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Early Experience of Using Transfacetal Screws for Lumbar Spine Stabilization without Decompression in Cases of Degenerative Spine Disease

Amr Adel Abd-Elaal, Mohammed Abd-EL-Baset Hegazy*, Mahmoud Elsayed Massoud
Spine Surgery Department, Helmeya Military Hospital, Military Academy, Cairo, Egypt
***Corresponding author:** Mohammed Abd-Elbaset Hegazy, **Email:** moh7503174@gmail.com, **Phone:** +201271402041

ABSTRACT

Background: The 1ry event that begins and propels the procedure of spinal degeneration is generalized or segmental spinal instability. The 2ry spinal events to 1ry spinal instability have been determined as all identified consequences of spinal degeneration, including ligamentum flavum collapse, disc space reduction and osteophyte formation.
Aim: To assess the effect of tranfacetal fixation of lumbar spine in degenerative spine disease.
Patients and Methods: Fourteen cases with spinal segmental vertical instability associated with lumbar canal stenosis have been managed at Helmeya Military Hospital through the transfacetal implantation of screws into each articular assembly.
Results: Throughout the follow-up period, all cases who were treated reported a high degree of satisfaction with the relief of their symptoms, and their spinal levels demonstrated robust bone stabilization. There were no complications associated with the insertion of the screws. Screw misplacement or implant rejection were not observed.
Conclusions: The spinal segment can be securely fixed and stabilized by inserting screws into the firm and predominantly facets cortical bones of the spine.
Keywords: Facets, Transfacetal screws, Lumbar instability, Lumbar canal stenosis.

INTRODUCTION

According to the new concept of **Prof. Atul Goel**, the spinal degeneration nodal point was instability of vertical spinal, which has been characterized by telescoping or spondylolisthesis of the superior facet over the inferior facet [(1)]. It has been proposed that degenerative spondylosis is not caused by disc degeneration, disc space reduction, or disc water content reduction. Rather, spinal instability, whether it be segmental or generalized, is the essential event that gets the process started and drives it forward [(2)].

All the identified outcomes of spinal degeneration, as the loss of disc space, the buckling of ligamentum flavum, and the formation of osteophytes, have been recognized as the 2ry spinal events that lead to 1ry spinal instability. The spinal segment instability is the main reason for symptoms associated with degenerative spondylotic radiculopathy. It is also the nodal site of pathogenesis because it brings about the condition. The only treatment involves spinal stabilization, which is accomplished by simple procedures [(2)].

It is generally accepted that the prolonged result of unmanaged prolapse of disc is the resorption of the herniated portion, which is subsequently followed by intervertebral body bone fusion. Thus, instability of vertical spinal is the nodal point of the pathogenesis of a variety of entities that are encompassed under the umbrella term of degenerative spinal diseases. Consequently, the only therapy we utilize is spine fixation to rectify the process. There is no requirement for direct decompression of soft tissue or bone [(3)].

Spinal stabilization methods have had remarkable enhancement in the last few decades. Transfacetal screw insertion appears to have been underutilized for surgical management, even though the safety, simplicity, and pedicles firmness make it a highly popular and viable technique for lumbar stabilization utilizing poly-axial screws and rods [(4)].

The procedure is made easier and safer by the vertical orientation of the joint, the large size, and firmness of the facet bones. The biomechanical advantage of the technique is derived from the potential to open the joint, denude articular cartilage, insert a bone graft into the joint cavity, and secure the joint at the fulcrum of spinal movements [(5,6)].

In the current study, we discussed the technical intricacies of transfacetal screws and shareed our experience with the use of 2 screws for each facet.

PATIENTS and METHODS

Throughout the duration from July 2024 to September 2024, Spine Department in Helmya Military Hospital treated 14 cases (10 males and 4 females) having degenerative spine disease with only fixation by transfacetal screws. The medical history of each case has been thoroughly examined, and a physical examination and neurological evaluation were conducted. X-rays (flexion/extension lateral lumbar, lateral lumbar, standing anteroposterior) and computed tomography or magnetic resonance imaging of the lumbar spine have been conducted in all cases. The patients' ages varied from twenty to sixty-five years. Classical clinical characteristics of degenerative spine disease were present in all cases. In all patients, there was a mild neurological deficit, whether it be sensory or motor. In this research, the cases have been managed according to our recent philosophy of "only fixation". The operation has been designed to achieve arthrodesis of the managed segments, and no bone decompression has been performed. The surgery has been performed at 1 level in one case, at 2 levels in three cases, at 3 levels in six cases, at 4 levels in three cases, and at 5 levels in one case. The implantation of "double insurance" screws has been performed in facet joints, out of the eighty-four joints that were managed.

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Ethical Consent

Authorization for the investigation was procured from the Academic and Ethical Committee of Helmeya Hospital. Each participant provided informed written consent for data collection prior to inclusion in the study. This research was meticulously conducted in strict alignment with the ethical standards delineated by the global Medical Association's Declaration of Helsinki concerning human subject investigation.

Surgical Technique

The cases were positioned prone for the operation, and the surgery table was angulated properly to eliminate the lordosis and position the low back in a flexed or horizontal situation.

Visual identification parameters and fluoroscopic assessment were utilized to verify the area of operation. Following a midline skin incision, the spine was expanded laterally to reveal the articular joint cavity and the facets through sharp dissection. Diathermy was not utilized to alleviate postoperative discomfort. The levels of fixation of spinal segmental were determined by the status of the facet joints, in addition to the radiological and clinical parameters. An open joint cavity and mal-aligned articular surfaces were present in the joints of facets that were visually determined to be unstable. The decision regarding the requirement of fixation was significantly influenced by **Dr. Atul Goel**'s personal experience in evaluating the degree of stability and managing the joints. Before any instrumentation was performed, the facetal exposure was initially acquired at all levels and their status was verified. The medial (or inferior facet of rostral vertebra) facet was extensively exposed at the planned management level through the use of precise dissection. The screws were inserted in accordance with the parameters that had been previously discussed, after guide holes were 1st created using a power-driven drill [(3)].

Anatomical concerns: An angle of approximately ninety to one hundred and ten degrees from transverse body plane was where the facet joint of the spine is located. In the rostral vertebra, the inferior facet of the articulation was determined by the medial facet of the articulation, while the lateral facet was the superior facet of the caudal vertebra. In the inferior facet of the rostral vertebra, the upper or superior screw was inserted three millimeters beneath the superior edge and six millimeters medial to the facet articular edge. The inferior or lower screw was placed in a position in line with the inferior edge of the lamina, about five millimeters above the inferior edge and eight millimeters medial to the articular edge of the facet. The screws were angled at an angle of sixty-five degrees lateral and thirty-five degrees inferior to the horizontal or transverse plane of the superior screw, and at an angle of sixty-five degrees lateral and twenty degrees inferior to the inferior screw, both of which were directed toward the superior or lateral facet of cervical vertebra. The suggested location and angle of screw insertion caused the screw to pass from the transverse course to the junction of pedicle and the base of the transverse **process** (**Figure 1**).

On average, the utilized screws were eighteen millimeters in length and 2.8 millimeters in thickness. The superior screw was inserted at an angle that was perpendicular to the facet line. The facets and lamina were then covered with bone graft material that had been ground through the spinous process into small fragments following the host bone that had been correctly prepared[(4)] **.**

Figure 1: Shows intraoperative foto after screw insertion.

Figure 2: Shows pre- and post-operatve imaging.

Following surgery, the cases have been mobilized with the attention to prevent heavy work and exercises for a duration of approximately three months. Throughout this time, it was recommended that a lumbar girdle be worn. All activities, including athletics, had been allowed following three months.

Table 1: Advantages of transfacetal fixation [7].

Shorter duration of operation.
Short segment fixation.
Less hardware. Low cost.
Lower occurrence of neurological injury as the screws traverses the lamina tangential to the spinal canal.
Artifacts in the MRI following surgery don't obscure the spinal canal.
Large surface area is available for graft placement as most of the posterior arch still intact.
Adjacent facet joints aren't disturbed.
Insertion of screw through the lamina minimizes screw contact with muscle as only the 2 screw heads project above the level of the bone.
May be utilized to attain worldwide fusion with limited intervention from the posterior aspect.
Comparatively easy learning curve.

Statistical analysis:
Data were calculated and presented as frequency and percentage.

RESULTS

Throughout the average monitoring duration of three months, all the patients who were managed had a high satisfaction index with relief of symptoms. In this investigation, the result was assessed using the VAS and ODI scales. No case of infection, screw back-out, or implant rejection has been observed.

Table 2 Clinical results of transfacetal screw fixation

Number of levels / Results	Excellent	Good	Fair	Poor
1 level (1 case)	1 (100%)	-	-	-
2 levels (3 cases)	2 (67 %)	1 (33%)	-	-
3 levels (6 cases)	4 (67%)	2 (33%)	-	-
4 levels (3 cases)	3 (100%)	-	-	-
5 levels (1 case)	-	1 (100%)	-	-

DISCUSSION

Regardless of its description in 1944, the transarticular or transfacetal screws weren't frequently utilized for spinal fixation [8]. There are a small number of papers that address the technical aspects and the benefits (or drawbacks) of utilizing these screws [7]. The widespread use of screw-rod systems for stabilization is a result of the technique's simplicity and safety, as well as the secure acquisition of screws into the firm and great pedicles. The biomechanical efficacy of transfacetal screws has been validated by a limited number of investigations. **Vanden Berghe *et al.*** discovered that the biomechanical characteristics of facet fixation and pedicle screw fixation are comparable [9].

Several technical differences were addressed about transfacetal screws implantation. The translaminar transfacetal technique of insertion of screw was the subject of Magerl's discussion [10].

Rajasekaran and Naresh-Babu deliberated on the contralateral side for translaminar facetal screw insertion. When utilizing this method, the screw is initially placed into the base of the opposing lamina, and then it proceeds to pass through the material of the lamina prior to commencing its transfacetal course [7]. In their study, **Jang *et al.*** used a percutaneous approach for the implantation of translaminar facetal screws along the spine. This is the primary region of the spine that is involved in all the main spinal motion. The determination of the precise location of the fulcrum of motions, as opposed to a point that is situated at a distance from the origin of the activity, has different biomechanical advantages, as is the case in other regions of the spine. The screw prevent damage to the neural structures by traveling away and laterally from the dural tube under direct vision. The nerve root is distant from the lateral course. A considerable edge over the transfacetal fixation procedure is provided by the remarkable simplicity of the method and the ability to conduct fixation of screw under direct vision. The lumbar interbody fusion procedure can be managed by sectioning the spinous process at its base, which provides an appropriate angle for screw insertion [11].

Shin *et al.* stated the application of fluoroscopy for the purpose of evaluating the placement of screws with a percutaneous approach [12]. There are several distinct advantages that transfacetal screws offer for segmental spinal fixation; yet these advantages have been plainly neglected. The facetal articulation serves as the focal point or pivot for major motions at the level. The only true joint of angulation is the facet joint. There is a significant reduction in the amount of metal that is utilized for fixation than the pedicular polyaxial screw-rod technique of fixation. The time required for the insertion of the screws is nearly equivalent to the time required for the creation of the guide hole, then the insertion and securing of the screws. Transfacetal screw insertion is a fixation technique that is recognized for its distinct superiority due to its safety, unparalleled ease, rapidity of technique, and evident biomechanical advantages. The technique is further strengthened by the potential for the insertion of 2 screws in each facet, or the "double insurance" method for insertion of screw[13]. The validity of this method is supported by the successful clinical outcomes of all patients.

CONCLUSION

Facet distraction and fixation has demonstrated to be a safe and effective alternative to other techniques. In addition, considering that facet instability could be involved in the cascade of events that ultimately result in spinal canal stenosis, facetal fixation offers the

opportunity to directly counteract part of the pathogenetic mechanisms underlying spine degeneration.

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