This study aimed to determine the feasibility and effectiveness of retrograde stenting with a silicone-coated T-tube via choledochotomy to relieve obstructive jaundice in patients with an unresectable Klatskin tumor.

In order to relieve bile obstruction, 6 patients with Klatskin tumor in whom curative tumor resection was unsuccessful and with choledochotomy in place underwent retrograde stenting with a single drainage catheter via the choledochotomy. By using angiographic technique and equipments, a silicone-coated T-tube was successfully inserted into both the left and right hepatic ducts via the choledochotomy; no major complications were noted.

The mean survival time was 6.3 months. The average duration after which the T-tube was replaced was 1.9 months. The T-tube was changed in each patient at an average frequency of 2.9 times.

Retrograde stenting with a silicone T-tube via choledochotomy for managing a malignant hilar stricture is an easy, economic, and safe method to relieve obstructive jaundice. In patients with a malignant hilar stricture with poor prognosis, this retrograde stenting could be the method of choice if the patients had choledochotomy.

The clinical management for the Klatskin tumor with malignant stricture at hepatic hilum remains challenging [1-4]. Accurate preoperative staging is difficult because the tumor is usually small and infiltrative, and its superficial spread cannot be easily detected by imaging studies. Not infrequently, a surgeon may judge the tumor as unresectable only after surgical exploration. Choledochotomy with a surgical T-tube insertion for biliary drainage is the conventional procedure in such patients. However, the insertion of a surgical T-tube is not selective, that is, it may only drain either the left or the right hepatic duct. Sometimes, it could be difficult to even pass the tube through the malignant stricture. Inappropriate biliary drainage is inevitable in patients with an unsuccessful curative surgery and who have undergone choledochotomy with T-tube drainage. Percutaneous placement of biliary stent through T-tube tract was reported [11]. However, it is usually difficult to obtain effective drainage by using a single tract alone for hepatic hilar biliary obstruction. The aim of this study is to assess the feasibility and effectiveness of using angiographic equipments and technique and placing a silicone-coated T-tube catheter to drain both bile ducts separately via choledochotomy.

**PATIENTS AND METHODS**

From June 1999 to January 2004, 6 patients with Klatskin tumor who had undergone choledochotomy with T-tube insertion were referred to reestablish adequate biliary drainage because of elevating serum bilirubin level. The patients consist of 4 men and 2 women with a mean age of 55.6 years (range, 47-67 years) (Table 1). The malignant hilar stricture was managed by retrograde stenting with a silicon-coated T-tube via the choledochotomy at 5 weeks after surgery, that is, after the choledochotomy tract had matured.

---

Reprint requests to: Dr. Jeng-Hwei Tseng
Department of Medical Imaging and Intervention, Chang-Gung Memorial Hospital.
No. 5, Fu Hsing Street, Kwei-Shan, Taoyuan 333, Taiwan, R.O.C.
First, the left and right hepatic ducts were selectively canalized with a 0.035-inch hydrophilic guidewire (RADIFOCUS® Guide wire M; Terumo, Tokyo, Japan) and a 5-F HI angiocatheter (High-Flo™ Silver Polyethylene catheter; COOK, IN, USA). The angiocatheter was then advanced into the occluded bile duct, and cholangiography was performed (Fig. 1). The length of the stricture was measured in both left and right hepatic ducts. The guidewire was left in situ in each bile duct after the removal of the angiocatheter (Fig. 2) and serial dilatation by fascial dilators (8-F; 10-F and 12-F). Next, a 12-F silicone T-tube (All Silicone T-Drain Tube; Cliniy, Yokohama, Japan) with multiple side-holes on each arm (6-F) was advanced through the stricture into both the hepatic ducts via the respective guidewires. The length of side arm on both sides was measured according to the length of IHD stricture causing by tumor with 1.0-1.5 cm in length as safe margin. Cholangiography was performed again to check the function of T-tube stenting (Fig. 3). All the 6 patients had been given anesthesia (Demoral 50 mg IM) and sedation (Midazolam 5mg IV Roche, Basel, Switzerland) during the procedure.

After the procedures, the patients were regularly followed on a out-patient basis. The indications for T-tube were (a) an acute episode of cholangitis or sepsis, (b) abdominal discomfort, and (c) oozing of bile from the choledochotomy. For patients without signs of tube dysfunction, we routinely change the T-tube catheter every 3 months.

RESULTS

All the 6 patients successfully underwent retrograde T-tube hilar stenting via choledochotomy. No major complications such as hemorrhage, sepsis, or shock occurred. Only endurable pain during tract dilatation and transient low-grade hemobilia were noticed, which all subsided in 12 hours. The serum bilirubin level decreased to below 3 mg/dl after 2–4 weeks in all the patients (Table 1); in 1 patient, the bilirubin level was normalized after 2 weeks of T-tube stenting (Patient 1).
The average length of side arm was 3-4 cm on left side; 4-5 cm on right side. The mean survival time was 6.3 months (range, 5-10 months). The average duration and frequency of T-tube exchange were 1.9 months (range, 21 days ~ 3 months) and 2.8 times, respectively (Table 1). With regard to T-tube function, disease progression may cause dysfunction or occlusion of the T-tube catheter because of clogging of the tube by tumor debris, hemorrhage, and tumor ingrowth. Hemobilia and biliary stricture (tumor progression) were noticed in all patients during replacement of the T-tube.

**Table 1. Patient Demographics and Outcome of T-tube Stent**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Bismuth classification</th>
<th>Bilirubin Before</th>
<th>Bilirubin After 4 weeks</th>
<th>Survival Time (months)</th>
<th>Stent Patency Periods (months)</th>
<th>T-tube Exchange Frequency (times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>Male</td>
<td>IV</td>
<td>20.8</td>
<td>2.3</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Patient 2</td>
<td>Male</td>
<td>IV</td>
<td>21.0</td>
<td>2.8</td>
<td>5</td>
<td>0.7</td>
<td>5</td>
</tr>
<tr>
<td>Patient 3</td>
<td>Male</td>
<td>IV</td>
<td>19.3</td>
<td>2.7</td>
<td>6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Patient 4</td>
<td>Female</td>
<td>IV</td>
<td>15.6</td>
<td>2.8</td>
<td>6</td>
<td>1.6</td>
<td>3</td>
</tr>
<tr>
<td>Patient 5</td>
<td>Male</td>
<td>IV</td>
<td>17.3</td>
<td>2.7</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Patient 6</td>
<td>Female</td>
<td>IV</td>
<td>17.0</td>
<td>2.9</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Figure 3.** Cholangiography revealed a. a separate obstruction at the hilar region and b. a good flow of the contrast medium into bilateral hepatic ducts.

**DISCUSSION**

Curative or palliative surgery for cholangiocarcinoma with hilar obstruction is sometimes difficult because the superficial spread of the tumor may not be detected by imaging studies [2, 4]. All our 6 patients were found to be non-resectable during surgical exploration and intra-operative choledochoscope failed to pass the IHD stricture. Inappropriate biliary drainage is inevitable who have undergone choledochotomy with T-tube drainage. A good biliary drainage is essential to maintain patient's survival [2, 3, 5]. Traditionally, obstructive jaundice is managed by percutaneous transhepatic biliary drainage or endoscopic nasobiliary drainage.
For improving the life quality of these patients, metallic or plastic endoprosthesis placement is becoming increasingly popular. However, occlusion and migration of endoprosthesis, tumor ingrowth, and ascending cholangitis remain the major issues. In patients with the inserted plastic stent being occluded, removal of the stent and reinsertion of a new endoprosthesis, either percutaneously or endoscopically, may be difficult and suffering. Patients who develop bile duct occlusion after metallic prosthesis deployment require restenting with a new metallic endoprosthesis. Similarly, patients with a hilar stricture usually require 2 or more metallic stents, and the treatment costs are high. In the method proposed herein, choledochotomy is used as a safe percutaneous route for accessing the biliary system, and each arm of the T-tube is utilized for the simultaneous drainage of both the hepatic ducts. Replacement of the old T-tube with a new one is easy under fluoroscopic guidance and does not cause discomfort or major complications. Besides, the silicon-coated T-tube catheter is less expensive than the metallic stent; it costs only 30 US dollars. In the present study, no migration of the silicone T-tube was observed because the side-arm of silicone T-tube was anchored to the hepatic bile ducts by its 2 long arms. The silicone T-tube is external drainage, the disadvantages of these methods is (a) wound caring and infection (b) only for patient had choledochotomy.

Unresectable hilar-type cholangiocarcinoma has a poor prognosis, with a survival time of 3.2–4.8 months after metallic stent placement. The mean duration for which the metallic stent remains patent is approximately 3.76-4.5 months. Replacement with a new endoprosthesis may be necessary to increase the survival time. The silicone T-tube is a cost-effective choice for such patients with poor prognosis.

CONCLUSION

To relieve obstructive jaundice induced by a hilar stricture, retrograde stenting with a silicone T-tube via choledochotomy is an easy, inexpensive, and safe method. In patients with a malignant hilar stricture with poor prognosis, this method could be the method of choice, while in patients with a benign hilar stricture, silicone-coated T-tube insertion may provide temporary relief from obstructive jaundice.

REFERENCE

7. Stoker J, Lameris JS. Complications of percutaneously inserted biliary Wallstents. JVIR 1993; 4: 767-772
9. Nib S. Common areas of interest between interventional biliary radiology and endoscopy. AJR Am J Roentgenol 1995; 547-551
經總膽管瘻管進行 T- 型矽膠管置放術以引流肝門膽道癌引起之兩側膽道狹窄

潘廣澤  朱崧毓  洪建福  蘇奕豪  曾振輝

長庚大學  林口長庚紀念醫院  影像診療科部

對於少數惡性肝門膽道癌的病患，在手術中發現腫瘤轉移或血管入侵而不可切除時，外科醫師通常是進行總膽管切開術，並且放入引流管。但是引流管的位置通常不恰當。即使恰當也只能引流一側的肝內膽管。我們介紹一種技術可經由總膽管瘻管，逆行性置入壹 T- 型矽膠管引流兩側肝內膽管以降低病患的黃膽，防止併發膽管炎並保存肝功能以提升病患的存活率。我們初步的經驗顯示，對於這些病患，置放 T- 型管是一個有效、安全且簡單的方法。