Epidural anesthesia is effective for extracorporeal shock wave lithotripsy of pancreatic and biliary calculi

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RESULTS: Ninety eight percent of the 1509 patients underwent ESWL under TEA. The subjects selected were within American Society of Anesthesiologists grade I to III. ESWL using EA permitted successful elimination of bile duct or pancreatic calcui with minimal morbidity. The procedure time was shorter in patients with TEA than in those who underwent ESWL under total intravenous anesthesia.

CONCLUSION: Almost all patients undergoing ESWL with EA had effective blocks with a single catheter insertion and local anesthetic injection.

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Key words: Thoracic epidural anesthesia; Extracorporeal shock wave lithotripsy; Bile duct calculi; Pancreatic duct calculi

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INTRODUCTION

Extracorporeal shock wave lithotripsy (ESWL) is an effective, non-invasive technique for the treatment of difficult pancreatic and large bile duct calculi[1,2]. Millimetric fragmentation of pancreatic and bile duct stones by ESWL has improved the results of endoscopic therapy. The ESWL machine uses high pressure shock waves generated by an
ellipsoid cup with the aid of biplanar fluoroscopy. The treatment is often painful and requires large doses of analgesics. Many different anesthetic techniques have been used for ESWL. To date general anesthesia, epidural anesthesia (EA) with local anesthetic agents or opioids, intercostal nerve blocks with local infiltration, intravenous fentanyl, combinations of intravenous analgesics and sedatives have all been used\[1-12\].

In our institution we routinely employ continuous thoracic epidural anesthesia (TEA) using Bupivacaine 0.25% with or without Clonidine to achieve a sensory block level in the region of T6-T12. This paper describes our vast experience of this regimen.

**MATERIALS AND METHODS**

The patient selection criterion for ESWL was the presence of large bile duct calculi which could not be extracted by routine endoscopic methods using a balloon or mechanical lithotripter\[1\]. Old and frail patients with a high surgical risk or those with retained common bile duct stones after cholecystectomy were also considered\[3,14\]. The subjects required nasobiliary drainage catheters or T-tubes to serve T 8-9 or T 9-10 thoracic intervertebral space. The insertion catheter (Perifix 18 G B Braun) was inserted in the T 7-8, mostly midline or occasionally para median. An epidural complications is important for correct placement of the catheter. Detailed knowledge of the anatomy, technique and possible complications is important for correct placement of the catheter. The catheter introduction approach was mostly midline or occasionally para median. An epidural catheter (Perifix 18 G B Braun) was inserted in the T 7-8, T 8-9 or T 9-10 thoracic intervertebral space. The insertion site was covered with a sterile adhesive dressing (Tegaderm 3M). Bupivacaine 0.25% (Sensorecaine Astra Zeneca India) in combination with or without Clonidine hydrochloride (Cloneon, Neon Laboratories Ltd. India) was injected incrementally in all the subjects to achieve a sensory analgesia level of T6 to T12. The dose of local anesthetic given was calculated depending on the age, weight and height of the patient and the segments to be blocked. Sensory analgesia was determined using pinprick testing\[10\].

The procedure was initiated after adequate analgesia was achieved. The intensity of shocks used varied from 1 to 6, depending upon the density of the stone. A top-up dose of the local anesthetic was administered when breakthrough pain occurred. The number of sessions was a minimum of one to a maximum of four (rare). The epidural catheter was left in situ in patients who required multiple sessions of ESWL\[17\]. The dose of local anesthetic had to be increased when more than one session was required due to tachyphylaxis [sensitization to the Local Anesthetic (L.A.) drug]\[18\].

All the patients were moved to the post anesthesia care unit (PACU) after the procedure. PACU discharge criteria included: the patient being spontaneously awake and appropriately responsive to questioning and able to move all extremities; blood pressure and heart rate within 20% of baseline values; minimal or no pain; minimal or no nausea. The patients were allowed to go home when they could walk with a steady gait and void spontaneously without any difficulty\[10\].

**Statistical analysis**

Descriptive statistics was analyzed by SPSS 13.0 version (Chicago, IL, USA).

Patient characteristics including age, height, weight, gender, ASA grade and insertion site of the epidural catheter were recorded (Table 1). The average procedure time per session was 55 min. Total dose of the anesthetic drugs given, the level of dermatomes blocked and the dermatome regression time were documented. Duration of stay in the PACU was recorded. Procedure starting time was defined as the beginning of ESWL. Patients rated their assessment of the adequacy of anesthesia in facilitating lithotripsy as excellent, good or fair. All medications administered during the procedure and recovery were noted. All intra operative complications like pain, patient movement, saturation of oxygen in arterial blood flow (Spo2) < 90% and hypotension were recorded. Postoperative complications recorded included nausea, emesis, and urinary retention. Nurses in the PACU assessed patients every 15 min until PACU discharge criteria were met.

**RESULTS**

The subjects selected for ESWL ranged from ASA-I to ASA-III [ASA-I 1103 (73%), ASA-II 358 (24%) and ASA-III 48 (3%)]. Out of a total of 1509 patients, 1490 (98.7%) underwent ESWL under TEA, 19 (1.3%) under general anesthesia and 8 under total intravenous anesthesia.
The premature ventricular beats observed in some patients were caused either by a triggering effect of the shock waves or by other factors in our elderly patients. There were no significant post-procedural complications. A very small number of patients who complained of nausea, were treated with antiemetics. TEA is an ideal mode of anesthesia for ESWL in the geriatric group of patients compared to general anesthesia. In TEA the drug volume requirement is significantly reduced and the degree of motor block is also minimal. Any hypotension, when it occurred, was very mild. Some patients who underwent ESWL for pancreatic calculi reported experiencing pain which required oral analgesics at the time of discharge. Patients with partial clearance of stones (pancreatic calculi) which required oral analgesics at the time of discharge. Some patients received midazolam at the time of epidural catheter insertion at a dose of 0.05 mg/kg body wt.

Thoracic epidural catheters were placed successfully on the first attempt in most of the patients. The volume of local anesthetic injected was 5 to 12 mL, and the maximal cephalad extent of sensory block was T5 (range T5-T6). The caudal spread was up to a maximum of L1 (T11 to L1). Some patients who had more than one ESWL session required a higher dose of epidural local anesthetic injection for the subsequent sessions. Subjects who underwent ESWL under TIVA were restless and registered a lot of disruptive movements due to pain. The procedure time was shorter in patients with TEA compared to those who underwent ESWL under TIVA. Transient hypotension during the procedure was observed in 91 (6%) patients and was treated with intravenous bolus injections of ephedrine (5-15 mg). There was respiratory depression and hypoxemic episodes in some of these patients. Bradycardia was seen in some of our TEA subjects and was corrected by giving intravenous atropine injection. Ventricular premature complexes were observed in 53 (3.5%) of our patients. They were controlled by a single dose of intravenous lignocaine at 1.0 mg/kg body wt. Most of our patients were pain free in the post procedure period. Some who underwent ESWL for pancreatic calculi had pain for which they were treated with NSAIDS or Fentanyl at 1 mg/kg body wt. Patients were monitored in the PACU for 4 h and then moved out unless they required further monitoring for other co-morbid conditions. There were no airway related complications. One to three sessions were required for clearance of the calculi in either of the groups. Patients stone clearance was 448 (30%) in one session, 573 (38%) in two sessions and 475 (31%) in three sessions. There were very few who required a fourth session. The assessment of adequacy of EA was excellent in 1147 (76%), good in 302 (20%) and fair in 60 (4%) of our patients, including both groups i.e. pancreatic calculi and bile duct stones.

**DISCUSSION**

We chose EA because of its established effectiveness, continuous nature and low incidence of complications. The average recovery time after EA was 3 h. The patients were monitored in the PACU for about 4 h. The recovery time may not be as short as for general anesthesia, but the incidence of side effects observed is definitely low. The disadvantage of general anesthesia includes daily intubation of patients for 2 to 3 consecutive days depending upon the number of sessions required. An in-dwelling thoracic epidural catheter is a good neuraxial option. Midazolam anxiolysis (0.05 mg/kg body wt iv) was administered to patients who were sensitive to the sound generated by the Dornier Medtech Compact Delta machine. Pain is associated with increased levels of circulating catecholamines, which results in tachycardia, hypertension and increased cardiac work leading to increased myocardial oxygen consumption. Pain control due to EA can significantly decrease the incidence of pulmonary morbidity. TEA promotes faster recovery of bowel function (as it increases the microcirculation of the bowel) and earlier fulfillment of discharge criteria. Provision of good pain relief aids good targeting of the calculi (absence of tachypnea and tachycardia) and leads to reduction of morbidity and complications. This results in better patient satisfaction which is an important component of good quality care.

The premature ventricular beats observed in some patients were caused either by a triggering effect of the shock waves or by other factors in our elderly patients. There were no significant post-procedural complications. A very small number of patients who complained of nausea, were treated with antiemetics. TEA is an ideal mode of anesthesia for ESWL in the geriatric group of patients compared to general anesthesia. In TEA the drug volume requirement is significantly reduced and the degree of motor block is also minimal. Any hypotension, when it occurred, was very mild. Some patients who underwent ESWL for pancreatic calculi reported experiencing pain which required oral analgesics at the time of discharge. Patients with partial clearance of stones (pancreatic calculi) preferred to have EA again when they returned later for repeat ESWL. ESWL using EA permitted successful elimination of bile duct or pancreatic calculi with minimal rates of morbidity, and with no deaths among some high-risk
patients who were otherwise untreatable by conventional techniques. When used appropriately, regional anesthesia can provide good, prolonged analgesia and a safer alternative to general anesthesia.

Our experience suggests that continuous EA is ideal, safe and effective for outpatient procedures like ESWL. It comes with low morbidity, and high patient satisfaction.

COMMENTS

Background
Extracorporeal shock wave lithotripsy (ESWL) is an effective, non-invasive technique for the treatment of difficult pancreatic and large bile duct calculi. The treatment is often painful and requires large doses of analgesics. Many different anesthetic techniques have been used. The aim was to evaluate the efficacy of thoracic epidural analgesia for ESWL.

Research frontiers
Success for non-invasive techniques for the treatment of difficult pancreatic and large bile duct calculi lies in providing a quiet, comfortable, pain-free environment. Thoracic epidural analgesia (TEA) is the ideal technique.

Innovations and breakthroughs
The authors aim to show that TEA which is not used in many centers is ideal, effective and safe for ESWL of difficult pancreatic and large bile duct calculi.

Applications
This methodology may represent a future strategy for therapeutic intervention in the treatment of patients with difficult pancreatic and large bile duct calculi.

Terminology
Millimetric fragmentation of pancreatic and bile duct stones by ESWL can be achieved by the safe introduction of epidural catheters in the D7 to D10 thoracic intervertebral space. 18G epidural catheters are ideal as they do not get blocked easily.

Peer review
As a surgeon, the manuscript tells interesting information about ESWL for stones in hepato-pancreatico-biliary area. It is kind a surprising to know so many patients undergo this treatment under EA with this disease.

REFERENCES
1. Ong WC, Tandan M, Reddy V, Rao GV, Reddy N. Multiple main pancreatic duct stones in tropical pancreatitis: safe clearance with extracorporeal shockwave lithotripsy. J Gastroenterol Hepatol 2006; 21: 1514-1518
2. Tandan M, Reddy DN, Santosh D, Reddy V, Koppuju V, Lakhakia S, Gupta R, Ramchandani M, Rao GV. Extracorporeal shock wave lithotripsy of large difficult common bile duct stones: efficacy and analysis of factors that favor stone fragmentation. J Gastroenterol Hepatol 2009; 24: 1370-1374
3. Abe T, Go R, Mori K, Kohyama A. Epidural fentanyl provide sufficient analgesia for extracorporeal shock wave lithotripsy (ESWL) in Japan. Masui 1997; 46: 694-699
4. Cormack JR, Hui R, Ollive D, Said S. Comparison of two ventilation techniques during general anesthesia for extracorporeal shock wave lithotripsy: high-frequency jet ventilation versus spontaneous ventilation with a laryngeal mask airway. Urology 2007; 70: 7-10
5. Demir E, Kilciler M, Bedir S, Ertan K, Ozgok Y. Comparing two local anesthesia techniques for extracorporeal shock wave lithotripsy. Urology 2007; 69: 625-629
6. Erdem IA. Artukoglu F, Gozcan A, Ozgen S. Comparison of propofol/fentanyl and ketamine anesthesia in children during extracorporeal shockwave lithotripsy. Saudi Med J 2007; 28: 364-368
7. Kaygusuz K, Gokce G, Gursoy S, Ayan S, Mimaroglu G, Gulenik Y. A comparison of sedation with dexmedetomidine or propofol during shockwave lithotripsy: a randomized controlled trial. Anesth Analg 2008; 106: 114-119, table of contents
8. Lindström E, Borch K, Kullman EP, Tiselius HG, Ihs I. Extracorporeal shock wave lithotripsy of bile duct stones: a single institution experience. Gut 1992; 33: 1416-1420
9. Mazdak H, Abazari P, Ghassami F, Najafipour S. The analgesic effect of inhalational Enlonox for extracorporeal shock wave lithotripsy. Urol Rev 2007; 35: 331-334
10. Richardson MG, Dooley JW. The effects of general versus epidural analgesia for outpatient extracorporeal shock wave lithotripsy. Anesth Analg 1998; 86: 1214-1218
11. Sackmann M, Doll J, Sauter GH, Pauletzki J, von Ritter C, Paungartner G. Extracorporeal shock wave lithotripsy for clearance of bile duct stones resistant to endoscopic extraction. Gastrointest Endosc 2001; 53: 27-32
12. Shenman Z, Eidelman LA, Corev S. Continuous spinal anesthesia as an ideal, effective technique for extracorporeal shock wave lithotripsy in patients with cardiac disease. Can J Anaesth 1988; 35: 624-627
13. Bland KI, Jones RS, Maher JW, Cotton PB, Pennell TC, Amorsen JR, Munson JL, Berzi G, Fuchs GJ, Way LW. Extracorporeal shock-wave lithotripsy of bile duct calculi. An interim report of the Dormier U.S. Bile Duct Lithotripsy Prospective Study. Ann Surg 1989; 209: 743-753; discussion 753-755
14. Frank M, McAteer EJ, Cohen DG, Blair JJ. One hundred cases of anesthesia for extracorporeal shock wave lithotripsy. Anesth Analg 1985; 67: 341-343
15. Britton JP, Ferro MI. Comparative evaluation of general, epidural, and spinal anesthesia for extracorporeal shockwave lithotripsy. Anesth Analg 1989; 79: 336
16. Abbott MA, Samuel JR, Webb DR. Anaesthesia for extracorporeal shock wave lithotripsy. Anaesthesia 1985; 40: 1065-1072
17. Lipfert P. [Tachyphylaxis to local anesthetics] Reg Anaesth 1989; 12: 13-20
18. Monk TG, Bouré B, White PF, Meretyk S, Clayman RV. Comparison of intravenous sedative-anaesthetic techniques for outpatient immersion lithotripsy. Anesth Analg 1991; 72: 616-621
19. Monk TG, Rater JM, White PF. Comparison of alfentanil and ketamine infusions in combination with midazolam for outpatient lithotripsy. Anaesthesiology 1991; 74: 1022-1028
20. Rodgers A, Walker N, Schug S, McKee A, Kehlet H, van Zundert A, Sage D, Futter M, Saville G, Clark T, MacMahon S. Reduction of postoperative mortality and morbidity with epidural or spinal anesthesia: results from overview of randomised trials. BMJ 2000; 321: 1493
21. Terlecki RP, Triest JA. A contemporary evaluation of the auditory hazard of extracorporeal shock wave lithotripsy. Urology 2007; 70: 898-899
22. Groeben H. Epidural anesthesia and pulmonary function. J Anesth 2006; 20: 290-299
23. Spackman DR, McLeod AD, Prienue NL, Leach RM, Reynolds F. Effect of epidural blockade on indicators of splanchic perfusion and gut function in critically ill patients with peritonitis: a randomised comparison of epidural bupivacaine with systemic morphine. Intensive Care Med 2000; 26: 1638-1645
24. Kopacz DJ, Carpenter RL, Mulroy MF. The reliability of epidural anesthesia for repeat ESWL: a study of changes in epidural compliance. Reg Anesth 1990; 15: 199-203

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