The value of spiral CT and image reconstruction technique in intestinal obstruction diagnosis

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Abstract: The purpose of this study is to investigate the effect of intestinal obstruction diagnosis by CT combined image reconstruction technique. 65 patients were collected and diagnosed by 64-slice spiral CT and image reconstruction technique. The advantage of spiral CT combined image reconstruction technique was analyzed by comparing the spiral CT images and classifying five levels based on intestinal obstruction disease grade. The results indicated that sensitiveness with CT alone was 88% and the spiral CT combined image reconstruction was 89%. Specificity with CT alone was 87% and the spiral CT combined image reconstruction was 90%.The level Ⅰ intestinal obstruction was 0 with either CT alone or the spiral CT combined image reconstruction. However, for the level Ⅱ it was 6 and 0 respectively; the level Ⅲ was 8 and 3; the level Ⅳ intestinal obstruction was 10 and 8; the level Ⅴ intestinal obstruction was 41 and 54. In conclusion, the spiral CT combined image reconstruction is better than spiral CT alone in diagnosis of intestinal obstruction, since the latter is capable of showing the location, types and pathogeny of intestinal obstruction.

1. Introduction

Intestinal obstruction is a common surgical emergency, which demands an early diagnosis because of its serious nature [1, 2]. Plain abdominal radiography remains the first step in diagnostic imaging evaluation of the intestinal obstruction. However, the diagnosis accuracy of plain radiographs alone is low [3-5]. Therefore, the spiral CT has become an important method to diagnose the intestinal obstruction. However, the spiral CT is not perfect in diagnosis of accurate intestinal obstruction, because it has only 81% accuracy by CT alone [6]. The spiral CT combined image reconstruction is a new technique, which can enhance the ability of diagnosing the intestinal obstruction. In this study, the purpose is to find out the usage of the spiral CT combined image reconstruction.

2. Materials and methods

2.1 Ethics statement

This study received ethical approval from the Ethics Committee of the People's Hospital of Yucheng city, Shandong, China. The possible adverse effects of exposure and the complications were explained to all patients. Written informed consent was obtained from each patient to participate in this study.

2.2 Clinical data

65 intestinal obstruction patients were involved in this study, including 42 male and 23 female with age ranging from 29 to 78. Exclusion criteria were a history of abdominal distention, visible intestinal peristalsis, hyperactive bowel sounds, intestinal gurgling sound disappeared, abdominal tenderness and rebounding pain. 55 intestinal obstruction patients were confirmed by surgery and 10 intestinal obstruction patients were confirmed by gastrointestinal decompression.

2.3 Operation of spiral CT and evaluation of image quality

Firstly, patients were given the total abdominal volume scanning with breath-holding by the 64-slice spiral CT (Light-speed 64, GE Medical Systems), with scanning scope from diaphragmatic dome to synchondroses pubis. Common scanning and enhancement scanning were performed with a gantry

rotation time of 350 ms and tube voltage of 120 kVp. The spiral CT image was performed twice: one was 5 mm section thickness and 5 mm section interval, and another was used for image reconstruction with 0.625 mm section thickness and 0.625 mm section interval. Two senior radiologists performed the evaluation. There were 5 levels for evaluation. Level Ⅰ: there was no intestinal obstruction; Level Ⅱ: there might be no intestinal obstruction; Level Ⅲ: not sure there was intestinal obstruction; Level Ⅳ: there might be intestinal obstruction; Level Ⅴ: there was intestinal obstruction.

3. Results

The same results of spiral CT and spiral CT combined image reconstruction were 63 patients showing the intestinal obstruction position, 34 patients showing bowel wall thickening, 65 patients showing Intestinal pneumatosis, 20 patients showing ascites, 21 patients showing reduced enhancement of the bowel wall.

The same imaging features of spiral CT and spiral CT combined image reconstruction were 63 patients showing bowel dilatation, 14 patients showing concentric circle sign, 50 patients showing air fluid level, 23 patients showing transitional zone, 25 patients showing cord sign, 13 patients showing whirl sign, 10 patients showing fecal sign. However, the spiral CT combined image reconstruction could show the image features directly, while for CT alone the diagnosis should consider the upper and lower level.

Sensitiveness with CT alone was 88% and the spiral CT combined image reconstruction was 89%. Specificity with CT alone was 87% and the spiral CT combined image reconstruction was 90%. Both the sensitiveness and specificity showed no statistical differences between the CT alone and the spiral CT combined image reconstruction.

The level Ⅰ intestinal obstruction was 0 with either CT alone or the spiral CT combined image reconstruction. The level Ⅱ intestinal obstruction was 6 and 0 with CT alone and the spiral CT combined image reconstruction respectively. The level Ⅲ intestinal obstruction was 8 and 3 with CT alone and the spiral CT combined image reconstruction respectively. The level Ⅳ intestinal obstruction was 10 and 8 with CT alone and the spiral

CT combined image reconstruction respectively. The level Ⅴ intestinal obstruction was 41 and 54 with CT alone and the spiral CT combined image reconstruction respectively ($P<0.01$).

4. Discussion

The X-ray plain abdominal radiograph was common to examine the intestinal obstruction but CT has a better view to determine the location, types and pathogeny than plain abdominal radiograph. CT has an ability to show the morphology of enteric cavity and intestinal wall, which is observed by plain abdominal radiograph. Besides, CT is capable of avoiding the tissues overlapping to determine the location of disease more precisely [7, 8]. However, CT is short of the ability to tell the small local disease focus, especially the three dimensional space of the intestinal obstruction.

64-slice spiral CT has higher scanning speed (0.5s) and resolution thinner layer image (0.5mm) compared with traditional CT. Therefore, it can acquire a thinner layer image without sacrificing the scanning scope and can reduce the respiratory artifact effect. Spiral CT has an ability to acquire the isotropic imaging and to diagnose digestive system diseases through transect section, coronal section and vertical plane section images to broaden the scope of diagnosis in digestive system to improve the sensitiveness [9]. If combined the image reconstruction, the 64-slice spiral CT could diagnose the digestive system diseases, especially the intestinal obstruction. Therefore, it can show the disease vividly and specific and show adjacent tissues around the intestinal obstruction, helping to determine the cause of disease. Spiral CT combined image reconstruction could analyze the morphology and features inside the obstruction directly to make diagnosis in time [10].

However, some study showed that the in diagnosis of secondary disease, spiral CT combined image reconstruction has no advantages comparing the spiral CT alone, especially the bowel wall thickening, the dilated bowel and abdominal dropsy [9, 11].

Therefore, the spiral CT combined image reconstruction had some advantages over spiral CT alone in diagnosis of intestinal obstruction, because it can show the location, types and pathogeny of intestinal obstruction.

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