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Case Series

Surgery Section

Ultrasound-assisted Upper Thoracic Epidural Anaesthesia in Awake Breast Surgeries: A Case Series

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ABSTRACT

Carcinoma of the breast is a leading cause of hospitalisation in elderly women and the most common surgery performed in Surgical Oncology and General Surgery Departments. Traditionally, General Anaesthesia (GA) was used for patients undergoing modified radical mastectomy. However, GA is not an ideal choice for patients with restrictive pulmonary diseases, obesity, or Chronic Obstructive Pulmonary Disease (COPD), as it is associated with increased intraoperative and postoperative complications. Regional anaesthesia is a suitable alternative, as it has the advantages of reduced sympathetic stimulation, no airway manipulation, and avoids polypharmacy, thereby reducing the hospital stay. A series of 10 female patients were presented, who were scheduled for modified radical mastectomy surgery under ultrasound-assisted thoracic epidural anaesthesia, and the patients were awake and conscious throughout the surgery. The ultrasound-assisted upper thoracic epidural was performed with a 100% success rate, and the mean procedure time taken was 238.5 seconds (ultrasound examination plus needle placement). Out of the 10 patients, one patient had two needle punctures. The needle redirections were absent in three patients, two times in three patients, and one time in four patients. Except for one patient, the epidural was successfully placed on the first attempt. Patient comfort was assessed based on the Modified Comfort Scale, with Grade-1 in five patients, Grade-2 in four patients and Grade-3 in one patient. No complications such as dural puncture or bloody tap were reported. In patients scheduled for modified radical mastectomy, performing an upper thoracic epidural using a landmark-guided technique is challenging, as the thoracic spines are very acutely angulated (T3-T6). Therefore, the ultrasound-assisted thoracic epidural technique is a safe and effective bedside tool that can be used to identify the epidural space without any side effects for the patients.

Keywords: Bloodstained tap, Comfort scale, Modified radical mastectomy

INTRODUCTION

Traditionally, epidural anaesthesia relied mainly on the landmark-guided technique to identify the interspinous levels. However, at the upper thoracic levels, negotiating the interspinous space may be difficult due to acutely angulated spinous processes, spine degeneration, inappropriate landmarks, or ligament calcification, especially in the elderly age group and obese patients [1]. This may lead to repeated needle passages, patient discomfort, and sometimes a failed epidural technique [2]. The ultrasound-assisted upper thoracic epidural anaesthesia technique provides improved precision and efficacy in overcoming these technical difficulties [2].

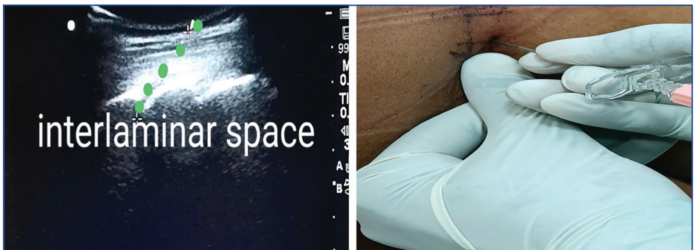
CASE SERIES

In this case series of 10 patients graded according to the American Society of Anaesthesiologists Grade-2 and 3, those scheduled for modified radical mastectomy, were included [3]. Patients with coagulopathies, American Society of Anaesthesiologists Grade-4, local skin infection, allergies to local anaesthetics, severe neurological, hepatic, or renal disorders were excluded.

Preprocedural ultrasound was performed by an experienced anaesthesiologist, and the epidural was carried out by a separate anaesthesiologist. Ultrasound examination of the spine was conducted in a sitting position using a low-frequency curvilinear probe of the Sonosite Edge II machine. The appropriate interspinous level was identified using the below technique [Table/Fig-1]. The probe was placed in the supraclavicular fossa, and the first rib was located [Table/Fig-2]. From there, the probe was gradually moved down, counting the ribs until reaching the T5-T6 spinous process level, which was then marked with a surgical marker. Landmarks were marked using the transverse spinous process view and parasagittal oblique interlaminar view, and the depth of the epidural space was measured. An 18G

[Table/Fig-1]: Counting down technique. **[Table/Fig-2]:** Ultrasound image of first rib in countdown technique. (Images from left to right)

Tuohy needle was inserted 1.5 cm below the marked point and 0.5 cm lateral to the midline. The needle was then inserted perpendicularly to hitch the lamina and then walked over the lamina, directed medially to enter the interlaminar space. Confirmation of the space was achieved using the loss of resistance to saline technique, and then the catheter was threaded in, with a 5 cm length kept inside. A graded epidural was performed with 0.5% bupivacaine, and after confirming the adequate sensory level using the pinprick method, the surgeon was allowed to proceed with the surgery [Table/Fig-3,4].



[Table/Fig-3]: Sonoanatomy of interlaminar space. **[Table/Fig-4]:** Needle insertion. (Images from left to right)

Authors evaluated the number of needle punctures, first-pass success, number of needle redirections, time taken for the procedure from ultrasound to needle placement, intraoperative haemodynamics (pulse rate, non invasive blood pressure, saturation), patient comfort during surgery, procedure-related complications such as dural puncture and bloody tap, duration of hospital stay and time of ambulation after surgery.

In the present case series, authors studied 10 patients whose median age was fifty years, and the median weight was 68.3 kg [Table/Fig-5]. The ultrasound-assisted upper thoracic epidural was performed with a 100% success, and the mean procedure time taken was 238.5 seconds (including ultrasound examination and needle placement). Out of 10 patients, one patient had two needle punctures. The needle redirections were nil in three patients, two times in three patients, and one time in four patients. Except for one patient, all others had the epidural done with a single attempt [Table/Fig-6]. Patient comfort was assessed based on the Modified Comfort Scale [4], with gradings from 1 to 5 based on alertness, calmness, facial tension, heart rate and blood pressure. Patient comfort was Grade-1 in five patients [Table/Fig-7], Grade-2 in four patients, and Grade-3 in one patient. No complications like dural puncture or bloody tap were reported, and the surgical relaxation was good according to the surgeons. Intraoperative haemodynamics, including pulse rate, non invasive Blood Pressure (BP), and saturation, were stable in all cases.

S. No.	Age (years)	Weight (kg)	ASA status	Hospital stay
1	50	68.5	2	3 days
2	62	59	3	3 days
3	54	69	2	2 days
4	45	70	2	2 days
5	50	65	2	2 days
6	73	70	3	4 days
7	49	67.8	2	3 days
8	32	68.9	2	3 days
9	39	54.5	2	2 days
10	55	60.2	2	3 days

[Table/Fig-5]: Demographic characteristics.
ASA: American society of anaesthesiologists

DISCUSSION

The ultrasound-assisted technique aids in the precise localisation of the targeted space and the insertion and advancement of the needle in that direction, helping achieve a 100% success rate with a single attempt, minimal redirections and almost no complications. Pakpirom J et al., in their study on real-time ultrasound-guided vs anatomic landmark-based thoracic epidural placement, indicate that real-time ultrasound guidance is superior to a conventional anatomic landmark-based technique for first-pass needle success, significantly higher in the ultrasound group 33/48 (68.8%), but it took longer than the conventional technique [2]. When compared with the previous studies case series, the present cases also showed an increased first-pass success rate with ultrasound-guided upper thoracic epidural.

Kim DH et al., in their study examining the T5-T6 space of twenty patients using ultrasound and Magnetic Resonance Imaging (MRI) proved ultrasound to be a better value than MRI, correlating with the present study [5]. Murata H et al., evaluated the correlation between difficult thoracic epidural needle placement and anatomical findings obtained by Three Dimensional Computed Tomography (3D CT) image processing techniques, concluding that 3DCT increased the first puncture success rate [6]. Chin KJ et al., concluded that preprocedural ultrasound imaging of the spine reduces the technical difficulty of neuraxial blockade and improves clinical efficacy [7]. Jain D et al., conducted a meta-analysis of five trials with 904 participants to determine the utility of ultrasound for caudal blocks in paediatric patients, showing that ultrasound-guided procedures improved first-pass success and decreased complications [8].

Vadhanan P et al., in their study on ultrasound-guided caudal procedures for adult anorectal procedures, concluded that ultrasound guidance improved success and patient comfort [9]. Kesilmez EC et al., in their study, where 192 patients underwent fluoroscopy-guided Caudal Epidural Steroid Injection (CESI) (Group F) and 179 underwent ultrasonography-guided CESI (Group U), evaluated patients' pain and functional statuses using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) before (baseline) and after the procedure (post-intervention day 0-D0), during the second week (D15), the first month (D30), and the third month (D90). They found no difference between the two groups [10].

In the present case series, using ultrasound-assisted upper thoracic epidural, authors obtained a real image of the interlaminar space, ligamentum flavum, and dural complexes, which helped us to identify clear landmarks. The ultrasound-assisted technique aids in the

S. No.	Level of insertion	Time for procedure (seconds)	Number of needle punctures	Number of redirections	First pass success	Mean pulse rate (BPM)	Mean BP (mmHg)	Saturation	Patients comfort based on Modified Comfort Scale	Postoperative ambulation (hours)
1	T5-T6	140	1	1	Yes	69	108/76	99%	2	04:20
2	T5-T6	180	1	0	Yes	78	129/77	99%	2	04:12
3	T6-T7	280	1	1	Yes	67	132/92	98%	3	04:45
4	T5-T6	300	2	1	No	85	133/97	98%	1	05:10
5	T6-T7	384	1	2	Yes	68	129/76	99%	1	04:32
6	T5-T6	252	1	0	Yes	79	128/77	98%	2	03:30
7	T5-T6	156	1	0	Yes	82	118/82	99%	2	04:00
8	T6-T7	160	1	2	Yes	67	109/75	97%	1	04:48
9	T6-T7	172	1	1	Yes	69	107/60	97%	1	03:38
10	T5-T6	356	1	2	Yes	78	106/62	98%	1	05:00

[Table/Fig-6]: Parameters observed.
BPM: Beats per minute

[Table/Fig-7]: Comfortable patient.

precise localisation of the targeted space, inserting and advancing the needle in that direction, achieving 100% success with a single attempt, minimal redirections and almost no complications. With this ultrasound-assisted technique, the authors could place the catheter at the optimal level required for the surgery, minimising the volume of local anaesthetics needed and enabling us to create a true segmental epidural. This contributes to achieving good haemodynamic stability and postoperative analgesia. Patients were mobilised early and had a minimal hospital stay of only 48-72 hours postsurgery. By avoiding GA, polypharmacy was also avoided, allowing elderly patients to maintain their cognitive function and reducing complications such as atelectasis and the need for postoperative ventilator support.

CONCLUSION(S)

Ultrasound-assisted upper thoracic epidurals facilitated performing the epidural with a single puncture, minimal redirections and under pure regional anaesthesia. Patients were awake and comfortable during surgery, making this technique ideal for awake breast surgeries.

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