



Contents lists available at ScienceDirect

## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

## Novel use of a balloon dilatation catheter to enable mechanical lithotripsy of difficult common bile duct stones after initial failed attempt: A case report

Wei-Liang Loh<sup>b,\*</sup>, Joshua Yi Min Tung<sup>a</sup>, Trevor Hwee Yong Tan<sup>a</sup>, Li Ting Tan<sup>a</sup>, Shaun Tan<sup>a</sup>, Sing Shang Ngoi<sup>a</sup>

<sup>a</sup> Gleneagles Hospital, 6A Napier Road, 258500, Singapore

<sup>b</sup> Singapore General Hospital, Outram Road, 169608, Singapore

## ARTICLE INFO

## Article history:

Received 6 December 2017

Accepted 9 January 2018

Available online 28 January 2018

## Keywords:

Case report

CBD stones

Mechanical lithotripsy

ERCP

## ABSTRACT

**INTRODUCTION:** Difficult and large common bile duct stones can be crushed and removed using a mechanical lithotripter. Very often the lack of working space within the common bile duct causing the failure of mechanical lithotripsy would inevitably mean repeat or further invasive procedures.

**PRESENTATION OF CASE:** A patient with large and multiple common bile duct stones underwent ERCP, and initial deployment of a mechanical lithotripter failed due to the lack of working space within the common bile duct. A through-the-scope (TTS) dilator was utilized to increase the working space before successful deployment of the mechanical lithotripter, and subsequent clearance of all stones within the same setting.

**DISCUSSION:** We herein describe a novel and ingenious technique of utilizing a through-the-scope (TTS) dilator in helping to expand the space within the common bile duct to allow for full deployment of a mechanical lithotripter and successful clearance of common bile duct stones. This method can be easily applied by advanced endoscopists and is expected to lead to increased success rates of difficult common bile duct stones clearance in a single setting.

**CONCLUSION:** Use of TTS dilators to increase working space within the common bile duct can be useful in increasing the success rates of mechanical lithotripsy in the setting of large and multiple common bile duct stones.

© 2018 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### 1. Introduction

Cholelithiasis or common bile duct (CBD) stones are a common occurrence, seen in about 10% of patients undergoing cholecystectomy. Their size (1–2 mm to >3 cm) and number can vary greatly with varying degrees of complexity in endoscopic management [1]. Endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (ES), with or without endoscopic papillary large-balloon dilation (EPLBD), coupled with basket and balloon extraction can successfully remove up to 85% of CBD stones [2]. Factors associated with failure of extraction include older patient age, altered anatomy (e.g. Billroth Type II anatomy, Roux-en-Y gastrojejunostomy, peripapillary diverticulum), large number of stones (>10), large size of stones (>15 mm), unusual shape and location of stones, distal CBD stricture and angulation [3,4]. Mechanical lithotripsy (ML), electrohydraulic lithotripsy

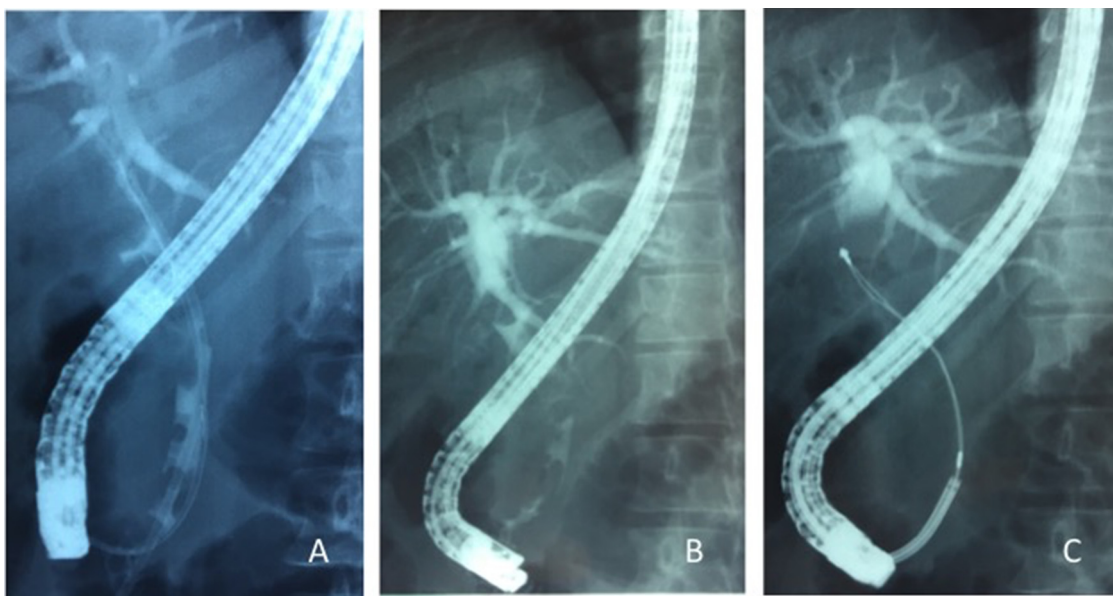
(EHL), laser lithotripsy (LL), extracorporeal shockwave lithotripsy (ESWL), per-oral cholangioscopy are dedicated techniques which can be utilized based on operator preference and ability to aid in difficult stone extractions [5]. These capabilities are not often available in most institutions. If these methods fail, then operative management with CBD exploration is required, or frequent biliary stent changes if the patient is not a fit surgical candidate, thus increasing their morbidity and healthcare costs.

This case, which was carried out in a private hospital, is unique due to the novel use of a balloon dilatation catheter to dilate the CBD after an initial failed deployment due to lack of working space, thereby not subjecting the patient to a potentially more morbid and costly procedure. This technique should be included in the armamentarium of advanced endoscopists to increase their rate of difficult CBD stone clearance.

This work has been reported in line with the SCARE criteria [6].

\* Corresponding author.

E-mail address: [wei-liang.loh@mohh.com.sg](mailto:wei-liang.loh@mohh.com.sg) (W.-L. Loh).



**Fig. 1.** A: Presence of multiple CBD stones with previous stent in-situ. B: Dilated CBD with multiple stones. C: Failure of deployment of mechanical lithotripter demonstrated, due to space constraints within CBD.

## 2. Case report

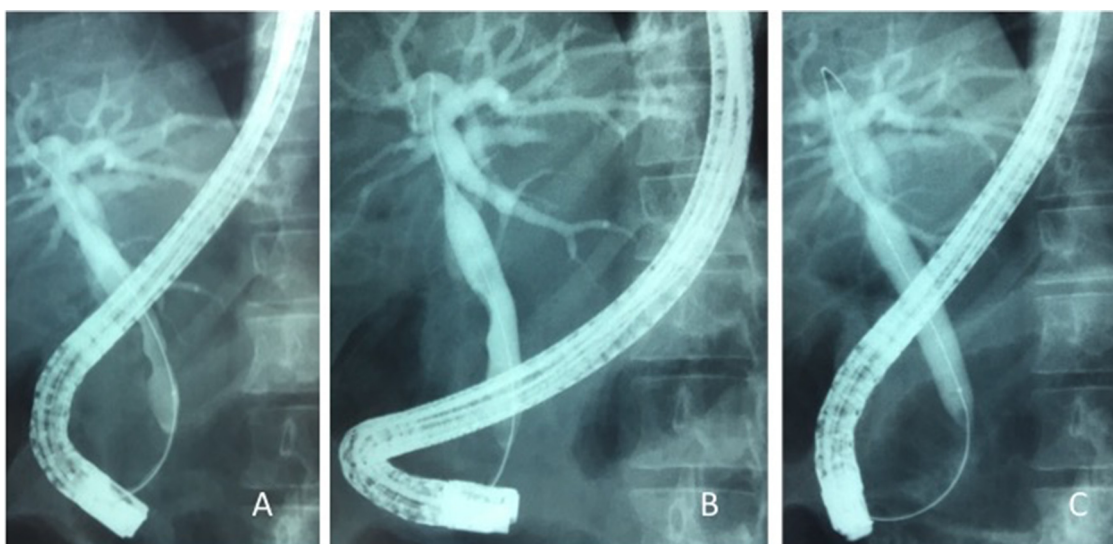
The patient in question is a 40 year old Chinese lady with no past medical history who presented at an overseas hospital with initial symptoms of fever and jaundice for one week, and signs of mild abdominal tenderness. Initial blood investigations showed an obstructive liver enzymatic profile and leukocytosis, and she was diagnosed with cholangitis. An ultrasonography showed a dilated CBD with multiple large stones ranging from 12 to 18 mm, and the patient underwent an ERCP and ES. However, due to the large nature of the stones, stone extraction (unclear if balloon trawling or Dormia basket was utilized) failed and a plastic biliary stent (10 Fr, 12.0 cm) was inserted for biliary drainage. Her sepsis was controlled with antibiotics and she was then transferred to our centre via ambulance for further management.

On arrival, she was afebrile, normotensive with a normal heart rate. She was moderately jaundiced with a bilirubin of 60 mg/dL,

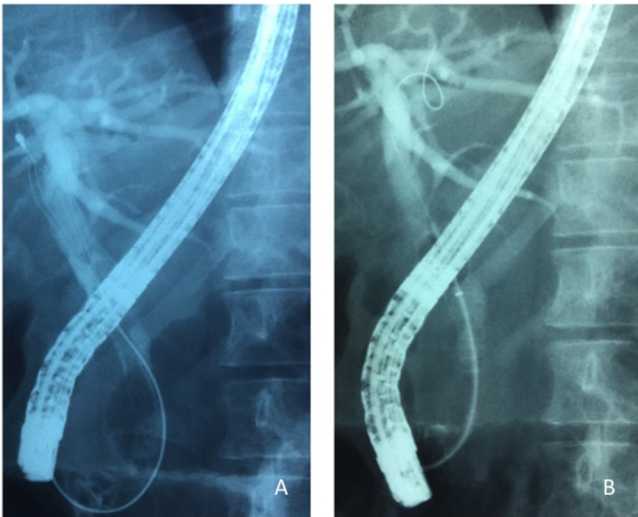
and her white cell count was mildly elevated at  $12.0 \times 10^9/\text{dL}$ . Rest of her blood work up was largely unremarkable.

One week after her initial ERCP and ES, the patient underwent a repeat ERCP at our centre. Initial cholangiogram confirmed the presence of multiple large CBD stones (Fig. 1A). Her previous biliary stent was removed and a wider ES performed. Another cholangiogram after stent removal revealed more clearly the presence of upstream biliary dilation (Fig. 1B). Balloon trawling was attempted but failed as the CBD stones were stuck at the mid-CBD. A BML-V442QR-30 single-use mechanical lithotripter (Olympus, Shinjuku, Tokyo, Japan) was inserted into the CBD but could not be fully deployed due to the extremely limited space within the CBD from the multiple large stones (Fig. 1C).

At this point, the decision to attempt a novel technique of dilating the CBD to allow for full deployment of the mechanical lithotripter was made. A 7.5 Fr CRE™ Wireguided Esophageal/Pyloric Balloon Dilatation Catheter (Boston Scientific,



**Fig. 2.** A and B Sequential images demonstrating waisting of balloon dilator within CBD due to multiple stones. C: Resolution of balloon dilator waisting, indicating adequate space created from balloon dilation.



**Fig. 3.** A: Re-introduction of mechanical lithotripter with successful deployment, trapping and lithotripsy of CBD stones. B: Trawling of CBD stones with routine balloon catheter.

Marlborough, Massachusetts, United States) was chosen. This dilatation catheter has a balloon length of 5.5 cm and a width of 10–12 mm depending on insufflation pressure, and can be utilized in a through-the-scope (TTS) method with a minimum working channel of 2.8 mm.

The balloon dilatation catheter was inserted into the CBD over the existing guidewire with the entire length of the balloon portion within the CBD (i.e. no papillary dilatation was performed) and sequentially insufflated. There was initial waisting of the balloon (Fig. 2A and B), which consequently improved significantly on sustained insufflation at the highest allowed pressure (Fig. 2C). Total insufflation time was approximately 10 min, with the highest insufflation pressure of 8 ATM (balloon diameter 12 mm, 36 Fr) held at two minutes.

Subsequently, the same mechanical lithotripter was re-introduced into the CBD with successful full deployment and trapping of the CBD stones (Fig. 3A). An additional 20 min was spent crushing the stones rather uneventfully and the debris was trawled out in a routine fashion using a balloon catheter (Fig. 3B). An occlusion cholangiogram confirmed no residual filling defects. A 10 Fr, 12 cm plastic stent was inserted for continued unobstructed biliary drainage (Fig. 4). At no point during the procedure was there any contrast extravasation from the CBD noted.

Patient remained stable throughout the ERCP, and post-procedure was able to resume feeds the same day.

The patient then underwent an uneventful laparoscopic cholecystectomy within 24 hours of the ERCP, and was discharged well on post-operative day two.

Both the ERCP and laparoscopic cholecystectomy was performed by the same surgeon, with a 30 year experience.

The patient was seen four weeks post-discharge, She was well and had returned to her routine work, and her liver function tests were normal. She was then discharged from follow-up.

### 3. Discussion

Large CBD stones usually require a degree of fragmentation before removal to prevent impaction. ML is the most commonly used technique and failure rates are less than ten percent [1]. Stone diameter, stone impaction, and failure to capture stones with a basket have previously been identified as factors that are associated with failure of ML [7].



**Fig. 4.** Insertion of plastic stent post-clearance of CBD stones for unobstructed biliary drainage.

Other endoscopic fragmentation methods such as EHL, LL, ESWL, per-oral cholangioscopy are not as readily available and generally cost more [8]. Surgical methods such as laparoscopic or open CBD exploration is another option but will be more invasive with its attendant anesthetic and surgical risks. Percutaneous removal is also possible but complex in nature and creates inconvenience for patients due to the need for a percutaneous catheter. Consequently, we consider pursuing ML even in the face of formidable CBD stones as a viable option. If performed successfully as in this instance, this can avoid repeat ERCPs or further invasive procedures with a minimization of cost and morbidity to patients.

The technique described above is not difficult to learn, and can be extrapolated from endoscopic papillary balloon dilatation (EPBD), which is one of two methods commonly employed by endoscopists for sphincter enlargement prior to stone removal. It also does not require any special equipment besides what is commonly found in most endoscopy suites, and is readily applicable for most endoscopists.

The possibility of CBD injury is the most concerning with this novel technique, and was not seen in this case. The risk can be mitigated by sequential and gradual insufflation of the balloon dilator, and release of pressure intermittently. Theoretically, patients with large soft, pigmented stones would be ideal candidates for this technique, as the nature of the stones will allow their fragmentation against the balloon catheter and CBD wall, with a lower risk of CBD wall injury. Being a newly described technique there are no recommendations available for the maximal allowable time per insufflation, but the guiding principle should be to start slow with steady and gradual increments of pressure and intervals. Contrast extravasation from the CBD and presence of retroperitoneal gas will be the most tell-tale signs of injury, and should actively be sought during and after the procedure.

In conclusion, this case illustrates a novel technique in which failure of deployment of a mechanical lithotripter due to space constraints (as is often the case with large and multiple CBD stones) can be rectified with safe dilatation of the CBD under fluoroscopic guidance. The ingenious off-label use of an esophageal/pyloric

balloon dilatation catheter can be considered by an experienced endoscopist as an additional trick in tackling difficult cases of choledocholithiasis. The main benefit is to increase the success rate of clearance of difficult and multiple large CBD stones, in order to prevent multiple procedures and improve patients' outcomes.

#### Conflict of interests

Authors report no conflicts of interests.

#### Funding

There are no external sources of funding.

#### Ethical approval

This study was exempt from ethics approval from my institution.

#### Consent

Consent has been obtained and is available for review if requested. 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 contribution

All authors have approved the final article.

Wei-Liang Loh: main author and editor of article.

Joshua Yi Min Tung: provided references and assisted in procedure.

Trevor Hwee Yong Tan: Assisted in manuscript production.

Li Ting Tan: Literature search and manuscript production.

Shaun Tan: Assisted in manuscript production.

Sing Shang Ngoi: Main procedurist for case report.

#### Guarantor

Ngoi Sing Shang.

#### Acknowledgements

We thank the staff of the Gleneagles Hospital (Singapore) Endoscopy Suite for their invaluable assistance.

#### References

- [1] G. Trikudanathan, U. Navaneethan, M.A. Parsi, Endoscopic management of difficult common bile duct stones, *World J. Gastroenterol.* 19 (January (2)) (2013) 165–173.
- [2] A. Katanuma, H. Maguchi, M. Osanai, K. Takahashi, Endoscopic treatment of difficult common bile duct stones, *Dig. Endosc.* 22 (2010) S90–S97.
- [3] H.J. Kim, H.S. Choi, J.H. Park, et al., Factors influencing the technical difficulty of endoscopic clearance of bile duct stones, *Gastrointest. Endosc.* 66 (December (6)) (2007) 1154–1160.
- [4] E. Christoforidis, K. Vasiliadis, K. Tsalis, et al., Factors significantly contributing to a failed conventional endoscopic stone clearance in patients with difficult choledocholithiasis: a single-center experience, *Diagn. Ther. Endosc.* 2014 (2014) 861689.
- [5] B. Ödemiş, U. Barış Kuzu, E. Öztaş, et al., Endoscopic management of the difficult bile duct stones: a single tertiary center experience, *Gastroenterol. Res. Pract.* 2016 (2016), Article ID 8749583.
- [6] R.A. Agha, A.J. Fowler, A. Saetta, I. Barai, S. Rajmohan, D.P. Orgill, for the SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, *Int. J. Surg.* 34 (2016) 180–186, <http://dx.doi.org/10.1016/j.ijssu.2016.08.014>, Epub 2016 Sep 7.
- [7] P.K. Garg, R.K. Tandon, V. Ahuja, G.K. Makharia, Y. Batra, Predictors of unsuccessful mechanical lithotripsy and endoscopic clearance of large bile duct stones, *Gastrointest. Endosc.* 59 (2004) 601–605.
- [8] G. Stefanadis, C. Christodoulou, S. Manolakopoulos, R. Chuttani, Endoscopic extraction of large common bile duct stones: a review article, *World J. Gastrointest. Endosc.* 4 (2012) 167–169.

#### Open Access

This article is published Open Access at [sciedirect.com](http://sciedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.