

# American Association for the Surgery of Trauma emergency general surgery guideline summaries 2018: acute appendicitis, acute cholecystitis, acute diverticulitis, acute pancreatitis, and small bowel obstruction

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## ABSTRACT

In April 2017, the American Association for the Surgery of Trauma (AAST) asked the AAST Patient Assessment Committee to undertake a gap analysis for published clinical practice guidelines in emergency general surgery (EGS). Committee members performed literature searches to catalogue published guidelines for common EGS diseases and also to identify gaps in the literature where guidelines could be created. For five of the most common EGS conditions, acute appendicitis, acute cholecystitis, acute diverticulitis, acute pancreatitis, and small bowel obstruction, we found multiple well-referenced guidelines published by leading professional organizations. We have summarized guideline recommendations for each of these disease states stratified by the AAST EGS anatomic severity score based on these published consensus guidelines. These summaries could be used to help inform evidence-based clinical decision-making, but are intended to be flexible and updatable in real time as further research emerges. Comprehensive guidelines were available for all of the diseases queried and identified gaps most commonly represented areas lacking a solid evidence base. These are therefore areas where further research is needed.

## ACUTE APPENDICITIS MANAGEMENT GUIDELINES SUMMARY

Multiple societies have published guidelines for the diagnosis and management of appendicitis. Notably, a consensus statement was published in *Surgical Endoscopy* in 2015, and a summary from the World Society of Emergency Surgery was published in the *World Journal of Emergency Surgery* in 2016. Several other comprehensive guidelines covering imaging recommendations, antimicrobial prophylaxis and duration, laparoscopic versus open surgical approach, and optimal management of perforated appendicitis have been published. This review summarizes and references evidence-based guidelines for appendicitis by stage, as a reference guide for surgeons practicing emergency general surgery.

American Association for the Surgery of Trauma grade	Description	Management	References
I	Acutely inflamed appendix, intact	Laparoscopic appendectomy Non-operative therapy with antibiotics may be a reasonable alternative No postoperative antibiotics are indicated in surgically managed appendicitis	1 2 3 4 6 7 3 2
II	Gangrenous appendix, intact	Laparoscopic appendectomy	1 2 3 4 6 7
III	Perforated appendix with local contamination	Laparoscopic appendectomy	1 2 3 4 6 7
IV	Perforated appendix with periappendiceal phlegmon or abscess	Laparoscopic appendectomy Non-operative therapy with antibiotics may be chosen in select patients	1 2 3 4 6 7 3
V	Perforated appendix with generalized peritonitis	Laparoscopic appendectomy when feasible	1 2 3 4 6 7

## Key points

Laparoscopic appendectomy is considered the gold standard for acute appendicitis and should be the procedure of choice, except when laparoscopy is contraindicated or not feasible. Studies have demonstrated the laparoscopic approach is equivalent to, or better than, the open technique in most circumstances. Conversion to open may be necessary in technically difficult cases, however. Laparoscopic appendectomy is safe in the obese, elderly patients, pediatric patients and pregnant patient populations, including in the third trimester.<sup>1, 2, 3, 4, 6, 7</sup>

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Non-operative therapy is a reasonable approach in *uncomplicated acute appendicitis*. Patients should be educated that the possibility of recurrence exists. Non-operative therapy may also be considered in some cases of acute appendicitis with phlegmon or abscess.<sup>3</sup> In most other situations, appendectomy is the standard of care.

CT imaging is more reliable than ultrasound for the diagnosis of acute appendicitis. The use of intravenous contrast may improve the sensitivity of this test and is generally recommended when CT imaging is performed. Exceptions to CT may be pursued in pregnant women and children to minimize exposure to radiation. Ultrasound is preferred for diagnosis in pregnant patients and children. If ultrasound is equivocal, MRI would be the next diagnostic test of choice.<sup>2,3,5,8</sup>

Preoperative antibiotics should be administered as soon as the diagnosis of acute appendicitis is made. There is no indication for postoperative antibiotics in uncomplicated appendicitis.<sup>2</sup> There are also no data supporting improvement in clinical outcomes with any given scoring system for acute appendicitis.<sup>3</sup>

Technical maneuvers, such as *peritoneal irrigation*, variations in appendiceal *stump closure* or methods of *mesenteric vascular control* have demonstrated no difference in outcomes.<sup>3</sup>

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- NGC:010146 American College of Radiology ACR Appropriateness Criteria® right lower quadrant pain — suspected appendicitis. <https://www.guideline.gov/summaries/summary/47652/acr-appropriateness-criteria--right-lower-quadrant-pain---suspected-appendicitis?q=appendicitis>

## ACUTE CHOLECYSTITIS MANAGEMENT GUIDELINES SUMMARY

Hepaticopancreaticobiliary conditions comprise up to 26% of emergency general surgery (EGS) admissions, of which 40% require an operation.<sup>1</sup> In 2012, acute calculus cholecystitis was the second most common gastrointestinal reason for hospital admission, resulting in over 225 000 hospital admissions.<sup>2</sup> Gallstones occur in 10%–15% of the adult population, of whom 80% are asymptomatic. Acute cholecystitis develops in 1%–3% of patients with symptomatic gallstones<sup>3</sup> and occurs most frequently in

patients aged 18–44. There is a predominance in females (86 cases per 10 000 discharges in women compared with 65 per 10 000 discharges in men) and the incidence and hospital costs associated with acute cholecystitis appear to be rising.<sup>4</sup>

There are multiple published guidelines related acute cholecystitis focusing on diagnosis, management, and timing of surgical therapy. Of these, the most prominent are the Tokyo Guidelines (published in 2007<sup>5</sup> with updates in 2013<sup>6</sup> and subsequently updated in 2018)<sup>7</sup> which include a severity grading for acute cholecystitis. As with several other common EGS disease states, the American Association for the Surgery of Trauma (AAST) has developed a grading system for acute cholecystitis that addresses clinical, radiologic, operative and pathologic features of acute cholecystitis and which has recently been validated in the literature.<sup>8</sup> The recommendations in this review are based on guidelines put forth by organizations whose mission includes the advancement of research and clinical care for patients with cholecystitis, but the underlying literature supporting these guidelines is heterogeneous with respect to inclusion criteria and definitions of exposures and outcomes. Notably, because this literature predates the publication of AAST severity grades for acute cholecystitis, the way in which these guidelines pertain to specific AAST grades of acute cholecystitis requires further investigation.

Grade	AAST disease grade	Corresponding Tokyo grade	Management	References
I	Local disease; confined to the organ; minimal abnormality	I	Operative (laparoscopic if possible) if within 10 days of onset of symptoms; consider antibiotics±percutaneous cholecystostomy tube if beyond 10 days	7 9 10 11
II	Local disease; confined to the organ; severe abnormality	II	Operative (laparoscopic if possible; consideration of conversion to open/subtotal cholecystectomy as dictated by intraoperative findings); antibiotics and percutaneous cholecystostomy tube may be considered, but evidentiary support for populations who may benefit from this approach is sparse	7 9 10–12
III	Beyond the organ; locally advanced only	II	Operative (laparoscopic if possible; consideration of conversion to open/subtotal cholecystectomy as dictated by intraoperative findings); antibiotics and percutaneous cholecystostomy tube may be considered, but evidentiary support for populations who may benefit from this approach is sparse	7 9 10–12
IV	Beyond the organ; regional extension	II	Operative (laparoscopic if possible; consideration of conversion to open/subtotal cholecystectomy as dictated by intraoperative findings)	7 9 10–12
V	Beyond the organ; widespread involvement	III	Operative (laparoscopic if possible; consideration of open approach in the setting of septic shock; strong consideration of conversion to open/subtotal cholecystectomy as dictated by intraoperative findings)	7 9 10–12

## KEY POINTS

*Cholecystectomy is the gold standard for treatment of acute calculous cholecystitis (ACC).*<sup>9</sup> Clinical outcomes for surgery are superior to observation in ACC and shows some cost-effectiveness advantages—due to gallstone-related complications and high rates of readmission and surgery in the observation group.<sup>13,14</sup>

Laparoscopic cholecystectomy is recommended over open cholecystectomy in ACC.<sup>10–11,15</sup> Among *high-risk patients*, in those with Child A and B cirrhosis,<sup>16</sup> advanced age >80,<sup>17</sup> or pregnant women,<sup>18</sup> laparoscopic cholecystectomy for ACC is feasible and safe. A laparoscopic approach should initially be attempted except in case of absolute anesthesiology contraindications or septic shock.<sup>15</sup>

Laparoscopic or open *subtotal cholecystectomy is a valid option* for advanced inflammation, gangrenous gallbladder, or any setting of the ‘difficult gallbladder’ where anatomy is difficult to recognize and main bile duct injuries are more likely.<sup>12</sup>

Although the definition of early versus late surgery varies by study, in general *early laparoscopic cholecystectomy is preferable to delayed laparoscopic cholecystectomy* in patients with ACC as long as it is completed within 10 days of onset of symptoms.<sup>19,20</sup> Laparoscopic cholecystectomy should not be offered for patients beyond 10 days from the onset of symptoms unless symptoms suggestive of worsening peritonitis or sepsis warrant an emergency surgical intervention. In people with more than 10 days of symptoms, delaying cholecystectomy for 45 days is better than immediate surgery.<sup>21</sup>

*Antibiotics* should be suggested as supportive care; they are effective in treating the first episode of ACC, but a high rate of relapse can be expected. Surgery is more effective than antibiotics alone in the treatment of ACC.<sup>19,22</sup> Patients with uncomplicated cholecystitis can be treated without postoperative antibiotics when the focus of infection is controlled by cholecystectomy.<sup>23</sup>

*Percutaneous cholecystostomy* could be considered as a possible alternative to surgery after the failure of conservative treatment in a small subset of patients unfit for emergency surgery due to their severe comorbidities.<sup>9</sup> There are no reports providing quality scientific evidence on the best timing for surgery after percutaneous cholecystostomy, so a consensus has not been reached.<sup>24</sup>

## AREAS OF ONGOING RESEARCH

Several guidelines suggest considerations for estimation of perioperative risk in ACC, but there is currently no consensus as to the most accurate and reliable method of risk stratification. Future works should focus on a generalizable and approachable method of identifying high-risk patients.

Use of percutaneous cholecystostomy tubes in patients at elevated risk for surgery appears to be increasing, but the indications for this procedure and the optimal management thereafter are not well defined. Future investigations should help address these knowledge gaps.

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## ACUTE COLONIC DIVERTICULITIS MANAGEMENT GUIDELINES SUMMARY

Acute colonic diverticulitis is the sixth most common gastrointestinal diagnosis and represents a significant burden of disease.<sup>1</sup> Between 2000 and 2009, admissions for diverticulitis increased 41%, representing over 219 000 discharges and US\$2.1 billion dollars in inpatient charges.<sup>2</sup> As the population ages, these numbers are likely to increase, since at least 60% of people over



the age of 60 have diverticulosis and 10%–25% will progress to diverticulitis at some point.<sup>2,3</sup> Though 85% of these episodes are likely to be uncomplicated, 15%–30% will experience at least one recurrence.<sup>3</sup>

Diverticulitis may occur at any age. Factors associated with diverticulitis include a low-fiber diet and a sedentary lifestyle leading to obesity.<sup>4</sup> The initial episode has the highest association with need for surgical therapy, as scarring related to these episodes is thought to make perforation with subsequent episodes less likely.<sup>1</sup> Complicated diverticulitis is associated with smoking, non-steroidal anti-inflammatory drug use, organ transplantation and steroid use.<sup>2,4</sup>

The American Association for the Surgery of Trauma (AAST) has developed a grading system for diverticulitis that addresses clinical, radiologic, operative and pathologic grades of disease. This system has been validated in the literature.<sup>5</sup> This addresses noted gaps of current grading systems, such as those inherent in the original Hinchey system or the Ambrosetti CT classification.<sup>4,6-8</sup> Recommendations regarding the management of diverticulitis are based on a combination of expert consensus and research. Overall, quality of the research is mixed, with many studies suffering from small numbers and issues with bias.

Grade	AAST disease grade	Corresponding Hinchey grade	Management	References
I	Local disease; confined to the organ; minimal abnormality	N/A, O	Outpatient care Selective antibiotics	2 3 4 9 10 11 14 3 4 9 11
II	Local disease; confined to the organ; severe abnormality	I, I	Outpatient care Selective antibiotics	2 3 4 9 10 11 14 3 4 9 11
III	Beyond the organ; locally advanced only	I, II	Antibiotics±percutaneous drainage	3 4 9 10 11
IV	Beyond the organ; regional extension	II, III	Antibiotics±percutaneous drainage	3 4 9 10 11
V	Beyond the organ; widespread involvement	III, IV, IV	Resection with stoma Selected single-stage operations	3 4 9 11 3 4 7 9 10 11

## KEY POINTS

For the management of uncomplicated diverticulitis (grades 1 and 2), it is safe and reasonable to manage as an *outpatient* in otherwise healthy patients.<sup>2, 3, 4, 9, 10, 11</sup>

Routine use of antibiotics is currently the standard of care and is successful in 90% of cases of grades 1 and 2 diverticulitis. Recent literature has indicated that a more *selective use of antibiotics*, individualized to the patient's clinical state, is preferable. Antibiotics have not been shown to decrease the severity or duration of symptoms and may be associated with allergic reaction and resistance.<sup>3, 4, 9, 11</sup>

There are no data to support avoiding seeds, nuts or corn, or other *dietary restrictions* as a means to avoid recurrent

diverticulitis. Data is mixed regarding the role of dietary fiber in preventing recurrent disease. Overall, increased vigorous activity is supported, though the exact role between activity and recurrent diverticulitis is unclear.<sup>4, 9, 10</sup>

In grades 3 and 4 diverticulitis, a contained abscess may be treated with antibiotics if small, or *percutaneous drainage and antibiotics* if larger, as long as there are no other indications for surgery.<sup>3, 4, 9, 10, 11</sup>

During the last decade, attempts have been made to treat grade 3–5 diverticulitis with *laparoscopic washout*. Multiple trials in Europe, including the laparoscopic lavage (LOLA) trial, the Scandinavian Diverticulitis trial and DIVER (Outpatient versus hospitalization management for uncomplicated diverticulitis) trial found increased need for subsequent operations in patients undergoing laparoscopic peritoneal lavage. Laparoscopic lavage is no longer supported in the treatment of acute diverticulitis.<sup>12, 13</sup>

The gold-standard remains exploratory *laparotomy with resection* for fecal peritonitis. A two-stage procedure (Hartmann's) is still the most commonly performed surgery in the setting of acute inflammation.<sup>3, 4, 9, 11</sup> A growing body of literature supports primary anastomosis, with or without a diverting loop ileostomy, in carefully selected patients.<sup>3, 4, 7, 9, 10, 11</sup>

Evidence regarding the role of colonoscopy screening after acute diverticulitis is mixed. In symptomatic patients, screening colonoscopy is still recommended. In asymptomatic patients, who are compliant with a standard screening schedule, additional colonoscopy is likely not warranted and low yield.<sup>1, 3, 4, 9, 10, 11</sup>

Elective colonic resection after the second episode of acute colonic diverticulitis is no longer recommended. The decision for surgery should be individualized to the patient. Laparoscopic approaches are recommended where possible to decrease post-operative risk of small bowel obstruction and post-operative hernia.<sup>9, 10</sup>

## Areas of ongoing research

Immunocompromised patients, including those who have had solid organ transplants or who take chronic steroids, are a special population. Earlier operative intervention, with a more conservative staged approach, may be warranted.

Duration of antibiotic therapy is still not standardized. An individualized, patient-based approach is still the preferred approach.

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## INTESTINAL OBSTRUCTION DUE TO ADHESIONS GUIDELINE SUMMARY

Small bowel obstruction (SBO) is a common cause for hospital admission and surgical consultation. Although the diagnosis of SBO has become relatively straightforward with the use of CT, there continues to be a debate as to its optimal management. Multiple societies have published guidelines for the diagnosis and management of SBO. This review summarizes and references evidence-based guidelines for diagnosis, treatment and management of SBO. This should be used as a reference guide for surgeons practicing emergency general surgery.

Grade	AAST disease grade	Diagnosis	Management	References
I	Partial SBO	CT scan of abdomen and pelvis Water soluble contrast follow through to rule out complete adhesive small bowel obstruction (ASBO) and predict need for surgery	Initial non-operative management. Water-soluble contrast follow through to rule out complete ASBO and predict the need for surgery. Surgery recommended after 3 days without resolution. Patients with SBO should generally be admitted to a surgical service	1 2 3 4 5 6
II	Complete SBO; bowel viable and not compromised	CT scan of abdomen and pelvis Water soluble contrast follow through to rule out complete ASBO and predict need for surgery	Initial non-operative management. Water-soluble contrast follow through to rule out complete ASBO and predict the need for surgery. Surgery recommended after 3 days without resolution. Patients with SBO should generally be admitted to a surgical service	1 2 3 4 5 6
III	Complete SBO with compromised but viable bowel	CT scan of abdomen and pelvis Water soluble contrast follow through to rule out complete ASBO and predict need for surgery	Operative management. Open surgery is preferred method. Laparoscopic approach can be attempted in select cases.	1 2 3 4 5 6

Grade	AAST disease grade	Diagnosis	Management	References
IV	Complete SBO with non-viable bowel or perforation with localized spillage	CT scan of abdomen and pelvis	Operative management. Open surgery is preferred method. Laparoscopic approach can be attempted in select cases. Patients with SBO should generally be admitted to a surgical service.	1 2 3 4 5 6
V	Small bowel perforation with diffused peritoneal contamination	CT scan of abdomen and pelvis	Operative management. Open surgery is preferred method. Laparoscopic approach can be attempted in select cases. Patients with SBO should generally be admitted to a surgical service.	1 2 3 4 5 6

## KEY POINTS

Radiographs have relatively limited use for the imaging confirmation and characterization of an obstruction. Patients with a strong clinical suspicion for ASBO, immediate cross-sectional imaging with CT should be considered.<sup>1</sup> CT scan has proven to be highly diagnostic in ASBO and is the diagnostic test of choice.<sup>1,2</sup> MRI is ideal for children and pregnant patients with known or suspected SBO, as well as younger patients with repetitive episodes of obstruction.<sup>1</sup> If intermittent, recurrent, or low-grade SBO is a primary concern, an enteroclysis is likely the next best test.<sup>1</sup>

Water-Soluble-Contrast-Medium such as Gastrografin is safe and has a definite role in diagnosis (for predicting the resolution or need for surgery) and therapy (for reducing the operative rate, shortening time to resolution, hospital stay).<sup>1,3-6</sup> The unique ability of Gastrografin to draw water into the bowel lumen expedites resolution of partial obstructions. Contrast in the colon on abdominal X-ray within 24 hours of its administration predicts resolution of ASBO.<sup>3-6</sup> If not obtained at admission, water-soluble contrast studies should be considered in patients who do not clinically resolve after 48 hours for both diagnostic and potential therapeutic purposes.

Patients with evidence of generalized peritonitis or other clinical deterioration (fever, leukocytosis, tachycardia, metabolic acidosis, continuous pain) should undergo timely exploration. The remainder of patients can safely undergo initial non-operative management for both partial and complete SBO. The goal is to immediately identify strangulation and need for urgent operative intervention using a combination of clinical signs and CT findings. Surgery is recommended after 3 days without resolution (but less than 5 days).<sup>3-5</sup>

Laparoscopy is safe and feasible in the hands of experienced laparoscopic surgeons and in selected patients.<sup>4,5</sup>

Patients with SBO admitted to a surgical service have shorter length of stay, less hospital charges, shorter time to surgery, and lower mortality than patients admitted to a medical service.<sup>4</sup>

Hyaluronic acid-carboxycellulose membrane and icodextrin are proven to reduce adhesions but have not proven to reduce the need for surgery.<sup>3</sup>

## AREAS FOR ONGOING RESEARCH

The role of surgical techniques and biomaterials that can prevent ASBO and reduce the need for surgical intervention are



topics that warrant further research. Adhesions quantification and scoring is a promising tool for further research that could help standardization and allow for more accurate analysis of ASBO.

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## ACUTE PANCREATITIS MANAGEMENT GUIDELINES SUMMARY

Acute pancreatitis is one of the most common diseases of the gastrointestinal tract and its incidence may be increasing. It is the most common discharge diagnosis for patients hospitalized for a gastrointestinal disease.<sup>4</sup> Changes in approach to acute pancreatitis have occurred during the last two decades. These changes were primarily driven by the development of the Atlanta classification for disease severity and the recognition of the early and later phases of disease. The early phase being a period of systemic inflammation of variable severity and the later phase being marked by local complications.<sup>4</sup> There are multiple published guidelines related to acute pancreatitis. Most of the guidelines focus on the areas of diagnosis, early management, indications for endoscopic procedures and indications for surgical procedures. This review highlights the American Association for the Surgery of Trauma (AAST) grade specific management recommendations for surgeons engaged in the care of these patients. This brief report summarizes guidelines published on the topic of acute pancreatitis until May 30, 2017. Only guidelines with rigorous, reproducible methodologies were selected for this report.

AAST grade	Description	Management	References
I	Acute edematous pancreatitis	Diagnosis by serum markers. Supportive management and enteral nutrition as tolerated. Cholecystectomy at index admission if gallstones present. Antibiotics not indicated. If concomitant cholangitis is present early ERCP should be performed. For choledocholithiasis, without cholangitis ERCP can be delayed for 72 hours.	1 2 3 4
II	Pancreatic phlegmon or peripancreatic fluid collection or hemorrhage	Same as grade I plus CT scanning at least 72 hours after symptom onset.	1 2 3 4

AAST grade	Description	Management	References
III	Sterile pancreatic necrosis	Same as grade II disease. Management in a monitored setting (intensive care unit). Parenteral nutrition for those failing enteral nutrition.	1 2 3 4
IV	Infected pancreatic necrosis or abscess	Same as grade III disease. Antibiotics for suspected infection. Consider percutaneous sampling or drainage. Necrosectomy delayed at least 14 days after symptom onset. Necrosectomy technique guided by local expertise. Open necrosectomy should be avoided.	1 2 3 4 5
V	Extrapancreatic extension of pancreatic necrosis involving adjacent organs, such as colonic necrosis	Same as grade IV disease.	1 2 3 4 5

## KEY POINTS

There is a lack of well-done clinical trials in acute pancreatitis that has led to variability in practice within institutions, between institutions and across continents. Therefore, recommendations must be tailored to the clinical situation and the patient being treated and do not represent a standard of care.

The diagnosis of pancreatitis is made when amylase and lipase elevations reach three times the upper limit of normal without renal failure. Abdominal ultrasound should always be obtained to assess for the presence of gallstones and the size of the common bile duct. However, confirmatory CT imaging should be reserved for more severe disease and should be performed after at least 72 hours of symptoms.<sup>1</sup> Magnetic resonance cholangiopancreatography (MRCP) or endoscopic ultrasound (EUS) are only indicated if the common bile duct is dilated, liver enzymes are elevated in an obstructive pattern or common bile duct stones are highly suspected for another reason.<sup>2,4</sup> If the patient is over 40, neoplastic causes should also be considered.

Supportive care including aggressive fluid resuscitation, correction of electrolytes and pain control should be provided. Aggressive fluid resuscitation should be with lactated ringers and occur during the first 12–24 hours in patients who have no contraindications to significant fluid loading.<sup>2,4</sup> In the event of concomitant cholangitis, urgent (within 24 hours) endoscopic retrograde cholangiopancreatography (ERCP) should be performed. ERCP should also be performed if common bile duct obstruction without cholangitis is suspected; however, in this case, it can be delayed up to 72 hours.<sup>1</sup> If ERCP is performed, pancreatic duct stents or postprocedural rectal non-steroidal anti-inflammatories should be used in patients at high risk for postprocedural pancreatitis.<sup>4</sup> The ongoing severity of disease should be assessed with daily C-reactive protein and Acute Physiology and Chronic Health Evaluation-II score for the first 72 hours.<sup>2</sup>

Optimal nutritional management and antibiotic treatment in acute pancreatitis remains somewhat controversial. In lower grades of pancreatitis, patients should take a diet as tolerated. If patients are intolerant of oral feeding, a nasojejunal tube is preferred over parenteral nutrition provided tube feeding can be tolerated.<sup>2,3</sup> Recommendations for antibiotics in pancreatitis have varied over time. Currently, antibiotics are only

recommended in the case of strongly suspected infection. Antibiotics that penetrate the pancreatic parenchyma should be used in cases of infected pancreatic necrosis.

Peripancreatic fluid collections management is based mostly on large retrospective studies. The main indication for intervention in pancreatic necrosis is infected pancreatic necrosis and clinical deterioration. However, sampling of fluid or necrosis should only be performed if infection is strongly suspected.<sup>2</sup> Intervention may also be indicated for persistent symptoms with sterile necrosis that has been present for at least 8 weeks. A step-up approach with initial image guided or endoscopic drainage should be used for infected pancreatic necrosis.<sup>2</sup> Surgical intervention in these cases should be delayed as long as possible and ideally for at least 4 weeks after onset of symptoms to allow the collection to become walled off.<sup>3</sup> Pseudocysts should only be drained if symptomatic or enlarging.<sup>2</sup>

Cholecystectomy on the index admission is indicated in mild gallstone pancreatitis when symptoms resolve. In patients with peripancreatic fluid collections, cholecystectomy should be delayed until resolution or 6 weeks, whichever is first.<sup>5</sup> If cholecystectomy is contraindicated, sphincterotomy should be considered.<sup>5</sup> In the case of multiple episodes of pancreatitis without a clear etiology, additional imaging including EUS or secretin-stimulated MRCP should be performed.<sup>3</sup>

### Areas of ongoing research

There are many controversies that remain with respect to acute pancreatitis from presentation to long-term follow-up. Although criteria to diagnose acute pancreatitis and assign a severity on presentation are firmly established, prediction of disease severity during the subsequent days has met with only limited success. Additional research in this area is important as the progress of disease is highly variable and predicting disease severity will allow for more directed use of resources.

Despite strong agreement on the need to delay CT scanning for acute pancreatitis until 72–96 hours after the onset of symptoms, there is only low-quality evidence supporting this practice. There is widespread use of MRCP and EUS; however, the evidence for their use is also minimal. Studies that more firmly establish the role and timing of imaging in pancreatitis are essential. Current therapeutic interventions in acute pancreatitis are also poorly supported. There is, however, reasonably good evidence for withholding intravenous antibiotics to prevent infectious complications of acute pancreatitis. Selective

gut decontamination and probiotic administration also remain controversial but may have a role if future studies demonstrate value. Despite strong agreement that enteral nutrition is superior to parenteral nutrition and that nasogastric feeding is equivalent to nasojejunal feeding, there is less agreement for the timing of feeding patients with acute pancreatitis and the type of feeding. Additionally, despite the strong agreement, the evidence for the superiority of enteral feeding is lacking.

Several uncertainties in the procedural management of acute pancreatitis also exist. Although there are relatively well-established indications for ERCP, the timing of ERCP in patients with concomitant pancreatitis and common bile duct obstruction and/or cholangitis has not been firmly established. There is likely benefit to early performance of ERCP when cholangitis is present, however, how early is unclear. There are insufficient data to make a recommendation regarding the method and exact timing of pancreatic necrosectomy for infected pancreatic necrosis. Similarly, there are insufficient data to recommend an initial procedure for draining infected pancreatic necrosis.

Other uncertainties also require further clarification. There is insufficient evidence to make recommendations regarding the evaluation of multiple episodes of idiopathic pancreatitis. Especially, as this pertains to cholecystectomy. There are insufficient data to recommend strongly for or against endoscopic sphincterotomy in patients with pancreatitis and gallstones and who are poor surgical candidates. Outcomes of acute pancreatitis have not improved significantly during the last decade; however, standardizing care by answering these important questions has the greatest immediate potential to improve outcomes.

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