COMPUTED TOMOGRAPHY EVALUATION OF BOWEL OBSTRUCTION

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SUMMARY

Background: Bowel obstruction (intestinal obstruction) is one of the most common acute surgical abdomen, occurring at all ages and for many reasons. Computed tomography (CT) has great value to diagnosis bowel obstruction, especially to determine the cause of bowel obstruction. Therefore, we conducted this study to investigate the common causes as well as the severe signs of bowel obstruction byCT scan. **Materials and methods:**The study including 47 patients who have image of bowel obstruction on CT at Hue Central Hospital and Hue University Hospital from April 2016 to May 2017. These variables were included a number of clinical features, the causes and some signs suggesting complications of bowel obstruction.**Results:** Abdominal pain is the most common symptom while abdominal distension is the most common sign. 72.3% of bowel obstructions occur in the small intestine; the other 27.7% occur in the colon. Adhesion is the most common cause (27.7%), other common causes are: malignant lesion(25.5%), bezoar (12.8%), volvulus (8.5%);4.3% of cases cannot be found cause on CT image. The most common sign suggesting complications are mesenteric fluid (59,6%).**Conclusion:**Computed tomography can determine most of causes of bowel obstruction and itcan show complications of bowel obstruction.

Keywords:*bowel obstruction , intestinal obstruction, computed tomography*

1. BACKGROUND

Bowel obstruction (intestinal obstruction) is one of the most common acute surgical abdomen in adults, only less than appendicitis, in which small bowel obstruction (SBO) is about 80-90%[1].

Bowel obstruction is a syndrome, it is seen in many diseases, had complicated pathophysiology, causing many complications, even death. Bowel obstruction is caused by a variety of causes, and there is considerable variation between the small and large intestines. Rate of causes inbowel obstruction varies widely between countries with different socioeconomic conditions, as well as between races. The rate of complications and mortality is highly dependent on the early and accurate diagnosis of bowel obstruction [1]. In the past two decades, computed tomography (CT) has been considered as the leading diagnostic imaging tool in bowel obstruction [2, 3, 4, 5, 6, 7]. Because of the high speed and accuracy, CT is capable of answering most of the questions that clinicians needs in a patient with acute abdominal painsuspected bowel obstruction [8]. We conducted this study to investigate the common causes and signs of bowel obstruction on CT images.

2. MATERIALS AND METHODS

Study subjects: This research include 47 patients who have image of bowel obstruction on CT at Hue Central Hospital and Hue University Hospital from April 2016 to May 2017.

Research Methodology: A descriptive cross-sectional study.

General characteristics: Age group, sex. Clinical features: Abdominal pain, vomiting, absence of passage of flatus and/or feces, abdominal distension, Von Wahl sign, visible peristaltic waves, abdominal mass, fever, abdominal guarding.

CT imageswas taken byShimadzu's SCT-7800TCA and GE's Hispeed Dual CT systems. Mechanical bowel obstruction revealed by CT with dilated bowel loops upstream and

collapse of bowel loops in downstream, with or without transition region. Ileusrevealed byCT with dilated both small bowel and large bowel to the rectum without a transition region. The bowel loops is called dilate when> 25 mm in small bowel and> 60 mm in large bowel[7]. Study variables: occlusion position, transition region, mesenteric fat stranding, mesenteric fluid, bowel wall thickening, decreased bowel-wall enhancement, abnormal gas (in bowel wall, in mesentery, in portal vein, in peritoneal cavity), causes of obstruction.

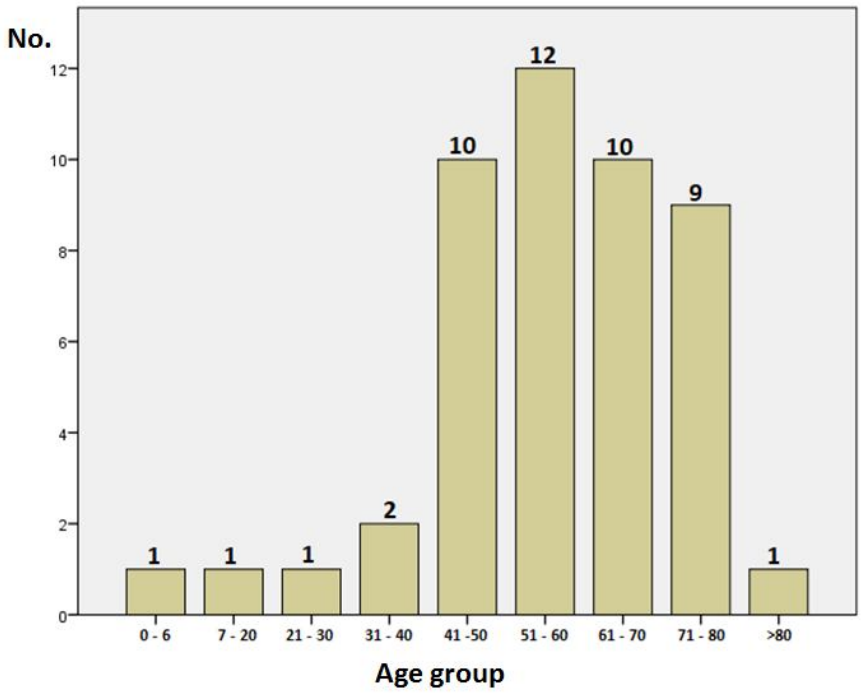
Compared with surgeryresult.

3. RESULTS

3.1. General features and clinical signs

In 47 patients have 28 males (59.6%), the male/female ratio is 1.47. Bowel obstruction occurs in all age groups, but highest in the over 40 years old group (89.4%) , mean is 56.53 ± 16.91 years old.

Chart 1. Age distribution in the study



Abdominal pain is the most common symptom while abdominal distension is the most common sign, no one have visible peristaltic waves.

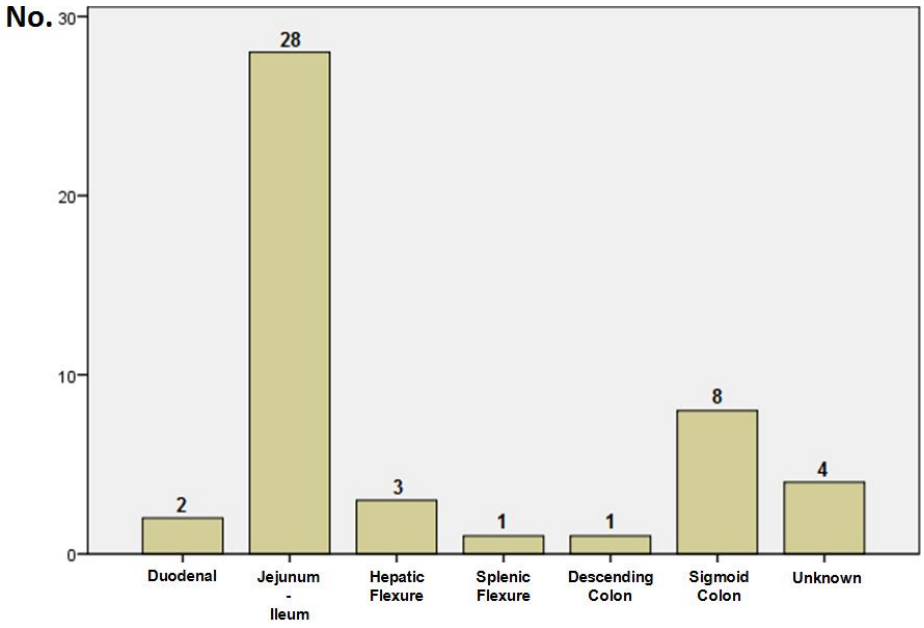
Table 1. Symptoms and signs

Symptoms	No.	%	Signs	No.	%
Abdominal pain	47	100	**Abdominal distension**	40	85.1
Vomiting	34	72.3	**Visible peristaltic waves**	0	0
Absence of passage of flatus	35	74.5	**Von Wahl sign**	9	19.1
Absence of passage of feces	35	74.5	**Fever**	4	8.5
			Abdominal mass	7	14.9
			Abdominal guarding.	6	12.8

3.2. Occlusion position and transition zone

In our study, 72.3% cases wasSBO and 27.7% cases was large bowel obstruction (LBO), the ratio SBO/LBO was 2.62. The most common transition zone in the jejunum and the ileum (59.5%). 8.5% cases did not see the transition zone on CT.

Chart 2. Transition zone location



3.3. Severe signs of bowel obstruction on computed tomography

Peritoneal fluid is the most common severe sign (59.6%). None of the patients had gas in the mesentery, in the portal vein and in the peritoneal cavity.

Table 2. Severe signs of bowel obstruction

Signs	No.	%
Mesenteric fat stranding	16	34
Mesenteric fluid	28	59.6
Bowel wall thickening	17	36.2
Decreased bowel-wall enhancement	7	14.9
Gas in bowel wall	2	4.3
Gas in mesentery	0	0
Gas in portal vein	0	0
Gas in peritoneal cavity	0	0

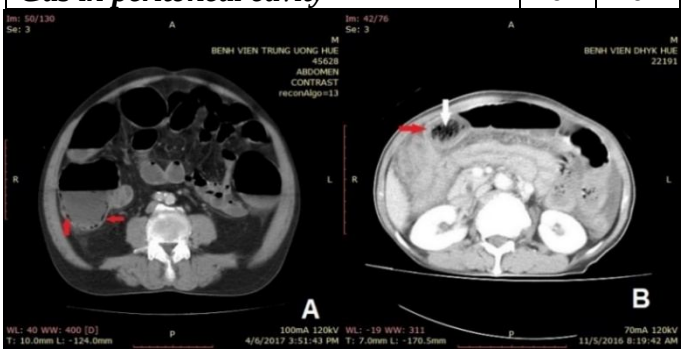


Figure 1.*(A) Gas in the bowel wall (red arrow). (B)Bowel wall thickening and decreased enhancement(red arrow), feces sign at transition zone (white arrow).*

3.4. Causes of bowel obstruction on computed tomography

Adhesion is the most common cause of SBO (38.3%), malignant lesion is the most common cause LBO (69.2%).

Table 3. Causes of bowel obstruction displayed on computed tomography

Causes	Small bowel (No.)	Large bowel (No.)	Total	%
Matted adhesions	13	0	13	27.7
Malignant lesion	3	9	12	25.5
Volvulus	3	1	4	8.5
Bezoar	5	1	6	12.8
Intussusception	2	1	3	6.4
Inflammatory bowel diseases (IBD)	3	1	4	8.5
Intestinal duplication	1	0	1	2.1
Hernia	1	0	1	2.1
Adhesive bands	1	0	1	2.1
Unknown	2	0	2	4.3
Total	34	13	47	100

Figure 2. Bowel obstruction secondary to Crohn disease: Bowel wall thickening (red arrow), ulcerative (white arrow), cobm sign (white arrow)

3.5. Compared with surgery result

Our study had 19 patients with surgery, all of them reported bowel obstruction. CT has a close correlation with surgery in the diagnosis cause of bowel obstruction.

Table 4. Compared with surgery result for cause diagnosis

Surgery / CT	Matted adhesions	Malignant lesion	Volvulus	Bezoar	IBD	Intestinal duplication	Unknown	Total
Matted adhesions	**4**	0	0	0	0	0	0	4
Malignant lesion	0	**7**	0	0	0	0	0	7
Volvulus	0	0	**3**	0	0	0	0	3
Bezoar	0	0	0	**1**	0	0	0	1
IBD	0	0	0	0	**1**	0	0	1
Intestinal duplicatio n	0	0	0	0	0	**1**	0	1
Unknown	1	0	1	0	0	0	**0**	2
Total	5	7	4	1	1	1	0	**19**
Kappa = 0,863					**p < 0,05**			

Figure 3. *Bowel obstruction due to sigmoid colonvolvulus: sigmoid colondilated with full gas (yellow arrow), whirlpool sign (red arrow), beak sign (white arrow).*

Figure 4.*Bowel obstruction due to intestinal duplication cysthemorrhage (white arrow: cyst wall, red arrow: bowel wall).*

4. DISCUSSION

4.1. General and clinical characteristics

Bowel obstruction is most common after age 40 with a rate of 89.4%. Our research has similarities with the authors in the world [9, 10, 11]. This can be explained that have a lot of causes of bowel obstruction, but the common causes usually meet in older patients: adhesion, neoplasm …

In our research, abdominal pain and distension have high rate and similar to many studies of other authors but other remaning signs have low rate [9, 10, 11, 12, 13, 14];this can be explained by the differences in the causes rates of bowel obstructions of our study group compared to other authors.

4.2. The role of x-ray and abdominal ultrasonography, indication of computed tomography in bowel obstruction

Surgeons recommended that erect abdominal radiograph is the diagnostic imaging technique should do first in all patients with suspect bowel obstruction [15]. However, in many several studies, this technique is less sensitivity and less specific for the diagnosis of bowel obstruction [3, 7, 16, 17, 18, 19].

Since ultrasound has become popular, it has helped a lot in the diagnosis of bowel obstruction, especially in diagnosing some of the causes of occlusion. However, ultrasound is limited by the bowel gas, which usually has in bowel obstruction [20, 21]. In addition,delay treatment ultrasound is a highly subjective technique and it is difficult to re-evaluate the accuracy of previous results as needed, as well as depending on the patient's cooperation.

CT indication in bowel obstruction is still present. On the part of clinicians, CT is recommended when clinical and radiological is unclear, or for suspected thrombotic obstruction [15]. However, on the part of radiologists, they recommended that CT should be widely

indication in patients with suspect bowel obstruction because of it has high sensitivity and specificity, and that the value of the X-ray is low and confusing in a large proportion of cases [22]; CT is considered to be the best technique to determine which patients should be delay treatment and who should under emegency surgery due to their early diagnosis of ischemic complications [23]. CT also can help build plan of surgical by reconstruction techniques.

4.3. Occlusion position and transition zone

The incidence of SBO / LBO in our study was 2.62, relatively low. In study of Ranjana Gupta et al. (2016) showed that the prevalence of SBO was 76.67% and that of LBO was 23.33%. The incidence was 3.55 [24]. According to the medicine literature of the world, the rate of SBO usually ranges between 80-90% and 4 to 5 times the colon [1].

In our research, the transition zoneinsmall bowelamost in jejunum - ileum, this is accordant because duodenal obstruction is rare.With large bowel, the transition zone usually at the sigmoid colon. This is explained that the most common cause of LBO is colon cancer, which usually at sigmoid and rectal, but rectal caliber is wide than sigmoid and sigmoid is long and movementable [25, 26]. Have 4 patients (8.5%) not found the transition zone, they are in the group of small-bowel obstruction, this shows the limits of non-invasive techniques, particularly techniques old survey.

4.4. Severe signs of bowel obstruction on computed tomography

Mesenteric fat stranding is a less specific sign, it commonly seen in inflammatory disease or abdominal neoplasm; In case of bowel obstruction if not caused by inflammation or neoplasm, mesenteric fat stranding may be seen due to increased mesenteric vein pressure, or mesenteric infarction and this sign contributes to the severity assessment of bowel wall ischemia [27]. Like mesenteric fat stranding, mesenteric fluid is a common sign in many causes. According to many reports, this sign is high sensitive but less specific for bowelischemia [28, 29, 30].

Decreased bowel-wall enhancementis considered the most specific sign of bowel ischemia[24]; according to many reports, this sign is low sensitive but nearly 100% specificity [27, 28, 30].

In case of bowel obstruction, bowel wall thickening but still preserves the structure is assessed as severe signs of bowel ischemia, and often accompanied decreased bowel-wall enhancement sign[27, 28, 30].It should be noted that this sign can also be seen in acute inflammatory bowel disease, but which is often accompanied increased bowel-wall enhancement sign and clinical symptoms of enteritis. Therefore, we need to consider carefully when evaluating this sign.In our research, only one patient has this sign.

Gas in bowel wall is a sign at the late stage of bowel obstruction, the bowel wall has actually been necrotic, the gas in the gastrointestinal tract enters the necrotic lining of the bowel wall and deposits there, patient status was quite serious. In our study, two patients (4.3%) had this sign, both of them underwent surgery and were assessed as severely with signs of bowel wall damage, they was indicationed CT late after had symptoms. According to a study by Yann Geffroy (2014), this marker has a specificity of 96% in the assessment of bowel infarction [28].

If cause of bowel obstruction is not removed, bowel wall may be punctured and gas can move into mesenteric vein, then move up to portal vein, or to peritoneal cavity, it can due to mesenteric infarction or pneumoperitoneum. In our study no case of this condition occurred.

4.5. Causes of bowel obstruction with computed tomography

In our research, the main causes of bowel obstruction is adhesion and neoplasm. This is similar to the study by Alec J. Megibow (1991) [31], the world's first study of the role of CT indiagnosis bowel obstruction.There were 4.3% of patients did not find a cause with CT despite careful evaluation with CT and clinical comparison, which showed the limitations of imaging techniques, and CT is a part of them.

In our research, there are some causes that Western authors' researchers often give to the rare group: bezoar and tuberculosis (identified by pathology). In particular, bowel obstruction due to bezoar accounted for 12.8%. This is explained by the fact that Vietnamese eating habits are somewhat different from those of other countries. There are many foods rich in fiber and latex such as ficus auriculata, ficus racemosa, bamboo shoots... and drink less. Vietnam is also a country where tuberculosis epidemics are prevalent. In our research, one case was diagnosed as bowel obstruction due to bowel tuberculosis (4.3%).

The leading cause of SBO is adhesion (38.3%) and LBO is neoplasm (69.2%). This is consistent with the medicine literature and research of other authors [1, 4, 24, 32].

Although research equipment is limited, it can be seen that the causes of bowel obstruction found on CT are varied. This represents the superiority of CT to ventricular radiography, with virtually cant diagnosis cause of bowel obstruction, except a few cases very particularlike Sigmoid volvulus with coffee-beans sign… [33]. Abdominal ultrasonography may also investigate the cause of bowel obstruction but requires that the ultrasonographer have good skills and requires doctorexamination meticulously. In the emergency setting, such as bowel obstruction, it is usually not allowed, and in the bowel obstruction, gas will limitultrasonography; On the other hand, abdominal ultrasound can not have a wide field of view such as CT.

4.6. Compared with surgery

In our research, we can see that CT is very high value in diagnosis bowel obstruction and its causes. According to many reports, CT has a sensitivity about 90-96%, a specificity about about 96%, and an accuracy about 95% in the diagnosis bowel obstruction [23]. Some studies also shown that CT has sensitivity or specificity to 100% [3, 7, 34].

5. CONCLUSION

CT is a technique that has many advantages in the diagnosis bowel obstruction, especially in diagnosis cause of bowel obstruction, which may not detected by clinical examination and other imaging techniques. CT is valuable in diagnostic complication of bowel obstruction, help clinicians have better manage and predict outcomes.

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