

Vascular Complications of Pancreatitis with Endovascular Treatment of Complications

Dinesh Kumar Reddy¹, Priyanka Vudumula², K.V Rajashekar³

¹Assistant professor, Department of Radiology, Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu, India, ²Post Graduate Student, Department of Radiology, Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu, India, ³Professor & HOD, Department of Radiology, Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu, India.

Abstract

Introduction: Most cases of pancreatitis are mild and self-limited. On the other hand, approximately one quarter of patients with pancreatitis may develop vascular complications. Vascular complications in pancreatitis are well recognized. Their exact incidence is not known. The most common complications are haemorrhage into a pseudocyst, erosions of the upper gastrointestinal arteries, thromboses of the portal venous system, formation of varices or pseudoaneurysms and rupture of a pseudoaneurysm. Pancreatitis in combination with vascular complications is dangerous and potentially lethal. The survival of patients with pancreatitis and vascular complications depends on the early diagnosis of these complications. This article focuses on the aetiology, presentation, recent developments in diagnosis and management of such complications.

Material and Methods: Study done in the Department of Radiology from March 2019 to February 2020 at Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu to set the findings of the present study in the context of available evidence, a computerised literature search of PubMed, Embase, ISIS and CAS were carried out. The key words/subject headings used were “haemorrhage,” “pancreatitis,” “false aneurysms,” “venous thrombosis,” “angiography” and “therapeutic embolisation”. Limits applied were to restrict searches as follows: human and English language. All references were reviewed to retrieve additional articles. Other sources included review articles and text-books.

Result: Among the 169 attacks of acute pancreatitis, follow-up CT examinations depicted local complications in nine patients, for an overall incidence of 5.3%. There was a total of 16 complications, with three patients showing multiple complications. The number and percentage of patients with complications, number of complications, and number and percentage of follow-up examinations were calculated and correlated with the CT grading scale. **Discussion:** The development of abdominal complications in patients with acute pancreatitis leads to a prolonged hospitalization and, when life-threatening and not detected in time, to an increased mortality rate. Some of these complications may coexist, occur at any time after an acute attack, and have different manifestations and clinical repercussions. By and large, they are closely related to the staging severity of an acute attack of pancreatitis. **Conclusion:** Although the vascular complications following pancreatitis are not very common, they should be considered in every patient with pancreatitis. These complications if diagnosed and managed early was result in considerable reduction of morbidity and mortality.

Keywords: Vascular, endovascular, Haemorrhagic pancreatitis, pseudoaneurysms, splenic vein thrombosis (SVT).

Corresponding Author: Priyanka Vudumula, Post Graduate Student, Department of Radiology, Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu, India.

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Introduction

Most cases of pancreatitis are mild and self-limited. On the other hand, approximately one quarter of patients with pancreatitis may develop vascular complications. Vascular complications in pancreatitis are well recognized. Their exact incidence is not known. The most common complications are haemorrhage into a pseudocyst, erosions of the upper gastrointestinal arteries, thromboses of the portal venous system, formation of varices or pseudoaneurysms and rupture of a pseudoaneurysm. Pancreatitis in combination with vascular com-

plications is dangerous and potentially lethal. The survival of patients with pancreatitis and vascular complications depends on the early diagnosis of these complications.^[1] This article focuses on the aetiology, presentation, recent developments in diagnosis and management of such complications.

Haemorrhage is one of the most life-threatening complications of pancreatitis. Haemorrhage is usually due to erosion of a major pancreatic or peripancreatic blood vessel or due to the formation and subsequent rupture of an arterial pseudoaneurysm. The frequency of fatal haemorrhagic complications

of pancreatitis varies between 1.2% and 14.5%, and these complications seem to be related to the severity of disease.^[2]

The formation of pseudoaneurysms occurring as a result of pancreatitis is well established. A pseudoaneurysm has been reported to occur in 3.5-10% of patients with pancreatitis. The development of a pseudoaneurysm from vessel wall erosion by a pseudocyst is due to uncontrolled, severe inflammation necrotising the vessel.^[3]

Isolated splenic vein thrombosis (SVT) is relatively common in patients with chronic pancreatitis, occurring in as many as 10-40% of cases. Although much less common, portal and superior mesenteric vein thrombosis can also occur as a result of pancreatitis.^[4]

Objectives of the study

Vascular complications of pancreatitis with endovascular treatment of complications

Subjects and Methods

To set the findings of the present study in the context of available evidence, a computerised literature search of PubMed, Embase, ISIS and CAS were carried out. The key words/subject headings used were “hemorrhage,” “pancreatitis,” “false aneurysms,” “venous thrombosis,” “angiography” and “therapeutic embolisation”. Limits applied were to restrict searches as follows: human and English language. All references were reviewed to retrieve additional articles. Other sources included review articles and text-books.

The retrospective clinical study done in the Department of Radiology from March 2019 to February 2020 at Meenakshi Medical college hospital and research institute, Kanchipuram, Tamilnadu. The fifteen patients included in the study were diagnosed with pseudoaneurysms of visceral arteries, as a complication of chronic pancreatitis. The diagnosis was made using contrast-enhanced computed tomography, followed by angiography. On admission, all patients were symptomatic, with varying degrees of abdominal pain. One patient was haemodynamically unstable. Treatments with endovascular techniques were analysed, along with their efficacy and outcomes. Coil embolization was performed in 5 patients. Stent graft was used in 1 patient. Liquid embolic agents were used in 7 cases, of which 5 patients were treated with thrombin injection and 2 with Squid. A combination of techniques was used in 2 patients.

In a hospital, the patient continued to present symptoms of early satiety and epigastric discomfort after meals and was severely debilitated. On a second CT scan the pancreatic fluid collection was further enlarged. As a first-line treatment was decided the endoscopic drainage of the pseudocyst, so the patient was referred to another hospital for interventional endoscopy. The endoscopic EUS showed a cystic mass behind

the stomach pressing its lumen with a large number of debris inside. Drainage of the pseudocyst through the stomach was performed with 500cc of necrotic fluid and solid material (debris), and a metallic stent was inserted into the cyst cavity. A nasogastric tube was placed in order to avoid aspiration.

Result

Among the 169 attacks of acute pancreatitis, follow-up CT examinations depicted local complications in nine patients, for an overall incidence of 5.3%. There was a total of 16 complications, with three patients showing multiple complications. The number and percentage of patients with complications, number of complications, and number and percentage of follow-up examinations were calculated and correlated with the CT grading scale. Follow-up CT examinations were available for review in 48.5% of the entire group and in 70% of patients presenting with fluid collections (in 54.2% of grade D and 100% of grade E patients). Local complications occurred exclusively in patients with fluid collections. The incidence of complications among the 73 patients with fluid collections was 12.3%, whereas no complications developed in the 96 patients without fluid collections. This incidence of complications is based on clinical evaluation and on CT follow-up studies in 51 of the 73 patients initially exhibiting peripancreatic fluid collections. A significantly higher complication rate was seen in patients with fluid collections (grades D and E) than in patients without fluid collections (grades A, B, and C) ($p \leq 0.001$); indeed, no complications occurred in those patients without fluid collections.

Table 1: CT Grading of Acute pancreatitis

Grade	CT Finding
A	Normal pancreas
B	Enlarged oedematous pancreas
C	Pancreatic and peripancreatic inflammation (peripancreatic stranding)
D	Single small peripancreatic fluid collection
E	Large or several fluid collections or retroperitoneal air

Follow-up CT studies in 51 of 73 patients with retroperitoneal peripancreatic fluid collections were available and revealed resolution of fluid within 2 weeks in 35 patients (68.6%), development of abdominal complications in nine patients (17.6%), and persistence of unencapsulated or partially encapsulated fluid collections in seven patients (13.7%) who were clinically asymptomatic at the time of hospital discharge. Three of these seven patients were lost to follow-up, whereas long-term clinical follow-up in four patients with residual fluid collections revealed no complaints or abnormal physical findings.

Table 2: Complications of Acute Pancreatitis in Patients Without Necrosis

Grade	No. (%) of Patients	No. (%) of Patients with Local Complications	No. of Local Complications	No. (%) of Patients with Follow-Up CT in ≥ 4 Days
A	12 (7.1)	0 (0)	0	1 (8.3)
B	24 (14.2)	0 (0)	0	11 (45.8)
C	60 (35.5)	0 (0)	0	19 (31.7)
D	48 (28.4)	6 (12.5)	7	26 (54.2)
E	25 (14.8)	3 (12.0)	9	25 (100)
D and E	73 (43.2)	9 (12.3)	16	51 (69.9)
Total	169 (100)	9 (5.3)	16	82 (48.5)

Table 3: Fate of Fluid Collections in 51 Patients with Follow-Up Examinations

Grade	No. of Patients	No. (%) of Patients with Rapid Resolution	No. (%) of Patients with Local Complications	No. (%) of Patients with Partially Encapsulated or Persistent Fluid
D	26	(69.2)	(23.1)	(7.7)
E	25	(68)	(12)	(20)
and E	51	(68.6)	(17.6)	(13.7)

The type and number of local complications in our series of 169 patients with acute pancreatitis as correlated to the A–E grading system are presented in Table 4. These complications developed entirely in our patients with fluid collections (grades D and E). Acute short-term life-threatening complications (haemorrhage, infection, or perforation) developed in five of 73 patients with peripancreatic fluid (6.8%), and chronic long-term morbidity (chronic pancreatitis or groove pancreatitis) was seen in three of 73 patients (4.1%).

Among the 73 patients with initial fluid collections, we detected five patients who developed single pseudocysts from 2 × 1 cm to 7 × 6 cm, for an incidence of 6.8%. Two of the pseudocysts developed hemorrhage and rupture with leakage of blood into the peritoneal cavity. One of these patients also developed duodenal perforation and required surgery, and the other recovered without surgical intervention.

There were two other cases of acute retroperitoneal haemorrhage, for a total of four cases of haemorrhage (5.5% in 73 patients with fluid collections). One case of duodenal perforation (1.4%), two cases of infection (2.7%), and one case of splenic vein thrombosis (1.4%) were also diagnosed. Chronic pancreatitis developed in two of 73 patients (2.7%) and groove pancreatitis in one patient (1.4%) on long-term follow-up CT examinations. Two patients with bleeding underwent diagnostic angiography that was negative. Three patients with complications, including haemorrhage, infection, and duodenal perforation, had surgical interventions with drainage and debride-

ment and protracted clinical courses. All patients in our series survived.

Discussion

The development of abdominal complications in patients with acute pancreatitis leads to a prolonged hospitalization and, when life-threatening and not detected in time, to an increased mortality rate. Some of these complications may coexist, occur at any time after an acute attack, and have different manifestations and clinical repercussions. By and large, they are closely related to the staging severity of an acute attack of pancreatitis.^[5] Abdominal complications occur predominantly between the second and fifth week after one or several episodes of acute pancreatitis and with decreasing frequency months to years later. They are mostly seen in patients with severe necrotizing pancreatitis. However, a smaller number of patients with no CT evidence of pancreatic necrosis can manifest severe systemic alterations and develop significant local complications. The nature and incidence of complications in this subset of patients, representing more than 80% of cases of acute pancreatitis, have not received much attention in the literature.

Digestion of the pancreatic gland or of peripancreatic tissues after the leakage of activated pancreatic secretions from acinar cells is responsible for the development of local complications. Enzymatic fluid secretions dissect fascial planes and have a deleterious effect on vascular structures, adjacent hollow or

Table 4: Type, Number and Incidence of complications in 169 patients with acute pancreatitis

Grade	Pseudocyst	Hemorrhage	Abscess or Infected Fluid	Perforation	Thrombosis	Chronic Pancreatitis	Groove Pancreatitis	Total
A	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0
D	3	2	1	0	0	1	0	7
E	2	2	1	1	1	1	1	9
D and E	5	4	2	1	1	2	1	16
Total	5 (3.0)	4 (2.4)	2 (1.2)	1 (0.6)	1 (0.6)	2 (1.2)	1 (0.6)	16 (9.5)

solid organs, and retroperitoneal fat, producing fat necrosis.^[6] Extensive retroperitoneal fat necrosis interferes with the rapid absorption of extravasated, and sometimes hemorrhagic, fluid collections. When these transitory collections are not rapidly absorbed or continue to increase in size, they tend to organize and loculate by developing partial capsules. Because liquefied necrotic tissue, blood products, and retained fluid are excellent media for bacterial growth, infection may develop. In the initial 1–2 weeks after an acute attack, however, the natural evolution of sterile fluid collections remains unpredictable, so we recommend that these collections be followed up with imaging examinations in symptomatic patients.^[7]

In our series of 169 patients, fluid collections were detected in 73 patients (43.2%) and almost totally resolved within 7–10 days in most patients. We were able to document resolution in 35 of the 51 patients (68.6%) in whom follow-up CT studies were available for review [Table 3]. The remaining 22 patients in whom long-term follow-up studies were not obtained all had small fluid collections (grade D). These patients had an uneventful clinical course and rapid improvement, and it may be presumed that because these patients remained asymptomatic, their small fluid collections resolved as well.^[8]

The occurrence and fate of fluid collections in acute pancreatitis have been previously reported in a series of 48 patients with and without pancreatic necrosis. In that series, fluid was found in 37% of patients. It resolved spontaneously in about half the patients and led to complications (pseudocyst, abscess, infected necrosis) in the other half.^[9] As was also seen in our collected data, the incidence of spontaneous resolution of extravasated fluid is substantially higher (70–80%) in patients without pancreatic necrosis.

The overall incidence of acute and chronic complications in our series of 169 acute attacks of pancreatitis is 5.3%. As expected, complications did not occur in the mild forms of grades A, B, and C pancreatitis, but occurred exclusively in the more severe forms, grades D and E pancreatitis, after the extravasation of pancreatic secretions.^[10] Even in

this subgroup of 73 patients with fluid collections, the morbidity rate was relatively low in the absence of pancreatic necrosis, with an incidence of complications of 12.3%. Acute life-threatening complications such as hemorrhage, infected collections, and duodenal perforation were seen in only five patients, representing 6.8% of the 73 patients with fluid collections or 3.0% of 169 cases overall.

When the initial peripancreatic fluid collections are not absorbed, they tend to organize and slowly evolve into fully encapsulated collections called “acute pseudocysts.” This evolution heralds the beginning of a potentially more complex and uncertain clinical course. The development usually takes more than 4 weeks, but because the timing is somewhat variable, the diagnosis is established only when a sharply defined circumferential capsule is clearly detected.^[11] As opposed to chronic pseudocysts, acute pseudocysts have a thin friable capsule and an unstable natural history. They can diminish or grow in size, resolve, rupture, drain into the pancreatic duct, or fistulize into the gastrointestinal tract. Spontaneous resolution has been reported in 40% of acute pseudocysts known to be present for less than 6 weeks, whereas they tend to remain stable when older than 12 weeks. Complications such as rupture, hemorrhage, or infection have been reported in 18–50% of cases. A follow-up CT series of 75 patients with acute pseudocysts reported enlargement or complications requiring surgery in about half and resolution or stable size in asymptomatic individuals in the other half.^[12]

Follow-up CT examinations in our 73 grades D and E patients with fluid collections documented five patients with single pseudocysts, for an incidence of 6.8%, or 3.0% of the entire group of 169 cases. Hemorrhage from rupture of a pseudocyst occurred in two patients, necessitating surgical intervention. The prevalence of hemorrhagic pseudocysts, similar to the two cases in our series, varies in different reports from 2% to 31% of acute pseudocysts.^[13] After an acute attack of pancreatitis, hemorrhage is usually not associated with ruptured pseudoaneurysms, which tend to occur later after an acute episode. Rather, in the acute phase, hemorrhage most often occurs sec-

ondary to capillary bleeding in the wall of the pseudocyst or in the retroperitoneum. Because the natural history, clinical significance, and surgical management are uncertain, a conservative noninterventional approach, particularly for asymptomatic pseudocysts smaller than 5 cm, has been accepted in clinical practice. Surgical or interventional drainage procedures are reserved for complications (such as hemorrhage or infection) and for symptomatic enlarging pseudocysts diagnosed by follow-up imaging studies.

Three individuals in our series of 169 patients developed chronic complications (two cases of chronic pancreatitis and one case of groove pancreatitis), for an incidence of only 1.8%. Groove pancreatitis was diagnosed when there was focal inflammation exclusively or predominantly involving the head of the pancreas and associated fluid in the groove between the head of the pancreas and the second portion of the duodenum. Although these are important long-lasting, irreversible, and clinically debilitating developments, their true incidence rate is difficult to establish without close patient supervision and repeated long-term follow-up examinations.^[14]

Our retrospective survey of 169 patients with attacks of no necrotizing acute pancreatitis has several limitations that may affect the veracity of our results. Because of its retrospective nature, this is not a controlled study, and long-term follow-up examinations in some of our patients with unresolved fluid collections and acute pseudocysts were not always available. Follow-up imaging studies were available for review in approximately 50% of our entire patient population and in 70% of patients with fluid collections, including 100% of grade E patients with larger collections and more severe and protracted clinical presentations.^[15] We likely underestimated the true incidence of acute and chronic complications because longer-term follow-ups in some of our patients with unresolved fluid collections and acute pseudocysts may have yielded additional complications. On the other hand, long-term follow-up examinations could have missed other unrecorded subliminal intervening acute episodes of pancreatitis, particularly in alcoholic patients, that might have contributed to the development of late complications. Patients may also have sought follow up care and undergone imaging at an outside institution, and they may have developed complications of which we were not aware. In addition, despite the improved accuracy of MDCT examinations, small superficial patchy areas of pancreatic necrosis that might have contributed to the severity of the acute attack in the development of subsequent complications could have been missed.^[16]

Conclusion

Although the vascular complications following pancreatitis are not very common, they should be considered in every patient with pancreatitis. These complications if diagnosed

and managed early was result in considerable reduction of morbidity and mortality.

The treatment of pancreatic pseudocysts should always involve an interdisciplinary therapeutic approach ensuring an initial adequate support. Endoscopic interventions, compared to surgical or radiologic approaches are more often successful when multiple wide stents are placed, and this does not elevate either morbidity or mortality. This is particularly true with regard to placement of pigtail catheters. Pigtail catheters are preferable to straight stents, because their complication rate is markedly lower. Finally, in cases of associated pancreatic duct disruption an attempt to bridge via endoscopic stenting may contribute to pseudocyst resolution. In summary, most pancreatic pseudocysts should be managed principally by endoscopic procedures and laparoscopic or open surgical approach would remain reserved to failures.

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