Spine

Spinal Fusion

Dieter Grob, MD
Editor

STATE OF THE ART REVIEWS

Volume 6/Number 3 September 1992
HANLEY & BELFUS, INC. Philadelphia

Publisher: HANLEY & BELFUS, INC.
210 South 13th Street
Philadelphia, PA 19107
(215) 546-4995
Fax (215) 790-9330

SPINE: State of the Art Reviews
Volume 6, Number 3

ISSN 0887-9869
ISBN 1-56053-090-1

SPINE: State of the Art Reviews is published triannually (three times per year) by Hanley & Belfus, Inc., 210 South 13th Street, Philadelphia, Pennsylvania 19107.

POSTMASTER: Send address changes to SPINE: State of the Art Reviews, Hanley & Belfus, Inc., 210 South 13th Street, Philadelphia, PA 19107.

This issue is Volume 6, Number 3.

HANSJÖRG F. LEU, MD
ADAM SCHREIBER, MD

PERCUTANEOUS FUSION OF THE LUMBAR SPINE:

A Promising Technique

From the Department of Orthopaedic Surgery Balgrist Medical School, University of Zurich Zurich, Switzerland

Reprint requests to:
Adam Schreiber, MD
Professor and Chairman
Department of Orthopaedic Surgery Balgrist
Medical School, University of Zurich
CH-8008 Zurich
Switzerland

EVOLUTION OF THE CONCEPT

Since its clinical introduction in 1979, the percutaneous approach to the intervertebral space for percutaneous nucleotomy has given rise to a stepwise growing concept for the treatment of different forms of lumbar disc affections. Previously, in 1975, Hijikata[2] in Japan had described for the first time a minimally invasive alternative for the treatment of lumbar disc herniation and reported his experience in 1978 at the SICOT meeting in Kyoto. Thus, the method found its way to Zurich, where Schreiber and Suezawa gained the first clinical experience showing the practicality of the method.

The original procedure, performed from one side with small calibrated cannulas, had some difficulty in achieving sufficient decompression in the posterior range of the intervertebral discs. Thus, a biportal approach using larger-sized 6-mm cannulas was clinically introduced in 1980 and 1981. In 1982, after further modifications of the instrumentation, for the first time the complementary introduction of a modified arthroscope became possible with immediate visual control of the intradiscal manipulations.[16] By this useful complement and some further instrumental improvements, the range of applications of percutaneous nucleotomy with discoscopy became standardized for various forms of subligamentary disc herniations.[15] For decompressive indications, since 1989 percutaneous laser nuclear photoablation[7]

under discoscopic control has been available, with further reduction in perioperative morbidity in the treatment of contained disc herniations. For foraminal and extraforaminal sequestrated herniations, the new technique of percutaneous foraminoscopy with an adapted working-scope, under clinical investigation since 1991, seems to enlarge further the range of percutaneous treatment of disc herniations.

Already after only a few years of experience, the percutaneous approach with discoscopy has shown its minimal aggressivity against the musculoligamentary apparatus in the treatment of disc herniations. So, it is understandable why this approach was considered for use also in the treatment of segmental instability.[13] After specific adaption of percutaneous shaver systems for more radical removal of disc tissue in 1986, in 1987 the technique of autologous intervertebral bone grafting for the treatment of monosegmental lumbar instability showed us the applicability of transcannular bone impaction to the intervertebral space. At that time, the use of coaxial shavers and curettes did not yet permit the preparation of vertebral plates sufficiently to allow solid bony ingrowth. So, in this preliminary series of 5 patients, a considerable reabsorption of the autologous "spacer" was documented after 1 year with reappearance of clinical symptoms in most cases. Specially adapted instruments had to be designed for sufficiently deep preparation of the often rather sclerotic adjacent vertebral plates. In addition to the intervertebral preparation, the need for sufficient postoperative stabilization also had to be considered. To this end, we introduced the percutaneous AO-external pedicular fixator[10] that we had used since 1985 for special traumatologic purposes. In addition to its function for postoperative stabilization of the fused segment, this versatile tool also was found to be useful in preoperative selection of an instable lumbar segment. Thus, since 1988, a series of over 35 patients has been treated with this technique of percutaneous lumbar interbody fusion under discoscopic control.

INDICATIONS FOR PERCUTANEOUS INTERBODY FUSION

The **indications** for this percutaneous interbody fusion technique are:

1. monosegmental instabilities of degenerative origin, in cases with spondylolysis or after previous back surgery, or
2. mild, nonerosive forms of (post)-inflammatory segment collapse.

In any case, free epidural sequesters still remain excluded for this technique. So, whenever transligamentary extrusion of disc tissue is suspected, the preoperative screening should include a contrast discomanometric study[5] with complementary discoscan. Minor foraminal stenosis in the presence of degenerative protrusion in degenerative instability is not a basic contraindication. The discogenous thrust in this case is reduced by the percutaneous subligamentary discharge, and the foramina are somewhat enlarged by the segmental distraction. This release is already obtained and clinically checked with the preoperatively applied external pedicular external fixation device (see below).[8]

The **screening** of segmental instability for operative therapy remains one of the most challenging tasks besides the selection of the appropriate surgical technique. In addition to the patient's history and clinical findings, the native radiograph showing segmental interbody narrowing with increased range of motion in the functional radiographs gives the first characteristic patterns. Also in these cases, conservative therapies with active lumbar stabilization, eventually with complementary elastic lumbar bandage, should be attempted first for at least 6 to 8 weeks. If there is insufficient effect, a more rigid external fixation with a

successful, then a percutaneous external pedicular fixator is mounted. This has to confirm the relevant clinical effects of the monosegmental stabilization with additional segmental distraction and, when necessary, interbody realignment. When under this condition and with functional loading of the patient, quantitative relief of symptoms is obtained, the percutaneous interbody fusion is indicated. So, for this second step, we preserve the successful interbody position by means of the external pedicular fixation during the percutaneous interbody fusion as well as for the time of primary postoperative bone healing.

Placement of the External Pedicular Fixator

In the practical procedure, as the first step of percutaneous interbody fusion, the external pedicular fixator is put in place under general anesthesia. The patient is in an orthogonal prone position, and the landmarks are inked on the skin under fluoroscopic control. As the optimal entry point, a position some 1.5 to 2 cm laterally of the pedicle's dermal epicentrum, visible as the pedicular "eye," is most suitable for sufficient convergence of the Schanz screws. For optimal selection of the entry points in the craniocaudal dimension, the fluoroscope is oriented following the lordosis of the upper vertebral plate of the respective vertebral body. Slight corrections may be calculated following the desired correction of the lordosis between the two adjacent vertebrae.

When this point is defined, a craniocaudal skin incision 1 cm long is made here. Next, the pedicular trocar with its sleeve-cannula is positioned penetrating the soft tissue down to the lateral edge of the pedicular "eye" under anteroposterior (AP) fluoroscopic control. The craniocaudal orientation is checked as well in fluoroscopy. With the trocar, a bone mark is applied and the sleeve-cannula is slightly impacted into the bone. Next, the trocar is retracted and the pedicle is drilled slowly with a 3.5-mm drill down to the transition into the vertebral body, under lateral fluoroscopic projection. In the AP view, at this point, the drill tip must not come medially of the medial border of the pedicle's "eye." Correct intrapedicular positioning of the drill can also be felt by the hands due to the low resistance of the intrapedicular spongious bone.

While the sleeve-cannula is held in place, the drill is retracted and replaced by a 5-mm Schanz screw, which is gently screwed in manually (Fig. 1) under stepwise lateral fluoroscopic control. With the aimed convergency of 10 to 15°, the tip of the screws should be targeted near the midsagittal plane, so they can be screwed down to about 5-mm from the anterior wall of the vertebral body. This procedure is performed at each of the four pedicular sites. A final axial fluoroscopic view is made to check the correct position of every Schanz screw in the "eye" of the pedicle (Fig. 2). The external fixator is then mounted on the Schanz screws, allowing the desired correction of lordosis and intervertebral distraction.

When necessary, a minor spondylolisthesis can be stepwise reduced by means of a complementary adapted spindle device (Fig. 3) that pushes the distal vertebra forward in relation to the overlying vertebra. Intraoperatively, we strive for optimal interbody distraction and/or realignment, as much as possible without excessive reductional stress. With this interbody correction, the patient is mobilized the same day without any restriction of physical activity. In the following 2 to 3 days, whenever necessary, the effect of the external fixator can further be modified until the patient's most comfortable correction

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.