CHAPTER 79

# Pancreatitis and Cholecystitis

Bart Besinger
Christine R. Stehman

## REFERENCES


1. Singh VK, Bollen TL, Wu BU, et al: An assessment of the severity of interstitial pancreatitis. *Clinical Gastroenterol Hepatol* 9: 1098, 2011. [PMID: 21893128]
2. Lankisch PG, Breuer N, Bruns A, et al: Natural history of acute pancreatitis: a long-term population-based study. *Am J Gastroenterol* 104: 2797, 2009. [PMID: 19603011]
3. Yadav D, O'Connell M, Papachristou GI: Natural history following the first attack of acute pancreatitis. *Am J Gastroenterol* 107: 1096, 2012. [PMID: 22613906]
4. Peery AF, Dellon ES, Lund J: Burden of gastrointestinal disease in the United States: 2012 update. *Gastroenterology* 143: 1179, 2012. [PMID: 22885331]
5. Petrov MS, Shanbhag S, Chakraborty M, Phillips AR, Windsor JA: Organ failure and infection of pancreatic necrosis as determinants of mortality in patients with acute pancreatitis. *Gastroenterology* 139: 813, 2010. [PMID: 20540942]
6. Mofidi R, Duff MD, Wigmore SJ, Madhavan KK, Garden OJ, Parks RW: Association between early systemic inflammatory response, severity of multiorgan dysfunction and death in acute pancreatitis. *Br J Surg* 93: 738, 2006. [PMID: 16671062]
7. Lankisch PG, Assmus C, Lehnick D, Maisonneuve P, Lowenfels AB: Acute pancreatitis: does gender matter? *Dig Dis Sci* 46: 2470, 2001. [PMID: 11713955]
8. Yang AL, Vadhavkar S, Singh G, Omary MB: Epidemiology of alcohol-related liver and pancreatic disease in the United States. *Arch Intern Med* 168: 649, 2008. [PMID: 18362258]
9. Yadav D, Lowenfels AB: The epidemiology of pancreatitis and pancreatic cancer. *Gastroenterology* 144: 1252, 2013. [PMID: 23622135]
10. Sadr-Azodi O, Andren-Sandberg A, Orsini N, Wolk A: Cigarette smoking, smoking cessation and acute pancreatitis: a prospective population-based study. *Gut* 61: 262, 2012. [PMID: 21836026]
11. Cheon YK, Cho KB, Watkins JL, et al: Frequency and severity of post-ERCP pancreatitis correlated with extent of pancreatic ductal opacification. *Gastrointest Endosc* 65: 385, 2007. [PMID: 17321236]
12. Lowenfels AB, Maisonneuve P, Sullivan T: The changing character of acute pancreatitis: epidemiology, etiology and prognosis. *Curr Gastroenterol Rep* 11: 97, 2009. [PMID: 19281696]
13. Al-Haddad M, Wallace MB: Diagnostic approach to patients with acute idiopathic pancreatitis, what should be done? *World J Gastroenterol* 14: 1007, 2008. [PMID: 18286679]
14. Yadav D, Pitchumoni CS: Issues in hyperlipidemic pancreatitis. *J Clin Gastroenterol* 36: 54, 2003. [PMID: 12488710]
15. Steinberg WM, Chari ST, Forsmark CE, et al: Controversies in clinical pancreatology: management of acute idiopathic recurrent pancreatitis. *Pancreas* 27: 103, 2003. [PMID: 12883257]
16. Kristiansen L, Gronbaek M, Becker U, Tolstrup JS: Risk of pancreatitis according to alcohol drinking habits: a population-based cohort study. *Am J Epidemiol* 168: 932, 2008. [PMID: 18779386]
17. Ammann RW: The natural history of alcoholic chronic pancreatitis. *Intern Med* 40: 368, 2001. [PMID: 11393404]
18. Trivedi CD, Pitchumoni CS: Drug-induced pancreatitis: an update. *J Clin Gastroenterol* 39: 709, 2005. [PMID: 16082282]
19. Badalov N, Baradarian R, Iswara K, Li J, Steinberg W, Tenner S: Drug-induced acute pancreatitis: an evidence-based review. *Clinical Gastroenterol Hepatol* 5: 648, 2007. [PMID: 17395548]
20. Wang GJ, Gao CF, Wei D, Wang C, Ding SQ: Acute pancreatitis: etiology and common pathogenesis. *World J Gastroenterol* 15: 1427, 2009. [PMID: 19322914]
21. Sah RP, Dawra RK, Saluja AK: New insights into the pathogenesis of pancreatitis. *Curr Opin Gastroenterol* 29: 523, 2013. [PMID: 23892538]
22. Banks PA, Bollen TL, Dervenis C, et al: Classification of acute pancreatitis–2012: revision of the Atlanta classification and definitions by international consensus. *Gut* 62: 102, 2013. [PMID: 23100216]
23. Kiriyama S, Gabata T, Takada T, et al: New diagnostic criteria of acute pancreatitis. *J Hepatobiliary Pancreat Sci* 17: 24, 2010. [PMID: 20012328]
24. Wu BU, Banks PA: Clinical management of patients with acute pancreatitis. *Gastroenterology* 144: 1272, 2013. [PMID: 23622137]
25. Tenner S, Baillie J, DeWitt J, Vege SS: American College of Gastroenterology guideline: management of acute pancreatitis. *Am J Gastroenterol* 108: 1400, 2013. [PMID: 23896955]
26. Cappell MS: Acute pancreatitis: etiology, clinical presentation, diagnosis, and therapy. *Med Clin North Am* 92: 889, 2008. [PMID: 18570947]
27. Meyers MA, Feldberg MA, Oliphant M: Grey-Turner's sign and Cullen's sign in acute pancreatitis. *Gastrointest Radiol* 14: 31, 1989. [PMID: 2910743]
28. Working Group IAP/APA Acute Pancreatitis Guidelines: IAP/APA evidence-based guidelines for the management of acute pancreatitis. *Pancreatology* 13: e1, 2013. [PMID: 24054878]
29. Vissers RJ, Abu-Laban RB, McHugh DF: Amylase and lipase in the emergency department evaluation of acute pancreatitis. *J Emerg Med* 17: 1027, 1999. [PMID: 10595892]
30. Winslet M, Hall C, London NJM: Relation of diagnostic serum amylase levels to aetiology and severity of acute pancreatitis. *Gut* 33: 982, 1992. [PMID: 1379569]
31. Shah AM, Eddi R, Kothari ST, Maksoud C, DiGiacomo WS, Baddoura W: Acute pancreatitis with normal serum lipase: a case series. *JOP* 11: 369, 2010. [PMID: 20601812]
32. Chang K, Lu W, Zhang K, et al: Rapid urinary trypsinogen-2 test in the early diagnosis of acute pancreatitis: a meta-analysis. *Clin Biochem* 45: 1051, 2012. [PMID: 22575591]
33. Moolla Z, Anderson F, Thomson SR: Use of amylase and alanine transaminase to predict acute gallstone pancreatitis in a population with high HIV prevalence. *World J Surg* 37: 156, 2013. [PMID: 23015223]
34. Johnson C, Levy P: Detection of gallstones in acute pancreatitis: when and how? *Pancreatology* 10: 27, 2010. [PMID: 20299820]
35. Fleszler F, Friedenberg F, Krevsky B, Friedel D, Braitman LE: Abdominal computed tomography prolongs length of stay and is frequently unnecessary in the evaluation of acute pancreatitis. *Am J Med Sci* 325: 251, 2003. [PMID: 12792243]
36. Mortele 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* 258: 174, 2011. [PMID: 20980450]
37. Perez A, Whang EE, Brooks DC, et al: Is severity of necrotizing pancreatitis increased in extended necrosis and infected necrosis? *Pancreas* 25: 229, 2002. [PMID: 12370532]
38. McMenamin DA, Gates LK Jr: A retrospective analysis of the effect of contrast-enhanced CT on the outcome of acute pancreatitis. *Am J Gastroenterol* 91: 1384, 1996. [PMID: 8678000]
39. Bollen TL, Van Santvoort HC, Besselink MG, van Es WH, Gooszen HG, van Leeuwen MS: Update on acute pancreatitis: ultrasound, computed tomography, and magnetic resonance imaging features. *Semin Ultrasound CT MRI* 28: 371, 2007. [PMID: 17970553]
40. Cucher D, Kulvlatunyou N, Green DJ: Gallstone pancreatitis. *Surg Clin North Am* 94: 257, 2014. [PMID: 24679420]
41. Banks PA, Freeman ML: Practice guidelines in acute pancreatitis. *Am J Gastroenterol* 101: 2379, 2006. [PMID: 17032204]
42. Wall I, Badalov N, Baradarian R, Iswara K, Li JJ, Tenner S: Decreased morbidity and mortality in patients with acute pancreatitis related to aggressive intravenous hydration. *Pancreas* 40: 547, 2011. [PMID: 21499208]
43. Warndorf MG, Kurtzman JT, Bartel MJ, et al: Early fluid resuscitation reduces morbidity among patients with acute pancreatitis. *Clin Gastroenterol Hepatol* 9: 705, 2011. [PMID: 21554987]
44. Gardner TB, Vege SS, Pearson RK, Chari ST: Fluid resuscitation in acute pancreatitis. *Clin Gastroenterol Hepatol* 6: 1070, 2008. [PMID: 18619920]
45. Wu BU, Hwang JQ, Gardner TH, et al: Lactated Ringer's solution reduces systemic inflammation compared with saline in patients with acute pancreatitis. *Clin Gastroenterol Hepatol* 9: 710, 2011. [PMID: 21645639]
46. Yi F, Ge L, Zhao J, et al: Meta-analysis: total parenteral nutrition versus total enteral nutrition in predicted severe acute pancreatitis. *Intern Med* 51: 523, 2012. [PMID: 22449657]
47. Eckerwall GE, Tingstedt BB, Bergenzaun PE, Andersson RG: Immediate oral feeding in patients with mild acute pancreatitis is safe and may accelerate recovery: a randomized clinical study. *Clin Nutr* 26: 758, 2007. [PMID: 17719703]
48. Moraes JM, Feiga GE, Chebli LA, et al: A full solid diet as the initial meal in mild acute pancreatitis is safe and result in a shorter length of hospitalization: results from a prospective, randomized, controlled, double-blind clinical trial. *J Clin Gastroenterol* 44: 517, 2010. [PMID: 20054282]
49. Wittau M, Mayer B, Scheele J, Henne-Bruns D, Dellinger EP, Isenmann R: Systematic review and meta-analysis of antibiotic prophylaxis in severe acute pancreatitis. *Scand J Gastroenterol* 46: 261, 2010. [PMID: 21067283]
50. Dellinger EP, Forsmark CE, Layer P, et al: Determinant-based classification of acute pancreatitis severity: an international multidisciplinary consultation. *Ann Surg* 256: 875, 2012. [PMID: 22735715]
51. Tenner S: Initial management of acute pancreatitis: critical decisions during the first 72 hours. *Am J Gastroenterol* 99: 2489, 2004. [PMID: 15571599]
52. Papachristou GI, Muddana V, Yadav D, et al: Comparison of BISAP, Ranson's, APACHE-II, and CTSI scores in predicting organ failure, complications, and mortality in acute pancreatitis. *Am J Gastroenterol* 105: 435, 2010. [PMID: 19861954]
53. Singh VK, Wu BU, Bollen TL, et al: Early systemic inflammatory response syndrome is associated with severe acute pancreatitis. *Clin Gastroenterol Hepatol* 7: 1247, 2009. [PMID: 19686869]
54. Mounzer R, Langmead CJ, Wu BU, et al: Comparison of existing clinical scoring systems to predict persistent organ failure in patients with acute pancreatitis. *Gastroenterology* 142: 1476, 2012. [PMID: 22425589]
55. Talukdar R, Clemens M, Vege SS: Moderately severe acute pancreatitis: prospective validation of this new subgroup of acute pancreatitis. *Pancreas* 41: 306, 2012. [PMID: 22015971]
56. Falor AE, de Virgilio C, Stabile BE, et al: Early laparoscopic cholecystectomy for mild gallstone pancreatitis. *Arch Surg* 147: 1031, 2012. [PMID: 22801992]
57. Trna J, Vege SS, Pribramska V, et al: Lack of significant liver enzyme elevation and gallstones and/or sludge on ultrasound on day 1 of acute pancreatitis is associated with recurrence after cholecystectomy: a population-based study. *Surgery* 151: 199, 2012. [PMID: 21975288]
58. Tse F, Yuan Y: Early routine endoscopic retrograde cholangiopancreatography strategy versus early conservative management strategy in acute gallstone pancreatitis. *Cochrane Database Syst Rev* 5: CD009779, 2012. [PMID: 22592743]
59. Everhart JE, Khare M, Hill M, Maurer KR: Prevalence and ethnic differences in gallbladder disease in the United States. *Gastroenterology* 117: 632, 1999. [PMID: 10464139]

60. Li V, Pulido N, Fajnwaks P, Szomstein S, Rosenthal R: Predictors of gallstone formation after bariatric surgery: a multivariate analysis of risk factors comparing gastric bypass, gastric banding, and sleeve gastrectomy. *Surg Endosc* 23: 1640, 2009. [PMID: 19057954]
61. Portincasa P, Moschetta A, Palasciano G: Cholesterol gallstone disease. *Lancet* 368: 230, 2006. [PMID: 16844493]
62. O'Connell K, Brasel K: Bile metabolism and lithogenesis. *Surg Clin North Am* 94: 361, 2014. [PMID: 24679426]
63. Behar J, Mawe G, Carey M: Roles of cholesterol and bile salts in the pathogenesis of gallbladder hypomotility and inflammation: cholecystitis is not caused by cystic duct obstruction. *Neurogastroenterol Motil* 25: 283, 2013. [PMID: 23414509]
64. Chang WT, Lee KT, Wang SR, et al: Bacteriology and antimicrobial susceptibility in biliary tract disease: an audit of 10-years' experience. *Kaohsiung J Med Sci* 18: 221, 2002. [PMID: 12197428]
65. Asai K, Watanabe M, Kusachi S, et al: Bacteriological analysis of bile in acute cholecystitis according to the Tokyo guidelines. *J Hepatobiliary Pancreat Sci* 19: 476, 2012. [PMID: 22033864]
66. Tanaka A, Takada T, Kawarada Y, et al: Antimicrobial therapy for acute cholangitis: Tokyo guidelines. *J Hepatobiliary Pancreat Surg* 14: 59, 2007. [PMID: 17252298]
67. Berger MY, van der Velden JJ, Lijmer JG, et al: Abdominal symptoms: do they predict gallstones? A systematic review. *Scand J Gastroenterol* 35: 70, 2000. [PMID: 10672838]
68. Diehl AK, Sugarek NJ, Todd KH: Clinical evaluation for gallstone disease: usefulness of symptoms and signs in diagnosis. *Am J Med* 89: 29, 1990. [PMID: 2368790]
69. Rigas B, Torosis J, McDougall CJ, Vener KJ, Spiro HM: The circadian rhythm of biliary colic. *J Clin Gastroenterol* 12: 409, 1990. [PMID: 2398248]
70. Silen W, Cope Z: *Cope's Early Diagnosis of the Acute Abdomen*, 22nd ed. New York: Oxford University Press; 2010.
71. Trowbridge RL, Rutkowski NK, Shojania KG: Does this patient have acute cholecystitis? *JAMA* 289: 80, 2003. [PMID: 12503981]
72. Yokoe M, Takada T, Strasberg S, et al: New diagnostic criteria and severity assessment of acute cholecystitis in revised Tokyo guidelines. *J Hepatobiliary Pancreat Sci* 19: 578, 2012. [PMID: 22872303]
73. Wada K, Takada T, Kawarada Y, et al: Diagnostic criteria and severity assessment of acute cholangitis: Tokyo guidelines. *J Hepatobiliary Pancreat Surg* 14: 52, 2007. [PMID: 17252297]
74. Reynolds BM, Dargan EL: Acute obstructive cholangitis; a distinct clinical syndrome. *Ann Surg* 150: 299, 1959. [PMID: 13670595]
75. Gruber PJ, Silverman RA, Gottesfeld S, Flaster E: Presence of fever and leukocytosis in acute cholecystitis. *Ann Emerg Med* 28: 273, 1996. [PMID: 8780469]
76. Juvonen T, Kiviniemi H, Niemelä O, Kairaluoma MI: Diagnostic accuracy of ultrasonography and C-reactive protein concentration in acute cholecystitis: a prospective clinical study. *Eur J Surg* 158: 365, 1992. [PMID: 1356470]
77. Padda MS, Singh S, Tang SJ, Rockey DC: Liver test patterns in patients with acute calculous cholecystitis and/or choledocholithiasis. *Aliment Pharmacol Ther* 29: 1011, 2009. [PMID: 19210291]
78. Videhult P, Sandblom G, Rudberg C, Rasmussen IC: Are liver function tests, pancreatitis and cholecystitis predictors of common bile duct stones? Results of a prospective, population-based, cohort study of 1171 patients undergoing cholecystectomy. *HPB* 13: 519, 2011. [PMID: 21762294]
79. Peng WK, Sheikh Z, Paterson-Brown S, Nixon SJ: Role of liver function tests in predicting common bile duct stones in acute calculous cholecystitis. *Br J Surg* 92: 1241, 2005. [PMID: 16078299]
80. Nathwani RA, Kumar SR, Reynolds TB, Kaplowitz N: Marked elevation in serum transaminases: an atypical presentation of choledocholithiasis. *Am J Gastroenterol* 100: 295, 2005. [PMID: 15667485]
81. Yarmish GM, Smith MP, Rosen MP, et al: ACR appropriateness criteria right upper quadrant pain. *J Am Coll Radiol* 11: 316, 2014. [PMID: 24485592]
82. Kiewiet JJS, Leeuwenburgh MMN, Bipat S, Bossuyt PMM, et al: A systematic review and meta-analysis of diagnostic performance of imaging in acute cholecystitis. *Radiology* 264: 708, 2012. [PMID: 22798223]
83. Ralls PW, Colletti PM, Lapin SA, et al: Real-time sonography in suspected acute cholecystitis. Prospective evaluation of primary and secondary signs. *Radiology* 155: 767, 1985. [PMID: 3890007]
84. Ross M, Brown M, McLaughlin K, et al: Emergency physician–performed ultrasound to diagnose cholelithiasis: a systematic review. *Acad Emerg Med* 18: 227, 2011. [PMID: 21401784]
85. Kendall JL, Shimp RJ: Performance and interpretation of focused right upper quadrant ultrasound by emergency physicians. *J Emerg Med* 21: 7, 2001. [PMID: 11399381]
86. Rosen CL, Brown DFM, Chang Y, et al: Ultrasonography by emergency physicians in patients with suspected cholecystitis. *Am J Emerg Med* 19: 32, 2001. [PMID: 11146014]
87. Summers SM, Scruggs W, Menchine MD, et al: A prospective evaluation of emergency department bedside ultrasonography for the detection of acute cholecystitis. *Ann Emerg Med* 56: 114, 2010. [PMID: 20138397]
88. Shakespear JS, Shaaban AM, Rezvani M: CT findings of acute cholecystitis and its complications. *Am J Roentgenol* 194: 1523, 2010. [PMID: 20489092]
89. Charalel RA, Jeffrey RB, Shin LK: Complicated cholecystitis: the complementary roles of sonography and computed tomography. *Ultrasound Q* 27: 161, 2011. [PMID: 21873853]
90. Sugiyama M, Atomi Y: Endoscopic ultrasonography for diagnosing choledocholithiasis: a prospective comparative study with ultrasonography and computed tomography. *Gastrointest Endosc* 45: 143, 1997. [PMID: 9040999]
91. Anderson SW, Lucey BC, Varghese JC, Soto JA: Accuracy of MDCT in the diagnosis of choledocholithiasis. *Am J Roentgenol* 187: 174, 2006. [PMID: 16794173]
92. Kim CW, Chang JH, Lim YS, Kim TH, Lee IS, Han SW: Common bile duct stones on multidetector computed tomography: attenuation patterns and detectability. *World J Gastroenterol* 19: 1788, 2013. [PMID: 23555167]
93. Colli A, Conte D, Valle SD, Sciola V, Fraquelli M: Meta-analysis: nonsteroidal anti-inflammatory drugs in biliary colic. *Aliment Pharmacol Ther* 35: 1370, 2012. [PMID: 22540869]
94. Thompson DR: Narcotic analgesic effects on the sphincter of Oddi: a review of the data and therapeutic implications in treating pancreatitis. *Am J Gastroenterol* 96: 1266, 2001. [PMID: 11316181]
95. Antevil JL, Buckley RG, Johnson AS, Woolf AM, Thoman DS, Riffenburgh RH: Treatment of suspected symptomatic cholelithiasis with glycopyrrolate: a prospective, randomized clinical trial. *Ann Emerg Med* 45: 172, 2005. [PMID: 15671975]
96. Rothrock SG, Green SM, Gorton E: Atropine for the treatment of biliary tract pain: a double-blind, placebo-controlled trial. *Ann Emerg Med* 22: 1324, 1993. [PMID: 8333639]
97. Gomi H, Solomkin JS, Takada T, et al: TG13 antimicrobial therapy for acute cholangitis and cholecystitis. *J Hepatobiliary Pancreat Sci* 20: 60, 2013. [PMID: 23340954]
98. Fuks D, Cosse C, Regimbeau JM: Antibiotic therapy in acute calculous cholecystitis. *J Visc Surg* 150: 3, 2013. [PMID: 23433832]
99. Solomkin JS, Mazuski JE, Bradley JS, et al: Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Clin Infect Dis* 50: 133, 2010. [PMID: 20034345]
100. Mazeh H, Mizrahi I, Dior U, et al: Role of antibiotic therapy in mild acute calculus cholecystitis: a prospective randomized controlled trial. *World J Surg* 36: 1750, 2012. [PMID: 22456803]
101. Mentzer RM Jr, Golden GT, Chandler JG, Horsley JS III: A comparative appraisal of emphysematous cholecystitis. *Am J Surg* 129: 10, 1975. [PMID: 174453]
102. Rigler LG, Borman CN, Noble JF: Gallstone obstruction: pathogenesis and roentgen manifestations. *JAMA* 117: 1753, 1941.
103. Kalliafas S, Ziegler DW, Flancbaum L, Choban PS: Acute acalculous cholecystitis: incidence, risk factors, diagnosis, and outcome. *Am Surg* 64: 471, 1998. [PMID: 9585788]
104. Schofer JM: Biliary causes of postcholecystectomy syndrome. *J Emerg Med* 39: 406, 2010. [PMID: 18722735]