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Shift from Conventional to Robotic Approach in First Rib Resection for Thoracic Outlet Syndrome

Purpose

- Thoracic outlet syndrome (TOS) is a condition characterized by a group of disorders resulting from compression of the neurovascular bundle as it transverse the thoracic outlet.
- The surgical treatment for TOS is first rib resection (FRR), which can be performed via conventional open surgery or minimally invasive surgery.
- In Korea, reports on surgical outcomes for TOS are rare, and no studies on robotic FRR have been reported.
- In this study, we report our surgical outcomes of FRR using either the supraclavicular approach or robotic-assisted thoracoscopic surgery (RATS).

Methods

- Between October 2005 and July 2024
- Single center, Single surgeon
- Routine outpatient clinic follow-up at 2 weeks and 10 weeks after discharge
- Clinical outcomes were assessed with Derkash's classification and patient's subjective degree of improvement
- Derkash's classification
  - Excellent: No pain and easy return to preoperative professional and leisure activities
  - Good: intermittent pain well tolerated and potential return to preoperative activities
  - Fair: Intermittent pain with bad tolerance and difficult return to preoperative professional and leisure daily activities
  - Poor: Symptoms not improved or aggravated

Results

Table 1. Baseline characteristics of enrolled patients (n = 21)

Variables	Values
Age (years)	28 [21–68]
Sex	
Male	13 (61.9%)
Female	8 (38.1%)
Height (cm)	171 [150–184]
Body weight (kg)	69.3[52.2–143.7]
Body mass index (kg/m^2)	23.7 [20.5–42.5]
Location	
Right	10 (47.6%)
Left	6 (28.6%)
Bilateral	5 (23.8%)
Symptom duration (months)	16 [1–78]
History of trauma	5 (23.8%)
Repetitive work	5 (23.8%)
Occupations	
Office worker	8 (38.1%)
Non-office worker	12 (57.1%)
Student	1 (4.8%)
Hospital visits due to unresolved symptoms	17 (81.0%)
Type of TOS	
nTOS	15 (71.4%)
vTOS	5 (23.8%)
aTOS	1 (4.8%)
Symptoms of nTOS (n=15)	
Paresthesia	14 (93.3%)
Pain	12 (80.0%)
Weakness	8 (53.3%)
Abnormal findings in nTOS (n=15)	
EMG/NCV	3 (20.0%)
MRI	12 (80.0%)

- 23 cases of FRR were performed on 21 patients.

Results

Table 2. Perioperative outcomes of the first rib resection (n = 23)

Variables	Total (n=23)	SC-FRR (n=10)	R-FRR (n=13)	*P* value
Type of TOS				0.643
nTOS	17 (73.9%)	8 (80.0%)	9 (69.2%)	
vTOS	5 (21.7%)	2 (20.0%)	3 (23.1%)	
aTOS	1 (4.3%)	0 (0.0%)	1 (7.7%)	
Operation time (min)	96 [63–211]	80 [63–90]	105 [70–211]	0.136
NRS pain score	3 [1–7]	4.5 [3–7]	3 [1–5]	0.021
Complications	1 (4.3%)	0 (0.0%)	1 (7.7%)	1.000
Injury of subclavian artery	1 (4.3%)	0 (0.0%)	1 (7.7%)	
Duration of drainage (days)	1.6 [0.5–5.0]	1.8 [0.5–2.9]	1.0 [0.6–5.0]	0.508
Duration of Hospital stays (days)	2.0 [2.0–7.0]	2.5 [2.0–7.0]	2.0 [2.0–7.0]	0.822
Derkash's classification				0.487
Excellent	19 (82.6%)	8 (80.0%)	11 (84.6%)	
Good	3 (13.0%)	2 (20.0%)	1 (7.7%)	
Fair	1 (4.3%)	0 (0.0%)	1 (7.7%)	
Poor	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Subjective degree of improvement (%)	95 [60–100]	92.5 [70–100]	95 [60–100]	0.747

- Among the 23 cases of FRR, 13 were performed via RATS.
- The median operation time was 96 min, with the supraclavicular and the RATS having median operation times of 80 min and 105 min, respectively (p = 0.136).
- Clinical outcomes were categorized as 'Excellent' in 19 patients (82.6%).
- The only difference in postoperative outcomes between the two approaches was the peak NRS score (4.5 vs. 3, P = .021).

Conclusion

- In well-selected patients, both the supraclavicular and robotic FRR demonstrated successful surgical outcomes, with the robotic approach offering some advantages.

- During surgery, it is important to completely resect the first rib and address the culprit lesions causing neurovascular bundle compression.