

Research Article

Percutaneous Treatment of Postoperative Bile Leaks with Coil Embolization After Cholecystectomy

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Abstract

Objectives: To evaluate safety and efficiency of percutaneous coil embolization in patients with bile leakage after cholecystectomy.

Methods: Patients who underwent percutaneous coil embolization for treatment of bile leakage between January 2016- January 2018 were included in this retrospective case series study. Technical success, procedure related complications, time for leak stoppage and catheter indwelling time were evaluated.

Results: There were 5 patients (4 men, mean age 60 years) who were treated with percutaneous embolization of bile leak. Technical and clinical success were 100%. Most common procedure related complication was pain at catheter insertion site. There was no major complication. Mean time for cessation of leakage was 2 days (Range: 1-3) after embolization and mean duration of the percutaneous catheters was 12 days (Range: 9-14).

Conclusion: Percutaneous coil embolization is a safe and effective method in management of bile leaks after cholecystectomy. Early decision of embolization of the leak source may improve the quality of life and clinical outcomes. Prospective larger studies are needed to determine the role of percutaneous embolization in this specific clinical scenario.

Keywords: Bile leak, embolization, percutaneous

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Bile leakage after cholecystectomy is an uncommon but serious complication and associated with increased mortality and morbidity.^[1–3] Early detection and treatment are essential in this case scenario to improve the clinical outcome. There is no clear consensus in management of bile leakage and in most centers, patients were treated endoscopically with sphincterotomy and endoscopic stent placement. Nevertheless, in some cases endoscopy is not feasible due to altered anatomy and high-grade leaks may fail to regress after endoscopic treatment.^[4,5] Previously, endoscopic and percutaneous methods of embolization of the leakage site with biopolymers such as N-butyl cyanoacrylate (Glue) and ethylene vinyl alcohol (Onyx) were described as case reports.^[6–9] In this study, we report our

single center experience of percutaneous embolization of bile leaks with platinum coils in treatment of postoperative bile leakage.

Methods

Study Population

In this single center cohort study, 5 patients who underwent percutaneous treatment with coil embolization for bile leakage after cholecystectomy, between 2016-2018 were evaluated. All patients except one were presented after laparoscopic cholecystectomy for acute cholecystitis and one presented after open cholecystectomy and choledochal exploration due to co-existing biliary stone disease.

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All patients were informed about their clinical condition and informed consent form had been signed before the procedure. This study was approved by local review board (Date 22.07.2020-No:20).

Technique

All procedures were performed under mild-moderate conscious sedation in interventional radiology unit. First, every patient underwent percutaneous biliary drainage under ultrasound and fluoroscopic guidance and bile leakage demonstrated with percutaneous cholangiography. Bile diversion attempted prior to the embolization by placement of an 8F external drainage catheter proximal to the leakage site. After biliary drainage, if persistence of leakage confirmed by continuous outcome more than 100 cc from indwelling drainage catheters which were placed to treat biliomas at presentation or pre-existing drains placed during surgery, embolization of the leakage source was considered.

An Amplatz stiff guidewire was introduced through pre-existing external drainage catheter and a 9F sheath was placed over the guidewire. After depiction of the leakage site by cholangiography, leaking duct was selectively catheterized with 5F Cobra catheter and a 2.7 F microcatheter as distally as possible. After contrast injection and confirmation of appropriate position, detachable fibered platinum coils (Interlock-18, Boston Scientific, Natick, MA) were deployed and leaking source was embolized until to the origin. The procedure was terminated with placement of a 10 F external drain placement proximal to the leakage site in order to divert the bile flow and accelerate the healing process. Sample cases are presented in Figure 1 and Figure 2.

Follow-up

Patients were followed during their hospital stay and outcomes from bilioma drains or surgical drains were noted. A control cholangiography taken after daily drainage from the drains reduced to 10cc or below. After cholangiography, if the termination of the leakage documented, biliary drainage catheter was removed. After discharge, patients were scheduled for control visits at first week, first month and 6-months interval annually.

Outcomes

Technical success, clinical success, procedural complications, catheter indwelling time, hospitalization time and late complications were evaluated in this study.

Technical success was defined as successful catheterization of the bile duct of leakage source and documentation of termination of bile leakage after embolization. Clinical success was defined as patients resolving of presenting symptoms without relapsing during the follow-up period.

Results

There were 5 patients of biliary leakage after cholecystectomy during the study period whom were treated with coil embolization percutaneously. Mean age of the patients was 60 years (Range: 33-73). Endoscopic sphincterotomy and biliary drainage were first attempted in 3 patients but failed. In two patients, previous upper gastrointestinal surgery precluded endoscopic intervention. All patients were presented with abdominal pain, nausea and fever. Bile leak was originating from cystic duct stump in 4 cases and segment 4a radicle in one case.

Mean time from operation to presentation was 6.2 days (Range: 3-11). Mean time from operation to biliary drainage was 10.6 days (Range: 5-15). Mean time from operation to embolization of the leak tract was 15 days (Range: 12-18).

Percutaneous drainage and coil embolization of the leakage site were successful in all patients. There was no procedure related major complication and the most common minor complication was pain at catheter insertion site (n=4), all of which controlled with oral analgesics. None of the patients needed re-intervention since bile leakage stopped (recorded from bilioma drains) in 1-3 days after tract embolization and mean catheter indwelling time was 11.8 days (Range: 9-14). Clinical characteristics and follow-up results were summarized in Table 1.

Mean follow up of the patients were 13.4 months (Range 7-25) after catheter removal. One patient died at 214th day due to advanced stage gastric cancer. In one patient dislocation of coils in to the common bile duct was detected. Patient was symptom free and during follow-up imaging dislocated coil was not found and presumed to be dislodged in to intestinal system. All other patients were without any symptoms and both blood tests and ultrasound examination did not show any disturbance regarding the biliary system.

Discussion

In this study, we report our single center experience in percutaneous treatment of bile leaks with coil embolization. We achieved technical success in all of our patients without procedure related major complications. By early decision of percutaneous treatment, we shortened the catheter indwelling times and hospitalization period of the patients when compared to previous studies evaluating the efficiency of percutaneous biliary drainage alone.^[10-13]

Bile leakage is a rare but major complication that can be seen after open or laparoscopic cholecystectomy which causes prolonged hospital stay and need for reintervention. If not treated early, bile leakages result in substantially increased morbidity and mortality.^[1-3] Biliary diversion is a



Figure 1. 33-years old male patient presenting with abdominal pain and fever eight days after laparoscopic cholecystectomy. Control cholangiography showed bile leakage from cystic duct stump **(a)**. Cystic duct stump catheterized with 5F cobra and 2.7 F microcatheter coaxially **(b)**. Coil embolization performed after selective catheterization **(c)**. Final cholangiography demonstrates no bile leak and successful coiling of the leak source **(d)**.

widely used method in bile leaks and endoscopic treatment with sphincterotomy with or without drain placement is accepted as the first line treatment method. Unfortunately, up to 25% of the cases were failed with endoscopic treatment.^[3] Although percutaneous drainage for biliary decompression in patients with bile leaks had been reported with clinical

success between 70-100%, long catheter dwelling times and hospitalization periods are major drawbacks.^[10-13] For patients in whom percutaneous and endoscopic treatment failed closure of the leakage site should be proposed.

In literature, various techniques were reported for closing the bile leakage site. Injection of sclerosing agents in to

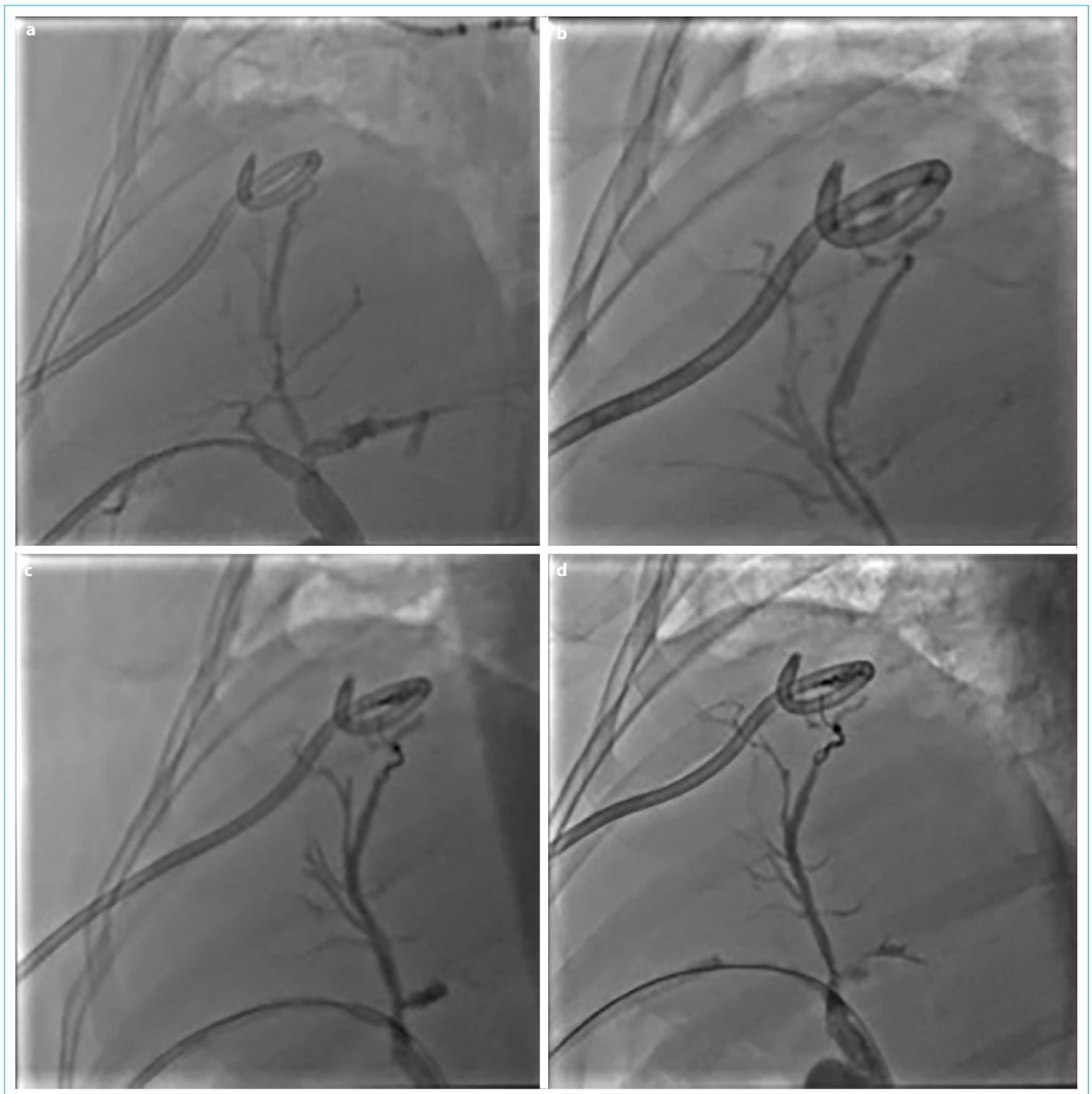


Figure 2. 56 years old female patient with bile leakage originating from segment 8 bile duct. Early cholangiography shows no clear bile leakage (**a**). After selective catheterization of the segment 8 bile duct and contrast injection, bile leak was depicted (**b**). Coil embolization performed after selective catheterization (**c**). Final cholangiography demonstrates no bile leak and successful coiling of the leak source (**d**).

the affected bile ducts were reported in case reports and case series. Ethanol ablation of injured isolated bile ducts percutaneously were described by Ito et al.^[14] Ethanol causes dehydration of the target tissue, causes necrosis and scar formation as obliteration of the target bile duct. It is not recommended for bile ducts with communication of central bile duct system. As cystic duct has direct com-

munication with common bile duct there is a potential risk of reflux and stricture of the common bile duct. Due to liquid nature of the ethanol there is increased risk of unintentional peritoneal extravasation which may cause peritonitis and systemic inflammation. The risk is even greater in cystic duct injection which is another cause of limited usage of ethanol in cystic duct leakage. There are

Table 1. Characteristics and follow up results of the patients

Patient	Presentation	Age	Sex	Time of presentation (day)	Time to percutaneous drainage(day)	Time to embolization (day)	Time to cessation of the bile leak (day)	Time to biliary drain removal (day)
Patient 1	Abdominal pain, fever, bilioma	70	Male	3	5	12	14	17
Patient 2	Bilioma, biliopleural fistula	56	Female	5	12	18	19	25
Patient 3	Abdominal pain, fever, bilioma	33	Male	8	11	14	15	22
Patient 4	Abdominal pain, fever, bilioma	66	Male	11	15	17	19	24
Patient 5	Abdominal pain, biliocutaneous fistula	73	Male	7	10	15	18	24

also possible systemic adverse reactions such as flushing, fever, leukocytosis and hypotension.

Another sclerosing agent used for embolization was N-butyl cyanoacrylate (Glue). Vu et al.^[9] reported 6 cases treated with N-butyl cyanoacrylate. Four patients treated successfully in the first attempt and two of them in whom there were central bile duct communication, needed second procedure with combination of coil embolization of the persistent tract. Similar to this report, Gorich et al.^[15] reported four cases of biliary fistulas treated successfully with percutaneous embolization with Ethibloc (Ethicon, Somerville, NJ) and isobutyl-2-cyanoacrylate. There was no major complication. Both authors reported unintentional distribution of the glue into the main biliary system. Although this complication was reported clinically insignificant in these cases, there is a potential risk of biliary stricture formation and peritonitis in uncontrolled extravasation of the material. A novel agent, ethylene vinyl alcohol copolymer (Onyx) had been reported as an effective material for embolization in case reports and a case series of five patients by Uller et al.^[8] Compared to Histoacryl, Onyx provides better control of injection in the leakage site and risk of impaction (Gluing) in the microcatheter is lesser. For protection from unintentional ablation of a major duct and in second procedures of unsuccessful cases, some authors used microcoils as a strut for safety and better closure of the leakage site.^[6,9] Controlled usage of liquid agents is essential since complications such as hepatic vein thrombosis and pulmonary artery embolism may occur.^[16]

Other embolization materials in interventional radiology armamentarium such as vascular plugs, hydrocoils and occlusion balloons had also been reported in case reports for treatment of bile leakages.^[17-19] Usage of coils in treatment of bile fistulas were previously reported by Oliva et al. and Hunt et al.^[20,21] Both reported three cases successfully treated with cessation of the bile leak in 2-5 days. Nezami et al.^[22] reported seven cases treated via coil embolization

of the leakage tract through pre-existing bilioma drainage catheter. This simple technique is an effective alternative to previously described technique which uses percutaneous biliary drainage route. Authors claimed percutaneous drainage of the non-dilated biliary system in bile leakage is technically challenging and may be associated with more complications. In our practice, we did not experience any difficulty in percutaneous biliary drainage procedures and we believe biliary diversion helps in early closure of the leakage so we preferred percutaneous drainage as the initial step of the treatment. Another advantage of this approach is availability of imaging the whole biliary system before removing the gallbladder fossa drain and availability of reintervention if needed.

We experienced one coil migration as a procedure related complication in our study without clinical significance similar to the previous reports.^[22-24] Although clinically subtle, this complication may cause biliary obstruction or like previously reported if migration into the peritoneal space occurs it may result with recurrence of the bile leak and deterioration of the clinical status.^[23] Elaborate planning of the procedure, stable catheterization of the tract with microcatheters, careful deployment and tight packaging of the coils is essential to avoid this complication. We did not use liquid embolization agents in our cases and sole coil embolization was enough for effective closure of the leak site. We preferred not to use liquid agents to avoid unintentional reflux of the agent in to the main biliary system. Detachable coils provide more control compared to liquid agents, which is essential in locations such as cystic duct stump.

Retrospective design and limited number of patients were the main limitations of our study. As percutaneous treatment of the bile leaks was reported in case reports and very small case series, we believe results of our study still contributes to the growing data on this subject.

Conclusion

Percutaneous coil embolization of the bile leaks after cholecystectomy seems to be feasible and safe when endoscopic treatment is not available or failed. Larger studies on percutaneous treatment of post-operative bile leaks with coil embolization and comparison with endoscopic treatment will determine the role of this approach in future.

Disclosures

Ethics Committee Approval: The study protocol was approved by Okan University Ethics Committee with 22/07/2020 dated and 20 numbered decision.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – S.A.U., B.G.; Design – S.A.U., U.O., H.C.; Supervision – B.G., B.Y.; Materials – U.O., E.A.; Data collection &/or processing – U.O., E.A.; Analysis and/or interpretation – S.A.U., H.C.; Literature search – S.A.U., H.C.; Writing – S.A.U., B.G.; Critical review – B.G.

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