

Retained KEHR's Tube Following Choledochotomy: A Prospective Study of 12 Cases at a Tertiary Care Hospital

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Abstract

Background: Common bile duct (CBD) drainage via Kehr's/T-tube after choledochotomy is a standard procedure following CBD exploration. Retention of Kehr's-tube/fragments after extraction represents an uncommon but clinically grave complication. This prospective study examines 12 cases of retained Kehr's-tube fragments to establish presentation profiles, causative mechanics, and therapeutic algorithms.

Methods: Twelve consecutive patients referred with retained Kehr's-tube/ fragments foreign bodies were prospectively categorized into four distinct presentation groups based on the structural nature of the retained component, timeline of presentation, and underlying cause of retention.

Results: Group 1 (n=5): Retained crossbar with short stem presenting on POD 14–16 with fever and upper abdominal pain (1 open, 4 laparoscopic choledochotomy); all successfully retrieved via laparoscopic exploration. Group 2 (n=2): Inability to extract T-tube on POD >14 due to inadvertent suturing of the stem to the CBD wall; managed by laparoscopic suture division and safe extraction. Group 3 (n=4): Fractured T-tube with retained stem and crossbar presenting late (3 cases within 4 months, 1 case at 12 years) with intermittent jaundice, fever, and severe pain; dense periductal fibrosis prevented laparoscopic retrieval, requiring open exploration with fibrosis excision. Group 4 (n=1): Retained small stem and crossbar fragment associated with a persistent biliocutaneous fistula 17 days post-removal, successfully retrieved laparoscopically.

Conclusion: Retained Kehr's-tube fragments must be suspected in patients with persistent or recurrent post-procedural biliary symptoms. Early laparoscopic intervention is highly successful, whereas delayed presentation complicated by dense fibrosis typically mandates open surgical retrieval.

Keywords: Kehr's-tube Retention, CBD Exploration, Laparoscopic Retrieval, Choledochotomy, Biliocutaneous Fistula, Periductal Fibrosis.

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Introduction

Common bile duct exploration (CBDE) remains a cornerstone procedure in biliary surgery for managing complex choledocholithiasis and biliary obstructions. Following choledochotomy during CBDE, insertion of a Kehr's-tube is routinely performed to decompress the extrahepatic biliary tree, ensure external bile drainage, and allow postoperative diagnostic cholangiography prior to tube removal.

Anatomical & Technical Specifications of Standard Kehr's Tubes:

- **Transverse Limb ("Crossbar"):** Shorter horizontal arm placed inside the CBD, with

limbs facing upward toward the hepatic ducts and downward toward the duodenum to allow physiological bile passage while providing decompression.

- **Longitudinal Limb ("Stem"):** Longer vertical tube extending through the choledochotomy site and abdominal wall to an external drainage collection bag.
- **Distal End (Port):** External port used for output monitoring, bile sampling, or capping during clamping trials.
- **Material Composition:** Constructed from 100% biocompatible medical-grade silicone, latex, or polyvinyl chloride (PVC).

- **Radio-Opaque Line:** Embedded radiopaque longitudinal strip allowing fluoroscopic and radiographic visualization during cholangiography.
- **Sizing Scale:** Sized on the French/Charrière scale, typically ranging from 10 Fr to 24 Fr based on ductal diameter.

Despite widespread use, Kehr's-tube drainage carries inherent risks including bile leak, ductal stricture, displacement, and tube fracture with intra-ductal fragment retention. Retained Kehr's-tube fragments act as foreign bodies that predispose patients to severe cholangitis, stone nidus formation, biliary fistulae, and dense chronic inflammatory fibrosis. This prospective study analyzes 12 consecutive cases referred to our tertiary center to delineate clinical presentation patterns and optimal surgical management.

Materials & Methods: A prospective observational study was conducted at a tertiary care medical referral center involving 12 patients referred with retained Kehr's-tube/ its fragments or non-removable Kehr's-tube after index open or laparoscopic choledochotomy with CBDE. All

patients underwent comprehensive baseline clinical evaluation, liver function tests, and radiological mapping (ultrasonography, CT, MRCP, or fistulography).

Patients were categorized prospectively into four distinct clinical cohorts:

- **Group 1:** Retained crossbar with short stem remnant following attempted routine extraction.
- **Group 2:** Inability to extract intact Kehr's-tube due to inadvertent suture fixation to the CBD wall.
- **Group 3:** Broken Kehr's-tube with long retained stem and crossbar presenting late with dense periductal fibrotic encasement.
- **Group 4:** Retained small stem and crossbar fragment associated with a chronic bilioductaneous fistula.

Results

Clinical profiles, index procedures, time to presentation, retention etiology, and surgical interventions across all 12 cases are detailed in Table.

Table 1:

Group	Cases	Index Operation	Presentation & Timeline	Mechanism of Retention	Definitive Surgical treatment
Group 1	5	1 Open Choledochotomy 4 Lap Choledochotomy	POD 14–16 Fever & upper abdominal pain	Retained crossbar with short stem after traction removal	Laparoscopic exploration & fragment retrieval
Group 2	2	Choledochotomy + CBDE	POD >14 Inability to extract tube despite standard traction	Crossbar inadvertently sutured to CBD wall during repair	Laparoscopy: Division of anchor suture & extraction
Group 3	4	Choledochotomy + CBDE	3 cases: <4 months 1 case: 12 years post-op Jaundice, fever, severe pain	Broken T-tube with retained stem & crossbar; dense fibrosis	Open exploration: Fibrosis excision & duct clearance
Group 4	1	Choledochotomy + CBDE	POD 17 post-removal Chronic pain & bilioductaneous fistula	Retained small stem & crossbar in CBD with fistulous tract	Laparoscopic exploration: Retrieval & fistula repair

Group Analyses & Operative Findings

Group 1 (n=5): Patients presented acutely 14–16 days post-op following forceful traction during planned removal. Imaging confirmed a transected T-tube segment (crossbar + short stem) in the subhepatic space/CBD. Laparoscopic exploration was successful in all 5 cases; soft acute tissue reaction allowed safe grasper extraction and ductal closure.

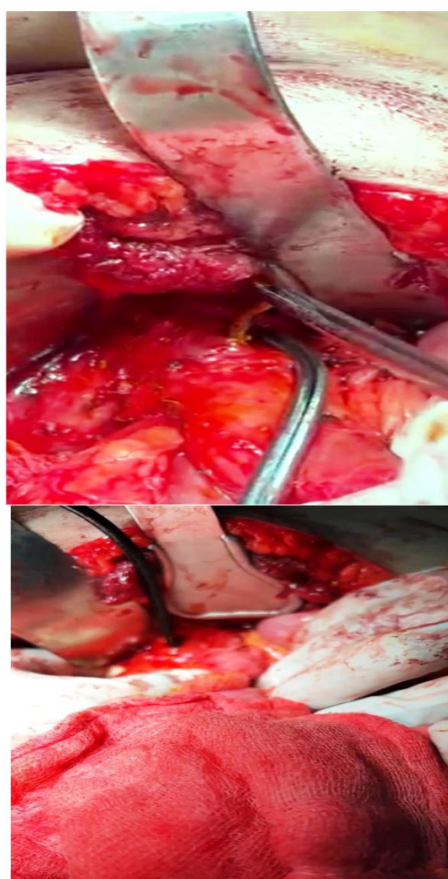
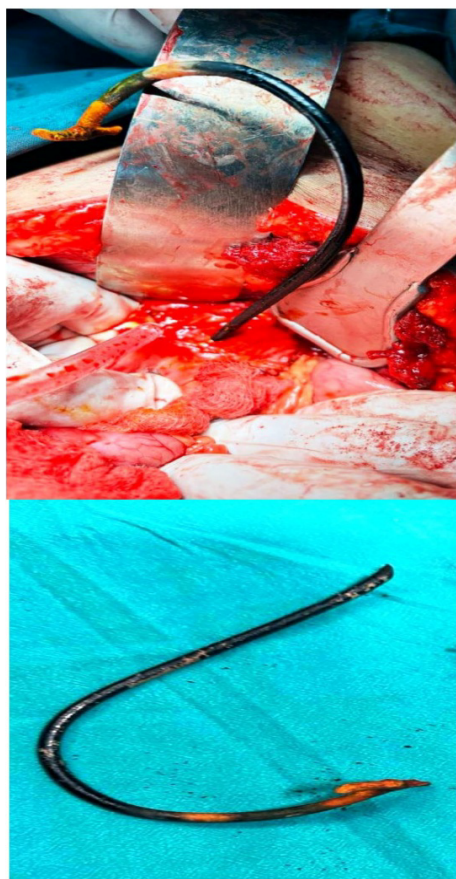
Group 2 (n=2): Kehr's-tube could not be extracted on POD >14 due to strong anchor resistance. Laparoscopy revealed that non-absorbable choledochotomy closure sutures had inadvertently transfixed the crossbar. Suture division

immediately freed the intact Kehr's-tube for gentle extraction without ductal tearing.

Group 3 (n=4): Represents the most complex cohort. Three patients presented within 4 months and one patient presented 12 years after index surgery with recurrent cholangitis, severe pain, and obstructive jaundice. In all 4 cases, the retained foreign body was encased in a dense, woody mass of chronic periductal fibrosis around the porta hepatis. Laparoscopic dissection was unsafe due to obliteration of anatomical planes. Open surgical exploration was performed (Figures 1 & 2), requiring sharp fibrosis excision, choledochotomy, and complete segment extraction.

Group 4 (n=1): A patient presented 17 days post-removal with a persistent biliocutaneous fistula. Laparoscopy identified a small stem and crossbar

fragment in the CBD. Fragment retrieval and fistulous tract curettage resulted in complete fistula resolution.



Figures 1,2,3&4:

Group Analyses & Operative Findings

Group 1 (n=5): Patients

Discussion

Kehr's-tube retention or fracture typically arises from technical or material factors: excessive traction against an unyielding tract, inadvertent suture transfixion during choledochotomy closure (Group 2), material degradation/hardening from prolonged bile exposure, or improper trimming of crossbar limbs prior to insertion.

Surgical Approach Matrix: The feasibility of laparoscopic retrieval versus open surgical exploration is governed primarily by the duration of retention and the extent of chronic reactive fibrosis.

In early-phase presentations (Groups 1, 2, 4), tissue inflammation is soft and pliable.

Laparoscopic exploration offers superb visualization, low morbidity, and prompt recovery.

In contrast, delayed presentations (4 months to years; Group 3) induce intense foreign-body giant

cell reactions and mature collagen deposition, forming a thick vascular mass encasing the CBD and hepatic artery. In such "frozen" anatomical environments, open surgical exploration with meticulous fibrosis excision is mandatory for safe retrieval.

Conclusion

Retained Kehr's-tube fragments must be suspected in any patient presenting with pain, jaundice, fever, or persistent fistula following T-tube extraction. Early cases are safely managed via laparoscopic retrieval. Delayed cases complicated by dense fibrotic encasement necessitate formal open exploration and scar excision. Prevention relies on proper crossbar trimming and careful choledochotomy closure.

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