PERCUTANEOUS VERSUS OPEN SURGICAL FIXATION OF LUMBOSACRAL SPINE IN CASES OF DEGENERATIVE SPONDYLOLISTHESIS

Mohammed Galal Mohammed, Mohammed Abd Allah Al werdany, Shafik Tahseen El Molla, Ahmed Roshdy Farghaly and Omar El Farouk Ahmed

ABSTRACT:

Background and Objectives: Degenerative spondylolisthesis is frequently associated with LBP and leg pain. When conservative treatment fails to relief symptoms, the surgical spine fixation and neural tissue decompression becomes the treatment of choice as it leads to functional and symptomatic improvement. In this study we compare between percutaneous spine fixations versus open spine fixation in cases of degenerative spondylolisthesis.

Patients and Methods: 40 patients with degenerative spondylolisthesis were divided randomly and equally in two groups, group A of patients underwent spine fixation with conventional open surgery approach, while group B underwent percutaneous spine fixation, we recorded intraoperative difficulties and post-operative outcome in the two groups every 6 months for 18 months.

Results: The mean operation time was 174 minutes in group A and 168 minutes in group B, the mean amount of blood loss in group A was 443 ml, while was 165 ml in group B (p value < 0.001), the mean duration of hospital stay in group A was 2.45 days, while it was 1.8 day in group B (p value <0.002), there is no statistically significant difference between the two groups in reduction of leg pain, back pain and ODI either immediately post-operative or after 6, 12, and 18 months of follow up

Conclusions: Percutaneous spine fixation has the advantage of being less invasive, with less intra operative bleeding, less operation time and post-operative hospital stay than the conventional open spine fixation technique. However, both techniques have the same results of improving patients’ leg and back pain on the long term.

Key word: Degenerative spondylolisthesis, Percutaneous lumbar fixation, Open lumbar fixation.

INTRODUCTION:

Degenerative spondylolisthesis (DS) causes slippage of one vertebral body over the one below as a result of the degenerative changes in the vertebral column, which may be associated with spinal canal stenosis and leads to lower back pain (LBP) and leg pain in many cases(1).

It is a common pathology with prevalence of 2.7% in males and 8.1% in females.(2)

conservative treatment should be considered intially in the treatment of most cases of degenerative spondylolisthesis, either its accompanied by neurological symptoms or not. Medical reatment in the form of NSAIDs and other analgesics can
be tried to control pain; physical methods such as bracing and flexion strengthening exercises are helpful in controlling pain in many cases, while epidural steroid injections can be done in selected cases with poor response to medical treatment.(1)

If the medical treatment fails to relief symptoms, surgical treatment is indicated.

In this study we compare between two techniques of spine fixation in cases of degenerative spondylolisthesis, the conventional open surgical spine fixation versus percutaneous spine fixation as regarding intraoperative details and difficulties, post operative complications and recovery, with follow up of patients of the two groups after 6, 12 and 18 months.

PATIENTS AND METHODS:

This study is a prospective randomized study held between October 2017 and May 2022 on 40 patients with degenerative spondylolisthesis divided randomly into two groups, group A which includes the odd numbers underwent conventional open surgery for spine fixation, while group B which includes the even numbers underwent percutaneous spine fixation. All patients suffered from single level degenerative spondylolisthesis causing LBP with or without associated leg pain, age should be between 25 and 60 years old, with average body mass index and no history of previous surgery in back, with good general condition without other comorbidities.

Full detailed medical history was obtained before surgery for each patient in study, with full preoperative clinical and neurological assessment of each patient. For each patient we assessed LBP and Leg pain with visual analogue scale (VAS), and we assessed patients functionally with Oswestry disability index (ODI). For each patient we did full preoperative lab investigations, MRI LSS, lateral dynamic x-ray LSS, full detailed informed consent has to be read and discussed with each patient before he signed it. Intra operative, we recorded blood loss, operation time, intraoperative difficulties and complication. In group A, we made a longitudinal lower back skin incision, with back muscle separation lateral to transverse processes, insertion of pedicular screws after identification of the entry point under guide floroscopy, we perform full laminectomy and foramenotomy, followed by either posterolateral or interbody fusion.

In group B we do insert percutaneous screws under flouroscopy guide, with separate small skin incision 1 cm lateral to the pedicular line for each screw, then we do small midline incision with minimal muscle separation for lamenectiontomy, foramenotomy with insertion of PLIF.

Post-operative clinical and neurological assessment was done for each patient, with assessment of LBP and leg pain for each patient after 6, 12 and 18 months, assessment of bony fusion in addition to evaluation of patients functionally according to Oswestry disability index was done. CT LSS was obtained to review screws direction. Bone fusion was assessed after three and sex months using X-ray LSS which was classified into 4 grades as follows: Grade 1: Complete fusion which is achieved with formation of bone bridge between the upper and lower vertebral bodies; Grade 2: In which Bone bridge were not formed, but there is no translucency observed around the cages with thick fusion mass formation; Grade 3: Fusion not occured with translucency around the cages; Grade 4: Pseudarthrosis which is indicated by sinking of the cage into the vertebral body or by bone resorption around cages.

Ethical consideration:

The approval of medical ethical committee was taken from faculty of medicine Ain Shams university in 2017.
RESULTS:

The total of 40 patients was divided randomly in two groups, group A of patients underwent conventional open spine surgery approach, while group B underwent percutaneous spine fixation, each group included 20 patients, the mean age of patients in group A was 51 (Mean±SD 51.72 ± 7.71), and 47 (Mean±SD 47.35±10.91) in group B (fig1), the mean operation time was 174 minutes in group A (Mean±SD 174.00±40.83) and 168 minutes in group B (Mean±SD 168.75±36.63) (fig3), the mean amount of blood loss in group A was 443 ml (Mean±SD 443.00±161.83), while was 165 ml in group B (Mean±SD 165.00±64.85) (fig4), (p value < 0.001), the mean duration of hospital stay in group A was 2.45 days (Mean±SD 2.45±0.51), while it was 1.8 day in group B (Mean±SD 1.80±0.62) (p value <0.002)(fig5), the reduction of leg pain post operative was -73.34 % ( ±24.89 %) in group A while it was -57.69 % (±18.80%) in group B (fig6), leg pain reduction after 6, 12, and 18 months was -91.06 (±15.67%), -94.70(±11.94%), and -96.97(±10.04%) respectively in group A, while it was -78.17(±22.09%), -92.66(±14.74%) and -92.66(±14.74%) for group B with no statistically significant difference between the two groups. (fig6)

According to assessment of interbody fusion, in group A ,grade 1 of fusion was achieved in 50% of patients after 3 months, and in 100% of patients after 6 months indicated full fusion, while in group B, grade 1 of fusion was achieved in 70% of patients after 3 months, and in 85% of patients after 6 months, with no statistically significance between the two groups in grade of fusion after 6 month of surgery.(fig10)

According to complications, two cases of group A had intraoperative dural tear which has been stitched intraoperatively with no post operative CSF leak, one other case had superficial wound infection around two stitches which resolved completely with systemic and topical antibiotics. Only one case in group B has dural tear with no post-operative CSF leak.
Mohammed Galal Mohammed, et al.,

Figure (1): Comparison between open surgery group and percutaneous surgery group according to age “years”.

Figure (2): Comparison between open surgery group and percutaneous surgery group according to gender.

Figure (3): Comparison between open surgery group and percutaneous surgery group according to operation time “min”.

482
Percutaneous Versus Open Surgical Fixation Of Lumbosacral Spine In Cases Of Degenerative…

Figure (4): Comparison between open surgery group and percutaneous surgery group according to blood loss.

Figure (5): Comparison between open surgery group and percutaneous surgery group according to “hospital stay”.

Figure (6): Comparison between open surgery group and percutaneous surgery group according to reduction% of VAS for leg Pain
Mohammed Galal Mohammed, et al.,

Figure (7): Comparison between open surgery group and percutaneous surgery group according to reduction of oswestry.

Figure (8): Comparison between open surgery group and percutaneous surgery group according to reduction of VAS for back Pain.

Figure (9): Comparison between open surgery group and percutaneous surgery group according to single level cost.
Figure (10): Comparison between open surgery group and percutaneous surgery group according to grading of fusion after 3 months.

**DISCUSSION:**

In recent years, there have been several case series and comparative studies on minimally invasive lumbar spine fusion. (4)

In conventional open surgical fixation of spine, it's necessary to provide exposure for the pedicle screw entry points, especially the most rostral screw, so it is necessary to do muscle dissection off the facet joints and transverse process, which is one important source for postoperative wound pain, while the use of percutaneous pedicle screws requires minimal muscle dissection and thus avoids this morbidity. (5)

Also the conventional open spine fixation technique involves far lateral muscle dissection off the transverse processes to allow posterolateral fusion, which is considered an additional source of postoperative wound pain, while percutaneous spine fixation procedure involves interbody fusion alone, so no lateral dissection of muscle off the transverse processes is necessary. (5)

This study was done to compare between percutaneous and open surgical fixation of LSS as two modalities of surgical treatment of degenerative spondylolisthesis and to review percutaneous LSS fixation procedure and its anatomical considerations. This study was conducted on 40 patients suffering from degenerative spondylolisthesis between October 2017 to May 2022. The 40 patient was divided in a randomized manner into 2 groups, group A includes the odd numbers between 1-39 which were subjected open surgery for lumbar or lumbosacral fixation and group B which includes the even numbers between 2 and 40 which were operated for percutaneous lumbar fixation.

Kotani et al in 2011 Conducted a study on 80 patients with degenerative spondylolisthesis to compare between the midterm clinical results of minimally invasive decompression and Posterolateral fusion (MIS-PLF) with percutaneous pedicle screws versus conventional approach for degenerative spondylolisthesis with a spinal stenosis, 43 patients of them underwent MIS PLF (14 male patient and 29 female patients), and 37 cases (12 of them are male patient and 25 female patients) underwent open surgery for lumbar fixation, the mean age of surgery was 65 years, up till the date
of Kotani study at 2011, no study has demonstrate the efficacy of minimally invasive lumbar decompression and posterolateral fusion in degenerative spondylolisthesis of lumbar spine\(^4\).

Elkhatib analyzed retrospectively the clinical outcome of 17 patients (12 males and 5 females) with low grade spondylolisthesis underwent instrumented fixation of lumbar spine to compare between posterior lumbar interbody fusion augmented with pedicle screw fixation versus PLIF augmented with percutaneous pedicle screw fixation, he divided patient into 2 groups, Group A included 9 patients who underwent PLIF with conventional open surgery and Group B which included 8 patients underwent PLIF with percutaneous spine fixation system, the mean age for surgery was 43.5 years\(^6\).

Mooney et al in 2021 reviewed the data of the quality outcome database (which is a nationwide registry in USA instituted in 2012) for 11213 patients who underwent elective lumbar fusion for degenerative lumbar disease to compare between outcome of minimally invasive lumbar fusion (MIS) versus open lumbar fusion, the study included 6145 patient had degenerative spondylolisthesis, 5270 underwent open lumbar fusion and 875 underwent MIS\(^8\).

In our study, the mean age of the open surgery group was 51.8, while the mean age of the percutaneous surgery group was 47.3, and no statistically significant difference between the two groups. According to gender, the open surgery group included 8 males and 12 females representing 40% and 60% of patients respectively, while the percutaneous surgery group includes 4 male patients and 16 female patients representing 20% and 80% respectively. The most affected levels in our study were L4-L5 (70% in open surgery group and 80% in percutaneous surgery group), we exclude patients below 25 years old and those above 60 years old, patients with associated painful conditions as neoplastic, traumatic and inflammatory conditions in area of lumbar spine, patients with spine infections or previous operative intervention in lower back will be excluded, patients with true lumbar disc prolapse accompanied with radicular pain will be excluded, patients with BMI over 25 will be excluded and patients with bad general condition will be excluded.

While all patient in Kotani et al study has L4-L5 degenerative spondylolisthesis with apparent intermittent neurological claudication and/ or radicular neurological symptoms which were explained by neural compression due to spondylolisthesis with spinal stenosis, he excluded patients complaining the lower back pain alone preoperative\(^4\).

Elkhatib reported that the majority of his cases occurred at L4-L5 level (11 out of 17 patients), then L5 S1 (5 out of 17 patients), He included Cases of any age, both sexes with low grade (Grade 1 and 2) degenerative and isthmic lumbar spondylolisthesis, Symptomatic patient with low back pain, radiculopathy and/or neurogenic claudication not responding to at least 3 months of conservative treatment with oral medication and physical therapy, All lumbar levels are to be included. He excluded patients with general diseases that preclude surgical management (osteoporosis and active infection), patients with Spondylolisthesis of grades higher than grade 2. Patients with morbid obesity as measured by body mass index >40, previous lumbar surgery, pregnancy, Blood coagulation disorder, and traumatic conditions\(^6\).

In our study, In group of conventional open surgery we used pedicular screws for fixation of lumbar spine followed by either posterolateral or interbody bony fusion, after good decompression of canal and bilateral foramentomy at the affected level, while in patients underwent percutaneous fixation we used a hybrid technique in which we utilized
Percutaneous Versus Open Surgical Fixation Of Lumbosacral Spine In Cases Of Degenerative…

In Elkhatab study, blood loss was calculated for both groups and was found to be much less for group B (300 to 500ml mean 370 ml) than group A (500 to 1100ml mean 800ml), and so blood loss during percutaneous fixation procedure was significantly less than open surgery.(4)

In our study, hospital stay post-operative ranges in group of open surgery from 2 to 3 days (mean 2.45), while in percutaneous group hospital stay ranges between 1 to 3 days (mean 1.8), so there is statistically significant difference between the two groups in post-operative hospital stay, with less post-operative hospital stay in after percutaneous surgery.

Kotani et al evaluated VAS for LBP preoperatively and postoperatively on the first, second and seventh days, after two weeks and then at six months and after one year. Both groups showed a rapid decrease in their lowe back pain on visual analogue scale, which was maintained until two weeks post operative; however, the reduction was more obvious in the MIS-PLF group. The LBP VAS on the third day postoperative in the MIS-PLF group was statistically lower than that in the open-PLF group.

ODI was evaluated preoperatively and post operatively after two, three and six weeks and then at after one year and two years. After two weeks postoperatively, there was a dramatic reduction in ODI value in the MIS-PLF group and there was a statistical significant difference in ODI values between the two groups at two weeks postoperatively. After three months, the MIS-PLF group demonstrated further reduction in ODI to an average of 13.2; however, the average score for the open-PLF group remained 32.1, which was a statistically significant. This difference was maintained after six months, one year and after two years postoperatively. (4)

Kotani et al reported that in the group of MIS PILF a small midline incision (4 cm) for neural decompression and bilateral medial facetectomy, another small parasagittal incision is done unilaterally (1.2 cm), from which he inserted percutaneous screws at L4-L5 unilaterally followed by unilateral posterior fusion utilizing iliac bone graft inserted in the lateral gutter from the same incision using Depuy spine expandable retractor, while patient underwent open surgery were fixated bilaterally with pedicular screws with bilateral posterolateral fusion with bone graft.(4)

Elkhatib reported that in patients who underwent percutaneous lumbar fixation, the surgical access for interbody fusion was obtained using tubular retraction system and done on the most symptomatic side, while patient underwent open surgery had interbody fusion with iliac crest graft after good decompression of lumbar canal and foramenotomy.(6)

In our study, no significant difference between the two groups in surgical time, the same result was reported by Kotani et al and by Elkhatib.

In our study the intraoperative bleeding during percutaneous fixation (which ranges between 70 and 300 ml) was significantly less than bleeding during conventional open surgery as it ranges between 200 ml and 700 ml.

Kotani reported that the average blood loss in the MIS PLF groups was 181 ml, while in open surgery group was 453 ml and so there was statistically significant difference between the two groups in intraoperative bleeding(4).

a small mid line skin for lameneectomy, foramenotomy and lumbar canal decompression with performing of interbody fusion after insertion of percutaneous lumbar screws through separate small parasagittal incisions.

Kotani et al reported that in the group of MIS PILF a small mid line skin for lameneectomy, foramenotomy and lumbar canal decompression with performing of interbody fusion after insertion of percutaneous lumbar screws through separate small parasagittal incisions.
Elkhatib reported that the mean ODI in both groups decreased postoperatively from mean of 56 preoperatively to a mean of 23 postoperatively\(^{(6)}\).

Kotani et al reported that in his study the LBP vas shows more rapid reduction in the MIS PLF group over the initial seven days than it did with open surgery group with significant difference in the first 3 days, even though both groups demonstrated a rapid reduction in their LBP VAS, which was maintained until day 14\(^{(4)}\).

The better outcomes for postoperative LBP and reduction of ODI in the MIS-PLF group was maintained until two years, suggesting that it has a better mid-term effect on back muscle preservation\(^{(4)}\).

In Kotani study, no major complications were reported, there was no vascular or neural injury and no deep wound infections. However, in the MIS-PLF group there was some surgical difficulty in rod placement during the percutaneous rod placement procedure. In these cases, extended midline skin incisions involving lateral intramuscular exposure was done, but without conversion to a major open procedure and the rods were placed directly on heads of pedicle screws\(^{(4)}\).

Elkhatib reported that on follow-up of patients postoperatively, VAS for leg pain was reduced from a preoperative mean of 65 to a postoperative mean of 45 (P =0.031), as it decreased in group A from 65 to 43 while in group B from 61 to 40. VAS for back pain decreased from a preoperative mean of 52 to a postoperative mean of 40 (P =0.003), as it was reduced in group A from 55 to 43 while in group B from 54 to 39. As in Kotani study, Elkhatib reported that no major complications related to surgery occurred, such as, additional neurological dysfunction, wound infection or vascular injuries due to screw placement. The postoperative LBP was much less in the percutaneous group with relatively longer time for fusion. Elkhatib reported that percutaneous pedicle screw fixation technique is minimally invasive technique and is associated with less damage to muscle and skin, less post-operative back pain, less blood loss and quicker return to normal activities. Although, percutaneous fixation technique is safe and efficacious in the management of low grade spondylolisthesis, the complex biomechanics of instrumentation, slow fusion process and high learning curve in addition to increased radiation exposure limits its application in all cases. These results seem to favor PLIF with conventional screw fixation rather than PLIF with percutaneous PSF in the treatment of low grade spondylolisthesis\(^{(6)}\).

In our study, there was no significant difference between the two groups in preoperative VAS for Leg pain, and also there was no significant difference between the two groups in VAS for leg pain immediate post-operative, though there is more improvement in VAS of leg pain in group of open surgery after 6, 12 and 18 months, the difference between the two groups was not significant.

The mean VAS of back pain preoperative in group A and B was 9 and 10 respectively, with no significant difference between the two groups, also there is no significant difference between the two groups in VAS of back pain immediate post-operative, and after 6, 12, and 18 months.

As regarding ODI, there was no significant difference between the groups in ODI preoperative, immediate post-operative, 6, 12, and 18 months.

Ai-Min Wu in 2018 conducted a study on total of 167 patients with single segmental spondylolisthesis treated by TLIF were included, 79 cases in minimally invasive TLIF (MI-TLIF) group and 88 cases in open TLIF group\(^{(7)}\).

He suggested that MI-TLIF is a safe and effective choice in the treatment of lower grade lumbar spondylolisthesis (grade II or
less), and it has advantages of less blood loss, postoperative hospital stay when compared to open TLIF.\(^{(8)}\)

Ezequiel et al compared results between open and minimally invasive fusion in lumbar degenerative diseases, VAS was used to evaluate lower back pain and leg pain while ODI was used to assess patients functionally. They also compared between the two groups as regarding intraoperative blood loss, hospital stay, operative time and complications. At the end of their study they concluded that the use of a minimal invasive technique is associated with less blood loss and a shorter hospital stay in comparison to the group that underwent conventional open surgery; however, they observed longer operating times and more X-ray exposure and associated with a higher learning curve than in the conventional surgery. Both surgical techniques led to a significant reduction in radicular and back pain scores, and in the case of the minimal invasive group, the reduction in LBP pain was significantly greater. The ODI score was significantly lower in the minimal invasive group compared to the open surgery group during the 12-months follow-up. The complications like dural tear, wound infection and postoperative neurologic lesion were not related to the type of surgery used\(^{(9)}\).

Conclusions:

The percutaneous fixation of lumbosacral spine in case of degenerative lumbosacral spondylolisthesis has the advantage of being less invasive, with less intra operative bleeding, less operation time and post-operative hospital stay than the conventional open surgery fixation technique. However, both techniques have the same results of improving patients’ leg and back pain on the long term but the percutaneous fixation system is much more expensive and its cost exceeds the benefit of being followed by less hospital stay duration.

Conflict of interest:

We declare that there are no conflicts of interest for this paper.

REFERENCES:


تثبت الفقرات القطنية العرضية عن طريق الجلد في حالات التزحزح الفقاري

محمد جلال محمد ومحمد عبد الله الورداني وشيقي حسين البلا و أحمد رشدي فرغلي و عمر الفاروق احمد

قسم جراحة المخ والأعصاب كلية الطب جامعة عين شمس

بعد التزحزح الفقاري التنكسى ماين الفقرات القطنية والفقرات القطنية العرضية من أكبر الاسباب شيوعا للالم اسفل الظهر والام الساقين في حالة فشل الإساليب العلاجية التهذيبية في الحصول على نتائج مرضاي للمريض يصبح التدخل الجراحي في صورة تثبت الفقرات القطنية العرضية أكثر طرق العلاج فعالية في تخفيض الام الظهر والساقين.

تتضمن النتائج الجراحي المعايير في تثبت الفقرات القطنية العرضية إجراء جراح طولي منتصف اسفل الظهر مع فصل واسع للعضلات تحت السمحاق المغلق للفقرات القطنية والعرضية و هو ما تم استخدامه لتثبيت الفقرات القطنية العرضية اذ كان يرتبط بإلم حاده باسفل الظهر بعد إجراء الجراحة بالإضافة إلى فقد كمية كبيرة من الدم أثناء الجراحة وكذلك يتطلب ضره إقامة المريض بالشفاء لفترة طويلة بعد إجراء الجراحة.

ومع تطور أساليب التدخل الجراحي المحدود في تثبت الفقرات القطنية العرضية، اتاح نظام تثبت الفقرات عن طريق الجلد فرصة جيدة لتقليل من تدمير الأنسجة أثناء الجراحة بالإضافة إلى تقليل فترة التعافى بعد الجراحة و أيضا لي تحسن مدى الرضا لدى المرضى.

وفي هذا المجال، أقيمت العديد من الدراسات العلمية لمقارنة بين تثبت الفقرات باستخدام طريقة الفتح الجراحي المعتمد لاسفل الظهر وبين تثبت الفقرات باستخدام نتائج تثبت الفقرات عن طريق الجلد في حالات الإصابات والاعراض التنكسية.

هذه الدراسة، تقوم بالمقارنة بين هذين الطريقين فيما يتعلق بالتقنية المستخدمة أثناء الجراحة، وكذلك مقارنة المضاعفات والصعوبات أثناء الجراحة، بالإضافة إلى المقارنة بين نتائج ما بعد الجراحة في الطريقين ومدى رضا المرضى عن النتائج بعد الجراحة.

في هذه الدراسة، نقوم بالمقارنة بين هذين الطريقين فيما يتعلق بالتقنية المستخدمة أثناء الجراحة، وكذلك مقارنة المضاعفات والصعوبات أثناء الجراحة، بالإضافة إلى المقارنة بين نتائج ما بعد الجراحة في الطريقين ومدى رضا المرضى عن النتائج بعد الجراحة.

تتميز تثبت الفقرات القطنية عن طريق الجلد أنه أقل تعودا في الأنسجة، كما انه يقل من فقد الدم أثناء الجراحة بالإضافة إلى قصر مدة الجراحة ما يقنع بالتدخل الجراحي التقليدي وكذلك يقلل من فترة الانتظار والمستشفي بعد إجراء الجراحة.

ومع ذلك فإن الطبيعة التنكسية لمرض التزحزح الفقاري التنكسى والتي يتم ضيقها ضد الفقار العرضية القطنية نتيجة لتضخم الأرجل والعصعص القطنية ما يزيد من احتمال امراض الفقار العرضية القطنية و نقص مساحة الفقار العرضية القطنية وذلك يجعل التحصين الجراحي محدودا في تثبيت الفقرات القطنية أثناء استخدام قصور كمبيوتر يوضع بين الفقار العرضية القطنية و يعتبر من المurities الذي يناسب هذا المرض في بينما يضيف ذلك إلى زمن الجراحة والزمن الزمن للمريض في الانتظار ما بعد الجراحة.

من خلال متابعة المرضى في المجاميعن ما بعد إجراء الجراحة في الشهر السادس والسادس والثاني عشر والثاني عشر، ابدي المرضى في كل المجموعات استجابة جيدة للتدخل الجراحي في جميع الأنسجة في الام الساقين وكذلك استعادة القوة على المقاومة (ODI) المستخدم لقياس الوظيفة البدنية الدورية والمراقبة لوقوع أي نقص في التحصين في الام الساقين وفاة فروع الأمل. في النهاية النتائج الجراحي وعدها وكذلك مقاييس حاليا(VAS).

وفقًا لهذه الدراسة، فإن كلا这两种 الجراحين فعالين في علاج التزحزح الفقاري التنكسى، إلا أن تقنية تثبت الفقرات القطنية عن طريق الجلد تعد أكثر كفاءة وتثبيت جراحي تعليميا أعلى مع النتائج في إجراء تدخل جراحي على نطاق واسع في حالة إجراء الجراحة على نطاق واسع على الأنسجة العضوية والإخراج الفقري القطني من أجل مزيد من الاتصال للعمود الفقري، مما يجعل تقنية الجراحة المفتوحة التقليدية تقنية جيدة وفعالة لعلاج الإزالت الفقري التنكسى.