To explore the value of gastrointestinal contrast-enhanced ultrasonography in the diagnosis and treatment of peptic ulcer in children

Abstract

Background: With the development of follow-up diagnosis and treatment technology, the detection rate of peptic ulcer in children is getting higher and higher. Gastroscopy is the gold standard for the diagnosis of peptic ulcer, but gastroscopy is an invasive operation. Gastrointestinal contrast-enhanced ultrasonography has the advantages of painless, non-invasive, non-radiation, simple operation, safety and so on. The purpose of our study is to investigate the clinical value of contrast-enhanced ultrasonography in the diagnosis and treatment of peptic ulcer in children. Methods: Collect 43 children with digestive tract symptoms in our hospital from January 2021 to June 2022. All children were examined by routine ultrasound, gastrointestinal contrast-enhanced ultrasound and gastroscopy. Taking the pathological results of gastroscopy as the gold standard. Routine ultrasonography was performed before gastrointestinal contrast-enhanced ultrasonography. Conventional ultrasound can observe the thickness of gastroduodenal wall, the level of wall, gastric peristalsis and the adjacent organs and tissues around the abdominal cavity. Gastrointestinal contrast-enhanced ultrasound recorded the thickness of gastroduodenal wall, the size, location and echo shape of ulcer, gastric peristalsis and adjacent organs and tissues around the abdominal cavity. The results of routine ultrasound and gastrointestinal ultrasound were compared with those of gastroscopy. To evaluate the diagnostic results and coincidence rate of routine ultrasound and gastrointestinal contrast-enhanced ultrasonography. Results: Among the 43 cases, 17 cases were diagnosed as peptic ulcer by gastroscopy, 26 cases as non-peptic ulcer, 8 cases as peptic ulcer diagnosed by conventional ultrasound and 35 cases as non-peptic ulcer. The diagnostic coincidence rate of peptic ulcer in children was 79.1% (34pm 43). Gastrointestinal contrast-enhanced ultrasound diagnosed 15 cases of peptic ulcer and 28 cases of non-peptic ulcer. The diagnostic coincidence rate of peptic ulcer in children was 95.3% (41max 43). Conclusion: The diagnostic coincidence rate of gastrointestinal contrast-enhanced ultrasound is high, and it has high clinical value in the diagnosis of peptic ulcer diseases in children. It is a good supplement to gastroscopy and can be used as a preliminary screening method for peptic ulcer in children.

Keywords: Contrast-enhanced ultrasound; Peptic ulcer; Children; Gastrointestinal tract; Abdominal pain; Acoustic contrast agent

Introduction

Digestive system disease is a common and frequently-occurring disease in childhood, in which peptic ulcer is also more common in clinic. However, the clinical symptoms of peptic ulcer in children are not typical and lack of specific symptoms and signs in the early stage. And children can not accurately express the conscious symptoms or it is difficult to accurately describe the location and nature of the symptoms, resulting in peptic ulcer easily missed diagnosis or misdiagnosis. Gastroscopy can directly observe the gastric and duodenal mucosa and the degree of pathological changes, which is the
"gold standard" for the diagnosis of gastrointestinal diseases [1]. However, as gastroscopy is an invasive method, clinicians and parents have some concerns about whether children can tolerate the examination process and safety [2]. At present, with the improvement of ultrasonic image resolution and the continuous improvement and development of ultrasonic diagnostic technology, contrast-enhanced ultrasonography is safe, simple and non-invasive, which makes the acceptance of patients higher [3].

This paper makes a retrospective analysis of 43 children with digestive tract symptoms treated in our hospital from January 2021 to June 2022 to explore the clinical diagnostic value of routine ultrasound and gastrointestinal contrast-enhanced ultrasonography in children with peptic ulcer.

Materials and methods

1. General information  In this study, 43 children with gastrointestinal symptoms in our hospital from January 2021 to June 2022 were selected. All patients were examined by routine ultrasound, gastrointestinal contrast-enhanced ultrasound and gastroscopy. Eight patients with peptic ulcer were diagnosed by routine ultrasonography, The age was 8 to 15 years old, and the average age was (10.8±2.5) years old, including 8 males and 0 females. Fifteen patients with peptic ulcer were diagnosed by Gastrointestinal contrast-enhanced ultrasonography, The age was 8 to 15 years old, and the average age was (11.4±2.3) years old, including 13 males and 2 females. The above cases all had different degrees of upper gastrointestinal symptoms, such as epigastric fullness, nausea, vomiting, epigastric pain, some children showed periodic epigastric pain, empty abdominal pain or night pain, intermittent black stool, anemia and so on. The diagnosed children were compared with the results of gastroscopy.

2. Methods

2.1 The method of gastroscopy is based on 《Routine examination and operation of fiberoptic gastroscopy in children》 and 《Diagnostic criteria of gastroscopy for chronic peptic ulcer in children》 [4-5].

2.2 Use Philips's EPIQ7 color Doppler ultrasound diagnostic instrument, L12-5 linear array probe, frequency 5-12 MHz. You should eat a light diet for dinner the day before the inspection, and you should not eat food that is easy to produce gas and is not easy to digest. Generally fasting for 8 hours and drinking for more than 4 hours before examination. Choose contrast medium for stomach window of Hu Qingyu Hall in Hangzhou. Before taking the contrast medium, the contraindications such as gastrointestinal perforation, acute gastric dilatation and intestinal obstruction were eliminated by whole abdominal scan, and then the contrast medium which had been adjusted by boiling water was taken orally. At room temperature, add 35-45 degree boiled water about 150~200ml, pour the contrast medium into the cup, stir well, then add hot water greater than 90 degrees to
400~500ml, stir well and set aside. After cooling to a suitable temperature, instruct the child to drink. The dosage depends on the age of the child: 3 to 10 years old: 200~400 ml; 10 to 15 years old: 400~500ml.

2.3 Contrast-enhanced ultrasonography: All are operated by the same ultrasound physician on the same machine. Do not know the pathological results of the child before the examination. Mainly in sitting position, supine position and right supine position, a series of vertical and transverse and oblique scans were performed in the left middle and upper abdomen. There are mainly the following scanning sections: (1) The section of cardia and lower esophagus (figure A): The probe was placed obliquely under the left costal region near the xiphoid process and rotated to the left and rear to obtain the long-axis sonogram of the lower esophagus and cardia, and then the cross-exchange scan was performed to obtain the short-axis section and sonogram of the cardia and lower esophagus. (2) Gastric fundus section (figure B): the probe is tilted to the left quarter rib and rotated to the left, posterior and upper, with an angle range of 0-80 °. This section can show the fundus sonogram more completely. (3) The section of the gastric body (figure C): the long axis of the gastric body can be displayed when the probe is positioned longitudinally on the left upper abdomen, and the short axis of the gastric body can be displayed when the probe is moved horizontally on the left upper abdomen. (4) Gastric angle section (figure D): the probe is placed horizontally on the abdomen and scanned continuously around the umbilical cord to obtain a sonogram similar to the "double ring sign". The double-ring junction is the cross section of the gastric angle, the left ring is the gastric body, and the right ring is the gastric antrum. (5) Antrum section (figure E): the long axis of the probe is placed obliquely between the navel and the right upper abdomen, and the longest acoustic image of the gastric cavity is obtained by scanning at different angles, and then moving left and right or up and down in this direction, a complete image of the long axis of the gastric antrum can be obtained. with the position of the probe in the long axis section of the gastric antrum, the complete short axis image of the gastric antrum can be obtained by continuous cross scanning. (6) Gastric coronal oblique section (figure F): the probe is placed obliquely between the periumbilical region and the left upper abdomen, and a continuous lateral scan to the right front can show a clear gastric coronal oblique section.(7) Duodenal section (figure G): the probe is longitudinally placed in the right upper abdomen, its upper end rotates 60 °to the right and 30 °to the left, and the lower end of the probe is relatively fixed. A more complete duodenal sonogram can be obtained in this range. Observe the duodenal bulb, the descending part of the duodenum, the horizontal part of the duodenum and the ascending part of the duodenum.
2.4 Typical contrast-enhanced ultrasonographic findings of peptic ulcer: Local thickening of the gastric wall, interruption and depression of the gastric mucosa at the bottom of the ulcer. The diameter is about 5-10mm, the shape is complete, the edge is symmetrical and slightly raised, and it is like a crater. The thickened gastric wall at the base of the depression and around it showed low echo, the concave surface of the mucous membrane was flat or speckled high echo, and the local peristalsis of the gastric wall weakened or disappeared. Duodenal bulbar ulcer showed localized thickening of intestinal wall, deformed bulb, poor fluid filling, localized depression on the surface of duodenal bulbar ulcer with a diameter of about 5-10mm, and strong echo spots on the surface [6].

Figure H and J is the contrast-enhanced sonogram of duodenal ulcer. The shape of the duodenal bulb is irregular and the area is small. Hyperechoic plaques can be seen in the anterior wall of the duodenum. The local wall shows hypoechoic thickening, and the mucosal folds of the bulbar wall are slightly thickened. Figure I and K is the corresponding gastroscopic image, showing an ulcer on the anterior wall of the duodenal bulb, covered with thick yellow and white moss, easy to bleed, hyperemia and edema of the surrounding mucosa.

3. Statistical analysis
Using SPSS16.0 statistical software, the counting data (diagnostic results, coincidence rate, diagnostic accuracy) were tested by chi-square (X2) and expressed as percentage (%). The two groups of data were in the range of P value (P < 0.05) indicates statistical difference.

Results
A total of 43 children were included in the criteria, 17 cases of peptic ulcer and 26 cases of non-peptic ulcer were diagnosed by gastroscopy. Among them, 15 children with peptic ulcer were male and 2 female, 15 children were positive for Hp antibody and had different degrees of abdominal pain. Hemoglobin decreased in varying degrees in laboratory examination. Hemoglobin 51~105g/L, average (82.1 ±13.8g / L).
Routine ultrasound diagnosed 8 cases of peptic ulcer, 35 cases of non-peptic ulcer and 9 cases of missed diagnosis. The results compared with gastroscopy are shown in Table
Gastrointestinal contrast-enhanced ultrasound diagnosed 15 cases of peptic ulcer, 28 cases of non-peptic ulcer and 2 cases of missed diagnosis. The results compared with gastroscopy are shown in Table 2.

Table 1 comparison of the results of routine ultrasound and gastroscopy

<table>
<thead>
<tr>
<th>Method (%)</th>
<th>Total</th>
<th>X2</th>
<th>p</th>
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<td></td>
<td>routine ultrasound</td>
<td>gastroscopy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8(18.60)</td>
<td>17(39.53)</td>
<td>25(29.07)</td>
</tr>
<tr>
<td>Group</td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>43</td>
<td>86</td>
</tr>
</tbody>
</table>

* p<0.05 ** p<0.01

It can be seen from the above table that there is a significant difference between the results of conventional ultrasound and gastroscopy (X2=4.568, p=0.033<0.05). The percentage difference shows that the positive rate of gastroscopy is 39.53%, which is significantly higher than that of conventional ultrasound (18.60%). In summary, there is a significant difference between conventional ultrasound and gastroscope, indicating that the result of gastroscopy is better than that of conventional ultrasound.

Table 2 comparison of the results of gastrointestinal contrast-enhanced ultrasound and gastroscopy

<table>
<thead>
<tr>
<th>Method (%)</th>
<th>Total</th>
<th>X2</th>
<th>p</th>
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<tr>
<td></td>
<td>Gastrointestinal contrast-enhanced ultrasound</td>
<td>gastroscopy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15(34.88)</td>
<td>17(39.53)</td>
<td>32(37.21)</td>
</tr>
<tr>
<td>Group</td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>43</td>
<td>86</td>
</tr>
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</table>

* p<0.05 ** p<0.01

From the above table, there is no significant difference between the results of gastrointestinal contrast-enhanced ultrasound and gastroscopy (p > 0.05). Through the percentage difference, we can see that the results of gastrointestinal contrast-enhanced ultrasound and gastroscopy are consistent and there is no difference. In summary, there is no significant difference between gastroscope and contrast-enhanced ultrasound, indicating that the coincidence rate of gastrointestinal contrast-enhanced ultrasound and gastroscope is high.

Discussion

Peptic ulcer (peptic ulcer, PU) mainly refers to the chronic ulcer in the stomach and duodenum. It is a common disease in adults, mainly caused by the erosion of gastrointestinal mucosa by gastric acid and pepsin. In the past, it was considered that PU was rare in children, but with the development of diagnosis and treatment technology, the diagnosis rate of PU increased continuously. Domestic investigation showed that the detection rate of PU in children was 7% [7], and the incidence rate of school-age children was the highest[8]. Peptic ulcer in children is caused by many factors. The common cause is Hp infection. Hp is infectious. Oral and fecal
transmission is the main route of transmission. Hp infection is mainly obtained in childhood, and adults can transmit Hp to children. Li Xingchuan and other investigations show that the total infection rate of Hp among children and adolescents in China is 29% [9]. In this study, the number of children with Hp infection is as high as 88% (15 beat 17). Foreign studies have also shown that the prevalence of Helicobacter pylori and peptic ulcer is very high in symptomatic children. To this end, it is essential to develop a plan for early detection of Helicobacter pylori to reduce the risk of peptic ulcer[10].

In this study, there are more males than females in children with peptic ulcer, which is consistent with the study of he Yun [11]. Possible reasons: 1. the level of estrogen in girls is higher, estrogen can inhibit the secretion of gastric juice and duodenal intestinal juice, and reduce the activity of pepsin, so as to protect gastrointestinal mucosa [12] and reduce the occurrence of ulcer. 2. Adolescent boys have a large amount of exercise, eat a large amount of food and eat fast, which leads to excessive and rapid secretion of gastric acid, which in turn destroys the duodenal mucosal barrier and increases the occurrence of ulcer [13].

The clinical symptoms of peptic ulcer in children vary with age. Studies have shown that younger people may be irritable, poor feeding, gastroesophageal reflux, no significant weight gain, and older patients may be characterized by abdominal pain, flatulence, hematemia and black stool [14]. In this study, all children have varying degrees of abdominal pain, because most children can not accurately describe the degree, location and duration of abdominal pain, it is easy to miss diagnosis, misdiagnosis, resulting in delayed treatment, seriously affecting the health of children. Moreover, the proportion of perforation, massive hemorrhage, severe anemia and other serious complications of peptic ulcer in children is higher [15]. In our research all children with peptic ulcer have anemia, and other studies[16] have also shown that iron deficiency anemia can be used as the first symptom of peptic ulcer in children.

At present, the results of gastroscopy are used as the gold standard for the diagnosis of peptic ulcer in children. However, gastroscopy is an invasive examination method, and the anatomical structure of upper digestive tract in children is different from that in adults. Children's gastrointestinal tract is narrow and difficult to operate, gastrointestinal wall is thin and easy to perforate, and it is difficult to cooperate. The risk of operation is significantly higher than that of adults [17]. Children do not cooperate well with ordinary gastroscopy, even painless electronic gastroscopy may have adverse reactions such as hypotension, myocardial ischemia, drug allergy, arrhythmia and so on [18]. Therefore, ultrasound as a safe, simple, non-invasive and rapid examination method for screening peptic ulcer in children is particularly important.

A total of 43 children were included in this study, 17 cases of peptic ulcer were diagnosed by gastroscopy, all of them were duodenal ulcer, 8 cases were diagnosed by routine ultrasound, the diagnostic accuracy was 47.1% (8/17), and the coincidence rate was 79.1% (34/43). Ultrasonography showed thickening of the local intestinal wall of the duodenum, decreased echo, stiffness and decreased peristalsis. 15 cases were diagnosed by gastrointestinal contrast-enhanced ultrasonography, the diagnostic
accuracy was 88.2% (15/17), and the coincidence rate was 95.3% (41/43). Ultrasound showed that the shape of duodenal bulb was irregular, the area was small, the local intestinal wall showed hypoechoic thickening, the mucosal folds of the duodenal wall thickened, the ulcer surface had local depression, and strong echo spots could be seen on the surface. Gastrointestinal contrast-enhanced ultrasonography missed diagnosis in 2 cases, which may be due to the fact that the ulcer area of two children with missed diagnosis was smaller, and the gastric and duodenal ulcer in children was more difficult to display than that in adults [19]. The lesion is small, with a diameter of 3 ~ 4 mm, and the ulcer is superficial, the bottom is smooth, and the thickening of the gastric wall around the ulcer is not obvious, so it is easy to miss diagnosis. The occurrence of these missed cases shows the limitations of contrast-enhanced ultrasound. It is less sensitive to small and superficial upper digestive tract ulcers and requires high operation techniques.

However, compared with gastroscopy, contrast-enhanced ultrasound has certain advantages in compliance, repeatability, incidence of complications and tolerance in children. The limitations of this study: few cases were selected, only the examination results and coincidence rate were analyzed, and the correlation between the size, location, age, weight and diagnostic accuracy of ulcer was not deeply studied. at the same time, the children with peptic ulcer were not reexamined to evaluate the clinical treatment effect and supervise the recurrence.

To sum up, gastrointestinal contrast-enhanced ultrasonography in children has a high accuracy, which provides pediatricians with a new and simple method for screening upper gastrointestinal diseases in children, which is easily accepted by children and parents, and is an effective supplement to gastroscopy. For children with recurrent abdominal pain and other upper gastrointestinal symptoms with unknown etiology, gastrointestinal contrast-enhanced ultrasonography should be performed in time to provide reference for clinical selection of appropriate treatment.

References


