

Management of Aorto-Duodenal Fistula: Case Series and Technical Notes

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Roberto Santoro^{1,†}, Laura Antolino^{1,2,†}, Debora Maruca³, Vittorio Brizi³, Manuela Brighi¹, Antonio Bovino¹, Armando Raso⁴, Fabrizio Chegai⁴, Emanuele Santoro⁵, Antonio Lorido³

¹Chirurgia Generale Oncologica, PO Belcolle, ASL Viterbo, 01100 Viterbo, Italy

²Fellowship of the Italian Society of Surgical Oncology SICO - ESSO Affiliated, 80100 Napoli, Italy

³Chirurgia Vascolare, PO Belcolle, ASL Viterbo, 01100 Viterbo, Italy

⁴Radiologia Interventistica, PO Belcolle, ASL Viterbo, 01100 Viterbo, Italy

⁵Chirurgia Generale ed Oncologica, AO San Giovanni Addolorata, 00184 Roma, Italy

Aorto-duodenal fistula (ADF) is a rare clinical condition characterized by abnormal communication between the 3rd or 4th portion of the duodenum and the aorta, typically associated with aneurysmal disease. The incidence of ADF is expected to increase, however, there remains a lack of consensus on the optimal approach for intestinal restoration. In this study, we present three cases of ADF and their respective treatments using three distinct surgical techniques. Initially, endovascular aortic repair was employed as a life-saving procedure, followed by elective open repair. The choice of surgical technique was determined based on the patients' overall health conditions and the specific characteristics of the duodenal defect. In all cases, an omental patch was utilized to separate the aortic plane from the intestinal staple lines, providing additional protection for the sutures. The importance of a multimodal treatment strategy cannot be overstated, given the complex interplay of vascular, intestinal, and septic factors involved in the treatment of ADF.

Keywords: aorto-duodenal fistula (ADF); endovascular aneurysm repair (EVAR); abdominal aortic aneurysm (AAA); hematemesis

Introduction

Aorto-duodenal fistula (ADF) represents a rare clinical entity characterized by frequent emergency setting onset and poor prognosis, with an overall two-year survival rate ranging from 15% to 38% [1]. These fistulae complicate approximately 0.7–2% of all abdominal aortic aneurysm (AAA) [2].

ADF is defined as an abnormal communication between the 3rd or 4th portion of the duodenum and the aorta, which is typically affected by aneurysmal disease. This particular type of fistula accounts for approximately 60% of all aorto-enteric fistulae [3].

The classical clinical presentation of ADF is characterized by Cooper's triad: abdominal pain, gastrointestinal bleeding, and pulsatile abdominal mass [4]. However, this complete triad is observed in only a minority of cases. A significant proportion of patients report a history of herald bleed,

which precedes the overt clinical manifestation [5].

ADF is divided based on its etiology into two distinct types: primary and secondary. Primary ADF occurs with no prior surgical intervention and involves a native aorta. Secondary ADF develops in patients who have undergone aortic intervention, either surgical or endovascular [5].

In the last 5 years in Italy, there have been approximately 10,000 hospitalizations per year with a diagnosis of AAA, encompassing both elective and emergency admissions for ruptured AAA [6]. Specifically, in the Lazio region, 1091 cases were reported during the year 2021 [7].

At present, there is no consensus regarding the optimal approach for gastrointestinal repair in the treatment of ADF [8].

Herein, we present a multicenter experience of three cases of ADF admitted to the Emergency Department, all of which were successfully treated and subsequently discharged. These patients underwent a staged two-step procedure, consisting of initial emergent endovascular intervention followed by elective surgical repair utilizing three different surgical techniques.

Case Reports

Case 1

In September 2021, a 73-year-old woman presented to our Emergency Department with hematemesis and hypotension. She was awaiting endovascular repair for a 56 mm

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Correspondence to: Laura Antolino, Chirurgia Generale Oncologica, PO Belcolle, ASL Viterbo, 01100 Viterbo, Italy; Fellowship of the Italian Society of Surgical Oncology SICO - ESSO Affiliated, 80100 Napoli, Italy. (e-mail: laura.antolino@asl.vt.it).

[†] These authors contributed equally.

AAA, which had been diagnosed during a routine computed tomography (CT) scan at an outpatient clinic following endoscopic treatment for a bleeding gastric angiodysplasia. At the time of the esophagogastroscope, the duodenum showed no mucosal alterations. Upon her arrival at the Emergency Department, a CT scan showed that the anterior wall of the infrarenal AAA was adhered to the third portion of the duodenum, with retrograde filling of a blood-like liquid (Fig. 1). Consequently, an urgent endovascular intervention was performed using an aorto-bisiliac endograft with suprarenal fixation (Endurant II, Medtronic Vascular, Inc, Minneapolis, MN, USA) (Fig. 2). This procedure successfully excluded the fistula and restored the patient's vital signs to normal levels. The immediate post-operative course proceeded without complications, and the patient was transferred from the Intensive Care Unit (ICU) on the second post-operative day. However, a CT scan performed two weeks post-surgery revealed persistent communication between the duodenum and the perianeurysmal sac, evidenced by the passage of oral contrast and free air. Subsequently, the patient underwent a second surgical intervention to address the fistula, which measured 2 cm in width. The procedure involved tangential stapling of the duodenum (Figs. 3,4), followed by the application of an omental patch to serve as a protective barrier between the suture line and the aorta (Figs. 5,6). The patient was discharged on the 14th post-operative day following the second procedure. At the 20-month follow-up, the patient exhibited satisfactory recovery, adhering to scheduled CT controls and reporting a return to normal daily activities.



Fig. 1. Computed tomography (CT) scan during hematemesis. The white arrow indicates the blood-filled duodenum.



Fig. 2. Emergency angiography in a bleeding primary aorto-duodenal fistula for endovascular aneurysm repair (EVAR). The white arrow shows the blood-filled duodenum.

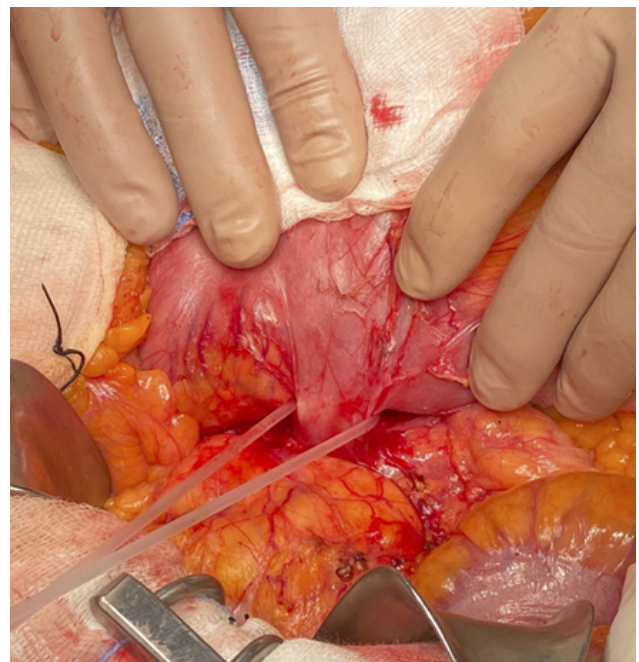


Fig. 3. Intraoperative view of the aorto-duodenal fistula (ADF).

Case 2

An 88-year-old woman presented to our Emergency Department in February 2022 with hematemesis, an abdominal pulsatile mass, and hemorrhagic shock. A CT scan showed an infrarenal aortic aneurysm (AA) (Fig. 7). She underwent an urgent endovascular aneurysm repair (EVAR) with an aortic-bisiliac endograft (Endurant II, Medtronic Vascular, Inc, Minneapolis, MN, USA) (Fig. 8). A subse-

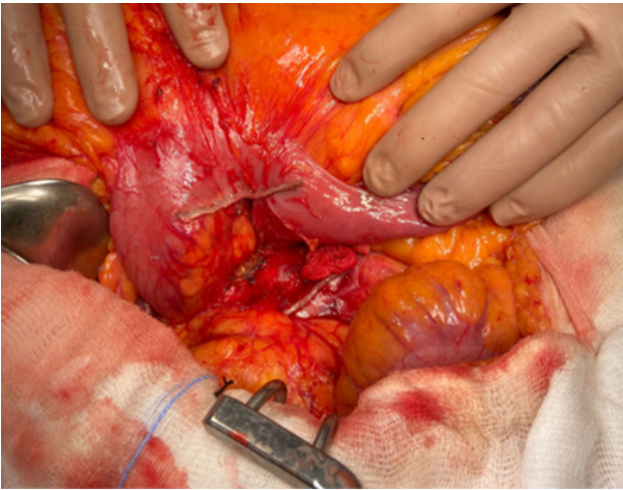


Fig. 4. Intraoperative view of the duodenal stapling.

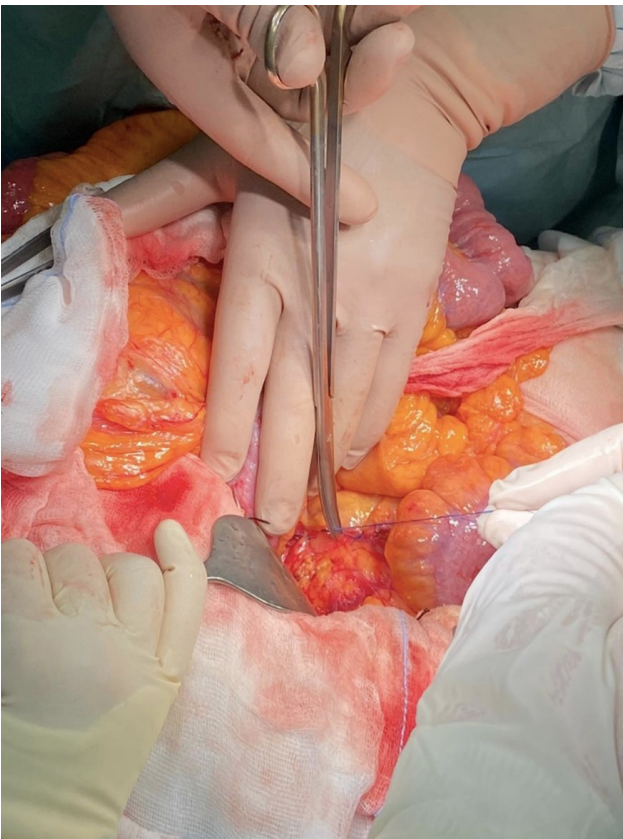


Fig. 5. Intraoperative view of the omental patch.

quent control CT scan indicated the presence of a collection with free air in the perianeurysmal sac. The patient subsequently underwent a delayed ADF repair (Fig. 9), which involved direct manual duodenal suturing and diversion via gastric outlet exclusion and gastroenteroanastomosis. After kocherization, a 4 cm defect in the duodenal wall was identified, which was deemed too large for primary repair. Consequently, the antrum was stapled, and intestinal continuity was restored through a manual side-to-side gastrojeju-



Fig. 6. Post-operative CT-scan. The white arrow indicates the omental patch between the staple line and the endoprosthesis.

nal anastomosis. The patient's surgical recovery progressed satisfactorily, with oral feeding resumed on the 10th post-operative day. The patient was discharged on the 30th post-operative day in a bedridden state with a prescribed home rehabilitation program. The patient died one week later.

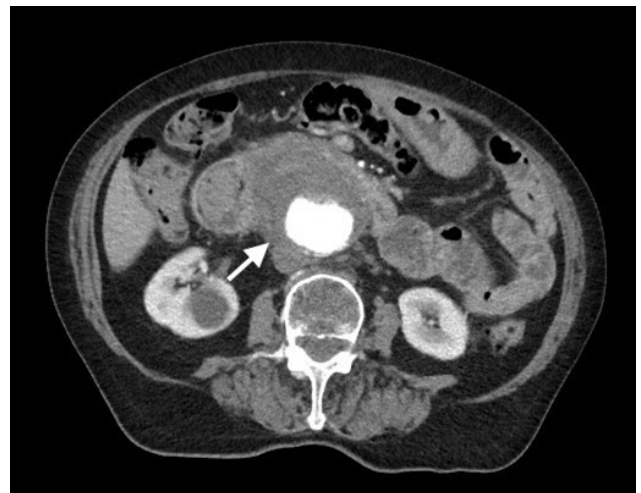


Fig. 7. CT scan during hematemesis. The white arrow points the infrarenal aortic aneurysm.

Case 3

A 72-year-old man presented to the Emergency Department with fever and right lower quadrant abdominal pain. The patient's medical history was significant for Leriche syndrome, previously treated with aorto-right iliac and left femoral bypass. Upon admission, a CT scan was per-



Fig. 8. EVAR in a bleeding primary aorto-duodenal fistula. The white arrow points the aortic-bisiliac endograft.

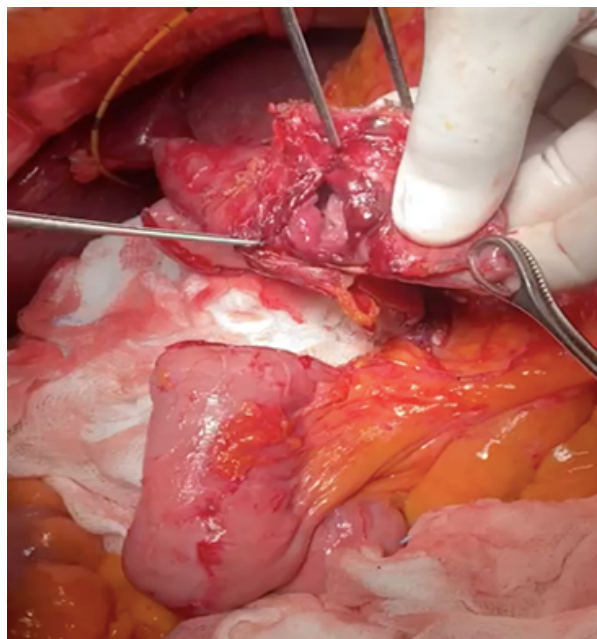


Fig. 10. Intraoperative view of the aorto-duodenal fistula in case 3.

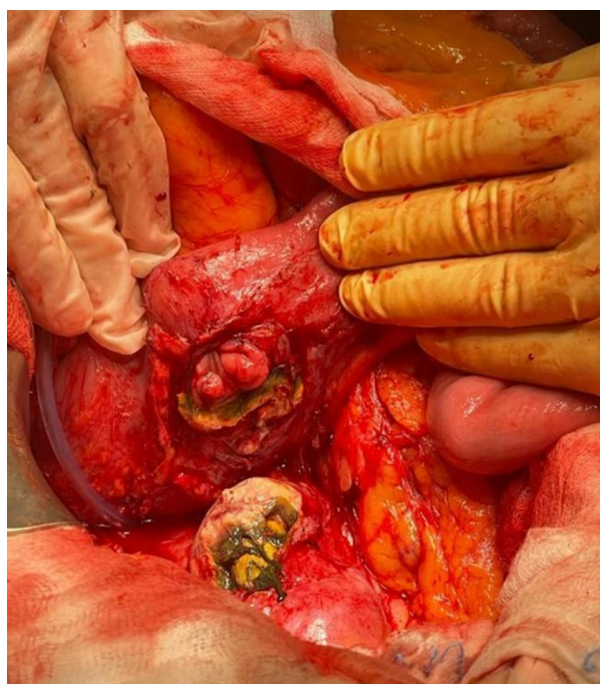


Fig. 9. Intraoperative view of the aorto-duodenal fistula in case 2.

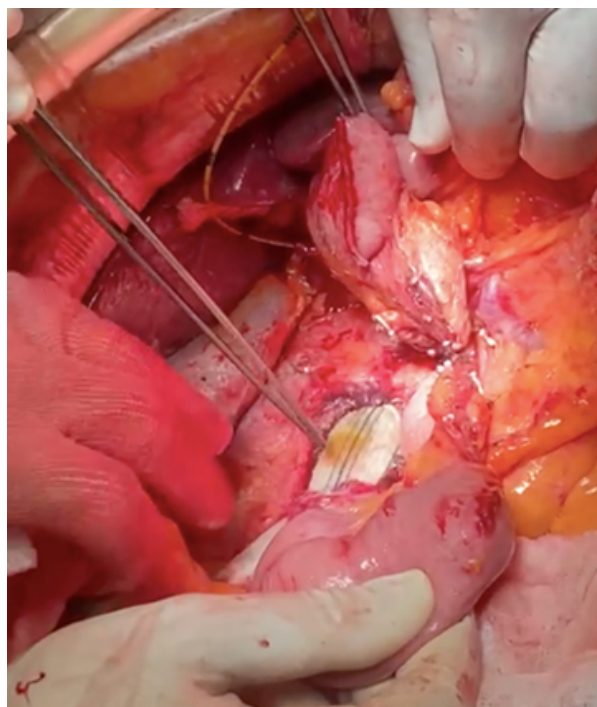


Fig. 11. Intraoperative view of the duodenal-jejunal junction resection.

formed, showing the presence of blood-like fluid in the gastric and duodenal lumen. These findings were suggestive of a secondary aorto-enteric fistula.

The patient underwent an urgent EVAR utilizing an aortic-bisiliac endograft (Endurant II, Medtronic Vascular, Inc, Minneapolis, MN, USA). Subsequently, a delayed abdominal duodenal-jejunal junction repair was performed, which

included resection of the affected segment and intestinal derotation to restore bowel continuity through a latero-lateral anastomosis (Figs. 10,11). The patient was discharged on the 20th postoperative day and exhibited satisfactory recovery during the 6-month follow-up.


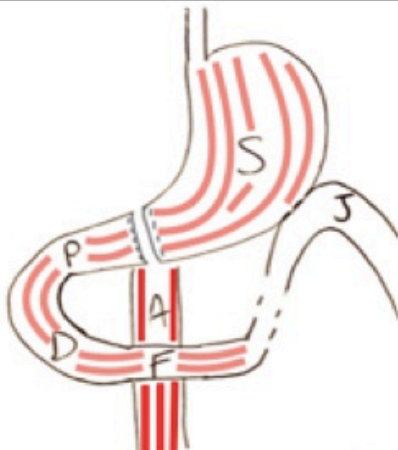
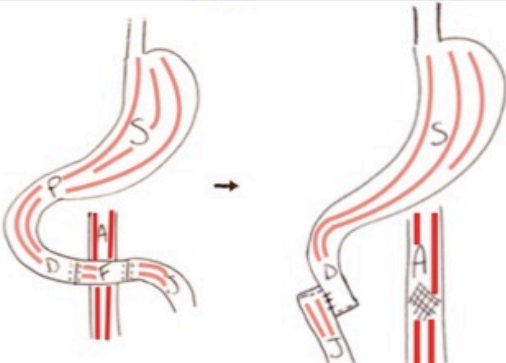
	SKETCH	STEPS
A		<ul style="list-style-type: none"> - Kocher maneuver - Fistula (<2cm) stapling - Perianeurysmatic sac debridement - Omental patch
B		<ul style="list-style-type: none"> - Kocher maneuver - Fistula (>3cm) suture - Antrum diversion - Gastro-jejunal anastomosis - Omental patch
C		<ul style="list-style-type: none"> - Kocher maneuver - Fistula (>3cm) suture - Duodenal resection - Intestinal derotation - Duodenal-jejunal latero-lateral anastomosis - Omental patch

Fig. 12. Surgical techniques. (A) Tangential duodenal stapling and omental patch. (B) Fistula direct suture and gastric outlet exclusion. (C) Duodenal-jejunal resection and latero-lateral anastomosis. Notes: This figure is handdrawn, post processed with the picture application © 2016, Apple Inc., San Francisco, CA, USA. A, aorta; S, stomach; Pa, pancreas; GO, Great Omentum; D, duodenum; F, fistula; J, jejunum; P, pylorus.

Discussion

A recent literature review identified 40 cases of ADF [2]. EVAR was used in 27.5% of these patients, with half of these cases involving a staged procedure before surgery. The follow-up data indicated survival rates extending up to three years. Advanced age was found to be a predictor of in-hospital mortality, while the width of the defect was associated with the recurrence of ADF [8].

Given the high volume of hospitalizations for AAA and the incidence of ADF complicating both untreated and treated AAA, general surgeons need to know how to manage this life-threatening condition.

In this case series, the surgical approaches varied in their technical aspects (Fig. 12). In the first case, tangential stapling of the duodenum was performed, with an omental patch used as a protective barrier between the suture and the aorta. The second case involved direct manual duodenal suture repair and digestive diversion via gastric outlet exclusion and gastro-enteric anastomosis. In the third case, resection of the duodenal-jejunal junction was undertaken, followed by restoration of bowel continuity through a latero-lateral jejuno-jejunal anastomosis.

The selection of treatment approaches was influenced by the width of the communicating tract and the patient's per-

formance status. In the first case, the narrow communication was easily surrounded and stapled. In the second case, the communication was larger and exhibited significant signs of acute inflammation, and the patient was elderly and fragile. Therefore, a direct suture of the duodenal defect, antrum diversion and gastro-enteric bypass were chosen as the less invasive and safer procedure. In the third case, the presence of wide communication, along with the patient's younger age and better PS, allowed a duodenal resection with intestinal derotation and duodeno-jejunal anastomosis as a long-lasting, definitive treatment. In all cases, an omental patch was interposed between the aortic plane and the site of intestinal anastomosis, as it serves as a natural barrier within the abdominal cavity. After discharge, follow-up revealed no evidence of septic complications.

Conclusions

The prevalence of ADF is projected to increase in the future, with multimodal intervention remaining the primary approach. Emergency EVAR is currently the recommended procedure to control the bleeding, serving as a bridge to subsequent staged open surgical repair of the fistula. Surgeons have various technical options to address both the duodenal defect and the septic complications.

Availability of Data and Materials

The case data in the article are available from the corresponding author upon reasonable request.

Author Contributions

Conceived and designed the paper: RS, LA, FC, ES, AL. Acquired the data: LA, DM, MB, VB, AB. Contributed to collect data or multimedia material: AB, AR, FC, ES, AL. Wrote the paper: RS, LA, DM, VB, MB, AB, AR. Revised the manuscript critically for important intellectual content: RS, LA, FC, ES, AL. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The patients presented in this study signed an informed consent that included authorization for the recording of multimedia material for scientific research purposes, as per the official consent of the Italian Society of Surgery (SIC). The present study was conducted in compliance with the Declaration of Helsinki, it was not eligible for review by our local ethics committee Comitato Etico Territoriale Lazio Area 4 because according to the REGULATION OF THE REGIONAL SINGLE ETHICS COMMITTEE FOR CLINICAL TRIALS (C.E.U.R.) version n.01_2023, "The Ethics Committee does not provide an opinion on case reports or case series". (cf. Art. 2 - Competencies of the Ethics Committee, paragraph "Specific Competencies").

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Conflict of Interest

The authors declare no conflict of interest.

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