To Treat Various Forms of TOSs

Resection of The Middle Third Of The First Rib Is Sufficient
A 30-Year Experience:
HowTo Do It And When Not

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Author disclosures

No conflict of interest related to the work being presented

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› Ann Chir. 1993;47(8):748-51.

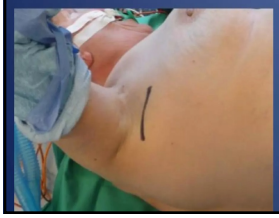
[Technical modification of transaxillary resection of the first rib in surgery of thoraco-brachial outlet syndromes]

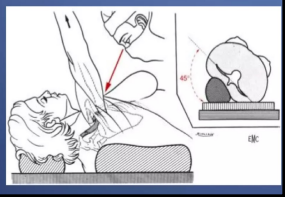
[Article in French]

C Vaislic [1], P Clerc, Y Adam, J Gosselin, J L Schmitt

•SURGICAL TREATMENT OF T.O.S.

- FRIST RIB RESECTION : Transaxillary approach (ROOS technique)
  - Patient installation





ANATOMY

- The thoracic outlet is composed of five successive spaces the vascular and nervous elements go through :
  - The inter costo scalenic defile
  - The prescalenic defile
  - The costoclavicular space
  - The sub-pectoral tunnel
  - The humeral space

Patient Selection Criteria

- Monocentric, observational, retrospective study
- Inclusion criteria:

Arterial STCTB operated on	Between April 1985 and December 2023
N	320 8/y
Female	70%
Age	35,7 (16-62)
Bilateral	28,7%
Dominant	37.7%

Patient Selection Criteria

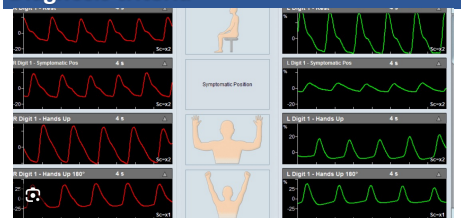
Major symptoms were arterial

- Arm claudication
- Coldness
- Raynaud

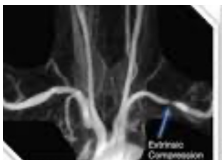
Patient Selection Criteria

- All patients had:
  - A physical examination with the four compression manouvres

Diagnosis criteria



•An echo doppler with arm abduction looking for complete or partial occlusion of the axillary artery



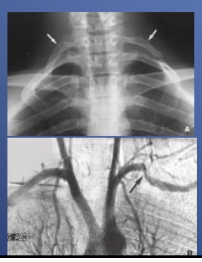
Patient Selection Criteria

We excluded venous or neurological compression

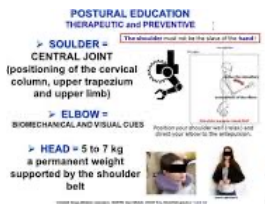
Anatomical abnormalities (1)

Present in less than 10% of T.O.S.

- Osseous congenital abnormalities
  - Subnumerous cervical ribs uni- or bilateral



Postural Education



Surgical Techniques and Evolution

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Immediate post-operative results

- Mean hospital stay= 4.8 days (m: 5 d, SD: 1.4 days, IC95% 4.51-5.07)
- No deaths
- Immediate complications (< 30 days)
  - 2 pneumothorax

Long-term post-operative results

- A total of 276 cases reassessed (86.7%)
- Mean fu: 15 years (median: 13 years)
- 243 clinical and Doppler re-evaluation

Favorable mean quality of life, mean Quick-DASH score = 15 (median: 0; standard deviation: 20.7; IC95% 10,1 :19,9

Long-term post-operative results

- A total of 276 cases reassessed (86.7%) by phone in case of abnormality mentioned by the patient

1. Duration of follow-up
2. Second or revision procedure(s)? (carpal tunnel syndrome, elbow ulnar nerve syndrome, cervical arthrosis, TOS
3. surgery)
4. Preoperative and current professional and leisure daily activities
5. Dominant side
6. Scar (aesthetics, pain)
7. Existing pain (neck, arm, forearm, index or ring fingers), with localization (medial, lateral, posterior)
8. Ability to wear weights and/or to work with shoulder(s) in abduction
9. Difficulties in catching small or large objects
10. Sensitivity to cold, numbness, swelling of extremities
11. Functional results according to patient's outcome (excellent, good, fair, poor) with explanation for outcome not
12. being excellent
13. Lack of force (analogic scale from 0 = no strength to 10 = good or excellent strength)
14. Last exams performed (duplex scan, electromyography) with precise results
15. Remarks of patient

Long-term post-operative results

- Results were assessed according to Derkash's classification:
  - excellent result (E): no pain, easy return to preoperative professional and leisure daily activities
  - good result (G): intermittent pain well tolerated, possible return to preoperative profes- sional and leisure daily activities;
  - fair result (F): intermittent or permanent pain with bad tolerance, difficult return to preoperative professional and leisure daily activities; poor result
  - (P): symptoms not improved or aggravated.

Long-term post-operative results

Excellent and good	Fair or poor
229 (84%)	44 (16%)

Discussion

TABLE 9. Reported Complications of TOS Surgery

Complication	TAFRE	SCFRE	SCR
Pleural opened/pneumothorax	383	287	25
Hemothorax	5	0	0
Chylothorax	1	0	0
Pleural effusion/atelectasis	11	21	1
Neurological injury			
Temporary	101	16	27
Permanent	21	2	0
Not reported prognosis	9	32	10
Lymphatic injury	1	11 (8 reoperations)	2
Acute bursitis of shoulder	2	0	0
Stiff shoulder	2 (1 permanent)	2 (responded well to therapy)	0
Wound infection	18 (1 reoperation)	4 (2 reoperations)	1
Wound hematoma/seroma	20 (1 reoperation)	5 (2 drainages)	1
Hemorrhage	8 (4 blood transfusions)	5 (2 reoperations)	0
Vein/artery injury	3 veins	4 (3 veins, 1 artery)	1 vein
Nonfatal pulmonary embolus	1 (responded well to anticoagulants)	0	0
Second rib excision	2 (2 reoperations)	0	0
Pain syndrome	10	2	0
Readmission	1 (not reported the cause)	2 (due to short of breath)	0
Death	1 (due to hemorrhage)	1 (no apparent reason)	0
Total complications	600	394	68
Studies included for complications data (n)	20	10	10
Cases receiving surgery (n)	2,662	1,523	539

Discussion

- Excellent and good : 207 (84%)
- Fair or poor :40 (16,%)

Centres	Procedure(s)	Follow up period (median, range)	Method of assessment	Rate of success (%)
Freeman ($n = 60$)	Anterior scalenectomy + Fibrous bands, Cervical rib excision First rib resection	43 months	Excellent + good + fair	90
Peterborough ($n = 52$)[6]	Transaxillary 1st rib excision	33 months	Resolution of symptoms	73
Leicester ($n = 37$)[13]	Cervical rib excision 1st rib excision Cervical band excision	44 months	Worthwhile or not	87
Finland ($n = 45$)[31]	Cervical rib excision Transaxillary 1st rib resection	8 years	Complete resolution of symptoms	43
U.S.A. ($n = 338$)[19]	Anterior scalenectomy	4–240 months	Good + fair	88
U.S.A. ($n = 3444$)[19]	Transaxillary 1st rib resection	6–180 months	Good + fair	88
U.S.A. ($n = 715$)[19]	Supraclavicular rib resection	1–84 months	Good + fair	96

Discussion

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- Fair or poor :40 (16%)

Study	N	Study type	Age median (range)	Male n(%)	Operation type	Complications	Outcome mean (SD) or n(%) unless stated otherwise	FU (months) median (range)	MINORS
Degeorges 2004[16]	38	Retrospective	36(16-62)	11(30%)	Transaxillary 1st rib resection or SCD if: - cervical rib present - arterial reconstruction required	Complications *21.6%, including: hemothorax, chylothorax, pneumothorax, reoperation for thoracic drainage, injury phrenic nerve, long thoracic nerve, intercostobrachial nerve, brachial plexus and Horner syndrome*	Derkash's classification *Excellent: 23(61%)* *Good: 10(26%)* *Fair: 1(3%)* *Poor: 4(11%)* Acute ischemia (n=5) vs other arterial symptoms *Excellent or good: 0% vs 87%; p<0.01* *Fair or poor: 100% vs 13%; p<0.01*	90(24-228)	10
Desai 2014[17]	5	Retrospective	50(15-68)	5(100%)	SCD + thrombectomy (n=4) + arterial reconstruction (n=5) + occasionally additional infraclavicular incision for distal arterial control	Pneumothorax *n=1(20%)* Brachial plexus injury *n=1(20%)*	Derkash's classification *Excellent: 4(80%)* *Good: 0(0%)* *Fair: 1(20%)* *Poor 0(0%)*	10(1-44)	12

Conclusion:

- We perform transaxillary resection of the middle segment of the first rib using the suspension technique described 30 years ago for arterial TOS
- We are able to treat these patients with a minimum of immediate risk and an excellent percentage of long-term improvement in their symptoms.
- We unreservedly recommend this technique as safe and effective