling. Due to intimal injury, a thrombus in the lumen gradually forms and blocks the initial segment of the CA. These two injury mechanisms are also the most common causes of blunt CA injuries. Some studies have also suggested that the dense nerve plexus may also be involved in the compression of the beginning of the celiac trunk[10].

Due to the abundant collateral circulation between the CA and the SMA, the blood flow through the pancreaticoduodenal arcade and the communicating branches from the esophagus and diaphragm substantially increase when the CA is occluded. The blood flow through the CA can be partially or even completely compensated[8].

The diagnosis of CA injury depends on CTA or interventional radiography. We encountered two consecutive patients with blunt CA injury in one week, which is relevant to the frequent use of contrast-enhanced CT to evaluate abdominal injury in recent years. If there are no obvious symptoms of ischemia or massive hemorrhage after blunt CA injury, it is easy to miss the diagnosis. In addition, the risk of CA and mesenteric vascular injury should be considered when patients have suffered thoracic and abdominal compression or a high fall injury. In the emergency room, the injury mechanism of the trauma patients should be carefully inquired. If there is suspicion of abdominal organ or blood vessel injury, if conditions permit, early and routine enhanced CT scan can help to detect hidden injuries, furthermore, provide important information for emergent surgery.

With the widespread use of modern diagnostic techniques, including contrast-enhanced CT, Magnetic resonance imaging and angiography, the diagnosis rate of CA injury may gradually improve[11, 12]. Therefore, abdominal contrast-enhanced CT should be used as a preliminary screening examination for CA injury[11]. To evaluate the blood flow from collateral branches and the risk of gastrointestinal ischemia, further angiography is more valuable and helpful. For patients with extremely rare celiacomesenteric trunk injuries[13, 14], the outcome can be catastrophic if the injury is not diagnosed in time.

Currently, there are no guidelines for the treatment of CA injury. We believe that conservative treatment is feasible when the patient's hemodynamics are stable and there is no evidence of abdominal organ ischemia. For stable and asymptomatic patients, short-term anticoagulation should be used to prevent thrombus progression. Before a CA thrombus is stable, abdominal signs should be closely observed. If there are signs of intestinal colic, a lack of bowel sounds or peritonitis, it is suggested that the local thrombus may progress[15]. Therefore, if there are changes in the abdominal signs, it is necessary to promptly perform contrast-enhanced CT and determine the need for surgery.

The following indications suggest that emergent laparotomy may be required: active arterial bleeding, progressive pseudoaneurysms and perivascular retroperitoneal hematoma, evidence of obvious ischemia of the stomach, intestines or liver, vascular anatomical variations (such as in the celiacomesenteric trunk) [16], and arterial dissection or concomitant abdominal organ injuries. When there are no resources available for interventional operations, direct surgical treatment of the CA is the simplest and most effective treatment method. Surgical treatments include repair, ligation, and bypass. The risk of organ ischemia is small after CA injury, which also shows that it is safe and feasible to ligate the CA during damage control surgery[16].

Endovascular interventions include balloon dilation, stent implantation, and coil embolization. Intravascular procedures may increase the risk of vascular injury. Other related complications include endoleaks, stent-graft occlusion, stent-graft migration, and aneurysms. Silvia reported a patient who underwent abdominal stent implantation due to abdominal angina and found that the stent migrated to the splenic artery three months later[17]. We did not choose balloon dilation or stent implantation because the patient's liver had sufficient blood supply, and the occluded CA was beneficial to the patient's

injury at that time. For patients with CA occlusion, our experience suggests that the celiac trunk can be retrogradely opened through the SMA with a microwire, and then, the stent can be placed in an antegrade manner.

There may be occlusion, arterial rupture, aneurysm or dissection after a CA injury[12]. If the patient has atherosclerosis or hypertension, intravascular stent implantation can help reduce the risk of long-term complications. In theory, due to compensatory dilation, aneurysms and even rupture of the pancreaticoduodenal artery may occur[18]. There have been no reports of recanalization of the CA after it became occluded.

Conclusions

Blunt CA injuries are rare events with a high mortality rate. The management of two cases in a short period in our department may indicate the incidence of CA injury has been underestimated. Early use of contrast-enhanced CT for patients with chest and abdomen injuries, especially in emergency room period, will reduce the missing rate of CA injury. Due to the abundance of collateral branches, the dominant organs usually do not show significant ischemia after occlusion of the CA. In patients with CA occlusion, interventional treatment of the CA or dominant organs can be performed through SMA. There are no guidelines for the treatment of CA injury, so management should be individualized. For patients with stable hemodynamics and no abdominal organ ischemia, conservative treatment and close observation of abdominal signs is safe and feasible.

Abbreviations

CA: Acute celiac artery; SMA: Superior mesenteric artery; CT: Computed tomography; CTA: Computed tomography angiography

Declarations

Ethical Approval and Consent to participate

The ethics approval was waived by the ethics committee of Chongqing University Central Hospital, and written informed consent was obtained.

Consent for publication

Written informed consent for publication of the clinical data and images was obtained from the patient.

Availability of data and materials

All relevant data and materials are presented in the paper

Competing interests

The authors declare no conflict of interests.

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Authors' contributions

All the authors participated in the treatment of this patient, the conclusions were developed by HL, TL, JY, PH and TA. HL wrote the draft and reviewed by YAX, TL and TA. JY and TA edited the final draft. All authors had read and approved the final version of the manuscript.

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Figures

Figure 1

Abdominal CTA indicated that the initial segment of the CA was not visualized and the length of the occlusion was approximately 1.5 cm.

Figure 2

(A) The microcatheter was inserted into the abdominal aorta through the MSA and CA, and the abdominal aorta is indicated by the arrow. (B) The CA was retrogradely opened with a microwire through the superior mesenteric artery, and the right hepatic artery was embolized with coils through the CA.

Figure 3

The initial segment of the CA was occluded; collateral circulation had already been established; and compensatory dilation of the pancreaticoduodenal artery was demonstrated.