Case Report

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Endovascular Treatment in a Polytraumatized Patient with Rupture of the Infrarenal Aorta and Thrombosis of the Superior Mesenteric Artery

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INTRODUCTION

Abdominal aortic injury is diagnosed in 0.04% of all blunt trauma admissions and is frequently associated with the presence of fractures of the thoracolumbar spine [1-3]. The superior mesenteric artery (SMA) ranks second, followed by the renal arteries, as the most commonly injured abdominal vessel after blunt trauma [4].

Vascular injuries after blunt trauma can be caused by three mechanisms [4]: rapid deceleration (as in high-speed traffic accidents, which is the most common cause in our environment [1], or falls from height), by direct anteroposterior crushing (as caused to car occupants by seatbelts) or by direct rupture of a major vessel by a bone fragment.

The clinical presentation depends on the injured vessel, the size and type of injury, the presence of concomitant injuries and the time elapsed since the injury [3]. Many patients may be normotensive on admission due to vascular thrombosis or a contained tear, and become unstable minutes later [3,4]. Protocolized management of these patients is critical. According to the Advanced Trauma Life Support (ATLS) diagnostic algorithm [5], a stable patient with blunt abdominal trauma requires axial computed tomography angiography with contrast to assess for possible injury. Endovascular techniques have revolutionized the treatment of traumatic thoracic aortic injuries [2,6-8], although their role in the abdominal aorta is generally limited. They are gradually being used successfully in selected cases with infrarenal aortic lesions, such as dissections, pseudoaneurysms, ruptures or aortocaval fistulas [6,9].

Ethical Approval and Informed Consent

Ethical approval was not required as all data was anonymized. Informed consent was obtained from the patient. The patient consented to the description of his clinical course for educational purposes.

CASE REPORT

We present the case of a 24-year-old man with multiple traumas after a traffic accident involving a road exit and a fall from a height of about 5 meters, who was wearing a seat belt. On arrival at the hospital, he was conscious, oriented and cooperative with a Glasgow score of 15/15, hemodynamically stable with a blood pressure of 110/60 mmHg and a heart rate of 70 bpm, had 98% saturation without work of breathing and had no external bleeding. CT angiography showed rupture of the infrarenal abdominal aortic artery and thrombosis of the SMA (Figures 1 and 2) approximately 4 cm from its origin, distal to the middle colic artery with hemoperitoneum and infarction in the lower left renal pole. In addition to the bone injuries in the left upper extremity, there were rib fractures of

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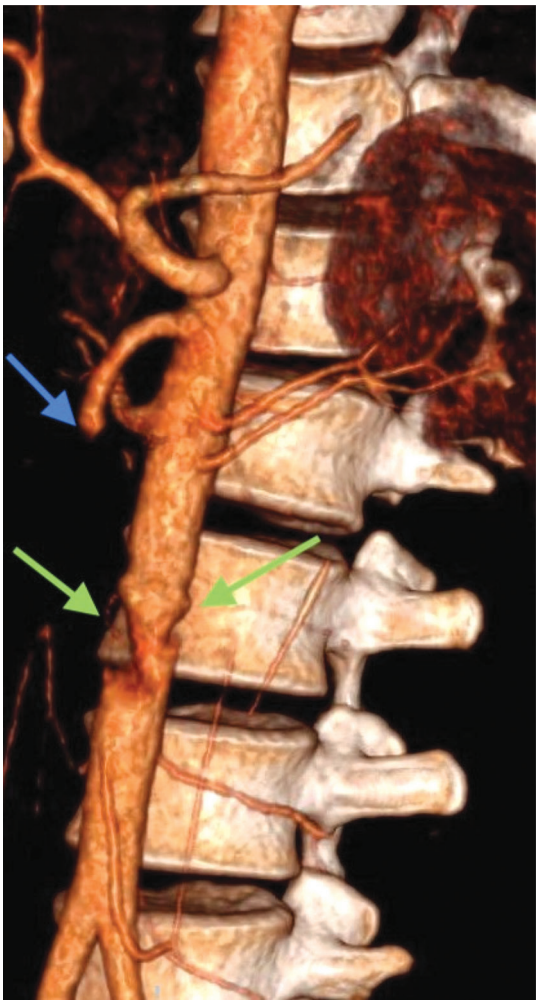

Figure 1 CT angiography reconstruction of the lesion in the infrarenal aorta (green arrows) and thrombosis of the superior mesenteric artery (blue arrow).

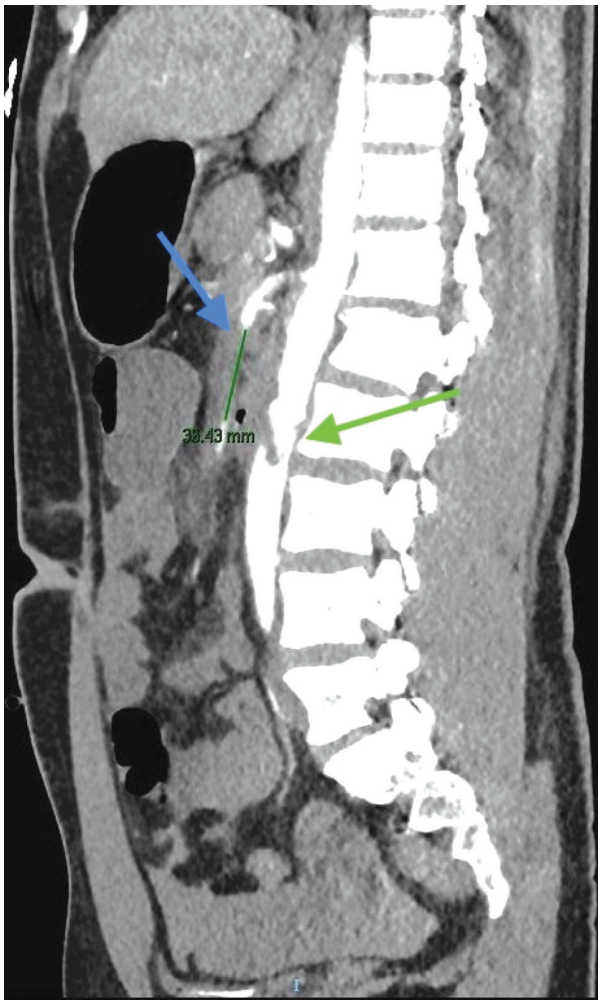

Figure 2 Sagittal CT angiography section of the lesion in the infrarenal aorta (green arrow) and 36.43 mm thrombosis of the superior mesenteric artery (blue arrow).

the 9th and 10th on the left and the 10th and 11th on the right, and vertebral fractures at the level of D12 and L1.

In view of these findings, an urgent intervention was decided jointly by the Departments of Angiology and Vascular Surgery and General Surgery. Through a bilateral open transfemoral approach, a 16 × 48 mm balloon-expandable covered BeGraft Bentley® endoprosthesis was implanted in the infrarenal aorta under fluoroscopic view and with the assistance of intravascular ultrasound, with an oversizing of 10% and proximal to the inferior mesenteric artery (IMA), which measured approximately 14 mm at this level of the aorta, with the rupture area sealed (Figure 3). The SMA was then canalized and thromboaspiration performed using an AngioJetTM ZelanteDVTTM catheter. After a control arteriography, the dissection could be seen at the origin of the thrombosed segment, so it was decided to implant a self-expanding, covered 6 × 50 mm GORE® VIABAHN endoprosthesis. We prefer this stent to a balloon-expandable stent because of the lower stiffness of self-expanding stents. The control angiography showed the closure of the aortic rupture area, the patency of the renal arteries, the SMA and the IMA.

The total time for the endovascular procedure was 70 minutes with a fluoroscopy time of approximately 12 minutes for which 50 ml of iodinated contrast medium was used.

A midline laparotomy was then performed by general surgery, which revealed an injury to the abdominal wall below the belt mark with diffuse hemoperitoneum. The entire abdominal cavity was explored and a mesenteric lesion of the small bowel was found 60 cm distal to the Treitz angle with a traumatic segment of the omentum that was dislocated (Figure 4). This required resection of 5 cm of the jejunum. Necrotic plaques were found in the cecum and transverse colon (Figure 5).

The abdomen was left open with the ABTHERA system for review in 24 hours, where, due to the progression of the lesions, a re-resection of 10 cm of jejunum distal to the previous resection was performed and a mechanical isoperistaltic ileo-ileal anastomosis carried

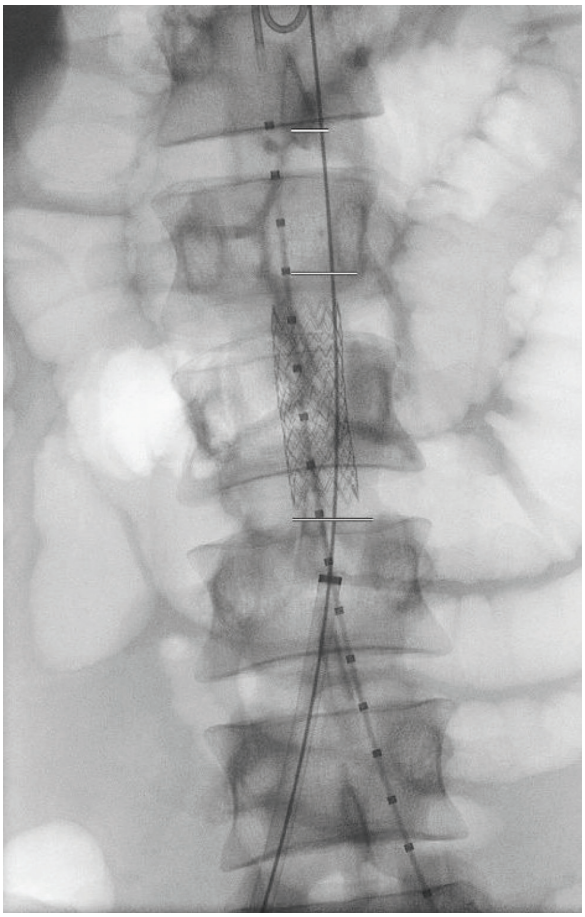

Figure 3 Implantation of the aortic graft, with markings from top to bottom indicating emergence from the celiac trunk, the kidneys and the inferior mesentery.

out from side to side with a 55-mm linear stapler. In addition to the removal of the necrotic plaque in the transverse colon and a simple suture with 3/0 Monocril, the abdominal wall was finally closed.

The patient, after making good progress and with CT angiography showing patency of the stent in the SMA and the aortic graft 72 hours after the procedure (Figure 6), was discharged from trauma 30 days after closure of the

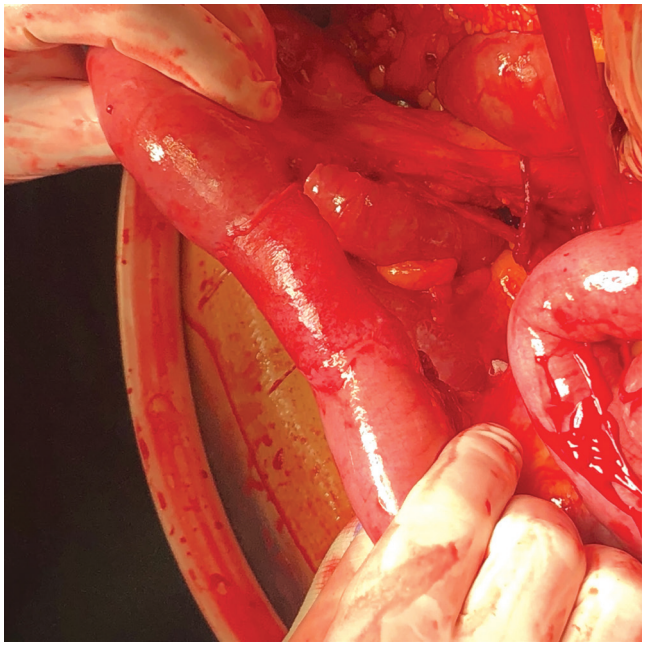

Figure 4 Abdominal laparotomy. Loop of small bowel 60 cm from the Treitz angle, separated from its meso.

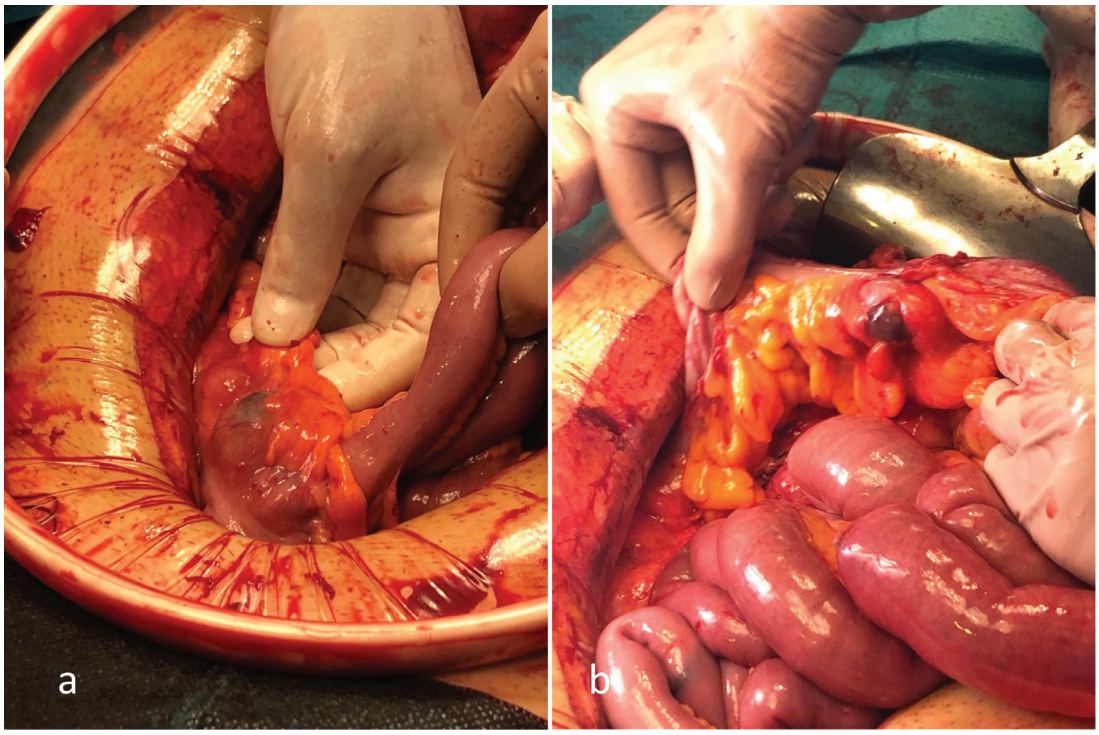

Figure 5 Abdominal laparotomy. Examination of the remaining intestinal loops reveals the following: (**a**) necrotic plaque in the cecum; (**b**) necrotic plaque in the transverse colon.

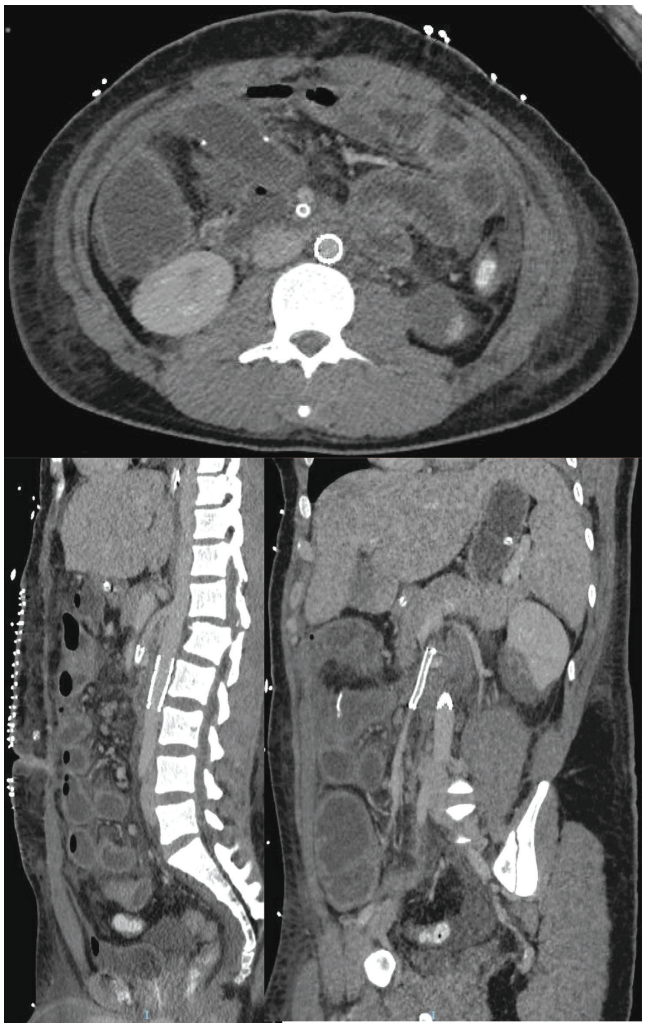

Figure 6 Control CT angiography with aortic Begraft and Viabahn patency in SMA.

abdominal wall and surgical repair of fractures of the lumbar spine, ribs and left upper extremity. The patient received treatment with acetylsalicylic acid 100 mg and clopidogrel 75 mg, which he maintained for 6 months, followed by simple antiplatelet therapy indefinitely.

We will follow up with the patient in consultations with a follow-up CT angiography at 3 months, 6 months, 1 year and 2 years. Thereafter, we will continue to monitor the patient annually and only request a follow-up CT angiography in case of clinical changes.

DISCUSSION

The treatment of patients with traumatic injuries to the abdominal aorta and its vessels is very complex and requires a multidisciplinary team. A correct diagnosis of all lesions is crucial for the success of the treatment and the survival of the patient, which is why, as already mentioned, CT angiography must be performed when the patient arrives at the hospital. Currently, the choice of aortic repair strategy is challenging as there are no clear guidelines [10].

Conservative treatment may be considered for small dissections [10,11] as described by Shalhub et al. [12] in which 89.5% of patients with small dissections were successfully treated conservatively.

At surgery, in addition to the surgeon's preference, some aspects must be considered to decide between open or endovascular repair. Injuries to the bowel are common and in these cases the possibility of graft infection is greater when an in-situ repair with prosthetic material is performed [13]. Therefore, an endovascular approach would be the optimal option in these patients as the risk of infection is lower. However, it must be kept in mind that aortic or iliac thrombosis carries a risk of distal thrombosis and a greater risk of stent complications [10].

In such cases, the use of rifampin-soaked Dacron grafts and covering of the omentum flap help to protect these grafts from infection [10].

When considering endovascular repair, there are a few factors that should be considered. Age is important, as patients may be young with a life expectancy that requires a long durability of the procedure and a high fatigue resistance of the endovascular material. In young patients, growth can lead to an anatomical mismatch between the adjacent native aorta and the aortic segment treated with endovascular technology, resulting in hemodynamically significant stenosis with flow restriction, especially during exercise and possible endograft migration. An additional difficulty arises from the underestimation of the true aortic diameter in patients in shock. We normally oversize by 10%. This helps to compensate for the measurement error in a hemodynamically unstable patient and to avoid excessive oversizing, which can lead to kinking and thrombosis in young patients with a small aortic diameter [10].

CONCLUSION

Endovascular treatment for closed abdominal traumatic injuries with vascular involvement of the visceral arteries and/or abdominal aorta shows good results in polytraumatized patients with hemodynamic stability, when working with the collaboration of a multidisciplinary team.

Ethics Statement

(1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
(2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Author Contributions

All authors made a substantial contribution to the manuscript and were sufficiently involved in the submission to take public responsibility for the content. The publication has been seen and approved by all authors and by the competent authorities where the work was performed.

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