Application of CT angiography in diagnosis of gastrointestinal hemorrhage after abdominal surgery

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Introduction. To evaluate the value of CT angiography in the diagnosis of gastrointestinal hemorrhage after abdominal surgery.

Methods. From January 2022 to January 2023, the clinical data of 100 patients with gastrointestinal hemorrhage after abdominal surgery were retrospectively analyzed. According to the treatment methods, the patients were divided into conventional treatment group and CT vascular 3D imaging group, 50 cases in each group. Patients in the conventional treatment group received interventional therapy after the conventional treatment failed, and patients in the CT vascular 3D imaging group received CT vascular 3D imaging diagnosis. The hemostatic efficiency, fecal occult blood test results, red blood cell infusion volume, hemostatic time, occult blood conversion time and hospital stay were compared between the two groups.

Results. The hemostatic effective rate of CT vascular three-dimensional imaging group was higher than that of conventional treatment group, the difference was statistically significant ($P<0.05$). After interventional treatment, the positive rate of fecal occult blood test was decreased in both groups, and the CT vascular three-dimensional imaging group was lower than the conventional treatment group, the difference was statistically significant ($P<0.05$). The amount of red blood cell transfusion in CT vascular 3D imaging group was less than that in conventional treatment group, and the time of hemostasis, the time of occult blood

conversion and the length of hospital stay were shorter than that in conventional treatment group, the differences were statistically significant (P<0.05).

Conclusion. CT three-dimensional vascular imaging diagnosis and interventional therapy in acute gastrointestinal massive hemorrhage is effective, can improve the hemostatic efficiency, reduce the positive rate of fecal occult blood test, shorten the hemostatic time, occult blood conversion time and hospital stay, worthy of clinical application.

Keywords. CT vascular three-dimensional imaging; Abdominal surgery; Massive bleeding of digestive tract; diagnosis.

INTRODUCTION

Laparoscopic gastrointestinal hemorrhage is a common serious complication in the abdominal cavity, with rapid development, severe condition and high mortality [1]. Common symptoms include: (1) decreased blood pressure, irritability, and confusion; (2) Abdominal pain and vomiting; (3) Hematemesis and melena; (4) Turning blue or cyanosis in the face. Due to the lack of complete and accurate anatomical data, there is still a lack of effective clinical diagnosis and treatment. Conventional X-ray photography is ignored due to its own limitations and cannot obtain accurate anatomical information [2]. Clinically, the common gastrointestinal bleeding in clinic is generally confirmed by clinical symptoms, physical examination, auxiliary examination, X-ray plain film and other examinations. However, the above methods have their own limitations, which cannot provide accurate anatomical structure and complete and accurate diagnostic results [3]. In recent years, the application of CT angiography (CTA) in gastrointestinal bleeding after abdominal surgery has attracted more and more attention. This project plans to collect 100 cases of acute gastrointestinal bleeding admitted to our hospital from January 2022 to January 2023, and explore the role of CT vascular three-dimensional imaging in the diagnosis of gastrointestinal bleeding after abdominal surgery combined with CTA technology, so as to provide new ideas and methods for clinical diagnosis and treatment.

MATERIALS AND METHODS

1.1 General Information

From January 2022 to January 2023, 100 patients with massive gastrointestinal bleeding who underwent abdominal surgery in our hospital were retrospectively analyzed, including 60 males and 40 females, aged from 23 to 81 years, with an average age of (47.5±13.4) years. Sixty-five patients (76.0%) had symptoms of massive gastrointestinal bleeding, which were misdiagnosed as biliary stones, gallbladder cancer, liver cancer and other diseases before operation. All patients were confirmed by surgical pathology.

1.2 Inclusion and exclusion criteria

Inclusion criteria: ① consistent with the clinical diagnosis of acute gastrointestinal bleeding; ② bleeding more than 1000 ml in a short time; ③ Clinical manifestations included hematemesis, bloody stool, sweating and fatigue. ④ Fecal occult blood, gastric juice, vomit and fecal occult blood were all positive.

Exclusion criteria: ① Taking antacid drugs within one week; ② Use of a hemostatic agent within the last day; ③ contraindications to coronary angiography; ④ patients with contraindications to surgery.

1.3 Methods

The patients in the conventional treatment group were treated with conventional treatment, and the patients in the CT angiography group were treated with CT angiography.

After admission, patients should be given symptomatic treatment, routine fasting, drug hemostasis, transfusion (such as plasma: concentrated red blood cells 100mL:1U,

fibrinogen level and platelet count should be between 1.5g/L and 75×109/L before transfusion, and given large volume resuscitation, use of blood bioactive drugs, proton pump inhibitors, etc.).

Three-dimensional CT angiography group. Dual-plane CT scanning technique was used. Scanning parameters: tube voltage 120kV, tube current 100mA, pitch 1.2. Non-ionic iodinated contrast agent (UVX) was used as contrast agent at a dose of 60-80 μg/kg. The scanning parameters were adjusted according to the patient's age and lesion characteristics. After scanning, the images were uploaded to the HIS system and PACS system of the hospital for data analysis and three-dimensional reconstruction. All the patients underwent angiography. All patients underwent CTA examination, including plain scan and enhanced scan. The plain scan was performed by spiral CT with scanning parameters of 120kv, 90mA, slice thickness of 5mm, and interval of 5mm. Iohexol (50mL/s) 100-150 μg/mL was injected via the antecubital vein with a high pressure syringe, and the delay time was 60-90s. The contrast agent was iopromide injection (1mg/ml) 200-300 ml, which was infused through the elbow vein at a rate of 250mL/h.

1.4 Observation indicators and effect evaluation criteria

Both groups were followed up for 1 month. ① Compared with the conventional treatment group and the CT three-dimensional imaging group, the total hemostasis rate of the two groups was observed. ② The amount of red blood cell transfusion, hemostasis time, occult blood negative conversion, and average hospitalization days of the two groups were observed.

1.5 Statistical methods

The SPSS21.0 statistical analysis program was used for big data analysis. The calculated data were expressed as "x±s", the calculated data were expressed as t test, the comparative calculated data were expressed as percentage (%), and the

comparison was performed by c2 test. P value <0.05 was considered as significant difference.

2 RESULTS

2.1 Comparison of hemostatic efficiency between the two groups

Compared with the conventional treatment group, the total effective rate of hemostasis in the three-dimensional CT angiography group was 92.0% (46/50) and 72.0%(36/50), respectively, with significant difference ($\chi 2=12.830$,$P<0.05$).

2.2 Comparison of red blood cell transfusion volume, hemostasis time, occult blood clearance time and hospitalization time between the two groups

Three-dimensional CT angiography reduced venous blood flow, hemostasis time, occult blood conversion, and length of hospital stay (P<0.05, Table 1).

Table 1 Comparison of red blood cell transfusion volume, hemostasis time, occult blood clearance time and length of hospital stay between the two groups（x±s）

Groups	Red blood cell transfusion (U)	Hemostasis time (h)	Occult blood clearance time (d)	Length of stay (d)
Three-dimensional CT angiography group (n=50)	4.1±1.3	6.7±1.5	2.7±0.8	10.7±1.6
Conventional treatment group (n=50)	7.2±1.2	19.6±3.2	4.4±1.3	15.8±2.2
t	4.312	6.978	3.186	4.539
P	<0.05	<0.05	<0.05	<0.05

CTA findings: All the 50 patients underwent gastrointestinal surgery, including 20 cases of gastrointestinal bleeding after subtotal gastrectomy, 13 cases of gastrointestinal bleeding after subtotal gastrectomy, 10 cases of gastrointestinal bleeding after subtotal gastrectomy, and 3 cases of gastrointestinal bleeding after

radical gastrectomy. In this group of 50 patients, the gastroduodenal artery of 9 patients showed different degrees of enhancement, of which 4 patients showed cystic enhancement at the beginning of the left gastroduodenal artery, and the other 5 patients showed isodensity enhancement at the beginning of the right branch of the gastric portal vein. In addition, there were abnormal density differences between the gastroduodenal artery and the gastric antrum, splenic hilum, splenic artery and abdominal aorta in 22 patients with gastrointestinal hemorrhage after subtotal gastrectomy, and 11 of them had abnormal density differences between the gastroduodenal artery and the left and right gastric branches. CT angiography showed that 6 of 50 patients had abnormal density difference between gastroduodenal artery and gastric antral vein, and the remaining 44 patients had massive gastrointestinal bleeding after gastrointestinal surgery.

2.3 Density difference between gastroduodenal artery and antral vein

Clinically, there is no clear diagnostic criteria for the abnormal density difference between the gastroduodenal artery and the gastric antral vein, but according to clinical experience, this density difference should be caused by the obstruction of the gastric antral vein. The antral vein is a part of the stomach, and its position in the gastric cavity is in the middle of the upper abdomen. Under normal conditions, the density difference between the gastroduodenal artery and the antral vein should be uniform. There are also some special cases in clinical practice, for example, in patients with massive gastrointestinal bleeding after partial subtotal gastrectomy, there is an abnormal density difference between the gastroduodenal artery and the gastric antral vein. The main reason for this situation may be that the gastroduodenal artery is cut off during radical gastrectomy, which leads to an Angle between it and the antral vein, resulting in a significant increase in the density difference between the gastroduodenal artery and the antral vein. For patients with abnormal density difference between gastroduodenal artery and gastric antral vein, interventional therapy is generally used to improve the low-density area in the patient's body. However, interventional therapy

cannot directly repair low-density areas, so for patients, abnormal density difference will bring a series of complications to patients. Therefore, for patients with abnormal density difference, relevant treatment and nursing measures should be actively carried out after operation. Therefore, CT three-dimensional imaging technology is of great significance in the application of massive gastrointestinal bleeding after abdominal surgery.

2.4 Abnormal density difference between gastroduodenal artery and gastric portal vein

The abnormal density difference between the gastroduodenal artery and the gastric antral vein is mainly due to the retrograde flow of blood in the gastric antrum into the gastric antral vein, which leads to the increase of the density difference between the gastric antral vein and the gastroduodenal artery. For patients with gastric cancer, gastric varices can lead to increased pressure in the antrum, splenic hilum and abdominal aorta, which leads to abnormal density difference between the gastroduodenal artery and the gastric portal vein. Because of the large abnormal density difference between the gastroduodenal artery and the gastric portal vein, when a patient has major gastrointestinal bleeding, there will be a large amount of blood loss in a short period of time, leading to a decrease in blood pressure. When the patient's blood pressure drops too fast, it will cause systemic shock symptoms. And when the patient's blood pressure is too low, there will be a loss of consciousness, coma and other shock symptoms. Therefore, the abnormal density difference between the gastroduodenal artery and the gastric portal vein poses a serious threat to the life and health of patients. Especially for patients with gastric cancer, hepatic insufficiency, liver transplantation and cholecystectomy, the abnormal density difference between gastroduodenal artery and gastric portal vein will seriously threaten the life and health of patients after massive gastrointestinal hemorrhage.

2.5 Vascular imaging of other organs

There is an abnormal density difference between the gastroduodenal artery and the left and right branches of the stomach, which is fully reflected in patients with massive gastrointestinal bleeding after subtotal gastrectomy. In addition, there were abnormal density differences among the gastric antrum, splenic hilum and splenic artery, and these abnormal density differences could be consistent with the abnormal density differences between the gastroduodenal artery and the antral vein. Among them, the abnormal density difference among gastric antrum, splenic hilum and splenic artery is manifested in patients with gastrointestinal hemorrhage after subtotal gastrectomy: there is an abnormal density difference between the left splenic artery and the gastric antrum vein, and there is an abnormal density difference between the right splenic artery and the gastric antrum vein. In addition, some patients have an abnormal density difference between the gastroduodenal artery and the antral vein.

3 DISCUSSION

Massive gastrointestinal hemorrhage after abdominal surgery is a serious complication with high mortality, and early diagnosis can significantly reduce mortality [4]. CT angiography technology can perform three-dimensional reconstruction of blood vessels in vivo, and through the observation of three-dimensional reconstruction images of blood vessels, the bleeding site, bleeding volume, bleeding nature and vascular source of bleeding and other related information can be analyzed, so as to make an accurate diagnosis of HSSD and provide a basis for clinical treatment. The occurrence of massive gastrointestinal hemorrhage after abdominal surgery is mostly intra-abdominal hemorrhage, which has acute onset, rapid progress, often accompanied by hemorrhagic shock, and high mortality. If effective measures are not taken in time for clinical treatment, serious life risks will occur [5][6]. With the continuous development of CT technology, CT angiography

technology is also constantly evolving. CTA can clearly show the vascular distribution and lesions in the gastrointestinal tract, which can provide more intuitive diagnostic basis for clinicians, and has been widely used in clinical practice [7]. However, a certain radiation dose may occur in the process of CTA examination, which will cause certain damage to the human body. Therefore, higher requirements have been put forward for CTA examination in clinical practice [8].

The incidence of massive gastrointestinal hemorrhage after abdominal surgery is about 1.5%-6.5%, and the mortality rate is as high as 40%-70%, which has a serious impact on the quality of life and prognosis of patients [9]. At present, the clinical diagnosis of massive gastrointestinal hemorrhage after abdominal surgery mainly depends on clinical manifestations, auxiliary examination and X-ray plain film examination. These methods have certain limitations and cannot provide comprehensive and accurate anatomical information, so it is difficult to provide comprehensive and accurate diagnostic basis for clinical practice [10]. With the development of CT technology, CTA, as a new examination method, has been gradually recognized in massive gastrointestinal bleeding after abdominal surgery [11].

CTA can detect the stenosis or occlusion of portal vein, splenic vein and other parts before operation, and can accurately locate and measure them, which provides the basis for subsequent surgical treatment. CTA can accurately display the stenosis or occlusion of portal vein, splenic vein and other parts, and can accurately measure the intraluminal diameter, intraluminal thrombosis and embolism range, so as to provide help for the diagnosis of postoperative massive gastrointestinal bleeding. Preoperative and postoperative gastrointestinal bleeding and portal hypertension can also be measured. Therefore, CTA has a high diagnostic value in the diagnosis of massive gastrointestinal bleeding after abdominal surgery, and can provide comprehensive, accurate and timely information for the clinic.

Patients with acute gastrointestinal hemorrhage have large blood loss and rapid progression, which can easily cause multiple organ dysfunction and hemodynamic

disorders [12]. At the same time, in the case of massive bleeding, blood components such as coagulation factors and red blood cells in plasma will be lost in large quantities, therefore, platelets, plasma, etc. must be repeatedly infused into the patient's body, which leads to some waste of blood resources.

Our study showed that the hemostatic effect of CT angiography was significantly better than that of traditional methods ($P<0.05$). The red blood cell transfusion volume, hemostasis time, occult blood clearance time and hospital stay were significantly reduced in the CT angiography group ($P<0.05$). This is because the traditional treatment, trauma is relatively large, the effect is slow, the effect is not ideal, and can not be guaranteed. If the patient has cardiopulmonary insufficiency, or even shock, there is also a great risk, even if the infusion is given.

In conclusion, CT vascular three-dimensional imaging examination has obvious therapeutic effect on gastrointestinal bleeding after abdominal surgery, can significantly improve the effective rate of hemostasis, shorten the time of hemostasis, shorten the time of bleeding, shorten the hospital stay of patients, is a method worthy of clinical promotion.

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