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SHORT COMMUNICATION

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## 20-year experience in operations for subclavian steal syndrome

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### Abstract

**The aim of this article is to summarize our experience in operations for subclavian steal syndrome. We recommend anaesthesia with preservation of patient's consciousness and mobility, and we prefer transposition of arteries to prosthesis implantation. The main characteristic of this approaches is an attempt to increase safety of operation.**

**A feasible procedure is suggested also in the case of reconstruction occlusion: the axillo-axillary bypass. (Fig. 6, Ref. 3.)**

**Key words: subclavian steal syndrome, anaesthesia, operations.**

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**Fig. 1. Reversal of blood flow in vertebral artery.**

Subclavian steal syndrome represents a reversal of blood flow in the vertebral artery, which entails, that blood flowing into the subclavian artery steals oxygen from the brain (Fig. 1). The vertebral artery becomes a collateral for the subclavian artery. This syndrome can be connected with arm claudication, and therefore it is inappropriate to perform a vertebral-carotid transposition (Fig. 2). In this case, a subclavian-carotid transposition (Fig. 3) or a carotid-subclavian bypass are the best options.

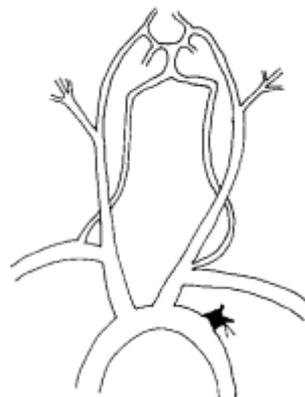
### Methodology

Between 1985 and April 2004, i.e. during past 20 years, a total of 36 arterial reconstructions for subclavian steal syndrome were performed at the 2nd Department of Surgery of St. Anne's University Hospital Brno.

Till 1994, the operations had been performed under general anaesthesia. Then the algorithm was changed, preferring preservation of consciousness for permitting a cooperation with the patient during transient occlusion of the carotid artery. If the patient tolerated the test of transient occlusion of the carotid artery and did not lose his/her consciousness, the entire operation was performed under cervical epidural anaesthesia or, later, under cervical plexus block. If an unconsciousness had occurred



**Fig. 2. Vertebral-carotid transposition.**



**Fig. 3. Subclavian-carotid transposition.**

we restored the blood flow in the carotid artery and abandoned the operation. Our team was the first in the Czech Republic using cervical epidural anaesthesia, from 1994. Since 1999, cervical epidural anaesthesia has been replaced by cervical plexus block.

For the classic treatment, 2 types of reconstruction were chosen: carotid-subclavian bypass with a prosthesis or a direct arterial connection – subclavian-carotid transposition.

In the case of an occlusion of the carotid-subclavian reconstruction, an axillo-axillary bypass with an incompressible PTFE prosthesis appeared to be the safest method.

### Results

A total of 36 patients, 31 men (86.1 %) and 5 women (13.9 %), were operated on for the subclavian lesion. The mean age of patients was 58.9 years. Pre-operative problems were following: headache, dizziness, TIA in 11 patients (30.6 %), ischaemic symptoms in upper limbs, manifested with claudication-type pain, tingling in fingers, cold sensation in fingers in 18 patients (50 %). Combination of both types occurred in 6 patients (16.7 %). One patient was without problems (2.8 %).

Following risk factors were found: ischaemic heart disease in 30 patients (83.3 %), hypertension in 27 patients (75.0 %), diabetes mellitus in 18 patients (50.0 %), and hypercholesterolaemia in 22 patients (61.1 %).

Mean duration of the operation was 130 minutes, 3x a combined operation with desobliteration of the internal carotid artery (ICA) was performed. Mean time of the carotid artery occlusion was 30 minutes.

Mean time of hospitalization (including pre-operative period) was 9 days, mean time of postoperative hospitalization was 7 days.

In 28 cases (77.8 %) was the left side operated, the right side was operated in the 8 cases (22.2 %).

A carotid-subclavian bypass with a prosthesis was implanted in 28 patients (77.8 %). In 2 of these patients (5.6 %) with a subtotal stenosis of the internal carotid artery (ICA) was the carotid-subclavian bypass with a prosthesis combined with des-



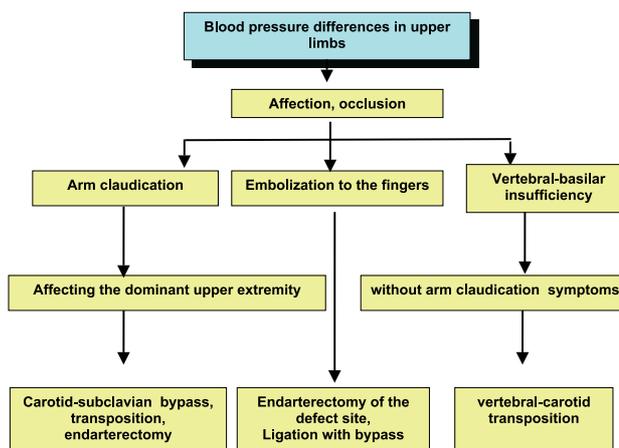
**Fig. 4.** The carotid-subclavian bypass with a prosthesis was combined with desobliteration of the ICA with venous patch implantation from great saphenous vein to the arteriotomy site.

obliteration of the ICA with venous patch implantation from the great saphenous vein to the site of arteriotomy (Fig. 4). A subclavian-carotid transposition was performed in 5 patients (13.9%), vertebral-carotid transposition was not performed. Two times (5.6%) was operation abandoned due to of patient's unconsciousness after common carotid artery clamping.

After operation, 28 patients (77.8%) reported improvement, 5 patients (13.9%) did not notice any change, and 3 patients (8.3%) reported deterioration. Thrombosis of the subclavian-carotid bypass occurred 3x, thrombectomy was performed 2x, in one of these cases thereafter a stroke developed. Therefore, in the last case of the occlusion of the subclavian-carotid re-



**Fig. 5.** The axillo-axillary bypass with an incompressible PTFE prosthesis.



**Fig. 6.** Treatment standard.

construction, was the procedure different. An axillo-axillary bypass with an incompressible PTFE prosthesis was performed (Fig. 5).

3 patients (8.3%) died during the follow-up period, all without direct relation to the operation.

Our results are comparable to those in a similar patient group (2).

## Discussion

In upper limbs blood pressure differences up to 20 mmHg indicate a possible affection (Fig. 6). A difference higher than 40 mmHg indicates an occlusion (1). Reverse blood flow in the vertebral artery can be detected using ultrasonography or angiography. Subclavian affection can cause an arm claudication, embolization to the fingers of the affected side, or vertebral-basilar insufficiency. Symptoms can be augmented by a simultaneous affection of the circle of Willis or carotid stenosis.

In case of an arm claudication, especially when affecting the dominant upper extremity and manifesting during work or recreation, a carotid-subclavian bypass, transposition, or endarterectomy are the best options.

In case of an embolization to the fingers it is possible to perform an endarterectomy of the affected site, or ligation with bypass.

Finally, in case of a vertebral-basilar insufficiency without arm claudication symptoms it is appropriate to perform a vertebral-carotid transposition.

Because of a risk of cerebral embolization during reoperation for a subclavian-carotid bypass occlusion, it is appropriate to proceed in a different way. The best option is an axillo-axillary bypass with an incompressible PTFE prosthesis (3).

## Conclusion

Invasive methods of angioplasty are not evaluated in the article. We believe that a better operation results can be achieved by:

- 1) using anaesthesia with preserved patient's consciousness during surgery,
- 2) preference of direct arterial connection,
- 3) appropriate choice of type and length of prosthesis if necessary,
- 4) in case of reconstruction thrombosis, performing an axillo-axillary bypass with an incompressible PTFE prosthesis.

#### Future

In future, following areas will develop:

- 1) diagnostics,
- 2) new types of anaesthesia in selected groups of patients – anaesthesia with preserved consciousness and mobility,
- 3) protection of brain during surgery,
- 4) quantified and reproducible diagnostics, indication and treatment standards.

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Received August 15, 2004.  
Accepted September 2, 2004.