THE MAST TLIF LUMBAR SPINAL FUSION TECHNIQUE: A TWENTY-FOUR MONTH RETROSPECTIVE ANALYSIS FOR THE TREATMENT OF SYMPTOMATIC SEGMENTAL LUMBAR DISC DISEASE-SSLDD

David P. Rouben, M.D.
River City Orthopaedic Surgeons
Louisville, Kentucky
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Background:

The controversy concerning the efficacious options for surgical treatment of disabling, pain producing, Symptomatic Segmental Lumbar Disc Disease-SSLDD has been placed on the top of a list of treatment options being meticulously scrutinized by health care providers, governmental, and commercial insurance carriers. Unfortunately the existing peer-reviewed published research on this subject lacks consistency from the perspective of data points that lend themselves to comparison and confirmation. Anecdotal evidence, from those who perform any number of the plethora of surgical treatment options, seems to favor continuation of this approach, rather than accepting the laborious and uncertain outcome facing patients who engage in months and months of myriad of non-surgical treatments without any sense of when or if a positive outcome can be expected. This research is being presented to establish a basis from which all interested parties might compare fairly many of the factors that lend themselves to making a decision about the legitimate use of minimally invasive spinal fusion to permanently and consistently reduce and relieve pain emanating from a single specific lumbar spinal segment.

Purpose:

It is the intent of the paper to present a minimum two year (up to four year), post-operative, retrospective analysis of 114 consecutive adult patients who were surgically treated using the MAST TLIF- Minimal Access Surgical Technology/ Transforaminal Lumbar Interbody Fusion- surgical approach for single level, symptomatic segmental lumbar disc disease-SSLDD. Inclusive in this analysis are multiple data points that will offer interested parties, with legitimate legal, financial, and scientific interests, to evaluate the efficacious benefit of the MAST TLIF technique as compared to both non-surgical and surgical treatment options performed for the same maladies.

Outcome Measures:

Successful compilation of Oswestry patient outcome data points were meticulously recorded for each patient. Additionally, each patient was tracked by interview as to the
time each returned to their normal pre-injury work status (assuming a position was available) or to their normal pre-injury activity status.

Study Design/ Setting:

All 114 adult patients were evaluated by the author pre-operatively. All of the patients had proven focal single segment lumbar pain producing disease. All patients underwent a physical examination, lumbar spine radiographs, and an MRI of their lumbar spine. All Patients had unsuccessfully undergone a minimum of at least six weeks of non surgical treatments. All patient complaints and physical examinations were consistent with the suspected anatomical pathology. In cases involving the possibility that symptoms might not emanate from the specific suspected segment, then discograms with CT scans, nerve root blocks, and/or radiologically confirmed segmental facet nerve blocks were used to corroborate the diagnosis. Any patient who could not be proven to have their total pain coming from a confirmed isolated, focal, lumbar segment was excluded. All patients were operated on by the author at one of two hospitals. All patients participated in pre and post operative Oswestry data collection. Patient data points included hospitalization time, blood loss, surgical time, intra-operative fluoroscopic X-ray time, return to work time from surgery, sex, age, implant type, change in segmental lordosis, change in disc height, reduction of spondylolisthesis, fusion rate, pre-operative diagnosis, and complications.

Patient Sample:

There were 114 consecutively studied patients between January 2002 and December 2004. There were 57 males and 57 females. Ages ranged from 17 to 73 years of age, but averaged 45 years old. The diagnoses of the patient population included: 15 (13%) grade I and grade II spondylolisthesis, 43 (38%) failed laminectomy/laminotomy-discectomy cases, 26 (23%) herniated discs with interbody collapse, 8 (7%) cases of uni-segment stenosis, 21 (18%) cases of massive disc extrusion and sequestration, and one failed postero-lateral fusion. All patients were seen by their personal primary care physician and cleared medically for surgery. All patients who were 50 years of age underwent a pre-operative cardiological clearance.

Methods:

All patients underwent general anesthesia and positioned prone on the Jackson table. Incisions were made only through the skin and subcutaneous layers directly over the involved pedicles on either side of the midline. A single OEC C-Arm 9800 was used to identify the appropriate segment and its anatomical structures. The Medtronic® CD HORIZON® SEXTANT® Percutaneous Rod system was utilized to access, drill, tap, and insert multi-axial cannulated pedicle screws and connecting rods. The 26 mm Medtronic® METRx® Minimal Exposure Tubular Retraction System was used via a muscle fiber separation technique to minimize permanent injury to the muscle tissue. The predominant symptomatic sides were access at the level of the interpedicular space at a
25-30 degree angle from the vertical plane of the posterior process. Resection of the entire facet and ligamentum flavum from the postero-lateral canal space and the interpedicular space was performed. The annulus and nucleus were resected through the interpedicular space. Intra-discal distraction was accomplished by the Medtronic® SCISSOR JACK™ Distractor. The endplates were debrided of their cartilage surfaces. Local bone was harvested during access and decompression was morselized and placed in the anterior third of the disc, followed by Medtronic® INFUSE® BMP-2, followed by a Cage filled with Medtronic® INFUSE® BMP-2 and autologous bone. Pedicle Screws was locked in compression. Wounds were closed in layers with the skin sealed with Glue. Patients were discharged when they were comfortable on analgesics by mouth and participated in a supervised and structured rehabilitation program beginning seven days after surgery. Patients returned for follow-up at 4, 8, and 12 week post-op, followed by 6, 12, 15, 18, and 24 month intervals. A personal interview with each patient occurred at each return follow up visit to discern the status of each of the data points being tracked for this study. Lumbar segmental lordosis was measured by drawing a perpendicular from the top of the superior fused vertebrae to the bottom of the inferior vertebrae. In the case of S1, the perpendicular was drawn along the superior endplate of S1. The disc height was measured from the inferior posterior edge of the superior vertebrae to the superior posterior edge of the inferior vertebrae. The extent of spondylolisthesis reduction of an individual segment was made by measuring the percentage of anterior slip that no longer existed after surgery.

**Results:**

The average age of the patient group was 45 years. There was an equal distribution of male to female patients. The average hospitalization for each patient was 13 hours (range 2-96). The average blood loss per patient was 159 cc (range 60-350 cc.). The average radiation exposure to each patient was 169 seconds (range 81-355). The average time to complete each procedure was 154 minutes (range 105-300). Whereas 22% of the patient population were legally disabled or retired at the time of surgery, of the remaining 89 patients (78%), 90% of those patients returned to their pre injury job no later than 10 weeks from the date of surgery. No patients who returned to work after surgery, discontinued work again unless they sustained a completely new injury. The average number of months that patients took narcotic analgesics was five months. 100 % of all patients were taking some form of a narcotic pain medication at time of surgery. 23% of the patients were still on narcotic analgesics for chronic pain at 24 months post op, a reduction of 77%. All of these patients were under the control of a chronic pain specialist at the time of the most recent follow up visit.

Three different interbody implants supplied by Medtronic® were used in the study. 43 PYRAMESH® Surgical Titanium Mesh oval implants, 63 boomerang shaped VERTE-STACK ANATOMIC PEEK™ Spacer Implants, and 8 HYDROSORB® Resorbable Material ring implants were used.

The average lordosis for each type of implant was measured at the pre operative, post operative, and finally the final 24 month follow up visit. The PYRAMESH® Surgical Titanium Mesh oval implant patients displayed a lordosis of 16 degrees, 21 degrees, and 17
degrees, respectively. The boomerang VERTE-STACK ANATOMIC PEEK™ Spacer implant patients measured a lordosis of 14 degrees, 21 degrees, and 16 degrees, respectively. Finally, the HYDROSORB® Resorbable implant patients demonstrated a measured lordosis of 13 degrees, 13 degrees, and 13 degrees, respectively.

The average intervertebral height (disc height) was measured pre operatively, post-operatively, and finally at the 24 month follow-up visit for each implant type. The PYRAMESH® Surgical Titanium Mesh oval implant patients measured 6.4 mm, 7.9 mm, and 7.3 mm, respectively. The boomerang VERTE-STACK ANATOMIC PEEK™ Spacer implanted patients measured 5.9 mm, 7.1 mm, and 5.8 mm, respectively. Finally, the HYDROSORB® Resorbable implanted patients measured 6.0 mm, 6.5 mm, and 5.9 mm, respectively.
Fourteen patients were treated for symptomatic spondylolisthesis. 57% had a 100% reduction in their slip. The remaining patients all had varying degrees of slip reduction with associate resolution of their symptomatic slip disease. Only one of the patients, an elderly osteoporotic female, lost complete stabilization and reduction when her pedicle fixation failed to maintain boney continuity.
Oswestry outcome measurements were performed on all patients pre-operatively and then again at the initial post op visit, six, nine, twelve, fifteen, eighteen, and twenty-four month intervals and computed for comparative assessment. The results demonstrated that pre operatively patients measured an Oswestry score of 64.4. Post operatively their measured scores were 32.2, 23, 40, 27, 32.5, 36.3, and 30.2 respectively.

Complications were listed and compiled as a matter of record for short term events (less than six months) and for long term events (greater than six months). There were no post operative infections. No patients to date have undergone surgery for adjacent level symptomatic disease.
Of the short term events, the following findings were made according to frequency. 2.6% of the patients were treated for piriformis syndrome or noted radiographic evidence of a misdirected pedicle screw. 1.8% of the patients were hospitalized for post operative depression. 0.8% of the patients were either hospitalized post operatively for a cardiac event or loss of fixation, or symptomatic leg pain from a misdirected pedicle screw necessitating re-operative surgery.

Long term complications were listed in order of prevalence. 20% of the patients complained of unresolved back pain necessitating chronic narcotic use. 3.5% of our patients’ necessitated removal of their pedicle implants for persistent focal back pain. 1.8% of the patients complained of unresolved pre operative leg pain or never returned to work. 0.8% of the patients experienced new onset leg pain that persisted or experienced a pseudo-arthrosis of the fused segment.
Conclusions:

In spite of the paucity of published, peer reviewed, comparative studies showing confirmable and reproducible short or long term results supporting the decision to treat patients with symptomatic segmental disc disease of the lumbar spine with a lumbar fusion, we believe that the decision to offer our patients the MAST TLIF- lumbar fusion procedure as a surgical treatment option has been legitimized by the data demonstrating a less than 1% failed fusion rate, a 90% return to normal work rate by week 10 after surgery, a 77% reduction in narcotic dependency for pain control, no evidence of adjacent level degeneration, a dramatic reduction in hospitalization time and services usage, and no infections. We continue to follow all patients and to compile and analyze the data to date. We have treated over 300 patients since January of 2002 and our statistics continue to remain unchanged. We believe that the MAST TLIF lumbar fusion procedure is a viable and appropriate treatment option for symptomatic segmental lumbar disc disease-SSLDD. We further submit that the MAST TLIF lumbar fusion data certainly refutes all previous reports or studies that suggest that lumbar fusion surgery is a poor and inconsistent choice for the treatment this pain producing phenomenon.