

Outcome of Modified Wiltse Paramedian Approach For Fusion Of Single Level Lower Lumbar Spinal Instability

Pandey KK, Peepra D, Pawar S

Study performed at Netaji Subash Chandra Bose Medical College, Jabalpur (M.P.)

Abstract

Background: Conventional midline dorsal approach to spine leads to excessive muscle retraction and hence muscular injury, denervation, atrophy or ischemic necrosis. Wiltse paraspinal sacrospinalis-splitting approach prevents these complications. We retrospectively evaluated the outcome of this modified Wiltse approach done for fixation of single level lower lumbar spinal instability.

Material & Methods: 12 patients of single level lumbar spinal instability in vertebral burst fracture or in spondylolisthesis at L4-L5 or L5-S1 level operated via modified Wiltse approach with minimum of one year follow up, were evaluated for pain by VAS score, neurology, blood loss, duration of surgery and hospital stay and radiologically for assessment of pedicle screw fixation.

Results: The mean age in the group was 34.6 years (range 16 to 45 years). 4 patients were male and 8 were female. Mean blood loss for the surgery was 150 ml (range 134 to 170 ml). The average C arm exposure was 12.5 (range 8 to 21). The average length of hospital stay was 3.5 days. None of the patients had any postoperative neurological complications or deterioration. The mean VAS score improved from 8.3 pre-operatively to 3.3 at third postoperative day and finally to 1.2 at one year follow-up.

Conclusion: Wiltse Paraspinal approach, being a muscle sparing approach, provides excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes.

Keywords: Wiltse approach, Paraspinal approach, Spondylolisthesis, Trans-sacrospinalis approach

Address of correspondence:

Dr. D. Peepra,
Associate Professor,
Department of Orthopaedics and
Regional Spinal Injury Center, NSCB
Medical College, Jabalpur (M.P.)
Email – dpeepra@gmail.com

How to cite this article:

Pandey KK, Peepra D, Pawar S. Outcome Of Modified Wiltse Paramedian Approach For Fusion Of Single Level Lower Lumbar Spinal Instability. Ortho J MPC. 2021;27(1): 10-14



Introduction

Conventional open posterior midline approach is the most common approach used for pedicle screws fixation for lower lumbar pathology. This approach requires excessive retraction of the bulky lower lumbar muscles, which results in paraspinal muscle damage and denervation, which may lead to postoperative flat back deformity and chronic back pain [1]. In order to prevent these complications, Wiltse in 1968, developed the paramedian approach, also known as posterolateral or paraspinal

muscle sparing approach. It is based on lateral dissection between the muscles, two finger breadths away from the midline spinous process rather than midline approach elevating the muscles from spinous process, specifically used for the far lateral discectomy. This approach had advantages of minimal muscle injury, lesser intra-operative bleeding and a shorter hospital stay [2]. Later on, he modified his approach to the sacro-spinalis splitting approach to have clear cleavage between multifidus and longissimus paraspinal

muscle [3]. In the process of further refinement, he extended the indications for the approach from lateral discectomy to other uses like insertion of pedicle screws and decompression of the opposite side from inside the vertebral canal [4]. We retrospectively evaluated the results of this modified Wiltse approach done for fixation of single level lumbar spinal instability as an alternative to conventional open posterior approach to avoid muscle damage and reduce radiation exposure.

Material and Methods

This retrospective study was conducted at our tertiary level institute from January 2017 to December 2019 in patients operated for single level lumbar spinal instability at L4-L5 or at L5-S1, via modified Wiltse approach.

Institutional ethical clearance and written informed consent from all the patients was obtained. All patients with lumbar spine instability at L4-5 or L5-S1 operated via modified Wiltse approach with minimum one year follow up were included in the study. Lumbar spine instability was evaluated on dynamic X-ray's and Magnetic resonance imaging. Burst fractures and spondylolisthesis either grade 1 or 2 at single level were included in the study. Patients operated for more than grade 2 listhesis, for more than one level involvement of lower lumbar instability or for lumbar canal stenosis were excluded from study.

All the patients were operated under general anesthesia in prone position over longitudinal bolster under image intensifier. All patients were operated via modified Wiltse approach, via single midline skin incision. After midline skin incision and subcuticular dissection in midline, lumbosacral fascia was identified. Two paraspinous vertical incisions were made through the fascia approximately 3-4 cm lateral to the spinous process at the marked level on both the side. Superficial and deep fascia was split longitudinally along with blunt splitting of sacrospinalis, identifying the clear cleavage plane between the natural gap of multifidus medially and longissimus laterally (fig1). Small amount of fat helped to delineate

this plane. The muscles were then meticulously teased apart in avascular plane till the transverse process. Following this the transverse process and facet joints were palpated and after retraction with Meyerdinger's retractors, the entry point for the pedicle screws was identified at mamillary process. Slightly nibbling the base of superior articular facets, the desired size pedicle screws were inserted into the appropriate vertebra after, inspecting the walls of the channel with a ball-tipped probe. The direction and position of pedicle screw placement was confirmed with fluoroscopy. For applying another pedicle screw, the retractor was moved up or down, maintaining it between the inter-muscular planes. The required numbers of pedicle screws were inserted and then assembly was completed by placing connecting rods. In case, of spinal trauma only pedicles screws were inserted whereas in cases of spondylolisthesis, the facet joint was removed and bone filled inter body cage, was additionally inserted after discectomy and preparation of vertebral body endplates by high speed burr. Local bone grafts were harvested from posterior iliac crest with same incision in case of L5 vertebral burst fracture for posterolateral fusion whereas in cases of listhesis bone graft removed during decompression and facet removed was used for inter body fusion. After checking decompression, fixation and reduction under image intensifier the closure was done with both sides of fascia with running suture without any drain.

Postoperatively, patients were mobilized with help of lumbar corset from second postoperative day and discharged after three to five days. Suture removal was done at two weeks. Patients were followed monthly for three months and then three monthly up to one year. All patients were assessed for pain by VAS score, neurology, blood loss, duration of surgery and hospital stay. Fixation of the pedicle screws was assessed radiologically.

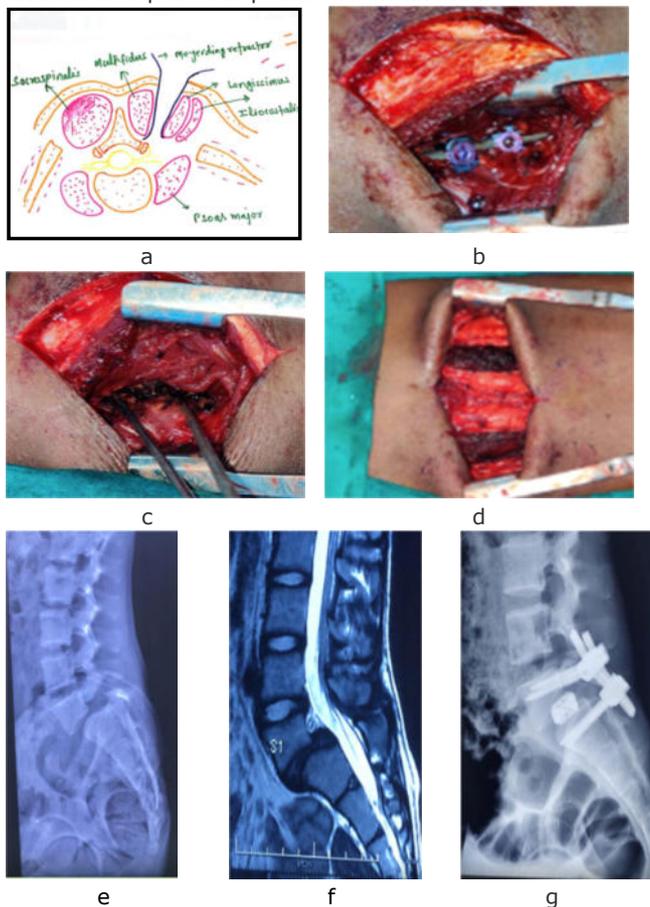
Results

12 patients of single level lumbar spine instability at L4-L5 or L5-S1 were included in the study. The mean age in the group was 34.6 years (range 16 to 45 years). 4 patients

were male and 8 were female. Out of 12 patients, 2 patients were with L5 vertebral body burst fracture, 6 patients had L4-5 and 4 patients had L5-S1 isthmic spondylolisthesis.

Mean blood loss for the surgery was 150 ml (range 134 to 170 ml). The average C arm exposure was 12.5 (range 8 to 21). The average length of hospital stay was 3.5 days. None of the patients had any postoperative neurological complications or deterioration. The mean VAS score improved from 8.3 pre-operatively to 3.3 at 3rd post-operative day and finally to 1.2 at one-year follow-up. None of the patients needed any analgesic medications at 1-year follow-up. Follow up anteroposterior and lateral X-rays at 1-year showed stable hardware with no screw loosening, infection or any root symptoms in any case (fig 1).

Fig 1. Illustration (a) and intraoperative photographs (b to d) showing modified Wiltse approach between multifidus and longissimus with two vertical paramedian facial opening with single midline skin incision, the pedicle geometry and muscle sparing approach with pedicle screw insertion. Preoperative lateral (e) X rays and sagittal MRI scan (f) of 18 years' patient with L5-S1 spondylolisthesis. Postoperative lateral X rays (g) showing inter body fixation with posterior pedicle screw fixation.



Discussion

Conventional midline dorsal approach to spine involving erosion of paraspinal muscles from spinous process leads to excessive muscle retraction by retractors while approaching far lateral side [1]. Prolonged overstretching of the paraspinal muscle by retractors also occurs during exposure of entry points for pedicle screw fixation. This stretching can damage the posteromedial branch of the spinal nerves and descending branches of posterior lumbar artery supplying the muscle [5-7]. This can cause muscular injury, denervation, atrophy or ischemic necrosis of muscle leading to poor outcome with increased chronic pain or failed back [1]. This paraspinal muscle damage have been described by numerous authors and also confirmed by increased muscular edema and levels of inflammatory mediators in patients undergoing conventional midline muscle-stripping approach versus those undergoing surgery by minimally invasive approach [8-13].

Wiltse's, paraspinal sacrospinalis-splitting or trans-sacrospinalis approach to the lumbar spine, prevents these complications by reducing excessive retraction of paraspinal muscles because this approach involves access to the spine from lateral side through the muscular plane between multifidus and the longissimus parts of the sacrospinalis muscle [2-4]. The advantage of this approach is that it offers a more direct route to the pedicle screws entry point i.e. transverse processes and facets of the lumbar spine with almost minimal muscle stretching and less bleeding than through the midline approaches [14,15]. Olivier et al in their cadaveric study documented that two incisions 3 cm away from the midline, are in the middle of the two vascular networks which prevents the skin necrosis [16]. Further, moving the retractor between and maintaining the intermuscular planes, places minimal pressure on the muscles and that too only for very short time which avoids any undue pressure on the muscle, thereby decreasing muscle ischemia and related problem. Thus this approach maintains the integrity of the paraspinal musculature and soft tissues. Wiltse Paraspinal

approach, being a muscle sparing approach, has many advantages as compared to the traditional midline approach like excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes [17].

We retrospectively reviewed the results of this modified Wiltse's approach, used for fixation of 12 patients with mean age 36.4 years of single level lumbar instability in vertebral burst fracture or in spondylolisthesis at L4-L5 or at L5-S1 level and found the approach to be safe, minimally disruptive, less damage to the paraspinal musculature and improved outcome as seen in improved VAS score. The radiation exposure in our series was also quite low by this approach, which is due to better direct visualization of the pedicle screw entry point which is a therapeutic benefit of this approach, in contrary to increased radiation exposure by percutaneous techniques which are associated with higher radiation exposure [18]. Recently this approach is widely used for non-fusion dynamic lumbar spine stabilization as it is

quicker and safer [18,19]. The approach can be done via minimally invasive means also for easy access to extraforaminal and foramina part of disc space, which further decreases muscle damage and blood loss.

Wiltse approach is limited by lesser operating space and less obvious surrounding anatomic landmarks which can be overcome by better magnification with loop and clear intraoperative imaging. It allows for placement of screws from the facet in a more lateral to medial trajectory leading to higher chances of facet violation, and hence the surgeon must be very careful when placing screws [21].

Conclusion

Modified Wiltse approach can be used safely for fusion of single level lower lumbar spinal instability with early ambulation and minimal morbidity. Wiltse Paraspinal approach, being a muscle sparing approach, provides excellent exposure to transverse process, minimal intraoperative bleeding, low infection rate, low postoperative morbidity and improved outcomes

References

1. Kim CW. Scientific basis of minimally invasive spine surgery: prevention of multifidus muscle injury during posterior lumbar surgery. *Spine (Phila Pa 1976)*. 2010;35:281-6.
2. Wiltse LL, Bateman JG, Hutchinson RH, Nelson WE. The paraspinal sacrospinalis-splitting approach to the lumbar spine. *J Bone Joint Surg Am*. 1968;50(5):919-26.
3. Wiltse LL. The paraspinal sacrospinalis-splitting approach to the lumbar spine. *Clin Orthop Relat Res*. 1973;91:48-57.
4. Wiltse LL, Spencer CW. New uses and refinements of the paraspinal approach to the lumbar spine. *Spine (Phila Pa 1976)*. 1988;13(6):696-706.
5. Waschke A, Hartmann C, Walter J, Dunisch P, Wahnschaff F, Kalff R, Ewald C. Denervation and atrophy of paraspinal muscles after open lumbar interbody fusion is associated with clinical outcome electromyographic and CT-volumetric investigation of 30 patients. *Acta Neurochir (Wien)*. 2014;156(2):235-44.
6. Pourtaheri S, Issa K, Lord E, Ajiboye R, Drysch A, Hwang Ki, Faloon M, Sinha K, Emami A. Paraspinal Muscle Atrophy After Lumbar Spine Surgery. *Orthop*. 2016;39(2):209-14.
7. Li, H., Yang, L., Xie, H., Yum, L., Wei, H. and Cao, X. Surgical Outcomes of Mini-Open Wiltse Approach and Conventional Open Approach in Patients with Single-Segment Thoracolumbar Fractures without Neurologic Injury. *J Biomedical Res*. 2015;29:76-82.
8. Rantanen J, Hurme M, Falck B, et al. The lumbar multifidus muscle five years after surgery for a lumbar intervertebral disc herniation. *Spine*. 1993;18(5):568-74.
9. Mayer TG, Vanharanta H, Gatchel RJ, et al. Comparison of CT scan muscle measurements and isokinetic trunk strength in postoperative patients. *Spine*. 1989;14(1):33-6.
10. Kawaguchi Y, Yabuki S, Styf J, et al. Back muscle injury after posterior lumbar spine surgery. Topographic evaluation of intramuscular pressure and blood flow in the porcine back muscle during surgery. *Spine*. 1996;21(22):2683-8.

11. Kawaguchi Y, Matsui H, Tsuji H. Back muscle injury after posterior lumbar spine surgery. Part 2: Histologic and histochemical analyses in humans. *Spine*. 1994;19(22):2598-602.
12. Sihvonen T, Herno A, Paljarvi L, Airaksinen O, Partanen J, Tapaninaho A. Local denervation atrophy of paraspinal muscles in postoperative failed back syndrome. *Spine*. 1993;18(5):575-81.
13. Stevens KJ, Spenciner DB, Griffiths KL, et al. Comparison of minimally invasive and conventional open posterolateral lumbar fusion using magnetic resonance imaging and retraction pressure studies. *J Spinal Disord Tech*. 2006;19(2):77-86.
14. Fan SW, Hu ZJ, Fang XQ, Zhao FD, Huang Y, Yu HJ. Comparison of paraspinal muscle injury in one-level lumbar posterior inter-body fusion: modified minimally invasive and traditional open approaches. *Orthop Surg*. 2010;2(3):194-200.
15. Vialle R, Wicart P, Drain O, Dubousset J, Court C. The Wiltse Paraspinal Approach to the Lumbar Spine Revisited: An Anatomic Study. *Clin Orthop Relat Res*. 2006;445:175-80.
16. Olivier E, Beldame J, Slimane M, Defives T, Duparc F. Comparison between one midline cutaneous incision and two lateral incisions in the lumbar paraspinal approach by Wiltse: A cadaver study. *Surg Radiol Anat*. 2006;28:494-7.
17. Street JT, Andrew Glennie R, Dea N, DiPaola C, Wang Z, Boyd M, Paquette SJ, Kwon BK, Dvorak MF, Fisher CG. A comparison of the Wiltse versus midline approaches in degenerative conditions of the lumbar spine. *J Neurosurg Spine*. 2016;25(3):332-8.
18. Anekstein Y, Brosh T, Mirovsky Y. Intermediate screws in short segment pedicular fixation for thoracic and lumbar fractures: a biomechanical study. *J Spinal Disord Tech*. 2007;20(1):72-7.
19. Anand N, Baron EM, Bray RS Jr. Modified muscle-sparing paraspinal approach for stabilization and interlaminar decompression: a minimally invasive technique for pedicle screw-based posterior nonfusion stabilization. *SAS J*. 2008;2(1):40-2.
20. Behairy HM. Utilizing Wiltse approach for minimal access posterolateral lumbar stabilization. *Open J Modern Neurosurg*. 2018;8:101-8.
21. Shah RR, Mohammed S, Saifuddin A, Taylor BA. Radiologic evaluation of adjacent superior segment facet joint violation following transpedicular instrumentation of the lumbar spine. *Spine*. 2003;28(3):272-5.