# Pancreatitis And **nutrition**

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# Introduction

- There are two major inflammatory diseases of the pancreas:
  - **acute pancreatitis**
  - **chronic pancreatitis**
- In both circumstances, nutrient digestion and absorption can be impaired (either short-term or definitively).
- Nutritional support is different in acute and chronic pancreatitis and nutritional deficiencies can occur in both

# Definition

- Pancreatitis is an inflammation of the pancreas caused by inappropriate activation of pancreatic enzymes (trypsin, phospholipase, elastase) within and surrounding the pancreas, resulting in autodigestion of pancreatic tissue, edema, and possibly necrosis or hemorrhage

# Mechanism

- The mechanisms behind why these factors lead to pancreatitis are still being elucidated.
- Less common contributors include severe hypertriglyceridemia, hypercalcemia, mumps, abdominal trauma, cigarette smoking, and medications such as azathioprine, ACE inhibitors, valproic acid, thiazide diuretics, narcotics, hormones, and steroids.
- Pancreatitis also occurs as a transient complication of endoscopic retrograde cholangiopancreatography (ERCP).

# ACUTE PANCREATITIS

# Epidemiology

**Acute Pancreatitis:**

- The annual global incidence of acute pancreatitis ranges from 13-45 per 100,000 persons.
- About 70-80% of acute pancreatitis cases result from chronic excessive intake of alcohol or from gallstones.

# Clinical presentation

- **Acute pancreatitis** ranges from a mild, self-limited condition to a severe pathological process with hemorrhagic necrosis leading to systemic multi-organ failure and death.
- Clinical presentation includes steady, severe epigastric pain and tenderness.
- The pain often persists for hours to days, radiates to the back, and may be relieved by leaning forward.
- Further symptoms include abdominal distention, nausea, vomiting, fever, tachycardia, diaphoresis, and jaundice.
- Severe cases may present with signs of peritonitis (guarding, rebound tenderness, fever), dehydration, and shock.

# Assessment of the severity of acute pancreatitis

**Table 1**
**Ranson's criteria of severity for acute pancreatitis (9)**

| |
|---|
| **Admission criteria**<br>Age > 55 years<br>WBC > $16.0 \times 10^9$/L<br>Glucose > 10 mmol/l (180 mg/dl)<br>Lactate dehydrogenase (LDH) > 350 IU/L<br>Aspartamine Transaminase (AST) >250 U/L |
| **Following initial 48 hours Criteria**<br>Haematocrit decrease of >10%<br>BUN increase of > 1.8 mmol/l (5.1 mg/dl)<br>Calcium < 2 mmol/l (4 meq/l)<br>$PaO_2$ < 60 mmHg (8 kPa)<br>Base deficit > 4 mEq/L<br>Fluid sequestration >6 L |

# Assessment of the severity of acute pancreatitis

**Table 2**
**Atlanta classification (11)**

**Atlanta Classification**
**(Defining Severe Acute Pancreatitis)**

- **Evidence of Organ Failure**
  - Shock (Systolic Blood Pressure <90 mm Hg)
  - Pulmonary insufficiency (PaO2<60 mm Hg; 8kPa)
  - Renal failure (creatinine > 2mg/dl; 177umol/l)
  - Gastrointestinal bleed (>500 ml/day)
- **Or Local Complications**
  - Pancreatic necrosis >30%
  - Pancreatic abscess
  - Pancreatic pseudocyst
- **With Unfavorable Prognostic Signs**
  - Ranson Criteria $\geq$3 or
  - APACHE II score $\geq$8

# Assessment of the severity of acute pancreatitis

**Table 3**
**Computed tomography (CT) grading system of Balthazar (10)**

| **CT grade** | | **Quantity of necrotic pancreas** |
|---|---|---|
| Grade A = **0** | Normal appearing pancreas | |
| Grade B = **1** | Focal or diffuse enlargement of the pancreas | |
| Grade C = **2** | Pancreatic gland abnormalities accompanied by mild parapancreatic inflammatory changes | <33% = **2**<br>33% - 50% = **4** |
| Grade D = **3** | Fluid collection in a single location, usually within the anterior pararenal space | > 50% = **6** |
| Grade E= **4** | Two or more fluid collections near the pancreas or gas either within the pancreas or within parapancreatic inflammation | |
| **Total score = CT grade (0-4) + necrosis (0-6)** | | |

# Epidemiology

**Chronic pancreatitis:**

- Approximately 45% of all cases result from long-standing alcohol abuse but these numbers vary by gender.
- Among males, about 60% of cases are due to alcohol, while among females, less than 30% of cases appear to be due to excess alcohol.
- Other causes of chronic pancreatitis include cystic fibrosis, severe malnutrition, and hyperparathyroidism.

# Risk factors:

- **Alcohol use.**
- **Gallstones.**
- **Genetics.**
- **Cigarette**
- **Diabetes mellitus,**
- **Celiac**
- **Hypertriglyceridemia,**
- **Hypercalcemia,**
- **Multiple viral infections.**
- **A wide array of medications**

# Diagnosis

- Biochemistry exam
- Abdominal films; CT Scan, Ultrasound,
- Endoscopic retrograde cholangiopancreatography (ERCP)

# Biochemistry

- complete blood count (CBC),
- a complete metabolic panel, including calcium and liver function tests,
- blood alcohol level,
- amylase, lipase,
- lipid panel,
- A pregnancy test should be obtained in any female of reproductive age.
- Hypokalemia, hypocalcemia, and leukocytosis are often present in acute disease.

# Abdominal films, CT scan, and ultrasound

- They evaluate for gallstone-related blockages, pancreatic necrosis or edema, and abscess or pseudocyst formation, and rule out nonpancreatic etiologies of abdominal pain.

# Endoscopic retrograde cholangiopancreatography

- Endoscopic retrograde cholangiopancreatography (ERCP) and magnetic resonance cholangiopancreatography (MRCP) will reveal strictures of the common bile duct and pancreatic duct.
- ERCP can also be therapeutic as papillotomy, stricture repair, and gallstone retrieval can take place during this procedure.
- Given similar sensitivity and specificity between MRCP and ERCP, ERCP, due to its associated morbidities, is generally reserved for patients with a high clinical suspicion or with obvious signs of choledocholithiasis on imaging

# Treatment

**Supportive care is the mainstay of treatment:**

- This includes aggressive IV fluid administration to maintain blood pressure;
- bowel rest (no oral intake; insert nasogastric tube if patient is vomiting);
- IV medications for pain control;
- antiemetics to relieve nausea or vomiting;
- monitoring and correcting electrolyte abnormalities, especially calcium.
- In advanced cases, admission to an intensive care unit (ICU) may be indicated.

# Treatment

- Addressing the underlying etiology is another treatment priority. Limiting other risk factors, such as alcohol and fatty foods, is also prudent.
- Cholecystectomy for gallstone pancreatitis should be delayed until the acute event resolves.
- Endoscopic or surgical intervention may be necessary in select cases.

# Nutritional Considerations

# Underweight and obesity

- Undernutrition is present in 50%-80% of chronic alcoholics, and alcohol is a major aetiological factor in men with acute pancreatitis (30%-40%).
- Patients with biliary pancreatitis, more dominant in women, have a high tendency to be overweight.

# Glucose metabolism

- Endogenous gluconeogenesis is increased as a consequence of the metabolic response to the severe inflammatory process.
- This can counteract, to a certain degree, the deleterious and unwanted effect of protein catabolism.
- The maximal rate of glucose oxidation is 4 mg/kg/min:(6 g/ kg/d) in adult resting subjects.

➢it is recommended that not more than this amount be administered.

  - The administration of excess glucose can lead to hyperglycaemia and lipogenesis, which can be dangerous for the patient.
  - Hyperglycaemia, in particular, has been suggested to be a risk factor for infection and metabolic complications, making monitoring of blood glucose essential.

# Protein metabolism

- Increased protein turnover and negative nitrogen balance is often observed in severe acute pancreatitis.
- Protein losses should be minimized, especially in complicated and long-term disease.
- When acute pancreatitis is complicated by sepsis, most patients will be in a hypermetabolic state.
- A negative nitrogen balance is associated  with adverse outcomes.
- Nitrogen losses are as much as 20-40 g/day in some patients with acute pancreatitis

# Fat metabolism

- Elevated levels of plasma triglycerides can be associated with acute pancreatitis.
- After an acute attack, serum lipid concentrations return to normal ranges.
- The mechanism of this response is not completely understood, but it may be partially due to stress.
- Acute pancreatitis can be a consequence of high triglyceride levels in patients with severe hyperlipidaemia.

# Fluid derangements

- According to some studies, pancreatic blood flow decreases by 73% immediately after the onset of acute pancreatitis.
- The resulting ischaemia is probably responsible for further derangement in acinar cells, with subsequent intracellular activation of digestive enzymes by lysosomal hydrolases and for progression of mild pancreatitis to parenchymal necrosis.
- Another consequence of splanchnic hypoperfusion is intestinal ischemia.
- This can result in damage to barrier function with subsequent infective complications and development of multiple-organ failure.

# Early fluid resuscitation

- It has been repeatedly shown that early fluid resuscitation can prevent these disturbances.
- The administration of lactated Ringer's solution intravenously at an infusion rate of 6.5 ml/kg/1/h, for 4 h prevented a decrease in pancreatic blood flow in dogs with experimental pancreatitis.

# Early fluid resuscitation

- All patients presenting with abdominal pain, high CRP levels, and a high level of amylase should be considered to be potentially progressing to severe pancreatitis.
- Hartman's solution or lactated Ringer's solution should be given at an initial rate of 1-2L/h to maintain urinary output to 50-150 ml/h If urinary output is low after administration of 2-4 L of fluid, a urinary catheter should be inserted.
- Fluid (saline and lactated Ringer's solution) should be given at 6-10 1 per day (or even more) according to the urinary output, systemic and central venous pressure, and microcirculation.
- During the first 3 days, patients can accumulate 6-12 L of fluid and 600-1200 mmol of sodium according to severity of disease.

# Requirement for energy and macronutrients

- The more severe the acute pancreatitis, the more excessive is the hypermetabolism.
- Resting energy expenditure can be variable in these patients; 77%-158% of the predicted energy expenditure has been reported.
- If the disease is complicated by sepsis or multiple-organ failures, the resting energy expenditure is significantly increased.
- It has been shown that in severe acute pancreatitis, the Harris-Benedict equation is not sufficiently sensitive to estimate caloric expenditure.
- In these cases, indirect calorimetry is recommended to avoid overfeeding or underfeeding.
- For enteral or parenteral nutrition, 25-35 kcal/kg/day is recommended

# Requirement for energy and macronutrients

- Overfeeding and hyperglycaemia should be avoided.
- Blood glucose concentrations should not exceed 11 mmol/l.
- Insulin treatment is recommended but the dose should not be higher than 5-8 units/ h.
- The impaired rate of glucose oxidation cannot be fully normalized by insulin administration.
- Normally, 3-6 g /kg/d of carbohydrates can be recommended.
- The optimal goal of protein supply is 1.2-1.5 g/kg/d.

# Requirement for energy and macronutrients

- Lower intake of protein should be given only to patients with renal failure or severe hepatic failure.
- Fat can be given up to 1 g/kg/d, but blood triglyceride levels must be monitored carefully.
- Plasma triglycerides up to 12 mmol/1 have been shown to be safe in relation to inflamed pancreatic tissue.
- However, the ideal concentration of plasma triglycerides should be < 3 mmol/l due to metabolic problems unconnected with pan

# Energy requirement

| Substrate | Quantity |
|---|---|
| Energy | 25–35 kcal·kg$^{-1}$·d$^{-1}$* |
| Protein | 1.2–1.5 g·kg$^{-1}$·d$^{-1}$ |
| Carbohydrates | 3–6 g·kg$^{-1}$·d$^{-1}$ corresponding to blood glucose concentration (aim for <10 mmol/l)* |
| Lipids | Up to 1 g·kg$^{-1}$·d$^{-1}$ corresponding to blood triglyceride concentration (aim for <4 mmol·l$^{-1}$)* |

*Overfeeding should be avoided, especially in obese patients, possibly according to measured resting energy expenditure (REE; indirect calorimetry)

**Benefits of early enteral feeding**

| |
|---|
| Maintain gut integrity (reduce bacterial challenge) |
| Set tone for systemic immunity (down-regulate immune response) |
| Attenuate oxidative stress |
| Lessen disease severity |
| Promote faster resolution of the disease process |
| Reduce complications (less infection and need for surgical intervention, shorter hospital length of stay, and possibly less multiple organ failure) |

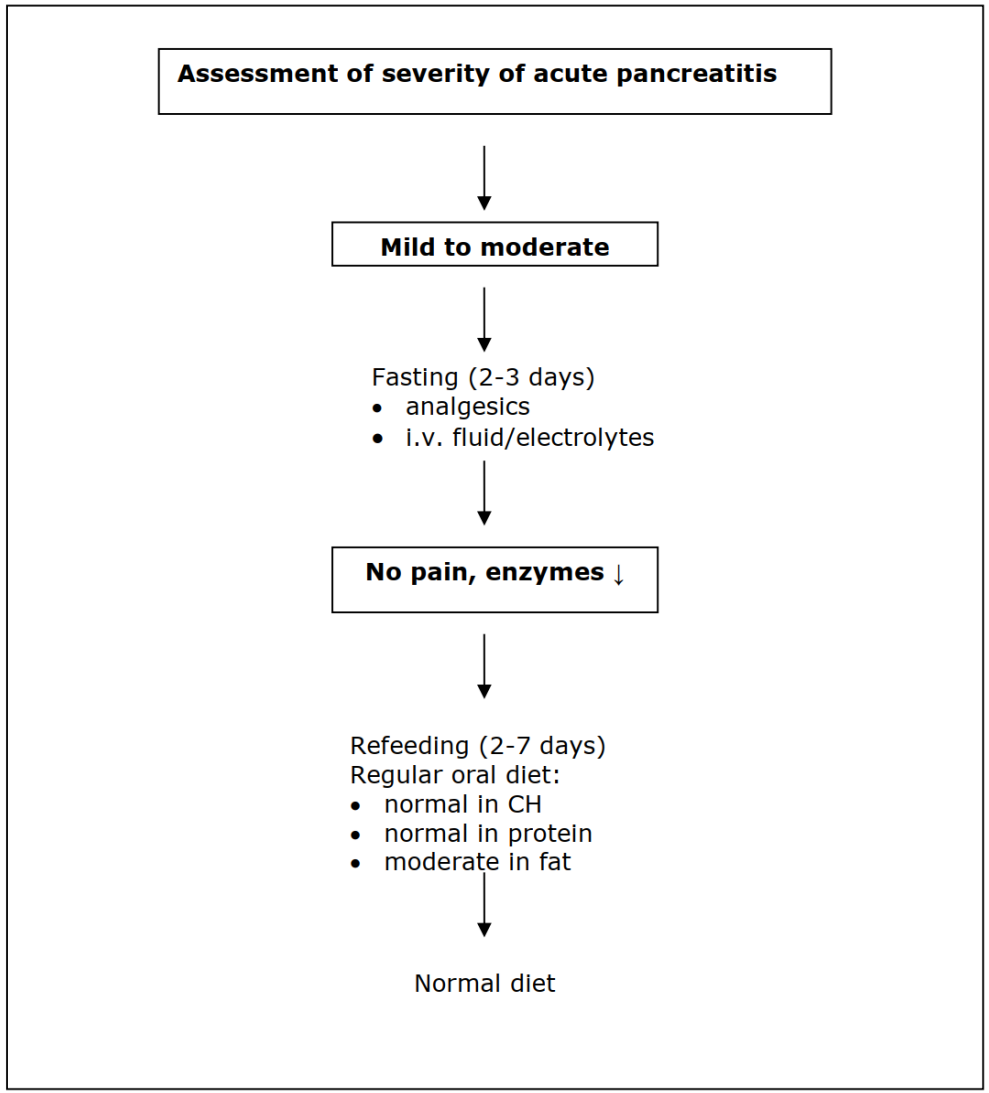
# Enteral or parenteral nutrition

- Total parenteral nutrition (TPN) was often used in the past in this setting to avoid stimulation of exocrine pancreatic secretion.
- *Several prospective, randomized clinical trials have been conducted comparing entera nutrition with parenteral nutrition in patients with acute pancreatitis’”, In mild-to-moderate acute pancreatitis, these studies showed no effect on outcomes in these patients. TPN did not change the course of the disease, but TPN was more expensive or accompanied by an increase in catheter-related infections and a longer stay in hospital.*
- Recently, nutritional management has shifted from parenteral to enteral feeding.
- Enteral feeding in acute pancreatitis may reduce catabolism and loss of lean body mass, and may modulate the acute-phase response and preserve visceral protein metabolism with the potential to downregulate the splanchnic cytokine response.

# Nutritional support in mild-to-moderate pancreatitis

- There is no evidence that nutritional support (enteral or parenteral) has a beneficial effect on outcome in patients with mild acute pancreatitis.
- Enteral nutrition is unnecessary if the patient can consume normal food after 5-7 days.
- Up to 80% of patients can receive an oral diet within 7 days.
- However, for the first few days, a diet with a reduced fat content is recommended.
- Early nutrition support is indicated in patients with pre-existing severe malnutrition or in patients with uncertain oral feeding within 5-7 days.

# Management of mild to moderate



# Nutritional support in severe acute pancreatitis

- In patients with severe pancreatitis who have complications or need surgery, early nutritional support is necessary to prevent the adverse effects of undernutrition.
- Again, if possible, enteral nutrition is indicated first.
- Parenteral nutrition is indicated when planned nutrition cannot be given enterally.
- In the last few years, the optimal route for enteral nutrition in severe acute pancreatitis has been redefined.
- Jejunal feeding is not always necessary, gastric or even oral feeding is sometimes possible.

# The role of body weight

- The risk for severe acute pancreatitis in obese individuals is 2-3 times greater, compared with normal weight persons.
- Obesity also significantly increases the risk for multi-system organ failure that often accompanies a severe acute attack of pancreatitis.
- Gallstones are a risk factor for acute pancreatitis, one that also occurs more frequently in obese persons.
- Although a diet low in fat and high in fiber has not been shown to reduce the risk for all types of pancreatitis, it is likely to be helpful for the prevention of gallstone-related pancreatitis.

# Triglyceride

- To reduce triglycerides, a diet restricted in fat and simple carbohydrates is advised, as well as weight loss and abstinence from alcohol.
- The only exception is the therapeutic use of high doses of omega-3 fatty acids, which reduce triglycerides by as much as 50%.
- Foods with a high glycemic load, particularly sucrose (table sugar) and high fructose corn syrup, also tend to raise triglycerides, and one study found a 60% greater risk for non-gallstone-related acute pancreatitis in persons who consumed diets with the highest glycemic load, compared with the lowest.
- Patients with triglyceridemia-related pancreatitis may be well-advised to choose carbohydrates that do not raise triglyceride levels, i.e., ones that are rich in fiber and have a low glycemic index.

# Fruits and vegetables

- A review of modifiable risk factors for pancreatic disease (acute, chronic, and pancreatic cancer) found that consuming the highest amounts of fruit reduced the risk for pancreatic diseases by 27%, while eating the most vegetables reduced risk by nearly 30%, compared to persons consuming the lowest amounts.

# Acute Pancreatitis

- **Enteral nutrition.**
- According to a 2014 review, enteral nutrition reduces mortality, infections, and multi-organ failure among patients with severe acute pancreatitis, and earlier administration of enteral nutrition (within 48-72 hours) rather than later is ideal.
- Other guidelines suggest enteral nutrition intervention within 24-48 hours of hospital admission, with oral nutrition encouraged for mild cases and following patient’s hunger cues.

# Chronic pancreatitis

EXOCRINE PANCREAS

# Epidemiology

- Incidence
- Alcohol
- Smoking
- Genetic
- Idiopathic

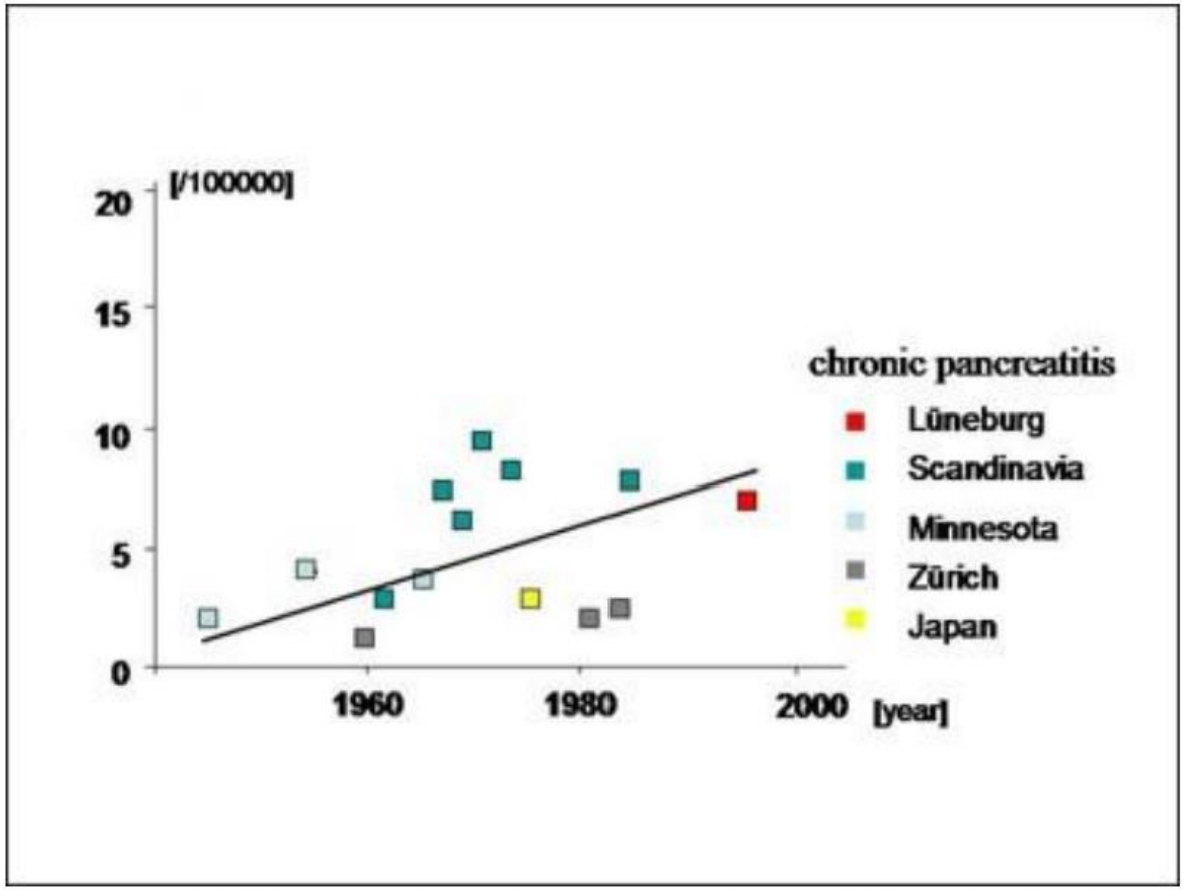
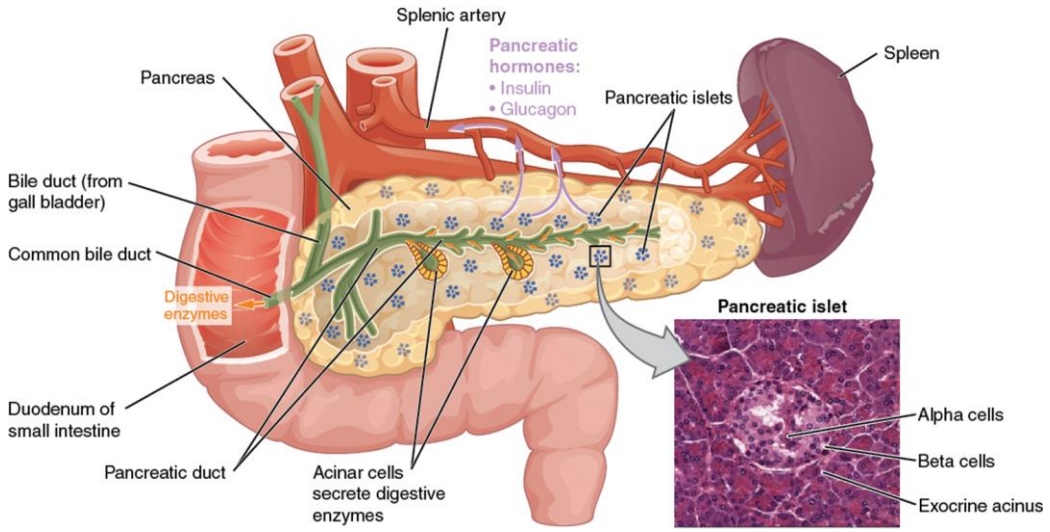



**Fig. 1** Incidence of chronic pancreatitis in the industrialized countries over the last 60 years

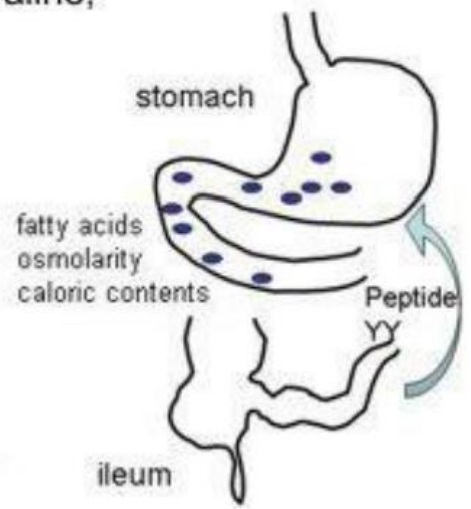
# Pancreatic physiology

- The exocrine response of the exocrine is time dependent and related to several factors.

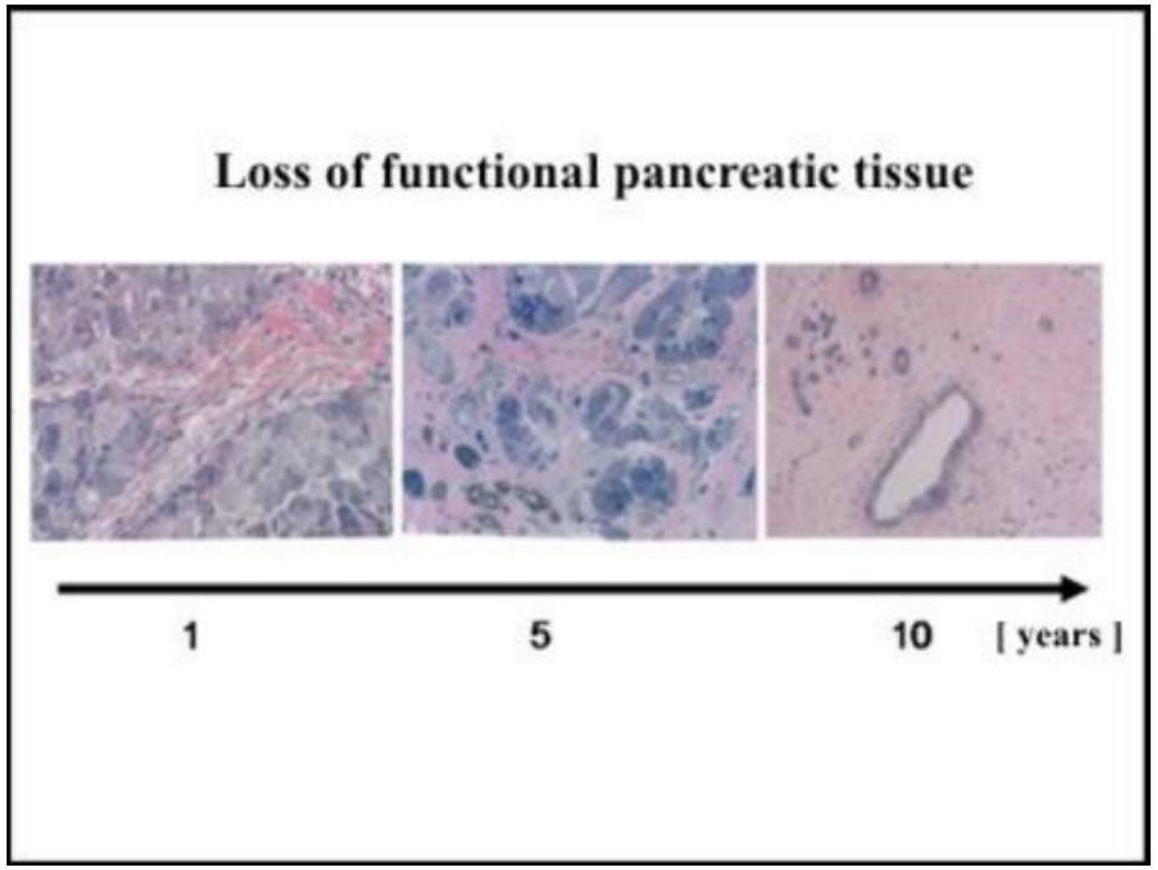



## Factors Regulating Exocrine Pancreatic Secretion

- Caloric content (>500 kcal - max. enzyme response)
- Lipids (duodenal free fatty acids) are the strongest stimulants
- Essential amino acids (phenylalanine, valine, methionine, tryptophane)
- Sustained response to solid meal compared to an equicaloric homogenized meal (slower gastric emptying)
- Nutrient in the duodenal lumen are the main stimulator throughout the digestive phase
- The distal small intestine participates in the regulation of exocrine pancreas (inhibition)



# Pathology of chronic pancreatitis




- The large physiological reserve of pancreas is the reason why clinical signs of fat malnutrition occurs late in the course of CP, typically when 80% of the secretory capacity of pancreas has been lost.
- Fat maldigestion is the major problem.
- Creatorrhoea only when occurs when trypsin output is less tan 10% of normal.

# Pathology of chronic pancreatitis

- Several studies have found an increase in oxidative stress in patients with chronic pancreatitis.
- One possible contributor is the deficiency of fat-soluble vitamins (A, D, E, and K) that is common in patients with chronic pancreatitis due to chronic malabsorption.
- A known source of this imbalance is the metabolism of xenobiotics, resulting in glutathione depletion and subsequent damage to pancreatic acinar cells.

# Pathology of chronic pancreatitis

- Certain antioxidant defense mechanisms (e.g., glutathione) are compromised in patients with chronic pancreatitis.
- Melatonin is known to scavenge oxygen and nitrogen radicals and activate antioxidant enzymes such as superoxide dismutase, catalase, and glutathione; consequently, connections have emerged between low melatonin levels and the likelihood of having more severe attacks of pancreatitis.

# Clinical features of CP

- Pain
- Loss of exocrine function, with concomitant steatorrhoea
- Weight loss
- Jaundice
- Pancreatic calcification
- Pancreatic pseudocyst
- Splenic vein thrombosis
- Loss of endocrine function, resulting in diabetes

# Clinical presentation

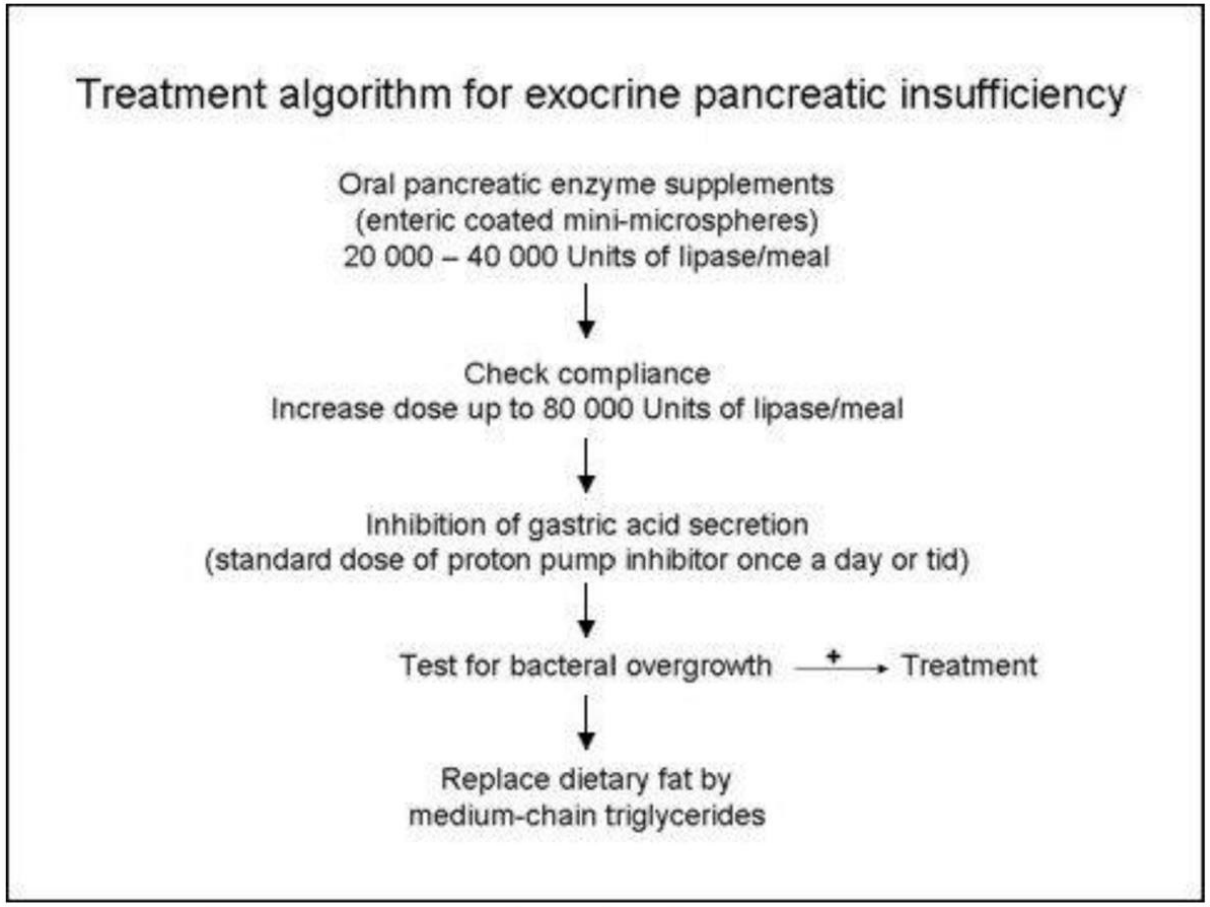
- **Chronic Pancreatitis**
- The clinical syndrome of **chronic pancreatitis** results from a slowly progressive destruction of pancreatic tissue that occurs over several years due to persistent inflammation and fibrosis.
- Presentation may be similar to that of acute pancreatitis, with epigastric pain that often radiates to the back, nausea, vomiting, food intolerance, steatorrhea, jaundice, and glucose intolerance.
- However, chronic pancreatitis may be asymptomatic

# Nutritional status in CP

- Body weight and body composition
- Metabolic situation
  - RMR increased in 30-50%
  - Glucose intolerance 40-90%
  - Insulin independent diabetes (type c) develops in 20-30%
  - Impaired glucagon release and reduced counter regulatory capacity
- Minerals, micronutritions and vitamins
  - Vitamins A, D, E, and K deficiency
  - Calcium Deficiency

# TREATMENT

# 1-Pancreatic Enzyme Replacement



# 2-Pain Treatment

- ANALGESICS
- TRICYCLIC ANTIDEPRESSANTS
- PANCREATIC ENZYME SUPPLEMENTATIONS
- ACID REDUCESRS
- ERCP
- COELIAC PLEXUS NERVE BLOCK
- SURGERY

# 3-Diet Recommendations:

- **ER:** 35 KCAL/KG/DAY
- **HIGH** PR:1-1.5 G/KG/24
  - **REPLACEMENT WITH MCT?**
- **MODERATE FAT:**0.7-1 G/KG/DAY
- **RICH CHO:**
- **FAT SOLUBLE AND VIT B12**
- **ANTIOXIDANTS: VIT C, SELENUM, VIT E**

# Chronic Pancreatitis

- An updated systematic review and meta-analysis found that antioxidant therapy, consisting mainly of combinations of vitamins C, E, beta-carotene, selenium, N-acetylcysteine, and glutamine, significantly reduced the length of hospital stay when compared with controls.
- Some of these trials utilized intravenous antioxidants, while others provided this in oral form.
- Other reviews have concluded that antioxidant combinations are effective for pain reduction in patients with chronic pancreatitis, particularly when combined with methionine.

# Chronic Pancreatitis

- Several controlled clinical trials with antioxidants in the treatment of chronic pancreatitis have been published.
- These have indicated that individual antioxidants are ineffective.

# Nutrition support for hospitalized patients

- Reviews of controlled clinical trials have concluded that intravenous glutamine or a combination of glutamine and long-chain omega-3 fatty acids significantly reduces the risk of infectious complications, mortality, and length of hospital stay when compared with controls.

# Role of enteral feeding

| **Indications for enteral nutrition in CP** |
| --- |
| ▪ Oral food intake is not possible due to persistent pain<br>▪ Gastric outlet syndrome due to enlarged pancreatic head or pseudocyst formation<br>▪ Acute complication (e. g. acute flare-up, fistula)<br>▪ Before and after surgery<br>▪ Progressive weight loss despite adequate medical therapy |

# What to Tell the Family

- There are many risk factors for pancreatitis.
- Supporting the patient in avoiding these risk factors can decrease the likelihood of future episodes of pancreatitis.
- Avoiding excessive alcohol use, or abstaining altogether, and adopting a low-fat, high-fiber diet are two lifestyle steps that can greatly reduce risk.
- Family members can help the patient manage medications, taking care to alert physicians to any that may elevate risk to the pancreas.

# Pancreatic physiology