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Duodenocaval Fistula Caused by Duodenal Ulcers: A Case Study and Literature Review

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1. Abstract

Duodenocaval Fistula (DCF) is a disease that affects the digestive and circulatory systems. There are only a handful of documented cases of this disease worldwide. This disease is rare; however, it spreads rapidly and has a high mortality rate when it does occur. Our department diagnosed one case of DCF caused by duodenal ulcers. Following the diagnosis, surgical treatment was carried out in a hybrid operating room. This article summarises and discusses the DCF using a case study and relevant research.

2. Case Report

A 38-year-old man was admitted to the emergency department of the Second Affiliated Hospital of Anhui Medical University on March 1, 2022, with the following symptoms"black stool for one week and fever for three days.". The patient's history of duodenal ulcers stretches for more than a decade. The patient was hospitalized, where he was closely monitored, and initial lab tests were taken.

2.1. Laboratory and radiologic findings

Initial blood testing provided the following findings: leukocyte 10.54 × 10^9 / L, neutrophils 10.38×10^9/L, hemoglobin 71 g / L, platelet count 73 × 10^9 / L, C-reactive protein 139.3 mg / L.

The computed tomography (CT) scan revealed exudation in the hilar region of the liver, the descending part of the duodenum, and around the right kidney. This exudation was an indication of the descending duodenal diverticulum. Further examination indicated that the patient had a duodenal diverticulum, gastrointestinal bleeding, and was in septic shock. The patient was ultimately transferred to the Intensive Care Unit (ICU), where he was provided with conservative treatment. This treatment consisted of rehydration, anti-inflammatory medication, and a blood transfusion; however, the patient's condition did not improve. The gastroduodenoscopy on March 3 revealed that the duodenal bulb was actively bleeding; however, the bleeding point could not be identified due to a blood clot. On the other hand, the gastrointestinal radiography performed on March 7 revealed a trace quantity of linear and bubble-like extravasation of the contrast material (Figure 1). Duodenocaval Fistula (DCF) was diagnosed via phlebography, which showed air accumulation in the inferior vena cava (IVC) and the formation of an inferior vena cava fistula in the duodenal bulb (Figure 2).

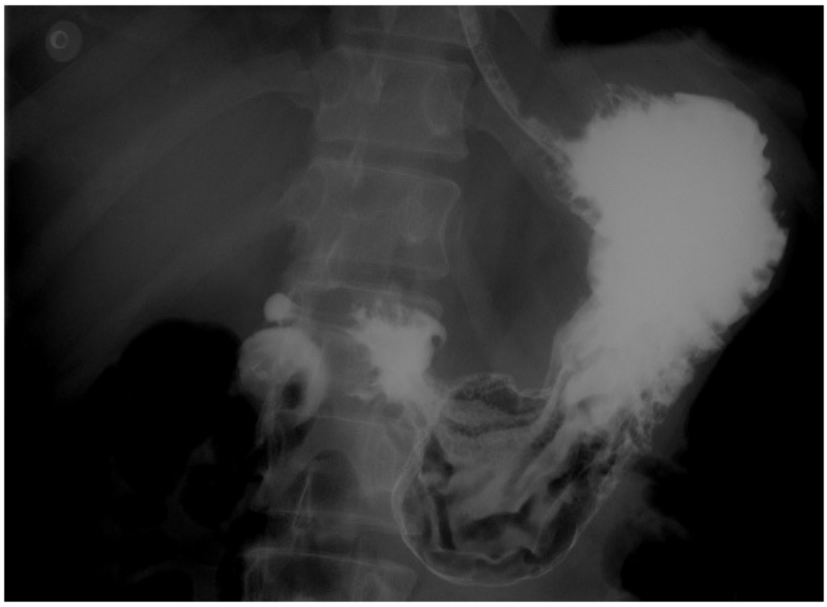

Figure 1: Phlebography showed a small amount of linear and bubble-like contrast medium extravasation.

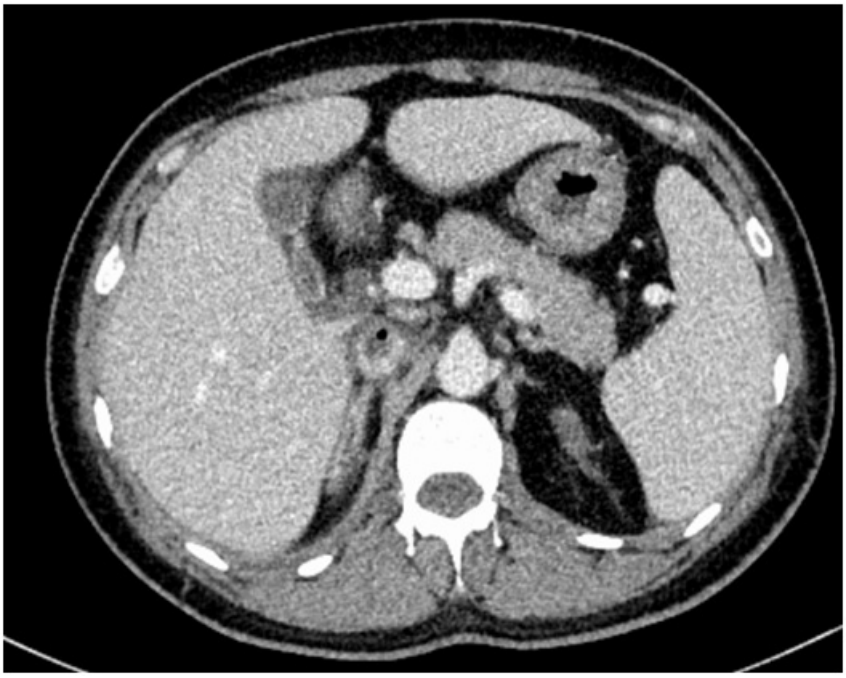

Figure 2: Arteriovenous angiography showed pneumatosis in inferior vena cava.

2.2. **Treatment and complications**

After analyzing the findings of the gastroduodenoscopy, gastrointestinal radiography, and phlebography, the patient was moved to an operating room equipped with a C-arm on March 11. Digital subtraction angiography (DSA) was used in the C-arm operating room to conduct right femoral vein puncture angiography and IVC balloon occlusion. Opened exploration immediately after IVC occlusion.

Observations made throughout the operation: a massive ulcer lesion measuring 6 cm * 5 cm * 4 cm was discovered at the intersection of the duodenal bulb and the descending portion. The diameter of the posterior wall of the duodenum was 3.5 cm, with perforation and mucosal valgus. The IVC wall had deteriorated due to duodenal perforation. A perforation with a 2 cm diameter can be observed in the IVC, and a thrombus of 2 cm* 2 cm* 1.5 cm had developed at the perforation of the IVC (Figure 3). The duodenum and the IVC perforation were healed using intermittent sutures, and the wounds were covered by omental transplanting. After the operation, the patient's condition began to stabilize, and as a result, he was eventually transferred from the ICU to a regular hospital ward. Following the patient's discharge, we checked in with him a week later, and the findings of the follow-up investigation turned out to be positive.

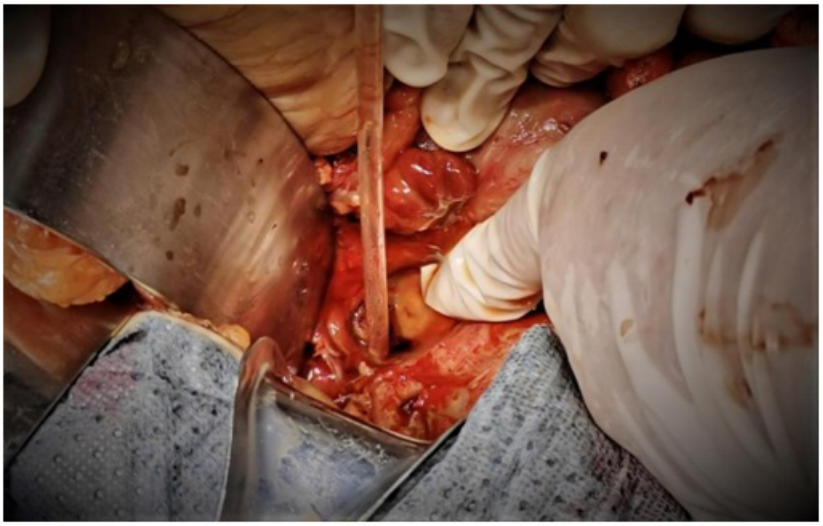

Figure 3 Intraoperative pictures.

3. Methods

The condition known as DCF is quite rare. Only 48 instances of DCF have been documented in the medical literature because of the modest beginning of the disease and the challenges associated with making a prompt diagnosis. As a direct result, the total mortality rate is around 40% [1]. The etiology of DCF is complex. Most DCF (33%) is a long-term complication caused by chemoradiotherapy of retroperitoneal sarcoma. In addition, another pathogeny of DCF can be divided into retroperitoneal sarcoma without chemoradiotherapy, gastrointestinal foreign bodies (toothpicks, animal bones, etc.), vascular filters, trauma and duodenal ulcer, etc. As part of our research, we reviewed case reports of DCF published in medical journals during the past fifty years. (Tables 1-3) [1-15] summarize the clinical data of all previously published cases in the medical literature.

Table 1: Summary of pathogeny

Pathogeny	Total number of cases n = 48 (%)	Number of deaths	Mortality (%)
Retroperitoneal sarcoma with chemoradiotherapy	16 (33)	11	69
Retroperitoneal sarcoma without chemoradiotherapy	2 (4)	0	0
Gastrointestinal foreign bodies	9 (19)	4	44
Toothpicks	7 (15)	4	57
Fishbone	1 (2)	0	0
Chicken bone	1 (2)	0	0
Vascular filters	10 (21)	0	0
Duodenal ulcer	8 (17)	5	63
Rauma	3 (6)	0	0
Total	48 (100)	20	42

Table 2: Treatment measures

Treatment measures	Total number of cases = 48 (%)	Number of deaths	Mortality (%)
Surgery	32 (67)	13	41
Intervention / endoscopy	9 (19)	1	11
Symptomatic treatment	7 (15)	6	86

Table 3: Diagnosis

Diagnosis	Total number of cases	Confirmed cases	Diagnostic rate(%)
Surgiry	20	18	90
Autopsy	14	14	100
CT	20	12	60
Endoscopy	27	8	30
Gastrointestinal radiography	13	6	46
Phlebography	9	4	44

4. Discussion

The clinical diagnosis of DCF is extremely challenging. The patient's clinical manifestations are nonspecific, consisting primarily of gastrointestinal bleeding and sepsis. Some individuals experience gastrointestinal bleeding as their initial symptom. Hence endoscopy is frequently performed initially. By doing a gastroduodenoscopy, one can intuitively detect a duodenal ulcer and the incarceration of a foreign body; nevertheless, it is difficult to estimate the depth of the lesion. The endoscopic visual field was disturbed by the blood clot at the fistula, resulting in the endoscopic diagnosis rate of only 30% (Table 3). It is noteworthy that there have been reports of fatal cases of cerebral air embolism after endoscopy [2]. Endoscopy requires inflation to maintain clear vision. A large amount of air enters the IVC through the fistula, which leads to cerebral air embolism. Therefore, we do not recommend endoscopy as a routine examination for patients with DCF. If necessary, blind inflation should be avoided. The presence of a contrast medium in IVC after gastrointestinal angiography can be used as a direct sign of the diagnosis of DCF. The diagnostic rate is only 46%. However, it has the advantages of being noninvasive and convenient.

According to (Table 3) of this report, CT has the highest preoperative diagnosis rate and a diagnosis rate of roughly 60%. The IVC and its tissues can be examined with CT scans without undergoing any invasive procedures. A CT scan can also detect thrombus and gas in the IVC, infectious effusion or abscess around the IVC and duodenum, and incarcerated foreign bodies and filters. In CT, some individuals may not exhibit direct signs of a fistula between the duodenum and IVC in the early stages. In IVC, there are few low-density gas shadows; hence, CT is repeated frequently. Proper diagnosis of vascular thrombosis or filling defects requires further CT imaging and phlebography. However, venous hypertension produced by the contrast agent may wash away the thrombus, form pulmonary embolism and lead to the patient's death [3]. Therefore, phlebography must be carried out with extreme caution when DCF is being considered.. This case came to our hospital with hematemesis, black stool and fever. After admission, many blood clots were seen by emergency gastroscope, and the bleeding point and lesion location could not be found accurately. Then digestive tract perforation was highly suspected, but multiple CT examinations failed to make a definite diagnosis.

However, DCF was confirmed by the accidental discovery of a contrast medium in the IVC after gastrointestinal angiography. A repeated review of CT showed that a little low-density gas shadow could be seen in the IVC. We suggest that the occurrence of DCF should be considered when patients have symptoms of gastrointestinal bleeding complicated with sepsis. It is recommended to perform CT in the early stage and carefully identify whether there is a gas shadow in the IVC. If necessary, gastrointestinal angiography should be performed to observe the presence of a contrast medium in the IVC. Careful endoscopy can identify ulcers and bleeding lesions in the gastroduodenal. Routine angiography is not recommended, which may lead to serious pulmonary embolism.

DCF involves both IVC and duodenum, and the probability of massive hemorrhage and explosive sepsis is high. Symptomatic treatment has high mortality; therefore, the early surgical clinical intervention has become a consensus [4]. Among the 48 cases of DCF recorded in the medical literature, the mortality of surgical treatment was 41%, interventional/endoscopic treatment was 11%, and symptomatic treatment was 86% (Table 2). At present, surgery is considered the best measure for the treatment of DCF. The previous view is that the choice of operation will be different according to the etiology. Duodenal and IVC fistula repair only needs to be performed in DCF patients with trauma, duodenal ulcer, gastrointestinal foreign body, vascular filter, and retroperitoneal sarcoma without chemoradiotherapy. In DCF patients with retroperitoneal sarcoma, pancreaticoduodenectomy should be coupled with chemoradiotherapy [17]. However, we believe that emergency interventional therapy can quickly stop bleeding and prevent bacteria from entering the blood, improves the patient's general condition in a short time, and provides a guarantee for the second stage of operation. By consulting the medical literature in recent ten years, it has been reported that two cases of DCF combined with chemoradiotherapy were treated surgically, and only fistula repair was performed; both patients had symptoms of improvement and were discharged from the hospital shortly [4,5]. Staged surgery was performed in one case: Boisvert et al. [4] first performed stent placement to block the IVC fistula. The secondary duodenal fistula repair was performed four months later. The author's team concluded that surgical suture or patch / omental transplantation is the first choice to repair the Fistula of the duodenum and IVC.

It should be noted that the common fistula of the duodenum and IVC may be blocked by thrombus. Once the thrombus is removed, the fistula of the IVC will bleed extensively and will be incredibly difficult to stitch. The suture vision can be obtained by temporary compression and occlusion of the IVC. The fistula can be repaired after local IVC stent placement and vascular intervention. For patients with severe inflammatory adhesion around the IVC fistula and unable to repair it, pancreaticoduodenectomy is necessary to expose the IVC fistula. For critical cases of IVC fistula that cannot be repaired, emergency ligation can be given at the lower edge of the renal vein.

Endoscopic foreign body removal combined with intravascular stent implantation is a feasible treatment, but it has high case selectivity. Lovelock M [6] stated that the therapy mentioned above should meet the following two conditions at the same time: DCF caused by a foreign body or vascular filter, and the patient's condition must be stable.

It was reported that nine individuals with DCF were treated with interventional/endoscopic therapy. Eight of the nine cases were caused by foreign bodies or vascular filters, and patients were able

to recover and be discharged after interventional or endoscopic removal of the foreign bodies. Another case was retroperitoneal sarcoma combined with radiotherapy. Hamblin J [7] tried to repair the fistula by vascular intervention. Unfortunately, the patient relapsed after six weeks, complicated by a stent infection, resulting in sepsis and eventually died. We have noticed that 12 reported patients with DCF caused by animal bones (chicken bone, fishbone) and vascular filters recovered and were discharged after surgical intervention [1,6,8-10]. This is because animal bones and vascular filters can be clearly developed on CT, which improves the early diagnosis rate, and timely surgical clinical intervention enhances the cure rate. In addition, the successful treatment of 3 cases of traumatic DCF [1,11] reported in the literature confirms the above view. Because trauma patients often need emergency laparotomy. The early implementation of surgery has improved the diagnosis rate, and the success rate of treatment has also been improved.

The only case of successful symptomatic treatment was reported by Ippolito D [12]. The DCF patient was caused by radiotherapy for retroperitoneal sarcoma. After the onset of the disease, the IVC was blocked by blood clots, so there were no bleeding symptoms and risks. In this case, surgery or stent / endoscopic treatment was not performed in the hospital, and the final long-term follow-up was well. However, the remaining eight patients (86%) died in hospital.

5. Summary

For gastrointestinal bleeding with sepsis symptoms, we should be alert to the occurrence of DCF. It is important to go over the patient's medical history thoroughly. CT should be completed early, and the abnormal manifestations in inferior vena cava(IVC) should be carefully identified. If DCF is clinically diagnosed or strongly suspected, appropriate surgical intervention should be undertaken promptly and decisively in accordance with the disease's etiology to have a favorable outcome.

6. Informed Consent Statement

The patient has read the full text and signed for publication.

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