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Extracorporeal shock wave lithotripsy for the rescue of post-endoscopic or surgically retained biliary duct stones: Does saline irrigation affect the outcome ?

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Abstract

Extracorporeal shock wave lithotripsy (ESWL) has been found valuable in situations where obstructing stones in the common bile or intrahepatic ducts are retained following surgery or attempted endoscopic removal. However, success rates are dependent on the type of ESWL system employed and upon a high frequency rate of repeated treatment sessions. We outline our experience with 23 cases of retained, obstructing bile duct stones, ranging in size from 10 to 40 mm diameter, treated with Dornier HM3 ESWL. In the initial 12 patients in the series, successful stone fragmentation occurred in 83% of cases with a median 1.6 treatment sessions. In the latter 11 cases in the series, patients were treated prone and the stone-bearing biliary duct was irrigated with saline solution during ESWL delivery. With this technique, successful stone break up was achieved in all patients (100%) with a single treatment session. Endoscopic sphincterotomy is, however, a prerequisite for extracorporeal lithotripsy and, despite the high success rates now available with new techniques, we believe the ESWL should continue to be employed in support of primary endoscopic methods of management for obstructing bile duct stones.

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Full Text

Endoscopic retrograde cholangio-pancreaticography (ERCP) and percutaneous techniques have revolutionized the treatment of biliary duct stones[1] . It has been demonstrated that 85-90% of all stones in the common or intrahepatic bile ducts can be effectively removed by endoscopic sphincterotomy combined with Dormia basket or balloon catheter manipulation[2],[3],[4]. In the remaining instances, retained stones can be dealt with by mechanical lithotripsy[5], electrohydraulic (EHL)[6] or laser induced shockwave lithotripsy (LISL) under fluoroscopic or cholangioscopic control[7],[8],[9], or by extracorporeal shock wave lithotripsy (ESWL)[10],[11],[12],[13],[14],[15]

Of the latter techniques, ESWL is the most attractive on account of being the least invasive and because it is equally applicable to retained stones in the intrahepatic ducts, a region that often provides difficulties with endoscopic procedures[12],[13]. However, success rates with ESWL treatment of biliary duct stones are reported to vary widely from 67% to 90%. [14],[15],[16] and would seem to depend upon such factors as the type of ESWL technology employed and the persistence of the operators in continuing with repeated treatment sessions. We report our experience with Dornier HM3 lithotripsy in a series of patients with postsurgical or post endoscopically retained biliary duct stones and describe the evolution of an ESWL technique, using saline irrigation during the treatment, that has been proven to provide a reliably successful results.

Patients and Methods

Twenty three adult patients with retained biliary duct stones were referred for ESWL. Six patients had previously undergone open surgical cholecystectomy with exploration of the common bile duct and placement of a draining T-tube. The remaining patients, all of whom presented with obstructive jaundice associated with common bile or intrahepatic duct stones were referred for ESWL with an indwelling nasobiliary drain after they underwent primary ERCP with endoscopic sphincterotomy and failed attempts to remove the stones using Dormia baskets, balloon extraction catheters and mechanical lithotripsy. One patient had a percutaneous transhepatic cholangiographic (PTC) drain. In two cases, successfully Dormia-ensnared stones proved impossible to recover due to impaction at the sphincteric region of the common bile, were referred to ESWL with the Dormia basket indwelling.

[Table 1] details age and sex distribution of patients in the series together with stone and treatment particulars. There were 12 female and 11 male patients with an age range of 36-90 years (mean 59 years). Apart from the six cases referred with retained stones following surgery, four other patients had a past history of cholecystectomy at periods from two to 14 years prior to their current admission. Stone sizes ranged from 10 to 40 mm diameter. Fifteen patients had solitary calculi and the remaining eight had two or more stones in the common bile or intrahepatic ducts. Patients were scheduled for ESWL after stabilization of their clinical and blood biochemical status.

All the patients underwent ESWL with the unmodified Dornier HM3 apparatus under epidural analgesia. In the initial part of the series, patients were positioned in the standard supine position usual for renal stone treatment. With evolution of our treatment technique, patients were later placed prone so that ESWL was delivered transabdominally in an anteroposterior direction. Stones were targeted with X-ray fluoroscopy following injection of contrast via the indwelling biliary drains. In the last 11 patients in the series, normal-saline irrigation was employed intermittently with contrast injection so as to disperse and flush stone fragments during ESWL treatment.

Post-ESWL cholangiography was usually performed at 24 hours when a decision was made to proceed to repeat endoscopy and evacuation of retained stone fragments or to repeat ESWL treatment.

Results

ESWL was successful in fragmenting stones retained following ERCP or surgery in 21 (91.3%) of the 23 cases in this series [Table 1]. Of the two instances where this failed, ESWL treatment had to be aborted in one patient (Case #4) when he developed epileptiform spasms in response to shockwave delivery. In the second patient (Case #9), a diabetic with a history of duodenal ulcer who had undergone three previous attempts at endoscopic manipulation of multiple biliary duct stones, it was considered expedient to proceed with definitive surgery rather than to repeat further ESWL or ERCP treatment. Both patients underwent cholecystectomy with removal of their common bile duct stones.

One further patient (Case #1) required surgery to remove an impacted Dormia-ensnared stone that proved impossible to dislodge and recover, even after adequate ESWL. At surgery, the stone fragments were discovered to be tightly jammed together by the Dormia wire basket. With our second case of a retained basket-entrapped stone, the domiia catheter was easily dislodged and withdrawn following a single session of ESWL treatment (Case #22).

Of the nine patients treated in the supine position during our initial experience, where ESWL was delivered postero-anteriorly, four (44%) of the targeted stones failed to show appreciable fragmentation. Two of these subsequently had an excellent result with repeat ESWL treatment performed in the prone position (antero-posteriorly directed shock waves). All the 14 patients treated with prone ESWL showed a successful fragmentation outcome, although the first three patients so treated required two or more sessions of ESWL. In the later series of 11 patients, where prone ESWL was combined with saline irrigation of the stone-bearing biliary duct during treatment, all showed a successful outcome with a single session of treatment. The mean number of treatment sessions and the mean total shock wave energy received by the two groups of patients treated with and without saline irrigation during ESWL is compared in [Table 2].

The morbidity attributable to ESWL in this series of patients with biliary duct stones was negligible. Three patients showed a mild increase in serum amylase levels 24 hours after ESWL but all returned to normal within few days. In four patients, ESWL-fragmented calculi were evacuated spontaneously within the 24-hour period leading up to their post-ESWL cholangiographic examination. The remaining 16 patients (excluding those requiring surgery) had endoscopic evacuation of post-ESWL stone fragments. One patient proceeded to laparoscopic cholecystectomy shortly after successful ERCP and ESWL treatment of his common bile duct stone.

Discussion

ESWL technique has been extensively used in the urinary tract with an excellent safety record[17],[18]. In the biliary tree although the indications for ESWL are limited but the short and long term safety is well documented, with few clinically insignificant side effects[19],[20],[21]. In our experience in those 23 patients treated with ESWL, supine or prone, there were no clinically significant side effects related to the ESWL technique.

ESWL, EHL and LISL have all been used in treatment of retained bile duct stones after failed endoscopic removal with variable degrees of success[6],[7],[8],[9] used together they may obviate the need for surgery in almost 100% of cases[8]. Their rule is complimentary rather than competitive and their use depends on the availability of the technique, the experience of the endoscopists and their satisfaction regarding the degree of invasiveness in any particular technique. We chose ESWL because it is available to us, we believe it is minimally invasive and is equally applicable to stones in the intrahepatic ducts and it also provides a safe means of rescue from situations where biliary duct stones are retained following surgery or prove difficult to extract with ERCP procedures. The previously reported experience, particularly with ultrasonically guided ESWL targeting systems, has however shown a varied and unpredictable outcome. Weiss et al[4] reported a 25% failure rate of stone break up in 32 patients with bile duct stones subjected to Piezolith ESWL and believed this was due either to the large size of the stones treated or to failure of the ultrasound targeting technique. Using the Dornier MPL 9000 ESWL system, which also employs ultrasound guidance, Kim and associates[12]reported an 89% success rate but with a median four treatment sessions and 6,288 total shock waves per patient. The initial experience with the Siemens Lithostar in ESWL treatment of bile duct stones showed success rates of 67%[15] to 69.3%[11]. Using the same system, Binmoeller et al[3] have shown successful fragmentation and clearance in seven of 10 patients treated for intrahepatic duct stones that proved inaccessible to endoscopic treatment with a mean of 8 ESWL treatment sessions per patient. x-ray-targeted dormer ESWL achieves higher success rates, in the range of 80-95%[14],[16], but several treatment sessions will still be required in around one-third of cases.

Our initial experience of X-ray targeted Dornier HM3 ESWL, in the first 12 patients of our series, was attended with an 83% success rate and a mean treatment frequency of 1.6 sessions [Table 2]. With the institution of our current routine of prone ESWL, together with saline irrigation of the stone bearing biliary ducts during treatment, we have achieved a single-session success rate of 100% in our latter series of 11 patients. Moreover, the total shock wave energy required for adequate fragmentation has been appreciably reduced. Ponchom and associates[22]reported the injection of saline into the bile duct during ESWL treatment, but that was to enhance the acoustic impedance of tissues surrounding the stones to make ultrasound localization of the stones easier rather than to enhance the ESWL effect on the stone. In our experience saline irrigation was used to enhance the ESWL effect. We believe that saline irrigation of the treated stone during ESWL improves the lithotriptic effect by dispersing already fragmented surface particles from the outer crust of the stone bulk, similar to the beneficial effect of irrigation that has been noticed with ESWL treatment of urinary stones impacted in the ureter or a tight renal pelvis, where it is believed that the `distension chamber effect' induced by fluid injection aids lithotripsy by enhancing the shock wave pressure effect on the targeted stone.[23],[24]

Despite the predictably good results now available with improved extracorporeal shock wave techniques, we believe that the role of ESWL must continue to be in support of primary endoscopic management of obstructing or retained biliary duct stones. Endoscopic sphincterotomy is a pre-requisite to ESWL treatment. Moreover, with X-ray-guided ESWL system, that appear to provide the highest success rates in fragmentation of biliary duct stones, an indwelling biliary line is essential for contrast injection and flushing. ESWL is particularly suited to treatment of retained intrahepatic stones, which are reported to be relatively more frequent in certain regions of the tropics[25], and present difficulties with endoscopic treatment.

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