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Application and Prospect of 3D Laparoscopic Technique in the Treatment of Hepatic Echinococcosis

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Abstract: ***Hepatic echinococcosis is a common zoonosis caused by the invasion of echinococcosis into the liver in pastoral areas. It is divided into unilocular echinococcosis and alveolar echinococcosis. At present, surgical treatment is the most effective development for radical treatment of hepatic echinococcosis. With the continuous development of minimally invasive surgery, laparoscopic surgery has become the mainstream method for radical treatment of hepatic echinococcosis. However, 2D laparoscopy has the problems of loss of stereoscopic vision and weakened perception of surgeons, which prolongs the operation time and increases the difficulty of operation and the possibility of postoperative complications. In recent years, surgeons have tried to solve these problems by combining 3D phenomenological techniques with laparoscopic surgery. This article reviews the application of 3D laparoscopy in the treatment of hepatic echinococcosis and discusses its future development.***

Keywords: 2D laparoscopic; 3D laparoscopic; Hepatic echinococcosis; Development.

1. Introduction

Hepatic echinococcosis, also known as hepatic echinococcosis, mainly includes two types: cystic echinococcosis and alveolar echinococcosis. China is mainly prevalent in the western region, especially in some parts of the Qinghai-Tibet Plateau, the prevalence rate is as high as 6 %, the mortality rate of patients with alveolar echinococcosis is as high as 90 % in 10-15 years, and the mortality rate of cystic echinococcosis is 2 % -4 % [1]. According to WHO statistics, the annual incidence of cystic echinococcosis in the world is (1 ~ 200) / 100,000, and the incidence of alveolar echinococcosis is (0.03 ~ 1.2) / 100,000 [2]. At present, with the development of minimally invasive surgery, laparoscopic treatment has gradually become a common method for radical resection of hepatic echinococcosis. However, due to the lack of layering in traditional 2D laparoscopy, the operator 's perception of the operating distance is weakened, and the stereo vision is lost, thereby increasing the difficulty of operation, prolonging the operation time, and increasing the risk of postoperative complications. In recent years, with the advent of 3D imaging technology, surgeons have combined 3D technology with laparoscopic surgery to make up for the shortcomings of traditional laparoscopic surgery. Therefore, the progress and possible future development of 3D laparoscopic technology in the treatment of hepatic echinococcosis are reviewed as follows:

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2. Basic Overview of Laparoscopic Treatment of Hepatic Echinococco

At present, with the development of minimally invasive surgery, abdominal endoscopic surgery has gradually become the mainstream in the field of abdominal surgery. In the 1980 s, after the completion of the first laparoscopic cholecystectomy [3], Professor Xun Zuwu, a famous surgeon in China, completed the first laparoscopic cholecystectomy in China in 1991 [4]. After years of clinical experience, China 's laparoscopic technology has gradually matured. Similarly, in the surgical treatment of hepatic hydatid disease with obvious local characteristics, laparoscopy has gradually developed into the main treatment.

In recent years, the development of laparoscopy in the treatment of hepatic echinococcosis is mainly divided into partial hepatectomy, complete cystectomy of the external capsule, subtotal cystectomy of the external capsule, and traditional internal capsule excision. Each has its own advantages. For example, Tan Qin [5] et al. found that the operation time and intraoperative blood loss of patients undergoing anatomical hepatectomy were significantly higher than those of patients undergoing external capsule complete cystectomy and internal capsule excision in the study of the efficacy of different laparoscopic procedures for the treatment of hepatic echinococcosis. The complications such as bile leakage, residual cavity effusion and residual cavity infection in patients undergoing anatomical hepatectomy were better than those in the other two groups. Such studies have been supported by a large number of literatures. It can be seen that different laparoscopic surgical methods have many harsh applicable conditions and problems to be solved in the treatment of hepatic echinococcosis. However, in general, laparoscopy has an undeniable advantage over traditional open surgery in the treatment of hepatic echinococcosis. Clinical studies conducted by Zhang Jie [6] and other scholars have found that laparoscopic surgery has the characteristics of rapid recovery and high safety performance. They verified that laparoscopy has the advantages of short operation time, less bleeding and rapid recovery of gastrointestinal function compared with open surgery through randomized controlled methods. The comparison of the clinical efficacy of laparoscopic and open surgery has proved the feasibility and safety of laparoscopic surgery for the treatment of hepatic echinococcosis. After years of clinical experience and a large number of clinical trials, laparoscopic surgery has considerable advantages over traditional open surgery. However, as Tan Qin [5] and other studies, laparoscopic surgery still has problems that cannot be ignored. For example, different laparoscopic surgery methods for hepatic echinococcosis may have some complications such as postoperative bleeding. These problems may be related to the defects of laparoscopy itself. For example, traditional laparoscopy will make the surgeon 's sense of three-dimensional loss, perception decline, etc., which may cause intraoperative bleeding, lack of observation perspective, etc., resulting in complications. In order to solve this problem, surgeons have gradually combined 3D imaging technology with laparoscopy, hoping to solve the congenital problems of traditional laparoscopy.

3. The Application and Advantages of 1.3D Laparoscopy in the Treatment of Hepatic Echinococcosis

In order to solve the inherent defects of 2D laparoscopy, scientists applied the first generation of 3D laparoscopy to clinical practice as early as 1992 and completed the first 3D laparoscopic cholecystectomy. However, due to the immaturity of 3D imaging technology at that time, this new technology was not widely used in clinical practice. With the rapid development of science and technology, the second generation of 3D laparoscopy has also been born. It has made up for many problems of the first generation of 3D laparoscopy and achieved a major breakthrough in high-definition stereo vision, which has greatly promoted the development of laparoscopic surgery [7]. China has also made attempts in general surgery, urology, and obstetrics and gynecology.

Hepatobiliary surgery is also one of the earliest fields to carry out 3D laparoscopic surgery.

Au KP, Chan MY [8] and other scholars have recently summarized the results of comparative studies on the clinical application of 3D and 2D laparoscopic hepatectomy in tertiary hepatobiliary surgery centers through retrospective analysis. The results of this study are that the two groups of patients undergoing 3D and 2D laparoscopic surgery are comparable in terms of operation time (218 minutes vs.218 minutes, $p = 0.50$) and blood loss (0.2 vs.0.2 L, $p = 0.49$). However, the overall complications of the 2D group were higher (1.4 vs.11.1 %, $p = 0.03$). Patients who underwent 3D laparoscopy had shorter hospital stay than similar patients (7 days vs. 6 days, $p = 0.003$). Furthermore, they concluded that 3D imaging can greatly improve the feasibility of laparoscopic surgery, and 3D resection may further reduce the incidence of surgical complications without interfering with the surgical results. From such literature, it is not difficult to see that with the development of 3D laparoscopic technology, it has promoted the process of hepatobiliary surgery in the field of minimally invasive surgery and played an important role.

Similarly, whether the application of 3D laparoscopy in the treatment of hepatic echinococcosis is also applicable. The team composed of Duan Shuai and Ma Jianxiong [9][10]. Retrospectively collected and analyzed the patients who underwent 3D laparoscopic surgery for hepatic echinococcosis in their hospital. The conclusion is that they believe that 3D-LH is safe and feasible in hepatic alveolar echinococcosis, and has the advantage of precision and minimally invasive, which is worthy of clinical promotion and application. Subsequently, their team conducted a randomized controlled study of patients undergoing 3D laparoscopic surgery and patients undergoing traditional 2D laparoscopic surgery. The results showed that the intraoperative blood loss, postoperative tube time and postoperative hospital stay (150 (188) ml, 4 (1) d, 6 (2) d) in the 3D laparoscopy group were significantly lower than those in the 2D laparoscopy group (400 (300) ml, 7 (4) d, 9 (4) d, $Z = -3.568, -3.956, -2.675$; $p < 0.05$), which further illustrates the clinical value of 3D laparoscopic surgery in hepatic alveolar echinococcosis. For another type of hepatic echinococcosis, ' hepatic cystic echinococcosis ', Yang Jinyu, Liu Linxun and other scholars used a retrospective cross-sectional study method to draw the conclusion that 3D laparoscopy can also be applied to the surgical treatment of cystic echinococcosis, and put forward the view that it has a very obvious advantage for irregular hepatic cystic echinococcosis [ ]. Summing up the above literature, it is not difficult to find that 3D laparoscopy can also be applied to the surgical treatment of hepatic echinococcosis, and has a very obvious advantage over traditional laparoscopy, that is, it reduces the incidence of postoperative complications caused by 2D laparoscopic vision loss.

In the process of surgical treatment of hepatic echinococcosis, why 3D laparoscopy can significantly reduce the occurrence of bleeding compared with 2D laparoscopy, which is likely to be determined by the characteristics of 3D laparoscopy. It has the characteristics of high-definition stereo imaging, restores the three-dimensional sense of laparotomy, and improves the perception effect of the surgeon 's operation. It also takes into account the advantages of flexible laparoscopic lens of 2D laparoscopy, which can quickly locate the lesion site on the premise of avoiding the loss of normal tissue as much as possible. Under the three-dimensional surgical field of view of 3D high-definition magnification, the operation time is accelerated, and the occurrence of intraoperative bleeding and postoperative complications is minimized [11]. These may be the reasons why the treatment of hepatic echinococcosis under 3D laparoscopy can achieve good results. The unique characteristics of 3D laparoscopy provide a new way and idea for the surgical treatment of hepatic echinococcosis. However, due to the endemic characteristics of hepatic echinococcosis and the lack of sufficient experimental conditions, the statistical evidence of big data is insufficient. At present, a large number of applications of 3D laparoscopy are concentrated in the field of surgical treatment of hepatic alveolar echinococcosis. The

efficacy of 3D laparoscopy in the treatment of cystic echinococcosis still needs a lot of data to support.

4. The Current Problems and Possible Development of 3D Laparoscopy in the Treatment of Perihepatic Disease

4.1 The Current Problems of 3D Laparoscopic Technique in the Treatment of Hepatic Hydatidosis

According to the characteristics of 3D laparoscopic technology itself, in recent years, it has been found that it itself needs to wear 3D glasses for operation. The surgeon is easy to cause ' dizziness ' during the operation; and compared to the traditional laparoscopic expensive, patients can not afford such defects [12]; in the field of liver hydatid surgery, because liver hydatid disease is an endemic zoonosis, it is impossible to carry out large-scale, multi-center clinical controlled studies, and there is no big data evidence to support the advantages and problems of 3D laparoscopy.

4.1.1 Defects caused by the characteristics of 3D laparoscopy

Because the image transmitted by 3D laparoscopy is a three-dimensional effect synthesized by the camera, the surgeon needs to wear 3D glasses to operate, which brings a lot of inconvenience to doctors who are not accustomed to wearing glasses. When watching the 3D screen, the surgeon should maintain a certain distance and angle to avoid the occurrence of adverse reactions such as ' dizziness ', which greatly increases the difficulty of operation for the doctor. Yao Hongwei [13] and other medical workers analyzed the influence of 3D laparoscopy on the experience of surgeons in the study of the advantages and disadvantages of 3D laparoscopy in radical resection of colon cancer. They believed that 3D laparoscopy had obvious advantages in identifying the structure of lesions, but wearing 3D glasses for a long time would cause dizziness, eye fatigue and other discomforts, which greatly affected the quality of surgical operation. These problems still need to be further improved. Iman Komaei, MD et al. also proposed in a systematic review that 3D laparoscopy has a problem that 3D visual system seems to cause more obvious discomfort to surgeons than 2D. These literatures seem to focus on the shortcomings of 3D laparoscopy, which brings many challenges to surgeons.

In addition, 3D laparoscopic surgery is more expensive than traditional laparoscopy. Due to their own economic reasons, patients are more inclined to traditional laparoscopic surgery. This is also one of the important reasons why large-scale RCT trials cannot be carried out to verify the clinical cost performance of 3D laparoscopy. It has also become a major bottleneck restricting the development of 3D laparoscopic technology.

4.1.2 Problems in surgical treatment of hepatic echinococcosis

In the field of hepatic echinococcosis surgery, due to the regional prevalence of the disease itself and the characteristics of specific populations, multi-center trials cannot be performed. Systematic research on the clinical effects of 3D laparoscopic surgery in the treatment of hepatic echinococcosis has made the current level of evidence at a low level. It is impossible to comprehensively and objectively evaluate the advantages and disadvantages of 3D laparoscopic surgery in radical resection of hepatic echinococcosis and the value of clinical promotion. At present, there is a lack of relevant ' evidence-based medicine ' evidence to guide clinical application. According to the existing research results, a large number of clinical application studies of 3D laparoscopic technology are mainly focused on the study of alveolar hepatic echinococcosis. For the treatment of cystic echinococcosis, due to the relatively strict indications of laparoscopic surgery, if the corresponding surgical procedure is not carefully selected for surgery, it may lead to more serious complications than traditional open surgery

[14][15]. Therefore, 3D laparoscopic surgery has certain limitations in the surgical treatment of hepatic echinococcosis.

4.2 Possible Future Development of 3D Laparoscopy in Surgical Treatment of Hepatic Echinococcosis

Although there are many problems in 3D laparoscopy, in general, 3D laparoscopy is more accurate than 2D laparoscopy and traditional open surgery [16]. Surgeons can more accurately identify the location of lesions and more clearly distinguish the anatomical structure, which further reduces the occurrence of postoperative complications. Compared with more advanced robotic surgery [17], the application cost of 3D laparoscopy is also more acceptable to patients. In view of the defects of 3D laparoscopic technology itself, with the continuous development of 3D technology, the continuous development of bendable 3D lens, naked eye 3D, 4K HD and VR technology may improve the defects of existing 3D imaging technology and provide greater development space for the development of minimally invasive surgery of hepatic echinococcosis [18]. In terms of the lack of 3D laparoscopic evidence for the application of hepatic echinococcosis, with the rise of 3D technology, it is expected to apply 3D technology to expand the indications of laparoscopic surgery for hepatic echinococcosis in the future, so as to make up for the lack of evidence of ' evidence-based medicine ' for two types (especially cystic type) of hepatic echinococcosis. At the same time, in recent years, with the continuous development of robotic surgery, surgeons have combined robotic surgery with 3D imaging technology to perform surgery and achieved considerable results. This new technology is expected to be applied to the surgical treatment of hepatic echinococcosis in the future. In short, with the continuous development of science and technology in the future, the defects of 3D laparoscopic surgery will be solved, and more effective methods will be provided in the radical treatment of hepatic echinococcosis.

5. Complimentary Close

Hepatic echinococcosis is a major zoonotic disease in the western region of China. Surgical treatment is currently the most effective method for radical cure. The rise of 3D imaging technology provides a new possibility for laparoscopic treatment of hepatic echinococcosis. Compared with traditional laparoscopic surgery, 3D laparoscopic surgery can allow surgeons to identify the lesion site more clearly during the operation. Under the premise of achieving the same therapeutic effect as 2D laparoscopic surgery, by enhancing the surgeon 's three-dimensional sense, sense of hierarchy and the perception of the operating equipment, the intraoperative vascular loss can be avoided as much as possible, the bleeding can be reduced, and the occurrence of postoperative complications can be greatly reduced. At the same time, the operation time and hospitalization time are shortened, and the postoperative pain is alleviated for the patients. Although 3D laparoscopy still has many shortcomings in the treatment of hepatic echinococcosis, such as 3D laparoscopy itself will cause adverse reactions such as vertigo to surgeons, affecting the quality of surgery; Due to the endemic characteristics of hepatic echinococcosis, it is impossible to obtain a large amount of evidence-based medical research evidence. However, with the continuous development of science and technology in the future, through the application of bendable lens and VR technology, 3D laparoscopic technology will be further improved, providing more effective methods for the treatment of two types of hepatic echinococcosis. Researchers are also constantly exploring and studying the application of 3D laparoscopic technology in the treatment of hepatic echinococcosis.

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