Nutritional management in pediatric pancreatitis

Dr. Mohammad Hassan Sohouli

Introduction

The pancreas is involved in three primary functions associated with digestion and regulation of macronutrients:

- **production of bicarbonate fluid to neutralise gastric acid in the duodenum**
- **synthesis and secretion of digestive enzymes**
- **production of hormones to regulate nutrient use and storage**

Inflammation within the parenchyma of the pancreas leads to pancreatitis, and this impacts on all of the above pancreatic functions. Dietetic management of pancreatitis depends on the type of disease, which may be acute, acute-recurrent or chronic.

Diagnosis

Table 10.19 Diagnostic criteria for pancreatitis.

Type of pancreatitis	Diagnostic criteria
Acute pancreatitis	*Requires at least 2 of 3 criteria*: Lipase/amylase greater than three times the upper normal limit Epigastric/abdominal pain Imaging findings compatible with acute pancreatitis
Acute-recurrent pancreatitis	*Requires 2 distinct episodes of acute pancreatitis*: Complete resolution of pain ≥1 month between episodes OR Complete normalisation of serum amylase/lipase between episodes with resolution of pain symptoms irrespective of time interval between episodes
Chronic pancreatitis	*Requires at least 1 of 3 criteria*: Abdominal pain consistent with pancreatic origin and imaging suggesting pancreatic damage Exocrine or endocrine pancreatic insufficiency and suggestive pancreatic imaging findings Surgical or pancreatic biopsy showing histopathological features of chronic pancreatitis

Causes of pancreatitis

Causes for pancreatitis in children differ from those of adults where lifestyle factors such as alcohol and smoking are common. Common causes of pancreatitis in children are:

- idiopathic
- drugs and toxins, e.g. valproic acid and azathioprine
- biliary tract, e.g. gallstones, biliary tract malformations choledochal cysts, pancreas divisum, pancreatic ductal abnormalities and annular pancreas
- genetic, e.g. mutations in PRSS1, CFTR and SPINK1
- autoimmune
- metabolic disorders, e.g. glycogen storage disease and hypertriglyceridaemia
- trauma, e.g. non-accidental injury, fall from horse/bicycle, seat belt laceration and endoscopic retrograde cholangio-pancreatography (ERCP) complication

Nutrition assessment

Patients with pancreatitis require regular nutritional assessment. The frequency of assessment is determined by thetype and severity of pancreatitis

Learning points: nutritional assessment of pancreatitis

- *Nutritional management will depend on whether the pancreatitis is acute, acute-recurrent or chronic*
- *Anthropometric measurements (weight, height, BMI) should be repeated every 3–6 months*
- *Assessment should include signs of malnutrition, diabetes, pancreatic exocrine insufficiency, the clinical condition (severity and type of pancreatitis) and the presence and severity of abdominal pain*
- *Dietary assessment should explore how pancreatitis symptoms are impacting on nutrition*

Acute pancreatitis

Acute pancreatitis is sudden inflammation of the pancreas. Children commonly present with abdominal pain, weight loss and nausea or vomiting on eating. Management depends on the severity of pancreatitis, which may range from mild to severe

Table 10.21 Severity of acute pancreatitis.

Mild	No organ failure No local or systemic complications Resolves in first week
Moderately severe	Transient organ failure resolving in <48 hours, or exacerbation of co-morbid disease or local complications
Severe	Organ failure for >48 hours

Nutrition support is particularly important in acute pancreatitis caused by trauma. Trauma severity can range from minor lacerations to complete transection of the pancreas and damage to the main pancreatic duct. There may also be injuries to other structures including the liver, intestine, spleen and kidneys. Depending on the type and extent of trauma, surgery may be required, resulting in an extended period of NBM, which may impact on nutritional status.

Acute pancreatitis

Dietetic management:

- ✓ The practice of treating patients with acute pancreatitis with a period of NBM to suppress pancreatic enzyme secretion, thus 'resting' the pancreas, has been shown to provide no benefit
- ✓ In addition, the risk of bacterial overgrowth and gut translocation due to prolonged periods of NBM may exacerbate pancreatic infection risk

- ❑ Enteral nutrition has been reported to be well tolerated in mild acute pancreatitis and is associated with shorter length of stay, reduced critical care admissions and reduced progression to severe acute pancreatitis
- ❑ In severe acute pancreatitis enteral nutrition has been associated with reduced complications and mortality Recommendations are to commence early enteral nutrition (oral/NG/nasojejunal) following any necessary fluid resuscitation and to commence PN only in children unable to tolerate enteral nutrition

Table 10.22 Dietetic management of acute pancreatitis.

Timing of initiating nutrition	In mild acute pancreatitis: within 48 hours In severe acute pancreatitis: within 72 hours
Route of nutrition	Commence oral/nasogastric feeding Consider nasojejunal feeding if oral/nasogastric feeding not tolerated Consider parenteral nutrition alongside enteral nutrition if enteral not well tolerated
Type of nutrition	If oral feeding • Normal oral diet • A fat restriction is not recommended If tube feeding • Standard feed If receiving parenteral nutrition • Standard PN should be given (p. 67)
Surgical interventions	ERCP (Table 10.2): NBM for 1–2 days may be required Puestow procedure (anastomosis of pancreatic duct to jejunum): NBM for 5 days may be required

ERCP, endoscopic retrograde cholangio-pancreatography.

Acute pancreatitis

Dietetic management:

- ✓ **In patients with AP and inability to feed orally, EN shall be preferred to parenteral nutrition (PN).**

- ✓ **What is the optimal timing for initiating EN in patients with AP?**
  - ✓ **EN should be started early, within 24-72 h of admission, in case of intolerance to oral feeding.**

- ✓ **What type of EN is indicated?**
  - ✓ **In patients with AP a standard polymeric diet shall be used.**

    - **Elemental and semi-elemental formulas are thought to induce less pancreatic stimulation, require less digestion, and are readily absorbed into small intestine. A physiological study in healthy subjects found that pancreatic enzyme secretion reduced by 50% when polymeric formula was changed to elemental formula**
    - **Even though few studies directly compare between elemental/semi-elemental formulas and polymeric formula, there are one RCT and one retrospective cohort study showing elemental and semi-elemental formulas were not superior over polymeric formula in terms of feeding tolerance, diarrhea, and infectious complications**

Acute pancreatitis

Dietetic management:

✓ **What route should be used for EN in patients with AP?**

> If EN is required in patients with AP, it should be administered via a nasogastric tube. Administration via a nasojejunal tube should be preferred in case of digestive intolerance.
>
> Grade of Recommendation B – Strong consensus (95% agreement).

✓ **In patients with AP, when should PN be initiated?**

> PN should be administered in patients with AP who do not tolerate EN or who are unable to tolerate targeted nutritional requirements, or if contraindications for EN exist.
>
> Grade of Recommendation GPP – Strong consensus (97% agreement).

Acute pancreatitis

Dietetic management:

- ✓ Approximately 10-20% of patients with AP will develop necrosis of the pancreas and/or peripancreatic tissue (ANP).
- ✓ These patients with ANP have moderate or severe forms of AP, and a higher risk for development of multiple organ failure, secondary infection of the necrosis, and death.
- ✓ Unfortunately, to date there are no published data on nutritional support in patients with AP treated by the minimally invasive approach.
  - ✓ In the aforementioned trial, all patients received oral nutrition, if tolerated.
  - ✓ If this was not tolerated, a nasojejunal feeding tube was introduced and EN was started.
  - ✓ If gastrointestinal feeding was contraindicated, the patient received PN. No specific data were reported regarding nutrition-related outcomes.

> Oral food intake in patients undergoing minimally invasive necrosectomy is safe and feasible and should be initiated in the first 24 h after the procedure, if the clinical state (hemodynamic stability, septic parameters, gastric emptying) of the patient allows it.
>
> Grade of Recommendation GPP – Strong consensus (95% agreement).

Acute pancreatitis

Dietetic management:

✓ **How should medical nutrition (EN and PN) be provided in critically patients with severe AP (intra-abdominal hypertension (IAH), abdominal compartment syndrome (ACS) with need for open abdomen)?**

In patients with severe AP and intraabdominal pressure (IAP) < 15 mmHg early EN shall be initiated via nasojejunal, as the preferred route, or nasogastric tube. IAP and the clinical condition of patients during EN shall be monitored continuously.

Grade of Recommendation A – Strong consensus (91% agreement).

In patients with severe AP and IAP > 15 mmHg EN should be initiated via nasojejunal route starting at 20 mL/h, increasing the rate according to the tolerance. Temporary reduction or discontinuation of EN should be considered when IAP values further increase under EN.

Grade of Recommendation B – Strong consensus (94% agreement).

In patients with severe AP and IAP > 20 mmHg or in the presence of ACS, EN should be (temporarily) stopped and PN should be initiated.

Grade of Recommendation GPP – Strong consensus (94% agreement).

- The mortality of patients with severe AP who develop IAH/ACS during the course of the disease rises from 25% up to 66%.
- It has been clearly demonstrated that EN in patients with severe AP reduces mortality and infectious complications, decreases organ failure and surgical intervention rate, has a trend towards reduction of hospital stay, and is safer and more effective than PN.

- **Nevertheless, it has been reported that EN may increase intraluminal pressure with subsequent elevation of IAP and development of severe complications. Therefore, it is recommended that EN should be administered with caution when IAP reaches 15 mmHg and over**

Acute pancreatitis

Dietetic management:

- ✓ **Is there any role for immunonutrition (glutamine, antioxidants) in severe AP??**
  - ✓ **When EN is not feasible or contraindicated and PN is indicated, parenteral glutamine should be supplemented at 0.20 g/kg per day of L-glutamine. Otherwise, there is no role for immunonutrition in severe AP.**

- ✓ **Is there any role for probiotic use in severe AP?**
  - ✓ **Probiotics cannot be recommended in patients with severe AP.**

    - ✓ **A meta-analysis of six RCTs including 536 patients revealed no significant benefit of probiotics on pancreatic infection rate, overall infection rate, operation rate, length of hospital stay and mortality**

- ✓ **Omega-3 fatty acids: Omega-3 fatty acids have shown beneficial anti-inflammatory effects and may improve systemic inflammation, multiorgan failure, and clinical outcomes in severe pancreatitis. A meta-analysis of 8 small RCTs demonstrated that the administration of omega-3 fatty acids was beneficial for reducing mortality, infectious complications, and length of hospital stay, especially when received parenterally.**

Acute-recurrent pancreatitis

- Acute-recurrent pancreatitis is where there are at least two episodes of acute pancreatitis with resolution of pain or normalisation of measured serum enzyme levels between episodes. PERT, previously used in acute-recurrent pancreatitis, is not recommended as these patients are, by definition, pancreatic exocrine sufficien.

- For children with acute- recurrent pancreatitis caused by hypertriglyceridaemia, a low fat diet is required. Otherwise a normal fat- containing diet should be given, with a low fat diet only being used if there is vomiting or abdominal pain.
- There is little evidence on how restricted in fat the diet should be. Low fat diets can increase the likelihood of weight loss as fat is such a significant source of energy, and as a result these children may require high energy low fat nutritional supplements or advice on increasing the energy density of the diet

Table 10.23 Dietetic management between episodes of acute pancreatitis.

Timing of initiating nutrition	A regular diet should be started within one week after the onset of acute pancreatitis
Type of nutrition	A diet with normal fat content should be initiated A low fat diet should be initiated if: • There is abdominal pain/vomiting on a normal fat diet • Pancreatitis is caused by hypertriglyceridaemia

Chronic pancreatitis

- **Chronic pancreatitis is the result of irreversible damage to the anatomy and function of the pancreas. It initially presents as acute pancreatitis manifesting into recurring episodes before progressing to irreversible fibrosis as a result of long-standing inflammation.**
- Exocrine insufficiency may be seen in one third of children due to a loss of acinar cells, and there is an increased risk of type 3c diabetes due to a loss of islet cells. The endocrine defect is insufficient insulin secretion (the abnormality in type 1 diabetes) rather than insulin resistance (as in type 2 diabetes)

Dietetic management

- ❖ **Children with chronic pancreatitis are at increased risk of malnutrition. This may be due to a higher resting energy requirement; however, there is limited evidence for this in children.**

- ❑ **Which diagnostic tests are preferred to assess nutritional status in patients with CP?.**
  - ❑ **Fat-soluble vitamin levels should be measured every 6–12 months, and bone mineral density should be measured in children with malnutrition and persistently low serum vitamin D levels or a history of fractures .**
- ❑ **Malnourished patients with CP should be advised to consume high protein, high-energy food in five to six small meals per day.**

Nutritional assessment in the patient with chronic pancreatitis.

Anthropometric assessment	Biochemical assessment	Symptom assessment	Body composition
• Change in body weight • Functional assessment: Hand-grip strength dyna-mometry/6-min walk tests/sit to stand tests. • Skin fold thickness, waist circumference and mid arm muscle circumference. • Presence of ascites/edema	• Fat soluble vitamins (A, D, E, K) • Bone health (Parathyroid hormone) • Trace elements (magnesium, selenium, zinc) • Anemia screen (iron studies, B12, folate, ferritin and CRP) • Glycemic control: HbA1c and random glucose	• Change in dietary intake • Appetite • Presence of symptoms that impact on oral intake (nausea/ pain/indigestion/ early satiety) • Presence of exocrine/ endocrine dysfunction	• CT/US imaging of muscle stores (muscle mass) • DXA scanning (bone mineral density)

CRP = C-reactive protein, HbA1c = hemoglobin A1c, CT = computed tomography, US = ultrasound, DXA = dual-energy X-ray absorptiometry.

Dietetic management

- **Children with chronic pancreatitis should have a normal fat-containing diet.**

> In patients with CP, there is no need for dietary fat restriction unless symptoms of steatorrhea cannot be controlled.
>
> Strong consensus (100% agreement).

- **In patients with CP, diets very high in fiber should be avoided.**
- **Those with pancreatic exocrine insufficiency are at risk of fat malabsorption, micronutrient deficiencies and poor bone health and should have PERT.**

✓

Table 10.24 Dietetic management of chronic pancreatitis.

Type of nutrition	Normal oral diet
Pancreatic exocrine insufficiency	Require: • Pancreatic enzyme replacement therapy • More frequent follow-up to monitor for malnutrition
Consequent diabetes	Require: • Specialist diabetes input • More frequent follow-up to monitor for malnutrition and complications

Dietetic management

- ❑ **When is micronutrient supplementation indicated in patients with CP (not including osteoporosis prevention)?**

- ❑ **When is EN indicated in patients with CP and how should it be administered?**

  - ✓ **EN should be administered in patients with malnutrition who are not responding to oral nutritional support.**
  - ✓ **EN should be administered via the nasojejunal route in patients with pain, delayed gastric emptying, persistent nausea or vomiting and gastric outlet syndrome**
  - ✓ **Long-term jejunostomy access (percutaneous endoscopic gastrostomy with jejunal extension (PEG-J) or direct percutaneous endoscopic jejunostomy (DPEJ) or surgical jejunostomy) can be used in those requiring EN for more than 30 days.**

Fat-soluble (A, D, E, K) and water-soluble (vitamin B12, folic acid, thiamine) vitamins as well as minerals such as magnesium, iron, selenium and zinc should be monitored (if available) and administered if low concentrations are detected or if clinical signs of deficiency occur. Supplementation should be proposed to patients with known malabsorption.

Grade of Recommendation GPP – Strong consensus (95% agreement).

Semi-elemental formulas with medium chain triglycerides can be used if standard formulas are not tolerated.

Grade of Recommendation GPP – Strong consensus (94% agreement).

Dietetic management

- **When is PN indicated in patients with CP and how should it be administered?**

  - **PN may be indicated in patients with gastric outlet obstruction and in those with complex fistulating disease, or in case of intolerance of EN.**
  - **For PN the preferable route is central venous access.**


Thank
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