

G. Schütze

Epiduroscopy – Spinal Endoscopy

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With 178 figures and 10 tables

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The Pain Clinic Iserlohn has initiated and adopted a quality system for the scope of application diagnosis and treatment of pain syndromes with a focus on spinal endoscopy – epiduroscopy – and neuromodulation which meets the following international standard: ISO 9001:2000 (identical with DIN EN ISO 9001:2000 and EN ISO 9001:2000). The demonstration was provided by a certification audit, Report No. 6008804. The condition for maintaining the certification is the implementation of annual surveillance audits.

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To achieve the possible, you must keep
attempting the impossible.

Hermann Hesse

Foreword

We are on the threshold of a new era in disease and symptom management. Vision gained from pioneering work in spinal canal endoscopy hints at gains to come.

Everything we do in success or failure in pain medicine is ultimately expressed at the cellular level and represents changes in electrical patterns, neurotransmitters and metabolism. We up- and down-regulate cells, alter neurotransmitters, change electrical patterns through medication, physical therapy, surgery, chemotherapy, radiation, acupuncture, cognitive behavioral therapies, etc. For any therapy to be successful there has to be a return of homeostasis, a return to the normal regulated state. Spinal canal endoscopy provides a window into the inner workings of the body and allows for direct observation of anatomy such as movement of nerves back and forth through neural foramina, but the spinal canal endoscope's future is pinned on its unique ability to study physiology from a number of different vantage points. (This distinguishes endoscopy from standard imaging techniques.) By reaching out and physically touching and potentially sampling areas of interest, a better understanding will develop of mechanisms of disease (inflammation) and allow for creation of cures, return to homeostasis when heretofore symptom management was all that was dreamed of for spinal related pain syndromes.

Spinal canal endoscopy is the visualization of the spinal canal using a flexible fiber optic light source and endoscope. When intrathecal (subarachnoid), the term is myeloscopy, when epidural, epiduraloscopy or epiduroscopy. A convergence of technologies has given birth to spinal canal endoscopy: principally miniaturization of flexible fiber optics, non-heat emitting light sources and digital photography/videography. Currently, spinal endoscopy is primarily utilized as epiduroscopy. Direct observations are made of the dorsal and ventral epidural space, allowing for visualization of blood vessels, ligaments, connective tissue, fat, inflammation and the products of inflammation, scar tissue. These images are direct images of the spinal canal as opposed to computer reconstructions via tomography or magnetic resonance. There is visualization of color, allowing localization of inflammation and blood flow and dynamic observations, viewing what happens to the dura mater, nerve roots, blood vessels, etc when contents are tugged via various maneuvers such as a straight leg raise. It is through these observations that better understanding is achieved of gross anatomy affecting function of the spinal canal contents and through these observations the dichotomy of spinal canal disease anatomically/physiologically appreciated. For example, adherent scar tissue identified by pulling and tugging on nerve roots and obstruction of venous return secondary to ligament hypertrophy (tourniquet effect) with formation of venous channels compressing nerve are both anatomic observations not appreciated via other forms of imaging. These are both gross anatomic observations and in themselves contribute to the possibility of how to manage a disease state. Presumably by releasing scar or cutting back ligament, nerve pulled or compressed will be freed. Today such procedures can possibly be done with difficulty depending on nature, location, available technology if anatomic cause of the pain complaint is found. Our ability to make disease-altering observations is limited because the vastness of the spinal canal, the tremendous number of structures involved, the endless array of connective tissues, scar, fat, blood vessels, etc that are anatomically present, some a part of the normal aging process and not a part of the pain complaint, make effective targeting difficult.

Spinal canal endoscopy as it is practiced today attempts to lyse scar tissue in an effort to mobilize tissue planes, but for the reasons cited above, as well as the fact that the underlying physiology after lysis is the same as before lysis, regeneration of scar (inflammation) is prob-

able; long-term benefits simply from lysis unlikely. If scarring/inflammation is responsible for loss of tissue plane mobility or for obstructive effect on blood flow, it would seem managing growth/regeneration of scar (inflammation) should be the goal of evolving epiduroscopic care. Further research needs to be directed into this area. We know that as part of an inflammatory cascade, cellular elements are called in from the immune system, via cytokine messaging, and activated to deposit collagen. The reasons for deposition are unclear, but may be reflective of a protective mechanism, shielding irritants (contents of a nucleus pulposus) from the immune system (umbrella effect.) Interfering with the process, release of irritants, activation and response of the immune system would alter the inflammatory reaction and the consequences; pain, inflammation, scarring, etc. This constitutes physiological high ground and should be the focus of active research.

Our current mode of management has some impact on the inflammatory process, presumably from irrigating the area with saline to remove inflammatory mediators, cytokines, often followed by steroid, designed to membrane stabilize and slow an inflammatory response. This technique has the potential to work well if the mediators are adequately removed and re-accumulation of mediators prevented. Unfortunately, the underlying anatomic derangements that led to a leaky disc or synovial joint are usually still present after epiduroscopy. Thus if there was some canal stenosis and irritation complicating the canal stenosis, endoscopic irrigation and injection of steroid might help. However, to get long-term response, it would be necessary to achieve reduced functional irritation from the stenosis. This is unfortunately nearly impossible via non-surgical means, although altering posture through use of a shoe orthotic is potentially helpful. It would be far better to be able to interfere with the inflammatory process at the target with specific chemotherapy that inhibits recurrence of inflammatory state, despite persistence of pathology.

It is medically probable that an endoscopic device will be able to sample the tissue bed involved in the inflammatory process and via a bedside test kit the nature of the inflammatory response determined. In so doing this, specific chemotherapies could be placed to inhibit the reaction, inflammation, and scarring and improve long-term outcome. Thus the endoscopic platform has a very rich future. The textbook *Epiduroscopy – Spinal Endoscopy* written by Dr. Schütze is a gateway to the future and reveals opportunities and an entirely new subspecialty: spinal canal endoscopy. With the knowledge imparted from this text, it is our hope that future endoscopists will be inspired to fulfill the vast potential of these new devices.

Lloyd R. Saberski, M.D.

New Haven, Connecticut, USA

Introduction

The publication of the English edition of my German book *Epiduroscopy – A practice-oriented guide to epiduroscopic diagnosis and treatment of spinal pain syndromes* provided an opportunity to thoroughly revise and complete the book. The new edition reflects the latest developments in this area of medicine and expands the textbook.

Diagnosing and treating spinal pain syndromes is often difficult and is generally of limited success. It continues to pose a challenge in clinical practice. The effectiveness of the drugs used for pain management and the patients' tolerance of these drugs, as well as surgical procedures and their costs play a role.

Manchikanti (2000) reported that in the United States, back pain is a widespread problem affecting between 8% and 56% of the population. An estimated 28% of the population will suffer from back pain at least once during their lifetime. Fourteen percent of the U.S. population experience pain episodes that persist at least 2 weeks. Each year, 8% of the entire workforce misses work due to back pain.

The lifetime prevalence for low back pain has been reported as between 65% and 80%. The symptoms of back pain often last for only brief periods and in 80% to 90% of cases, disappear after six weeks regardless of treatment. On the other hand, several studies describe recurrent, chronic back pain evaluated at 3 months, 6 months and 12 months and which occurred in 35% to 79% of chronic pain patients. The risk factors for chronic back pain reported by Manchikanti are affected by numerous factors, which may be physical, emotional or sociodemographic in nature.

Effective pain management is one of the physician's major responsibilities. However, studies by Breivik et al. show that one-third of all patients with chronic pain are not treated, and only 2% of all patients are treated by pain therapists. In Europe, the symptoms of 90% of all pain patients are not explained through medical tests. Over 60% of all pain patients report that their treatment is suboptimal and associated with intolerable side effects.

In Germany, too, the results of traditional treatment measures offered by a wide spectrum of medical specialties for chronic low back pain is often disappointing for the patients in question.

In response to the fact that up to 30% of all disc operations produce unsatisfactory results, a number of minimally invasive treatment methods have been developed in the past decades.

The early 1990s saw a vision emerge that involved the use of an endoscope to examine the epidural space, which can contain key information for diagnosis and treatment, and possibly develop an examining technique for clinical application. It was the rapid development of flexible, small-caliber endoscopes with corresponding image transmission systems that provided the technical capabilities needed to perform spinal endoscopy.

This textbook is based on my years of clinical experience in pain management. It intends to serve as a guide and a strategy for epiduroscopic diagnosis and therapy in patients with spinal pain syndromes.

As a percutaneous minimally invasive endoscopic examination, epiduroscopy (EDS) permits spatial, real color visualization of spinal anatomical structures such as the spinal dura mater, blood vessels, ligamentum flavum, longitudinal ligament and nerve and fatty tissue. In addition, epiduroscopy allows pathological and anatomical anomalies to be distinguished, such as epidural fibrosis after invasive procedures, adhesions, fibrotic lesions, nerve root compression, scar and granulation tissue and spinal stenosis, which often cannot be visualized with other imaging methods.

The indication for invasive diagnostics and pain therapy is frequently persistent unresolved pain experienced by a patient who has been subjected to any number of ineffective treatment attempts.

In day-to-day practice, an exact diagnosis is often elusive, because precisely locating the anatomical pain generator is not possible in the patient with chronic pain.

In many cases, the pain symptoms have been improperly treated, resulting in chronicity of the pain.

Incorporating invasive epiduroscopic diagnosis and treatment at an early stage in a sensible multidisciplinary pain management concept is thus extremely important.

Choosing the proper time for performing epiduroscopy is an important criterion for averting potential pain chronicity. Simply continuing conservative treatment without questioning its effect carries with it the risk that pain chronicity will set in.

For clinical pain management, epiduroscopy permits treatment such as targeted drug delivery, placement of catheter systems, as well as epidural surgery including biopsy, laser adhesiolysis, microsurgical lysis of fibrosis and removal of foreign bodies, even if the anatomical circumstances are problematic.

Based on our clinical experience and results with EDS management in over 1600 chronic pain patients, all of which has been positive, and the high level of patient satisfaction, epiduroscopy can be considered an extremely efficient procedure, and if performed by a well-trained therapist, is a safe means of endoscopic diagnosis and therapy for spinal pain syndromes.

However, in order to ensure that epiduroscopy is effective, the pain therapist must have a well-founded theoretical background, experience with the method and a high level of manual dexterity.

This guide has been written for doctors working in all specialties in both clinical and private practice settings. It offers a hands-on introduction to the world of epiduroscopy and its use in the specific area of pain medicine.

The book provides the reader with a brief overview of the latest options for endoscopic diagnostics and treatment of spinal pain syndromes. The primary focus is on the basic features of the procedure. Many details are mentioned only in passing. The major medical and technical foundations and special methods in this discipline have been presented in a detailed and easy to understand manner. The tips and advice presented here can be put into practice directly.

This textbook aims to provide helpful and supportive impulses for both novices and experienced users of epiduroscopy. In addition, it intends to offer advanced users help with problems they may experience or issues they may encounter in their everyday work with EDS. This revised edition, now in English, should serve to provide a practical overview of epiduroscopic diagnostics and therapy of spinal pain syndromes. The images in this textbook present examples of visualized findings. Supplementary material is available as a DVD (G. Schütze: *Epiduroscopy*. Multilingual DVD-ROM, ISBN 3-89756-757-1). In addition to a detailed presentation of epiduroscopy (topographic and endoscopic anatomy, endoscopic pathology, clinical applications of epiduroscopy, endoscopic equipment, preoperative measures, preparation, approach technique, additional diagnostic procedures, epidural irrigation, examination, epiduroscopic procedures, complications, golden rules, prognosis), the DVD also presents epiduroscopic findings as an image atlas and video album. This DVD may be ordered free of charge from Karl Storz GmbH & Co. KG, Mittelstraße 8, 78532 Tuttlingen, Germany, www.karlstorz.com.

The theoretical overview is supported by the results from our clinical experience with epiduroscopy. They underscore the merit of incorporating this new, intelligent form of diagnosing and treating spinal pain syndromes into a multimodal strategy for modern, future-oriented and intelligent pain management to benefit the chronic pain patient.

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Evolution of Epiduroscopy

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The development of endoscopy from the invention of the first real endoscope by Adolf Kussmaul in 1868 to the presentation of the first flexible fiber-glass endoscope by Hirschowitz at the 1958 World Congress for Gastroenterology in Washington, D.C. is a medical milestone.

Its history was launched by Frankfurt physician Phillip Bozzini, who constructed the first rigid medical endoscope in 1806. In 1855, French physician Antonin J. Desormeaux replaced the candle Bozzini had used as a light source with a kerosene lamp, thus refining the »Bozzini« endoscope. In 1879, German physician Maximilian Nitze presented the »cystoscope,« which he had produced with the help of the Austrian craftsman Josef Leiter, marking the beginning of the application of endoscopy in clinical practice with a rigid endoscope. B.I. Hirschowitz then developed the first flexible endoscope in 1958, a milestone in medicine, which gave rise to meteoric advances in diagnostics and therapy, evolving from a combination of intuition and meticulous observation on the part of committed researchers, as well as sheer coincidence, egregious errors, false assessments and misinformation.

Endoscopic examination of the epidural space is still a relative fledgling technique with regard to clinical application. However, experiments for visualizing the spinal canal have already been carried out for over 60 years.

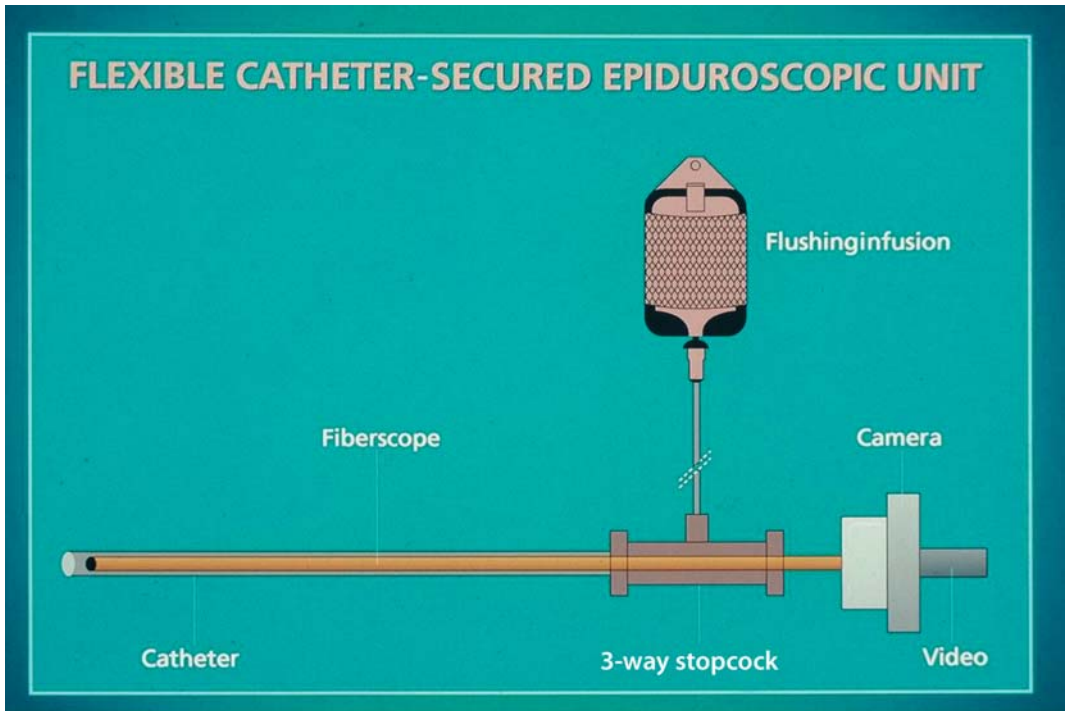
Pioneer work was performed by Burman, who used arthroscopic instruments to inspect cadaver vertebral columns. The first myeloscope used on patients was developed by Stern (1936). Pool reported on the first clinical application of myeloscopia in 1937 and by 1942, had examined 400 patients using this technique. In a large number of cases conditions such as neuritis, herniated disc, neoplasms, adhesions and venous congestion could be diagnosed. Despite these encouraging results, there were no further reports on myeloscopia in the literature until the late 1960s. This is especially surprising considering the lack of competing methods in this pre-CT era and the relative ease with which myeloscopia can be performed. Saberski attributed this to the introduction and widespread application of myelography and the fact that findings could not be photographically

documented. Starting in 1967, the Japanese researcher Ooi restored the focus on myeloscopia. Between 1967 and 1977, he examined 208 patients with an instrument that combined a flexible light source with rigid optics. In the years that followed, Blomberg, Olsson, Holström and Möllmann et al. the epidural space of both human cadavers and live patients.

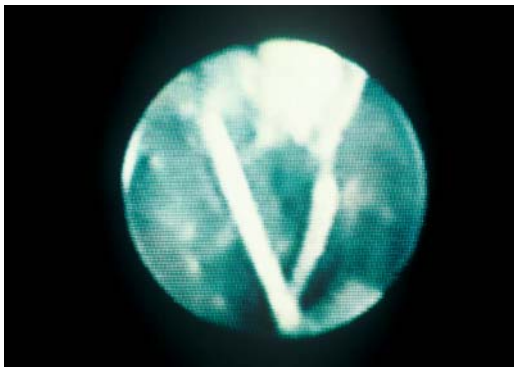
The key breakthrough for clinical application of spinal endoscopy – epiduroscopy (EDS) – was the development of small-caliber, flexible optics and light sources.

In 1991, Heavner et al. reported on endoscopic examinations of the epidural and spinal space of rabbits, dogs and human cadavers using a flexible endoscope. Epiduroscopic technology with flexible optics has been used in clinical application on patients since the early 1990s. In 1993, Leu reported on peridural and intraductal endoscopies in patients in whom the sacral approach technique was used. In addition to diagnostics, endoscopy can also be used for therapeutic intervention. Kizelshteyn et al. reported on the adhesiolysis of epidural adhesions with an epidural balloon catheter system in animal experiments. The use of an epidural catheter to lyse epidural adhesions under radiological control has been reported as well.

In 1994, Schütze and Kurtze published results of the first video-optic examinations of the epidural space in chronic patients with a »flexible catheter-secured epiduroscopic unit.« Between February and August 1992, the lumbar epidural spaces of 12 patients with various pain syndromes were examined endoscopically before placing an epidural catheter. A flexible catheter-secured epiduroscopic unit was developed for visual examination of the epidural space (■ Fig. 1.1). This examination unit consisted of an ultralow bore 0.8-mm fiberscope with an aperture angle to a Karl Storz Endovision 9050, a camera control unit (CCU), and a VHS videorecorder and monitor. The irrigation system consisted of a catheter (1.1×1.7 mm, 350 mm long) with a 3-way stopcock. An infusion pump system was used for epidural irrigation with sterile 0.9% saline solution. The epidural space was punctured with a 14-gauge Hustead needle. The flexible catheter-secured epiduroscopic unit was



■ Fig. 1.1. Flexible epiduroscope, used for epidural diagnostics in chronic pain patients for the first time in 1992



■ Fig. 1.2. First picture of the epidural space with pathological structures (tissue filaments) from the flexible catheter-secured epiduroscopic unit (1992)

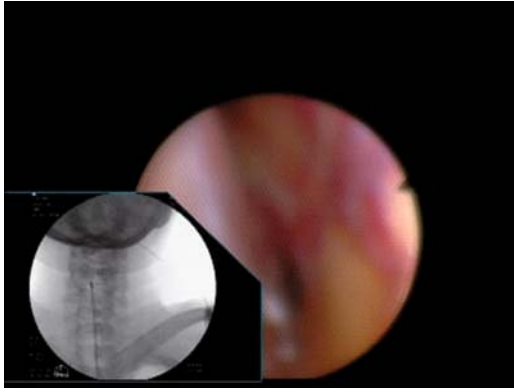
then introduced into the epidural space through this needle. During the examination, the epiduroscope was advanced a total of 5 to 8 cm in a cephalad direction (■ Fig. 1.2).

In 1996, the U.S. Food and Drug Administration (FDA) approved epiduroscopy for visualization of the epidural space.

In 1997, Schütze published the first report on epiduroscopically assisted SCS electrode implantation. Ruetten et al. reported on clinical application of epiduroscopically assisted laser therapy for post-nucleotomy syndrome.

Michel and Metzger reported in 1997 that EDS is advantageous because it can be used to assess the epidural pathology. In 1999, Winston C.V. Parris of the University of South Florida in Tampa stated that epiduroscopy is a technique that may dominate in the new millennium. In 2000, Ovassapian wrote that the role of epiduroscopy for chronic back pain is explored

In the same year, Schütze reported on the method and described the results of a retrospective examination of 165 epiduroscopies. In 2001, the same author reported on ultrasonography-assisted epiduroscopic examinations.



■ **Fig. 1.3.** The first cervical epiduroscopy performed with a brand new 90-cm epiduroscope (KARL STORZ, Germany), February 16, 2006, Pain Clinic Iserlohn, (Picture-in-Picture technique)

In June 2000, Igarashi et al. reported on epiduroscopic examinations in 52 pregnant women.

In 2004, Schütze described over 500 epiduroscopies in chronic pain patients. This publication described endoscopically assisted epidural analgesic therapy as well as the treatment of painful epidural fibrosis and adhesions with laser technology. Lorinson et al. (2006) described percutaneous epiduroscopy in dogs. Graziotti (2007) reported that he had performed nearly 300 epiduroscopic interventions. The launch of the flexible epiduroscope with FLEX-X² technology in 2005 made it possible to effectively carry out diagnostics and treatment in the entire epidural space, from the sacral to the cervical segments (■ Fig. 1.3).

2006 saw the publication of the first book on epiduroscopy, G. Schütze's *Epiduroscopy – A practice-oriented guide to epiduroscopic diagnostics and therapy of spinal pain syndromes*. Pabst Verlag, ISBN 389967-252-6 (in German) and the DVD *Epiduroscopy* ISBN 3-89756-757-1 (English and German).

1.1 Definition

According to Schütze, EDS is a percutaneous minimally invasive endoscopic examination of the epidural space that permits spatial and color imaging

of spinal anatomical structures such as the spinal dura mater, blood vessels, connective tissue, nerves and fatty tissue. Pathological structures and changes such as adhesions, sequestrers, inflammatory processes, fibrosis and stenosing processes can also be described via endoscopy.

The following definition of epiduroscopy was approved in 2002 in line with the international recommendations of September 17, 1998 in Iserlohn, Germany, the conference of experts of October 3, 1998 in Bad Dürkheim, Germany, the consensus conference in Innsbruck, Austria, in 2001:

»Epiduroscopy is a percutaneous minimally invasive endoscopic examination of the epidural space that can also be used for therapeutic inventions.«

The consensus committee [D. Beltrutti (Italy), G.J. Groen (The Netherlands), L. Saberski (United States), A. Sander-Kiesling (Austria), G. Schütze (Germany), G. Weber (Austria)] of the Consensus Conference held in Graz, Austria, on March 3 and 4, 2006 and organized by the World Initiative on Spinal Endoscopy (WISE), agreed on the following definition:

Epiduroscopy (EDS) or spinal (canal) endoscopy is defined as a percutaneous minimally invasive endoscopic investigation of the epidural space with the assistance of a flexible endoscope introduced through the sacral hiatus. It allows visualization of normal anatomical structures, such as the dura mater, blood vessels, connective tissue, nerves and fatty tissue, as well as of pathological structures, such as adhesions, sequestrers, inflammatory processes, fibrosis and stenotic changes. It permits potential targeted treatment, such as delivery of epidural steroids, epidural catheter placement, SCS electrode implant and application of cytokine-targeting drugs. In addition to epiduroscopy, other analyses, such as biopsy or aspiration are possible.

I understand epiduroscopy to be an integral component of invasive pain management. It can serve as an important diagnostic procedure and supportive treatment option in a multimodal, multidisciplinary pain management strategy if indicated and if risks and possible side-effects are taken into account.

1.2 Indications

A major task for the pain therapist involves treating unexplained pain symptoms.

Spinal pain syndromes do not disappear by simply ignoring them. On the other hand, they are resistant to a number of treatments. Zenz emphasized the importance of spotting the yellow and red flags and of carrying out in-depth and comprehensive pain diagnostics.

It can be extremely difficult to classify and treat chronic spinal pain syndromes when there is no explanation for the pain. Epiduroscopy offers a technique for diagnosing and treating spinal pain syndromes. It makes sense to distinguish between diagnostic and therapeutic indications for epiduroscopy:

Diagnostic indications

The main indication for epiduroscopy is for diagnosis of spinal pain syndromes. This may involve distinguishing pathological and anatomical structures and circumstances, such as epidural fibrosis following invasive procedures and radiculopathies, performing biopsies and smears, removing irrigation fluid, as well as performing an epidural pain provocation test (EPPT).

Therapeutic indications

Therapeutic indications for epiduroscopy include procedures such as direct application of pharmacologic therapy, lysis of scar tissue, catheter placement (epidural, intrathecal) and implantation of stimulation electrodes (radio frequency therapy, spinal cord stimulation) under direct vision, in the case of problematic passage through the epidural space or if placement is not possible or too risky for the patient during radiological procedures. Support during minimally invasive surgical procedures is another therapeutic indication for epiduroscopy.

In 2006, the consensus committee of the World Initiative on Spinal Endoscopy (WISE) defined the following indications:

Indications for spinal endoscopy (WISE):

To improve diagnosis:

- Diagnosis of clinically relevant epidural pathology, if pain can be attributed to epidural space (spinal canal) structures based on current history, physical examination and supportive present day laboratory investigations
- Biopsy for histopathological and/or histochemical analysis
- Provocative stimulatory tests (e.g. electrical, light, mechanical)

To provide (potential) treatment:

- Irrigation
- Direct application of therapeutic agent
- Direct lysis of adhesions/scar tissue with physical or chemical agents (e.g. mechanical, pharmacological, laser, radio frequency)

As a supportive tool:

- Placing catheter systems (epidural, spinal)
- Implanting stimulation electrodes (spinal cord stimulation)
- As an adjunct in minimally invasive surgery
- Retrieval of foreign bodies
- (Potentially) for postoperative assessment

At our clinic, epiduroscopy has become an integral component for the diagnosis and treatment of spinal pain syndromes. We believe that it should be used as a »first-line« treatment.

In the case of equivocal, contradictory clinical and/or radiological findings, epiduroscopy should be used as early as possible to counteract pain chronicity in patients with spinal pain syndromes.

1.3 Contraindications

The contraindications for epiduroscopy correspond to those for epidural regional anesthesia techniques. In addition, the particular anatomical circumstances of the patient must be taken into account.

The major contraindications for epiduroscopy are listed below:

- Bleeding tendency
- Therapy with anticoagulants

- Infections in the area of the puncture site
- Special neurological disorders
- High risk of cardiovascular disease
- Patient's refusal to undergo the procedure

The recommendations of the German Association for Anesthesiology and Intensive Care Medicine for epidural regional anesthesia and thrombolytics/anticoagulation and the required time interval between administration of anticoagulants and peridural/spinal puncture and removal of a peridural catheter should also be observed.

In 2006, the consensus committee of the World Initiative on Spinal Endoscopy (WISE) defined the following contraindications:

Absolute contraindications. Psychiatric diseases that potentially interfere with informed consent and/or perception of pain, retinal disease, presence of or increase in intracranial pressure, pregnancy, manifest bowel and bladder dysfunction and sensory disturbances in the S2-S4 area, congenital anomalies that do not permit safe endoscopy, cerebrovascular disease, renal or liver insufficiency, inflammatory or dystrophic skin lesions in the area of the sacral canal (anal fistula, sacral osteomyelitis, etc.), meningeal cysts, meningoceles, meninomyeloceles, severe respiratory insufficiency (COPD), known allergies to the drugs required to implement epiduroscopy, unstable angina pectoris, malignant tumors.

Relative contraindications. Coagulopathy, psychiatric diseases that potentially interfere with informed consent and/or perception of pain, inability

to lie in a prone position for more than 60 minutes, severe respiratory insufficiency (COPD), drug or alcohol abuse, etc.

1.4 Our own results

In our patient population, which to date numbers more than 1600 epiduroscopies, the primary indications for epiduroscopy are epidural diagnostics and targeted epidural analgesic therapy for chronic spinal pain syndromes.

Over 64% of the 1130 epiduroscopies evaluated in 2005 involved patients who had undergone spinal surgery. In the majority of these patients, symptoms were classified as failed back surgery syndrome (FBSS, ICD-10 M96.1). Thirty-five percent of the patients undergoing epiduroscopy suffered just as frequently from chronic back pain and other chronic pain requiring epidural catheter placement for pain management (EAT).

Another frequent therapeutic indication for epiduroscopy was primary epidural surgical pain management, such as biopsy, adhesiolysis or the resection of scar tissue.

In 22% of the patients with clinically and radiologically equivocal spinal pain syndromes undergoing epiduroscopy, the diagnosis was confirmed by the epiduroscopy or the histological examination of a tissue specimen from the epidural space. In this special group of patients, the diagnosis of radiculopathies is another important indication for epiduroscopy.

Since the introduction of our laser pain provocation test (LPPT) in 2004, this test has been

■ **Table 1.1.** Primary diagnoses of 230 patients undergoing EDS at the Iserlohn Pain Clinic in 2006

| Number of patients | ICD-10 classification | Diagnosis |
|--------------------|-----------------------|--|
| 134 | M 96.1 | Postlaminectomy syndrome, not elsewhere classified |
| 66 | M 51.2 | Other specified intervertebral disc displacement |
| 55 | M 48.0 | Spinal stenosis |
| 6 | M 50.1 | Cervical disc disorder with radiculopathy |
| 7 | M 50.2 | Other cervical disc displacement |
| 13 | M 54.5 | Lumbar pain |