



Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.comA novel endoscopic treatment of major bile duct leak[☆]Aiman Al Wahaibi^a, Khalid AlNaamani^{b,c,d,*}, Ahmed Alkindi^{e,f}, Issa Al Qarshoubi^{g,h,i}^a Department of Medicine, Oman Medical Specialty Board, Muscat, Oman^b Department of Medicine, Armed Forces Hospital, Muscat, Oman^c Division of Gastroenterology, Armed Forces Hospital, Muscat, Oman^d Division of Therapeutic Endoscopy, Armed Forces Hospital, Muscat, Oman^e Department of Surgery, Armed Forces Hospital, Muscat, Oman^f Division of Hepatobiliary Surgery, Armed Forces Hospital, Muscat, Oman^g Department of Medicine, Sultan Qaboos University Hospital, Muscat, Oman^h Division of Gastroenterology, Sultan Qaboos University Hospital, Muscat, Omanⁱ Division of Therapeutic Endoscopy, Sultan Qaboos University Hospital, Muscat, Oman

ARTICLE INFO

Article history:

Received 23 August 2013

Received in revised form

30 November 2013

Accepted 27 January 2014

Available online 7 February 2014

Keywords:

Liver resection

Bile leak

ERCP

Metallic coil

N-butyl cyanoacrylate

ABSTRACT

INTRODUCTION: Bile leak is a serious complication of hepatobiliary surgery. The incidence has remained the same over the last decade despite significant improvement in the results of liver surgery.

PRESENTATION OF CASE: A 21-year-old man was a passenger in a motor vehicle and sustained a blunt abdominal trauma in a high-speed collision leading to major liver laceration. He had right lobe hepatectomy complicated by major bile leak. He was not fit for further surgery and he, therefore, had ERCP and obliteration of the leaking bile duct using a combination of metallic coil and N-butyl cyanoacrylate.

DISCUSSION: Endoscopic therapy has become the modality of choice in the treatment of biliary tract injuries. Different modalities of management of persistent bile leak such as sphincterotomy, plastic biliary stents, and nasobiliary drainage have been described. Obliteration of bile duct leak using N-butyl cyanoacrylate and coil embolization has been described but most of these reports used the percutaneous transhepatic approach.

CONCLUSION: In this paper, we describe the second reported case in English literature of a novel endoscopic technique using a combination of metallic coil embolization and N-butyl cyanoacrylate in a patient with major bile leak who was not a candidate for surgery as well as a third report of the late complication of coil migration to the common bile duct.

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1. Introduction

A major blunt abdominal trauma is the leading cause of hepatic injury and significant damage to the biliary tract causing intrahepatic biloma, intraperitoneal bile leak and hemobilia.^{1–3} Partial liver resection has been widely used as an effective treatment for severely injured liver.⁴ Bile leak is a serious complication that may lead to sepsis and peritonitis and, therefore, has high mortality rate if left untreated. The incidence of bile leak posthepatobiliary surgery varies and ranges from 3.6 to 12%.⁴ This incidence has remained the same over the last decade despite a significant improvement in the results of liver surgery.^{5–7}

Endoscopic therapy has become the predominant modality of choice used in both the diagnosis and treatment of biliary tract injuries.⁸

In this paper, we describe a novel endoscopic treatment used in a patient who underwent right hepatectomy for severe liver injury complicated by a major bile leak who was not a candidate for further surgery.

2. Case report

A 21-year-old man was the driver of a motor vehicle and sustained a blunt abdominal trauma in a high-speed collision leading to major liver laceration. The patient was initially managed at a secondary care hospital where he underwent liver packing. He received 20 units of packed red blood cells (PRBC) with fresh frozen plasma (FFP) and was transferred to the Armed Forces Hospital (AFH) for further management. At AFH he required more blood and FFP. However, he continued to bleed from the site of the liver laceration and underwent emergency right hepatectomy.

He remained intubated with mechanical ventilation in the intensive care unit (ICU) for three months. His prolonged ICU course was complicated by pneumothorax, sepsis, bed sores, renal failure, coagulopathy, and cardiac arrest on day 15 of his ICU admission. He had deranged liver enzymes and abnormal liver function associated with abdominal distension and drain of bile from the abdominal drainage.

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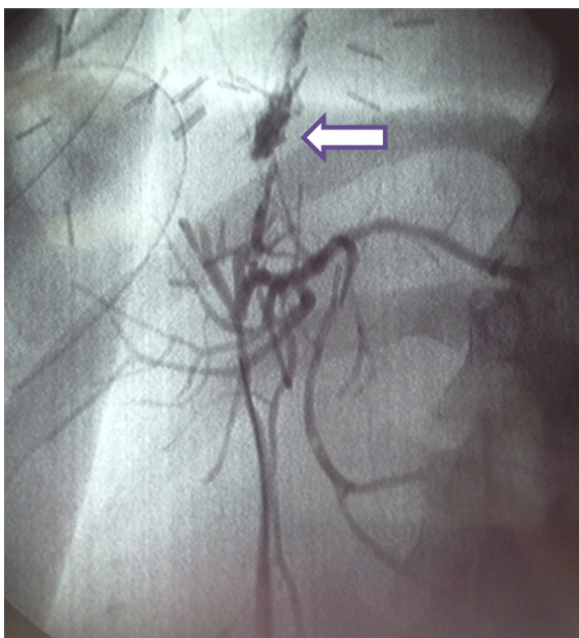


Fig. 1. Major bile leak from one of the main branches of left main bile duct.

Endoscopic retrograde cholangiopancreatography (ERCP) was performed which confirmed a major bile leak from one of the main branches of the left main bile duct on the resected edge (Fig. 1). A 10 Fr 5 cm plastic stent was inserted with good biliary drainage. Sphincterotomy was not performed due to coagulopathy.

There was an improvement in the abdominal distension, bile drainage and liver function for about three weeks. He started to have abdominal distension some days later with deranged liver chemistry, mainly high bilirubin and alkaline phosphate. Blocked or migrated stent was anticipated and he underwent a second ERCP for stent replacement. However, the previous stent was in place with good drainage. Injection of contrast into the biliary tree beside the stent revealed a major leak from the right hepatic duct stump (Fig. 2).

The patient was considered high risk for any further surgical intervention. The plastic stent was removed and the leaking bile

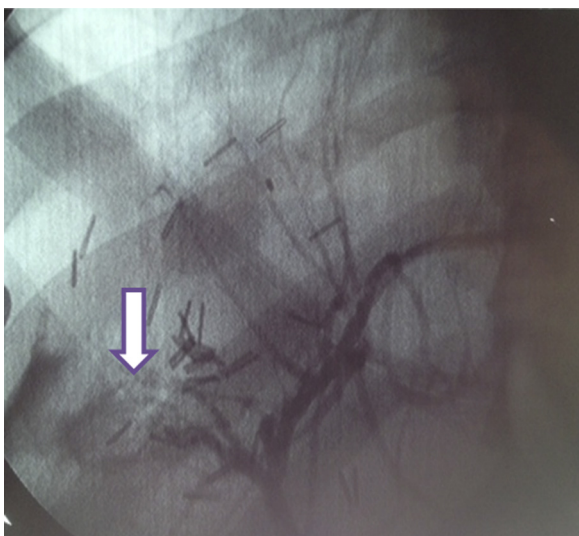


Fig. 2. Major leak from right hepatic duct stump.



Fig. 3. Embolization of metallic coil into the leaking duct.

branch was selectively cannulated using a 0.035 mm Boston Scientific guide wire. A metallic endovascular coil (3/30 mm), (Boston Scientific) was deployed in the terminal end of the leaking bile duct followed by an injection of 1.5 ml of a mixture of NBCA and lipidol at a ratio of 2:1 (Fig. 3).

There was marked improvement in his liver enzymes and bile drainage postendoscopic intervention. His general condition improved and he was discharged home (Fig. 4).

The endovascular coil remained in place on CT abdomen done three months postendoscopic intervention (Fig. 5).

Six months postdischarge, he presented with abdominal pain and low grade fever. He had mild elevation in his liver enzymes with preserved function. CT abdomen revealed mildly dilated CBD with a radio-opaque object most likely migrated endovascular coil at the distal CBD causing biliary obstruction (Fig. 6)

He was treated initially with antibiotics. ERCP was performed three days after his presentation. However, the CBD was found to be patent; most likely he passed the endovascular coil.



Fig. 4. Postdeployment cholangiogram revealed no bile leak.

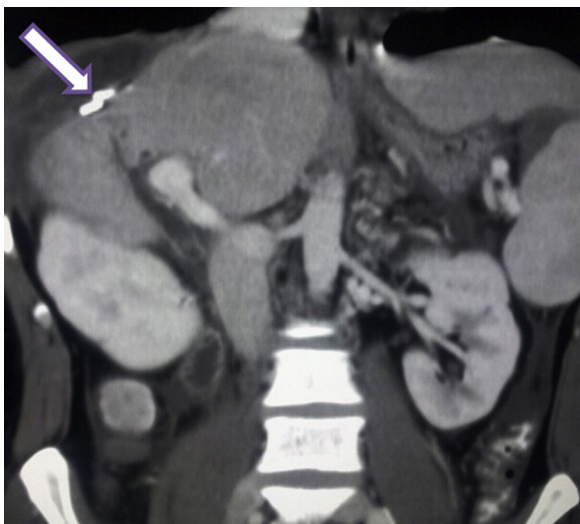


Fig. 5. Metallic coil in place three months postprocedure.

3. Discussion

Bile leak still represents one of the most common complications after liver resection and its incidence has not decreased during the past decade.^{8–10} Bile leak can be managed by various therapeutic techniques, aiming at decreasing the intrabiliary duct pressure, to allow bile to flow through the path of least resistance and, therefore, passive closure of bile leak. Multiple studies, supporting early intervention, have shown an improved outcome with repair by experienced hepatobiliary specialists.^{11–13} In selected cases, non-operative intervention may provide durable and definitive biliary drainage. Multiple groups reported high success rates with endoscopic retrograde cholangiopancreatography (ERCP). ERCP is preferable to surgery as the first step in the management of non-complicated biliary duct injury.^{14,15} Assessment of bile leak severity can be obtained during ERCP and appropriate management planned.

Different modalities of endoscopic management of persistent bile leak such as sphincterotomy, plastic biliary stents, nasobiliary

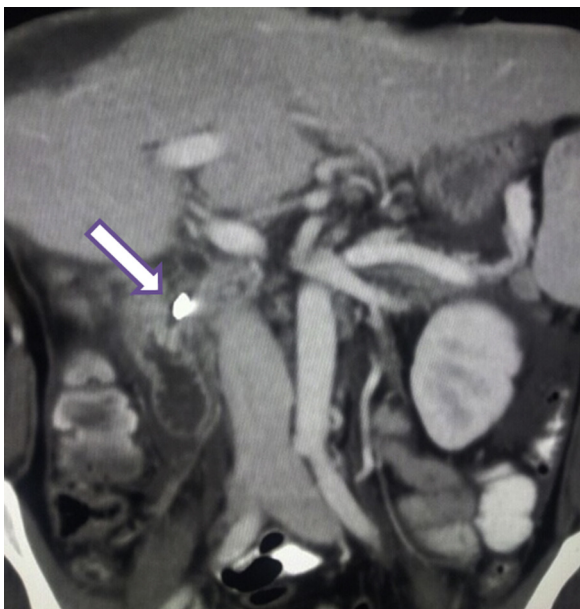


Fig. 6. Migrated coil into the common bile duct.

drainage, embolization with micropledgets, obliteration with N-butyl cyanoacrylate (NBCA) and coil embolization have been described.^{16–19}

Low grade leak, defined by Sandha et al.,¹⁶ can be managed by sphincterotomy. However, in high grade bile leak, a biliary stent is a must.

Marks et al.¹⁷ suggested that biliary stenting is more effective compared to sphincterotomy in treating bile leak.

Our patient had high grade bile leak (Fig. 1). Therefore, a 10 Fr 5 cm plastic stent was inserted. However, after a few weeks of improvement, he started to have more bile coming out of the abdominal drain. Stent migration or blockage was anticipated. However, a second ERCP revealed another major leak coming out from a biliary branch, different from the first one. In fact, there was no further leaking from the first bile duct. Since the patient had a major bile leak, despite the presence of a functioning stent and his condition did not permit further major surgery, the decision was made to deploy an endovascular coil within the terminal end of the leaking bile duct followed by an injection of Cyanacrylate.

There are few reports in the literature describing embolization of biliary leaks using metallic endovascular coils. Oliva et al.¹⁸ and Hunt et al.¹⁹ described percutaneous management of biliary fistula using metallic coil embolization. The percutaneous use of hydrocoil to manage cystic duct stump leak is described by Doshi et al.²⁰ Hydrocoils have the advantage of swelling or expansion when the hydrophilic polymer comes into contact with fluids.

Endoscopic approach is less traumatic and associated with less complications compared to the percutaneous approach. Schelhammer et al.²¹ reported the first successful ERCP management of persistent cystic duct leak using embolization of fibred platinum coils into the cystic stump. The presence of coil within the leaking duct and the high viscosity of the bile will most likely lead to mechanical occlusion.

NBCA is a low viscosity tissue glue monomer that polymerizes and become solid once in contact with body fluids at neutral pH.

Successful use of NBCA to occlude biliary leak has been reported by few authors.^{22–28} Percutaneous route was the most commonly used procedure to inject NBCA. Seewald et al.²⁵ reported the successful endoscopic application of NBCA in seven out of nine cases with no complication. They mixed NBCA with lipidol in (0.5 ml:0.3 ml) ratio. A median volume of 0.8 ml mixture was used. All of the seven patients required one session to close the biliary fistula.

Ganguly et al.²⁷ reported the first case of the endoscopic combination of coils and NBCA. The coils act as a scaffold for the glue. A 0.5 ml mixture of NBCA and lipidol at a ratio of 3:1 was used.

Due to the high output biliary leak, despite the present of functioning plastic stent, we decided to use a combination of metallic coil embolization followed by obliteration with NBCA. The short stump of a leaking bile duct was a challenge in our case due to the high risk of common bile duct occlusion. One short metallic coil (3/30 mm) was deployed to act as a matrix for the NBCA. This was followed by an injection of 1.5 ml of a mixture of NBCA and lipidol at a ratio of 2:1. Immediate follow up cholangiogram revealed no leak.

His abdominal drain was removed two days after the procedure. Subsequent CT abdomen a month after the procedure showed the coil to be in place (Fig. 5).

The short and long term complications of such a procedure is difficult to assess due to the small number of patients treated with such a technique. Our patient had a rare complication of such a procedure. He presented with cholangitis secondary to coil migration and CBD obstruction. To our knowledge this is the third description of coil migration to the common bile duct from its site of

insertion.^{29,30} Coil embolization without NBCA was the technique used in the first two cases. The combined use of coil and NBCA as in our case did not prevent coil migration.

4. Conclusion

To our knowledge this is the second reported case in English speaking literature describing the endoscopic combination of metallic biliary coils and NBCA for the management of biliary leak. This novel modality of treatment can be effectively applied in selected cases. Collaboration of different specialties is the key to success of such cases.

Conflict of interest

All authors reported no conflict of interest.

Funding

None.

Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contributions

Aiman Al Wahaibi contributed to the data collections, data analysis and writing. Khalid AlNaamani contributed to the study design, data collections, data analysis, writing and review all the case. Ahmed Alkindi contributed to the data collections and data analysis. Issa Al Qarshoubi contributed to the data analysis.

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