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Dilation - Assisted Stone Extraction in Endoscopic Removal of Large Stones: A Retrospective Study

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Abstract: ***Introduction: In patients with large bile duct stones Dilation - Assisted Stone Extraction (DASE) facilitates stone removal without increasing procedure related complications. Limited sphincterotomy combined with endoscopic papillary large - balloon dilation has become widely accepted for removing challenging CBD stones. Objective: To assess the efficiency and risks associated with sphincterotomy and sphincteroplasty for the removal of difficult and big bile duct stones. Materials and methods: A retrospective study was conducted among 92 patients who underwent DASE in ourtertiary care centre. The study included patients of all age groups belonging to either sex with bile duct stones >10mm on cholangiogram who underwent sphincterotomy plus sphincteroplasty using CRE balloon up to 15mm. Data regarding age, gender, stone size and success of sphincteroplasty and complications were noted and was entered into Microsoft Excel, and analysed using SPSS version 21.0 Results: Among 92 patients who underwent DASE, 52 (57%) were males and 40 (43%) were females. Mean stone size 12.61±3.55mmwith largest 27mm. The success of DASE in our study was 90.2% patients. Mild pancreatitis seen in 7 (7.6%) patients. Stone size was significantly associated with failure of sphincteroplasty. Failure of stone removal was seen more common in those with stone size >15mm (33.3%). Conclusion: DASE is a successful and secure method for removing a challenging common bile duct stone.***

Keywords: Dilated Assisted Stone Extraction (DASE), Sphincteroplasty, Common bile duct (CBD) stones, Sphincterotomy.

1. Introduction

The most effective method of managing common bile duct stones is endoscopic retrograde cholangio - pancreatography (ERCP), frequently in conjunction with endoscopic sphincterotomy (EST).15–25% of individuals who have EST will not completely remove their stones, necessitating either sophisticated endoscopic or surgical procedures.1Risk factors for challenging stone extraction include large stones measuring >12mm, many stones, stones above the stricture, and/or a small or tapering CBD.[2]

To assist in the extraction of large or complicated biliary stones, Ersoz, Tekesin, Ozutemiz, and Gunsar originally developed dilation assisted stone extraction (DASE) in 2003.3Bilateral endoscopic sphincterotomy (BES) with biliary orifice balloon dilation (BBD) or full or limited endoscopic sphincterotomy (EST) with endoscopic papillary large balloon dilation (EPLBD) are terms that are frequently used to describe dilation - assisted stone extraction. However, the process is carried out in four steps, starting with deep bile duct cannulation and ending with balloon dilation of the biliary tree and endoscopic sphincterotomy of the papillary orifice. Endoscopic sphincterotomy was first described as being done at the papillary orifice and extending to the transverse fold.

After sphincterotomy, dilatation is performed using a large diameter balloon (esophageal/pyloric type balloons over the guidewire) to a range of 12 to 20 mm, depending on the size of the stone. It is important to notice that balloon inflation is kept up for 20 to 45 seconds after the balloon's waist gradually vanishes; this is supposed to signify a gradual opening up of the orifice.

In order to remove challenging common bile duct (CBD) stones, limited sphincterotomy in conjunction with endoscopic papillary large - balloon dilatation has become regular practise. The purpose of the current study is to assess the effectiveness and risks of removing tough and large bile duct stones using sphincterotomy and sphincteroplasty.

2. Methodology

After receiving approval from the institutional ethical committee, a retrospectivestudy was conducted among 92 patients who underwent DASE from January 2017 to October 2022in ourtertiary care centre.

The study included patients of all age groups belonging to either sex with bile duct stones >10mm on cholangiogram who underwent sphincterotomy plus sphincteroplasty using CRE balloon up to 15mm.

We excluded patients with previous sphincterotomy who required extension to sphincterotomy and those who required pre - cut sphincterotomy for access.

Our study includes the case files of all eligible patients. Data regarding age, gender, stone size and success of sphincteroplasty and complications were noted.

All information was entered into Microsoft Excel, and SPSS version 21.0 was used for statistical analysis. Using the independent sample t - test, continuous variables were compared and are shown as mean and standard deviation. Comparing categorical data that were presented as frequencies and percentages was done using the Chi - square test.

3. Results

We studied total of 92patients who underwent DASE in our hospital. Of them 52 (57%) were males and 40 (43%) were females. The mean age of our cases was 57.32±14.7years. The patient'sage was ranged between 11 to 86 years. Majority of our study participants were aged between 51 to 70 years (52.2%)

Table 1: Age distribution of study participants

Variables		Frequency	Percentage
Age	≤30 years	7	7.6%
	31 - 40 years	6	6.5%
	41 to 50 years	15	16.3%
	51 to 60 years	23	25%
	61 to 70 years	25	27.2%
	71 to 80 years	13	14.1%
	≥81 years	3	3.3%
Gender	Males	52	56.5%
	Females	40	43.5%
Total		**92**	**100%**

The mean stone size of our cases was 12.61±3.55mm. The stone size ranged between 6mm to 27mm. Majority of our patients had stone size between 11 to 15mm (48.9%)

Table 2: Stone size of study participants

Stone size	Frequency	Percentage
≤10 mm	37	40.2%
11 to 15 mm	45	48.9%
16 to 20 mm	7	7.6%
≥21mm	3	3.3%
Total	**92**	**100%**

Among 92 patients, stones were removed with sphincteroplasty in 83 patients accounting to overall success of DASE in our study to 90.2%. We had 9 patients (9.78%) who were advised to have surgery after sphincteroplasty failed to remove the stones. Mild pancreatitis was seen in 7 (7.6%) patients; none of the patients experienced acute pancreatitis, a perforation, or post - procedure haemorrhage.

Table 3: Sphincteroplasty among study participants

Variables		Frequency	Percentage
Sphincteroplasty	Success	83	90.2%
	Failure	9	9.8%
Complications	Mild pancreatitis	7	7.6%
	Severe pancreatitis	0	0
	Perforation/ Bleeding	0	0

Table 4 shows the association of factors affecting failure of sphincteroplasty. We found that age and gender were not associated with failure of sphincteroplasty, however, the stone size was significantly associated with failure of sphincteroplasty. Failure of stone removal was seen more common in those with stone size >15mm (33.3%).

Table 4: Factors for failure of sphincteroplasty

Variables		Sphincteroplasty		p - value
		Success	Failure	
Age	≤30 years	7 (8.4%)	0	0.355
	31 - 40 years	6 (7.2%)	0	
	41 to 50 years	12 (14.5%)	3 (33.3%)	
	51 to 60 years	21 (25.3%)	2 (22.2%)	
	61 to 70 years	22 (26.5%)	3 (33.3%)	
	71 to 80 years	13 (15.7%)	0	
	≥81 years	2 (2.4%)	1 (11.1%)	
Gender	Males	46 (55.4%)	6 (66.7%)	0.727
	Females	37 (44.6%)	3 (33.3%)	
Stone size	≤10 mm	35 (42.2%)	2 (22.2%)	**0.023**
	11 to 15 mm	41 (49.4%)	4 (44.4%)	
	16 to 20 mm	6 (7.2%)	1 (11.1%)	
	≥21mm	1 (1.2%)	2 (22.2%)	

4. Discussion

DASE, also known as small endoscopic sphincterotomy (EST) combined with endoscopic papillary balloon dilatation is more efficient than endoscopic sphincterotomy alone for the removal of large common bile duct stones. EST is now considered to be the industry standard for removing CBD stones.[4, 5] EST has been shown to be safe in numerous studies, however there are procedure - related hazards (5–11%) [6, 7], including severe pancreatitis, bleeding, and perforation. Ascending cholangitis and bile duct stone recurrence are two potential long - term side effects of sphincterotomy that have also received attention. However, EST is still the treatment of choice in the majority of patients.[8]

The most popular endoscopic method for removing stones from the bile duct is called EST. It is known to be the most effective nonsurgical method of treating common bile duct stones because to its success rate of above 90%.[9 - 13] Acute complications from EST, including as bleeding, perforation, cholangitis, and post - procedure pancreatitis, still occur at a rate of 8% to 12%.[14 - 19]Additionally, it permanently damages the biliary sphincter, which can result in long - term issues such duodenal biliary reflux, bacterial contamination, and persistent biliary system inflammation.[14]

Large - diameter (15 to 20 mm) EPBD was the second alternate management strategy for large bile duct stones that Ersoz et al.3 reported using after EST. Subsequently, several studies supported the claim that sEST+EPBD can increase effectiveness and decrease problems.

Endoscopic sphincterotomy combined with large - balloon dilatation resulted in fewer overall problems than EST alone, according to a meta - analysis by Yang et al.[20] (OR = 0.53, 95%CI: 0.33 - 0.85, P = 0.008).

According to Heo et al.2[1], the usage of mechanical lithotripsy (8.0% vs.9.0%), big size (>15 mm) stone removal (94.4% vs.96.7%), and overall successful stone removal (97.0% vs.98.0%) were all comparable between EST with LBD and EST alone. Between the two groups, complications occurred similarly (5.0% vs 7.0%, P =.767).

ESLBD produced similar results in terms of overall successful stone removal (100% vs.97%) and complications

(4% vs.6%), according to Itoi T et al.[22]; however, compared to when EST alone was utilised, the rate of complete stone removal in the first session with ESLBD tended to be higher. (96% vs.85%, P=0.057), it was not statistically significant.

According to Kim HG et. al., the rates of total stone removal with a single session were 86% in the endoscopic sphincterotomy group and 85% in the small sphincterotomy combined with endoscopic papillary big balloon dilatation group (P = 0.473).2[3]Nine out of 27 patients (33%) in the small sphincterotomy combined with endoscopic papillary big balloon dilation group and nine out of 28 patients (32%, P = 0.527) in the endoscopic sphincterotomy group required mechanical lithotripsy to remove the stones.[23]

Large stones, numerous stones, barrel - shaped stones, and a tapering of the distal CBD are all factors that make removing bile duct stones challenging. sEST+EPBD is an efficient and secure treatment for big CBD stones.[24]

The success rate was comparable between groups when the stone was less than 12 mm. The success rate in the sEST with EPBD group was noticeably greater than in the EST group when the stone was less than 12 mm. The outcomes indicate that sEST+EPBD is efficient for CBD stones.[24]

Recent evidence suggests that, when carried out properly in accordance with recognised protocols, LBD does not result in major side effects including severe pancreatitis and bile duct perforation.[25 - 27]Similar to that, there were few issues with our study. The first sphincterotomy could theoretically direct future dilation in a way that causes a tear to form away from the pancreatic opening, potentially lowering the risk of pancreatitis. Another factor that may be linked to post - ERCP pancreatitis is the length of time between cannulation and stone removal. Only two studies[28, 29] included information on the overall procedure time, and a meta - analysis revealed no difference between the two groups' ERCP times. The impact of operation length on the risk of pancreatitis cannot be calculated.

5. Conclusion

DASE is a successful and secure method for removing a challenging common bile duct stone.

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