

The Advantages and Disadvantages of Transgastric Natural Orifice Transluminal Endoscopic Gallbladder-Preserving Surgery Compared with Traditional Operation and its Clinical Application

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ABSTRACT

In recent years, the incidence rate of gallstones has been increasing under the multiple influences of environment, heredity and diet. In the modern science and technology developed, treatment effect requirements are higher and higher. At present, no scar, less trauma, fast recovery of the NOTES surgery is more popular. Based on the understanding of NOTES, after searching the literature about gallbladder disease or clinical application, combined with related cases, this paper summarized the treatment measures, specific advantages and application cases of transgastric gallbladder conserving surgery. It has the advantages of no scar, less pain, faster recovery, fewer complications, shorter hospital stay and a series of important functions of gallbladder. At present, the key point of treatment is to select the most appropriate surgical method according to individual differences, physiological and genetic characteristics, disease characteristics, personal willingness and tolerance.

Abbreviations: NOTES: Natural Orifice Transluminal Endoscopic Surgery; APC: Endoscopic Argon Ion Beam Coagulation; OTSC: Over-The-Scope-Clip System; LC: Laparoscopic Cholecystectomy; ESD: Endoscopic Submucosal Dissection; SCC: Esophageal Squamous Cell Carcinoma; PSC: Primary Sclerosing Cholangitis; DVT: Deep Venous Thrombosis; PE: Pulmonary Embolism Competition

Introduction

Cholelithiasis refers to the gallstone that occurs in the gallbladder. The main component is cholesterol. The cholesterol

in bile is dissolved in water in the form of bile salt phospholipid microcapsules and bile salts. The incidence rate of cholelithiasis

has increased from 10% to 20% in recent years [1]. Transgastric approach of gallbladder preservation surgery refers to With the help of transparent cap, a full-thickness endoscopic incision was made in the posterior antrum near the lesser curvature of the stomach and the anterior wall of the lower part of the gastric body with hook knife and its knife [2]. After full-thickness resection, the greater omentum in the abdominal cavity was separated layer by layer, and the passage between stomach and abdominal cavity was opened, Then the gallbladder was found in the abdominal cavity, and a small incision was made at the junction of gallbladder with hook knife [2]. With the same tool, the window was enlarged to allow the endoscope to enter the gallbladder, and the gallbladder was pulled by the clip with inner ring, so that the endoscope could enter the gallbladder easily. The stone was removed with stone basket or snare traction, APC and hot biopsy forceps to remove gallbladder polyps [2,3].

After the operation, the local gallbladder opening was closed with metal clip, and the gastric wall defect was closed with OTSC (ultra-mirror clip) combined with metal clip [3]. Traditional open surgery or laparoscopic cholecystectomy to achieve the purpose of treatment of stones or polyps, although the effect is good, but the gallbladder as an organ with a variety of physiological functions, such as absorption, secretion, immunity, plays an important role in human metabolism. Many studies have confirmed that cholecystectomy is associated with the incidence rate of colorectal cancer, choledocholithiasis, digestive function impairment, bile duct injury, immune defense function, chronic liver injury, metabolic abnormalities, hepatic steatosis and metabolic syndrome [3,4]. Patients after cholecystectomy are prone to abdominal pain, diarrhea, jaundice, bleeding, reflux gastritis, reflux esophagitis, bile leakage, intestinal obstruction, peritonitis and other complications [5,6].

Therefore, it is of great value to treat gallbladder diseases with NOTES. Notes refers to a series of surgical interventions through some natural lumen, such as stomach, colon, rectum, vagina, oral cavity, urethra, etc. into the abdominal cavity to reach different direct target organs or distant target organs, and then carry out a series of surgical intervention [7-9]. However, notes still has some defects. How to avoid the complications of exogenous infection, avoid the anastomotic leakage caused by poor closure, overcome the disorder of intraperitoneal spatial orientation, and select the patients who are mainly suitable for notes need to be explored in clinical practice [2]. In this review, we aim to outline the advantages and disadvantages of choledocholithotomy under gastroscope compared with traditional surgery and related indications and contraindications.

Characteristics and Treatment Options of Gallstones

Cholelithiasis is a mass of the gallbladder or biliary tract caused by the abnormal elevation of cholesterol or bilirubin (the

decomposition product of heme) in the bile [10]. The incidence of cholelithiasis increased with age, the prevalence of cholelithiasis in female was higher than that in male, and the genetic tendency was obvious [10]. Due to the type, location, characteristics, accompanying symptoms and individual characteristics of gallstones, there are many methods to treat gallstones. From traditional open surgery to later laparoscopic surgery, and then to the NOTES operation. Notes is the third generation of operation after open surgery and laparoscopic surgery. It refers to the operation mode of various diagnosis and surgical operation through hollow viscera or natural opening (such as vaginal vault, stomach, etc.) into peritoneal cavity [11]. As there is no abdominal incision in notes, there are no abdominal wall complications, which can achieve good cosmetic effect and reduce anesthesia requirements [12].

The treatment of gallstone and polyp is more and more advanced. Compared with traditional laparotomy, NOTES has the advantages of further reducing trauma, abdominal wall or chest wall trauma, postoperative pain, postoperative recovery time, postoperative complications, wound infection, and other advantages, and there are long-term problems such as hernia reduction, postoperative inflammatory response is not obvious, less physical discomfort, almost no visible scars [13-15]. Therefore, NOTES is a good choice to treat gallbladder disease.

Clinical Application of Notes

NOTES can be roughly divided into two categories: remote NOTES and short NOTES. Remote NOTES refers to the process of getting from one healthy visceral organ to another distant organ; Short notes refers to the procedure of directly entering the target organ without interfering with another organ (e.g., oral endoscopic myotomy [poem]) [16]. This article describes the stomach through the road to protect the gallbladder stone surgery is attributed to the former. Short range notes are widely used at present, Endoscopic submucosal dissection (ESD) has achieved significant initial results, including endoscopic full-thickness resection of gastrointestinal submucosal tumors, oral endoscopic myotomy and submucosal tunnel endoscopic resection [17,18]. And oral endoscopic myotomy (POME) for children with achalasia of cardia [19]. In addition, endoscopic submucosal dissection (ESD) is becoming the preferred treatment for early esophageal squamous cell carcinoma (SCC), including highly atypical hyperplasia and superficial esophageal cancer [20].

For long-term notes, many departments have already used them. A series of experiments have proved the feasibility of adrenalectomy, uterus surgery and gallbladder surgery through natural orifice surgery in general surgery, urology and Gynecology, but the clinical application is very limited [11,21]. For patients with intra-abdominal emergency, when a series of diseases such as ulcer perforation and infectious pancreatic necrosis caused by interruption of blood supply (bleeding, ischemia) or normal

gastrointestinal tract (obstruction, perforation or leakage) need emergency intervention, the application value of notes is more important. Compared with other surgical methods, notes not only reduces intra-abdominal invasion, but also improves the prognosis [22]. In addition, notes also has relevant clinical application in weight loss surgery [23].

From open surgery to laparoscopic surgery, laparoscopic cholecystectomy (LC) is now considered as the standard for the treatment of cholelithiasis. The acceptance of LC in the world is mainly due to the quick recovery, good cosmetic effect, short hospital stay and early return to work [24]. However, the gallbladder is an important organ of human metabolism, there will be a series of sequelae after resection. Studies have shown that cholecystectomy is associated with an increased risk of prostate cancer in patients with gallstones, and the risk also increases with the extension of follow-up time. Cholecystectomy may not be the appropriate choice for patients with high-risk prostate cancer [25]. And people with a history of cholecystectomy are more likely to develop liver cancer [26].

Therefore, with many complications after cholecystectomy and people's understanding of the important functions of the gallbladder, gallbladder conserving surgery began to develop. At present, notes can be carried out through stomach, rectum and esophagus, among which transvaginal is the most common way. Vaginal subtotal hysterectomy and transvaginal appendectomy have been reported. Transvaginal subtotal hysterectomy has been proved to be feasible and safe by related studies, and it has the advantages of less pain, no scar, and rapid recovery [9,27,28]. However, there are few studies on gastric approach. In 2004, Kalloo and Colleagues were examined by gastroperitoneoscopy for the first time in a pig model [29]. Next, Rao and reddy21 demonstrate the first human gastric NOTES appendectomy [29]. Jacques Marescaux performed the first gastric cholecystectomy in humans [29]. These studies have opened the way for minimally invasive surgery via gastric approach. In addition, compared with the rectal approach, the transabdominal approach not only has a shorter route, but also saves time and does not need to clean the intestine [3]. Therefore, transgastric approach is the first choice for some researchers because it has no gender specificity, low risk of infection and strong healing ability of gastric wall [30].

Indications of Gallbladder Preservation

At present, there is no complete consensus on the indication and application scope of transgastric notes choledocholithotomy. The most common indication of open cholecystectomy was severe cholecystitis (72.1%), followed by cirrhosis, cholelithiasis and portal hypertension (18.2%), empyema or gallbladder perforation (6.1%) [31]. Therefore, choledocholithotomy is not recommended for patients with the above disease characteristics. Laparoscopic cholecystectomy is more suitable for patients with primary

sclerosing cholangitis (PSC) due to the increased risk of malignant transformation; patients with venous thrombosis risk are more suitable for cholecystectomy rather than gallbladder conserving surgery, because relevant studies show that gallstones will increase the risk of venous thrombosis, including DVT or PE, and the risk of DVT and PE in patients with gallstone after cholecystectomy is reduced [32].

Most guidelines recommend that cholecystectomy be considered for polyps 10 mm or larger and smaller but growing polyps [33]. For gallbladder polyps or stones which are not included in the above scope, transgastric choledocholithotomy (or polyp) can be performed. For patients with prostate cancer, according to previous research results, cholecystectomy may not be an appropriate choice, so we can think that such patients may be more suitable for the treatment of notes gallstone. Although notes have the advantages of less trauma and faster recovery than traditional surgery, there are still some problems. Among them, disinfection method, closure technique and operation experience are the most important problems.

As for the choice of disinfection methods for gastric notes, intravenous antibiotics as a traditional disinfection method still has exact clinical significance, but whether single intravenous antibiotics can achieve the purpose of controlling infection remains to be further confirmed [34,35], The local mucosal disinfectants mainly include antibiotic suspension, dichlorobenzidine hexane and povidone iodine. There are also extensive reports on their application. The disinfection effect and safety are worthy of partial affirmation. However, compared with the intravenous application of antibiotics, whether the efficacy of local disinfection is better is still worth discussing.

Disadvantages and Future Development of Transgastric Natural Orifice Endoscopic Surgery

For the technical problems of gastric cavity closure, because the complications of vaginal wall closure are smaller than those of digestive tract closure failure, so for the choice of notes abdominal approach, vaginal approach is more preferred than gastric approach [29]. And through the vagina surgery case and research is also more, in this aspect also has the sufficient experience. However, transvaginal approach has the disadvantage of gender specificity. Therefore, transgastric approach for natural cavity oral surgery has a good development prospect. However, at present, transgastric notes surgery still faces the challenge of the feasibility and safety of access closure [30]. The types of closure techniques reported include traditional titanium clip, OTSC clip, endoscopic suture system, endoscopic stapler, diaphragm occluder, absorbable biological plug, nduplicator, g-prox, t-tags and so on. However, it is not clear which closure technology has the advantages. At present, it is widely accepted that OTSC combined with metal clip is used to close the local gallbladder opening and gastric wall defect after

operation [3].

OTSCs and greater omental plasty are the most promising techniques for safe and effective closure of notes gastric pathway [36]. Whether there will be postoperative gastric leakage and local peritoneal infection need further clinical research to determine the most appropriate use of guidelines [30]. However, the cost, training, operation time and tools seem to limit their application in common operations such as cholecystectomy and appendectomy [37]. With the development of science and technology, robot natural oral mirror surgery has entered into innovation. According to relevant research, robot notes hysterectomy has the advantages of feasibility, safety, no scar, no pneumoperitoneum, and the ability to improve human efficacy and range of motion [38]. In the surgical treatment of benign uterine diseases, it is better in fine anatomy, hemostasis and suture, and can replace notes assisted vaginal hysterectomy or traditional robotic laparoscopic single site hysterectomy. However, due to its shortcomings and safety inflammation, it has not been widely used in clinical practice [38]. Through the stomach natural oral mirror surgery can also be studied robot operation, to achieve more precise surgical standards. This may also be a direction for future development.

Conclusion

There are many ways to treat gallstones and polyps. At present, laparoscopic cholecystectomy is the most common treatment, and the treatment of gallbladder preservation by laparoscopy is also recorded. The focus of this paper is on the gallbladder preservation therapy of NOTES surgery. At present, the clinical application of NOTES is still more, but most of the abdominal approach is transvaginal, but it has gender specificity. There are few studies on transgastric gallbladder preservation, which may be related to the safety of postoperative gastric channel closure and complications of gastrointestinal closure. Moreover, the operation requirements, equipment, operation cost and time of NOTES are very high. Although NOTES have many advantages over laparoscopic or traditional open surgery, it could not be completely sure that NOTES surgery is better than laparoscopic surgery. Different characteristics of patients have the most appropriate treatment, and we can't totally deny which one. But the emergence of NOTES has also opened a milestone for the development of minimally invasive surgery. In the future, the development of NOTES is of great significance in surgery.

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