Introduction

The treatment of chronic low back pain is a pain therapy problem that has not been yet solved. During lifetime roughly 80% of the population suffers from chronic low back pain, they give significant part of the orthopedic pain patients. In every 10th case of chronic low back pain a radiculopathy can be diagnosed. Different forms of therapy are suggested and used. However, until now neither a satisfactory therapeutic solution nor a uniformed consent for the therapy of this type of pain has been found. Already the exact diagnosis is in the praxis extremely difficult, because in the case of many chronic pain patients no exact anatomical category of the pain causing structure can be found. In addition to that many cases show false treatment of the pain symptomatic – allowing the condition to become chronic.

Origin of the radiculopathy

Scars

Besides intervertebral disc protrusion or prolapse also epidural scars can be discussed as possible cause of painful radiculopathy. They can occur with an incidence of 10-30% after open interventions in the area of the intervertebral discs. An indication for an operative revision by periradicular scars should be set very strictly, for there is only a 50% likelihood for a good result after a first revision of a disk/spine surgery. In the case of a second revision the likelihood of a good pain-killing result is reduced to 20%.

From the process of unspecific lumbar back pain is well known that by primary manifestation a clinically relevant improvement can be achieved in 85% of the cases already by exclusive use of physiotherapy (without the use of any further therapeutical means) so that beforehand no radiological methods or operative interventions were executed.

While scars themselves give no pain, they can induce mechanical problems and lead to scarred connections with neighboring nerve endings. Due to movement the length changes; that leads to scarred connections; these connection let draw tension and mechanical irritation of the affected nerve roots (with a typical image of radiculopathy) occur.
**Inflammation processes**

Besides these mechanically induced radiculopathies also inflammation processes can be the cause of pain. So for example exiting disc tissue can lead to local inflammatory reactions, so that connective tissue hyperplasias and later fibrosis can be produced which can also lead to irritation of the affected nerve roots.

Under mechanical influence – due to scars or disc parts – local, pressure related perfusion disorders can occur. While great pressure can induce direct mechanical damage of the nerve roots, minor local pressure can reduce the blood supply. Already at 5-10mmHg the blood circulation of the veins of the affected segment is reduced in a great measure; by the same pressure the blood circulation of the arteries is reduced at 20-30%. Due to these changes perineural oedemas can be observed, they lead to further great perfusions disorders – this can all end in a circulus vitiosus.

In order to causally treat local changes such as inflammations, oedemas, fibroses, venous congestion, increased mechanical pressure and reduction of the blood flow in the arteries Gabor Racz developed a method named after him. During this interventional therapy contrast fluid, local anesthetics, the proteoltyical enzyme hyaluronidase and a 10%NaCl-solution and corticosteroids will be applied by the means of an epidural catheter directly to the affected nerve roots. The effect of this catheter therapy is based of following hypothesis:

- antinflammatorical therapy because of the use of corticosteroids,
- antioedematical therapy because of the use of hypertonic (10%) NaCl-solution and corticosteroids,
- local pain therapy for the initial break of the pain sensation because of the use of local anesthetics,
- pain therapy with hyperton 10% NaCl solution
- antifibrosis therapy because of the use of the enzyme hyaluronidase,
- mechanical lysis by the means of the catheter and finally a washing effect because of the applied volume.

Goal of the study was to show the clinical effect of this intervention for the treatment of chronic radiculopathy in a prospective manner.

**Method**

**Patients**

Within the framework of the study 98 patients have been examined from the viewpoint of eligibility for the study. It has been found that in 29 cases inclusion criteria have not been fulfilled or exclusion criteria have been found. 7 patients with inclusion and no exclusion criteria have resigned to participate in the study because of personal reasons. In one case the reason of not participation could not be discovered. Therefore with a positive vote of the internal ethical commission of the clinic 61 patients could be treated with the minimal invasive percutaneous epidural neurolysis by Racz.
**Indications**

Indications for the catheter treatment have been determined according to special inclusion and exclusion criteria (See table 1.). The exact localization of the affected roots followed a clinical neurological diagnostic, by necessity additional electrophysiological examinations (EMG, NLG) were carried out. As primary goal criteria was determined the change according to the Oswestry-Scores. This shows and quantifies the restrictions and pain sensation during everyday–activities such as walking, weight-lifting, sleeping, sitting, etc. It is a spine score well evaluated and easy to apply.

As a secondary goal criteria was defined the change of the subjective pain sensation according to the McNab-Score. This score is easy to apply; it gives four categories of the subjective disposition:

- excellent (sehr gut)
- good (gut)
- moderate (mäßig)
- bad (schlecht).

In order to determine the goal criteria the most crucial date is that of the examination in the 6 postoperative months after the treatment. However, there was an examination in the 3rd postoperative month so that the healing process could be determined and undesired effects could be defined.

In the study patients of several medical professions have been presented and included such as orthopedics, neurology, psychosomatics, physical medicine, physical therapy. The technique of the catheter treatment was carried out also with the participation of several disciplines such as orthopedics and anesthetics.

The checking of the goal criteria, data input and data evaluation is carried out by an independent observer other than the physician performing the treatment.

**Statistics**

The statistical evaluation was carried out in the same way – independently from the physician and the clinical observer. In order to test the primary hypothesis in relation with the primary goal criteria (change of the Oswestry-Score in the 6th postoperative month) a t-test was carried out in 2 random sample cases for the statistical determination of the group differences. The statistical significance level has been defined with p<0.05. The statistical analysis of the secondary goal criterion (change of the McNab-Score) has been descriptively carried out with the use of the Wilcoxon test (ranked-summarization).

**Technique**

**Preparation measures**

There are several special preparation measures to be taken before the technical performance. For example the detailed information of the patients is a crucial element of the treatment, for the Racz-method is a not evaluated process which has gained no effectiveness verification yet. An essential part of the information process is the reference to substances that have not been approved. Such is the application of hyaluronidase and...
hyperton NaCl-solution. Within the framework of this study the use of these substances happened only in single and well explained cases, which means only by missing therapeutical alternative as part of a new treatment approach. Naturally the patients have been informed about method typical complications such as catheter shearing, allergic reactions to contrasts media and also about general, typical complications of epidural injections and those of the relating technique.

In addition to that in every single case a special anesthetical judgment has been required in order to evaluate the narcosis risk, the traditional general operation preparation – as by conventional, open operations – has been carried out. Special attention has been paid to the control of coagulation

**Performance of the intervention**

After the setting up of a heinous entry, ECG, not invasive measurement of blood-pressure and measurement of saturation with pulsoxymeter the hiatus sacralis has been defined in supine position by the means of anatomical orientation points and X-ray images. This has been followed by surgical skin disinfection, the puncture area has been sterile covered and a local infiltration with local anesthetics (e.g. 5ml Mepivacain 1%) has been carried out. Finally a 16-gauge-TW-epidural introducer needle of the Company Epimed International, Johnstown, NY, USA) has been introduced with the leading canule into the hiatus sacralis and inserted until the maximum height of S4. By the injection of 1 ml water-soluble contrast medium Iopamidol (Solutrast-300, Byk Gulden, Konstanz) the place of the introducer needle has been controlled with radiological methods.

After this the TUN-L-XL catheter of the Company Epimed International, Johnstown, NY, USA has been introduced into the trokar and maneuvered into the side and goal segment identified earlier. After exact placing 10ml water-soluble contrast medium has been injected for epidurographie, by which in the area of fibroses an adequate typical filling effect has been shown. (Abb 1.) The epidurographie must be carried out in every case in order to control the catheter placement so that accidental intrathecal injection of the substances, which could have severe complications, can be reduced (avoided). By an exact ventral-epidural position 4 ml Ropivacain (Naropin 2mg/ml, AstraZeneca, Wedel) will be injected and 15 minutes waited in order to find out whether a motor-block is built up. That helps to disclose a subarachnoid placement, by which the procedure has to be interrupted. If there are no signs of a subarachnoidal placement, the following substances are delivered: 6ml local anesthetic (Naropin 2mg/ml, AstraZeneca, Wedel), afterwards 10ml 10%NaCl solution (Natriumchlorid 10%, Braun AG, Melsungen) with 40mg Triamcinolin acetoid (VOlon A40, Bristol-Myers Squibb, München) and 1500 IE Hyaluronidase (Hylase Dessau 1500 I.E., Pharma Dessau, Dessau). Finally the catheter was washed out with 1ml NaCl 0,9% (Natriumchlorid 10%, Braun AG, Melsungen), it was fixed with two holding stitches, a bacterial filter was connected (Epimed International, Johnstown, NY, USA) and a sterile bandage was put on. For infection prophylaxis wide range antibiotics were provided (Sobelin 300mg, Pharmacia, Erlangen). On the 1st and 2nd day after the treatment 10ml Naropin 2mg/ml, 10 minutes later 10 ml hyperton NaCl (10%) over 30 minutes per infusion was given and the catheter was afterwards washed out with 1ml isotonic saline. After the last application, the catheter was removed and thoroughly inspected. The antibiotic treatment was carried on until the 1st day after the catheter removal with 4 times 300mg Sobelin.
Results

Patients

Within the framework of this prospective study 98 patients have been successively screened, they presented themselves with monoradicular low back pain in our pain clinic. 61 patients (35 women and 26 men) could be admitted to the study and treated with the described method. Abb 2 gives the reasons for the exclusion criteria and the proportion of exclusion at different examination times. After the 3rd postoperative month 59 patients, while after the 6th postoperative month 55 patients could be examined. The study process is presented in the flow chart (Abb 2.) according to consort statement. The average age at the time of the treatment was 49±16 years; the average pain anamnesis was 22±12 months. Exclusively monosegmental treatments have been executed. In most cases the levels L5/S1 (n=27) and L4/5 (n=21) have been treated. Only 11 patients had a radiculopathy at the level L3/L4, the segment L2/L3 was affected in two cases.

Score improvement

At the start of the study (baseline) the reference value of the Oswestry-Score (primary goal criterion) was by 67±14 points. Three months after the catheter treatment a significant improvement to 19±11 points (p<0.01, shown in Abb. 3) could be observed in comparison with the baseline value. Further improvement of stabilization of the results could not be observed: the comparison of the 3 month reference value with the 6 month reference value (Oswestry-Score 28±15) gives a minor, statistically not significant deterioration; at the same time the 6 months value is also significantly better (p<0,01) compared to the baseline value. The improvement after treatment was both after 3 months and 6 months clinically relevant with an improvement value of over 50% compared to the baseline value. Also the subjective pain sensation evaluated with the McNab-Score progressed in the same positive manner. Before the treatment 22 patients evaluated their pain situation with ‘bad’ and 39 with ‘moderate’. No one used the expression ‘good’ or ‘excellent’. 12 postoperative weeks after the treatment following evaluation occurred:

- 19 with ‘excellent’,
- 27 with ‘good’,
- 9 with ‘moderate’,
- 4 with ‘bad’.

Six months after the epidural neurolysis a minor deterioration of the three-month’s value could be observed. Even so there was still a significant improvement compared to the baseline value (p<0,01).

The distribution on the McNab-Score after the 6th postoperative months was like that: 14 patients categorized their pain sensation with ‘excellent’, 19 patient with ‘good’, the success of the treatment was evaluated in 15 cases with ‘moderate’ and in 7 cases with ‘bad’ (Abb. 4). By one patient the final result was worse than the baseline value, with further investigation by the means of clinical examination, MR-tomography and laboratory diagnostics an infection after (due to) the catheter therapy could be diagnosed.
Complications

Acute complications (paralysis, Plegie?, cauda-equina-syndrom, cardiovascular or allergic reactions) could not be found by our examinations. 21 patients developed a decent transitory neurological deficit within the area of the lysised nerve roots right immediately after the intervention, this went back without any further measures. These deficits were in 14 cases exclusively sensitive. After the discharge from the hospital (3rd postoperative day) in every case a restitution ad integrum could be found. By 2 patients a dura-mater-perforation could be observed during the treatment, this has been found out by the means of the epidurography before the instillation of the foreseen medicaments so that the intervention was interrupted and carried out 6 weeks later without any complications.

Also by two patients a partial shearing of the catheter happened during the placing of the epidural catheter and by the following necessary attempts to position the catheter. This was discovered in time during the manipulation of the catheter. The catheter has been changed for new systems without delay and the intervention was carried out without further difficulties.

In one case an epidural infection occurred. This was discovered due to clinical examination, MR-tomography and laboratory diagnostics (CRP, BSG, BB) and was treated successfully with antibiotics.

Discussion

Which treatment method is the most adequate for the healing of chronic radiculopathy, in order to improve the pain situation of the individual patient and to support the rehabilitation, today this question cannot be answered in a coherent manner. There is a wider range of therapeutic methods such as acupuncture, physiotherapy, physical therapy and classical medicinal therapy, but also invasive interventions such as operations and the minimal-invasive epidural neurolysis by Racz. There are no controlled randomized studies of the different therapeutical methods available, they are totally missing. An evidence based evaluation of the therapeutical options is made difficult due to the unknown spontaneous progress of chronic radicular pain.

Epidural injection treatment

Published results regarding the effectiveness of epidural injection treatments are contradictory. Most of the referring studies published show significant biometrical defects (failures). 63 The perineural infiltration with a local anesthetic in combination with corticosteroids can make sense in the acute stage of radicular pains. In a prospective randomized double-blind study regarding the effectiveness of periradicular infiltration Karpinnen at al has studied a group of 160 patients with disc protrusion; they have neither undergone surgery nor have been conservatively treated beforehand. A group has been conservatively randomized with a mixture of corticosteroids and local anesthetics, the other group has been perineurally infiltrated exclusively with isotonic NaCl solution. Surprisingly both groups have shown significant improvement after the intervention. The groups have been visited by a follow-up visit postoperatively after 2 weeks, 3 months and 6 months. With an exception of the visit after the 2nd week, by which the cortisone group showed significantly better results, there could be no difference detected at the later
follow-up-visits (3 months and 6 months after the treatment). 20 The same result has come out and has been confirmed by an other similarly structured, randomized, double blinded study. 7

**Frequency and volume of infiltration**

By different infiltration treatments near to the medulla spinalis the frequency and the applied volume of the injections have both considerable significance. Especially by the Racz-method the volume of the infiltration (73ml) is of notable measure. In combination with the radiologically controlled, exact positioning of the epidural catheter tip in the target area we can speak about a so called maximum ‘rinsing effect’ in relation with this method. By this method the chemical, immunological and inflammatory inflammation mediators 4, 27, 41, 66, 67 induced by the mechanical passage are removed and the induction of local fibrotes is possibly avoided. 34, 51, 52 In the group of this already attested substances belongs a line of proinflammatory cytokins such interleukin-8 (IL-8) or phospholipase A2 and neurotrope hormones like ‘nerve growth factor NGF’ or the ‘brain-derived neurotropic factor BDNF’ that play a cardinal role in the process when the pain becomes chronic. 39, 40

**Anatomical specialties**

Bogduk and Twomey differentiate a ventral and a dorsal regions compartment in the lumbar spinal area. 5 The ventral compartment is innerved with strongly ramified, multisegmental nerve tissue that has its origin in the rr. communicantes of the spinal nerves and the perivascular nerves. 5, 37, 49 Therefore is the importance of an exact catheter positioning with site-specific active agent application in this for the named mediators especially vulnerable area apparent. The dorsal epidural area is sensitive because of the rr. lateralis and the mediales of the r. dorsalis of the spinal nerves, it is nourished by the rr. communicantes and has a lower significance. Further help during the catheter tip positioning in the ventral epidural area can be provided by the observation. The conventional therapy of chronic radiculopathies, which means a treatment without x-ray control and without the help of directable epidural catheters, will not be successful. By such a process the catheter tip will lay with great inclination in the dorsolateral epidural area due to which a high concentrate of the active agents cannot be achieved in the target area that is the ventral epidural area. 18

Reasons for the confinement of the periradicular area can be various. Nevertheless, there are typical clinical syndromes for all symptoms, they correlate directly with the measure of the mechanically correlating stenoses 40, 42 Beside the anti-inflammatory therapy by the application of corticosteroid the Racz-method also uses a 10% hyperton NaCl-solution with antioedematous effect. The postulate dehydrating effect of osmosis and the resulting water-pumping from the surrounding soft tissue leads to mechanical easing of the compressed neural structures – however, this effect is controversially discussed. Examinations on intraoperatively gained intervertebral disc tissue incubated with different hyperton NaCl solution could not show this in vitro effect-mechanism. 66

**Periradicular scars**

Racz et al could prove it in very early studies that periradicular scars can be broken up mechanically. 46 Within the framework of the epidurography Racz could demonstrate
that the application of the catheter can lead to the discharging of periradicular scars. Heavner et al could confirm the same effect and indicated in a prospectively controlled study that the application of hyaluronidase can lead to better results also on a long term. 17 This was explained with the proteolytical enzymatical effect under the influence of which a discharge of periradicular fibroses is postulated. Periradicular infiltrations have been used with excellent results also in the examination of Viton et al 60. Even 90 days after the periradicular infiltration in up to 85% of the cases a statistically significant reduction of the perceived pain could be recognized. These results are limited because of uncontrolled study design, the differing frequency of the infiltrations and the aspect that acute patients have also been included in the study. In reference to this topic it has to be mentioned that correctly realized metaanalyses and review publications have come to controversial results by the evaluation of the effectiveness regarding epidural corticosteroids. 7, 24, 63 This result can be explained by the inclusion and analysis of strongly varying patient population, due to which a strongly scientific based data analysis and data interpretation cannot be executed.

**Technical-methodical problems**

In addition to varying biometrical study conditions also technical-methodical failures can be responsible for inhomogeneous study results. While for example transforaminal periradicular injections can lead in up to 21% of the cases to undiscovered injection failures (intravasale injection), by the technique examined in our study it is much less likely. Firstly because we have used the recommended catheter by Racz with an atraumatic blunt spiral tip so that the likelihood of accidental dural or neural puncture can be reduced. Secondly because the catheter slides over the hiatus sacralis through epidural fat that also reduces the probability of intravasal application. In this was the applied pharmaceuticals can be placed contrary to the transforaminal technique safely into the desired place of effect. 5, 45, 46

**Complications**

Regarding possible complication of the Racz-method until now there has not been much published. However, the available incidence of the literature seems to be quite little. 9, 44, 29 In our study no major complications have occurred. In some cases a transient neurological deficit came up in the area of the lysised nerve roots, these went back spontaneously.

**Duraperforation**

A possible complication with clinical relevance is the accidental duraperforation that can be the case when a subarachnoid injection of NaCl-solution or a great amount of local anesthetics is not discovered. This major complication can endanger even the life of the patient, especially by already existing epidural fibroses. In these cases the manipulation of the catheter directly by the epidural accretions and fibroses can be extremely difficult. Not even the specially configured atraumatic and flexible tip of the Racz-catheter can give total safety; the risk of an injection in the wrong compartment (subarachnoidal, intravasal) has to be thought of. 9 A participation of anesthesiology in the treatment seems to be advisable, for a not recognized accidental subarachnoidal (‘spinal’) injection of the local anesthetics can lead in shortest time to a high spinal anesthesia, in extreme
cases even to a complete (‘total’) spinal anesthesia. This can show a high extent of heart-circulation-depression with hypotony and bradycardia followed by a central paralysis of the respiratory track.
In 10% of the cases by a subarachnoid application of hypertonic NaCl-solution temporary, cardiac (hypertonia, tachycardia) and respiratory (tachypnia, lung oedema) complications have been described. 22, 28 The reason for this can be seen in the increased liquor volume in relation with the osmosis that can lead to a consecutive increase of the intracerebral pressure. 59

**Intravasal injection**

Also a not intended intravasal injection can occur. 9 Normally this can be the outcome of a not discovered epidural vein puncture. As a consequence of intravasal injections of local anesthetics – depending on the type and volume – toxic local anesthetic values can be generated. These can be shown in the form of perioral surdity and unclear speaking, by higher value of the active agents it can come to tonical-clonical cramps, coma and no respiratory activity.

**Allergic reactions**

By the application of contrast media and hyaluronidase there is a risk of allergic reactions. While this is well known for contrast media, it is not so much known for hyaluronidase. In the information meeting with the patient prior to the intervention the probability of an allergic reaction in 3% of the cases has to be mentioned and written down. 9, 35, 44 An accidental subarachnoid injection of the hyaluronidase seems to have no clinically relevant side effects. 15

**Epidural room demand**

Epidural room demand does not occur very frequently, but when it does, it is a severe complication. It can have its origin in infection (abscesses) and haematomas. 9 In the case of more than 3,000 executed epidural neurolyses Racz reports only 2 patients developing meningitis.
In our study an epidural infection occurred in one case that could be successfully treated with antibiotics. In the publications there is no report about intrathecal abscesses. 43, 46 The risk of an infection in the area of the spinal cord can be evaluated as low. A higher risk exists without doubt by immune suppressed patients and by patients with diabetes mellitus so that this factor has to be considered by the indication definition by the use of the Racz-catheter.
Regarding possible spinal haematomas in relation with the Racz-catheter technique there has been no discussion yet. There is a significant risk of this in case of prior coagulability treatment. When in those cases there is a decision for a Racz-catheter-treatment, the time intervals between the supply of the anticoagulancy agents and the epidural punction or removal of the catheter should be considered very carefully. 14

**Material**

In most of the cases of complications in relation with materials they relate especially to the catheter constructed by Racz. Despite of widest realization of the requirements towards the material of the catheter there are reports about clinically relevant
complications such as catheter shearing. 30, 48 This happened also in our study, a partial catheter shearing occurred in two cases during the positioning of the catheter in the epidural goal area. This was immediately recognized and there was no influence on the patient. Racz reports about much lower incidence in relation with this kind of complications (5 cases of complete catheter shearing with a revision demand among 3,000 cases) 9, 44

**Therapy timing**

There is no definite proposal to find in the available publications saying what time is the most appropriate for the application of the Racz catheter technique. However, Weber could determine regarding a potential spontaneous improvement that acute radicular pains originating in the vertebral disc can go back in 70 % of the cases within 4 weeks, a persistence of the complaints is to expect only in 30% of the cases. 64 Due to the fact that the data situation regarding the efficiency of the method shows only little evidence and further investigation would generate high costs, there is a consensus that only chronic processes should be processed. A significant criterion regarding therapy timing is the avoidance of a possible pain chronifising and the knowledge of its origin. This chronifising process – which can start already a few minutes after a painful irritation and can cause morphologically functional changes within a few days - is not easily accessible in the causal therapy. 54 By pain existing more than 12 weeks there is a known high risk of chronifising. 13, 68 Later it comes to the development of a pain memory with plastic neural changes and apparent growth of the central receptive sensorial fields, so that after all even unspecific irritation can lead to subjective specific pain sensation. 33, 54

**Long term results**

Regarding long term results of the Racz catheter technique there are only a few publications at the moment available. There is only one study reporting longer term results; this study reports about a minor increase of the complaints after 12 months, but altogether there is a clinically significant improvement recognizable. 45 Our experience shows the same result. In the age of evidence based medicine it is axiomatical that therapeutical methods should undergo strict clinical examinations. This has been done meanwhile for several conservative methods and the result show that only a few therapeutical options are evidence based. Within this framework it is to mention that there is no proof until today that operative methods show on a long term better results than the spontaneous flow of a complaint or other conservative methods. 53 However, valuable studies and metanalysises have been able to show that with combined interdisciplinary multimodal pain therapy concepts good results can be achieved on a long term and they are superior to monotherapeutical methods. The all-inclusive concept of the intensive multidisciplinary biopsychosocial rehabilitation is an evidence based therapeutical concept. 16 Also behavioral therapy initiatives in combination with single interventional methods have been proved as efficient pain therapy methods. 58 When the efficiency of the minimal invasive catheter technique by Racz can be proved, this therapy option is to be integrated in a multimodal treatment concept. This can be realized within the framework of an interdisciplinary pain therapy concept with the participation of the
interventionally active medical professions such as orthopedics, anesthesia and the combined help of neurology, physiotherapy and psychosomatic.

The results of the present study conclude that by therapy of chronic radicular pain the application of the percutaneous minimal-invasive epidural neurolysis seems to be clinically reasonable and it should be executed under controlled clinical conditions. However, if there are strict criteria set for the adjudication of the efficiency of this method, than there is to say that the necessary level of evidence 2 or 1 cannot be reached at this moment. In order to bring unambiguous proof for the efficiency of this method, there is a necessity for very qualified staff and cost intensive, controlled prospective randomized studies. These studies should be planned and realized according to the suggestions of Schäfer 55 and the international standard of the ICH and GCP directives. 56, 57. Until then the method has to be classified as not evidence based the application of which – with the goal of the evaluation - should be restricted to special centers. 23

**Conclusion for the practice**

In this prospective study it could be shown that the process of chronic radiculopathy after vertebral disc protrusions can be positively treated with the method described by Racz. The results published until now and the low incidence of clinically relevant complications could be accepted. Despite of the good results the study cannot bring an efficiency proof as required by the evidence based medicine. However, by judging this method it has to be considered that until now there is still no alternative treatment of the chronic radiculopathy with such an efficiency proof.

The results described above justify the clinical application of the Racz method in single cases. It should be executed after the consideration of all other therapy possibilities, the strict interdisciplinary determination of indication and under controlled conditions. Detailed information of the patients is absolutely necessary; the information meeting has to refer to the fact that the method is a new treatment approach by which drugs outside of the normal authorization will be used.