ABSTRACT

Acute pancreatitis is an emerging problem in pediatrics, with an incidence that is rising in the last 2 decades. Data regarding the optimal management and physician practice patterns are lacking. We present a literature review and updates on the management of pediatric pancreatitis. Prospective multicenter studies defining optimal management of pediatric pancreatitis are needed to guide care and improve outcomes for this patient population.

Key Words: acute pancreatitis, acute recurrent pancreatitis, chronic pancreatitis, pediatric

Pancreatitis is an insult to the pancreas that leads to the presence of acute inflammatory cells, edema, and necrosis that may result in organ damage or fibrosis (1). In the majority of patients this inflammation is self-limited and reversible, leading to a 1-time acute pancreatitis (AP) episode. In some patients, AP progresses to acute recurrent pancreatitis (ARP) or chronic pancreatitis (CP) (2). Patients with CP experience pain and possible pancreatic exocrine and/or endocrine insufficiency (3).

In the last 2 decades, an increased incidence of AP has been observed in the pediatric population (4). Although the cause is unclear, it may be explained by a heightened awareness of AP in children (5). Despite this more frequent presentation, data are lacking on the best diagnostic and management approaches to pediatric AP. The present management is extrapolated from adult studies and guidelines (6), in which the etiology is distinct. Biliary etiologies and alcohol play significant roles in adult AP (7,8), whereas pediatric cases are associated with different etiologies and/or endocrine insufficiency (3).

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The authors report no conflict of interest.

Received December 4, 2013; accepted February 28, 2014.

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DOI: 10.1097/MPG.0000000000000360
the etiology is clearly known, such as lowering the triglyceride level in hypertriglyceridemic pancreatitis (23).

Imaging Studies

Despite the present availability of advanced imaging modalities, abdominal US remains the first imaging study to be ordered in most patients with AP, including pediatric AP (9,24). US can be used to help confirm the clinical diagnosis of AP, and to assist in identifying underlying etiologies such as biliary pancreatitis. It is important to recognize the limitations of ultrasonography, specifically its lower sensitivity of approximately 70% in visualizing the pancreas in patients with AP compared with a sensitivity of >90% for CT scans (25,26). Abdominal CT is the second most common imaging modality used to diagnose and identify etiologies of pancreatitis (9,24). CT may be most helpful in patients with severe and complicated AP because it allows better visualization of masses, necrosis, and hemorrhage (27,28).

Although magnetic resonance cholangiopancreatography (MRCP) is seldom required for first attack of AP, it constitutes a valuable tool in the evaluation of pancreatoxbiliary abnormalities. It has the advantages of not requiring ionizing radiation or the administration of iodinated contrast, and it provides high-quality multiplanar images of the pancreatic and biliary ductal systems. MRCP is useful in detecting intrahepatic and pancreatic ductal abnormalities, common bile duct abnormalities, cholelithiasis, strictures, pancreas divisum, long common channel, and pancreatic and biliary tumors (29,30). Hence, MRCP has supplanted endoscopic retrograde cholangiopancreatography (ERCP) for diagnostic evaluation of the pancreatoxbiliary system in many instances and has become the imaging study of choice to assess for ductal abnormalities. The use of MRCP during an episode of AP remains controversial because edema can obscure visualization of the ductal system (31). Intravenous secretin, a synthetic human hormone, increases the pressure of the sphincter of Oddi, leading to distention of the pancreatic ducts. It also has a role in detecting pancreatic divisum that may be missed in about one fourth of patients if an MRCP is performed without secretin (32). Literature on the use of secretin in MRCP is sparse in pediatrics. Although a few pediatric studies have shown improved visualization of the pancreatic duct by using secretin in MRCP (33,34), a recent study showed a small but significant increase in pancreatic and intrahepatic duct diameters, importantly, without a significant difference in overall image quality or duct visibility after the administration of secretin (35). In addition, MRCP with secretin may be used to assess duodenal filling and pancreatic duct compliance, as possible markers of abnormal exocrine pancreatic function—an area that needs further research in pediatrics (36).

Endoscopic US is yet another imaging study that may be considered in AP when there is no underlying cause identified by alternative modalities. The advantage of endoscopic US is the ability to obtain biopsies under direct visualization from lesions when indicated (37).

The authors recommend an US as the first-choice imaging modality and would reserve ordering of CT and/or MRCP for patients with complicated and severe pancreatitis.

Pain Management

Abdominal pain is the most common presenting symptom of AP. Pain management requires a careful balance between adequate control and oversedation. There are no data on optimal pain management in pediatric AP, and studies in adults have not identified a single superior medication. Morphine or related opioids were used in 94% of children with AP according to the INSPPIRE physicians’ questionnaire (10). Despite concerns that morphine may cause sphincter of Oddi spasm and thus exacerbate AP, there are limited and conflicting data that the effect of morphine is significantly different from that of other opioids (38). Meperidine is used in adults but has the limitations of a shorter duration than morphine and the risk of neurotoxic metabolites with repeated dosing. Direct comparison of meperidine and morphine in AP is lacking.

More specialized pain management with celiac (39) and thoracic epidural analgesia (40) has been used effectively for AP pain in adults. The procedures do have associated risks (41), and their safety and efficacy have not been reported in pediatric AP. For patients requiring long-term use of narcotics, constipation is a well-recognized adverse effect. Recent studies in adults have found that μ-opioid antagonists methylnaltrexone (42) and alvimopan (43) improve opioid-induced dysmotility but have not been used routinely in pediatrics.

Narcotic-sparing medications including indomethacin have shown promise in pain management in AP (44). Newer medications including intravenous acetaminophen and ketorolac have also shown promise in reducing narcotic use following surgery in pediatric patients (45), and clinical trials of these narcotic-sparing medications in pediatric AP are warranted.

Intravenous Fluid Management

Supportive care in the management of uncomplicated AP, irrespective of etiology, continues to be the mainstay of therapy. Fluid resuscitation is an integral part of this care as evidenced by recently published guidelines (12,46). Unanswered questions remain as to the optimal components, timing, rate, and volume of fluid administration. The adult literature on the approach to optimal fluid resuscitation is limited, whereas comparative available pediatric data are grossly deficient. Most commonly, crystalloid solutions are the fluid of choice for intravenous fluid resuscitation (47). Recently, a randomized controlled trial on the use of lactated Ringer’s solution versus normal saline in adult patients with AP found a reduction in the systemic inflammatory response syndrome presumably secondary to the greater pH-buffering capacity in lactated Ringer’s solution (48). In line with efforts to favorably alter the course of AP, there is now supportive evidence for early, aggressive fluid resuscitation (47,49). “Early resuscitation” has been defined as receiving greater than one-third of the total 72-hour intravenous fluid volume within the first 24 hours of presenting to the emergency department (47). These findings emphasize the importance of first responders for patients with AP, starting with the emergency department providers, to implement early fluid management strategies, which may significantly affect the morbidity and/or mortality of patients with AP.

A small number of studies have concluded that aggressive fluid therapy may be associated with negative outcomes (50,51). In this context, it is worth mentioning that these studies had limitations of including only patients with severe pancreatitis (52), and in the fluid therapy was predominantly given during the second 24-hour period (51). Despite these results, the intuitive value of fluid resuscitation based on subjective measurements instead of a 1-size-fits-all approach seems logical and prospective studies are needed to define optimal fluid management in pediatric AP.

Nutrition

Nutrition has an important role in the management of AP through maintenance of the gut barrier function, inhibiting bacterial translocation and lowering the systemic inflammatory response (53,54). There are no published studies on the optimal timing of
nutritional intervention and mode of nutrition in pediatric pancreatitis. The data from adults are convincing that the earlier the nutrition is implemented, typically within 24 to 72 hours, the more favorable the outcomes and the lower the risk of progression into a multisystemic disease (55,56). According to recent meta-analyses, enteral nutrition was superior to total parenteral nutrition with a lower incidence of infection and multiorgan failure, resulting in lower mortality rates and a shorter hospital stay (57). To date, studies have shown that early enteral feeding via oral, nasogastric, or nasojejunal routes is safe and well tolerated in moderate and severe AP (58). A full general oral diet was tolerated in mild AP in adult patients and was not associated with abdominal pain relapse (59). In addition, there were no differences in outcomes between polymeric and elemental formulas and no evidence that immunonhanced nutrients or probiotics are helpful in the management of AP (56). Optimal nutritional therapy in pediatrics should be further studied so that it can be uniformly applied.

Pharmacological Therapies

During the 350 years since Tulp first described AP (60), multiple attempts at medical therapies have failed to alter the course of the disease (61). More important, the latest meta-analyses have all concluded that initiation of antibiotics at presentation does not improve outcomes in adult AP and thus prophylactic antibiotic use is not recommended (62). A query of www.ClinicalTrials.gov identified a number of studies under way targeting the inflammatory response (dexamethasone, activated protein C, ulinastatin), pancreatic perfusion (pentoxifylline, localized low-molecular-weight heparin infusion, epidural anesthesia), and enteral supplements (glutamine, fish oil emulsions) in patients with AP. All clinical trials must overcome the fact that when targeting patients with predicted severe outcome early in the clinical course, it is likely that the inflammatory cascade has been triggered for a significant and variable period of time before treatment resulting in a heterogeneous population in which “early intervention” is a misnomer.

ERCP

Endoscopic therapy, specifically ERCP, should have a limited role in the management of AP. With the advancement in imaging modalities, ERCP is now used primarily as an interventional therapeutic tool in the care of both adults and children. In the setting of AP, ERCP is most helpful for gallstone pancreatitis in alleviating obstructive stones or sludge (63). According to the American Gastroenterology Association recommendations, urgent ERCP (within 24 hours) should be performed in gallstone pancreatitis with cholangitis, and early ERCP (within 72 hours) should be performed in patients who present with a high suspicion of a persistent common bile duct stone (64).

Gallstone pancreatitis usually needs to be managed by cholecystectomy or an ERCP before cholecystectomy (65,66). Data from adults are convincing that the earlier the nutritional intervention and mode of nutrition in pediatric pancreatitis, the better the outcomes and the lower the risk of progression into a multisystemic disease (55,56). According to recent meta-analyses, enteral nutrition was superior to total parenteral nutrition with a lower incidence of infection and multiorgan failure, resulting in lower mortality rates and a shorter hospital stay (57). To date, studies have shown that early enteral feeding via oral, nasogastric, or nasojejunal routes is safe and well tolerated in moderate and severe AP (58). A full general oral diet was tolerated in mild AP in adult patients and was not associated with abdominal pain relapse (59). In addition, there were no differences in outcomes between polymeric and elemental formulas and no evidence that immunonhanced nutrients or probiotics are helpful in the management of AP (56). Optimal nutritional therapy in pediatrics should be further studied so that it can be uniformly applied.

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Acknowledgment: The authors are thankful to Daniel J. Podberesky, MD, for reviewing the imaging section.

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