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Case Report

Case report – Computed tomography diagnosis of an abdominal aortic aneurysm complicated with primary aortoduodenal fistula [☆]

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ABSTRACT

Abdominal aortic aneurysm has been described as a rare condition touching 1% of the population over the age of 50 years with a high percentage of mortality. Aneurysms progress in size, causing deadly complications such as ruptures and fistulas. Computed tomography angiography is considered the gold standard imaging exam for the evaluation of abdominal aortic aneurysms and their complications. We report the case of an elderly patient admitted to the emergency room due to recurrent gastrointestinal bleeding. The computed tomography imaging findings were in favor of an abdominal aortic aneurysm complicated with a primary aortoduodenal fistula.

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Introduction

Abdominal aortic aneurysm (AAA) is defined in the literature as a focal dilatation of the aorta that is more than 50% of its diameter [1].

Abdominal aortic aneurysm is a rare disease that affects elderly people (8% of the male population aged more than 65 years). In most cases, it remains asymptomatic until compli-

cations occur. Rupture of an AAA and its associated catastrophic physiological injuries carry an overall mortality rate in excess of 80% [2].

The main risk factors that have been found relevant in the different studies include age, male gender, tobacco usage, family history, hypercholesterolemia, and hypertension [3]. The pathogenesis of AAA involves the complex interaction of a variety of factors acting over many years, which weaken the aortic wall and increase the load upon it, leading to a

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Fig. 1 – Axial computed tomography with contrast images (Arterial phase) showing a sacciform aortic abdominal aneurysm measuring 30 mm.

progression in its size with rupture occurring at the end of the growth spectrum [4].

The complications of AAA include rupture, infection, aorto-enteric fistula, aorto-caval fistula, pseudoaneurysm, thrombotic occlusion of the branch vessel, and compression of adjacent structures [5].

Abdominal aortic aneurysm (AAA) rupture is defined as bleeding outside the adventitia of a dilated aortic wall. Ruptures can be divided into free ruptures when they flow into the peritoneal or retroperitoneal cavity. In a minority of cases, AAAs rupture into the intestinal tract, frequently in the last portion of the duodenum, creating an aortic enteric fistula or into the cava vein [6].

The aortoenteric fistulas are subdivided into primary fistulas, which are very rare and are defined as communications between the native aorta and the duodenum; gastrointestinal bleeding represents the first symptom. Secondary aortoduodenal fistulas are postoperative complications that happen between the suture line of a vascular graft and the intestine [7].

Computed tomography angiography is considered the gold standard imaging exam for the evaluation of abdominal aortic aneurysm and its complications [5].

Case report

We report the case of a 90-year-old male patient admitted to the emergency unit of our hospital with the chief complaint of gastrointestinal hemorrhage. The patient's history reveals recurrent gastrointestinal bleeding episodes (Melena and hematemesis) explored multiple times with a diagnosis of a Dieulafoy's lesion treated with Argon Plasma Coagulation (APC).

The patient presented 2 days before his admission with massive melena and hematemesis, which is why he was ad-

mitted to the emergency room. At the moment of admission, the patient was hemodynamically stable, with the presence of a conjunctival pallor. fever was noted. The physical examination found epigastric pain and tenderness with palpable abdominal mass. A rectal examination found signs in favor of melena.

His pertinent initial labs showed a hemoglobin of 4.1 g/dL with a hematocrit of 23%. The rest of the laboratory findings were normal. The patient was transfused with 3 units of blood. Control hemoglobin was 8.6 g/dL.

Since the patient's history revealed Dieulafoy's disease, an esophagogastroduodenoscopy was performed initially after transfusion and stabilization of the patient, which revealed a minimal fundic blood lake with a large nonmobilizable blood clot, a millimetric antral ulcer, micronodular bulbitis, and a nonmobilizable duodenal blood clot in the depressed mucosal area.

Since there was active cause found of the gastrointestinal bleeding on the esophagogastroduodenoscopy, the investigation was completed with a computed tomography scan with contrast that showed the presence of a sacciform aortic abdominal aneurysm measuring 30mm (Figs. 1 and 2) in close contact with the third portion of the duodenum with the presence of soft-tissue oedema surrounding the aorta and loss of the fat plane separating the aorta and the duodenal tract (Fig. 3) with disruption of the aortic wall and extravasation of aortic contrast to the intestinal lumen associated with a focal thickening of the duodenum wall (Fig. 4), all in favor of a primary aortoduodenal fistula.

Once the diagnosis of the rupture of the abdominal aorta aneurysm was made, the patient was admitted to the intensive care unit (ICU). While being prepared for an emergency surgery, another episode of gastrointestinal bleeding occurred, and within a few minutes, cardiac arrest developed. Massive blood and clear crystalloid solutions and drugs were infused via an immediately administered subclavian vein catheter



Fig. 2 - 3-Dimensional reconstruction of computed tomography angiography of the abdominal aorta showing the sacciform aortic aneurysm (Blue arrow).

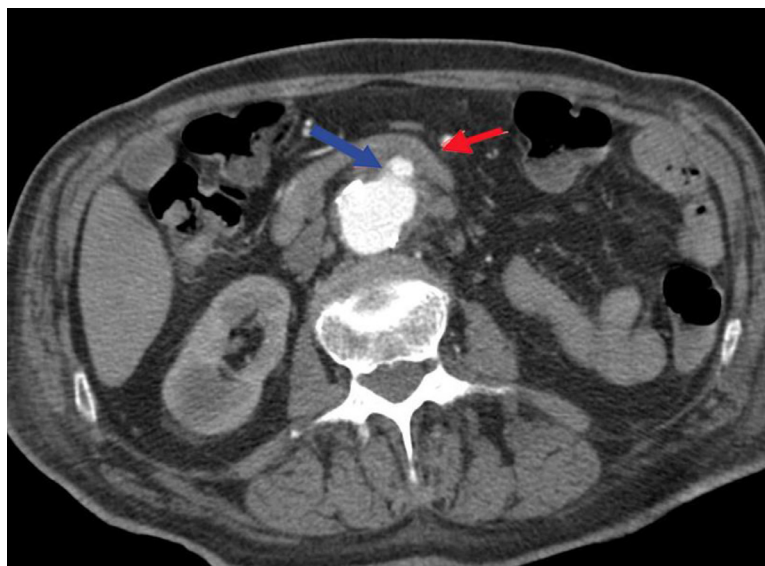


Fig. 3 - Axial computed tomography with contrast images (Arterial phase) showing the abdominal aortic aneurysm (Blue arrow) in close contact with the third portion of the duodenum (Red Arrow) with the presence of soft-tissue oedema surrounding the aorta and loss of the fat plane separating the aorta and the duodenal tract.

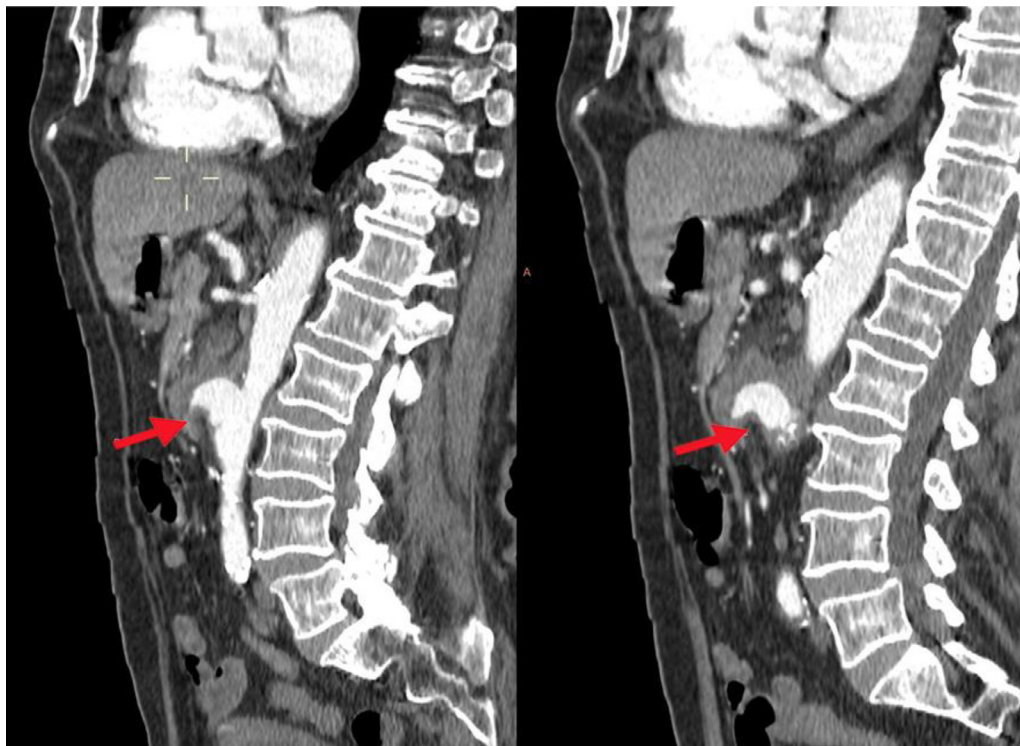


Fig. 4 – Coronal computed tomography with contrast images (Arterial phase) showing disruption of the aortic wall and extravasation of aortic contrast to the intestinal lumen associated to a focal thickening of the duodenum wall.

while an external cardiac massage was performed. The patient was deceased.

Discussion

The first case of primary aortoenteric fistula was reported by Sir Astley Cooper in 1822 [8]. The aortoenteric fistulas are subdivided into primary fistulas, which are very rare and are defined as communications between the native aorta and the duodenum; gastrointestinal bleeding represents the first symptom. Secondary aortoduodenal fistulas are postoperative complications that happen between the suture line of a vascular graft and the intestine [7].

Most of the primary aortoenteric fistulas are attributed to an existing abdominal aorta aneurysm. However, it can sometimes be associated with an infection, a tumor, a radiotherapy complication, or the ingestion of a foreign body [9]. The most frequent localization of the primary aortoenteric fistulas occurs between the aorta and duodenum (third portion) [10]. The classical triad of an abdominal aortoduodenal fistula consists of the presence of a pulsatile abdominal mass, abdominal, and back pain, and intermittent gastrointestinal hemorrhage [11].

Esophagogastroduodenoscopy is usually the first investigation in cases of gastrointestinal bleeding; however, its success rate in the diagnosis of an aortoduodenal fistula is very low. Indeed, in a review study done by S. J. F. Saers and M. R. M. Scheltinga, which included a total of 81 patients with primary aortoenteric fistula, the rate of success of the esophagogas-

troduodenoscopy was limited to only 25% [9]. The sensitivity of computed tomography angiography for detecting aortoenteric fistulas is substantially greater than that of esophagogastroduodenoscopy [12]. Imaging is essential for the detection of AAA, monitoring of the rate of growth, detection of complications (ruptures and fistulas), preoperative planning, and postoperative follow-up. Computed tomography angiography remains the gold standard and imaging modality of choice and has replaced conventional angiography for the evaluation of AAA [5]. Chervu reviewed 243 patients diagnosed with abdominal aorta aneurysms undergoing surgery and noticed that 38% of AAAs were initially suspected on physical examination. However, 62% of the patients were found incidentally by radiological examinations, showing the importance of the computed tomography examination in the diagnosis of the abdominal aorta aneurysm [13].

Computed tomography and angiography play a major role in the management of abdominal aorta aneurysms. In fact, it's the gold standard for incidental detection and early diagnosis of AAA. A patient's risk of AAA rupture can also be assessed by measuring the diameter of the aneurysms, tortuosity, thrombus extent, and wall stress. Anatomic variants as well as AAA etiology are determined with computed tomography angiography [14]. In cases of suspicion of an aortoenteric fistula, the computed tomography scans may show characteristic findings such as [15]:

- Direct signs: extravasation of aortic contrast to the intestinal lumen; leakage of enteric material into the periaortic space; disruption of the aortic wall; aortic or perivascular gas.

- Indirect signs: free fluid (<20 HU) or soft-tissue oedema (>20 HU) in a circumferential arrangement surrounding the aorta, loss of the fat plane separating the aorta, and the gastrointestinal tract, focal thickening of the intestinal wall >5 mm, complications of aortic aneurysm (pseudoaneurysm, intramural hematoma), presence of bubbles of ectopic gas more than 3-4 weeks following surgery or soft tissue sleeve, free fluid, and hematoma after 2-3 months.

The computed tomography scan diagnosis is not always that easy since there are many potential mimics of aortoenteric fistulas, such as retroperitoneal fibrosis, infected aortic aneurysm, infectious aortitis, and perigraft infection without fistulization in case of a secondary aortoenteric fistula suspicion [16]. Magnetic resonance imaging may have similar specificity and sensitivity, but its availability is limited in an emergency situation. Ultrasonography may be useful in unstable patients or those in whom the use of intravenous iodinated contrast material is contraindicated [17].

The outcome of the management of an aortoenteric fistula is conditioned by a rapid diagnosis and aggressive surgical intervention. Initial hemodynamic support with ongoing resuscitation is necessary to best temporize the patient for the intervention. At the time of aortoenteric fistula diagnosis, blood cultures should be drawn, and broad-spectrum antibiotics should be initiated to be narrowed following specific microbial growth. Surgical management is completed either through a traditional invasive open approach in the form of a laparotomy with or without thoracotomy. It is recommended that repair of the aortic aneurysm consist of an interpositional synthetic graft and primary repair of the gastrointestinal tract. If extensive destruction of the intestinal wall has taken place, segmental resection with end-to-end anastomosis is preferred, or via a less invasive endovascular repair of the aorta (EVAR) [18]. With advances in endoscopic techniques and equipment, large clips for the closure of vascular-enteric fistulas have come forward. Thus, clipping of fistulas with esophagogastroduodenoscopy has now become feasible, and the clipping of aorta-duodenal fistulas might be the next step forward [19].

Primary aortoenteric fistula with gastroenteric bleeding is associated with an almost 100% mortality rate if emergency surgical treatment is not performed or delayed. Surgery can decrease the mortality rate to 30%-40% if other complications occur, especially the infection of the abdominal aorta aneurysm [20].

Conclusion

Aortoenteric fistula is a life-threatening complication of abdominal aortic aneurysm. Its diagnosis and management cause usually a dilemma. The classical triad of pulsatile abdominal mass, abdominal and back pain, and intermittent gastrointestinal hemorrhage should alert the clinician. Computed tomography angiography plays a major role in the management of the abdominal aorta aneurysm and its complications, such as the aortoenteric fistula. The management of an

aortoenteric fistula is a vital emergency with a high mortality rate and bad outcomes.

Patient consent

Written informed consent for publication of this case study was obtained from the patient's family.

REFERENCES

- [1] Johnston KW, Rutherford RB, Tilson MD, Shah DM, Hollier L, Stanley JC. « Suggested standards for reporting on arterial aneurysms ». *J Vasc Surg* 1991;13(3):452–8. doi:10.1067/mva.1991.26737.
- [2] Nordon IM, Hinchliffe RJ, Loftus IM, Thompson MM. « Pathophysiology and epidemiology of abdominal aortic aneurysms ». *Nat Rev Cardiol* 2011;8(2):92–102. doi:10.1038/nrcardio.2010.180.
- [3] Chaikof EL, Dalman RL, Eskandari MK, Jackson BM, Lee WA, Mansour MA, et al. « The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm ». *J Vasc Surg* 2018;67(1):2–77. doi:10.1016/j.jvs.2017.10.044.
- [4] MacSweeney STR, Powell JT, Greenhalgh RM. « Pathogenesis of abdominal aortic aneurysm ». *Br J Surg* 2005;81(7):935–41. doi:10.1002/bjs.1800810704.
- [5] Kumar Y, Hooda K, Li S, Goyal P, Gupta N, Adeb M. « Abdominal aortic aneurysm: pictorial review of common appearances and complications ». *Ann Transl Med* 2017;5(12) 256–256. doi:10.21037/atm.2017.04.32.
- [6] Antonello M. « Ruptured abdominal aortic aneurysms ». Diagnosis, screening and treatment of abdominal, thoracoabdominal and thoracic aortic aneurysms. IntechOpen; 2011. doi:105772/19740.
- [7] Tütün U, Aksöyek A, Ulus AT, Parlar AI, Göl MK, Bayazit M. « Acute gastrointestinal bleeding due to primary aortoduodenal fistula: report of two rare cases ». *Turk J Gastroenterol* 2004;15(4):253–7.
- [8] Cooper A. *The lectures of Sir Astley Cooper on the principles and practice of surgery and Practice of Surgery with Additional Notes and Cases* By F Tyrell. 5th. Philadelphia: Haswell, Barrington and Haswell; 1939.
- [9] Saers SJF, Scheltinga MRM. « Primary aortoenteric fistula ». *Br J Surg* 2005;92(2):143–52. doi:10.1002/bjs.4928.
- [10] Spinelli F, et al. « Primary aortoduodenal fistula including the afferent loop of a Billroth II anastomosis. A case report ». *J Cardiovasc Surg (Torino)* 2002;43(5):711–14.
- [11] van Olffen TBM, Knippenberg LHA, van der Vliet JA, Lastdrager WB. « Primary aortoenteric fistula: report of six new cases ». *Cardiovasc. Surg. Lond. Engl.* 2002;10(6):551–4. doi:10.1016/s0967-2109(02)00104-7.
- [12] Deijen CL, Smulders YM, Coveliers HME, Wisselink W, Rauwerda JA, Hoksbergen AWJ. « The importance of early diagnosis and treatment of patients with aortoenteric fistulas presenting with herald bleeds ». *Ann Vasc Surg* 2016;36:28–34. doi:10.1016/j.avsg.2016.03.028.
- [13] Chervu A, Claggett GP, Valentine RJ, Myers SI, Rossi PJ. « Role of physical examination in detection of abdominal aortic aneurysms ». *Surgery* 1995;117(4):454–7. doi:10.1016/S0039-6060(05)80067-4.
- [14] Davis CA. « Computed tomography for the diagnosis and management of abdominal aortic aneurysms ». *Surg Clin North Am* 2011;91(1):185–93. doi:10.1016/j.suc.2010.10.007.

- [15] Nagrani Chellaram S, Martínez Chamorro E, Borrue Nacenta S, Ibáñez Sanz L, Alcalá-Galiano A. « Aortoenteric fistulas: spectrum of MDCT findings ». *Radiol. Engl. Ed.* 2020;62(4):280–91. doi:10.1016/j.rxeng.2020.01.011.
- [16] Vu K-N, Kaitoukov Y, Morin-Roy F, Kauffmann C, Giroux M-F, Thérasse E, et al. « Rupture signs on computed tomography, treatment, and outcome of abdominal aortic aneurysms ». *Insights Imaging* 2014;5(3):281–93. doi:10.1007/s13244-014-0327-3.
- [17] Vu QDM, Menias CO, Bhalla S, Peterson C, Wang LL, Balfe DM. « Aortoenteric fistulas: CT features and potential mimics ». *Radiographics* 2009;29(1):197–209. doi:10.1148/rg.291075185.
- [18] Dorosh J, Lin JC. « Aortoenterofistula ». StatPearls, Treasure Island (FL): StatPearls Publishing; 2023. Consulté le: 19 septembre 2023. [En ligne]. Disponible sur <http://www.ncbi.nlm.nih.gov/books/NBK567729/>.
- [19] Berner-Hansen V, Olsen AA, Brandstrup B. « Endoscopic treatment of primary aorto-enteric fistulas: a case report and review of literature ». *World J. Gastrointest. Endosc.* 2021;13(6):189–97. doi:10.4253/wjge.v13.i6.189.
- [20] Vilas-Boas F, Azevedo F, Marques M, Baldaque-Silva F, Cardoso H, Costa-Lima J, et al. « Primary aortoenteric fistula ». *Clin J Gastroenterol* 2013;6(4):299–302. doi:10.1007/s12328-013-0401-2.