



Excessive Threading Thoracic Epidural Catheter Placement Leads to Cephalad Migration, as Confirmed by Electrical Stimulation Test

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INTRODUCTION

Thoracic Epidural Analgesia and Catheter Insertion

- Thoracic epidural analgesia is crucial for managing perioperative pain during surgeries.
- Catheter insertion into the epidural space is recommended at 4–5 cm to avoid complications.
- The Electrical Stimulation Test (EST) confirms catheter placement by applying a low-voltage current.
- Excessive lumbar epidural catheters migrate in the caudad direction, while thoracic catheters hypothesis to migrate cephalad due to unique anatomical and physiological factors.
- Hypothesis: Excessive thoracic insertion leads to cephalad migration.

METHODS

- Retrospective analysis of data from 97 thoracic epidural procedures from December 2023 to February 2024.
- 32 patients EST confirmed epidural space.
- Catheters inserted 10-20 cm into the skin, then withdrawn.
- Myotomal activity levels were recorded at different depths to determine the catheter's direction.
- Catheter's path is categorized into upper thoracic, lower thoracic, and lower cervical regions.
- Muscle twitching responses compared across insertion depths using Fisher’s exact test.

RESULTS

Epidural Catheter Stimulation Study

- 41.18 out of 32 patients underwent EST stimulation.
- Myotomal activities evaluated at different depths.
- Muscle twitching observed above insertion points in 92.85% of cases.
- One case remained at same level.
- Over-threading catheter insertion led to cephalad migration (P < 0.05).

Table of Results

Age (years)	Weight (kg)	BMI (kg/m²)	Advanced thread			Withdrawn			Level difference
			Catheter Depth (cm)	Recorded muscle twitch	Catagorized myotome activities	Catheter Depth (cm)	Recorded muscle twitch	Catagorized myotome activities	
72	75.6	27.73	20	Anterior chest	upper thoracic	15	T7	lower thoracic	Cephalad
41	75.5	28.57	20	T5	upper thoracic	13	T8	lower thoracic	Cephalad
57	87.4	27.9	20	T4-5	upper thoracic	15	T8	lower thoracic	Cephalad
75	46.9	18.25	20	T3-4	upper thoracic	15	T7-8	lower thoracic	Cephalad
67	53.2	20.78	13	Chest	upper thoracic	11.5	Bilat. abdomen	lower thoracic	Cephalad
52	74.2	29.92	18	Anterior chest	upper thoracic	14	low ribs(T7)	lower thoracic	Cephalad
32	86.6	29.03	17	Anterior chest	upper thoracic	13	lower abdominal	lower thoracic	Cephalad
38	71.4	23.24	18	T6	upper thoracic	16	T8	lower thoracic	Cephalad
18	116.3	36.69	20	high anterior chest	upper thoracic	18	above breast bilaterally (T4)	upper thoracic	same
62	68.7	23.73	18	chest	upper thoracic	14	upper abdominal	lower thoracic	Cephalad
49	95	40.9	18	T4	upper thoracic	12.5	T8	lower thoracic	Cephalad
75	81.2	27.22	18	high anterior chest	upper thoracic	13.5	upper abdominal	lower thoracic	Cephalad
43	84.1	32.84	18	bilateral forearm movement	lower cervical	10	anterior chest wall	upper thoracic	Cephalad
43	98.4	37.25	20	bilateral anterior rib cage	upper thoracic	15	Bilat. abdominal muscles	lower thoracic	Cephalad

DISCUSSION & CONCLUSION

Study on EST in Thoracic Epidural Catheter Direction

- Excessive threading of thoracic epidural catheters leads to cephalad migration.
- Need for careful skin insertion sites for safer placement.
- EST aids in positioning catheter tips effectively, reducing complications.
- Real-time feedback enhances precision and reduces complications.
- Findings differ from previous lumbar epidural research, showing cephalad upward catheter migration.
- Further investigation needed to understand catheter migration across epidural regions.

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