

# Diagnostic Imaging Pathways - Pancreatitis (Acute)

## Population Covered By The Guidance

This pathway provides guidance on the investigation of adult patients with suspected acute pancreatitis and its complications.

**Date reviewed: January 2012**

**Date of next review: 2017/2018**

**Published: January 2012**

## Quick User Guide

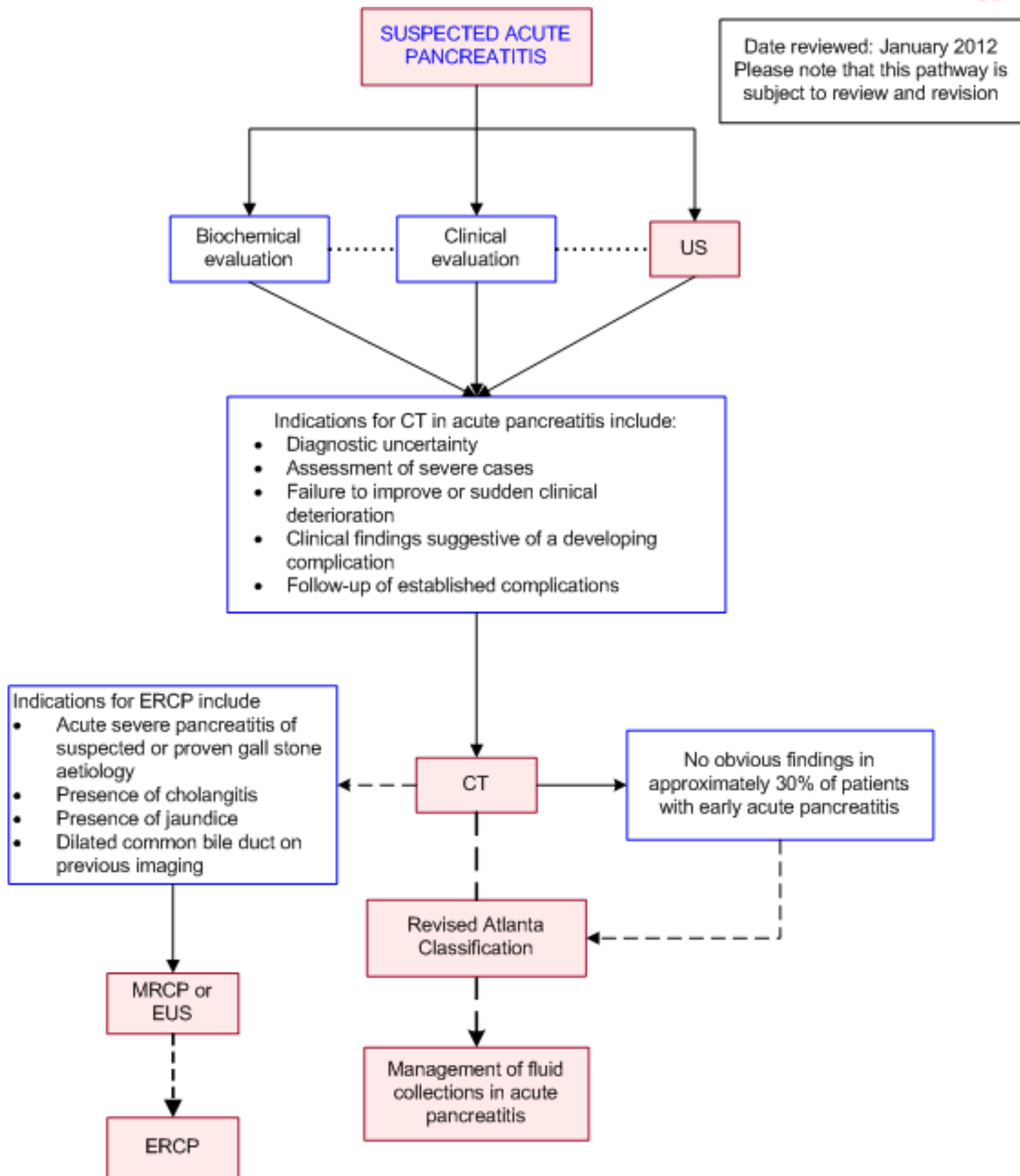
Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

## Pathway Diagram



## Teaching Points

### Role of Imaging in acute pancreatitis



- Exclude an underlying cause (e.g. gallstones)
- Assess severity
- Detect complications
- Guide treatment of complications (e.g. fluid collection drainage)

**CT SCAN** - routine CT scan is not indicated. Indications include

- Where diagnosis is in doubt
- Clinically severe cases to assess degree of pancreatic necrosis
- Failure to improve or sudden deterioration
- Imaging complications of pancreatitis

**US Scan**

- To help determine aetiology of pancreatitis
- Assess for gallstone-induced pancreatitis
- Assess bile duct if abnormal liver function

**ERCP (Endoscopic Retrograde Cholangiopancreatography)** - indications include

- Severe pancreatitis of proven or suspected gallstone aetiology
- Presence of cholangitis
- Presence of jaundice

## Acute Pancreatitis

- The diagnosis of pancreatitis is usually made clinically and biochemically [1](#)
- In suspected acute pancreatitis, imaging is used to [1](#)
  - Exclude an underlying cause (e.g. gallstones)
  - Assess severity
  - Detect complications
- Clinical definition of acute pancreatitis (whether or not chronic pancreatitis is present) requires at least 2 out of 3 of the following [2](#)
  - Abdominal pain strongly suggestive of acute pancreatitis
  - Serum amylase / lipase levels of ? 3 times normal level
  - Characteristic imaging findings on imaging (US / CT / MRI)

## Revised Atlanta Classification

- In 2008, acute pancreatitis Classification Working group revised the 1992 Atlanta classification to clarify previous areas of confusion, improve clinical assessment & management, standardise the description of patients for reporting clinical studies and to offer a standardised means of data collection for future studies to allow objective evaluation of new therapies [2](#)
- **Summary of Revised Atlanta Classification** [17,18](#)

Morphologic Type	Associated Collections
<4 weeks	
Interstitial edematous pancreatitis	Sterile / Infected Acute Peri-pancreatic fluid collection



	(APFCs)
Necrotizing pancreatitis	Sterile / Infected Acute parenchymal necrotic collections or Sterile / Infected Acute Peri-pancreatic necrotic collection or Sterile / Infected combined pancreatic and peri-pancreatic necrotic collection (ANCs)
?4 weeks	
Interstitial edematous pancreatitis	Sterile / Infected pseudocyst
Necrotizing pancreatitis	Sterile / Infected walled-off necrosis (WON)

- Clinical severity and organ failure is calculated using scoring systems like Marshall system, SOFA, APACHE-II or Ranson scoring systems [19,20,21,22](#)

## Computed Tomography (CT)

- Contrast enhanced CT (CE-CT) is the imaging modality of choice for evaluating pancreas and the surrounding tissues [3,7](#) and is often the first radiological investigation for suspected acute pancreatitis in many institutions
- Routine CT is not indicated in mild acute pancreatitis unless there are clinical or other signs of deterioration [1,7,8,9](#), and there is no advantage of performing early imaging to predict the clinical severity of acute pancreatitis more than a clinical evaluation [9](#)
- 14-28% of CT scans are normal in mild pancreatitis [7,8](#)
- Ideal time for CE-CT is 48 hours after onset of symptoms for better accuracy in detecting pancreatic necrosis but in practice, patients with undiagnosed abdominal pain CE-CT is often performed on admission or the diagnosis of AP would have been made on CE-CT
- Indications for CT scan include [1,3,8](#)
  - Diagnostic uncertainty
  - Assessment of severity and to detect complications
  - Failure to improve on treatment (>48 hrs)
  - Clinical findings suggesting a developing complication (e.g. fever, pain, hypotension, decreasing haematocrit)
  - Sudden deterioration in clinical status following an initial response to medical treatment
  - Follow-up and monitoring of established complications
  - Guidance of interventional procedures such as percutaneous fine needle aspiration and/or catheter drainage of fluid collections
- Combination of pre and post-contrast enhancement appearances permits the assessment of the degree of pancreatic necrosis and surrounding peri-pancreatic and intra-abdominal fluid collections. The severity of disease as demonstrated on CT (CT severity index) correlates with the risk of morbidity and mortality [10](#)
- Disadvantages - exposure to ionising radiation with repeat scanning

## Endoscopic Retrograde Cholangiopancreatography (ERCP)

- Mainly used to locate and remove gallstones in the common bile duct among patients with severe pancreatitis attributable to gallstones [1](#)
- Other indications for ERCP in the setting of acute pancreatitis include [1](#)
  - Presence of ascending cholangitis
  - Presence of jaundice
  - Dilated common bile duct on previous imaging
- Urgent ERCP and sphincterotomy is indicated in patients with severe gallstone pancreatitis who fail to respond to treatment within 48 hours [14,15](#)
- Similarly patients with gallstone acute pancreatitis who develop ascending cholangitis stand to benefit from early ERCP and endoscopic sphincterotomy [16](#)

## Fluid Collections In Acute Pancreatitis

- The RAC classifies fluid collections in acute pancreatitis based on both the morphologic classification they are associated with and the disease timeframe
- Collections can be sterile or infected at any time and can occur in all the collection types
- Fluid collections associated with IEP in the first 4 weeks of onset are called acute peri-pancreatic fluid collections (APFC). If these collections progress / persist for 4 weeks or more, they are termed pancreatic pseudocysts. Pseudocysts occur in 10-20 % of patients as a complication of acute pancreatitis [17](#)
- Fluid collections associated with necrotizing pancreatitis are called acute necrotic collections (ANC) if occurring within 4 weeks and walled-off necrosis (WON) after 4 weeks. ANCs can be further divided based on the morphological classification of the pancreatitis they are associated with. Parenchymal collections occurring within the first 4 weeks should also be classified as necrotic collections [17](#)
- The question of intervention (usually percutaneous aspiration/drainage) for relatively symptomatic pseudocysts/fluid collections is a balance between on the one hand, the risks of introducing infection into a sterile collection and draining an "immature" cyst and on the other hand, the complications of a large untreated, unresolved fluid collection
- Fluid collections in acute pancreatitis can be categorised into the following (general guidelines only)
  1. Acute peri-pancreatic fluid collections (APFCs)
    - Infection is extremely rare
    - Majority get reabsorbed with no complications
    - Fine needle aspiration (FNA) is only indicated if strong suspicion of infection. Otherwise no active invasive treatment is necessary
  2. Pancreatic pseudocysts [23](#)
    - A pancreatic pseudocyst consists of enzyme-rich fluid surrounded by a wall of granulation or fibrous tissue
    - May be localised to the pancreas or located remotely. Communication with the pancreatic ductal system is present in up to 80% of cases
    - Spontaneous regression occurs in 30-50% of cases and most pseudocysts less than 4cm in diameter resolve within 6 weeks
    - Infection can be noted by the presence of gas locules within pseudocyst. If no gas is visible on CE-CT, FNA can be done to rule out infection but risk of introducing infection by performing FNA should be taken into consideration
    - Drainage is indicated for pseudocysts larger than 5cm, that are growing, symptomatic or infected

### 3. Necrotic collections (ANCs and WONs)

- FNA is useful to distinguish between infected and sterile necrosis, with a sensitivity of 88-96% and specificity of 90-96% [24,25](#)
  - Indications for FNA include: failure to improve within 48-72 hours of commencing medical therapy, persistent symptoms for more than 7 days with greater than 30% necrosis or clinical suspicion of sepsis with less than 30% necrosis
  - Sterile ANCs may be drained based on patient's clinical condition. Percutaneous drainage is preferable though surgery and endoscopic procedures may be done rarely
  - Infected ANCs are drained with percutaneous drainage but surgery / endoscopic procedure may be needed later if recurs / inadequate
  - Sterile WON are drained based on clinical circumstances and percutaneous drainage is preferred but surgical drainage / endoscopic drainage may be needed for a cure
  - Infected WON are drained with percutaneous drainage as an interim with surgery to follow
- Indications for aspiration/drainage include [26,27,28,29](#)

1. Diagnosis of possible infection/abscess. If aspiration confirms infection, possible therapeutic options are dependent on the morphology of the collection and the clinical status of the patient. They include
  - Percutaneous catheter drainage either as a definitive procedure or as a "holding" measure pending surgery
  - Surgical drainage/debridement as a first-line treatment
  - Endoscopic drainage via the stomach or duodenum
2. Continuing symptoms considered due to the mass effect of the fluid collection
3. Cyst enlarging on serial follow-up imaging. In this situation ERCP may be useful. If communication between the pancreatic duct and the fluid collection is demonstrated, the need for prolonged drainage is likely and surgery may be a better option
4. Some authorities suggest size alone as a criterion for drainage (usually around 5 cm)

## Ultrasound

- Recommended to help determine the aetiology in all patients with suspected acute pancreatitis [1,2,3](#)
- Primarily used to assess the biliary tree for gallstones, duct dilatation/obstruction and to exclude other pathology [1,2,3](#)
- Helps distinguish fluid collections from solid inflammatory masses
- Useful for follow-up of pancreatic fluid collections if seen well on initial ultrasound [4](#)
- Limitations
  - Visualisation of the pancreas is usually sub-optimal due to overlying bowel gas from a coexistent ileus [5,6](#)
  - Detection of intra-parenchymal and retroperitoneal fluid collections correlates poorly with pancreatic necrosis [3](#)
  - Often underestimates the presence, extent and complexity of fluid collections

## Magnetic Resonance Cholangiopancreatography (MRCP) and Endoscopic

## Ultrasonography (EUS)

- In many centres MRCP and EUS are performed following CT scanning if gall stone pancreatitis is being suspected prior to patients undergoing invasive ERCP if needed
- MRCP is reported to have a high negative predictive value of 100% for CBD stones [11,12](#)
- MRCP is non-invasive and has no ionising radiation risk compared to CT. It is reported to have a sensitivity of around 62% and specificity of around 98% for CBD stones [12](#)
- EUS is an invasive imaging method but is reported to have a higher diagnostic yield (51% vs 20%) compared to MRCP in a prospective study looking for causes of idiopathic pancreatitis following traditional cross-sectional imaging [11](#)
- Some studies report higher diagnostic yield for EUS and MRCP compared to ERCP in idiopathic pancreatitis [13](#)

## Endoscopic Ultrasonography (EUS)

- In many centres MRCP and EUS are performed following CT scanning if gall stone pancreatitis is being suspected prior to patients undergoing invasive ERCP if needed
- EUS is an invasive imaging method but is reported to have a higher diagnostic yield (51% vs 20%) compared to MRCP in a prospective study looking for causes of idiopathic pancreatitis following traditional cross-sectional imaging [11](#)
- Some studies report higher diagnostic yield for EUS and MRCP compared to ERCP in idiopathic pancreatitis [13](#)

## References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

1. UK Working Party on Acute Pancreatitis. **United kingdom guidelines for the management of acute pancreatitis**. Gut. 2005;54(suppl III):iii1-iii9 (Guidelines). [View the reference](#)
2. Sarr MG, Banks PA, Bollen TL et al. **Revision of the Atlanta Classification of acute pancreatitis**. Acute Pancreatitis Classification Workgroup, 2008. April. Accessed 25/05/2012. (Guidelines). [View the reference](#)
3. Balthazar EJ. **Acute pancreatitis: assessment of severity with clinical and CT evaluation**. Radiology. 2002;223:603-13. (Review article)
4. Dalzell DP, Scharling ES, Ott DJ, et al. **Acute pancreatitis: The role of diagnostic imaging**. Crit Rev Diagn Imaging. 1998;39(5):339-363. (Review article)
5. Silverstein W, Isikoff M, Hill M, et al. **Diagnostic imaging of acute pancreatitis: prospective study using CT and sonography**. AJR Am J Roentgenol. 1981;137:497-502. (Level III evidence)
6. McKay A, Imrie C, O'Neill J, et al. **Is an early ultrasound scan of value in acute pancreatitis?** Br J Surg. 1982;69:369-72. (Level III evidence)
7. Jacobs JE, Birnbaum BA. **Computed tomography evaluation of acute pancreatitis**. Semin Roentgenol. 2001;36(2):92-8. (Review article)
8. Balthazar EJ, Freeny PC, vanSonnenberg E, et al. **Imaging and intervention in acute pancreatitis**. Radiology. 1994;193:297-306. (Review article)
9. Morteale KJ, Ip IK, Wu BU, Conwell DL, Banks PA, Khorasani R. **Acute Pancreatitis: Imaging utilization practices in an urban teaching hospital - analysis of trends with assessment of independent predictors in correlation with patient outcomes**. Radiology. 2011;258:174-81.



(Level III evidence)

10. Balthazar EJ, Robinson DL, Megibow AJ, et al. **Acute pancreatitis: value of CT in establishing prognosis.** Radiology. 1990;174:331-6. (Level II/III evidence)
11. Ortega AR, Gomez-Rodriguez R, Romero M, Fernandez-Zapardiel S, Cespedes Mdel M, Carrobes JM. **Prospective comparison of endoscopic ultrasonography and magnetic resonance cholangiopancreatography in the etiological diagnosis of "idiopathic" acute pancreatitis.** Pancreas. 2011;40(2):289-94. (Level II evidence)
12. Srinivasa S, Sammour T, McEntee B, Davis N, Hill AG. **Selective use of magnetic resonance cholangiopancreatography in clinical practice may miss choledocholithiasis in gallstone pancreatitis.** Can J Surg. 2012;53(6):403-7. (Level III evidence)
13. Mariani A, Arcidiacono PG, Curioni S, Giussani A, Testoni PA. **Diagnostic yield of ERCP and secretin-enhanced MRCP and EUS in patients with acute recurrent pancreatitis of unknown aetiology.** Dig Liver Dis. 2009;41(10):753-8. (Level III evidence)
14. Neoptolemos JP, Carr-Locke DL, London NJ, et al. **Controlled trial of urgent retrograde cholangiopancreatography and endoscopic sphincterotomy versus conservative treatment for acute pancreatitis due to gallstones.** Lancet. 1988;2:979-83. (Level I/II evidence). [View the reference](#)
15. Fan ST, Lai ECS, Mok FPT, et al. **Early treatment of acute biliary pancreatitis by endoscopic papillotomy.** N Engl J Med. 1993;328:228-32. (Level I/II evidence). [View the reference](#)
16. Neoptolemos J, Carr-Locke D, Leese T, et al. **Acute cholangitis in association with acute pancreatitis: incidence, clinical features and outcome in relation to ERCP and endoscopic sphincterotomy.** Br J Surg. 1987;74:1103-6. (Level III evidence)
17. Thoeni RF. **The revised Atlanta classification of acute pancreatitis: its importance for the radiologist and its effect on treatment.** Radiology. 2012;262(3):751-64. (Review article)
18. Bharwani N, Patel S, Prabhudesai S, Fotheringham T, Power N. **Acute pancreatitis: the role of imaging in diagnosis and management.** Clin Radiol. 2011;66(2):164-75. (Review article)
19. Marshall JC, Cook DJ, Christou NV, et al. **Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome.** Crit Care Med. 1995;23(10):1638-52. (Level I/II evidence)
20. Vincent JL, Moreno R, Takala J, et al. **The SOFA (sepsis-related organ failure assessment) score to describe organ dysfunction/failure. On behalf of the working group on sepsis-related problems of the European society of intensive care medicine.** Intensive Care Med. 1996;22(7):707-10. (Level II evidence)
21. De Campos T, Cerqueira C, Kuryura L, et al. **Morbimortality indicators in severe acute pancreatitis.** JOP. 2008;9(6):690-7. (Level III evidence)
22. Ranson JH, Rifkind KM, Roses DF, et al. **Prognostic signs and the role of operative management in acute pancreatitis.** Surg Gynecol Obstet. 1974;139(1):69-81. (Level III evidence)
23. Rosso E, Alexakis N, Ghaneh P, et al. **Pancreatic Pseudocyst in Chronic Pancreatitis: Endoscopic and Surgical Treatment.** Dig Surg. 2003;20:397-406. (Review article)
24. Buchler MW, Gloor B, Muller CA, Friess H, Seiler CA, Uhl W. **Acute necrotizing pancreatitis: treatment strategy according to the status of infection.** Ann Surg. 2000;232:619-26. (Level II evidence)
25. Uhl W, Warshaw A, Imrie C, et al. **IAP guidelines for the surgical management of acute pancreatitis.** Pancreatol. 2002;2:565-73. (Evidence-based guidelines). [View the reference](#)
26. Mithofer K, Mueller PK, Warshaw AI. **Interventional and surgical treatment of pancreatic abscess.** World J Surg. 1997;21:162. (Review article)
27. VanSonnenberg E, Wittich GR, Casola G, et al. **Percutaneous drainage of infected and non infected pancreatic pseudocysts: experience in 101 cases.** Radiology. 1989;170:757. (Level III evidence)
28. VanSonnenberg E, Wittich GR, Chon KS, et al. **Percutaneous radiologic drainage of**





- pancreatic abscesses.** AJR Am J Roentgenol. 1997;168:979. (Level III evidence)
29. Balthazar EJ. **Complications of acute pancreatitis: clinical and CT evaluation.** Radiol Clin North Am. 2002;40:1211-27. (Review article)
  30. Trout AT, Elsayes KM, Ellis JH, Francis IR. **Imaging of acute pancreatitis: prognostic value of computed tomographic findings.** J Comput Assist Tomogr. 2010;34(4):485-95. (Review article)
  31. Chang JH. Lee IS. Lim YS. Jung SH. Paik CN. Kim HK. Kim TH. Kim CW. Han SW. Choi MG. Jung IS. **Role of magnetic resonance cholangiopancreatography for choledocholithiasis: analysis of patients with negative MRCP.** Scand J Gastroenterol. 2012;47(2):217-24. (Level III evidence)
  32. Rifkind KM, Lawrence LR, Ranson JHC. **Initial roentgenographic sign in acute pancreatitis: a study of findings in 73 patients.** N Y State J Med. 1976;76:1968. (Level II /III evidence)
  33. Siegelman SS, Copeland BE, Saba GP, Cameron JL, Sanders RC, Zerhouni EA. **CT of fluid collections associated with pancreatitis.** AJR Am J Roentgenol. 1980;134:1121-32. (Level III evidence)

## Further Reading

1. Piironen A. **Severe acute pancreatitis: contrast-enhanced CT and MRI features.** Abdom Imaging. 2001;26:225-33. (Review article)
2. Steinberg W, Tenner S. **Acute pancreatitis.** N Engl J Med. 1994;330:1198-1210. (Review article)

## Information for Consumers

Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
<p><a href="#">Radiation Risks of X-rays and Scans</a></p> <p><a href="#">Computed Tomography (CT)</a></p> <p><a href="#">Magnetic Resonance Imaging (MRI)</a></p>	<p><a href="#">Computed Tomography (CT)</a></p> <p><a href="#">Iodine-Containing Contrast Medium</a></p> <p><a href="#">Magnetic Resonance Imaging (MRI)</a></p> <p><a href="#">Radiation Risk of Medical Imaging During Pregnancy</a></p> <p><a href="#">Radiation Risk of Medical Imaging for Adults and Children</a></p>

## Copyright

© Copyright 2015, Department of Health Western Australia. All Rights Reserved. This web site and its

content has been prepared by The Department of Health, Western Australia. The information contained on this web site is protected by copyright.

## Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change

## File Formats

Some documents for download on this website are in a Portable Document Format (PDF). To read these files you might need to download Adobe Acrobat Reader.



[Legal Matters](#)