

## Management of postoperative Complications after posterior lumbar spinal fixation

Mohamed Abd-Elbary Abd-Elaziz Al Saadwy, Yousof Barakat, Mohamed Fouad, Abd-Elaleem Abd-Elaleem Elgendy, Sayed Roshdy

Neurosurgery Department, Faculty of Medicine, Al-Azhar University

### ABSTRACT

**Background:** For increasing safety and reducing complications that may occur with Trans-Pedicular Screw Placement, different ways have been reported including application of C-arm X-ray view, application of axial computed tomography scan (CTS), frameless stereotactically guided screw placement and different guidance devices. However, the application of all these devices and techniques are not so easy and even in many operating rooms such kinds of instruments are not available. A posterior approach to anterior and middle column reconstruction is often preferred in the lumbar spine for two reasons, the first is that the morbidity associated with an anterior approach is significant and delays recovery, the second is that pedicle screws and rods or plates can be placed before dural retraction and dissection of the intervertebral disk. **Aim of the Work:** The aim of this work was to evaluate the postoperative Complications. In posterior lumbar transpedicular fixation and their management. **Patients and Methods:** Retrospective and prospective study for evaluating the history, clinical state, laboratory investigations, radiological findings and way of management in 25 cases of postoperative Complications after posterior lumbar spinal fixation. **Results:** 25 patients operated upon for posterior lumbar fixation were included in the present work, In the current work we divided complications of posterior lumbar fixation into intraoperative complications and postoperative complications, Among the 25 patients of our work we had 5 cases of intraoperative complications (20 %) and 20 cases of postoperative complications (80%), Dural tear was the most common intraoperative complications (8%), instrument failure was the most common postoperative complications 12 cases (48%). **Conclusion:** According to medical history smoking was statistically significant risk factor for intraoperative complications; significant epidural bleeding and dural tear. Hypertension was statistically significant risk factor for intraoperative complications; inappropriate screw insertion and fracture pedicle. Also, smoking was Statistically significant risk factor for development of postoperative complications; infection, C.S.F leak, infection, nerve root injury and pseudoarthrosis.

**Keywords:** Complications of posterior lumbar spinal fixation, Management of complications of lumbar fixation

### INTRODUCTION

Since the 1940's, pedicle screw fixation has evolved and become increasingly popular among spine surgeons. It designed to provide immediate stability and rigid immobilization of the spine without sacrificing additional motion segments required by other forms of conventional instrumentation. The design of the pedicle screw continues to be modified and updated for improved strength and purchase, New systems and techniques are continuously becoming available, and old systems are being modified and up-dated<sup>(1)</sup>.

There are three basic concepts that are important to the biomechanics of pedicle screw based on instrumentation. First, the outer diameter of the screw determines pullout strength, while the inner diameter determines fatigue strength. Secondly, when inserting a pedicle screw, the dorsal cortex of the spine should not be violated and the screws on each side should converge and be of good length. Thirdly, fixation can be augmented in cases of severe osteoporosis or revision. Studies on the biomechanics of the pedicle screw can be divided into three types: those that concern the characteristics of the screw itself,

those that address how they are inserted and those that deal with augmentation techniques<sup>(2)</sup>.

For increasing safety and reducing complications that may occur with trans-Pedicular Screw Placement, different ways have been reported including application of C-arm X-ray view, application of axial computed tomography scan (CTS), frameless stereotactically guided screw placement and different guidance devices. However, the application of all these devices and techniques are not so easy and even in many operating rooms such kinds of instruments are not available<sup>(3)</sup>. Pedicle screw systems provide significant and in many cases, improved and previously unattainable spinal fixation. However, pedicle screw systems represent difficult surgical techniques involving several potential problems and complications. Several different sizes and shapes of pedicle screws are available<sup>(4)</sup>.

A posterior approach to anterior and middle column reconstruction is often preferred in the lumbar spine for two reasons, the first is that the morbidity associated with an anterior approach is significant and delays recovery, the second is that pedicle screws and rods or plates can be placed before Dural retraction and dissection of the intervertebral disk<sup>(5)</sup>.

Causes of posterior lumbar spinal fixation:

1. Spinal fractures; The goals of the treatment of spinal fractures are fracture reduction, spinal canal decompression, and rigid stabilization of the spine to allow early mobilization. 2. Tumors and infection; The advantages of pedicle screw fixation in tumors or infection is based on the three-dimensional positional control and the rigid fixation. 3. Scoliosis; In scoliosis, the classic concept of correction with Harrington instrumentation is based on distraction of the concavity of the curve. 4. Spondylolisthesis; Since the first description of this procedure by Harrington, pedicle screws have been used to reduce high-grade spondylolisthesis. 5. Low-back pain; In low-back pain disorders, pedicular screw fixation allows a rigid segmental stabilization of the vertebral segments even in the absence of posterior elements (e.g., after laminectomies) <sup>(6)</sup>.

**Complications:** 1. The intraoperative complications; dural tearing, nerve injury (for example, cauda equina and/or nerve root damage), Pedicle fractures and pedicle screw malposition 2. The early postoperative complications; major complications such as pulmonary, cardiac, and cerebrovascular morbidity, infection, hardware failure (malposition, breakage or loss of correction.), and neurological complications. Postoperative wound infection is often subdivided into early and delayed infection, Infections are also deep (subfascial) and superficial (suprafascial) infection, Postoperative neurological complications were classified into three categories; 1- increased leg pain without motor loss, 2 - slight motor loss, with or without increased leg pain; 3- Severe motor loss, with or without increased leg pain.

3. The late postoperative complications; late infection, hardware failure, nonunion, and adjacent- segment degeneration <sup>(6,7,8,9,10,11)</sup>.

Management of Postoperative complications according to the type of complications: 1. Dural tear; Dural repair. 2. Screw mal position; reconstruction. 3. pedicle fracture and hardware loosening requiring immediate revision of surgery. 4. Screw breakage months after surgery; radiographical follow-up, revision surgery, hardware removal only, hardware removal and additional decompression, PLIF combined with decompression., screw corrections <sup>(6)</sup>. 5. Superficial

wound infection this settled spontaneously with appropriate antibiotics. 6. Deep infections; revision surgery, placement of an irrigation suction system, removal of infected tissues, necrotic muscle nonviable, Systemic antibiotic agents combined with an antibiotic containing irrigation system, Removal of spinal instrumentaion and follow up <sup>(12)</sup>.

## AIM OF THE WORK

The aim of this work was to evaluate the postoperative Complications. In posterior lumbar transpedicular fixation and their management. **The study was approved by the Ethics Board of Al-Azhar University.**

## PATIENTS AND METHODS

Presentation of different types of postoperative Complications after posterior lumbar spinal fixation and identifying their management strategies, retrospective and prospective study for evaluating the history, clinical state, laboratory investigations, radiological findings and way of management in 25 cases of postoperative Complications after posterior lumbar spinal fixation.

**Inclusion criteria:** All patients of both sexes and any age with clinical picture and radiological findings of different lumbar spine pathologies included in the study.

**Exclusion criteria:** 1- Patients with anterior and circumferential lumbar fixation. 2- Patients with uninstrumented posterior lumbar fixation. 3- Patients with different lumbar pathologies treated with conservative treatment without surgical interference.

All patients were subjected to full history taking, complete neurological examination. Personal history: Name. Age. Sex. Residence. Occupation.

Special habits of medical importance: To exclude health problems that may affect fitness of the patient for surgery.

Complaint: In the patient's own words.

Present history: This included the mode of onset, the duration and the course of illness, data concerning the presence of pain, nerve affection, motor weakness, sphincteric affection or constitutional inflammatory symptoms.

Past history: Preoperative complain, blood transfusion, bed stay postoperatively and drugs taken pre and postoperatively.

Past history of hypertension, diabetes mellitus, tuberculosis, other renal, cardiac, chest disease and other surgery.

All these data were analyzed to assess the general condition of the patient and fitness for surgery.

Family history: Family history of diabetes, hypertension and similar conditions were asked about.

Clinical examination: Examination of the patient included the general, local and neurological examinations.

I- General examination: The routine general examination was applied for every case including general appearance, pulse, temperature, blood pressure, respiratory rate, chest, heart, abdomen, urogenital and skeletal systems.

II- Local examination of wound site. Tissue inflammation or infection, moisture and edge of the wound.

III- Neurological examination: Complete neurological examination as follows: Motor system examination: posture, muscle state, muscle tone and power. Sensory system examination: superficial, deep and cortical sensations. Reflexes: superficial reflexes (abdominal, planter, cremasteric, gluteal, and anal reflexes), deep jerks of the four limbs (biceps, triceps, finger, supinator, knee and ankle reflexes) and special reflexes. Sphincters: disturbed bowel or bladder functions.

Investigations: Laboratory investigations. CRP. White blood cell count. ESR. CSF chemical analysis and culture for meningitis associated cases. Wound swab for superficial wound infection cases. Disc biopsy. Full blood picture. Blood urea and serum creatinine. Liver function tests. Fasting blood sugar and blood sugar two hours after food intake. Urine analysis.

Radiological investigations: Plain X-ray of the lumbar spine including; antero-posterior, lateral views and flexion and extension dynamic study. Computed Tomography (CT) of the lumbar spine. Magnetic Resonance Imaging (MRI) of the lumbar spine.

### Statistical analysis

Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Sciences) version 24. Data were summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using

frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using unpaired t test.

## RESULTS

25 patients operated upon for posterior lumbar fixation were included in the present work. The data collected from these cases were tabulated and analyzed. Characteristics of the work population.

### 1- Age distribution

The age of the patients included in the present work ranged between 25 – 65 years. The most common age group was 35-50 year (Table 1).

**Table (1):** Age distribution.

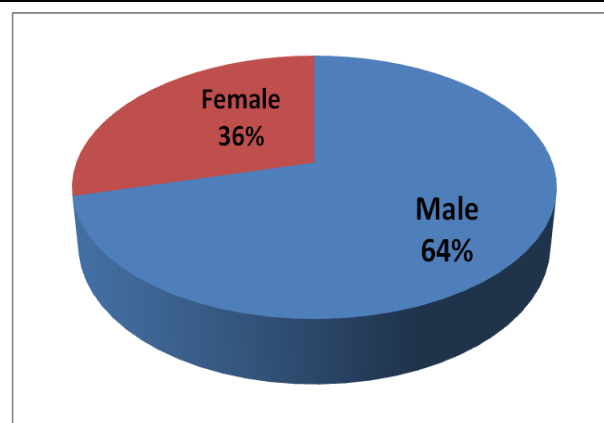
Age	No	%
25-34	2	8%
35-44	11	44%
45-54	8	32%
>55	4	16%

### 2- Sex distribution

In the present work there were 9 females and 16 males (table 2), (fig 1). There was no significant difference among the studied groups as regard gender differences.

**Table (2):** Sex distribution of the studied cases.

Sex	No	%
Male	16	64%
Female	9	36%



**Figure (1):** Sex distribution.

### 3- Previous medical history of the studied cases

In the present work, the medical history of our patients (table 3) revealed that 4 patients were hypertensive, 2 were diabetic, 1 patients had cardiac disease with drug history of oral anticoagulant, 6 patients was smoker, 5 patients was obese with body mass index more than 25%, 4 patients had hepatitis C, 1

patients had renal problems. Regarding the surgical past history, all patients had undergone previous spinal surgery in the form of laminectomy, hemilaminectomy, discectomies, or attempted lumbar fixation.

**Table (3):** Previous medical history.

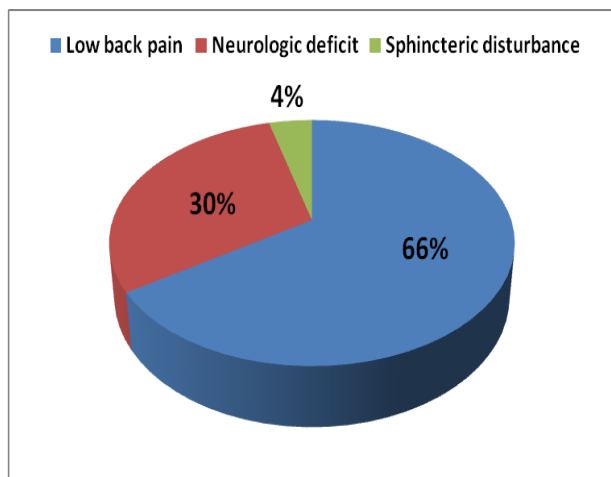
Past history	No	%
Hypertension	4	16%
D.M	2	8%
Cardiac disease with oral anticoagulant	1	4%
Smoking	6	24%
Obesity	5	20%
Hepatitis C	4	16%
Renal problem	1	4%
Previous spinal surgery	25	100%

**4- The clinical presentation**

Back pain with or without sciatica was the most common complaint among patients involved in the work (66%). The neurologic motor or sensory deficits were presenting symptoms in 30% of the cases while sphincteric disturbance was noted in 4% of the cases (Table 4, fig 2).

**Table (4):** Clinical presentation.

Presentation	%
Low back pain	66%
Neurologic deficit	30%
Sphincteric disturbance	4%



**Figure (2):** The clinical presentation.

**5- Neurological examination**

The most common neurological sign among the studied cases was sensory deficit found in 8 patients compared to combined motor and sensory deficits which were detected in 3 patients. There were 1 cases of cauda equina syndrome (motor, sensory & Sphincteric deficits) (Table 5).

**Table (5):** Neurological examination.

Neurological signs	No	%
Motor deficits	3	12%
Sensory deficits	8	32%
Motor and sensory deficits	3	12%
Cauda equina syndrome	1	4%

**6- The preoperative radiological examination**

Plain-X-ray, CT, and MRI were done for all the cases preoperatively.

**7- Type of lumbar pathology**

The indications to perform a posterior approach in the present work included; Infection, degenerated disc disease (DDD), failed back syndrome, spondylolisthesis, fractures (Table 6).

**Table (6):** Type of lumbar pathology.

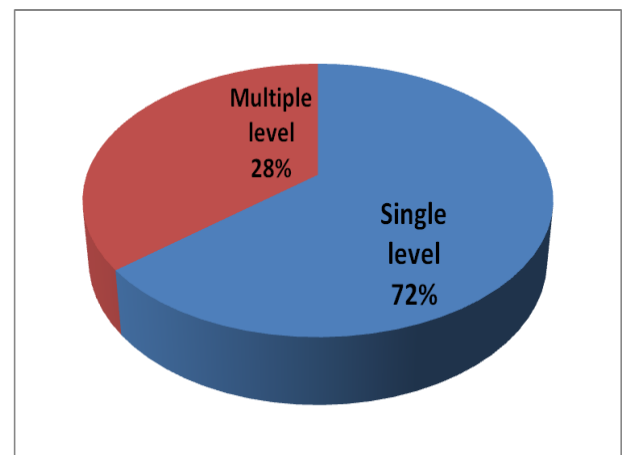
Indication	No	%
Fractures	1	4%
Spondylolisthesis	18	72%
Failed back syndrome	2	8%
DDD	2	8%
Infection	2	8%
Total	25	100%

**8- Levels of lumbar spine fixation:**

In the present work the single level was the most commonly used level followed by multiple levels of fixation (Table 7, fig 3).

**Table (7):** Level of lumbar spine fusion.

Level of fixation	No	%
Single level	18	72%
Multiple level	7	28%



**Figure (3):** Levels of lumbar spine fixation.

**Analysis of results of posterior lumbar fixation:**

Average skin incision length in the current work surgeries was 12 cm (range, 8-20 cm). The average blood loss was 300 ml (range, 200-1500),

blood transfusion was needed in 6 patients. The average surgery time was 150 minutes (range, 120-250). The average hospital stay was 5 days (range, 3-15). The average follow-up was achieved in all patients at a mean of 12 months (range, 6-18) through clinical and radiological examination. Results show that the average skin incision length, the average blood loss, the average surgery time, and the average hospital stay were higher in cases of lumbar fractures than in cases of DDD and spondylolithesis.

**Table (8):** Results of instrumented posterior lumbar fixation.

Results	
Average skin incision length (range) (cm)	12 (8-20)
Average blood loss (range)(ml)	300 (200-1500)
Transfusion (no. Of pts)	6
Average surgery time (range)(minutes)	150 (120-250)
Average hospital stay (range)(days)	5 (3-15)
Average follow-up (range)(months)	12 (6-18)

**Complication of posterior lumbar fixation:**

In the current work we divided complications of posterior lumbar fixation into intraoperative complications and postoperative complications and relation to various risk factors were discussed and compared to literature. Among the 25 patients of our work we had 5 cases of intraoperative complications and 20 cases of postoperative complications (Table 9).

**Table (9):** Complication of postoperative posterior lumbar fixation.

	No.	%
Intraoperative complication	5	20%
Inappropriate screw insertion	1	4%
Fracture pedicle	1	4%
Significant epidural bleeding	1	4%
Dural tear	2	8%
Postoperative complication	20	80%
Infection	2	8%
C.S.F leak	2	8%
Nerve root injury	1	4%
Pseudoarthrosis	2	8%
Instrument failure	12	48%
DVT	1	4%

**DISCUSSION**

More than 40,000 lumbar fusion procedures were performed in the United States each year. This number represents 20% of all lower back operations. Approximately half of these procedures were combined with instrumentation, and this combination has increased the complication rate and the percentage of patients discharged to nursing homes. Furthermore, spinal fusion increases the hospital and surgeon costs

by 50%; if instrumentation is added, the total cost increases by 100%.<sup>(13)</sup>

Assessment of the efficacy of a fusion procedure must include a thorough and long-term evaluation of cost, radiographic fusion, complications, clinical outcome, level of physical activity, and patient satisfaction<sup>(14)</sup>.

Both psychological factors and workers' compensation are confounding variables that must be considered. For example, Franklin and colleagues evaluated lumbar fusion with and without instrumentation in patients who received workers' compensation in Washington State. Sixty-eight percent reported that their back or leg pain was worse, whereas 56% reported that their overall quality of life was unchanged<sup>(15)</sup>.

**Patient characteristics**

The age of the patients included in the present study ranged from 25 years to 60 years with the age mean being 35.0 years. This data coincides with that of de Schepper et al series where the age ranged from 20 years to 70 years with the mean age being 35.0 years<sup>(14)</sup>.

The incidence of intraoperative complication was 20% during each age groups<sup>(15,16)</sup> while it was 12.5% in *Elliott et al.*<sup>(17)</sup> and >60 age groups. Incidence of postoperative complication was 29.4% in *Elliott et al.*<sup>(17)</sup> age group while it was 23.5% in<sup>(16,17)</sup> age groups and it was 17.6% in *Hilibrand and Robbins*<sup>(18)</sup> age group and 5.9% in >60 age group.

In the current work, there were 16 males and 9 females, resulting in the percentage of males being 64 % and females being 36 %. This data coincides with Rutherford et al where males represented 58% of 70 cases. Incidence of intraoperative complication was equal in males and females 4 cases for each sex. While postoperative complications were more in males 64.7% while it was 35.3% in females<sup>(19)</sup>.

Complications of instrumented posterior lumbar fusion In the current study complication was divided into intraoperative complications and postoperative complications and the relation of different complications with various risk factors was discussed. There were 5 cases (20%) of intraoperative complications and 20 cases (80%) of postoperative complications.

Intraoperative complications: 5 cases of intraoperative complication were reported in this work, 1 cases (4%) of fracture pedicle, 1 cases (4%) with inappropriate screw placement, 1 cases (4%) with significant epidural bleeding and 2 cases (8%) with dural tear.

Postoperative complications: In the current work there were 20 cases (80%) of postoperative complications 2 cases of infection(8%), 2 cases of CSF leake (8%), 1 cases of nerve root injury (4%), 2 cases of pseudoarthrosis (8%), 12 cases of instrument failure(48%) and 1 case of DVT (4%).

## CONCLUSION

In this work we concluded some important points regarding postoperative complication of posterior lumbar fixation: Dural tear was the most common intraoperative complication while instrument failure was the most common postoperative complication. Different risk factors of complications include: age, previous medical history, type of lumbar pathology, duration of operation, length of incision, blood transfusion, level of fusion and duration of hospital stay. Patients over 45 years are more liable to develop postoperative complication; infection, pseudoarthrosis and instrument failure.

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