Al-Nahraine university
Collage medicine
Department of surgery

Pedicle screw in treatment of spinal problems

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Dedication

to my great family who always support me in every step through all my life

to my supervisor , Dr. Yasir Hamandi for his guidance

Acknowledgement

I would like to express my sincere attitude to my supervisor

Dr. Yasir Hamandi for his great help , kind and enthusiastic support throughout the period of this study and Iam also grateful to my collage

Further , Iam greatly indebted to department of surgery team at Al-Nahrain Medical university , whose professional expertise is I would like to express my sincere to my supervisor Dr.Yasir Hamandi **matched only by their concern to make a research task as trouble free possible**

Finally , I express my gratitude to everyone who was help me in finishing this work in any point of its implementation , conduction and final execution

List of content

Abstract

Objective: Determine the most age group and the gender affected, cause of fixation on X-ray in patient present with history of numbness in lower limbs and urine retention or back pain and severity and management

Method:

19 patient with history of numbness in lower limbs and urine retention or back pain all referred for computed tomography scan (CT) and X-ray , A Performa was filled recording patient's name , age , gender , sign and symptom , X-ray and CT finding .

Data Analysis

: was done by using spss.25 ,mean and standard deviation were calculated for all numerical value , i.e age frequency and percentage were calculated for all categorical /qualities variables and statistics description .

Results:

** Data was collecting from 19 patient , 57.9 % female and 42.1% male , the mean age was 57 years ,*

* the cause of fixation (47.4%) had degenerative spine disease and (15.8%) had non pathological and (36.8%) had pathological cause.

* symptom there is (36.8%) had back pain and (31.6%) had numbness and (21.1%) had urine retention .

* the Diagnosis there is (84.2%%) diagnosed by X-ray and MRI and (15.8%) diagnosed by CT and MRI .

* all patient had poly axial screw , all patient had general anesthesia .

* the Complication of surgery there is (52.6%) had back pain and (21.1%) had infection and 4 No complication (5.3) had neurological injury .

* there is (57.9%) had improve radiculopathy and (21.1%) for improve incontinence and (21%) improve back pain .

*the duration of hospitalization was rang from 10-12 day .

Conclusion:

- Female are more use of pedicle screw fixation than male
- The peak age are (60-70) years
- The most common cause of fixation is degenerative spine disease
- The most spinal problem is diagnosed By X-ray and MRI
- All of patient use poly axial screw and general anesthesia
- Most of post operative evaluation of transpedicle stabilization by X-ray
- Most common complication is back pain
- Duration of hospitalization is 12 days

Keywords:

Pedicle screw, fixation , spinal problem , data analysis , thoraco lumber

Introduction :

The posterior trans pedicle screw fixation technique has been widely adopted for the management of an unstable spine, mainly due to trauma , Despite the advantages of a short-segment spinal instrumentation approach, such as improved correction of the spinal deformity, this procedure has also been associated with instrumentation failure, such as screw loosening, screw breakage and correction loss in some cases. Reinforcement of fixation at the fracture level can help to improve kyphosis correction and biomechanical stability , As a result, improved design and implantation techniques of pedicle screws have reduced the rate of pedicle screw and rod breakage and facilitated efficient application of the connecting rod without undue stress on the construct , Compared to a monoaxial screw design, the compression and bending strength at the polyaxial head is reduced due to its specific structural desi, but no studies have compared monoaxial and polyaxial pedicle screws with regard to the range of motion (ROM) [(1)].

Degenerative diseases of the lumbar spine are frequently encountered in the older adult population and sometimes require surgical interventions using pedicle screw fixation. Despite the reported overall effectiveness, the applied interventions are associated with a certain rate of complications that frequently require repeated surgery ,The most frequently reported contributing factor to screws loosening is altered bone quality; however, the efficacy of different diagnostic modalities in bone quality assessment is still debated. Dual energy x-ray absorptiometry (DXA) is frequently used to assess bone mineral density (BMD), which is a part of bone quality assessment , computed tomography (CT) is also capable of accurately defining bone radiodensity using Hounsfield units (HU). Even though it has been reported that BMD has a strong relationship with radiodensity measured in HU, application of those parameters for implant failure prediction remains controversial The additional factors that are supposed to influence pedicle screw instrumentation stability are lumbo sacral fixation because of sacral anatomy and multilevel fusion because of an increased load on pedicle screws, It has been shown that the resection of ligaments, facet joints, and laminectomy are associated with the increased range of movements in a spinal segment and as a consequence, an increase in the stress on screw-bone interface that may lead to pedicle screws loosening, It has been reported that the lack of the anterior support is a significant

factor for pedicle screws loosening; however, the extent of the influence and the role of the applied fusion type remain undetermined, Despite a considerable number of studies that were published on screws loosening, the reported data remains inconclusive because of different criteria used as indicator for implant loosening; the enrolled groups were heterogeneous regarding pathology without assessment of potential bias related [2]

. Furthermore, the majority of studies investigated the only single factor influence without assessment of other potential effects , The objective of this study is to determine risk factors that may affect the rate of pedicle screws loosening, unique contribution, and their interference in patients with degenerative diseases of the lumbar spine.

Direct pedicle screw fixation of the C2 is rarely performed in trauma owing to the risk of damage to the neurovascular structures. Computed tomography-based navigation has the problem of change in intersegmental anatomy after positioning for surgery. Iso-C-based computer navigation acquires the intra operative real-time images after patient positioning and thus avoids registration errors and improves accuracy [3]

The inclusion criterion for participation in this study was presence of a degenerative disease of the lumbar spine with unstable spinal segments, which was confirmed by functional radiograms or having low-grade symptomatic spondylolisthesis Indications for spinal instrumentations were [2]

- neurological deficit
- claudication
- axial and radicular pain syndromes with visual analog scale (VAS) over 4 and Oswestry Disability Index (ODI) over 40% resistant to repeated conservative treatment

The exclusion criteria were [2]

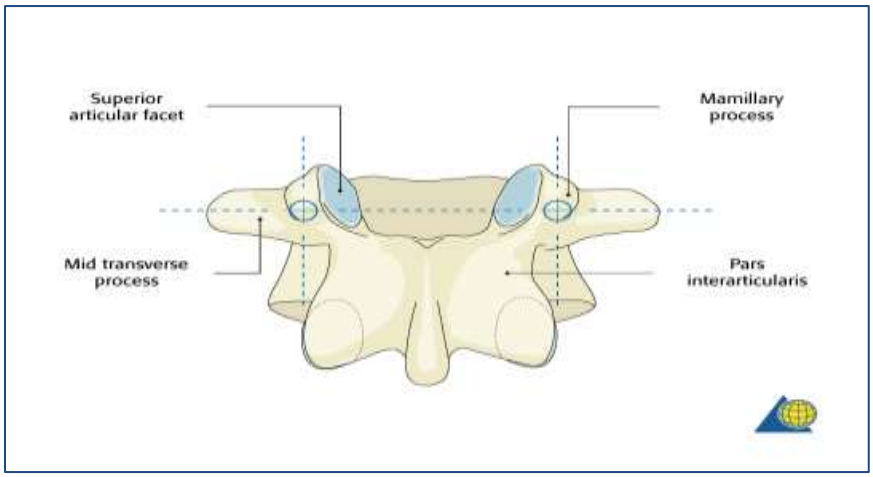
- patients with degenerative deformities that required more than fixation of 5 segments or spinopelvic fixation
- patients hospitalized for revision surgery
- patients with screw malposition and redirection detected on postoperative CT images
- patients with different types of fusion applied on different levels

pedicular screw:

- Lumbar spine

The entry point of the pedicle screw is defined as the confluence of any of the four lines:

- Pars interarticularis
- Mamillary process
- Lateral border of the superior articular facet
- Mid transverse process



***Figur*e(1) lumber spine**

The entry point of the pedicle screw for the lower thoracic segments is defined after determining the intersection of the mid portion of the facet joint and the superior edge of the transverse process. The specific entry point will be just lateral and caudal to this intersection.

The entry point tends to be more cephalad as one moves to more proximal thoracic levels.

Landmarks:

- Lateral border of the superior facet
- Lateral border of the inferior facet
- Ridge of the pars interarticularis and the transverse process

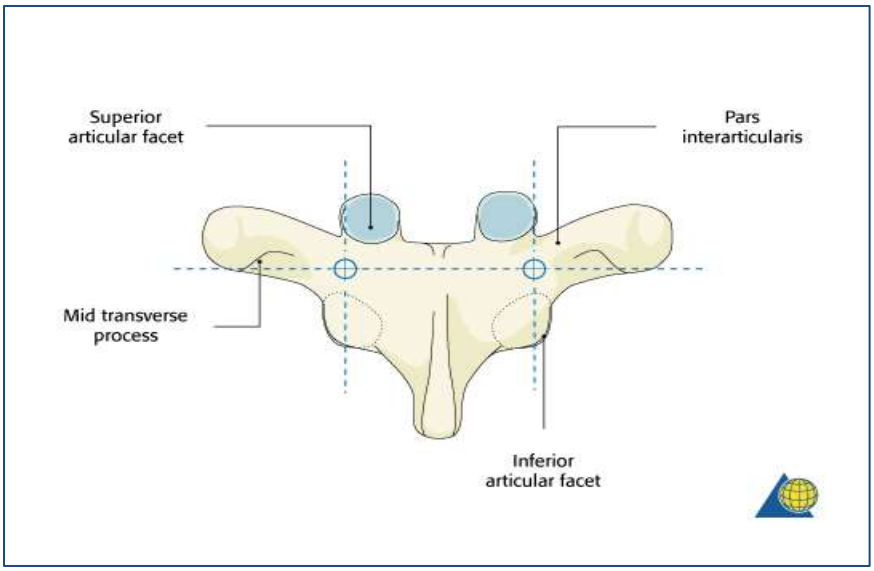


Figure 2 : Thoracic spine

What Is a Thoracic Spine X-Ray? [4]

A thoracic spine X-ray is an imaging test used to inspect any problems with the bones in the middle of your back.

An X-ray uses small amounts of radiation to see the organs, tissues, and bones of your body. When focused at the spine, an X-ray can help spot abnormalities, injuries, or diseases of the bones.

Your spine is divided into three main sections: cervical, thoracic, and lumbar. Each is made up of different sections of vertebrae, the bones that stack on top of one another to make up your spine. Your cervical spine has seven vertebrae and makes up your neck. Below it is the thoracic spine, with 12 vertebrae that are attached to your rib cage. Next is the lumbar spine with five vertebrae. The lumbar spine is followed by your sacrum and then your coccyx, or tailbone.

Along with your vertebrae, your spine also has discs of cartilage that pad the spaces between the bones. This allows the upper half of your body to twist and move independently from the lower half. Your body and your brain also communicate using the nerves that travel down the center of your spine.

Why a Thoracic Spine X-Ray Is Done?

An X-ray is one way your doctor can help uncover the cause of your back pain, which may be a result of an injury (such as a fracture), disease, infection, or other condition.

Your doctor might order a thoracic spine X-ray to further investigate:

- birth defects that affect the spine
- bone spurs
- dislocation of a vertebral bone
- herniated disk
- injury to the lower spine
- low back pain
- osteoarthritis
- scoliosis
- signs of cancer

An X-ray is only one of many tests your doctor may use to help determine the cause of your back pain. They may also order an MRI scan, an ultrasound, bone scan, or a CT scan. Each test provides a different type of image, which allows your doctor to make an accurate diagnosis and choose the proper treatment methods [4]

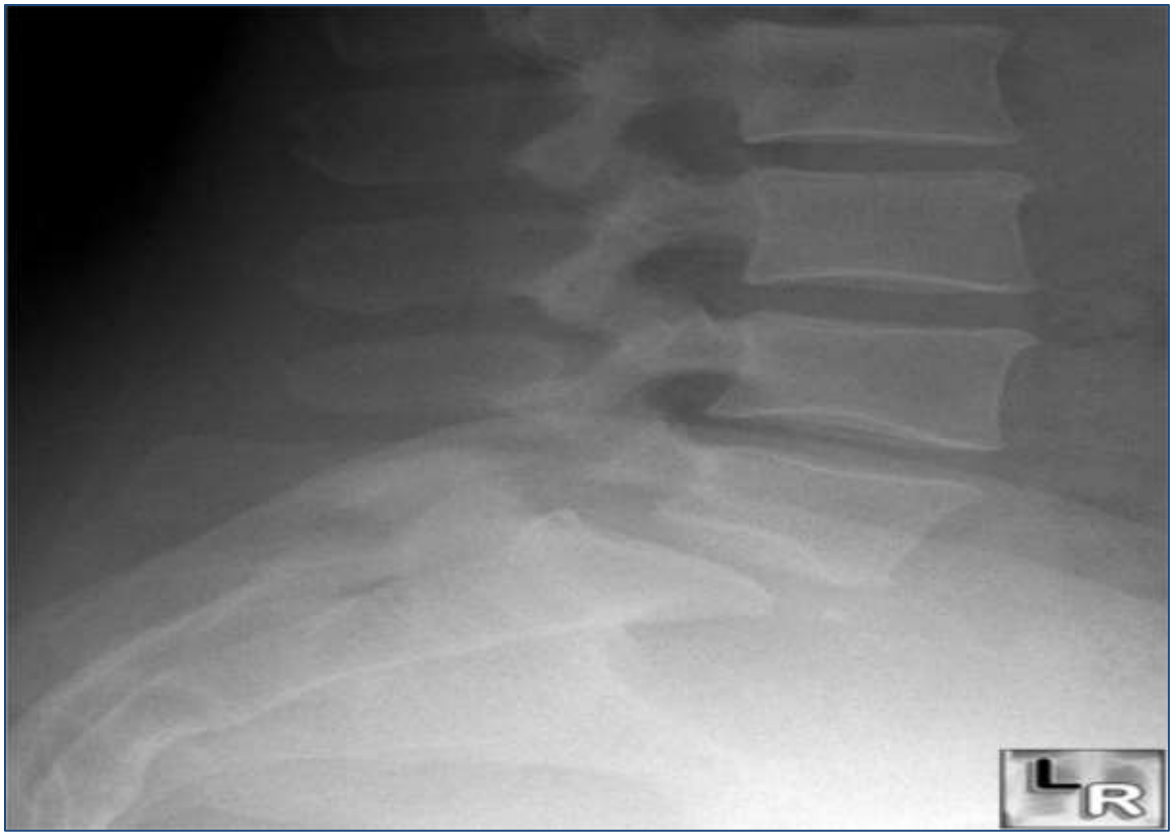


Figure 3 : spondylolisthesis

What It Is

Magnetic resonance imaging (MRI) of the lumbar spine is a safe and painless test that uses a magnetic field and radio waves to produce detailed pictures of the lumbar spine (the bones, disks, and other structures in the lower back).

An MRI differs from a CAT scan (also called a CT scan or a computed axial tomography scan) because it does not use radiation. An MRI scanner consists of a large doughnut-shaped magnet that often has a tunnel in the center. Patients are placed on a table that slides into the tunnel. Some centers have open MRI machines that have larger openings and are helpful for patients with claustrophobia. MRI machines are located in hospitals and radiology centers.

During the examination, radio waves manipulate the magnetic positions of the atoms of the body, which are picked up by a powerful antenna and sent to a computer. The computer performs millions of calculations used to create cross-sectional, black and white images of the body. These images can be reconstructed into three-dimensional (3-D) pictures of the scanned area. This helps to pinpoint problems in the lumbar spine when the scan focuses on that area.[5] [6]

Why It's Done

MRI can detect a variety of conditions of the lumbar spine, including problems with the bones (vertebrae), soft tissues (such as the spinal cord), nerves, and disks.

An MRI sometimes is performed to assess the anatomy of the lumbar spine, to help plan surgery on the spine, or to monitor changes in the spine after an operation. For example, it can find areas of the spine where the spinal canal (which contains the spinal cord) is abnormally narrowed and might require surgery. It can assess the disks to see whether they are bulging, ruptured, or pressing on the spinal cord or nerves.

MRI of the lumbar spine can be useful in evaluating symptoms such as lower back pain, leg pain, numbness, tingling or weakness, or problems with bladder and bowel control. It can also help to diagnose tumors, bleeding, swelling, developmental or structural abnormalities, and infections or inflammatory conditions in the vertebrae or surrounding tissues.

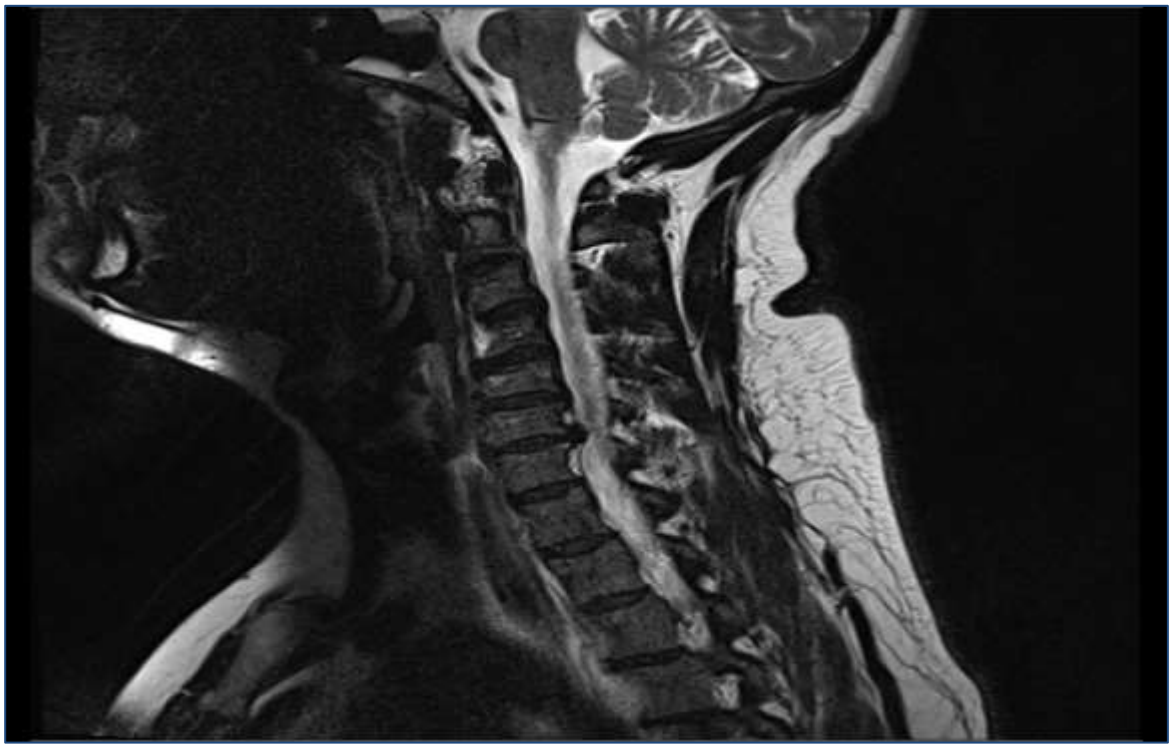


Figure 4 : disc-herniation-cevical-MRI

Complications [7] : - Intra operative complications consisted of:

- Pedicle fractures
- Cerebrospinal fluid leak , resolved spontaneously
- Screw misplacement , one patient had sensory L5 root changes, this settled within 3 weeks

- Postoperative complications consisted of:

- Deep wound infection , This was the only significant complication (superficial wound infection occurred in five cases, this settled spontaneously with appropriate antibiotics for 5 days). The deep infections followed instrumented spinal fusion following decompression of extradural metastatic carcinoma in immunocompromised patients who had received radio and chemotherapy concurrently .
- Screw loosening
- Screw-rod disconnection due to technical error .

Data Analysis

Data analysis was done by using available statistical package for social sciences version SPSS.25 mean and stander deviation calculated for all numerical value ,i.e age frequency percentage calculated for all categorical/qualitative variables , i.e gender cause of fixation and sing and symptom.

- **Age ( ) years**
- **Gender** **a. male**
  b. female

- **Cause of fixation**

✓ **Pathological (tumor) (infection)**
✓ **Non pathological (traumatic)**
✓ **Degenerative spine disease**

- **Sign and symptom** **a. problem of walking**
  b. extreme back pain
  c. urine retention
  d. numbness
  e. other

- **How the spiral problem is diagnosis**

✓ **Dorsal X-ray**
✓ **CT**
✓ **MRI**

- **Type of screw**

✓ **Poly axial**
✓ **Mono axial**

- **Type of anesthesia and why ?**

✓ **General**
✓ **Spiral**

- **post operative evaluation of transpedicle stabilization ?**

✓ **CT / X-ray**
✓ **MRT**

- **Complication of surgery**
- ✓ **Screw malposition or bending / breakage**
- ✓ **Neurological injury**
- ✓ **Infection**
- ✓ **Other**

- **duration of hospitalization ? ( ) days**
- **surgical out come ?**

Aim of study

Define the role of pedicle screw in treatment of spinal problems

Patients and Methods:

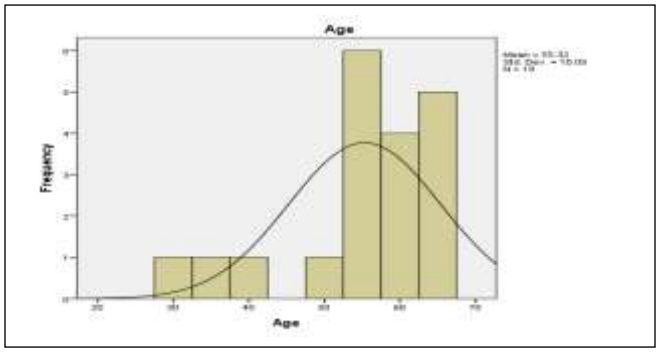
19 patient with history of numbness in lower limbs and urine retention or back pain all referred for computed tomography scan (CT) and X-ray , A Performa was filled recording patient's name , age , gender , sign and symptom , X-ray and CT finding .

Result and discussion :

According to age out of 19 patient , 9 (47.5%) had age range of (60-70) year and 7 (36.9%) had age range (50-59) year and 2 (10.6%) had age range (30-39) year and one patient (5.3%) had range of the age (40-49) year.

Table 1 : age distribution

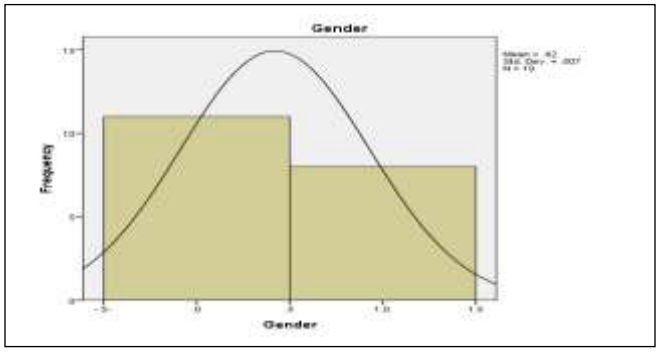
age	Number of patient	Percent
30-39	2	10.6%
40-49	1	5.3%
50-59	7	36.9%
60-70	9	47.5%
Total	19	100.0



According of gender distribution there is increase pedical screw fixation in female 11 (57.9%) and meal 8 (42.1%)

Table 2 : gender distribution

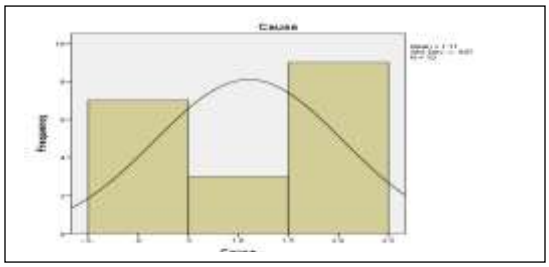
Gender	Number of patient	Percent
female	11	57.9
male	8	42.1
Total	19	100.0



According to the cause of fixation out of 19 patient there is 9 (47.4%) had degenerative spine disease and 3 (15.8%) had non pathological and 7 patient (36.8%) had pathological cause.

Table 3 : Cause of fixation

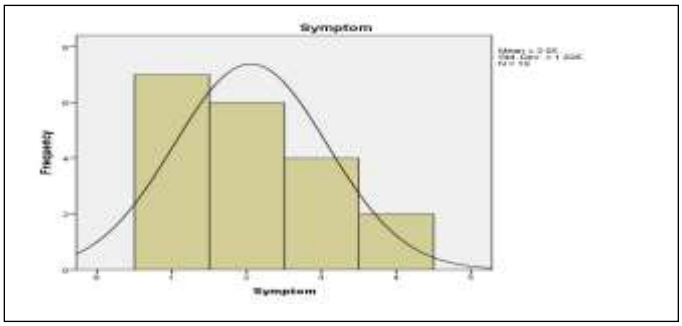
Cause of fixation	Number of patient	Percent
Pathological	7	36.8
Non pathological	3	15.8
degenerative spine disease	9	47.4
Total	19	100.0



According to the sign and symptom there is 7 (36.8%) had back pain and 6 (31.6%) had numbness and is 4 (21.1%) had urine retention and 2 (10.5) had other cause.

Table 4 : Symptom

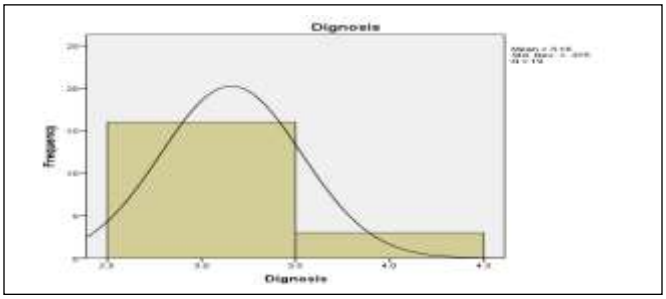
Symptom	Number of patient	Percent
back pain	7	36.8
numbness	6	31.6
urine retention	4	21.1
other	2	10.5
Total	19	100.0



According to the **Diagnosis** there is 16 (84.2%%) diagnosed by X-ray and MRI and 3 (15.8%) diagnosed by CT and MRI

Table 5 : **Diagnosis**

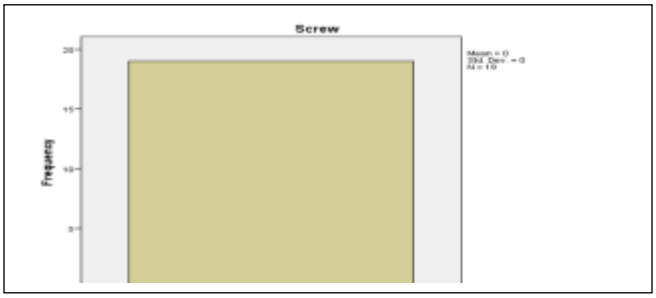
Diagnosis	Number of patient	Percent
X-ray / MRI	16	84.2
CT / MRI	3	15.8
Total	19	100.0



According to the type of screw there is all patient had poly axial.

Table 6 : type of screw

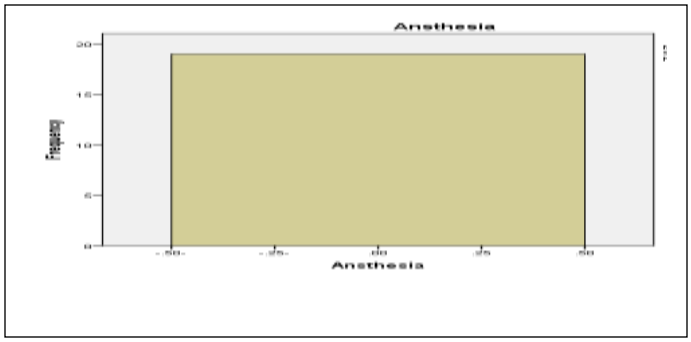
type of screw	Number of patient	Percent
Poly axial	19	100.0



According to the type of anesthesia , there is all patient had general.

Table 7 : type of anesthesia

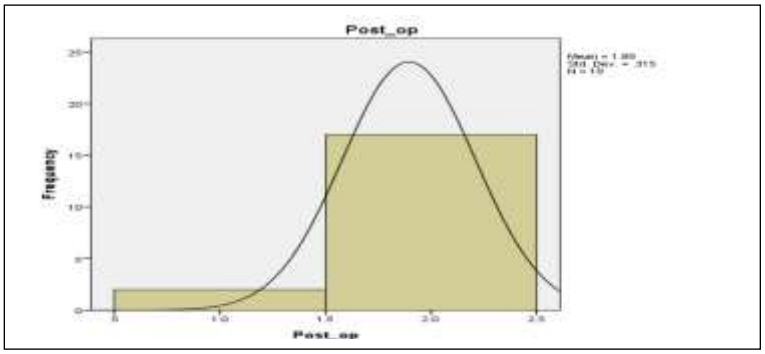
type of anesthesia	Number of patient	Percent
general	19	100.0



According to the post operative evaluation of trans pedicular stabilization , there is 17 (89.5%) had by X-ray and 2 (10.5%) had MRI .

Table 8 : **post operative evaluation of trans pedicular stabilization**

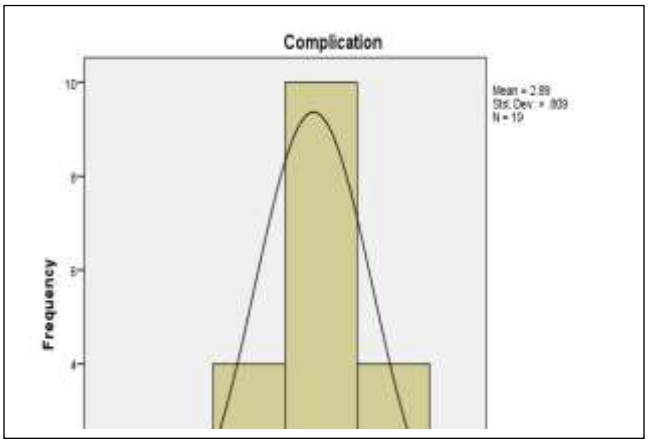
post operative evaluation	Number of patient	Percent
MRI	2	10.5
X-ray	17	89.5
Total	19	100.0



According to the Complication of surgery there is 10 (52.6%) had other- back pain and 4 (21.1%) had infection and4 No complication , 1 (5.3) had neurological injury.

Table 9 : **Complication** of surgery

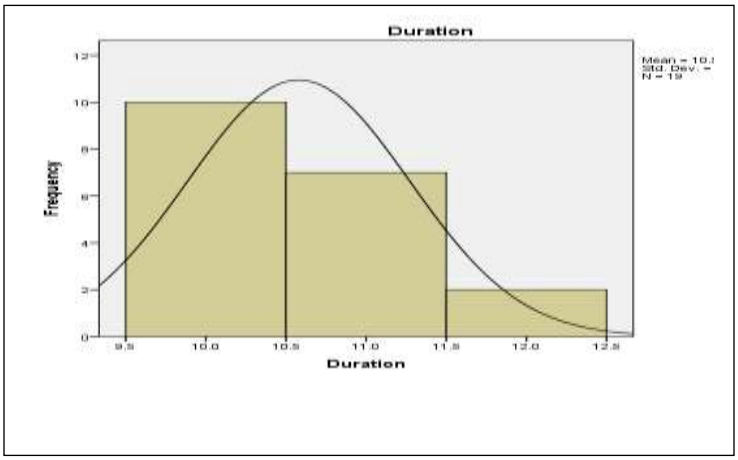
Complication of surgery	Number of patient	Percent
neurological injury	1	5.3
infection	4	21.1
(back pain)	10	52.6
No complication	4	21.1
Total	19	100.0



According to the duration of hospitalization there is 10 (52.6%) had 10 days and 7 (36.8%)11 days , 2 (10.5%) had 12 days .

Table 10 : duration of hospitalization

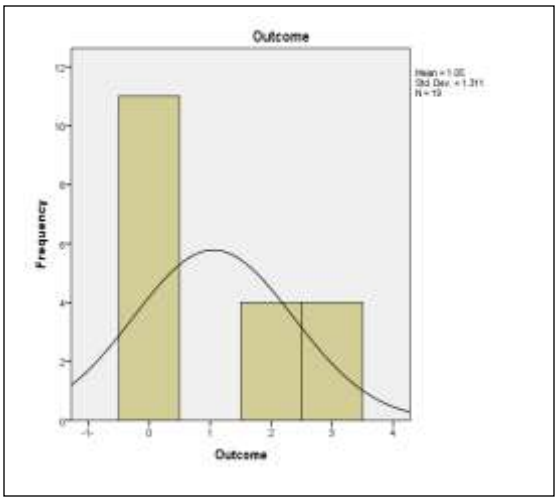
: duration of hospitalization	Number of patient	Percent
10	10	52.6
11	7	36.8
12	2	10.5
Total	19	100.0



According to the Surgical out come , there is 11 (57.9%) had improve radiculopathy and 4 (21.1%) for improve incontinence and 4(21%) improve back pain .

Table 11 : Surgical out come

Surgical out come	Number of patient	Percent
improve radiculopathy	11	57.9
improve incontinence	4	21.1
improve back pain	4	21.1
Total	19	100.0



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Discussion

* In comparison to other study done in India which the result show , the most common is burst fracture , the majority is male with age group 28+/- 12 [8][9]

* In comparison to other study in Pakistan Lumbar degenerative disease in advance age disc degenerative disease has now been proven as the most common of low back pain throughout, To lumbar disc cause evaluate the different aspects of lumbar disc degenerative disc disease and relate them with magnetic resonance image (MRI) findings and symptoms [10]

* In comparison to other study in china , The new technique by combination of percutaneous external transpedicular fixation a feasible, safe, useful, efficient, and minimally invasive method to treat thora columbar fractures.[11]

* In comparison to study From the Swedish Lumbar Spine Study Group

All the fusion techniques used in the study could reduce pain and improve function in this selected group of patients with severe chronic low back pain[12]

*In comparison to study in northern India shows the MRI in depicting objective evidence of lumbar degenerative disc disease in symptomatic young adult patients with clinical suspicion of disease. [13][14]

* *In* our study found that spine Transpedicular screw fixation provides the greatest stability in the unstable which is the same result showing by study done in Iraq [15]

Conclusion:

- Female are more use of pedicle screw fixation than male
- The peak age are (60-70) years
- The most common cause of fixation is degenerative spine disease
- The most spinal problem is diagnosed By X-ray and MRI
- All of patient use poly axial screw and general anesthesia
- Most of post operative evaluation of transpedicle stabilization by X-ray
- Most common complication is back pain
- Duration of hospitalization is 12 days

Recommendation

1. because the most common cause is degenerative spine disease ,so early screening by MRI and X-ray are useful for early diagnosis and good result

2. : post operative evaluation of transpedicular stabilization by X-ray to avoid complication

3. How ever , small sample size in our study is compare to wide diversity of pedicle screw fixation is one of potential limitation , there for we recommended further studies with large sample size and comparison with different surgical modalities

4. the spine surgery concept is change and its important to understand the biomechanic of spine including sagital and coronal balance to improve result and reduce complication

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