



Research Article

The Drill and Blast Procedure - or How to Treat Complicated Bouveret's Syndrome Endoscopically

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Abstract

Background and Study Aims: Bouveret's syndrome describes gastric outlet obstruction caused by a perforated gallstone following a cholecystoduodenal or a choledochoduodenal fistula. Biliary stones leading to gastric outlet obstruction are typically large making classic stone retrieval or destruction very challenging and time-consuming. We here present the first two cases of Bouveret's syndrome successfully undergoing the novel drill and blast technique.

Materials and Methods: After drilling a channel through the obstructing biliary stone by Electrohydraulic Lithotripsy (EHL), a balloon dilatation catheter was then guided through the drill channel. Balloon dilatation was then performed within the biliary stone and allowed stone fragmentation and retrieval.

Patients & Results: Two patients presenting with nearly complete gastric outlet obstruction underwent the drill and blast maneuver for Bouveret's syndrome. Gastroduodenal passage was successfully restored, and oral fluid and food intake was resumed in both patients. No adverse events were observed during a follow up of 30 days.

Conclusions: We suggest that drill and blast is a feasible and promising variant of EHL for large and impacted gall stones in Bouveret's syndrome.

Keywords: Bouveret's syndrome; Drill and blast; Electrohydraulic lithotripsy; Gallstone

Abbreviations

EHL	:	Electrohydraulic lithotripsy
ESWL	:	Extracorporeal shock wave lithotripsy
ILL	:	Intracorporeal laser lithotripsy
EGD	:	Esophagogastroduodenoscopy

Introduction

The incidence of gallstones (cholelithiasis) in western countries has been increasing over the last decades. The majority of historic data are derived from clinical estimation and autopsy

studies [1]. More recently, incidences between 5-20% have been suggested by ultrasound-based cross-sectional population screening among European populations [2,3]. Choledocholithiasis refers to an impacted gallstone within the common bile duct and is believed to occur in approximately 15-20% of patients with cholelithiasis [4]. Choledocholithiasis is most frequently caused by impaction of a passing gallstone (secondary choledocholithiasis), whereas primary formation of bile stones within the biliary ducts is less common. Classically, intraductal gallstones are removed by ERCP followed by cholecystectomy [5].

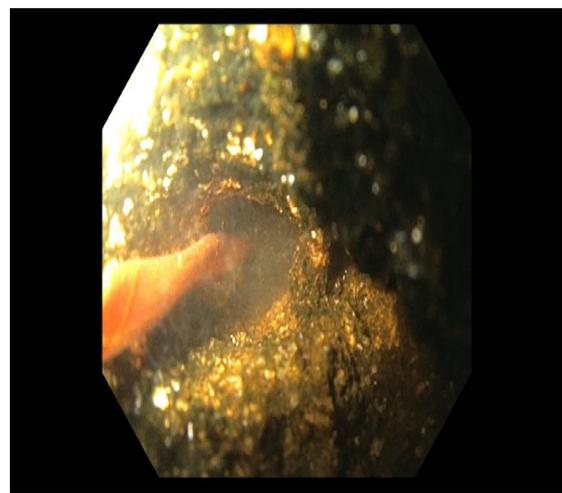
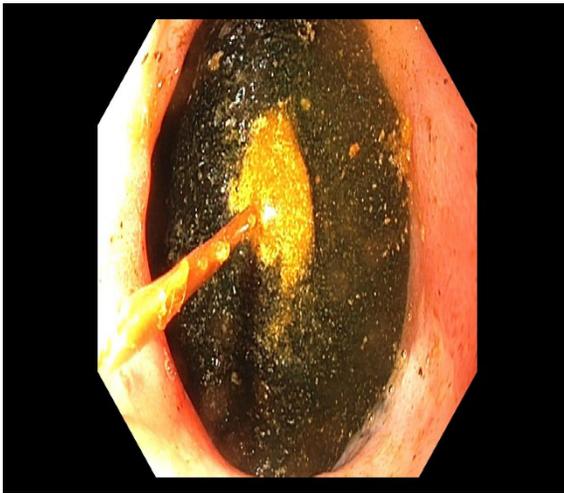
Bouveret's syndrome was first described in 1896. It describes gastric outlet obstruction caused by a perforated gallstone following a cholecystoduodenal or a choledochoduodenal fistula. Biliary stones leading to gastric outlet obstruction are typically larger than 2.5 cm making classic stone retrieval or destruction very challenging

and time-consuming. Available nonsurgical treatment approaches include endoscopic mechanical lithotripsy, Extracorporeal Shock Wave Lithotripsy (ESWL) [6,7], Intracorporeal Laser Lithotripsy (ILL) [8] and Electrohydraulic Lithotripsy (EHL) [9,10].

Materials & Methods

We used commercially available diagnostic Olympus video gastroscopes with a 2.8 mm working channel. The drill and blast maneuver were performed as follows: A channel through the biliary stone was created by electrohydraulic lithotripsy using a Walz EHL probe (diameter 4.5 Fr/1.5 mm, Walz Elektronik, Rohrdorf /

Germany) (Figure 1a and b). A balloon dilatation catheter (Boston Scientific, Galway, Ireland) was then guided through the drill channel (Figure 1c). The insertion depth of dilatation balloon needed to be at least two thirds of the stone diameter. Balloon dilatation was performed with a pressure of 10 atm to ensure a dilatation diameter of 8 mm. The drill and blast maneuver allowed stone fragmentation into at least two stone pieces. Fragments were finally either retrieved or further crushed by mechanical lithotripsy to allow natural passage (Figure 1d). All patients gave written informed consent for the endoscopies, as well as for the evaluation and publication of their anonymized medical data.



Figures 1a and 1b: A centered channel through the biliary stone is created by electrohydraulic lithotripsy using a Walz EHL probe.



Figure 1c: A balloon dilatation catheter is guided through the drill channel and inflated for dilatation.

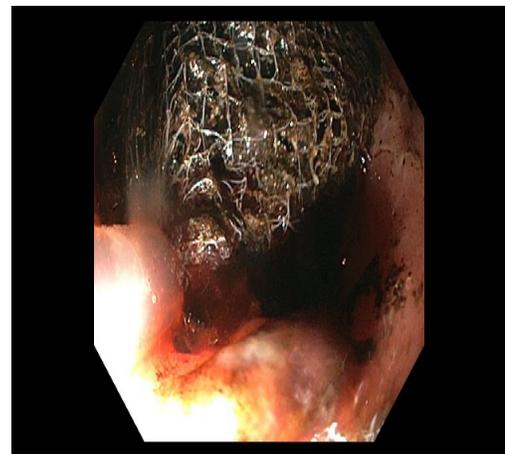
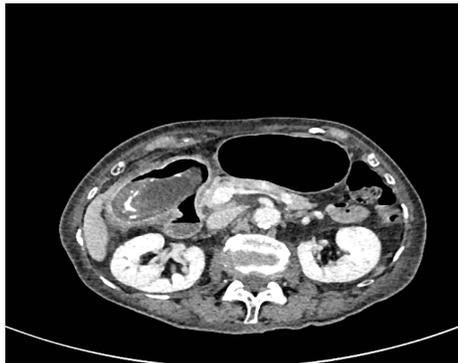


Figure 1d: Fragments are then retrieved with a basket.

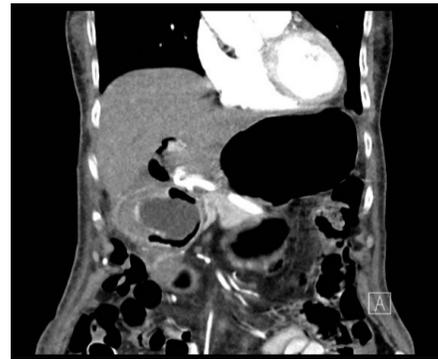
Patients & Results

Patient 1

A 93-year old female presented with severe vomiting due to nearly complete gastric outlet obstruction. Upon Esophagogastroduodenoscopy (EGD), complete obstruction of the duodenal bulb by an impacted biliary stone was diagnosed. Classic stone removal strategies including baskets, polypectomy nets and different grasping tools failed to successfully retrieve the impacted



gall stone. Transmural fixation of the migrated stone was suspected at this point. Considering the patient's age and comorbidities, a surgical approach was considered to be unreasonable. We therefore intended to restore luminal passage by means of the drill and blast technique as described in the method section. The intervention was successfully performed, and the patient was able to resume oral food intake shortly after. Post-interventional CT scan confirmed the transmural growth of the biliary stone in the sense of the tip of the iceberg (Figure 2a and b). However, further interventions were not necessary in the further course.



Figures 2a and b: CT scan in patient 1 confirming the transmural growth of the biliary stone from the gallbladder into the duodenal lumen.

Patient 2

Upon diagnostic work-up for persisting nausea and vomiting, an 80-year old female patient was diagnosed with an obstructing biliary stone of the duodenal bulb. Pre-interventional CT scan confirmed a purely intraluminal calcification and cystoduodenal fistula without additional cholecystolithiasis. As described in patient 1, conventional stone treatments failed, wherefore we successfully performed the drill and blast maneuver. The stone fragments were then partially extracted orally or passed through the small bowel. A follow-up of 30 days was available for both patients assuring no residual symptoms of gastric outlet obstruction.

Discussion

Bouveret's syndrome is a rare, but challenging to treat complication of cholelithiasis causing gastric outlet obstruction. Morbidity and mortality rates are substantial wherefore early diagnosis and treatment are pivotal. As patients with Bouveret's syndrome are frequently of advanced age and suffer from substantial comorbidities, endoscopic treatment, being minimally invasive, is the preferred course of treatment. As the mortality rates of surgical approaches such as enterolithotomy range between 19-24% [11], surgery is considered as a last resort treatment. Unfortunately, classic endoscopic removal or destruction techniques often fail depending on stone localization and diameter.

We used the drill and blast maneuver as it is used in the mining and tunneling industry to crack large and impacted stones under visual control. After drilling and blasting, the stone fragments were easily retrieved or further crushed to allow natural passage, as stone fragments were captured more easily by a basket than the initially impacted intact stone. The drill and blast maneuver being a purely endoscopic procedure is minimal invasive and efficient in aged patients with significant comorbidities to spare surgery. Drilling and blasting has major benefits over the classic lithotripsy performed with a lithotripsy basket. Biliary stones geometrically resemble spherical bodies displaying smooth and therefore difficult to grasp surfaces. On the other hand, drilling a centered tunnel is easily feasible due to the straightforward and perpendicular accessibility of the EHL probe onto the stone surface. Furthermore, enormous radial force may be generated by the biliary balloon from the stone center.

This allows more efficient destruction of the hard stone core as stone crushing by mechanical lithotripsy necessitating high forces would provide. To allocate such force by basket strings, the stone needs to be grasped perfectly centered and strong lithotripter set is indispensable. Stone crushing with two hard metallic surfaces would be desirable, yet the hollow human organs do not fit for such devices. Placing high pressure balloons into drilled stone tunnels mimics the common approach of the mining and construction

industry and outperforms the tightening maneuver of the classic basket lithotripsy. We suggest that it is advisable to run a CT scan previous to endoscopy in order to fully assess the dimensions and ingrowth of the impacted stone. This additional information is even more valuable in case if capture of the intact stone and transoral retrieval is considered. In our first patient, CT scan was run post endoscopy revealing transmural stone expansion. In conclusion, we suggest that drill and blast is a feasible and promising variant of EHL for challenging large and impacted gall stones in Bouveret's syndrome.

Conflicts of Interest

The authors hereby state they have no conflicts of interest.

Dedication

We dedicate this article to the memory of Piero Valli, MD, who deceased following an avalanche tragedy on 25th of December 2017. He initially designed and wrote this manuscript. He was a loving husband, father and a highly valuable and respected member of our team.

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