THE NEW STANDARD of CARE in Spinal Disease Treatment

Find out more about Minimally Invasive Advances
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“In 10 days I was able to do a lot of stuff.”

—Mary Herda
During the past year, we have been working diligently to secure our new Inspired Spine Clinic in Burnsville, Minnesota, opening in early 2018. IS also acquired Tristate Brain & Spine Institute in Alexandria, Minnesota. We expect continued growth in the coming years. We published our most recent study on the impact of oblique lateral lumbar interbody fusion (OLLIF) being used as the primary operation to correct and treat scoliosis. You can find the abstract in the current edition of the IS magazine.

The innovations of the minimally invasive surgery technique called the OLLIF continues to change the lives of our patients and the industry for the better.

OLLIF and our other minimally invasive procedures enable patients to get back to living their lives faster than they could have ever imagined and as well as sustain an exceptional quality of life. We continue to receive numerous testimonials from our patients that validate why we do what we do and why innovation is so important to spinal health.

Two critical advantages of the OLLIF procedure include: substantially shorter operating durations along with a significant reduction in blood loss. These two aspects have broadened the population that possesses an acceptable surgical risk profile, providing historically challenging cases with an opportunity to live free of pain.

We are overwhelmingly grateful and appreciative for the opportunity to share our findings and expertise with you as we continue to learn and grow with our patients needs.

In the following pages, you will find information about how Inspired Spine (IS) is creating a network of IS Certified Surgeons throughout the world to provide evidence-based minimally invasive procedures and corresponding protocols to combat difficult spinal health conditions.

Come join our team of surgeons in innovating the industry to improve the lives of those suffering from back and nerve pain.

All the best,
Dr. Hamid R. Abbasi, MD, PhD, FACS, FAANS
Things to Know

About Minimally Invasive Spine Surgery

1. Patients who have undergone minimally invasive spine (MIS) procedures, as compared to traditional open procedures, frequently experience less pain and fewer complications. Additionally, a patient’s hospital stay after an MIS Procedure is typically much shorter than a hospital stay after an open procedure. Spinal procedures that previously required up to 9 hours are now completed, on average, in 75 minutes. The shorter duration MIS procedures substantially reduce the amount of blood loss, which expands the population of patients now eligible for fusion surgery. On average, blood loss for traditional open spine surgery falls between 400-500 ml versus the average MIS procedure which typically delivers only 40-50 ml of blood loss.

2. According to Becker Spinal Health, the MIS spinal device market is projected to grow at a compound annual growth rate (CAGR) of 9.1 percent between 2016 and 2021, climbing from a $13.89 billion to $21.47 billion over the forecast period.

3. The technology that enables effective MIS spine surgery includes digital fluoroscopy, image guidance, high-resolution endoscopy and minimally invasive surgical tools. Radiation exposure continues to be a concern for spine surgeons and operating room (OR) teams. Although increased radiation exposure can be tolerable for patients, surgeons performing a high volume of these surgeries should take precautions to limit exposure. Furthermore, a recent study concludes that patients benefit from a 61.6 to 83.5 percent reduction in radiation exposure when they undergo cannulation and K-wire placement procedures.

4. The following pages include a recent study comparing the economic benefits of Oblique Lateral Lumbar Interbody Fusion (OLLIF) versus transforaminal lumbar interbody fusion (TLIF) procedures. MIS procedures have demonstrated to be more cost effective than traditional open spine surgeries. The results of Dr. Hamid Abbasi’s Economic study shows that relative to TLIF, OLLIF reduces the cost per surgery by an average of $11,834 with greater comparative reductions for multi-level procedures. Additionally, this study found that the savings delivered by the OLLIF may be even greater due to significantly fewer deep infections resulting from this approach.

5. MIS techniques have enabled surgeons to safely and effectively treat challenging cases such as patients with a high body mass index (BMI), old age, or a high ASA score, which indicates morbidity rate. Inspired Spine is currently conducting a study focused on high BMI patients who have undergone MIS spine surgery.
Inspired Spine presented a study on the economic performance of Oblique Lateral Lumbar Interbody Fusion (OLLIF) at the Spine Summit 2017 in Las Vegas.

The Congress of Neurological Surgeons sponsored the meeting, which includes spine industry leaders and innovators. The study examined 124 surgeries, comparing OLLIF with transforaminal lumbar interbody fusion. The principle investigator was Hamid Abbasi, MD.

**THE RESEARCHERS FOUND:**

1. Oblique Lateral Lumbar Interbody Fusion (OLLIF) delivered a 56 percent reduction in surgical time when compared with transforaminal lumbar interbody fusion (TLIF). The OLLIF procedures were more than one hour shorter than TLIF.

2. The shorter operative time also leads to a shorter hospital stay. TLIF patients stayed at the hospital approximately two days longer than the OLLIF patients.

3. Based on the U.S. Government Health Care Cost and Utilization Project, average costs associated with the OLLIF procedure delivered $11,834 in savings per case when compared with TLIF.

4. When taking the total U.S. spinal fusions performed last year into consideration, performing OLLIF instead of TLIF could save around $2.7 billion per year.

5. Study authors concluded hospitals that have bed constraints may become more efficient by using the OLLIF procedure.

U.S. average cost per OR minute is determined by using $83.51/OR minute (see citation below), subsequently then applying and compounding the U.S. Bureau of Statistics “Medical Care Indexation” from years 2006-2014.


U.S. average cost per inpatient day is determined by using $2090 (see citation below), subsequently then applying and compounding the U.S. Bureau of Labor Statistics “Medical Care Indexation” from years 2013-2014

Inspired Spine and the Elderly

A new approach to the aging spine

Recently, I rounded on two of my elderly patients on whom I performed surgery the day before. One of the patients was an 80-year-old female with an unfortunate history of having suffered back pain for 20 years. When I asked her how she was doing, she told me while smiling, “I would be dangerous if I was feeling any better.”
Patients can now be treated efficiently and minimally invasively with less muscle and tissue damage, leading to a faster recovery time, which has created a new standard of care for elderly patients.

The other patient was pain free as well and ready to go home, just one day after major surgery. After many years of back pain, the patient’s symptoms had vanished. Both patients received two-level interbody and posterolateral fusions after having failed repeated attempts of conservative therapy.

Such a fast improvement is not the usual post-operative experience of spine surgery patients. In fact, continuing to manage post-operative pain is a major concern for both the patient and the surgeon. These patients had not been offered surgical options, even though their respective pathologies had never been in question, because the risk of open surgery was considered too high. Each of these Inspired Spine procedures required one hour, and each patient ambulated just two hours after surgery and were ready to be discharged 1-2 days after surgery. The clinical benefits of such fast recoveries are so significant that we are convinced that our surgical techniques represent a “game changer” for spinal treatment, as these patient outcomes would not have been possible only a few years ago.

For a very long time, patient age was a major deciding factor in determining whether the patient was a candidate for spine surgery. Certainly, older patients are more likely to have less favorable outcomes. As described in several studies, the use of general anesthesia for greater than three hours substantially increases patient morbidity and mortality, and only a few of the traditional open corrective spinal fusion surgeries are completed in less than three hours. In many cases, elderly patient outcomes after open spine surgery are still questionable. Due to an accelerating increase in the U.S. population’s age, degenerative spine disorders and diseases are becoming much more prevalent, inflicting more and more people with the adverse consequences from these conditions. The increasing incidence of these pathologies in an aging population requires a combination of advanced surgical technology with a commensurate risk-benefit analytical approach to address this growing problem. As these new techniques deliver a much lower risk/benefit ratio versus traditional surgical methods, the selection criteria for these MIS surgical procedures must be appropriately modified to ensure that conditions historically determined to possess unacceptable risk are evaluated properly to ensure that a patient receives the best available treatment.

At Inspired Spine (IS) we have created a new approach to analyze and treat spine problems consisting of the following steps:

1. In many cases, spine pathology is not a singular problem, so we identify, categorize and prioritize the etiologies and break them into manageable segments;
2. We manage and improve as many of the etiologies as possible with conservative therapy protocols;
3. We stage surgical problems according to their impact on the patient’s daily life rather than radiograph severity. And we employ a whole new class of IS procedures, which are “game changers” in their respective fields for every key metric including OR time and risk, hospital stay, complication rate and outcome.
4. During any point in the process, if acceptable quality of life is achieved, we return to more conservative and less invasive treatments and management protocols.

Advancements achieved in recent years, which are the centerpiece of the IS initiative, involve more than simply treating the patient based solely on their diagnostic imaging studies. Not all pathologies require surgical intervention and some severely symptomatic pathologies are not visible in the first glance of a regular MRI. Using a vast amount of knowledge and empirical evidence to identify and categorize pathologies has opened new doors in spine pain management. New MIS procedures have made possible what was too risky not long ago. Patients can now be treated efficiently and minimally invasively with less muscle and tissue damage, leading to a faster recovery time, which has created a new standard of care for elderly patients.

IS addresses all of the issues mentioned above. The IS conservative treatment protocol is a very systematic approach for analyzing a complex spine problem by dissecting it into many small elements which, individually, are easier to treat and/or are more surgically approachable. IS’s staged surgery protocol optimizes risk vs benefit; an unmovable mountain is broken into individual rocks that can be rationally understood and removed from the equation by using a new portfolio of procedures that are truly game changers.

-DR. HAMID R. ABBASI, IS CHIEF MEDICAL OFFICER
Onboarding

Inspired Spine Physician On-Boarding & Continuing Support

INTRODUCTION

*Inspired Spine (IS)* provides surgical procedure training to ensure patient safety is the highest priority, and which is tailored to foster a surgeon specific level of familiarity with MIS techniques to assist surgeons in growing and expanding their practices.

Continuous assistance is available at different levels to provide guidance and direction with respect to didactic training, conservative care documentation, patient selection, surgical procedures, postoperative clinical questions, and outcome documentation.

Research opportunities are ongoing with *IS*, and any additional input and insights from partner physicians are encouraged. *IS* is committed to helping you and your patient.

**IS PHYSICIAN TRAINING PROTOCOL-OBlique Lateral Lumbar INTERBODY FUSION (OLLIF).**

An *IS* surgeon candidate is required to complete the following comprehensive training program. Each step is customized to accommodate the needs of each individual surgeon/practice/location.

Documentation is created and maintained by *IS*. Please contact *IS* (is01@tristatebrainspine.com) with any questions. Steps 1-3 can be completed by a candidate surgeon who attends *IS*’s semiannual training conference.

**STEP 1-DIDACTIC SESSION**

- OLLIF presentation, technique and outcome.
- IS conservative therapy protocol and patient-selection criteria
- IS case discussion

**STEP 2 - LAB SESSIONS**

Lab #1: Saw Bones, Swine or Cadaver, depending upon each particular situation.

Lab #2: “Hands-on” Cadaver Lab

Additional advanced labs as required (e.g., additional techniques such as Minimally Invasive Direct Lateral Interbody Fusion (MIS DLIF), Minimally Invasive Transforaminal Lumbar Interbody Fusion (MIS TLIF), etc.)

**STEP 3 - CASE OBSERVATION**

OLLIF Surgical case observation on actual patient

**STEP 4 – “SOFT TRANSITION CASE ASSIST”**

(# of cases required = 5 to 40; dependent upon rate at which individual surgeon becomes consistently proficient and comfortable with procedure)

A. Candidate assists *IS* instructor on instructor’s cases (Instructor’s Patients): 1 - 2 cases; Instructor bills as surgeon, candidate bills as Assistant (coordinate with *IS*);

B. Candidate assists *IS* instructor on candidate’s cases (candidate’s patient): 5 - 10 cases; Instructor and Candidate bill as Co-surgeons (coordinate with *IS*);

C. Instructor assists *IS* candidate on candidate’s cases (candidate’s patient): 10 - 20 cases or as required for candidate to demonstrate consistent proficiency; Instructor bills as Assistant; Candidate bills as surgeon (coordinate with *IS*).

**PROCESS:**

1. Candidate shall submit cases appropriate for the OLLIF with clinical history and key images via e-mail (habbasi@Inspired-Spine.org), pursuant to the *IS* conservative care protocols on which candidate has been trained and for which *IS* will provide guidance and direction.

2. Candidate and Instructor to discuss cases and review images together in person or via teleconference.

3. After a case has been discussed, patient preauthorization and surgical date coordination are completed.

4. After 4 or 5 cases are lined up, an *IS* Instructor will travel to the Candidate Surgeon’s office/facility to assist the Candidate Surgeon for each “Soft Transition” surgical case until both parties are comfortable with Candidate Surgeon’s consistent proficiency in performing the procedure(s).

5. Temporary privileges for the *IS* Instructor at the Candidate Surgeon’s institution may be necessary (if *IS* Instructor does not possess privileges). If so, Candidate Surgeon shall provide any required assistance to expedite *IS* Instructor’s acquisition of said privileges.
6. A Sample Operative Note including CPT codes for coding and billing purposes shall be provided to the IS Surgeon.

**STEP 5 - INSPIRED SPINE CERTIFICATION**
(Program Completion)

An IS accreditation certificate will be mailed to the new IS Surgeon.

All IS protocols and forms including patient IS-log book will be shared with the IS Surgeon.

IS Surgeon shall be included in the IS National Call Service System and listed in the “Inspired Spine Provider Directory” on the IS website.

IS Spine Surgeon shall commence Implementation of IS protocols as illustrated in the IS Patient Flow Chart (Exhibit A – attached).

**STEP 6 - ONGOING EDUCATION**

IS Instructors are available on a continuous basis to answer any questions, including pre and post-operative discussions and intraoperative challenges.

“In person” mentoring assistance for complex cases (i.e., IS Instructor attending case) is available upon request.

Advanced technique and refresher courses are provided on an on-going basis for the following: L5/S1 courses, thoraco-lumbar courses, MIS DLIF, MIS DTIF, sacroiliac fusion.

Candidates shall have the opportunity to become certified IS Instructors at multiple points during the soft transition process and thereafter. Said IS Instructors shall be compensated at a customary fair market value rate for teaching the IS procedures to Surgeon Candidates via the process and protocols outlined herein.

**STEP 7 - DATA COLLECTION**

Data collection is ongoing for both post-market clinical research studies and outcome measures (both clinical and radiographically). An IS surgeon is compensated at a customary fair market value rate for performing said data collection.
IS Patient Qualification Data Collection and OLLIF Scheduling

Name (Last, First): _________________________ DOB: _____________________

Today: ___________ Sched DOS: ___________ Actual DOS: ___________ Operation ___________

Exam:

Back pain ______ of 10, Radic ______ of 10, Dermatome ______ right / left, Claudcation Yes/No, duration ______

Weakness ______ muscle O/H TA G/EHL ______ of 5 progressive Yes/No, duration ______

Psychosocial Issues: Yes/No __________________________________________ Cleared with Psych consults Yes/No

Conservative Therapy

PT Visits: Nr. Visits ______ Time period __________________

Injections: _ESI_____ Facet____ MBB_____ RFA_____ Nerve Root__________________________

Bracing: ________________________________________________________________

Results: ________________________________________________________________

Imaging: [Available Online? -Include instruction]

Transitional S1 Yes/No/Unknown—Numbered from below Yes/No

MRI: Facility __________________ Date(s) ___________ Lumbar/Thoracic? ___________

Results: ________________________________________________________________

CT: Facility __________________ Date(s) ___________ pars defect Yes/No/Unknown

Previous Surgery in this region? Y/N ______ Date______ Hardware_________ Fusion____________________

Results: ________________________________________________________________

DISCOSGRAM: Facility __________________ Date(s) ___________

<table>
<thead>
<tr>
<th>Level</th>
<th>Morphology</th>
<th>Pain</th>
<th>Clinical Correlation/ Control</th>
<th>Level</th>
<th>Morphology</th>
<th>Pain</th>
<th>Clinical Correlation/ Control</th>
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<tr>
<td>T2/L1</td>
<td>Path/Norm</td>
<td>_____/10 C/NC</td>
<td></td>
<td>L3/4</td>
<td>Path/Norm</td>
<td>_____/10</td>
<td>C/NC</td>
</tr>
<tr>
<td>L1/2</td>
<td>Path/Norm</td>
<td>_____/10 C/NC</td>
<td></td>
<td>L4/5</td>
<td>Path/Norm</td>
<td>_____/10</td>
<td>C/NC</td>
</tr>
<tr>
<td>L2/3</td>
<td>Path/Norm</td>
<td>_____/10 C/NC</td>
<td></td>
<td>L5/S1</td>
<td>Path/Norm</td>
<td>_____/10</td>
<td>C/NC</td>
</tr>
</tbody>
</table>

Memo

X-ray- Flex Ex: Instability ______ L isthesi s ______ level______ Mobile yes/no ______

Scoliosis present? Y/N ______ Cobb ______ to Rt/Lt Levels________ Worsening Yes/No

Clinical Data

Oswestry Score (add the form)

Wheelchair bound Y/N ________ , how long: ___________ Bed bound Y/N ________ how long: ___________

Checklist:

<table>
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<th>Consented</th>
<th>N</th>
<th>Y</th>
<th>Imaging recent</th>
<th>Y</th>
<th>N</th>
<th>Symptoms progressive</th>
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<th>N</th>
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<tr>
<td>Alternative discussed</td>
<td>N</td>
<td>Y</td>
<td>Second opinion encouraged</td>
<td>Y</td>
<td>N</td>
<td>Weakness</td>
<td>Y</td>
<td>N</td>
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<td>Nerve Irritation discussed</td>
<td>Y</td>
<td>N</td>
<td>Proper disclosure</td>
<td>Y</td>
<td>N</td>
<td>Pain worsening</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Permission for data collection</td>
<td>N</td>
<td>Y</td>
<td>Conservative Therapy failed</td>
<td>Y</td>
<td>N</td>
<td>Radiculopathy</td>
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<td>N</td>
</tr>
</tbody>
</table>

Second Opinion received? Yes/No From whom ____________
Neurosurgeon Hamid Abbasi, MD, recently reached a milestone as he performed his 500th Oblique Lateral Lumber Interbody Fusion (OLLIF) on a patient at RiverView Health.

The OLLIF procedure represents medicine’s latest advancements in minimally invasive spine surgery. It treats many of the indications that result in back pain, including: degenerative disc disease, herniated discs, spondylolisthesis, scoliosis, and spinal stenosis. An OLLIF procedure is often required when a disc is damaged or is degenerated. Typically, the height of the disc is reduced, unstable, and bulging. This condition, in turn, can put pressure on the nerves exiting the spine and can cause severe pain in the legs and back.

According to Dr. Abbasi, that stabbing, crippling pain has been described as worse than childbirth by several of his patients. As people age, their discs become less elastic and are less able to stay in top working condition. OLLIF is intended to reestablish the height of the disc, reduce movement of the disc and alleviate pain.

Compared to traditional spinal fusion procedures, OLLIF is a much less invasive surgical technique that does not require removal of any bone or ligament structures. An OLLIF procedure only requires a skin incision of 15 millimeters – smaller than a dime. The diseased disc is removed through a small portal that protects the skin, muscles and nerves. After the disc is removed and the bone graft material is placed, an implant is positioned in the disc space. The implant maintains the spacing of the vertebrae while the fusion takes place. After the fusion is complete, a solid bone mass forms and the two vertebrae are joined together.

OLLIF is groundbreaking by today’s standards and revolutionary compared to the 1950s when physicians would remove a piece of the patient’s hip bone and go through their abdomen to place the hip bone piece inside the disc space to lift the spine and take pressure off the nerve. It often took patients six months to fully recover from the surgery, leaving muscles weak from the long period of nonuse.

A surgery that used to require seven or eight hours is now frequently performed as an outpatient procedure. OLLIF patients are often up and walking with assistance before a patient undergoing traditional open spine surgery would even be out of surgery. Hospital stays that were often up to five days in length are a thing of the past as well. Many patients receiving OLLIF have returned to work in just a few days.

Of his milestone 500th OLLIF procedure, Dr. Abbasi shared: “My proudest moment was to see that patient walk two hours after surgery, and then go home the next day making jokes with staff and feeling pain free for the first time in years.”

Dr. Abbasi officially joined RiverView’s medical staff earlier this year, although he has been doing procedures at RiverView since 2012.

He is board-certified with the American Board of Neurological Surgery, and is an expert in brain and spine disease and a leading surgeon in the minimally invasive treatment of the spine. His vast experience includes minimally invasive correction of deformities and scoliosis, surgical pain management, complex spine surgery, trauma and spinal stabilizations, spine and spinal cord tumors, brain tumors, pituitary tumors, brain hemorrhage and non-emergent trauma vagal nerve stimulator, peripheral nerve and carpal tunnel.

A graduate of the University of Heidelberg, Germany, with a doctorate of medicine and philosophy, he spent 13 years after graduation pursuing extensive neurosurgical training at world-famous institutions including the University of Heidelberg, Stanford University, Dartmouth College and the University of Texas including training in MD Anderson in Houston.

For more information on OLLIF, contact the RiverView Specialty Clinic at 218-281-9553.

Minimally Invasive Scoliosis Surgery with Oblique Lateral Lumbar Interbody Fusion: Single Surgeon Feasibility Study

Hamid Abbasi
Tristate Brain and Spine Institute
Lynn Miller
Minnesota Disc Replacement and Spine Restoration Center
Ali Abbasi
Pritzker School of Medicine, The University of Chicago Medicine
Vali Orandi
Vascular and Interventional Radiology, Lake Region Health Care
Kamran Khaghany
Radiology, Lakes Regional Health Care

Abstract

BACKGROUND
Degenerative deformities of the spine have traditionally been treated with extensive open surgeries. However, these open procedures are associated with a high degree of surgical morbidity. In this study, we explore whether clinical improvement in patients with spinal deformities can be achieved using a new minimally invasive surgery (MIS) called oblique lateral lumbar interbody fusion (OLLIF). OLLIF is a MIS single surgeon procedure in which the disc is approached through Kambin’s triangle. OLLIF can achieve correction of spinal deformities through careful cage placement.

PURPOSE
The purpose of this study is to establish the safety and efficacy of using OLLIF to correct spinal deformities and to collect early outcome data. Collected data includes perioperative outcomes, patient reported outcomes, and radiographic outcomes.


STUDY DESIGN/SETTING
This study is a retrospective review of 37 OLLIF surgeries in 36 patients with symptomatic degenerative spinal deformity. Collected perioperative data included surgery time, blood loss, and hospital stay. Follow-up was conducted at least 150 days post surgery. We recorded complications and patient reported outcomes such as Oswestry Disability Index (ODI) and pain scale. Imaging was conducted pre- and post-surgery. Fusion rates and changes in Cobb angle were also measured.

RESULTS
A total of 37 surgeries that treated 100 vertebral levels were performed. For two and three level procedures, respectively: the mean blood loss was 83 ml and 178 ml, the average surgery time was 74 and 158 minutes and the average hospital stay was 2.6 and 3.3 days. The patients ambulated within 24 hours in all but two cases. The patients reported pain improvements on the ten-point pain scale from 8.3 to 3.7 (p<0.001) and on the ODI from 53 to 32 percent. Cobb angles decreased from 16° to 9.3° (p<0.001), amounting to 2.5 percent of correction per level of surgery. Detailed imaging was reviewed by independent radiologists for 24 cases and 100 percent interbody fusion was achieved along with 71 percent right posterolateral and 74 percent left posterolateral fusion. There were three cases of mild nerve irritation/neuropaxia and no infections.

“Less invasively is a better way to go.”
—Rosalyn Ehler

“And I’m jealous.”
—DAVE Ehler
CONCLUSIONS
OLLIF is a safe and effective MIS technique to correct adult degenerative scoliosis. Unlike alternative procedures, OLLIF is technically less complex than comparable procedures and can safely be used from the thoracolumbar junction to S1.

The purpose of this study is to establish the safety and efficacy of using OLLIF to correct spinal deformities and to collect early outcome data.
OLLIF vs OLIF

Defining OLLIF Versus OLIF

Overview
There are quite a few surgical technique options for lumbar spinal fusions. A lot of them end with the letters “LIF,” which is short for Lumbar Interbody Fusion. This involves an implant (cage) being placed between the vertebral bodies to enhance fusion and relieve pain. There are seven well-known “LIF” procedures, all using different surgical approaches and techniques to achieve the same endgame.

The OLLIF (Oblique Lateral Lumbar Interbody Fusion) and OLIF (Oblique Lumbar Interbody Fusion) are two of the newer utilized techniques. While the fusion techniques are only one letter off in their abbreviation, there are significant differences in how they are performed! The more modern OLLIF is truly a minimally invasive approach, whereas, the OLIF actually requires an opening in the abdominal wall requiring direct visualization and a larger dissection.

The OLLIF (Oblique Lateral Lumbar Interbody Fusion) and OLIF (Oblique Lumbar Interbody Fusion) are two of the newer utilized techniques. While the fusion techniques are only one letter off in their abbreviation, there are significant differences in how they are performed! The more modern OLLIF is truly a minimally invasive approach, whereas, the OLIF actually requires an opening in the abdominal wall requiring direct visualization and a larger dissection.

The OLLIF (Oblique Lateral Lumbar Interbody Fusion) procedure is accomplished with the patient in the prone position with minimal rotation of the table required to achieve an adequate approach angle. Positioning time is short, with intervertebral disc preparation and spacer placement accomplished through a 15 mm incision.

The OLLIF incorporates a more advanced approach to the disc space, and utilizes Kambin’s triangle for entry in the most posterior lateral point. No direct visualization is required, with biplanar fluoroscopy showcasing the necessary landmarks. The graft placement is achieved with the image guidance, and over 500 cases to date have proven the tremendous safety record. This technique does require posterior instrumentation which is performed in a minimally invasive fashion. See Figure 3 on the following page.

Operative Time
An OLIF (OALIF) procedure may take several hours to fully complete when you take into consideration the posterior fixation. The anterior portion of the case is a minimum of one hour. With the OLLIF, the disc space approach and cage placement is a 10 to 25-minute procedure. The posterior hardware placement time widely varies based on surgeon experience and style.

One of the most compelling differences between the procedures is whether or not positioning needs to be changed. OLLIF patients are already prone, providing easy access to the posterior spine for screw placement. In OLIF (OALIF) cases, the sterile field needs to be removed and the patient needs to be repositioned and reprepped prior to beginning the posterior hardware placement. This usually requires at least 30 minutes.

All in all, operative time is significantly reduced with the OLLIF versus the OLIF procedures.
SUMMARY

There are very significant differences between the OLLIF and OLIF spinal procedures. The OLLIF, which was developed by the surgical experts at IS, took the traditional “LIF” procedure and modified it to minimize exposure, OR time, and provide 360 degree (front and back) fusion stabilization with outcomes that are stellar.

The interbody fusion outcomes seen with the OLLIF have been looked at in several studies. The minimally invasive nature of the procedure, combined with the peer-reviewed studies showing first-rate outcomes, confirms that the OLLIF procedure is the new standard of care for the “Battle of the LIF’s.”

<table>
<thead>
<tr>
<th></th>
<th>DLIF/XLIF</th>
<th>ALIF</th>
<th>OLIF (OALIF)</th>
<th>OLLIF</th>
<th>IS OLLIF and family (MIS DLIF MIS DTIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Lateral</td>
<td>Supine</td>
<td>Lateral or supine</td>
<td>Prone</td>
<td>Prone</td>
</tr>
<tr>
<td>Level possible</td>
<td>L1-L5</td>
<td>L3-S1</td>
<td>L2-S1</td>
<td>L1-S1</td>
<td>T6-S1</td>
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<tr>
<td>Levels difficult</td>
<td>L1/2 &amp; L4/5</td>
<td>L3/4</td>
<td>L5/S1</td>
<td>L5/S1</td>
<td>none</td>
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<tr>
<td>Time for anterior portion</td>
<td>60-90 minutes</td>
<td>60-90 minutes</td>
<td>60-90 minutes</td>
<td>10-15 minutes</td>
<td>10-15 minutes</td>
</tr>
<tr>
<td>Time for repositioning, reprepping and redraping in minutes</td>
<td>30-60</td>
<td>30-60</td>
<td>30-60</td>
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<td>0</td>
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<tr>
<td>Time for Posterior portion</td>
<td>45 -60 if minimally invasive (longer if open)</td>
<td>45 -60 if minimally invasive (longer if open)</td>
<td>45 -60 if minimally invasive (longer if open)</td>
<td>45 -60 if minimally invasive (longer if open)</td>
<td>20-30</td>
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<td>Posterior fusion</td>
<td>Only if open</td>
<td>Only if open</td>
<td>Only if open</td>
<td>Only if open otherwise only instrumentation</td>
<td>Yes all MIS</td>
</tr>
<tr>
<td>Breaking the table required</td>
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<td>NO</td>
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<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Direct visualization required</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
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</table>
Oblique Lateral Lumbar Interbody Fusion (OLLIF)

A Comparative Study of Perioperative and Clinical Outcomes

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DISCLOSURE
H.R. Abbasi MD PhD FAANS
(Present)
Zyga: Consulting, Research Study
AMW Spine LLC: Research Grant, Consulting
(Past)
Amendia: Consulting, ownership in distributorship

INTRODUCTION
Minimally Invasive (MIS) fusions of the lumbar spine are associated with lower complication rates and improved outcomes relative to their open equivalents, but have not gained widespread acceptance in part because of the technical challenges in the procedure. Oblique Lateral Lumbar Interbody Fusion (OLLIF) is a new MIS fusion of the lumbar spine that is technically straightforward, because it does not require direct visualization. Unlike other MIS fusions, OLLIF does not require facetectomy or laminectomy. In OLLIF the disk space is approached through Kambin’s triangle guided by electrophysiological monitoring and biplanar fluoroscopic imaging. Discectomy is performed through a 10mm working tube. After discectomy, the disc space is packed with tricalcium phosphate soaked in autologous bone marrow aspirate and the cage is inserted. OLLIF is complemented with MIS pedicle screw fixation.

METHODS
This is a retrospective single surgeon study of perioperative outcomes, patient reported disability and fusion data. The patient sample includes 303 OLLIF surgeries on 568 levels with a control group of 58 open Transforaminal Lumbar Interbody Fusions (TLIFs) on 153 levels. OLLIF is indicated for severe degenerative disk disease, listhesis and disk herniation after conservative therapy has failed. Perioperative outcome measures include surgery times, blood loss, fluoroscopy times and hospital stay. We also collected complications, fusion rates and patient reported outcomes on the oswestry disability index (ODI) one year post surgery.

RESULTS
OLLIF cuts surgery times and hospital stay in half relative to TLIF (59/132 min, 4.7/2.3 days respectively) and reduces blood loss by more than 87 percent (355/44 ml). Rates of nerve irritation and hardware failure are lower in OLLIF patients compared to TLIF patients. At follow up at least 9 months post-op, pain on a 10-point pain scale was reduced from 8.5±1.2 to 3.9±2.9 (N=213/303, p<0.001) and disability on the oswestry disability index was reduced from 55 percent ±17 percent to 36 percent±21 percent (N=141/303, p<0.001). Interbody and posterolateral fusion were achieved in 98.4 percent and 67.2 percent of levels operated on respectively.

Rates of nerve irritation and hardware failure are lower in OLLIF patients compared to TLIF patients.
DISCUSSION
OLLIF is a straightforward procedure with a steep learning curve for the surgeon. Unlike other MIS fusions, OLLIF significantly reduces surgery time relative to open fusions of the lumbar spine. OLLIF can be adapted to correct spinal deformities like scoliosis and for fusions of the thoracic spine. A modified version of OLLIF can be applied in L5-S1.

CONCLUSION
OLLIF is a MI fusion of the lumbar spine that is safe, effective and technically less demanding than comparable procedures. OLLIF has the potential to improve clinical outcomes relative to the current standard of care.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4652919/
Economic Performance of Oblique Lateral Lumbar Interbody Fusion (OLLIF)

With a Focus on Hospital Throughput Efficiency

Hamid R. Abbasi
Ali B. Abbasi

OBJECTIVES
Between 1998 and 2008 the number of spinal fusions in the U.S. increased 2.4 times and the cost per fusion increased 3.3 times, leading to a 7.9 fold increase in the cost burden of spinal fusions to the U.S. health care system. OLLIF is a new minimally invasive procedure for fusions of the Lumbar spine that can be employed safely and effectively from T12-L1 to L5-S1. OLLIF approaches the disk space through Kambin’s triangle. OLLIF does not require direct visualization but instead relies on bilateral fluoroscopic imaging and electrophysiological monitoring. OLLIF has reduced surgery times and hospital stay compared to TLIF. The purpose of this study is to evaluate the preoperative cost of OLLIF compared to TLIF.

MATERIALS AND METHODS
The study population is comprised of 69 OLLIF patients and 58 open TLIF controls. All patients underwent the full course of conservative therapy. Indications were degenerative disk disease, disk herniation, listhesis, stenosis (except osteogenic stenosis). This is a retrospective cohort study. All surgeries were single surgeon procedures and all TLIF cases were completed before the surgeon started performing OLLIF. We recorded surgery time, length of stay and infection rates. Perioperative outcomes were monetized by using a multiplier approach. Operating room time was monetized at $83.51/minute and hospital stay at $2,197/day. Infection rate was monetized relative to a 2.4 percent infection rate for open procedures.

RESULTS
OLLIF cuts surgery times and hospital stay in half relative to TLIF (59/132 min, 4.7/2.3 days respectively). When these differences are monetized, OLLIF reduces the average cost per surgery relative to TLIF by $11,834 per surgery, with higher cost reductions for multi-level procedures. In more than 500 OLLIF procedures to date, there have been no deep infections requiring drainage and only a single superficial infection (0.2 percent). We estimate that the reduction in infections saves an additional $316 per surgery, for a total cost reduction of $12,150.

DISCUSSION
In 2008, there were 207,495 lumbar fusions in the U.S. [1]. By saving $12,150 per surgery relative to the current standard of care, OLLIF could reduce U.S. health care expenditures by more than $2.5 billion. We are currently conducting a detailed study of the costs of OLLIF relative to TLIF. This study will include direct health care costs such as provider visits, injections, diagnostic tests, medication, and devices, as well as indirect health costs and productivity losses due to disability.

OLLIF could reduce U.S. health care expenditures by more than $2.5 billion
CONCLUSIONS

OLLIF is a new MIS spinal fusion that reduces perioperative costs relative to open surgery and could potentially reduce U.S. health care expenditures by $2.5 billion per year, through the preoperative cost savings alone. A comprehensive cost analysis is underway.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4524774/
Inspired Spine’s Study on Minimally Invasive Direct Lateral Interbody Fusion Shows Improved Effectiveness and Safety

Inspired Spine’s (IS) new study on minimally invasive direct lateral interbody fusion concludes faster, more effective and safer spinal fusion procedure for severe spinal condition to reduce back pain.

Minneapolis, Minnesota (PRWEB) February 16, 2017

(IS) announced that its study on minimally invasive direct lateral interbody fusion (MIS DLIF) has been published and is available on PubMed. MIS DLIF is a new single surgeon procedure that is shown to alleviate back pain in patients with degenerative disc disease, spondylolisthesis or severe disc herniation.

(IS)’s new method of minimally invasive direct lateral interbody fusion is proving to be a game changer for reducing back pain and producing better outcomes. Study concludes faster, more effective and safer spinal fusion procedure for severe spinal condition to reduce back pain.

The pilot study included nine participants and measured patient-reported pain, surgery time, duration of hospital stay and complications. The new MIS DLIF is an advancement of the previously developed DLIF/lateral lumbar interbody fusion procedure, which is completed within a fraction of the time and possesses the highest safety record.

Before surgery, patients reported an average of 9.3 out of 10 on sliding pain scale. At the first post- surgical follow-up, patients reported their pain was substantially reduced to 4.8 out of 10. Additional highlights of the study included: average surgery times were 44 minutes and 85 minutes for one and two segment procedures, respectively; and the average hospital stay was 0.3 days and 1.7 days for one and two segment procedures, with 4 of the 9 patients being discharged 2 to 4 hours after surgery.

These results indicate that MIS DLIF may soon be routinely performed as an outpatient procedure. Also, these results are demonstrably favorable when compared to those of traditional surgical methods, where procedural durations are between 2 and 4 hours and blood loss is typically 7 to 10 times higher.

MIS DLIF reduced the risk of complications in the study because its advanced minimally invasive technique substantially and reduced blood loss by eliminating the need for open surgery via the employment of real-time biplanar fluoroscopy X-ray imaging.

MIS DLIF is a Minnesota-born advancement in lumbar spinal disease management. Developed in Alexandria and Crookston Minnesota, it delivers the highest level of spine care to a rural population. This procedure has been demonstrated to be a game changer as an advanced minimally invasive spinal fusion alternative because, compared to open surgery, it substantially reduces recovery time. Early outcomes and a lack of complications demonstrate that MIS DLIF is a promising procedure that has the potential to become the standard of care which could deliver billions of dollars in savings to the US health care system.

To read the full study visit PubMed.

For more information on MIS DLIF visit Inspired Spine.

ABOUT INSPIRED SPINE

IS, a Minnesota-based advanced minimally invasive spinal surgery technology developer, has introduced and performed over 500 procedures using revolutionary new technologies and procedures in advanced minimally invasive systems. These new procedures are transforming how spinal surgeries are approached and can replace more traditional “open” spinal fusion surgeries.

IS is focused on the development of advanced minimally invasive surgical techniques, procedures and other health care technology to minimize or eliminate the physical and economic risks and discomfort that are created by the daily struggles of enduring back pain and its physical limitations.

Learn more at http://inspiredspine.com/
Minimally Invasive Direct Lateral Interbody Fusion (MIS DLIF)

Proof of Concept and Perioperative Results

Hamid R. Abbasi
Ali B. Abbasi

BACKGROUND
Minimally invasive direct lateral interbody fusion (MIS DLIF) is a novel approach for fusions of the lumbar spine. In this proof of concept study, we describe the surgical technique and report our experience and the perioperative outcomes of the first nine patients who underwent this procedure.

STUDY DESIGN/SETTING
In this study we establish the safety and efficacy of this approach. MIS DLIF was performed on 15 spinal levels in nine patients who failed to respond to conservative therapy for the treatment of a re-herniated disc, spondylolisthesis, or other severe disc disease of the lumbar spine. We recorded surgery time, blood loss, fluoroscopy time, patient-reported pain, and complications.

METHODS
Throughout the MIS DLIF procedure, the surgeon is aided by biplanar fluoroscopic imaging to place an interbody graft or cage into the disc space through the interpleural space. A discectomy is performed in the same minimally invasive fashion. The procedure is usually completed with posterior pedicle screw fixation.

RESULTS
MIS DLIF took 44/85 minutes, on average, for 1/2 levels, with 54/112 ml of blood loss, and 0.3/1.7 days of hospital stay. Four of nine patients did not require overnight hospitalization and were discharged two to four hours after surgery. We did not encounter any clinically significant complications. At more than 90 days post surgery, the patients reported a statistically significant reduction of 4.5 points on a 10-point sliding pain scale.

CONCLUSIONS
MIS DLIF with pedicle screw fixation is a safe and clinically effective procedure for fusions of the lumbar spine. The procedure overcomes many of the limitations of the current minimally invasive approaches to the lumbar spine and is technically straightforward. MIS DLIF has the potential to improve patient outcomes and reduce costs relative to the current standard of care and therefore warrants further investigation. We are currently expanding this study to a larger cohort and documenting long-term outcome data.

Minimally Invasive Direct Thoracic Interbody Fusion (MIS DTIF)

Technical Notes of a Single Surgeon Study

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Hamid R. Abbasi
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BACKGROUND:
Minimally invasive direct thoracic interbody fusion (MIS DTIF) is a new single surgeon procedure for fusion of the thoracic vertebrae below the scapula (T6/7) to the thoracolumbar junction. In this proof of concept study, we describe the surgical technique for MIS DTIF and report our experience and the perioperative outcomes of the first four patients who underwent this procedure.

STUDY DESIGN/SETTING:
In this study we attempt to establish the safety and efficacy of MIS DTIF. We have performed MIS DTIF on six spinal levels in four patients with degenerative disk disease or disk herniation. We recorded surgery time, blood loss, fluoroscopy time, complications, and patient-reported pain.

METHODS:
Throughout the MIS DTIF procedure, the surgeon is aided by biplanar fluoroscopic imaging and electrophysiological monitoring. The surgeon approaches the spine with a series of gentle tissue dilations and inserts a working tube that establishes a direct connection from the outside of the skin to the disk space. Through this working tube, the surgeon performs a discectomy and inserts an interbody graft or cage. The procedure is completed with minimally invasive (MI) posterior pedicle screw fixation.

RESULTS:
For the single-level patients the mean blood loss was 90 ml, surgery time 43 minutes, fluoroscopy time 293 seconds, and hospital stay two days. For the two-level surgeries, the mean blood loss was 27 ml, surgery time 61 minutes, fluoroscopy time 321 seconds, and hospital stay three days. We did not encounter any clinically significant complications. Thirty days post-surgery, the patients reported a statistically significant reduction of 5.3 points on a 10-point sliding pain scale.

CONCLUSIONS:
MIS DTIF with pedicle screw fixation is a safe and clinically effective procedure for fusions of the thoracic spine. The procedure is technically straightforward and overcomes many of the limitations of the current minimally invasive (MI) approaches to the thoracic spine. MIS DTIF has the potential to improve patient outcomes and reduce costs relative to the current standard of care. We are currently expanding this study to a larger cohort and recording long-term outcomes and costs.


Thirty days post-surgery, the patients reported a statistically significant reduction of 5.3 points on a 10-point sliding pain scale.
Inspired Spine holds 2nd Annual Minimally Invasive Spine Conference

Inspired Spine recently held its Second annual Minimally Invasive Spine Conference on June 26-28th 2017 in Alexandria, MN. Spine surgeons both nationally and internationally attended the conference, which highlighted the revolutionary oblique lateral lumbar interbody fusion (OLLIF) spinal procedure.

Board Certified Neurosurgeon Dr. Hamid Abbasi, who has performed more than 500 OLLIF cases to date, hosted the surgeons. Sessions included updates on clinical indications, published research, real case observation and several cadaver labs.

After the live OR observation of several cases, surgeons were able to then learn and practice the technique in the cadaver lab with guidance from Dr. Abbasi. The OLLIF procedure, has been revolutionary for treating degenerative disc disease, spinal stenosis/arthritis and degenerative scoliosis. The minimally invasive spinal surgery procedure is often performed as an outpatient with an incision the size of a dime. There is a thoracic variation of the OLLIF known as Direct Thoracic Interbody Fusion (DTIF) which was also taught. What makes the DTIF so amazing is the ability to perform a thoracotomy. Numerous peer reviewed publications in Cureus have appeared over the past year regarding the OLLIF, showing the procedure to incorporate 90 percent less blood loss than TLIF and significantly faster recovery with less hospitalization.

IS is dedicated to the education of surgeons on the most advanced up to date techniques established through evidence-based practice and peer-reviewed study publications that demonstrate remarkable patient outcomes superior to other techniques still being used. With more than 500 procedures performed to date successfully, IS’s OLLIF procedure has become the new standard of care in minimally invasive spine surgery. Visit http://inspiredspine.com to read about the proven benefits, hear from satisfied patients and see a detailed animation of the procedure. Call (888) 378-2828 for more information and to schedule a consultation.
Curriculum Vitae

Inspired Spine

Address: 6600 State Highway 29 S, Alexandria, MN 56308
Webpage: www.inspiredspine.com

PROCEDURES:
For more information on Inspired Spine procedures, please visit https://inspiredspine.com/treatments

THE INSPIRED OLLIF
THE INSPIRED MIS DLIF
THE INSPIRED MIS DTIF
MIS SI JOINT FUSION
MIS LAMINOTOMY
MIS LAMINOPLASTY

TEACHING & TRAINING EVENTS

August 2014 Cadaver Lab Eugene OR
1st Annual Inspired Spine OLLIF & MIS Technique Conference & Cadaver Lab: JTB2S016 June
OLLIF Cadaver Lab Seattle WA March 2017
Minneapolis MIS SIJ fusion training lab March 2017
Inspired Spine 2017 Winter Cadaver Lab Dallas at Eminent Medical Center, Plano, TX March 2017
2nd Annual Inspired Spine OLLIF & MIS Technique Conference & Cadaver Lab: TBSI June 2017

MEDIA:


PRESENTATIONS:

1. MIS spine surgery: oblique lateral lumbar interbody fusion. Paper presented at: 76th Annual Meeting and Fall Educational Conference of the Minnesota Society of Radiologic Technologists; September 6, 2014; St Cloud, MN.


9. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Paper presented at: 12th World Congress of MISTIC; November 9-11, 2016; Tehran, Iran.


“I live a whole different life.”
—Colleen Riley

15. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Poster presented at: 17th Annual Conference of the International Society for the Advancement of Spine Surgery; April 2017; Boca Raton, FL.


17. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Poster presented at: 2017 Scientific Meeting of the American Association of Neurological Surgeons; April 2017; Los Angeles, CA.


22. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Poster presented at: 2017 World Congress of Neurosurgery; August 2017; Istanbul, Turkey.


29. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Paper presented at: 7th European Congress of Neurosurgery; October 2017; Venice, Italy.


**PUBLICATIONS**


Links

Links to information regarding OLLIF, MIS DTIF, MIS DLIF & MIS scoliosis correction with OLLIF STUDIES/PUBLICATIONS:

STUDIES/PUBLICATIONS:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4524774
Abbasi H, Murphy CM. Economic performance of oblique lateral lumbar interbody fusion (OLLIF) with a focus on hospital throughput efficiency. Cureus. 2015;7(7):e292.


https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4996542

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5298193


INSPIRED SPINE MINIMALLY INVASIVE SPINE SURGERY IN THE NEWS:


ARTICLES:
