

Recent Pathophysiology and Therapy for Paralytic Ileus

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Abstract: Paralytic ileus is a disease with transport disturbance of intestinal contents due to decreased smooth muscle activity in the small intestine or colon. Complications will occur when paralytic ileus is not treated adequately. Intestinal passage interference occurs in paralytic ileus; therefore, the food cannot be digested. Paralytic ileus causes include postoperative ileus, inflammation, electrolyte disorders, metabolic disorders, drugs, intestinal obstruction and trauma. Paralytic ileus treatment can be divided into two: supportive therapy and etiology therapy. The prognosis of paralytic ileus patients is generally good.

1 INTRODUCTION

Paralytic ileus is a condition of transport disturbances from intestinal contents due to decreased activity of smooth muscle in the small intestine or colon. This disease is likely to resolve if the underlying cause of this ileus is successfully repaired. Paralytic ileus is one of the causes of gastrointestinal disease, but may also be one of the symptoms of other diseases, including postoperative peritonitis, sepsis, electrolyte disturbance, hormonal disturbances or gastrointestinal ischemia (Wintery et al., 2003).

Paralytic ileus should be distinguished from pseudo-obstruction or Ogilvie syndrome paralytic ileus since the former involves the entire intestine, while the latter only involves the colon (Bayupurnama and Putut, 2011). Paralytic ileus should be distinguished from ileus obstruction or known as intestinal obstruction (Neneng, 2011). Ileus obstruction is caused by a blockage, resulting in food transport interruption in the gastrointestinal tract. However, the interruption found in paralytic ileus might be the result of continuous obstruction, leading to decreased intestinal peristalsis to stimulate food movement (Karen, 2007). In addition, there are many other causes of paralytic ileus that need to be discussed.

Paralytic ileus is an important problem since many complications can occur if it is not adequately treated. Inadequate food transport in the body can cause reflux and intestinal bacterial colonization in stomach. The bacteria can move to the lung through vomiting or direct migration to the pharynx or esophagus (Madl and Druml, 2003). In addition, food material accumulation in the intestine may result in intestinal perforation (Summers, 1999). Intestinal perforation will cause bacterial spread into the peritoneal cavity that subsequently results in life-threatening peritonitis (Madl and Druml, 2003). In addition, nutrient disorders may occur due to interference from food transport in the intestine; therefore, it requires adequate paralytic ileus management.

2 EPIDEMIOLOGY

The statistical data of paralytic ileus incidence remains unclear. This may be due to a better prognosis compared with obstruction ileus (Wintery et al., 2003). However, the United States' National Center of Health Statistics 2003-2004 reported 0.2% paralytic ileus cases in 13 million diagnoses (Statistics, 2005). There are also susceptible paralytic ileus subjects, including patients

undergoing major surgery, as there are 36% of cases found in patients undergoing heart bypass surgery (Simic et al., 1999). Other studies reported that lack of fluid in fire victims caused 9% of paralytic ileus cases in 2,114 fire incidents. It could be inferred that paralytic ileus has some causes, but better records are still needed on its emergence in order to know the cause and epidemiology of paralytic ileus.

3 PARALYTIC ILEUS SYMPTOMS

Paralytic ileus causes symptoms that can make patients feel very uncomfortable with their stomach condition. Symptoms associated with paralytic ileus include mild to moderate abdominal pain, appetite loss, abdominal fullness, abdominal distension, bowel movement difficulty, breathing difficulty, nausea and vomiting (Wintery et al., 2003). There may also be signs of paralytic ileus causes, for instance a burning sensation may be found if inflammation causes the ileus (Karen, 2007).

The physical examination of paralytic ileus patients shows decreased bowel sounds with a distended stomach. This gastrointestinal symptom is the main symptom occurring in paralytic ileus patients (Vather et al., 2013). Paralytic ileus investigation includes several laboratory and radiological examinations. It is also important to consider the effectiveness of any such examinations; therefore, they can get better benefit from the examination. The laboratory examinations include complete blood tests to measure hemoglobin, leukocytes, or differential count levels of blood to determine infection or inflammation as the basis of paralytic ileus. It can also be equipped with serum electrolyte examination, particularly K, Ca and Mg ions. It also needs to be complemented by renal function examination (Wintery et al., 2003).

Radiological examination includes thoracic imaging to determine the source of infection. Plain abdominal imaging is also needed without contrast in 3 positions: erect, supine, and tilted (leg length discrepancy) (Wintery et al., 2003). Paralytic ileus commonly has intestinal dilation and gas accumulation in the stomach, intestine and colon. This is different from the radiological features of obstruction ileus usually found in step ladder, or herring bone appearance (Wintery et al., 2003). Radiological examination by contrast is also required to locate the position or determine the cause of obstruction. The contrast is usually reduced

immediately in paralytic ileus, but contrast inhibition may occur in the obstruction case. The step ladder even appears as air filling in the upper intestine, while food or liquid will fill below it to form a step ladder image (Summers, 1999). In general, ultrasound or other tests such as MRI are only required if suspected paralytic ileus causes are unidentified. Another important test is electrocardiography (ECG), as it can detect hypokalemia in paralytic ileus, prominent U waves and QT interval lengthening (Karen, 2007).

Some differences in clinical findings and symptoms of paralytic ileus or intestinal obstruction are summarized in Table 1.

4 PATHOGENESIS

Paralytic ileus is a condition with interference from the intestinal passage; therefore, food cannot be digested properly. This problem occurs due to impaired intestinal peristaltic movement controlled by the autonomic nervous system (Bayupurnama and Putut, 2011). One of the causes of paralytic ileus is the postoperative state involving intestine, inflammatory process or infections, electrolyte disturbances, hormonal disorders or certain drug consumption capable of inhibiting intestine motility such as narcotics (Karen, 2007). The cause of this paralytic ileus can be explained as follows.

4.1 Postoperative ileus

Postoperative ileus is a paralytic ileus that appears after surgery involving the intestine (Vather et al., 2013). Postoperative ileus is divided into two: immediate postoperative ileus after surgery and diminishing with flatus and bowel, and prolonged postoperative ileus. Postoperative ileus is an ileus occurring in 4 or more days after surgery. The ileus is characterized by an inability to tolerate oral diet during 24 hours postoperative, unable to pass gas within 24 hours postoperative, nausea, vomiting and radiologic disturbances in the form of bowel distention within 4 days after surgery (Vather et al., 2013). Primary Ovarian Insufficiency usually occurs within 0-24 hours if the surgery involves the small intestine, 24-48 hours when involving the stomach and can last for 48-72 hours when involving the colon (Frozt, 2009; Bayupurnama and Putut, 2011). In addition, surgery is the most common cause of paralytic ileus, followed by sepsis, electrolyte disturbance and drug use (Bayupurnama and Putut, 2011).

Table 1: Comparison of paralytic ileus and intestinal obstruction.

	Paralytic ileus	Intestinal obstruction
Anamnesis	Abdominal pain, nausea, vomiting, bloating, constipation, difficulty in passing gas	Abdominal pain, nausea, vomiting, constipation
Physical examination	Decreased or negative bowel sounds, abdominal distension, tympanic percussion	Increased bowel sounds even up to metallic sound, abdomen distension, darm contour, darm steifung
Plain abdominal X-ray	Small and large intestine dilatation, diaphragmatic elevation	Herring bone appearance, step ladder

(Bayupurnama and Putut, 2011)

There are many causes of postoperative ileus, including inflammatory responses emerging due to manipulation performed during surgery, autonomic nervous system dysfunction (stimulation of sympathetic nerves that inhibits gastrointestinal movement), gastrointestinal hormonal disorders and neuropeptides, or drugs used during surgery that disturb intestine motility, such as narcotics (Vather et al., 2013).

4.2 Inflammation

Inflammation resulting in paralytic ileus may be due to inflammatory bowel disease or infection, such as pneumonia or sepsis (Wintery et al., 2003). Inflammatory intestine results in inflammatory mediators' release such as nitric oxide, Vasoactive Intestinal Peptide (VIP), substance P and prostaglandins, causing interference with intestinal motility that subsequently results in paralytic ileus (Frozt, 2009). In addition, inflammation also causes leukocyte infiltration that will further aggravate ileus (Schwarz et al., 2002).

4.3 Electrolyte disorders

Electrolyte disorders resulting in paralytic ileus is generally due to impaired potassium, particularly hypokalemia. (Brigode et al., 2015). This is because potassium is responsible for depolarization in nerve cells that innervate muscle. If it occurs in smooth

muscle cells in the intestine, it will slow smooth muscle contraction in the intestine that subsequently results in paralytic ileus (Brigode et al., 2015). In addition to hypokalemia, hypocalcemia conditions can cause paralytic ileus. This is because calcium is associated with smooth muscle contractility; therefore, lower calcium levels may cause paralytic ileus (Lawrence, 2016).

4.4 Metabolic disorders

Paralytic ileus can also be caused by metabolic disorders such as hypothyroid conditions. The mechanism of paralytic ileus in hypothyroid remains unclear, but the possibility of abnormalities in the autonomic nervous system that conserve the nervous system in the colon results in decreased intestine motility that subsequently causes paralytic ileus (Umar and Wheeler, 1997). Another possibility is material deposition in the intestine that blocks the relationship between muscle fiber in the intestine and autonomic ganglion (Bastenie, 1946).

In addition, renal impairment, particularly uremic conditions, can cause paralytic ileus. Uremic gastropathy and diabetes mellitus can also cause paralytic ileus due to diabetic gastropathy (Rodrigo et al., 2011).

Another cause of impaired intestinal motility is (SLE). SLE leading to lupus enteritis is a result of vasculitis in blood vessels, causing ischemia in the intestines. It consequently causes ulcers in intestinal mucosa and edema, resulting in intestinal dilatation and impaired intestinal motility which may lead to the emergence of paralytic ileus (Lawrence, 2016).

In addition, hypoparathyroidism can also cause paralytic ileus. This is due to hypocalcemia occurring in hypoparathyroidism leading to muscle motility disorders that subsequently result in paralytic ileus (Lawrence, 2016).

4.5 Drugs

Drug usage, particularly opioids (e.g. codeine, anesthetic drugs) which can decrease intestine movement, can increase paralytic ileus incidence (Wintery et al., 2003). Generally, drugs affecting intestinal motility can be divided into two: central-acting drugs and peripherally acting drugs (Lawrence, 2016). Central-acting drugs directly affect the brain and cause intestinal motility obstruction. These drugs include opiates, such as loperamide, phenothiazine, tricyclic antidepressants, and anti-Parkinson's drugs. On the other hand, peripherally acting drugs include the anticholinergic

group, calcium-channel blocker group (e.g. verapamil), alpha-2 adrenergic agonist group (e.g. clonidine), opiate group, serotonin mimetic-acting group (e.g. Tegaserod) and somatostatin analog group (Lawrence, 2016).

4.6 Intestinal obstruction

Intestinal obstruction due to tumors or polyps in the intestinal lumen will initially cause symptoms of ileus obstruction (Jackson, 2011). However, if the obstruction is not successfully removed, it will slow intestinal movement over time, resulting in paralytic ileus.

4.7 Trauma

Trauma, particularly involving the spinal cord, can cause digestive disorders. This problem can occur in 27-62% of patients with spinal cord injury. The average complaints associated with this trauma include constipation (42-81%), abdominal distension (43-53%), and abdominal pain (14-38%). The cause of gastrointestinal disorder may be due to the spinal cord, particularly if affecting the autonomic nerves (sympathetic and parasympathetic nerves). Consequently, there may be a disruption of the passage, resulting in paralytic ileus (Ebert, 2011).

5 DIAGNOSIS CRITERIA

Paralytic ileus diagnosis can be performed using the following criteria (Wintery et al., 2003; Bayupurnama and Putut, 2011; Karen, 2007):

Abdominal fullness with urge to pass gas, followed by decreased bowel sounds, nausea, vomiting, accompanied by constipation or diarrhea, fever, decreased consciousness during severe illness, shock, underlying diseases, including diabetes mellitus, trauma, history of surgery, drug usage suspected of causing paralytic ileus, inflammation signs, infection and electrolyte disorders, decreased bowel sounds accompanied by a distended stomach, radiology examination showing abdominal distension, which is described with a large intestine.

6 THERAPY

In general, paralytic ileus management can be divided into two: supportive therapy and etiology therapy (Wintery et al., 2003; Bayupurnama and

Putut, 2011). Supportive therapy consists of four stages, namely improving the patient's general condition through bed rest, preparing the patient to fast, installing an IV line, followed by giving a crystalloid such RL or NaCl 0.9%. NGT mounting is performed for decompression to reduce pain, nausea and vomiting in patients. In addition, the patient is given total parenteral nutrition (Lawrence, 2016). A catheter is installed for 24-hour urine monitoring, followed by vital sign monitoring such as blood pressure, pulse, temperature and respiratory rate. Afterwards, clinicians perform laboratory examination and ECG monitor. An electrolyte correction protocol is performed if there is electrolyte imbalance. In addition, the patient is given total parenteral nutrition since the patient is fasting. It should be noted, however, that total parenteral nutrition administration should not cause overloading in a distended bowel (Lawrence, 2016). Patients are prepared for fasting until bowel sounds are heard and the patient can pass gas spontaneously. If the patient is able to pass gas and bowel sounds are positive, a diet is administered through a feeding tube (Wintery et al., 2003). Other therapies such as prokinetic drugs or vitamin B12 has not shown significant evidence of ileus repair (Bayupurnama and Putut, 2011; Lawrence, 2016).

Etiology therapy is required in addition to supportive therapy, for instance potassium correction protocol for patients with electrolyte imbalance such as hypokalemia, or antibiotics administration for patients with paralytic ileus resulting from sepsis (Summers, 1999). There is also surgical treatment if intestinal dysmotility only occurs in particular segments that can be resected. However, bowel resection can only be performed if the gut experiencing dysmotility has a length less than 1.2 meters. Surgery could not be performed if the length is more than 1.2 meters since it will lead to adhesions and other complications due to surgery (Lawrence, 2016).

Small bowel transplantation is another therapy that may be applicable to patients undergoing previous resection processes, patients requiring long-term parenteral nutrition, sepsis patients and patients with short gut syndrome, a condition that causes the bowel to become shorter due to resected bowel, volvulus, gastroschisis and necrotizing enterocolitis. The success rate of this therapy is quite high, about 80% in the last 3 years, thanks to good preparation, effective immunosuppressive administration such as tacrolimus and mycophenolate, and short transplant areas. This transplant has side-effects of infection or rejection

reactions. This process is also not performed on patients who have a poor condition, such as necrotizing colitis (Lawrence, 2016).

7 COMPLICATIONS

Paralytic ileus may lead to various complications, including malnutrition, excessive bacterial growth in the intestine and pneumatosis cystoides intestinalis or gas accumulation in the intestine which can cause pneumoperitoneum. In addition, paralytic ileus is also capable of causing sepsis due to translocation of intestinal bacteria to the bloodstream.

8 CONCLUSION

The prognosis for patients with paralytic ileus is generally good, even though it is occasionally difficult to establish its etiology. The length of hospitalization duration in patients with paralytic ileus varies with the cause. If the patient has sepsis signs, s/he will be hospitalized for around 1-3 weeks. One of the paralytic ileus causes is the postoperative state involving intestine, inflammatory process or infections, electrolyte disturbances, hormonal disorders or certain drug consumption capable of inhibiting intestine motility such as narcotics. Paralytic ileus management can be divided into two: supportive therapy and etiology therapy.

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