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Editorial comment

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Bipolar radiofrequency neurotomy for spinal pain – a promising technique but still some steps to go

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In this issue of the *Scandinavian Journal of Pain*, Rohof and Chen publish a non-controlled study on radiofrequency (RF) neurotomy of medial branches including a bipolar system for thoracic facet joints.

Thermal RF neurotomy is widely used in order to treat zygapophysial joint related neck and back pain [1]. Clinical RF-systems are divided into monopolar and bipolar devices. In a monopolar RF system high-frequency alternating current flows between the active electrode (an uninsulated tip of the RF needle) and a neutral electrode (ground plate) attached to the skin. The small surface of an active electrode leads to a high current density resulting in a localised thermocoagulation of the surrounding tissues [2, 3]. The size of the lesion usually covers no more than two electrode-widths, and the RF needle tip has to be placed closely adjacent to the target nerve. At thoracic levels thermal RF neurotomy is a time-consuming procedure and is difficult to perform due to anatomical variation of the transverse processes and pathways of the medial branches. In a recent, observational study Hambraeus and coworkers applied three to 15 lesions for each nerve in the thoracic region [4]. Although the Spine Intervention Society (SIS) has developed detailed guidelines for medial branch blocks and RF neurotomy, they so far only include RF interventions at the cervical and lumbar levels [5]. The clinical evidence of thermal RF neurotomy to thoracic medial branches is still limited, rated to level III [6], based on one single, randomised, controlled trial [7].

From these perspectives bipolar RF systems represent an interesting alternative. With two active electrodes placed close to each other the RF currency creates larger tissue lesions which again increases the chance to coagulate the target nerve [8]. Bipolar RF neurotomy has been tested in the treatment of structures with a more inconsistent or complex neural anatomy like sacroiliac joints, and lumbar discs with promising results [9, 10]. In a small case series *intraarticular* bipolar RF thermocoagulation of thoracic facet joints was associated with almost 50% pain reduction 1 month after treatment [11].

The present paper by Rohof and Chen is the first to describe bipolar thermal RF neurotomy of thoracic medial branches and the results are impressing. The paper is therefore rather interesting from a clinical point of view. Among 71 patients reporting pain in the thoracic, cervicothoracic or thoraco-lumbar regions, 82% reported >50% pain reduction 12 months after the treatment. The results are equivalent or even superior to previous non-controlled studies with monopolar RF, which have reported success rates between 40% and 80% [12–14]. A randomised, controlled study comparing monopolar RF neurotomy to alcohol ablations, reported an average effective period of 10, 7 months for the RF group, while the duration of 50% pain relief was not described [7].

Unfortunately, the present study is hampered by several important limitations. It has an open, retrospective design, limited description of the sample, only a few outcomes measures, and no control group. Thus, the study cannot assess the efficacy of bipolar neurotomy. The authors furthermore report a rather high drop-out rate. Out of 116 patients, treated with bipolar RF neurotomy, 98 were included in the study, and of these 27 persons were excluded, either due to loss in the follow up or missing data. Such a drop out rate (~27%) includes a risk of selection bias, as patients who do not respond to a treatment, may be less motived to provide data. Furthermore, most of the participants (83%) received additional monopolar neurotomy at cervical (*n*: 56) or lumbar (*n*: 3) levels. The study is therefore not a pure evaluation of bipolar thoracic neurotomy, but involves a mixture of monopolar and bipolar ablations. It should also be noted that such a large number of neurotomies (in some patients three levels were treated and if bilaterally, this means

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eight nerve ablations) as well as the interpretation of test blocks, are not in line with the clinical recommentations from SIS (they performed only one single test block and included patients with >50% pain reduction) [5]. The high success rate is therefore remarkable.

Larger thoracic RF lesions from a bipolar RF system will carry an increased risk of thermal injury to neural and vascular structures as well as the pleura. We therefore need more knowledge about factors predicting the geometry and size of bipolar RF induced lesions in relevant tissues. Future studies need to address technical issues like optimal electric density, duration time and space between the electrodes. Whether bipolar RF may heat metallic implants like surgical clips or interfere with implanted electrical devices has to be thoroughly tested although the risk should be less compared with a monopolar RF system from a theoretical perspective.

The present study by Rohof and Chen describes a promising technique for RF neurotomy of thoracic medial branches, but high-quality studies are needed to provide adequate evidence for efficacy and safety. We still have some steps to go!

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