

CASE REPORT

Open Access



Multifaceted surgical approach of combined thoracoretroperitoneal incision and midline abdominal incision for a secondary aortoenteric fistula

Tomoyuki Minami^{1,2*}, Takahiro Kojima¹, Naoto Yabu¹, Ichiya Yamazaki¹ and Aya Saito²

Abstract

Background We report a one-stage surgery to the case of secondary aortoenteric fistula (sAEF) after prosthetic reconstruction of abdominal aortic aneurysm, by multifaceted approach.

Case presentation A 63-year-old male was admitted to our unit under diagnosed of sAEF after prosthetic reconstruction of abdominal aortic aneurysm, and a pseudoaneurysm of thoracoabdominal aorta due to infection. The patient underwent emergency operation. Firstly, we placed the patient in a modified right lateral decubitus position and performed thoracoabdominal aortic replacement with retroperitoneal approach by thoracoretroperitoneal incision which combined thoracotomy and pararectal incision, and secondly, we changed to a supine position and performed closure of the duodenal fistula and omental flap transposition by midline abdominal incision. The patient was doing well without complications.

Conclusions A one-stage, multifaceted surgical approach covering both prosthetic reconstruction of thoracoabdominal aorta and closure of sAEF with omentopexy is reasonable and useful strategy.

Keywords Secondary aortoenteric fistula, Thoracoretroperitoneal incision, Midline abdominal incision

Background

Secondary aortoenteric fistula (sAEF) after prosthetic reconstruction of abdominal aortic aneurysm is a relatively rare complication; however, it is difficult to diagnose and is fatal [1, 2]. Massive bleeding from an aortoenteric fistula and sepsis due to prosthetic graft infection lead to a serious morbidity and high mortality; thus,

early treatment is required. Surgery is the first treatment of choice, but treatment for both the aorta and intestinal tract is required, and an optimal operative method has not been established.

In this case report, we report a one-stage surgery to the case of sAEF after prosthetic reconstruction of abdominal aortic aneurysm by multifaceted approach combined thoracoretroperitoneal incision and midline abdominal incision. We safely replaced the thoracoabdominal aorta and safely closed the duodenal fistula.

*Correspondence:

Tomoyuki Minami

tomo373@yokohama-cu.ac.jp

¹Cardiovascular Surgery, Fujisawa City Hospital, Fujisawa 2-6-1, Fujisawa 251-8550, Kanagawa, Japan

²Department of Surgery, Yokohama City University, Fukuura 3-9, Kanazawa-ku, Yokohama 236-004, Kanagawa, Japan



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Case presentation

A 63-year-old male with hypertension complained of hematemesis and hematochezia and sought consult at our emergency department. He had undergone prosthetic reconstruction for infrarenal abdominal aortic aneurysm by midline abdominal incision at another hospital 8 years prior. He had no fever and no evidence of elevated inflammatory response. His blood pressure was 80/50mmHg and he was in shock. Emergency upper gastrointestinal endoscopy was performed; however, the bleeding source could not be identified. Contrast-enhanced computed tomography (CT) showed soft tissue that connected the horizontal part of the duodenum at the anastomotic site of the artificial blood vessel, and a pseudoaneurysm of the anastomotic site was suspected. Furthermore, a pseudoaneurysm was found at the superior mesenteric artery bifurcation on the central side of the anastomotic site, suggesting a complication of infection (Fig. 1). A secondary aortoenteric fistula (sAEF) was diagnosed after prosthetic reconstruction of the abdominal aortic aneurysm and a pseudoaneurysm of

thoracoabdominal aorta. Emergency operation was performed. Firstly, we performed thoracoabdominal aortic replacement by thoracoretroperitoneal incision, and secondly, we changed his body position and performed closure of the duodenal fistula and omental flap transposition by midline abdominal incision.

The patient was placed in a modified right lateral decubitus position, with the left shoulder at 50 to 70 degrees to the operating table, and the pelvis rotated posteriorly as far as possible (corkscrew position) and a left inguinal incision was made to secure the femoral artery and vein. We performed thoracoretroperitoneal incision which combined a left seventh intercostal thoracotomy and pararectal incision (Fig. 2A). The aorta was reached via a retroperitoneal approach. Firstly, the descending aorta was secured. Then, the retroperitoneum was dissected and the intra-abdominal organs were displaced with the peritoneum. The Y-shaped artificial blood vessel that had been replaced was confirmed and was tightly adherent. The straight portion of the artificial blood vessel was secured. We dissected the proximal aorta and secured

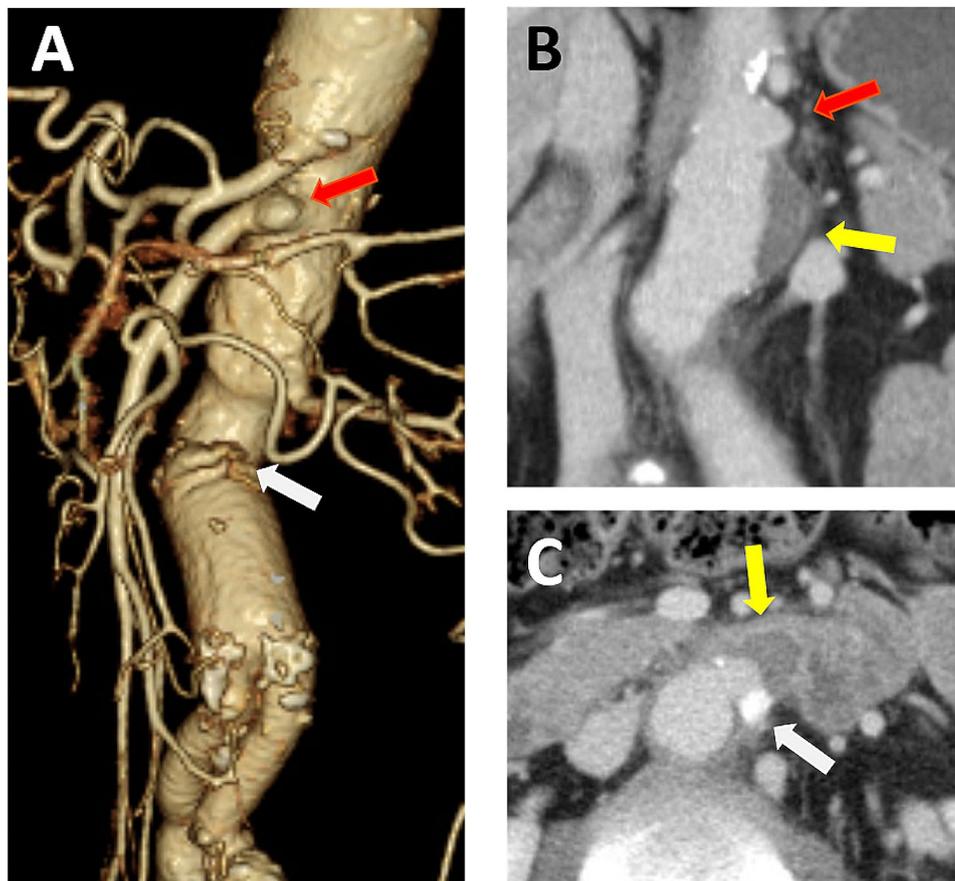


Fig. 1 Preoperative computed tomography. **A** Three-dimensional view showing a pseudoaneurysm of the anastomotic site (white arrow) and a pseudoaneurysm at the superior mesenteric artery bifurcation (red arrow). **B** Coronal view demonstrating a pseudoaneurysm at the superior mesenteric artery bifurcation (red arrow) and atheroma on the central side of the anastomotic site (yellow arrow). **C** Axial view demonstrating a pseudoaneurysm of the anastomotic site (white arrow) and soft tissue that connected the horizontal part of the duodenum (yellow arrow)

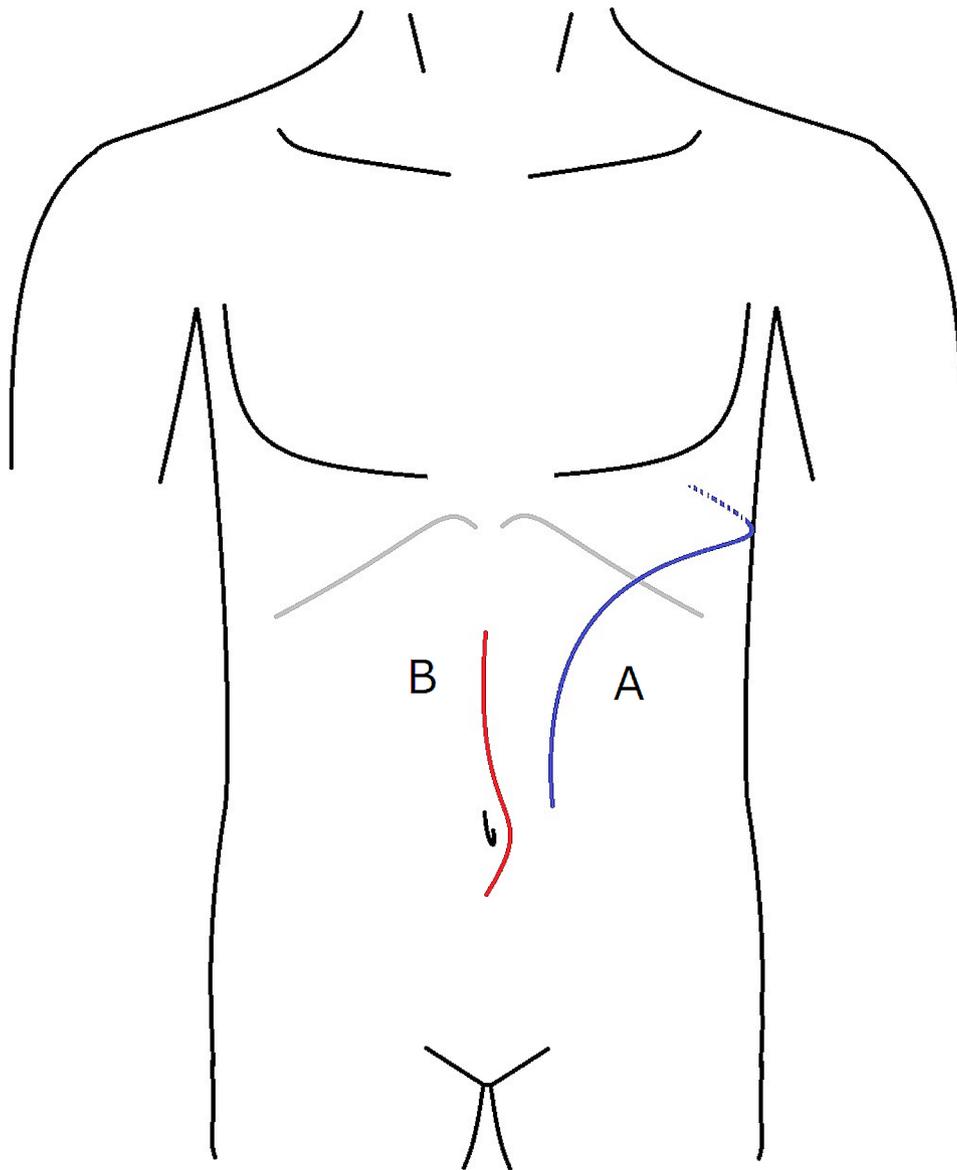


Fig. 2 Incisions on a supine patient. **A** (blue line) Thoracoretroperitoneal incision which combined a left seventh intercostal thoracotomy and pararectal incision. **B** (red line) Median upper-middle incision

the left renal artery, celiac artery, and superior mesenteric artery.

After heparin was administered, veno-arterial extracorporeal membrane oxygenation (V-A ECMO) was started using the left femoral artery and vein. The descending aorta and straight portion of the artificial blood vessel were clamped and the dorsal side of the aorta was incised. 12 French balloon-tipped catheters extending from the V-A ECMO were inserted into the celiac artery, superior mesenteric artery, and renal arteries for selective visceral perfusion. After the aortic wall was resected and cleaned, we used a Gelweave Coselli thoracoabdominal graft (Vascutek-Terumo, Renfrewshire Scotland, UK) bonded with rifampicin and the proximal and distal anastomosis were

performed before the visceral arteries are reattached. The Distal anastomosis was performed at the straight portion of the artificial blood vessel where there were no obvious signs of infection. After the clamp of the aorta was released, the renal, the celiac, the superior mesenteric anastomoses were carried out. After thoracoabdominal aortic replacement was performed, V-A ECMO was discontinued and protamine was administered and hemostasis was performed.

We considered complete artificial blood vessel resection around the aortoenteric fistula; however, a part of the artificial blood vessel around the aortoenteric fistula tightly adhered to the retroperitoneum and we were

concerned about intestinal perforation; thus, a part of the artificial blood vessel was left in place (Fig. 3A).

After rinsing with saline, a drain was placed and the chest and the thoracoretroperitoneal incision were closed.

The patient was then placed in a supine position and the abdomen was opened through a median upper-middle incision (Fig. 2B). The duodenum was rigidly attached to the retroperitoneum at the position of the aorta. This was considered as the fistula site. The fistula was detached closer to the retroperitoneum, and the duodenum was detached from the artificial blood vessel (Fig. 3B). The previous artificial blood vessel was trimmed and completely resected and the new artificial vessel was found inside the retroperitoneal perforation (Fig. 3C). The duodenal fistula site only had an 8-mm serosal membrane injury and a pinhole in the center (Fig. 3B). The fistula was closed using two layers of direct sutures because the condition of the duodenal wall was good. The space between the new artificial blood vessel and the duodenum was filled with the omental flap and the omental flap was filled as much as possible around the graft through the retroperitoneal perforator. After repair of the duodenum, an enterostomy was created.

After rinsing with saline, a drain was inserted and the median upper-middle incision was closed.

The patient was extubated the day after surgery. The patient's subsequent course was excellent. There were no obvious signs of infection. Antimicrobial therapy was continued, and the patient was switched from intravenous to oral therapy. The patient was discharged home on the 30th postoperative day. Postoperative CT showed no graft occlusion and the omental flap between the graft and the duodenum (Fig. 4).

Discussion and conclusion

Aortoenteric fistula can be further divided into primary and secondary, with primary being caused by aneurysm, infection, or trauma; secondary is defined as developing after prosthetic reconstruction, with a reported incidence of 0.36–1.6% [1, 2]. Secondary aortoenteric fistula (sAEF) is a highly lethal disease with a mortality rate of 40–70% [1], and 80% of these fistulas form in the duodenum [3].

The characteristic symptom of an aortoenteric fistula is a massive hemorrhage called a herald bleed. It precedes a fatal hemorrhage and occurs in approximately 2/3 of cases [1, 4]. In this case, the patient both had a massive hematemesis and hematochezia.

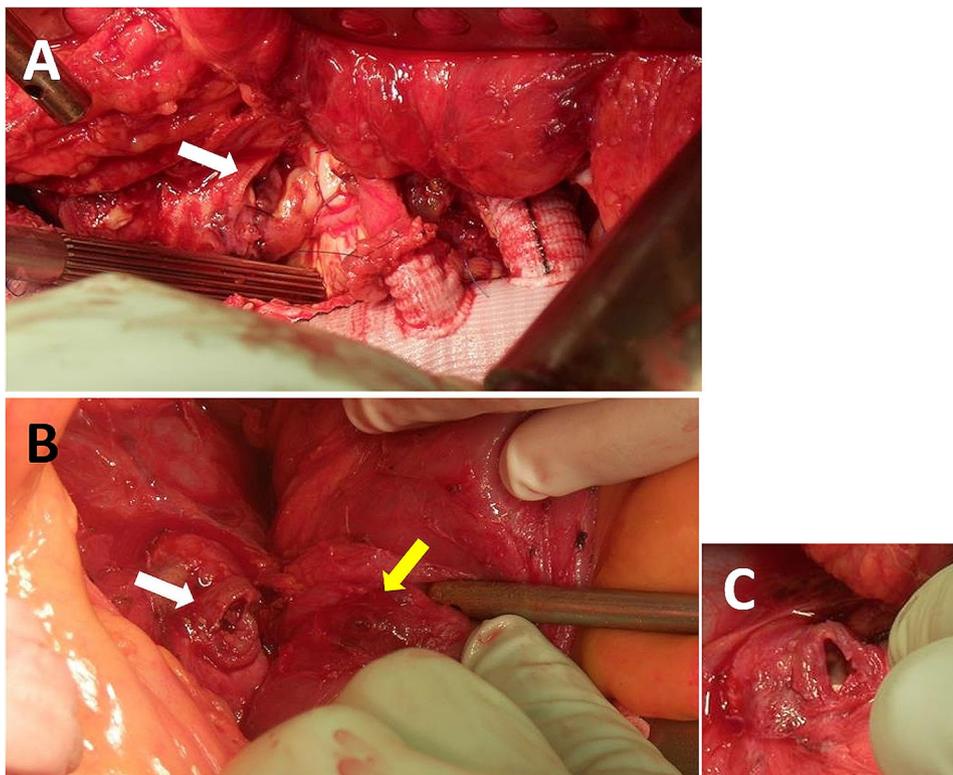


Fig. 3 Intraoperative photo. **A** In a right lateral decubitus position, a left seventh intercostal thoracotomy and a retroperitoneal approach were performed. Thoracoabdominal aortic replacement was performed using a graft bonded with rifampicin. The lumen of the anastomosis of the pseudoaneurysm was confirmed (white arrow). **B** In a supine position and midline abdominal incision, the retroperitoneal perforation (white arrow) and an 8-mm pinhole fistula in the duodenum (yellow arrow) were confirmed. **C** The new artificial vessel was found inside the retroperitoneal perforation

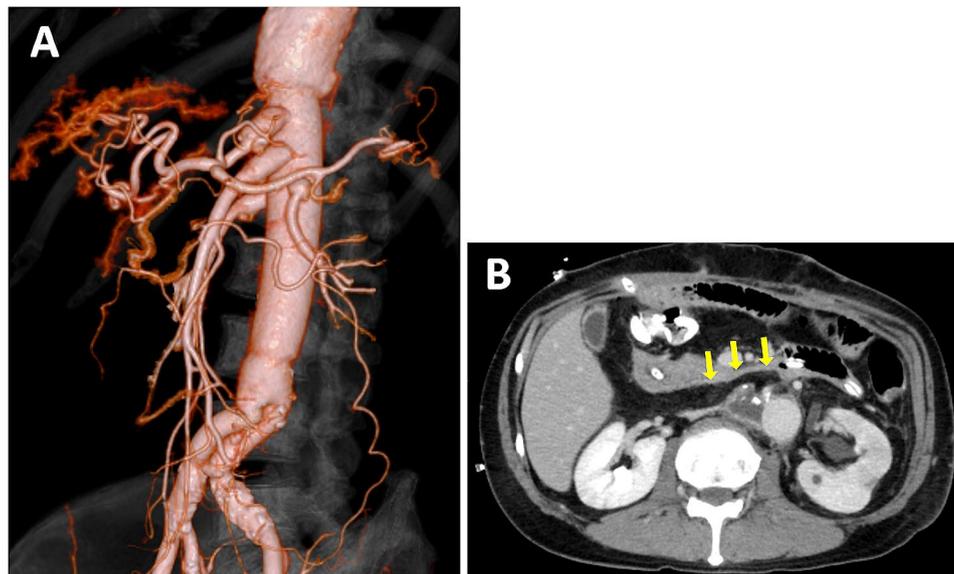


Fig. 4 Postoperative computed tomography. **A** Three-dimensional view showing no graft occlusion. **B** Axial view demonstrating the omental flap between the graft and the duodenum (yellow arrow)

It is difficult to diagnose sAEF by upper gastrointestinal endoscopy alone, because most fistulation sites are in the horizontal part of the duodenum, and persistent active bleeding cannot be confirmed during a herald bleed. Conversely, there are many reports [5] indicating that contrast-enhanced CT is useful for diagnosis, and findings such as a soft tissue shadow, air density around a contrasted artificial blood vessel, signs of liquid effusion, and false lump formation are highly suspicious for sAEF.

It is considered important to perform surgery immediately if sAEF is suspected; however, there is no consensus regarding the optimal operative method. In principle, the operative method should be divided into aortic and duodenal. Aortic revascularization can be performed by anatomic revascularization with artificial blood vessel replacement, non-anatomic revascularization, or bridge therapy with open surgery after endovascular aortic repair (EVAR). Many recent reports suggest that anatomic revascularization is preferable [6, 7, 8]. In this case, thoracoabdominal aortic replacement was required and EVAR was not considered due to the complexity of the procedure. For the duodenum, there are several techniques, including simple suture closure of the fistula, fistulectomy plus suture closure, and resection of the horizontal part of the duodenum plus reconstruction of the gastrointestinal tract [9]. The choice of technique should be based on an overall assessment of fistula size and the degree of intra-abdominal contamination. Omental flap transposition has also been reported to be useful [9].

This one-stage, multifaceted surgical approach combined thoracoretroperitoneal incision and midline abdominal incision is safely and useful strategy. The advantage is that aortic surgery can be performed

without any manipulation of the gastrointestinal tract. The risk of major bleeding can be reduced by securing the descending aorta early. In addition, since the gastrointestinal tract is not operated on concurrently, intestinal fluid does not extend into the artificial blood vessels, preventing further infection. This strategy can be used even in patients who will undergo only abdominal aortic replacement surgery without cardiopulmonary bypass.

Another advantage is that cardiovascular and gastrointestinal surgery teams do not need to operate simultaneously, allowing for a smooth handover between teams. Gastrointestinal surgery can also be performed safely since aortic replacement has already been completed and midline abdominal incision allows gastrointestinal surgeons to perform a variety of surgical procedures.

Conclusion

A one-stage, multifaceted surgical approach of combined thoracoretroperitoneal incision and midline abdominal incision improves aortic and gastrointestinal surgery safety for sAEF after prosthetic reconstruction of the abdominal aortic aneurysm. This method can be considered as one of the treatment options for sAEF.

Abbreviations

sAEF	Secondary aortoenteric fistula
CT	Contrast-enhanced computed tomography
V-A ECMO	Veno-arterial extracorporeal membrane oxygenation
EVAR	Endovascular aortic repair

Acknowledgements

None.

Author contributions

T. Minami, T. Kojima, N. Yabu, and I. Yamazaki performed the operation. T. Minami and A. Saito conceived the report. T. Minami wrote the main manuscript text and prepared Figs. 1, 2 and 3. All authors reviewed the final manuscript.

Funding

None.

Data availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Declarations**Ethical approval**

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Competing interests

The authors declare no competing interests.

Received: 24 July 2023 / Accepted: 14 January 2024

Published online: 28 January 2024

References

1. Busuttill SJ, Goldstone J. Diagnosis and management of aortoenteric fistulas. *Semin Vasc Surg.* 2001;14:302–11.
2. Kuestner LM, Reilly LM, Jicha DL, et al. Secondary aortoenteric fistula: contemporary outcome with use of extraanatomic bypass and infected graft excision. *J Vasc Surg.* 1995;21:184–95. discussion 195–6.
3. Connolly JE, Kwaan JH, McCart PM, et al. Aortoenteric fistula. *Ann Surg.* 1981;194:402–12.
4. Steffes BC, O'Leary JP. Primary aortoduodenal fistula: a case report and review of the literature. *Am Surg.* 1980;46:121–9.
5. Mylona S, Ntai S, Pomoni M, et al. Aorto-enteric fistula: CT findings. *Abdom Imaging.* 2007;32:393–7.
6. Lawlor DK, DeRose G, Harris KA, et al. Primary aorto/iliac-enteric fistula-report of 6 new cases. *Vasc Endovascular Surg.* 2004;38:281–6.
7. Sweeney MS, Gadacz TR. Primary aortoduodenal fistula: manifestation, diagnosis, and treatment. *Surgery.* 1984;96:492–7.
8. van Olfen TB, van der Knippenberg LH, et al. Primary aortoenteric fistula: report of six new cases. *Cardiovasc Surg.* 2002;10:551–4.
9. Tsuneki T, Yuasa Y, Fukuta M, et al. Secondary aorto-duodenal fistula successfully treated with a novel surgical method: a case report. *Int J Surg Case Rep.* 2020;72:17–21.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.