Prevention of Biliary Leakage after Removal of T-tube in Immunocompromised Patients

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Abstract Biliary leakage after T-tube removal is an important complication which can be lethal especially in patients who received immunosuppressant agents. The purpose of the study is to determine a method which can evaluate the completion of tract formation in high-risk patients. Participants include 46 patients who were candidates for open cholecystectomy and common bile duct (CBD) exploration and T-tube insertion. Twelve of patients received corticosteroids and were divided into two groups. In the first group, T-tube was removed conventionally, but in the other group, we performed a “fistulography” 1 month postoperative to evaluate maturity of tract between CBD and the skin. Biliary peritonitis was seen in half of patients who are managed conventionally, but no complication was detected in patients who underwent fistulography. Fistulography is suggested to be done before T-Tube removal in immunocompromised patients in order to detect tract formation, which is effective in reduction of postremoval complications.

Keywords Biliary leakage · Fistulography · T-tube removal · Tract Formation · Immunocompromised patients

Introduction

Since Kummell’s use of exploration of the common bile duct (CBD) for gallstone removal [1], several techniques have been

reported for the exploration and repair of CBD. Although primary closure of the duct without drainage of the CBD was advocated in several studies [2–4], usage of the T-tube is a popular method among surgeons.

One of the most important complications of T-tube usage is biliary leakage after tube removal [5–9]. Although this is rare overall, it is common and lethal in patients who received immunosuppressant agents, especially corticosteroids [10–13]. As we know, irritant properties of the T-tube simulate a reactive granulation tract around the tube, thereby ensuring a temporary biliary cutaneous fistula that will be closed normally within a few days of T-tube removal [13]. The purpose of the problem we discuss is to evaluate incomplete or partial tract formation around the T-tube that results in biliary leakage in immunocompromised patients.

We offer a manner to evaluate the complete tract formation around the T-tube before extracting it, for prevention of bile leakage after removal in high-risk patients.

Materials and Methods

The study included two parts—one was a retrospective study for the evaluation of T-tube removal complications (part 1), and the other was a prospective study where we evaluate our new technique (part 2). The study was conducted from March 2007 to September 2011 after the approval of the ethics committee (Mashhad University of Medical Sciences, Iran). Participants included 46 patients with age ranging from 31 to 84 years (40 patients in retrospective part and 6 in prospective part). These patients suffered from cholelithiasis and choledocholithiasis revealed by ultrasonography, who were candidates for elective open cholecystectomy with choledochal exploration and T-tube insertion. In all of the patients, CBD stone was the cause of

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operation. Selection of the open technique was due to limited access to laparoscopy facilities or the presence of contraindications for laparoscopic techniques. Endoscopic retrograde cholangiopancreatography (ERCP) has been tried in all of these patients, but unfortunately, it failed due to the technical or other problems.

Patients who had a contraindication for X-ray examination such as pregnancy or a history of allergy to contrast materials and latex were excluded from the study. Written informed consent was obtained from participating patients in the prospective part.

Corticosteroid and immunosuppressive drug usage, liver cirrhosis, morbid obesity, low proteinemia, anemia, and diabetes were considered as risk factors for biliary leakage after T-tube removal [14]. Patients without any risk factors for biliary leakage were inserted in group one (G1). In this group, patients underwent cholangiography through the T-tube 2 weeks after operation, and then the tube is removed if there was no problem (distal obstruction of retained stone) in the imaging. Patients who received corticosteroids (prednisolone 5–10 mg/day, at least from the last year) due to connective tissue disorders (CTD) were divided into two groups (G2 and G3). In the first group (G2), the T-tube was conventionally removed approximately 4–8 weeks postoperation after performing cholangiography through the T-tube. But in the other group (G3), we performed “tractography” or “fistulography” after 1 month of operation, and we removed the T-tube only when the tract between the CBD and the skin was mature. The technique of tractography was done by an insertion of a small flexible vascular catheter (24 gauge) into the external orifice of the tract (between skin and T-tube) followed by a gentle injection of 5–10 cm³ of water-soluble contrast agent (Urografin®) by hand. The catheterization and injection were performed gently to avoid disruption of the tract. After X-ray imaging, if we saw a completely mature tract between the skin and CBD (Fig. 1), then we removed the T-tube, but if the contrast agent extravasate to the abdominal cavity (Fig. 2), we performed this procedure

Fig. 1 Tractography in a case with completely mature tract between the skin and common bile duct

Fig. 2 Tractography in a case with incomplete tract between the skin and common bile duct and peritoneal leakage of contrast agent

again 2 weeks later. G1 and G2 were in the retrospective part, and G3 was in the prospective part.

All patients underwent general anesthesia with the appropriate anesthetic protocol (not the same for all). Patients underwent cholecystectomy through a 10–15-cm right subcostal incision which was then primarily closed in all the patients. A T-tube (14f) was placed in the CBD, and the duct was closed with 4/0 vicryl as continuous sutures. Since the material of the T-tube may influence the formation of reactive tissue around it, we used standard latex rubber T-tubes in all patients.

During the hospitalization period, all patients were evaluated for operation complications.

Finally, after removing of the T-tube, complications of this procedure such as biloma and biliary peritonitis were documented in all patients.

After data collection, statistical analysis was performed using SPSS (version 11), by Fisher's exact test.

Results

Among the 46 patients enrolled in the study, 34 (73.91 %) were female and the remaining six were male. The mean age of the patients was 59 years. Unfortunately, the three groups (G1, G2, and G3) were not matched in terms of age and sex. The cause of corticosteroid usage was connective tissue disorders in all of G2 and G3 patients.

After CBD exploration and closure on T-tube, for evaluating the procedure accuracy and ruling out of retained stone, intraoperative cholangiography was performed.

The patients in groups 2 and 3 (six patients in each group) were on corticosteroids, but in patients in group 1, there was no history of immunosuppressive agent consumption or any other conditions increasing the risk of tube removal complications. In group 1, nobody had complication after T-tube removal, but in half of group 2, biliary peritonitis was the outcome of tube removal (three patients). Considering the peritonitis happening, we could not use ERCP and stenting as a method of leakage

control in our patients; therefore, they underwent laparotomy and T-tube replacement in the CBD as well as abdominal cavity irrigation and drainage. During laparotomy, we understood that incomplete fistula tract formation between the common bile duct and skin was the reason for biliary leakage and peritonitis. This is bad, and it is resulting in two deaths (Table 1). Similar to group 1, no complication was seen in group 3 (Table 1). The morbidity and mortality rate was higher in group 2 than in group 3, but there was no statistically significant difference between them ($P=0.455$ for mortality and $P=0.182$ for morbidity). Biloma was not seen in our patients.

Discussion

Biliary leakage is a rare but an important complication after T-tube removal in patients who underwent open choledochal exploration and T-tube insertion [5–9]. Although the risk of bile leakage after T-tube removal in normal situation is low (0.8 to 5 %) [5–8, 10, 15–17], in cases of liver transplantation, the incidence rises up to 24 % [9, 13, 15, 16, 18]. Corticosteroid and immunosuppressive drug usage, liver cirrhosis, morbid obesity, low proteinemia, anemia, and diabetes are other risk factors for biliary leakage [14].

Bile leakage may have different clinical presentations. Bile ascites or peritonitis, necessitating laparotomy (approximately 75 % of patients), or localized biloma, which can be managed

conservatively with or without ultrasonography/computed tomography-guided drainage (25 % of patients), are the most common presentations [13, 15, 18–23].

In immunocompromised patients, we see a disorder in the production of connective tissue in body. The complication rate of T-tube removal in immunocompromised patients is a well-known problem because steroid therapy and chemotherapy agents might diminish the inflammatory reaction around the T-tube, resulting in failure to form a walled-off tract and often preventing the formation of a fibrous tract along the T-tube [10, 13, 15, 18, 24]. So in these situations, the T-tube should remain for a longer period to allow the maturation of the fistulous tract to occur [10].

In liver transplantation cases, in addition to immunocompromised condition, most surgeons use silicone or polyvinyl chloride tubes instead of latex or Red rubber tube that cause a relative slow and less intense reaction [18, 25, 26]. Therefore, the tube is usually expected to be left for a much longer period, and the risk of tract immaturity increases [9, 25, 27, 28].

The main question in these cases is how we can understand the time of complete formation of the T-tube tract before tube removal.

In one report, for this purpose, the tract was visualized with catheterization of the tract and administration of gastrograffin immediately after the removal of the tube [9]. If there was any evidence of disruption in the tract, then a drain is placed into the abdominal cavity to prevent peritonitis, and the patient was

Table 1 Frequency distribution of studied patients according to the mortality rate and the outcome of T-tube removal

		Group 1 ^a (G1)	Group 2 ^b (G2)	Group 3 ^c (G3)	Total
Mortality survey	Alive	34	4	6	43
		100 %	66.7 %	100 %	95.7 %
		77.3 %	9.1 %	13.6 %	100 %
	Dead	0	2	0	3
		0 %	33.3 %	0 %	4.3 %
		0 %	100 %	0 %	100 %
	Total (alive + dead)	34	6	6	46
		100 %	100 %	100 %	100 %
		73.9 %	13 %	13 %	100 %
	Complication survey	No complication	34	3	6
100 %			50 %	100 %	93.5 %
79.1 %			7 %	14 %	100 %
Peritonitis		0	3	0	3
		0 %	50 %	0 %	6.5 %
		0 %	100 %	0 %	100 %
Biloma		0	0	0	0
		0 %	0 %	0 %	0 %
		0 %	0 %	0 %	0 %
Total		34	6	6	46
		100 %	100 %	100 %	100 %
		73.9 %	13 %	13 %	100 %

^a Patients without any risk factors for biliary leakage

^b Patients who received corticosteroids—without fistulography

^c Patients who received corticosteroids—with fistulography

closely observed. In some reports, the removal of the T-tube under direct fluoroscopic guidance in the radiology suite or tube removal over a wire in the interventional radiology department had better results in the detection of tract disruption and prevention of later development of peritonitis [8, 9, 29, 30]. Although these techniques can diagnose the tract disruption and help prevent peritonitis, the main disadvantage of the techniques is that they detect the incompleteness of the tract formation only after the removal of the T-tube. The ideal method would be to visualize the tract prior to the removal of the tube in order to avoid removal of the tube in case of incomplete tract formation [9]. We claim that our technique is a way where we can discover the delay of the tract formation before tube removal, and therefore it can prevent later problems.

Because of the difficulty of evaluation, except corticosteroid usage with low dosage, patients with other causes of immunosuppression were not included in our study. In the study, there was no case of biloma; but in group 2, in the patients who received prednisolone and had no plan of fistulography, three had peritonitis and two of them died. However, there was no statistical difference in the mortality rate between groups 2 and 3, and this was due to the low number of patients that was introduced to the study. After accessibility to the new procedures and instruments such as ERCP, patients who are candidate for surgical choledochal exploration become scarce. But with these small groups, we saw a mortality rate of 33.3 % in group 2 versus group 3. This is while our patients received low dose of prednisolone and suffered from CTD, so they had better general condition than the patients who underwent liver transplantation. Although new reports on liver transplantation without T-tube usage are available, if the operation team were obliged to insert a T-tube, then our technique for their postoperative management would become useful.

An important point in our approach is the usage of latex rubber tube. Since latex tube is very soft, use of this type allows injecting a liquid material into the potential space between the tract and the tube because the tube can collapse. Although Red rubber tubes induce a good inflammatory reaction around the T-tube such as latex tubes, they are rigid, and the mentioned potential space cannot become an actual space. In this situation, if we use this technique, injection may rupture the tract.

Since the control arms are based on retrospective cohorts (G1 and G2), it was difficult to standardize the treatment received. In addition, T-tube removal was carried out at different time periods (G1=2 weeks; G2=4–8 weeks; G3=based on fistulography), and we are comparing different protocols, so the manuscript is mainly descriptive.

In conclusion, our findings suggest the effectiveness of fistulography before T-tube removal in immunocompromised patients for the detection of tract formation, as well as prevention of postremoval complications.

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