

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

Santosh Darisetty, Manu Tandan, Duvvuru Nageshwar Reddy, Rama Kotla, Rajesh Gupta, Mohan Ramchandani, Sandeep Lakhtakia, Guduru Venkat Rao, Rupa Banerjee

Santosh Darisetty, Rama Kotla, Department of Anesthesiology, Asian Institute of Gastroenterology, Hyderabad 500082, India  
Manu Tandan, Duvvuru Nageshwar Reddy, Rajesh Gupta, Mohan Ramchandani, Sandeep Lakhtakia, Guduru Venkat Rao, Rupa Banerjee, Department of Gastroenterology, Asian Institute of Gastroenterology, Hyderabad 500082, India

Author contributions: Darisetty S was responsible for the conception, design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content and final approval of the article; Tandan M, Reddy DN, Gupta R, Ramchandani M, Lakhtakia S, Rao GV and Banerjee R provided the collection of human material and the design of the manuscript; Kotla R helped with the procedures, patient data analysis and drafting of the article.

Correspondence to: Dr. Santosh Darisetty, Department of Anesthesiology, Asian Institute of Gastroenterology, 6-3-661, Somajiguda, Hyderabad 500082, India. [sant\\_dari@yahoo.com](mailto:sant_dari@yahoo.com)  
Telephone: 91-40-23378888 Fax: 91-40-23324255

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### Abstract

**AIM:** To evaluate the efficacy of thoracic epidural analgesia for extracorporeal shock wave lithotripsy (ESWL).

**METHODS:** ESWL is an effective, non-invasive technique for the treatment of difficult pancreatic and large bile duct calculi. The procedure is often painful and requires large doses of analgesics. Many different anesthetic techniques have been used. Patients with either large bile duct calculi or pancreatic duct calculi which could not be extracted by routine endoscopic methods were selected. Thoracic epidural anesthesia (TEA) was routinely used in all the subjects unless contraindicated. Bupivacaine 0.25% with or without clonidine was used to block the segments D6 to D12. The dose was calculated depending on the age, height and weight of the patient. It was usually 1-2 mL per segment blocked.

**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 calculi 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

**Peer reviewer:** Tokihiko Sawada, MD, PhD, Associate Professor, Second Department of Surgery, Dokkyo Medical University, Kitakobayashi 880, Mibu, Shimotsuga, Tochigi 321-0293, Japan

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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<sup>[1,2]</sup>. 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<sup>[3-12]</sup>.

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<sup>[11]</sup>. Old and frail patients with a high surgical risk or those with retained common bile duct stones after cholecystectomy were also considered<sup>[13,14]</sup>. The subjects required nasobiliary drainage catheters or T-tubes to serve as conduits for injection of contrast media into the biliary tree to radiologically visualize the radiolucent stones before ESWL and to monitor stone position during ESWL<sup>[2,3,14]</sup>. Subjects with pancreatic duct calculi not extractable by basket or balloon were included<sup>[11]</sup>. Subjects with radiolucent pancreatic calculi needed a nasopancreatic tube for admitting radiographic contrast medium to localize the stone using fluoroscopy<sup>[11]</sup>. The median diameter of the bile duct stones was 19 mm (range 6-40 mm) and 221 patients had more than one stone. The pancreatic calculi were of variable sizes and numbers. The patients were within American Society of Anesthesiologists (ASA) grade I to III. All the subjects underwent routine investigations including a complete blood picture, random blood sugar, blood urea, serum creatinine, ECG, coagulation profile, viral markers and X-Ray chest PA view. Informed consent was taken from all the patients. EA was avoided in pregnant women, patients in whom informed consent could not be obtained, ASA Class IV patients, subjects with neurological impairment, skin infections at the site of injection, disturbances of coagulation, pacemakers, uncontrolled dysrhythmias, severe scoliosis, vascular aneurysms and patients with known allergy to the drugs used<sup>[15]</sup>.

None of our patients received anti-emetic or anxiolytic injections prior to the insertion of the epidural catheter. All patients received prophylactic broad-spectrum antibiotics that were continued until the biliary system or the pancreatic duct were cleared of the stone debris<sup>[14]</sup>. Thoracic epidural catheters were inserted in all subjects unless contraindicated. Detailed knowledge of the anatomy, technique and possible complications is important for correct placement of the epidural 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 % (Sensorcaine 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<sup>[16]</sup>. 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<sup>[17]</sup>. 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]<sup>[18]</sup>.

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<sup>[10]</sup>.

## 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

Table 1 Patient characteristics

Characteristics	
Age (yr)	
Mean	34.64
Standard deviation	12.03
Range	7 to 79
Sex	
Male	984 (65%)
Female	525 (35%)
Total	1509
Height (cm)	
Mean	163.8
Standard deviation	61.3
Range	90.6 to 180.5
Weight (kg)	
Mean	55.8
Standard deviation	20.3
Range	21.5 to 83
ASA Classification	
ASA I	1103 (73%)
ASA II	358 (24%)
ASA III	48 (3%)
Inter vertebral space for epidural catheter	
D7-D8	1243 (82%)
D8-D9	198 (13%)
D9-D10	68 (5%)

ASA: American Society of Anesthesiologists.

(TIVA). The treatment plan was similar for both bile duct and pancreatic calculi. There was no correlation between age and recovery in any group<sup>[10]</sup>. A difference in drug requirement was seen at extremes of age. Some anxious 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 caudad 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<sup>[18]</sup>. 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)<sup>[16]</sup>. There was respiratory depression and hypoxemic episodes in some of these patients<sup>[10,19,20]</sup>. 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<sup>[11,15]</sup>. 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<sup>[21]</sup>. 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<sup>[21]</sup>. The disadvantage of general anesthesia includes daily intubation of patients for 2 to 3 consecutive days depending upon the number of sessions required<sup>[2]</sup>. An indwelling 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<sup>[22]</sup>. 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<sup>[23]</sup>. TEA promotes faster recovery of bowel function (as it increases the microcirculation of the bowel) and earlier fulfillment of discharge criteria<sup>[24]</sup>. Provision of good pain relief aids good targeting of the calculi (absence of tachypnea and tachycardia) and leads to reduction of morbidity and complications<sup>[11,2]</sup>. 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<sup>[11]</sup>. There were no significant post-procedure 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<sup>[3,25]</sup>. 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, cooperative and pain free patient. Thoracic epidural anesthesia (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.

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