Anterior Lumbar Interbody Fusion in the treatment of Lumbar Spondylolisthesis

Pier Francesco Eugeni

Neurosurgeon – Department of Surgery – Regional Hospital of Teramo
Director of the Neurosurgical Activities – Hospital of Giulianova (Teramo)
Director of Spinal Traumathology Program – Regional Agency for Public Health – Teramo
The spondylolisthesis is defined as the front or rear sliding of a vertebra respect to the underlying vertebrae.

Rationale of treatment

Neurological involvement
\[ \downarrow \]
nervous decompression and fixation of instability

pre-existing
or
induced by decompressive procedure
Rationale of treatment

spinal pain

solution of pain disorder refractory to drug therapy and / or physical therapy
described procedures

- Defect of the *pars interarticularis* repair
- Decompression (Gill’s osteotomy)
- Not instrumented posterolateral in situ fusion
- In situ decompression with fusion
- In situ fusion with or without decompression and instrumentation
- Reduction and fusion with instrumentation

Spinal fusion procedures with reduction

- Posterior or posterolateral fusion with posterior reduction
- Posterior interbody fusion with posterior reduction
- Posterior and anterior approach with reduction and posterior and anterior interbody fusion

All these procedures generally include the removal of the posterior arch and some types of internal fixation

Posterior Fusion Procedures

Artrectomy + instrumented PLIF

Decompression by laminoartrectomy (Gill 1955)

Posterior Lumbar Interbody Fusion – PLIF (Cloward 1953)

Pedicle screwing (Steffee 1988)

It is one of the procedures considered more effective because it allows

1. wider decompression
2. better visualization of the neural elements
3. without risk of destabilization
Artrectomy + Instrumented PLIF

Implies

significant manipulation of the paravertebral muscles
large demolition of posterior vertebral elements

Effects of Artrectomy + instrumented PLIF

Muscle atrophy due to compression by the retractors can be source of intense muscular pain in the postoperative period and sequelae


Gejo R., Matsui H., Kawaguchi Y., Ishihara H., Tsuji H. Serial changes in trunk muscle performance after posterior lumbar surgery Spine 1999; 24: 1023-1028


Mayer T.G., Vanharanta H., Gatchel R.J. Comparison of CT scan muscle measurements and isokinetic trunk strenghtth in postoperative patients Spine 1989; 14: 33-36
Mini-invasive posterior and posterolateral approaches

Also to obviate these drawbacks, posterior mini-invasive approaches have been conceived:

- TLIF
- XLIF
- Percutaneous screwing
- “Non Fusion” techniques
Anterior Fusion Procedures

ALIF

Capener (1932) - Burns (1933)

Burns BH. An operation for spondylolisthesis. Lancet 224:1233, 1933
Since the first descriptions the anterior surgical approaches have been criticized mainly for the "excessive surgical trauma" associated with this type of surgery.


Since the early 90's
ALIF has experienced a "rebirth" for the development of less invasive surgical techniques
Two "schools of thought"

1. Videolaparoscopy

2. Minilaparotomy ("Mini Open")
L-ALIF (Laparoscopic ALIF)

“Although this procedure is associated with a long learning curve, the technique, once mastered, is effective and advantageous over current approaches to lumbar fusion”

L-ALIF (Laparoscopic ALIF)

“The laparoscopic anterior approach to the lumbar spine can be safely performed by approach-surgeons skilled in advanced laparoscopic techniques”


“No conclusion regarding either the superiority or inferiority of LALIF to the open or mini-open ALIF can be drawn … some spine surgeons are abandoning this procedure and switching to the mini-open ALIF”

Mini ALIF (Minilaparotomy ALIF)

“Atraumatic techniques to reach the lumbar spinal levels L2-L3, L3-L4, L4-L5, and L5-S1. … Microsurgical modifications of the surgical approaches well known to the spine surgeon. … Can be learned in a step-by-step fashion, starting with a conventional skin incision and, once the surgeon is familiar with the instruments, moving on to the microsurgical technique.”

Mini ALIF (Minilaparotomy ALIF)

Advantages of Mini ALIF

- minimal tissue trauma
- minimal bleeding
- reduced surgical time
- low rate of complications

no laparoscopic experience is required

L-ALIF ⇔ Mini ALIF

“The individual surgeon's preference ultimately is likely to be the dictating factor”

With regard to the indications and contraindications the PLIF as well as the ALIF is accepted unquestioningly as an up-to-date method.

“Both ALIF and PLIF can produce good outcomes in treating lumbar spondylolisthesis, but ALIF is more advantageous in preventing the development of adjacent-segment degeneration”

“A literature search identified six randomized controlled trials comparing the fusion rates of different surgical approaches. No general conclusion could be made.”

Described ALIF Indications

degenerative instability
isthmic spondylolisthesis
Spinal stenosis with instability
Prior surgery failure syndrome
fractures
Spondylitis / spondylodiscitis
Pseudoarthrosis that follows other types of fusion (for example posterior lumbar intervertebral fusion)
Reported ALIF relative contraindications

- Previous laparotomy (hepatobiliary surgery, hysterectomy, surgery of the colon, etc.)
- Spondylitis / spondylodiscitis with a large mass of prevertebral soft tissue or psoas abscess
- Previous anterior vertebral fusion
- Lateral course of common iliac vein on left side that covers the lateral side of intervertebral space L4/L5
- Vascular bifurcation in front of L5/S1

Personal experience

ALIF
anteriorly instrumented
median extraperitoneal approach
Technique

"Mini Open" with anatomical access

Magnifying Loupes and Front lamp
Requirements

Training in Visceral and Vascular Surgery is recommended

No access general surgeon is required
Pre-operative Study

- Standard X-ray + Dynamic tests
- (Telespinogram)
- MRI (G-Scan eventual)
- Volumetric CT Scan (AngioCT eventual)
pre operative angio CT
Pre-operative preparation

- bowel preparation
- antithrombotic prophylaxis
- antibiotic prophylaxis
- bladder catheter
Operating position

Supine position - moderate lordosis

Fluoroscope under drapes
Fluoroscopic level control

The identification of the precise angle of access allows to minimize the incision
Self-retaining retractor

The use of the self-retaining retractor is essential and allows to limit to two the number of operators.
Surgical Technique

Skin incision

1. Median under navel pubic
2. Pfannenstiel transverse suprapubic
Surgical Technique
Surgical Technique

Left paramedian fascial incision
Surgical Technique

Lateral retraction of the medial rectus
Surgical Technique

Identification of

1. Epigastric vessels
2. Psoas
3. Ureter
4. Large retroperitoneal vessels
Surgical Technique

To expose properly L4-L5 is necessary to identify, tie and cut the ileo lumbar vessels. Particular attention is paid to this surgical step.
Surgical Technique

Homan’s self-retaining retractors positioning
Surgical Technique

"H" shaped incision of the anterior longitudinal ligament
Surgical Technique

discectomy
Surgical Technique

Removal of the cartilage without damaging the somatic plates
Surgical Technique

Intersomatic space spreading
Surgical Technique

size implant checking
Surgical Technique

Cage Filling
Surgical Technique

Cage Positioning
Surgical Technique

plating
Surgical Technique

These surgical steps assimilate lumbar and cervical techniques, from a biomechanical point of view and as regards the respect of anatomy, either using plans of bloodless dissection. The mobilization of the iliac vessels, when necessary, allows to operate instrumentation of multiple contiguous levels with a single plaque.
Surgical Technique

Fascia rectus closure

The accurate closure without tension of the rectus fascia reduces the risk of incisional hernia.
Postoperative
Described Complications

- Denervation of the rectus muscle
- Abdominal hernia
- Groin pain from compression and irritation of the genitofemoral nerve
- Vascular lesion in the retroperitoneal space
- Lesion of the dura and nerve roots
- Pseudomeningocele or CSF fistulas
- Temperature differences (usually transient), dysesthesia, impaired sweating in the lower extremities
- Lesion of the peritoneum, bowel, bladder, ureter, kidney and spleen
- Vascular lesions (common iliac artery and vein, median sacral vessels)
- Peritoneal and retroperitoneal fibrosis, ileus, ureteric compression
- Superior hypogastric plexus lesion with retrograde ejaculation in men, impaired sensation and genital muscle function and lubrication in women

Advantages

- Comfortable Postoperative Course
- Anatomical savings of the posterior spinal and muscular elements
- Reduction of bleeding
- Decreased surgical time
- Excellent cosmetic result (especially with transverse incision)
Advantages

The ALIF allows a contact area and arthrodesis wider than the PLIF
Advantages

The Osteosynthesis probably is equally solid than pedicle screwing
Clinical cases

15 February - 15 April 2011

5 female

44 to 70 years (mean 57)

2 years of follow-up
Clinical cases

- **DGM 60**  L5S1 I° spondylolisthesis
- **PS 44**  L5S1 I° spondylolisthesis
- **IMG 60**  L4L5 I° spondylolisthesis
- **FL 70**  L4L5 I° spondylolisthesis and L5S1 discopathy
- **JE 55**  L5S1 I° spondylolisthesis
clinical Presentation

- Disabling chronic low back pain refractory to drug and physical therapy
- Little or no radicular signs
- In two patients had documented the appearance of spondylolisthesis in the last few years
Case 1 - 60 years old
Case 1 - 60 years old
Case 2 44 years old
Case 2  44 years old
Case 3  60 years old
Case 3  60 years old
Case 3
60 years old
Case 4  70 years old
Case 4  70 years old

Previous surgical procedures

1. laparotomy cholecystectomy
2. bilateral inguinal hernioplasty
Case 4 70 years old
Case 4  70 years old
Case 5  55 years old
Case 5  55 years old
Case 5  55 years old
Results

the posterior instrumentation has never been necessary
It has never been necessary to adopt the trans peritoneal approach
Results

IN ALL CASES

Regular post-operative course
Mobilization on the first day without any type of orthesis
Very little blood loss from surgical drainage
No post operative vertebral pain
Moderate pain at the site of the abdominal wound
Rapid recovery of peristalsis
Feeding after the gases canalization
Complications

Postoperative anemia - 2 patients
(no hematoma on Abdomen CT)
myelodepression by antibiotics
Patient on the second post-operative day walks in full autonomy and painless
Conclusions

The ALIF represents a valid and safe technique in the treatment of grade I spondylolisthesis.

Self-management by the spinal surgeon of access and vessels mobilization optimizes surgical exposure of the target and helps to reduce the invasiveness of the procedure.
Winter view from Teramo of the Adriatic Side of the Gran Sasso d’Italia Mountain

Grazie