

Being Creative with Old Tools: The Dilating Balloon as a Weapon Against Difficult Bile Duct Stones

Jason N. Rogart

Published online: 25 May 2014
© Springer Science+Business Media New York 2014

One of the joys of practicing therapeutic endoscopy is the resourcefulness that is often required to solve the most difficult challenges with existing or available tools that are not necessarily designed for the problem at hand, with large or difficult-to-remove bile duct stones as prime examples. While 90 % of stones can be removed via endoscopic retrograde cholangiopancreatography (ERCP) using conventional methods and instruments (e.g., biliary sphincterotomy and balloon or basket extraction), approximately 10 % are “difficult” either because of their large size, impaction in the bile duct, the presence of bile duct strictures or relative stenoses distal to the stone(s), or of a massively dilated or distorted bile duct confounding stone capture [1]. In these circumstances, more advanced technologies and sophisticated techniques have been developed (see Table 1), but are often more expensive and unavailable at smaller medical centers.

The use of balloon dilation for the assistance of bile duct stone extraction was first described in 1983 by Staritz et al. [2] who used inflatable balloon catheters for ampullary dilation (ABD). In 2004, however, a randomized, controlled multicenter study reported significantly increased morbidity and mortality in patients undergoing ABD compared with endoscopic biliary sphincterotomy (EBS) [3], reducing enthusiasm and increasing the concern for using larger-sized balloons in the biliary system. In the late 2000s, however, several reports, including one randomized, control trial [4], were published on *post-sphincterotomy* balloon dilation (PSBD) to facilitate the extraction of large

bile duct stones, renewing the popularity of this technique, as it was safe, effective, inexpensive, and utilized tools readily available in most endoscopy units.

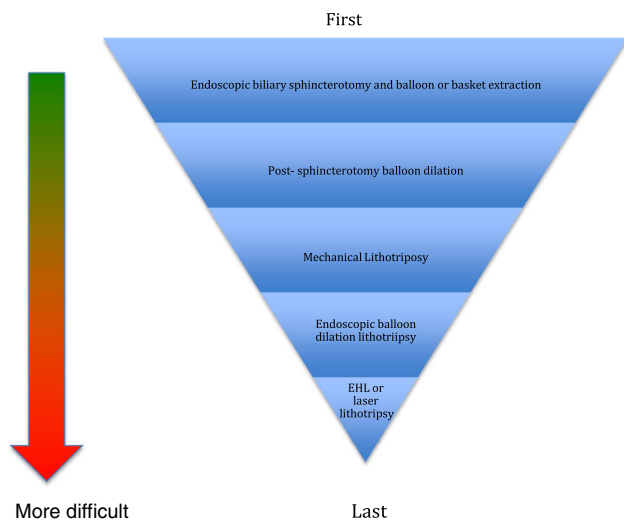
In this issue of *Digestive Diseases and Sciences*, Park et al. [5] have, for the first time, described the use of a similar balloon *within* the bile duct as a clever form of mechanical lithotripsy when more conventional means of bile duct stone extraction have failed. This study reported a single-center, single-endoscopist experience in seven patients who had large or impacted bile duct stones that could not be extracted with balloons, baskets, or mechanical lithotripsy [5]. The authors described “endoscopic balloon dilation lithotripsy” (EBDL), which involves inflating a standard 10–12 mm CRE-[controlled radial expansion] wire-guided balloon *within* the bile duct, adjacent to the offending stone for 60 s under fluoroscopic guidance in order to achieve stone fragmentation. The authors’ results are impressive—100 % success rate with no serious complications in any patient, but all the more impressive considering that the patients and stones involved presented exceptional technical challenges even for the most advanced endoscopists: mean stone size >3 cm (2.1–5.2 cm) and mean bile duct diameter >3 cm (1.5–5.2 cm). The authors argue that the greatest advantage of this technique, besides its efficacy and apparent safety, is that it uses widely available and inexpensive tools, in contrast to alternatives such as SPYglass cholangioscopy and electrohydraulic or laser lithotripsy.

There are, however, several limitations to the study and technique reported by Park et al. that need to be taken into consideration before the average endoscopist embraces and attempts EBDL. It is, for example, unclear whether all patients first underwent PSBD, and if so, to what size the ampulla was dilated, since PSBD is safe and effective [6], with its early use often obviating the need for mechanical lithotripsy, laser lithotripsy, or EHL (see Fig. 1).

J. N. Rogart (✉)
Interventional Gastroenterology and Therapeutic Endoscopy,
Capital Health Center for Digestive Health, Pennington, NJ,
USA
e-mail: jrogart@capitalhealth.org

Table 1 Current techniques/devices available for bile duct stone extraction

Extraction balloon
Wire basket
Mechanical lithotripsy basket
Post-sphincterotomy balloon dilation (PSBD)
Endoscopic placement of multiple biliary stents for several months
Electrohydraulic lithotripsy (EHL)
Laser lithotripsy (Holmium, FREDDY, etc.)
Extracorporeal shock-wave lithotripsy (ESWL)

**Fig. 1** Suggested order and the degree of difficulty for endoscopic extraction of difficult bile duct stones

Most obvious is that this is a study of only seven patients by a single, very experienced biliary endoscopist. Selection of appropriate patients, balloon size, and correct positioning of the balloon within the duct is likely to be critical for performing this technique safely and effectively, and likely requires an experience and comfort level that the majority of Western biliary endoscopists lack. In the United States, biliary endoscopists in the community are very hesitant to perform PSBD and therefore are even less likely than their counterparts at tertiary medical centers to attempt EBDL. Consequently, the endoscopists more likely to adopt EBDL are in most circumstances likely to have EHL or laser lithotripsy capabilities readily available and may be more likely to employ them prior to attempting EBDL. In the discussed study, three ERCPs were required for ductal clearance in 4 of the 7 reported patients, who had in turn undergone prior ERCPs, obscuring the total number of biliary procedures required to treat their stones. Furthermore, although the authors used cholangiography to confirm complete stone clearance, there was no mention of

follow-up duration to document that these patients were indeed stone-free. Most EHL and laser lithotripsy are performed via cholangioscopy (direct visualization), and there are data supporting that cholangioscopy is more accurate in detecting residual stones or fragments after lithotripsy than is conventional cholangiography, particularly in very dilated ducts [7, 8]. For the above reasons, the cost-effectiveness of this small study cannot be calculated.

Despite the above criticisms, this technique appears noteworthy and promising. Indeed, since initially reviewing this manuscript, I performed EBDL in two patients who would have met inclusion criteria for the discussed study. In both patients, EBDL was easy to perform, successful, and without complication. For gastroenterologists performing ERCP who are comfortable performing PSBD, I would therefore recommend considering adding EBDL as a complementary technique for dilation-assisted stone extraction when difficult bile duct stones are encountered (see Fig. 1). After all, if PSBD is being performed in a patient, the same balloon can then be used for EBDL without any increase in cost. It is clear that larger, multi-center studies are needed before EBDL can be routinely recommended as an alternative to EHL or laser lithotripsy, but in the mean time, I encourage my fellow ERCPists to continue being creative and thinking outside the proverbial box.

References

- Bergman JJ, Rauws EAJ, Fockens P, et al. Randomised trial of endoscopic balloon dilation versus endoscopic sphincterotomy for removal of bile duct stones. *Lancet*. 1997;349:1114–1115.
- Staritz M, Ewe K, Meyer zum Buschenfelde KH. Endoscopic papillary dilation for the treatment of common bile duct stones and papillary stenosis. *Endoscopy*. 1983;15:197–198.
- DiSario JA, Freeman ML, Bjorkman DJ, et al. Endoscopic balloon dilation compared with sphincterotomy for extraction of bile duct stones. *Gastroenterology*. 2004;127:1291–1299.
- Heo JH, Kang DH, Jung J, et al. Endoscopic sphincterotomy plus large balloon dilation versus endoscopic sphincterotomy for removal of bile-duct stones. *Gastrointest Endosc*. 2007;66:720–726.
- Park JS, Jeong S, Han JY, Lee DH. Endoscopic balloon dilation lithotripsy for difficult bile duct stones. *Dig Dis Sci*. (Epub ahead of print). doi:10.1007/s10620-014-3154-y.
- Stefanidis G, Viazis N, Pleskow D, et al. Large balloon dilation vs. mechanical lithotripsy for the management of large bile duct stones: a prospective randomized study. *Am J Gastroenterol*. 2011;106:278.
- Huang SW, Lin CH, Lee MS, Tsou YK, Sung KF. Residual common bile duct stones on direct peroral cholangioscopy using ultraslim endoscope. *World J Gastroenterol*. 2013;19:4966–4972.
- Itoi T, Sofuni A, Itokawa F, Shinohara Y, Moriyasu F, Tsu-chida A. Evaluation of residual bile duct stones by peroral cholangioscopy in comparison with balloon-cholangiography. *Dig Endosc*. 2010;22:S85–S89.