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## Radiofrequency ablation for the management of pharmacotherapy – resistant chronic pain

Zastosowanie termolezji w leczeniu bólu przewlekłego opornego na farmakoterapię

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### Key words

thermoleision, painful shoulder syndrome, trigeminal neuralgia, occipital neuralgia

### Słowa kluczowe

termolezja, zespół bolesnego barku, neuralgia nerwu trójdzielnego, neuralgia nerwów potylicznych

### Summary

**Introduction.** The International Association for the Study of Pain recommends interdisciplinary approach to the treatment of patients with chronic pain, including interventional methods in cases of pain resistant to pharmacotherapy. One of those methods, applied in our Pain Clinic, is thermoleision which utilizes high temperature to destroy structures of the nervous system.

**Aim.** The aim of the study was to assess the effectiveness and safety of the presented therapy.

**Material and methods.** The authors performed a preliminary evaluation of the results of the treatment among patients scheduled for thermoleision. Between 2009-2011 three groups of patients were examined. Suprascapular nerve thermoleision was performed in 20 patients with the painful shoulder syndrome (group I). The Gasser ganglion thermoleision was applied in 19 patients with the trigeminal nerve neuralgia (group II). Occipital nerve thermoleision was carried out in 33 patients with occipital neuralgia (group III).

**Results.** The thermoleision ensured good pain relief in the examined groups of patients. A positive effect of the therapy was observed among 18/20 (90%) patients in group I, 18/19 (94.73%) patients in group II, among 31/33 (93.93%) patients in group III.

**Conclusions.** Due to its characteristic features, and above all the predictability of the extension of destruction, thermoleision shows clinically relevant advantages and seems to be superior to other physical or chemical methods of neurodestruction. Accuracy in assigning patients to the procedure and precision in the performing of thermoleision results in low incidence of serious complications. Further investigations of the ever-increasing group of patients requiring interventional methods of therapy are planned to be conducted in the future.

### Streszczenie

**Wstęp.** Międzynarodowe Stowarzyszenie Badania Bólu IASP (The International Association for the Study of Pain) zaleca wielodyscyplinarne leczenie chorych z bólem przewlekłym, z uwzględnieniem zastosowania inwazyjnych metod leczenia w przypadku bólu opornego na farmakoterapię. Jedną z inwazyjnych metod leczenia, stosowanych w Radni Leczenia Bólu Kliniki Anestezjologii i Intensywnej Terapii CMKP, jest termolezja, czyli zniszczenie struktur układu nerwowego przy pomocy wysokiej temperatury.

**Cel pracy.** Celem badania była ocena skuteczności i bezpieczeństwa prezentowanej terapii.

**Materiał i metody.** Autorzy dokonali wstępnej oceny wyników leczenia chorych, u których zastosowano technikę termolezji. Badanie prowadzono w latach 2009-2011 w trzech grupach pacjentów. Pierwszą grupę stanowili chorzy z zespołem bolesnego barku, u których wykonoano termolezję nerwu nadłopatkowego (20 chorych), drugą chorzy z neuralgią trójdzielną, u których wykonano termolezję zwoju Gassera (19 chorych), a trzecią chorzy z neuralgią potyliczną, u których wykonano termolezję nerwów potylicznych (33 chorych). W ocenie zwrócono szczególną uwagę na skuteczność i bezpieczeństwo omawianej metody.

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**Wyniki.** Termolezja okazała się skuteczną metodą leczenia bólu przewlekłego w omawianych grupach pacjentów. Pozytywny efekt zabiegu obserwowano u 18/20 (90%) chorych z grupy I, 18/19 (94,73%) chorych z grupy II i 31/33 (93,93%) chorych z grupy III.

**Wnioski.** Dzięki swoim właściwościom, a przede wszystkim przewidywalności rozmiaru uszkodzenia, termolezja ma przewagę nad innymi technikami neurodestrukcji fizycznej i chemicznej. Poprawnie zastosowana technika i ścisłe przestrzeganie zasad ustalania wskazań i przeciwwskazań powodują, że częstość występowania powikłań jest niewielka. Dalsze badania i obserwacja stale rosnącej grupy chorych wymagających leczenia bólu przy pomocy termolezji będą tematem kolejnych opracowań.

## INTRODUCTION

Chronic pain has a complex mechanism of formation and is often resistant to pharmacotherapy. The International Association for the Study of Pain recommends multidisciplinary approach including interventional techniques: local blockades and neurodestructive procedures. Neurodestructive procedures can be carried out using chemical (neurolysis), physical (temperature) or mechanical (surgical cutting) agents. Thermolection is one of the invasive techniques which utilizes high temperature as a neurodestructive agent. It is a method based on controlled use of temperature above 45°C which is produced by radio waves spreading in tissues generated by RHF device. The procedure is enabled by a suitable device which precisely measures temperature and impedance and produces two kind of stimulation: sensory at a frequency of 50-100 Hz and motor at a frequency of 2-5 Hz. The device is also equipped with a high frequency waves generator which produces accordingly programmed temperature in a strictly fixed time on the electrode tip. Measuring the impedance and two kinds of stimulation facilitate precise placing of the active electrode tip. The rest of the electrode is insulated by a synthetic material. Uninsulated tip of the needle serves as an active electrode. Conducting thermolection at temperatures 45-65°C enables selective lesion in mixed nerves, thin sensory fibres A delta and C without impairment of the functions of thick motor nerves, resistant to this range of temperature. The indications for thermolection are established when other noninvasive procedures failed especially when the effect of the diagnostic – prognostic blockade is positive. Patients abusing drugs or alcohol and those whose pain perception can be influenced by psychological and social agents are not eligible for the procedure. Thermolection is carried out in such syndromes of chronic pain as: trigeminal neuralgia, cluster headaches, facet joint syndrome, occipital neuralgia, cancer pain, intercostal neuralgia, vascular pain, sympathetically maintained pain, stump limb pain (1, 2). The following analysis concerns the effect of thermolection treatment of the pain in: painful shoulder syndrome, trigeminal and occipital neuralgia in the years 2009-2011.

## AIM

The aim of the study was to assess the effectiveness and safety of the presented therapy.

## GROUP I: SUPRACLAVICULAR NERVE THERMOLECTION

### Introduction

Painful shoulder syndrome is a set of clinical symptoms related to the shoulder girdle characterized by pain, motor deficiency and impairment of the functions of the upper limb. It is often treatment resistant and inadequate therapy can lead to permanent motor impairment of the upper limb. The treatment of the painful shoulder syndrome encompasses: noninvasive methods pharmacotherapy and physiotherapy and interventional procedures (suprACLAVICULAR nerve blockades, thermolection, and surgery).

### Material and methods

The study was conducted among the patients of Pain Clinic of Department of Anaesthesiology and Intensive Therapy of the Medical Center of Postgraduate (Education/Studies) in Warsaw in 2009-2011 diagnosed with a painful shoulder syndrome with intensity of pain > 6 in numerical rating scale NRS (11 points scale in which 0 – means no pain, and 10 – worst pain imaginable). After series of blockade of the suprACLAVICULAR nerve with positive but transient effect, thermolection of suprACLAVICULAR nerve was performed. 20 patients (13 women, 7 men) aged 56-82 years were enrolled into the study. The chronic pain had lasted from one to 8 years. The written informed consent was obtained from all patients. The thermolection was applied ambulatorily with the use of Neuro-Therm RDG R/JK2C device and the electrode Top Nekropole Needle (EQUIPP MEDIKEY B.V.) the length of 6 cm (length of the uninsulated tip 5 mm). The correct positioning of the active electrode tip was verified by means of sensory (50 Hz) and motor (2-5 Hz) stimulation. The place of lesion was anaesthetized by injection of 1 ml 2% lignocaine (ASTRA ZENECA). The time of lesion was 60s, voltage 21 mV, intensity 50 mA. The current characterized by such parameters generates a temperature of 65°C at the tip of active electrode. After application, 1 ml (20 mg) of pentoxyphylline was given. The efficacy of the procedure was evaluated on the basis of NRS in chosen time points (before the procedure, 14, 30, 60 days after the procedure). The duration of pain reduction and the occurrence of side effects was also estimated.

## Results

The intensity of pain before the thermolesion was 7-10 point in NRS score. The pain relief was observed in 18 out of 20 patients (90%). In 13 patients (65%) the intensity of pain decreased to 2-4 points in NRS in all time points after the procedure. In 5 patients (25%) complete pain relief was achieved. In 2 patients (10%) no improvement was observed after the thermolesion. The average time of pain reduction was 5 months. The complications observed in our patients, such as hyperesthesia and increased muscle tension retreated spontaneously in 2 weeks. The thermolesion was carried out again in 7 patients (35%) with recurrence of complaints.

## Discussion

The thermolesion of the supraclavicular nerve has been carried out in our Pain Clinic since 2008. Previously we had treated the painful shoulder syndrome with blockades of supraclavicular nerve with the use of local anaesthetic agent and with steroid addition in chosen patients. The efficacy of thermolesion was high in our material. In 18 out of 20 patients (90%) treated with the discussed method significant improvement was achieved. In similar studies decrease of pain about 95% and improvement of motor function of the limb is reported. Technical precision in performing thermolesion and accuracy in assigning patients to the procedure results in low incidence of serious complications. Hyperesthesia and increased muscle tension observed in our patients subsided spontaneously in 2 weeks. We didn't observe decrease of muscle strength. No serious side effects have been observed in similar studies either. Only transient sensitive disorders appeared (3, 4). The preferable method in this technique of thermolesion is now pulsatile thermolesion. It is our plan in the nearest future to also use this method of treatment after the purchase of suitable device.

## Conclusions

The positive effect of the procedure in 18 out of 20 patients confirms the efficacy of the supraclavicular nerve thermolesion in the complex treatment of the painful shoulder syndrome. Low incidence of complications and their spontaneous retreat proves that the procedure is safe. Due to the long time of clinical improvement (5 months average) thermolesion is a useful alternative to the supraclavicular nerve blockades with the use of local anaesthetic agent in the complex treatment of painful shoulder syndrome.

## GROUP II: THE GASSERIAN GANGLION THERMOLESION

### Introduction

The facial pain is a difficult diagnostic and therapeutic problem because of its complicated patomechanism and many different causes. Rare occurrence, lack of objective diagnostic tests and a wide range of causes

and symptoms render an accurate recognition and an adequate therapy difficult. According to epidemiology studies, trigeminal neuralgia (NNT) is one of frequent causes of the unilateral facial pain. The incidence of trigeminal neuralgia is reported to be approximately 3-5 per 100 000 persons per year. Nowadays the widely preferable and accepted theory regarding ethiopathology of NNT is the theory of peripheral and central mechanism of NNT proposed by Rappaport and Devor 1994. They presumed that the lesion caused by the pressure on the root of trigeminal nerve leads to hyperactivity of a small group of neurons in the trigeminal nerve ganglion which consequently creates a kind of trigger. The choice of the therapy depends on its efficacy and influence on other later methods of treatment. Therapy has to be individual. Some patients are resistant to any kind of therapy or they experience side effects which preclude the continuation of the treatment. Clinical procedures are also very often determined by the clinical status and age of the patients. Unfortunately in all the methods, even the most radical ones, there is a percent of failure. The therapy is multistage from the least to the most invasive methods. Pharmacotherapy is the first step which is effective in 80% of the patients. The patients refractory to the medical therapy are subjected to invasive treatment options (5). The invasive methods are: surgical procedures among which we distinguish destructive methods (with a high percentage of complications), microsurgical decompression of the nerve root pressed by the vessel, and neurodestructive procedure (5, 6). The most of neurodestructive techniques concern the Gasserian ganglion. Among which the thermolesion of the Gasserian ganglion is the most often performed procedure (7, 8).

### Material and methods

In the out-patient Pain Clinic of Department of Anaesthesiology and Intensive Therapy of the Medical Center of Postgraduate (Education/Studies) in Warsaw since July 2008 till 2011, 31 thermolesions of the Gasserian ganglion were performed in 19 patients, aged 46-86. The duration of clinical symptoms was 2-30 years. All patients suffered from severe episodes of electric shock-like pain, some up to several dozen attacks per day, with intensity of pain 8-10 points in NRS score. In 5 patients, despite of paroxysmal pain, continuous pain (4-5 points in NRS score) was observed. Medical treatment proved to be ineffective or impossible to continue because of side effects. All patients were informed about advantages and risk of complications due to Gasserian ganglion thermolesion. The written informed consent was obtained. In the day of procedure patient came to the out-patient with an escort and the thermolesion procedure was carried out ambulatorily in the operating room conditions. The intravenous access was obtained and heart rate, blood pressure and saturation of hemoglobin were measured.

The thermolesion was applied with the use of Neuro-Therm RDG R/JK2C device and the electrode Top Nekropole Needle (EQUIPP MEDIKEY B.V.) the lenght of 10 cm (lenght of the uninsulated tip 5 mm). The patient was placed in supine with a head slightly leaned back to visualize in radioscopic projection foramen ovale through which the electrode is introduced to the Gasserian ganglion. The zero electrode was placed on the hip or abdomen of the patients. After surgical disinfection of operation area infiltration anaesthesia in the point of needle insertion (2-3 cm lateral from the lateral margin of the mouth in the line connecting mouth with processus mastoideus) was given. The correct positioning of the active electrode tip was assessed using the radiosscopic control with contrast medium, sensory (50 Hz) and motor (2-5 Hz) stimulation. After insertion of the electrode the possibility of a leak of blood or cerebrospinal fluid was checked. The place of lesion was anaesthetised by injection of 1 ml 2% lignocaine (ASTRA ZENECA). The lesion time was 60 seconds at 60-70°C, voltage 21 mV, intensity 50 mA. After the procedure 1 ml (20 mg) of pentoxiphylline was given.

## Results

The intensity of paroxysmal pain, before the procedure of thermolesion was 8-10 points according to NRS. 5 patients suffered from continous pain at 5 points in NRS. In 18 out of 19 patients (94.73%) there was a complete post-treatment reduction in pain intensity regarding both paroxysmal and continous pain. In one patient we have no information about the effectiveness of procedure. In 19 patients 31 thermolesions of the Gasserian ganglion were performed. In 10 patients the procedure was carried out once, in 6 patients twice, and in 3 patients 3 times. The post-treatment reduction in pain intensity persisted 7-24 months. In 8 patients after single procedure the pain relief is permanent till today. 17 patients are in remission state at the moment. We have no access to data regarding one patient. One of the patients with reccurent pain was subjected to the surgery after 7 months. After the microsurgical decompression complete pain relief was noticed. We didn't observe any severe complications. The transient oedema and ecchymosis of the bucca (5 x), transient sensory disorders (2 x), transient ptosis (1), were observed in 10 cases (30%). 2 (6%) of patients did not respond to the procedure of thermolesion. The average time of good reduction of pain was 5 months. 10 patients (30%) required a repetition of the procedure, for 2 patients (6%) the procedure of thermolesion has been performed three times.

## Discussion

The Gasserian ganglion thermolesion has been performed in our Out-Patient Clinic since July 2008. Earlier, in patients refractory to the pharmacotherapy the neurolysis of the pterygopalatinum ganglion was car-

ried out. Today this procedure is recommended for the patients with trigeminal nerve neuropathy. The efficacy of the procedure in our material was high in 18 out of the 19 patients (90%) pain relief was complete. We have no data as regard one patient. Data from the literature concerning the efficacy of the Gasserian ganglion thermolesion are conflicted. The pain relief is observed in 56-100% patients treated with this method. The immediate, after procedure pain relief is noticed even in 98% of patients. In 1-17% early pain reccurance in the period of some months and in 4-32% after some time after the procedure are described. The shortest time to the reccurrent pain in our material was 7 months. In 8 patients after single procedure, persistent pain relief has been lasting over 2 years (in 3 patients). The Gasserian ganglion thermolesion performed technically precisely results in low incidence of persistans complications. Major side effects as meningitis, abscessus, cranial nerves paralysis are very rare. In 25% of patients transient sensory disorders can occur, anaesthesia dolorosa in 1%, corneitis in 1-2%, hypoesthesia of the cornea in 20%. The more often complications are: facial muscles spasm, hyperesthesia in nerve dermatom area the oedema and ecchymosis of the bucca (1, 5, 7, 9-13). We didn't noticed any serious complications in our material. The transient ptosis (1 x), transient sensory disorders (2), transient oedema and ecchymosis of the bucca (2 x) were observed.

## Conclusions

1. The Gasserian ganglion thermolesion in patients with NNT resistant to pharmacotherapy, is highly effective procedure.
2. The average duration of pain relief after The Gasserian ganglion thermolesion is relatively long and has lasted 7-24 months in our group of patients.
3. The Gasserian ganglion thermolesion if performed correctly results in low incidence of serious complications.
4. The duration of the Trigeminal neuralgia didn't influence the effect of the therapy with the use of thermolesion procedure.

## GROUP III: THE OCCIPITAL NERVE THERMOLESION

### Introduction

Occipital neuralgia is a chronic pain in the distribution of the occipital nerves: the greater and the lesser one. The pain is accompanied by periodical, paroxysmal, aching paraesthesia. The most common cause of this neuralgy is trauma: for example working in a position with hiperextension of the cervical spine. More rarely the neuralgy is caused by the compression of the nerve root and spinal nerve C2 by osteoarthritis of the cervical spine. In the management of occipital neuralgia combined therapy is recommended: pharmacotherapy (analgesics, antidepressants, myorelaxants), neuromodulation, laser biostimulation, blockades and occipital nerves thermolesion (1).

## Material and methods

The study was undertaken among the patients of the Pain Clinic of Department of Anaesthesiology and Intensive Therapy of the Medical Center of Postgraduate (Education/Studies) in Warsaw in 2009-2011 who were diagnosed with occipital neuralgia with pain intensity > 7 points according to NRS score. After the series of diagnostic blockades patients were qualified for thermolesion. The pain relief after occipital nerve blockade was positive but short lasting in all patients. The thermolesion was performed in 33 patients (27 women, 6 men) aged 42-76. The period of complaints had lasted from 1 to 6 years. A written informed consent was obtained from all the patients. Thermolesion was applied ambulatorily with the use of Neuro-Therm RDG R/JK2C device and the electrode Top Nekropole Needle (EQUIPP MEDIKEY B.V.) 6 cm long (length of the uninsulated tip 5 mm). The correct positioning of the active electrode tip was verified by means of sensory (50 Hz) and motor (2-5 Hz) stimulation. The place of lesion was anaesthetized by injection of 1 ml 2% lignocaine (ASTRA ZENECA). The time of lesion was 60s, voltage 21 mV, intensity 50 mA. The current characterized by such parameters generates a temperature of 65°C at the tip of active electrode. After application, 1 ml (20 mg) of pentoxifylline was given. The efficacy of the procedure was evaluated on the basis of NRS in chosen time points (before the procedure, 14, 30, 60 days after the procedure). The duration of pain reduction and the occurrence of side effects was also estimated.

## Results

The intensity of pain before procedure of thermolesion was 8-10 points in NRS score. 31 in 33 patients experienced completely or significant relief in pain (94%). The intensity of pain was reduced to 2-5 points in NRS score in 21 (64%) patients. The pain disappeared completely in 10 cases (30%). 2 (6%) of patients did not respond to procedure of thermolesion. The average time of good reduction of pain was 5 months. 10 patients (30%) required repetition of procedure, for 2 patients (6%) the procedure of thermolesion has been performed three times.

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Side effects (discomfort in place of needle insertion, transient sensory disorders) was observed during first 7-10 days in 17 patients (52%).

## Discussion

The thermolesion of occipital nerve is performed in our Pain Clinic since 2008. Previously, for occipital neuralgia we used local anaesthetic blockades, occasionally with steroids.

In our material the effectiveness of thermolesion was high. 31 in 33 patients, treated with this method, experienced significant improvement in their symptoms (10 in 33 of patients – 30% – reported complete resolution of pain, 21 in 33 of patients – 64% – had relevant reduction in pain).

Our findings are similar to the results from other studies, where 60-80% effectiveness of thermolesion and lasting few months effect are described (14). Our experience shows efficacy and safety of thermolesion in case of necessity of second procedure. If technically well performed, thermolesion of occipital nerve results in a few complications. Discomfort in the place of needle insertion and transient sensory disorders has subsided in 10 days after procedure in our patients. We did not observe complications like: bleeding, infection, exacerbation of pain (15).

## Conclusions

Positive result of thermolesion in 94% of patients confirms effectiveness of this procedure in complex treatment of occipital neuralgia.

Low incidence of serious complications and their spontaneous subsiding proves that this procedure is safe. Long-lasting improvement after thermolesion (average 5 months) makes it helpful choice, in comparison to local anaesthetic blockades, for complex treatment of occipital nerve neuralgia.

## CONCLUSIONS

In conclusion, despite the small number of cases, it was proved that thermolesion is an effective and safe therapeutic method of treatment of pain resistant to pharmacotherapy. The same result occurred in all three groups of patients.

Further studies and observation of thermolesion applied in growing number of patients with chronic pain will be continued.

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