

Case Report

Near-transection of abdominal aorta due to stab injury: a case report

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ABSTRACT

Abdominal vascular injuries are amongst the most lethal injuries encountered by modern day trauma and vascular surgeons. Penetrating injuries to aorta have a wide spectrum of presentation mortality being 50-70%. 38-year-old male presented to emergency department with stab injury to abdomen with a knife stuck in-situ. Patient was conscious with herniating bowel loops from stab site. Bilateral limbs had good pulsations and no neurological deficit. Patient was taken for emergency laparotomy and found to have complete jejunal transection with near transection of aorta with knife stuck in the vertebra. Primary repair of aorta was done with prolene 5-0 along with jejuno-jejunal anastomosis. Patient was transfused with 12 units of blood and 8 units of FFP. Postoperatively patient recovered well and was discharged on post-operative day (POD) 14 with good recovery and follow up was uneventful. Spectrum of penetrating aortic injuries varies from stable patients to severely exsanguinated in vicious cycle of shock, acidosis, coagulopathy and arrhythmias causing high mortality and morbidity. Our case had contained retroperitoneal hematoma with stable vitals and good general condition and due to early diagnosis and timely institution of surgery the patient survived and recovered uneventfully. All abdominal stab injuries are to be taken as having vascular injuries. Surgery has to be taken up as an integral part of resuscitation with quickest and most effective diagnostics along with lifesaving procedures to have lesser morbidity and mortality.

Keywords: Stab injury, Abdominal aorta, Jejunum, Transection, Tamponade

INTRODUCTION

Abdominal vascular injuries are amongst the most lethal injuries encountered by the modern day trauma and vascular surgeons.^{1,2} Injuries have a wide spectrum varying from slight trauma to severe life threatening injuries requiring emergency lifesaving procedures and the extent of this injury determines the mortality risk.³

Penetrating abdominal aortic injury have mortality of 50-70% whereas penetrating inferior vena cava (IVC) injuries have 40-53%.⁴ Since 1996 studies report a mortality rates of 50-78% which are similar to the first report of DeBakey et al who in 1946 reported 2471 cases of vascular injuries during World War II.^{4,7} 90-95% of abdominal vascular

injuries are due to penetrating abdominal trauma whereas 5-10% are due to blunt trauma to abdomen.²

Here we present a case of a stab injury to the abdomen who sustained a lateral near transection of aorta and survived due to early diagnosis and prompt institution of operative procedure.

CASE REPORT

A 38-year-old male presented to the emergency department with a stab injury to the abdomen with a knife. On admission the patient was conscious, oriented with a blood pressure of 110/78 mmHg, pulse rate (PR)- 128/min, oxygen saturation (SpO₂) of 85% at room air and

respiratory rate (RR) of 32 cpm. The knife was seen in-situ in the abdomen with 7-8 cm sticking out with herniating bowel loops from the stab site. No active bleeding was found. Abdomen was distended with diffuse tenderness and absent bowel sounds and no signs of peritonitis. Reduced breath sounds over left side. Bilateral lower limb pulsations were present with good volume. No neurological deficits seen as patient was moving all 4 limbs adequately. Patient was started with O₂ and an RT was inserted along with Foleys catheter and no hematuria was seen. Patient was put on crystalloids and blood for investigation along with cross matching was sent.



Figure 1: Stab injury to abdomen with knife in-situ and herniating bowel loops.



Figure 2: Jejunal complete transection with mesenteric laceration.

Complete blood count revealed a hemoglobin (Hb) of 12.1 g/dl, red blood cells (RBC) count of 3.51 million/cumm, hematocrit 32.7%, total counts 32,000/cumm, platelets 2.56 lakh/cumm, prothrombin time – international normalized ratio (PT-INR) of 1.5. His arterial blood gas (ABG) analysis showed acidosis with pH of 7.17 with partial pressure of oxygen (PaO₂) of 299 mmHg and partial pressure of carbon dioxide (PCO₂) of 39.6 mmHg, sodium carbonate (HCO₃) of 13.9 mmol/l. His potassium was 3.3 mEq/l and sodium 135 mEq/l. Renal function test (RFT) and Liver function test (LFT) were within normal limits with an albumin of 4 g/dl. Chest x-ray showed imminent collapse of left lung with knife in-situ impinging on the vertebral column in lower half. No attempt was made to remove the knife and was left in-situ.



Figure 3: Spurt of bright red blood on manipulation of the knife stuck in vertebra.



Figure 4: Resected bowel segment.



Figure 5: Knife post removal. Artery forceps for scale.

Vascular injury along with bowel injury was suspected. Adequate blood was arranged, vascular instruments were made available and patient was taken for emergency laparotomy.

The herniating bowel loops were reduced and the incision was extended lengthwise from the edges of the stab wound. The peritoneal cavity was filled with blood which was drained and no active bleed was found intra-abdominally. Complete jejunal transection and mesenteric laceration seen. The bowel loops were moved towards the right to explore the retroperitoneum where a midline

hematoma was seen and slight movement of the stabbed knife which was stuck in the body of the vertebra and evacuation of hematoma led to severe bright red bleeding which led to the suspicion of aortic stab injury. Adequate proximal and distal clearance of retroperitoneum was obtained along with good exposure of proximal and distal parts of aorta. Blood transfusion was started. Finger compression given proximally and on distal aorta DeBakey clamp applied and the stabbed knife pulled out leading to massive bleeding from the stab injury which after drainage revealed an oblique linear incision of 3 cm over the right wall of aorta extending to posterior wall. Proximal aortic control achieved with clamp. Aorta was repaired with 5-0 prolene continuous running around 75% of its circumference over the right wall. Left wall of aorta continuity was left undisturbed. The lacerated segment of jejunum and mesentery was resected and jejuno-jejunal 2 layered anastomosis done. 2 drains kept, one in the pelvis and other in left para-colic gutter. The patient was transfused with 8 units of whole blood and 4 units FFP intraoperatively.



Figure 6: Follow up uneventful with no surgical site infection and complications.

The patient was shifted to intensive care unit and kept in Synchronized intermittent mandatory ventilation (SIMV) mode of mechanical ventilation as the patient had developed left lung collapse and was extubated 2 days later. Patient was put on meropenem and metronidazole with amikacin postoperatively and levoflox given after post-operative day (POD) 5. Subsequently patient was transfused with 4 units of whole blood and 4 units of FFP during his hospital stay. Potassium, calcium, Vitamin K, protein and nutritional supplementation done as patient developed hypokalemia, hypoalbuminemia and high PT-INR. Patient was allowed orally on POD 6 and was well tolerated. Both the drains removed subsequently when drain output reduced to minimal. Post operatively the patient had good pulsations in B/L dorsalis pedis artery (DPA) and also no neurological deficits. Patient was ambulatory and was discharged on 14th POD with oral medications.

DISCUSSION

Abdominal vascular injuries are the most lethal injuries encountered by today's modern day trauma and vascular

surgeons due to the associated injuries to other viscera and difficulties in exposure and vascular control.^{1,2,8} These patients present to the emergency either in exsanguinated state probably dead or those who survive present in severe hypotension and shock already ended up in vicious cycle of shock, acidosis, hypothermia, coagulopathy and cardiac arrhythmias and end up in complications later.¹ Exsanguination accounts for 84-90% of mortality in aortic penetrating injury.^{1,9}

Table 1: American association for the surgery of trauma-organ injury scale for abdominal vascular injury (AAST-OIS).²

Grade	AAST-OIS
Grade I	No named superior mesenteric artery or superior mesenteric vein branches. No named inferior mesenteric artery or inferior mesenteric vein branches. Phrenic artery/vein. Lumbar artery/vein. Gonadal artery/vein. Ovarian artery/vein. Other no named small arterial or venous structures requiring ligation.
Grade II	Right, left, or common hepatic artery. Splenic artery/vein. Right or left gastric arteries. Gastroduodenal artery. Inferior mesenteric artery, trunk or inferior mesenteric vein, trunk. Primary named branches of mesenteric artery (example- ileocolic artery) or mesenteric vein. Other named abdominal vessels requiring ligation/repair
Grade III	Superior mesenteric vein, trunk. Renal artery/vein. Iliac artery/vein. Hypogastric artery/vein. Vena cava, infrarenal.
Grade IV	Superior mesenteric artery, trunk. Celiac axis proper. Vena cava, suprarenal and infrahepatic. Aorta, infrarenal
Grade V	Portal vein. Extraparenchymal hepatic vein. Vena cava, retrohepatic or suprahepatic. Aorta, suprarenal, subdiaphragmatic

This classification system is applicable for extraparenchymal vascular injuries.

After its first report of penetrating aortic wound repair in 1922, many reports of patients' survival have been noted.^{10,11} DeBakey and Simeone reported a study in 1946 with 2471 patients during World War II with abdominal vascular injury in 49 (2%) of patients.⁷ Largest study on abdominal vascular injuries was reported by Asensio in 2000 with 302 patients and 504 injured vessels in a busy trauma centre.¹

Patients with such large abdominal vascular injury present mortality of 31-87% in 2 peaks of mortality- one at the site and in the operating room due to exsanguination (84%) and

the second being susceptible to a number of complications (16%) due post operatively like multiple system organ failure (MOSF), systemic inflammatory response syndrome (SIRS), transfusion related complications, adult respiratory distress syndrome (ARDS), Cardio-respiratory arrest or brain death.^{1,12}

These abdominal vascular injuries are classified according to American association for the surgery of trauma as follows.²

Mattox in 1975 reported a mortality of 50-70% in penetrating injuries to abdominal aorta 40-53% in penetrating injuries to IVC.⁴ Such abdominal aortic injuries were classified on CT by Azizzadeh and modified by Starnes et al as follows:

Intimal tear/minimal aortic injury: absence of aortic external contour abnormality and intimal defect and/or thrombus of 10 mm in length or width;

Large intimal flap: absence of aortic external contour abnormality and intimal defect and/or thrombus of 10 mm in length or width;

Pseudoaneurysm: external aortic contour abnormality and contained rupture;

Rupture: external aortic contour abnormality with free contrast extravasation or hemoperitoneum found upon laparotomy.¹³⁻¹⁵

The presence of midline retroperitoneal hematoma has to be taken as aortic or IVC injury unless proven otherwise and no attempt is to be made to explore it unless adequate proximal and distal control has been established and adequate blood is kept ready with vascular instruments and sufficient number of assistants.¹⁶ This hematoma when contained acts as a tamponade and the effectiveness of this tamponade has been noted for several years and has been relied upon for hemostasis in blunt abdominal trauma.^{17,6} Such contained hematomas are associated with mortality of 35% compared to 90% with decompressed hematomas.¹⁸ Richards also noted that intact abdominal wall to be effective in increasing the survival time with his study on dogs bled intraperitoneally and extraperitoneally.¹⁹ Myles reported that early tamponade is the most single factor affecting survival. This tamponade either due to retroperitoneal hematoma or due to intact abdominal wall or due to external devices like G-suit or Medical anti-shock trousers (MAST) increase the survival time by reducing the size of the defect.¹⁶

Those patients in severe shock who have intra-abdominal exsanguination not responsive to iv fluids can be taken up for left anterolateral thoracotomy and descending thoracic aorta can be clamped which reduces intra-abdominal bleed and provide critical circulation needed by the coronary and cerebral vessels allowing time to correct acidosis and locate and repair the aortic injury.¹⁶ During the entire time

the weapon is to be left in-situ until proximal and distal control of the aorta is obtained to avoid further exsanguination.³

Such penetrating injuries to aorta depending on the zones of retroperitoneum. Retroperitoneum is divided into 3 zones as follows- zone I spans the midline of the abdomen from aortic hiatus till sacral promontory and can be divided into the supramesocolic and inframesocolic regions; containing the aorta, IVC, celiac, and superior and inferior mesenteric arteries. Zone 2 is located bilaterally in the paracolic gutters and contains the renal vessels and kidneys. Zone 3 begins at the sacral promontory and downwards and contains the iliac arteries and veins.²⁰

In general, suspected aortic and mesenteric arterial and left zone 2 injuries are approached via a left medial visceral rotation, while suspected IVC and right zone 2 injuries are approached via a right medial visceral rotation. Exposure of the zone 3 is achieved by eviscerating the small bowel to the patient's right side; the retroperitoneum can then be divided over the aortic bifurcation allowing visualization of the common iliac artery.²⁰

Injuries to the aorta should be repaired primarily with a 3-0 or 4-0 prolene suture. If the defect in the aortic wall is large or if primary repair would result in significant narrowing of the lumen, patch angioplasty can be done using Dacron, polytetrafluoroethylene (PTFE) or an autologous vein or reimplantation can be considered. Most penetrating injuries can be repaired by lateral suture and posterior injuries are to be repaired by rotating the aorta or by anterior longitudinal aortotomy.^{20,6}

In our case the patient had a tamponade effect due to the contained retroperitoneal hematoma which caused patient to have stable vitals and good pulsations of lower limbs. Proper diagnosis and timely institution of surgery led to avoidance of further exsanguination and the patient's life was saved. On follow up the patient was completely stable and ambulatory, and no surgical site infection was seen.

CONCLUSION

Any case of abdominal stab injury is to be suspected to have vascular injury and has to be managed by a team of interdisciplinary specialists. Surgery should be taken as an integral part of resuscitation in severely hypotensive exsanguinated patients starting with ABC of ATLS guidelines and with the quickest and most effective diagnostics along with lifesaving procedures like blood transfusions, infusion of crystalloids and assessing and addressing the life threatening injury first to have lesser morbidity and mortality.

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