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Chemical cholecystectomy

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INTRODUCTION

Cholelithiasis is a commonly encountered disease in China. It was reported that the incidence rate is 7% by autopsy. Recent investigation of in natural populations disclosed an incidence rate of up to 10% by means of ultrasonography B, and the tendensy is increasing yearly. Since Langenbuch first succeeded in the cholecystectomy for cholelithiasis in 1882, this procedure has now become a classical way of operation for cholecystolithiasis, and its efficacy has been clinically proven for over 100 years. Cholecystectomy seems to be a simple operation, but the risk is practically existing there[1]. Thus, looking for a less invasive, easy and reliable procedure substitute cholecystectomy has become a research project of surgery. The small-incision cholecystectomy has been persistently reported in literature since Dubois reported it in 1982. But it is still controversial now. In 1984 Salomonowitz *et al*[2]performed a chemical cholecystectomy, with the advantages of less injury, low risk, nonoperative eliminat ion of cholecystlithiasis, and clearing out the bed of recurrent cholelithiasis[3]. It has attracted the attention and research of many authors.

CONCEPT

Chemical cholecystectomy is to use chemical method to destroy the mucous membran e of the gallbladder. As a result the reparation of fibrous tissue takes the place of cholecystectomy, so as to prevent the recurrence of cholecystlithiasis. Technicly it includes 4 steps, such as percutaneous cholecystostomy, lithotomy occlusion of the cystic duct and perfusion of the hardener.

Precutaneous cholecystostomy

This technic often failed in early stage due to mobility of the gallbladder, and the complications of bile fistula often occurred. In recent years, with the application of ultrasonography B and CT, this operation has become a simple and reliable one. A puncture cholecystostomy is carried out under the guidance of percutaneous and transabdominal B ultrasourd[4]. Percutaneous-transhepatic cholecystostomy can be also performed under the guidance of ultrasonography B[5]. The puncture point was usually located in intercostal space. At pre sent this technique is seldom used clinically, yet it remains an important alter native therapy for the high risk elderly patients with a difficulty of cholecsytectomy.

Percutaneous lithotomy

There are a variety of nonoperative ways of eliminating the gallstones. Roughly speaking they include chemically dissolution of stones, physical lithotrity and instrumental lithotomy *etc*; All of which are performed through percutaneous cholecystostomy. Of them, vibrative-wave lithotrity in the body, directly solving s tones with litholytic agent and instrumental lithotomy *etc*. must be finished through the tract of transcutaneous cholecystostomy. In recent years the appearance of laser lithotrity brings with it, the advantages of less injurious to gallbladder and safety *etc*., but the equipment is too expensive to get the technique popularized and spread. And most of all the laser lithotrity can not eliminate the causes of stone formation and recurrence rate is high after lithotomy. In general, the nonoperative procedure may have some severe complications, such as obstruction of the bile duct, infection, pancreatitis, *etc*. So its clinical application is greatly limited.

Occlusion of the cystic duct

Complete occlusion of the cystic duct is not only the premise of hardener perfus ion, but also the crux of preventing the hardener from injuring the common bile duct and intestine, as well as the regeneration of the cystic mucous membrane. Both of the destruction of the mucous membrane of the cystic duct and the occlusion of the cystic duct are the critical point of a successful chemical cholecyste ctomy[6]. There have been many ways that were used in blocking the cystic duct, such as cyanoacrylate, gelfoam embolus and adhesives, *etc*., since in 1984, Salomonowitz

first used aminoacrylic acid and the embolus made of collodion to occlude the cystic duct. But the shortcoming is that the embolus is easily dropped into the common bile duct, and it can not prevent the mucous membrane of the cystic duct from regenerating into the gallbladder, resulting in the growth of the mucosa of the cystic wall. In 1988, Becker *et al*[7] successfully occluded the pig's cystic duct by bipolar radio frequency-electro-coagulation. While the permanent occlusion took 2 wk, so was the perfusing of the hardener into the gallbladder. At home, Xu *et al*[8] reported 10 cases of cystic duct occlusion were performed by percutaneous cholecystoscopic micro-wave heat coagulation on human body. The result indicated that this type of cystic duct occlusion was due to local edema. The edema was most serious 24 h after heat coagulation, and it subsided obviously in 72 h. The occluded cystic duct may become unobstructed again. Therefore, the mucous inactive agent should be injected in to the gallbladder when edema of the cystic duct was most serious so as to make the cystic mucosa inactive. One injection was made every 4 h, and it was repeated for 5-6 times. A satisfactory result of inactivation of mucosa was achieved in all of the 10 cases. Chen *et al*[9] succeeded in using microwave heat coagulation to instantly make the occlusion of the cystic duct in 8 human bodies. A microwave electrode was inserted into cystic duct through a cholecystocope, but it needs to be further confirmed because of small sample size. In 1985, Getrajdman used rabbits to carry out his experiment. He tightly ligated the cystic duct with silk thread after laparotomy, so that the hardener can not leak into the common bile duct, and prevent the epithelial cells of the cystic duct from growing into the gallbladder. Guan *et al*[10] used metal clip or silk thread to block the cystic duct of the white rabbit. The result suggested that there was no difference between metal clip and silk thread in fibrosis formation rate. Metal clip can block the cystic duct, and so providing the evidence of using metal clip to block the cystic duct during laparoscopic chemical cholecystectomy.

Perfusion of the hardener

The selection of the hardener may directly affect the success or failure of the chemical cholecystectomy. Therefore the hardener must meet the following criteria: (1) Can destroy the mucous epithelium completely; (2) To be easily cleaned out and not to result in too much necrosis of the tissue; (3) Nontoxic: Will not lead to damage of the organs in the body; (4) Noncarcinogenic[11]. In 1984, Salomonowitz used dehydrated alcohol, tetracycline solution and heated contrast medium to destroy the mucous membrane, of rabbits' gallbladder, resulting in fibrosis of the mucous epithelium of the gallbladder wall. However it can not stop the regeneration of the mucous membrane of the cystic duct. Getrajdman (1985) proved that alcohol, tetracycline solution, methomethacrylate and trifluoroacetic acid can bring about fibrosis of the rabbits' gallbladder. Whereas the heated contrast medium and normal saline are ineffective. Peng *et al* carried out an animal experiment and pathologic investigation on the selection of the hardener. And he confirmed that the efficacy of the compound phenol is the best in destroying the epithelium and occluding the cavity of the gallbladder. Guan Hong Geng used with rabbits to do the experiment, and identified that 95% alcohol + 2 mol/L trifluoroacetic acid is the effective and safe mixture hardener for gallbladder. Up to date, according to the literature of home and abroad there are numerous hardeners can be chosen. Among them the followings are the most commonly used ones: 95% alcohol or dehydrated alcohol, 5% tetracycline solution, 2 mol/L trifluoroacetic acid, compound phenol solution, *etc*. Dehydrated alcohol and tetracycline solution are most frequently used in clinical practice. While tetracycline solution possesses a higher toxicity, and takes long time to destroy the mucous membrane. The dehydrated alcohol rarely affects the whole body, and needs less time to make the cystic mucosa inactive, so it has become a commonly used hardener.

PATHOGENIC CHANGES AFTER OPERATION

The hardener is absorbed by cystic mucous epithelium, leading to coagulation of cells' protein, cells' necrosis and inflammatory reaction, restoration of the fibrous scar tissues, and eventually, the whole gallbladder to be "self cholecystectomy" due to fibrosis. In 1984, Salomonowitz performed an experiment on rabbits. Fibrosis of the wall of the gallbladder and occlusion of the cystic cavity occurred 2 wk after perfusion of the hardener. In 1985 Getrajdman proved that the complete destruction of the cystic mucosa of the rabbits and the fibrosis of the wall of the gallbladder occurred 6-8 wk after perfusion of the hardener. At home, Guan Hong Geng[10]experimentally demonstrated that the pathological changes is characterized by epithelial exfoliation, necrosis and infiltration of inflammatory cells along with slight proliferation of fibrous tissues 2 wk after perfusion of the hardener. In 4-8 wk, mature fibrous tissue formed, and inflammatory reaction disappeared. Additionally observation of ultrastructure showed that a complete fibrous cicatrization of the gallbladder took place. Becker carried out a chemical cholecystectomy by way of percutaneous electro coagulation of the cystic duct, and found that the fibrosis of the cystic mucosa occurred 2-3 wk after the perfusion of the hardener. Reviewing reports in literature from home and abroad revealed, that the inflammatory reaction chiefly occurred within 2 wk after perfusion of the various kinds of hardener, and fibrous cicatrization 4-8 wk.

INDICATIONS AND CONTRAINDICATIONS OF CHEMICAL CHOLECYSTECTOMY

Indications include: Acute and chronic cholecystitis; gallstones, high risk elderly intolerable of cholecystectomy, or complicated with heart, lungs and kidney dysfunctions; hepatic cirrhosis with portal hypertension; patients unsuitable for cholecystectomy after cholecystostomy, and people who have had percutaneous cholecystoscopic lithotrity and lithotomy. Contraindications: Gallbladder gangrene or perforation; malignant tumour of the gallbladder, patients with complications of intrahepatic extrahepatic stones in bile ducts, or common bile duct obstruction; gallbladder communicated with accessory hepatic duct, or fistula formation between gallbladder and other organs; ceramic gallbladder.

ADVANTAGES OF CHEMICAL CHOLECYSTECTOMY

In 1890 Langenbuch believed that cholecystectomy is of necessity not on account of the presenting gallstones, but that it is the cause of the gallstone formation. The traditional cholecystectomy has the disadvantages of alarge incision, numerous complications, especially for the high risk cases of elderly and the weak or those with heart and lung dysfunction, for whom the complication may reach up to 24%[3]. Since nonoperative lithotomy doesn't eliminate the bed of the calculi, it is predisposed to recurrence of the gallstones. The calculi recurrence rate is 81%[12] after cholelithotomy. The ejection rate of gallstones was low. The procedure was rather complicated treatment was difficult and expenditure was high Various kinds of complications may occur during the process. Small incision cholecystectomy owns the advantages of small injury, rapid restoration of intestinal function, short duration of hospitalization, low cost and small scar of incision after healing compared with the traditional cholecystectomy. However, the lighting and exposure of the operative field are far from adequat e due to small incision. The operative field and manipulative space are too narrow to limit its application, and poses severe potential risks. Laparoscopic cholecystectomy has the over smaller incision cholecystectomy, merits of smaller incision, less pain, quicker recovery and shorter hospital stay. Nevertheless it has a strict operative indication, the device is expensive, the cost is high. Further more the operators must be trained specifically. All of which renders it rat her difficult and systemic intratracheal anesthesia is required to get popularized in the basic medical unit. Chemical cholecystectomy aims to wipe out the cystic cavity, make the gallbladder hardened, so that to prevent the caliculi recurrence. This nonoperative cholecystectomy has substituted the operative cholecystectomy, and is as same as the efficacy of the operative cholecystectomy. If laparoscopic cholecystectomy can be combined with the chemical

cholecystectomy, laparotomy may be avoided. It makes minimal would, simplifies the therapeutic manipulation, shortens the operating time and hospital stay reduce the operative risk, as well as the adhesion of adjacent organs after operation. In the mean time, the recurrent bed of the gallstones can be eliminated. The requirement for device and technology, is not so high that it can be practised in basic medical units. Consequently it will get greatly developed in the future.

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