Acute Abdomen in Infancy and Childhood

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Acute abdomen is a disease that needs to be diag nosed and treated immediately. Although the majority of it is related to surgery, surgical operation is not always necessary. Nevertheless, acute abdomen in infancy and childhood is always vital. Early diagnosis and appropriate treatment can reduce morbidity and mortality.

Since the problem of shortage of pediatric surgeons cannot be easily solved, general practitioners who work at local community hospitals should learn proper approaches to these problems. In fact, the diagnosis of acute abdomen is not difficult to make, patient history combined with physical examination and simple investigation, mostly lead to the correct diagnosis. However, the lack of cooperation from children and unfamiliar to these specific problems of the physician, could cause delayed diagnosis and inappropriate treatments.

The cause of acute abdomen in children varies based on the range of their age, which can be divided into three groups, namely:

1. Newborn babies within 1 month of life;
2. Infant between 1-2 years old; and,
3. Preschool age and children.

1. Newborn babies

Acute abdomen in newborn babies may cause from congenital intrauterine abnormality in which the baby is normally protected by their mother. The beginning of pathophysiologic change soon begins after birth and it increases in severity when time passes. Delayed diagnosis reduces the immunity that the baby has received from their mother, causing complication and increased mortality. A good example is seen in esophageal atresia, where the baby usually suffers from dehydration and malnutrition, there is also a chance to get pneumonitis from gastric aspiration.

In another way, acute abdomen in a newborn may be caused from any condition after birth. For example, perforation of gastrointestinal tract due to necrotizing enterocolitis happens after a period of intestinal infection. Early detection of this category of illness plus appropriate treatment can prevent the deterioration of the baby.

So the doctors who look after these babies should carefully look for any abnormality. When it is doubtful whether the baby has abdominal emergency, they should make early diagnosis and refer the patient in time for appropriate treatment.

Acute abdomen in the newborn baby is divided into two major topics, namely:

neonatal gut obstruction; and,
neonatal gut perforation.

Neonatal gut obstruction

Newborn babies who have gut obstruction always need immediate diagnosis. Only this can reduce their mortality rate. This group of baby usually has medical history during pregnancy: their mothers usually have polyhydramnios because of decreased area of absorption of the babies gastrointestinal tract. Therefore, babies who were born from mothers who have polyhydramnios have higher risk of gut obstruction than normal.[1] Physical examination of the mothers with polyhydramnios commonly show a large uterus, bigger than estimated size which also comes with difficulty in palpation of the fetus. Ultrasonography normally helps to confirm this abnormality. The physician will have to focus on history because it will lead to early diagnosis of neonatal gut obstruction.

Newborn babies who were born from polyhydramnios mothers should be inserted an orogastric as soon as possible. If the catheter cannot pass through the esophagus, the diagnosis of esophageal atresia should be made immediately without any risk of aspirated pneumonia from unawareness feeding. If the orogastric tube can pass into the stomach, the stomach content should be drawn for investigation. If the amount of the content is more than 20 ml, there may be the obstruction of GI tract.[2] Additional examination, plain abdominal x-ray intermittently can exclude the possibility of gut obstruction and the baby can be safely fed.

If the diagnostic test cannot be done at the beginning, and there may be no history of polyhydramnios, the symptoms will soon manifest: the baby who has gut obstruction will develop vomiting, abdominal distention, and delay passes of meconium.

Vomiting is a very important sign of the baby who has gut obstruction. Bilious vomiting almost always indicates that the baby has gut obstruction, except babies who have cerebral disturbance or sepsis. Vomiting without bile may occur from gut obstruction above the ampulla of vater, Since obstruction at a high level does not cause abdomi-

nal distention, the doctors do not suspect that the baby has an abnormality. So a baby who vomits with weight loss should also be suspected whether or not it has a gut obstruction, even though the vomitus does not contain any bile.

Abdominal distention is depending on the level of obstruction. If the level of obstruction is low, the abdominal wall is much distended. But if the level of obstruction is high, it is less distend or not distend at all. The timeline of abdominal distension is also important. Usually, abdominal distension from gut obstruction always occurs after 12 hours of life because it needs a period of time for air swallowing. Usually, a newborn who has history of abdominal distension from birth does not have gut obstruction, but it is caused by ascites or tumor in the abdomen.

Meconium passage usually occurs with in 24 hours after birth and at latest no later than 48 hours.[3] If this period is longer, the mechanical or functional obstruction of the intestine should be suspected.

In conclusion newborns who have gut obstruction can be divided into 2 groups according to their signs and symptoms:

1. Those who have abdominal distension and vomiting;
2. Those who have vomiting without abdominal distension.

1. Those who have abdominal distension with vomiting

These newborns usually have abdominal distension around 24 hours of life, together with vomiting without meconium passage. At first, the vomitus is milky as they are fed with milk, but later bile appears in it. The most important physical examination that should not be ignored is per rectal examination to see whether or not the baby has normal anus. If there is an abnormality of the anus, it can be anorectal malformations. But if the anus is normal, it may be one of the three possibilities, namely: meconium plug syndrome, Hirschsprung's disease and jejunoileal atresia.

The differential diagnosis can be performed by insertion of Neleton catheter size 12-16 F into the rectum and irrigate it with warm normal saline. If the result of the irrigation reveals a passage of meconium accompanied with flatus and the abdominal distension disappears, it means there is no gut obstruction above the level of the rectum. The possibility remains either meconium plug syndrome or Hirschsprung's disease. The meconium plug syndrome occurs from sticky meconium without abnormality of bowel and can simply be cured by normal saline irrigation. When the irrigation is stopped, the baby usually has normal defecation and can then be discharged. If abdominal distension occurs again after the irrigation has ceased, short segment Hirschsprung's disease should be suspected. Further investigation such as barium enema should be performed to exclude this condition.

In case of no meconium after irrigation with normal saline, and the patient still has much abdominal distension; it means that the level of obstruction is higher than the reach of the tube. This may be caused by jejunoileal atresia or long segment Hirschsprung's disease. The patient should be immediately referred to a neonatal surgical unit.

It is noticed that newborns who have abdominal distention and no meconium passage within the first 24 hours of life, the present or absent of meconium is most important. If there is normal meconium evacuated from irrigation, it is not a urgent case. But if there is no meconium from irrigation and the baby still has abdominal distension, it is urgent to refer the patient to receive surgical treatment as soon as possible.

Jejunoileal atresia is a congenital anomaly of small bowel occurring from intrauterine mesenteric vascular accident and followed by complete obstruction of the intestine.[4] The area that often occurs is the distal ileum. These newborns usually have history of polyhydramnios, bilious vomiting, abdominal distension and delayed passage of meconium. If the obstruction occurs at the jejunum, history of polyhydramnios and bilious vomiting will be obvious but the ileal obstruction will showed much more distension of the abdomen.

Usually, history and physical examination of the patient accompanying the absence of meconium from rectal irrigation is the clue for diagnosis. Confirmation with abdominal x-ray will show several degree of small bowel dilatation depending on the level of obstruction. If the level of obstruction is high such as jejunal atresia, the dilatation is only a few segments of small intestine compared to many segments in ileal atresia. The pressures in the intestine above the obstructed part usually increase after birth and cause gangrene and perforation. Early diagnosis helps reduce bowel distension. Naso-gastric tube insertion can release some pressure. Emergency operation when the baby is still healthy often leads to decreased mortality rate, from 40-50% to be less than 10%.[5]

Hirschsprung's disease is a congenital abnormality of the lower part of the intestine caused by the absence of neural cells that control bowel movement. So, the bowel segment demonstrates abnormal spasm. This abnormal spasm will not relax when the proximal bowel has peristalsis, causing the functional obstruction. The absence of neural cells will start from the most distal part of the intestine, from the lower rectum extended to various levels in each patient. Mostly, it stops at the rectosigmoid area, causing severe megacolon of the proximal colon, also known as congenital megacolon.

It is noticed that bowel obstruction from this disease may occur at various locations. Most of them occur at the rectosigmoid region where the obstruction can be released with rectal irrigation. In some cases, the lesion extends higher to the proximal colon, involving the entire colon, known as total colonic aganglionosis or involving small bowel, causing failure of rectal irrigation. In this case, emergency surgical decompression should be performed as soon as possible; otherwise, there could be increased risk of bowel perforation or enterocolitis which are the most common cause of death in the newborn of this period.[6]

2. Those who have vomiting without abdominal distension

These newborns demonstrate repeated vomiting without abdominal distension or local distension of the upper abdomen. They show the symptoms and signs of upper gut obstruction in which obvious abnormal physical signs are rarely found. At first, the patients only vomit. Usually, they are treated supportively until their conditions get worse from dehydration and malnutrition. The complications such as pneumonitis, sepsis may happen without any suspicion of this syndrome. The characters of vomiting

that should be noticed to be abnormal are bilious vomiting and severe vomiting until weight loss. The causes of upper gut obstruction in the newborn period are, namely: esophageal atresia, duodenal obstruction and infantile hypertrophic pyloric stenosis.

Esophageal atresia is congenital abnormality that causes esophageal obstruction. During the development of a fetus, the upper gut and the respiratory tract have close relation, so that the deformity of the esophagus is usually associated with tracheoesophageal fistula. The fistula is the common cause of complication due to aspirated pneumonia. Sometimes respiratory problems are more obvious than swallowing problem. This often draw the physicians to focus only on the lung condition without being aware of the underlying esophageal atresia, leading to deterioration and death of the patient.

These newborns are usually born from polyhydramnios mothers. If the physicians have intension on this history and insert orogastric tube soon after birth, the early diagnosis will be made easily. If there is no history of polyhydraminos, the disease should be suspected when the babies have foamy salivation and choking all the time. If the pneumonitis occurs, it is often followed by tacchypnea, dyspnea and cyanosis. Chest x-ray commonly shows coiling of N-G tube in the upper pouch of the esophagus and also signs of right upper lobe pneumonitis.

Although esophageal atresia can be subdivided into various types of abnormality, the type that should receive more attention as it occurs most frequently is the atresia of the upper esophagus accompanying fistula of lower esophagus and trachea. The associated anomalies, such as anorectal malformations, congenital heart disease, abnormalities of the spine, kidney and arms need to be investigated.

From the beginning, a careful prevention of aspirated pneumonia should be given to the patient by insertion of oropharyngeal tube to suck saliva from upper esophagus and place the newborn's head at the high position to prevent reflux of gastric content. Then the patient should be referred immediately. Closing tracheoesophageal fistula and end-to-end anastomosis of the upper and lower esophagus during the good condition of respiratory system often help the patient to survive more than 90%.[7]

Duodenal obstruction is one of the most common upper gut obstructions in newborns. Its obvious symptom is vomiting which occurs since early days after birth. Most of them are bilious vomiting but a non-bilious can also occur if the obstruction is above the opening of the bile duct. It was found that 30% of these cases happened in Down's syndrome and 50% of their mothers have history of polyhydramnios. The pathology of the obstruction includes duodenal atresia, duodenal stenosis, annular pancreas, duodenal web and malrotation with congenital Ladd's band.

In these cases, an abdominal x-ray usually identifies duodenal obstruction. It is commonly seen as double bubble sign which is specific of duodenal obstruction. Additional contrast radiological study is not necessary in case of a complete obstruction. In partial duodenal obstruction, however, a contrast study should be performed before operation to find out the exact point of obstruction. During the period of investigation, an N-G tube should be inserted and intravenous fluid should be given to get the patient ready for the operation.

Malrotation with congenital Ladd's band may have serious complication if midgut volvulus occurs. As the fix point of the mesentery of the small bowel are closer than normal, causing abnormal rotation of the small bowel around itself, which leads to large amount of bowel gangrene that makes the patient difficult to survive. Beside the sign and symptom of duodenal obstruction, there is usually abdominal distension, drowsiness, bloody stool and poor blood circulation. Gangrenous bowel loop could be palpated on physical examination. These newborns need to be operated as soon as possible to revive the affected bowel.

Infantile hypertrophic pyloric stenosis usually does not present any symptom at birth. The symptom usually begins with vomiting 2-3 weeks after birth. The vomiting is none bilious projectile. Although these newborns suffer from severe vomiting, they are still hungry and suck well. Physical examination may reveal a finger tip mass at the right upper abdomen. An abdominal x-ray commonly reveals marked dilatation of the stomach. An upper GI contrast study finds stenosis and elongation of the pyloric canal, so-called the string sign. If an ultrasonography is performed, thickening of the muscle layer of the pylorus is commonly found.

Since these patients are well fed and the obstruction is only partial, the diagnosis is normally delayed for several weeks after the beginning of the symptom.

The definite treatment after fluid and electrolyte correction is Rammstedt pyloromyotomy.

Neonatal gut perforation

Gut perforation in newborns is a serious condition with high mortality rate. Its common causes are, namely:

1. bowel perforation from necrotizing enterocolitis (NEC);
2. stomach perforation from spontaneous gastric perforation; and,
3. perforation of the caecum from Hirschsprung's disease or from anorectal malformations.

1. Bowel perforation from necrotizing enterocolitis:

Necrotizing enterocolits usually occurs in a premature baby with low birth weight, and newborn who have stress, hypoxia from various causes. The patient usually has abdominal distention, vomiting, drowsy and bleeding per rectum soon after feeding. If the diagnosis and treatment cannot be done correctly, the bowel may be perforated. The condition of the patient can get worsen and present as sepsis, redness of abdominal skin, less urine output. If the patient does not receive proper operation, severe complications can occur. Abdominal x-ray may show abnormal air in the bowel wall, called *pneumatosis intestinalis*; the air can be also seen in the portal vein and free air in peritoneal cavity when the bowel is perforated.

Operation should be performed as soon as the gangrene bowel or perforation detected. Sometimes the condition of the patient is so severe, local drainage may be done and the definite surgery should be postponed until the patient is better.[8]

2. Spontaneous gastric perforations:

This disease is rarely but it has high mortality rate. It

usually happens in newborns with low birth weight, and babies with severe illness in ICU. The causes may come from vascular compromises or iatrogenic insertion of an N-G tube.[9] It also occurs in normal babies who have history of banana feeding. It is suspicious whether there is some area of weakness in the wall of the stomach leading to perforation.[10] The newborns who have perforation of the stomach usually have severe abdominal distension, drowsiness and feeding difficulty. An abdominal x-ray commonly shows a large amount of free air in peritoneal cavity, so-called the football sign. Urgent treatment of intravenous fluid replacement, antibiotic administration and immediate operation should be performed.

3. Perforation of caecum from Hirschsprung's disease or from anorectal malformation:

The event occurs as in adults who have colonic obstruction, leading to cecal perforation. Although it rarely occurs and difficult to differentiate from the other causes of GI tract perforation, it should be suspected once cecal perforation is detected in a newborn.

2. The infant 1 month to 2 years old

Abdominal emergency in this age group is usually caused by intussusception and incarcerated indirect inguinal hernia.

Intussusception

This bowel obstruction is usually diagnosed late as the patient commonly has defecation with bloody stool. This leads the doctor to focus on the treatment of enterocolitis from infection as it occurs more often than intussusception. Until the condition gets worse, intussusception is then suspected.

The cause of the disease is unknown; around 50% of the patients have some evidence of viral infection.[11] Therefore, it is believed that viral infection may cause the swelling of the payer patch accompanying abnormal movement of the terminal ileum into the colon.

Normally, the patient is younger than 2 years old, and the most age is between 5-9 months old. It usually presents with an acute symptom of severe vomiting, abdominal coliky pain. Bleeding per rectum commonly occurs in healthy young infants. At first, the vomitus contains only food or milk. When the symptom becomes more severe, it becomes bile stained. Abdominal coliky pain usually makes the baby cry with body stretching intermittently. Bloody stool usually occurs after a period of pain and vomiting. This symptom is the leading cause of the parental fear. The appearance of stool is bloody mucus, so-called the currant jelly stool. Having seen this, the attending physician should be suspicious of the disease and should continue to exclude it. The finding on physical examination depends on the period of the disease. At first, the baby looks normal and presents only vomiting without much abdominal distension. Another commonly found on physical exam is an abdominal mass which looks like sausage along the colonic position. In severe stage, the baby appears more drowsiness with much abdominal distension which makes it more difficult to palpate. An abdominal x-ray commonly reveals a small bowel obstruction. Ultrasonography usually reveals intussusceptive mass. Barium enema provides an obvious diagnosis of intussusception and it may be used as the treatment by applying hydrostatic pressure from the contrast enema pushing intussusceptum out of intussusci-pient. If this fails, the operation should be performed after dehydration and electrolyte imbalance are corrected.

Intussusception in this age group does not have any leading point like in older age group which deserves more attention as it may be associated with a tumor of the bowel.

Incarcerated Indirect Inguinal Hernia

Around 70% of the cases of incarcerated indirect inguinal hernia occur in babies younger than 1 year old. As the infants have high risk of incarceration when indirect inguinal hernia occurs, every infant who is diagnosed of indirect inguinal hernia should be advised to have operative correction before any complication happens.

The most common symptom of incarcerated indirect inguinal hernia in infants is abnormal crying from pain with vomiting. There may be abdominal distension if symptom is severe. The physical examination commonly reveals abnormal swelling along the inguinal region with or without extension into the scrotal sac. In the early phase, the skin that covers the mass is normal but soon becomes red and swollen if bowel strangulation occurs.

Early treatment of non-strangulated IIH should be manual reduction. Early treatment can change the patient's condition from emergency condition to elective operation in the next 24-48 hours. But if there is a sign of vascular compromise or failure of manual reduction, the emergency surgery should be performed without hesitation.

3. Preschool age to childhood

The most frequent cause of abdominal emergency in this age group is acute appendicitis and the particularly problem is delayed diagnosis. A delayed diagnosis usually occurs because uncertain history and uncooperative child. The use of antibiotics and antispasmodic agent without the awareness of the physician may however obscure the diagnosis. The rate of perforation of appendicitis in preschool child is as high as 50-70%.

The diagnosis of appendicitis is not difficult in the patient who has clear history and cooperates in physical examination. The classical history of appendicitis is an acute abdominal pain, mostly not longer than 48 hours. At first the abdominal pain occurs around the umbilical area, then shifts to the right lower quadrant. The abdominal pain occurs with nausea and vomiting. Usually, vomiting occurs after the onset of abdominal pain, if the patient vomits before abdominal pain it should be diagnose as gastroenteritis. Then the patient has low grade fever until complications occur. A high-grade fever commonly indicates ruptured or gangrenous appendicitis. Diarrhea is rarely found in simple appendicitis but it is usually found in ruptured appendicitis. In some children, however, the history may not be clear because it is overlapped with symptoms of viral infection which also frequently occurs. Sometimes the history may be manipulated by the people who bring the child to see the doctor. Physical examination may be problematic in uncooperative child, especially when the doctor pays attention on abdominal examination at the beginning. Usually, the doctor has to give more time to be familiar with the child by talking and softly palpate the abdomen. The most important exam is feeling the pain at Mc Burney's point. Some children may be afraid and do not want to be examined at all. It is necessary to use observation technique and come back to examine after the child has fallen asleep. As for rectal examination, despite there is not much information about

pain, but it usually helps the differential diagnosis. It is possible that the child may suffer from constipation. When a large amount fecal material is found, rectal enema should be performed and the symptom will be cured. In addition, a rectal examination is also helpful in case of girls who have some abnormal reproductive organs.

Laboratory tests usually help the diagnosis; particularly when they show increased white cell count and shifting to the left. However, white cell count may be normal or lower than normal. A urine test usually does not find any abnormality. But sometimes a urine test may find some red blood cells or white blood cells in the case that appendix lies in proximity of the ureter.

If the doctors are unsure whether or not the child is having appendicitis, the treatment should not include antibiotics or antispasmodics. These inappropriate medications often obscure the diagnosis and lead to sever complications. Closed observation usually helps the diagnosis and operation before the appendicitis progresses to rupture is always the gold standard of treatment.[12]

REFERENCES

1. Deyoung VR. Hydramnios as a signal to the physician responsible for newborn infants. J Pediatr 1958;53:277-84.
2. Britton JR, Britton HL. Gastric aspirate volume at birth as an indicator of congenital intestinal obstruction. Acta Paediatr 1995;84:945-6.
3. Sherry SN, Kramer I. The time of passage of the first stool and first urine by the newborn infant. J Pediatr 1955;46:158-9.
4. Louw JH, Barnard CN. Congenital intestinal atresia; observations on its origin. Lancet 1955;269:1065-7.
5. Rescorla FJ, Grosfeld JL. Intestinal atresia and stenosis: analysis of survival in 120 cases. Surgery 1985;98:668-76.
6. Kleinhaus S, Boley SJ, Sheran M, Sieber WK. Hirschsprung's disease -- a survey of the members of the Surgical Section of the American Academy of Pediatrics. J Pediatr Surg 1979;14:588-97.
7. Teich S, Barton DP, Ginn-Pease ME, King DR. Prognostic classification for esophageal atresia and tracheoesophageal fistula: Waterston versus Montreal. J Pediatr Surg 1997;32:1075-9.
8. Rovin JD, Rodgers BM, Burns RC, McGahren ED. The role of peritoneal drainage for intestinal perforation in infants with and without necrotizing enterocolitis. J Pediatr Surg 1999;34:143-7.
9. Grosfeld JL, Molinari F, Chaet M, Engum SA, West KW, Rescorla FJ, et al. Gastrointestinal perforation and peritonitis in infants and children: experience with 179 cases over ten years. Surgery 1996;120:650-5.
10. Tan CE, Kiely EM, Agrawal M, Brereton RJ, Spitz L. Neonatal gastrointestinal perforation. J Pediatr Surg 1989;24:888-92.
11. Montgomery EA, Popek EJ. Intussusception, adenovirus, and children: a brief reaffirmation. Hum Pathol 1994;25:169-74.
12. Dado G, Anania G, Baccarani U, Marcotti E, Donini A, Risaliti A, et al. Application of a clinical score for the diagnosis of acute appendicitis in childhood: a retrospective analysis of 197 patients. J Pediatr Surg 2000;35:1320-2.