

Case-based review: bile peritonitis after T-tube removal

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ABSTRACT

T-tube placement into the common bile duct (CBD) is most commonly performed after CBD exploration for cholelithiasis or repair of an iatrogenic CBD injury. Bile peritonitis occurring after T-tube removal is generally considered an exceedingly rare complication, which on occurrence necessitates urgent intervention. No clear guidance exists on the timing of T-tube removal and its relationship to the development of bile peritonitis. This study aimed to determine the incidence of bile peritonitis after T-tube removal, its relationship to the timing of removal and how knowledge of this can help the general surgeon.

KEYWORDS

T-tube – Common bile duct – Choleperitoneum

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T-tube placement into the common bile duct (CBD) is most commonly performed after CBD exploration for cholelithiasis or repair of an iatrogenic CBD injury. T-tube functioning is based on the formation of multiple fibrous adhesions closing off any significant CBD defect over time. The T-tube allows passive decompression of the biliary tract, postoperative access to the CBD via T-tube cholangiography and further extraction of calculi via a matured drain tract. Despite this, T-tubes are associated with complications, particularly bile peritonitis at the time of T-tube removal, which can necessitate surgical intervention. We present a case of bile peritonitis after T-tube removal, and review the literature for evidence regarding the timing of T-tube removal and the development of bile peritonitis.

Case history

A 47-year-old woman was admitted for an elective laparoscopic cholecystectomy for symptoms of chronic cholelithiasis. She was otherwise fit and well with no additional past medical history. At surgery, conversion to an open procedure was undertaken owing to extensive chronic inflammatory changes preventing safe progression laparoscopically. Through blunt dissection it was possible to identify what was considered to be a short cystic duct and grossly dilated extrahepatic duct. On-table cholangiography was performed via cannulation of this duct, revealing that it was the CBD with multiple large gallstones obstructing flow of contrast into the duodenum.

In view of this obstruction, it was decided to explore the CBD. The choledochotomy was extended and the CBD ex-

plored using a choledochoscope. Three large gallstones were retrieved. A latex T-tube was inserted into the choledochotomy, which was sutured over the T-tube using an interrupted 3/0 Vicryl® (Ethicon, Somerville, NJ, US) suture placed both above and below the exiting limb of the T-tube. The course of the T-tube was as straight as possible to the skin but without tension, to avoid displacement in the early postoperative period. The T-tube was sutured externally to the skin, the wounds were closed and the patient was returned to the ward. Postoperatively, the T-tube was left open. The patient made good progress and was tolerating diet on day 5.

T-tube cholangiography was performed at seven days and demonstrated free flow of contrast into the duodenum with no leakage. The T-tube was clamped and the patient discharged with it in situ. She returned to the ward after four weeks for removal of the T-tube. Three hours after removal, she developed a temperature of 37.9°C, a heart rate of 120bpm and lower abdominal peritonism. She was admitted, and commenced on intravenous antibiotics and fluids.

The following day, symptoms persisted and computed tomography of the abdomen was requested, demonstrating a large amount (>1l) of free fluid in the abdomen. Conservative measures were continued and the patient demonstrated clinical improvement within 48 hours. She was discharged seven days after admission to be followed up in the outpatient clinic.

Discussion

Bile peritonitis occurring after T-tube removal is generally considered an exceedingly rare complication. The T-tube

Table 1 Summary of studies on bile peritonitis after T-tube removal

Authors	Patients with T-tubes in situ	Timing for T-tube removal (range)		Bile peritonitis	Return to theatre	Mortality
		Range	Median			
Maghsoudi, 2005 ⁸	1,375	21 days	21 days	2.5% (34/1,375)	2.5% (34/1,375)	0% (0/1,375)
Wills, 2002 ¹⁰	274	10–29 days	15 days	6.9% (19/274)	4.4% (12/274)	1.8% (5/274)
Gharaibeh, 2000 ¹¹	93	12–14 days	14 days	6.5% (6/93)	3.2% (3/93)	1.1% (1/93)
Gillatt, 1985 ¹²	36	6–18 days	7 days	19.4% (7/36)	2.8% (1/36)	0% (0/36)
Domellöf, 1977 ¹³	51	5–13 days	7 days	19.6% (10/51)	0% (0/51)	0% (0/51)

results in an inflammatory response along the entire length of the drainage tract. This reaction is characterised by the infiltration of lymphocytes, plasma cells, histiocytes, fibrin deposition and collagen formation around the tract. This reaction leads to the formation of a fibrous chimney along the intraperitoneal trajectory of the T-tube and a true biliary-cutaneous fistula. The tract prevents leakage of bile into the peritoneal cavity. When the T-tube is removed, this tract will remain leakproof and subsequently close down under the influence of intra-abdominal pressure.¹

The degree to which this inflammatory reaction develops depends on the T-tube material. When polyvinyl chloride (PVC) T-tubes were introduced in the 1960s, Winstone *et al* identified a higher incidence of this complication,² resulting in PVC T-tubes being withdrawn from the market. Michotey *et al* also found a marked absence of fibrosis along the tract when a PVC T-tube was removed at reoperation for choleperitoneum on the 16th day postoperatively.⁵ The inflammatory response is also considered muted and delayed with silicone-based T-tubes.⁴ Therefore, based on older experiments including animal models, current practice favours latex as the material of choice for T-tubes in terms of its inflammatory reaction, rate of development of a fibrous tract and absence of bile precipitation in the lumen.^{5,6} However, prospective trials involving latex T-tubes have also shown cases of bile peritonitis after their removal.⁷

It is considered safe to remove latex T-tubes at 7–10 days.⁷ However, other authors prefer to leave latex T-tubes in for 21 days.⁴ Little evidence exists to suggest any benefit from a longer period of time. Studies have shown no benefit in terms of fibrosis from leaving a latex T-tube in place for 6–12 weeks.^{8,9} The incidence of bile peritonitis after removal of latex T-tubes ranges from 2.5% to 19.6%.^{8,10–15} The incidence of patients returning to theatre as a consequence of bile peritonitis lies between 0% and 4.3%. The mortality as a consequence ranges from 0% to 1.8%.

Interestingly, the study conducted by Domellöf *et al*, which recorded an incidence of bile peritonitis of 19.6%, did not record any returns of patients to theatre, with all patients settling with conservative means.¹⁵ Conversely, Maghsoudi *et al* recorded the lowest incidence of bile peritonitis of 2.5% a large cohort of 1,345 patients but recorded all of these patients being returned to theatre.⁸

The mortality as a result of bile peritonitis is low, ranging from 0% to 1.8%.^{8,10–15} When we look at the timing of T-tube removal in relation to cases of bile peritonitis, a clear trend is observed. Studies by Domellöf *et al*¹⁵ and Gillatt *et al*,¹² in which the median length of time before T-tube removal was only 7 days, have incidences of bile peritonitis of 19.6% and 19.4% respectively. This is almost ten times higher than in the study by Maghsoudi *et al*, in which T-tubes were removed at 21 days and the incidence of bile peritonitis was only 2.5%.⁸

Since the 1980s, the overall usage of T-tubes has reduced owing to viable alternatives such as primary closure, stenting, endoscopic retrograde cholangiopancreatography (ERCP) and duct clearance. In a retrospective study of the treatment of CBD stones in 110,119 Swedish patients between 1965 and 2009, Strömberg and Nilsson demonstrated an evolution of clinical practice.¹⁴ They showed that the endoscopic procedures gradually replaced open surgery as the treatment for CBD stones. Between 1975 and 1979, 10,000 patients were treated for CBD stones and all of them underwent open surgery. In contrast, between 2005 and 2009, 20,000 patients were treated for CBD stones, of whom over 80% were treated with ERCP, the remaining 20% with open surgery (12%), laparoscopic surgery (5%) or surgery plus ERCP (3%).

However, patients in the ERCP group tended to be older, and were more likely to be male and have severe co-morbidities.¹⁴ Patients treated with laparoscopic CBD exploration were younger, more often female and tended to have less co-morbidity. Both 30 and 90-day mortality rates were around three times higher after ERCP than after open CBD exploration. Laparoscopic CBD exploration differed markedly from the other interventions as the 90-day mortality was zero. The proportion of patients having reintervention within 90 days after ERCP was 5–5 times higher than in the open and laparoscopic CBD exploration cohorts. The mean length of hospital stay was shorter after ERCP (7.2 days) and laparoscopic surgery (4.2 days) than after open surgery (16.2 days).

Primary closure of the CBD has had its advocates dating back to the earlier part of the last century. Collins *et al* looked retrospectively at a total of 462 choledochotomies between 1936 and 1957, of which 225 were closed primarily and 237 were drained. Interestingly, they found that the mortality from drainage was 8.9% compared with 1.8% for primary closure.¹⁵ In a prospective study of 117 patients, Lygidakis

Table 2 Summary of case studies on bile peritonitis after T-tube removal

Authors	Patients in case series	Returned to theatre	Deaths
Horgan, 1989 ²¹	15	10 (67%)	0 (0%)
Corbett, 1986 ⁷	71	54 (76%)	4 (6%)
Rovere, 1981 ²²	3	1 (33%)	0 (0%)
Mullany, 1978 ²³	3	3 (100%)	0 (0%)
Ellis, 1972 ²⁴	5	5 (100%)	1 (20%)

found that primary CBD closure was associated with a lower incidence of postoperative bacteraemia, mortality and morbidity rates (3.3%, 0% and 13.3% respectively) compared with T-tube drainage (31.5%, 3.5% and 36.1% respectively). He suggested that T-tube drainage might provoke exogenous acquisition of environmental microorganisms and thus promote further infection.¹⁶

More recent studies have supported such findings. In a randomised trial of 93 patients comparing laparoscopic exploration of the CBD with primary closure versus T-tube drainage, Zhang *et al* found that compared with the T-tube group, the operative time and postoperative stay were significantly shorter, the hospital expenses significantly lower, and the incidence of overall postoperative complications and biliary complications statistically lower in the primary closure group.¹⁷ In a prospective study of 122 patients undergoing laparoscopic choledochotomy, El-Geidie also found that compared with the T-tube group, the operative time and postoperative stay were significantly shorter, and the incidences of overall postoperative complications and biliary complications were significantly lower in the primary closure group.¹⁸ In a systematic review of primary closure versus T-tube drainage after open CBD exploration, Gurusamy and Samraj found bile peritonitis higher in the T-tube (2.9%) than in the primary closure group (1%) although this was not statistically significant.¹⁹ Hospital stay was significantly longer in the T-tube group.

Much less work has been reported on the use of biliary stenting compared with primary closure after choledochotomies. In their review, Gurusamy and Samraj commented on only a single trial comparing the two.¹⁹ They were unable to identify any statistically significant difference in any reported outcomes. In a study of 63 patients undergoing either antegrade biliary stenting or T-tube drainage after laparoscopic choledochotomy, Tang *et al* found that more patients in the stenting group developed a bile leak (14.2% vs 3.5%), requiring more intramuscular pethidine injections and therefore limiting the use of this technique.²⁰ This clearly highlights an area where further refinement of the procedure and more trials are required in order to validate the use of this technique.

Conclusions

Our case and review of the literature demonstrates that the incidence of bile peritonitis after T-tube removal can be as

high as 19.6% if removed at one week,¹⁵ reducing to 2.5% if left for three weeks.⁸ The majority of these cases will settle with conservative measures but up to 4.3% of these patients will need to return to theatre.¹⁰ This study suggests that bile peritonitis is not as 'exceedingly rare' as it is considered traditionally but rather a common complication of T-tube removal. Removal earlier than 21 days runs the risk of higher incidence of its occurrence and should be avoided. Even though cases of CBD exploration have reduced over the last 30 years,¹⁴ the use of T-tubes still remains popular, necessitating that surgeons should be aware of this 'not so rare' complication.

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