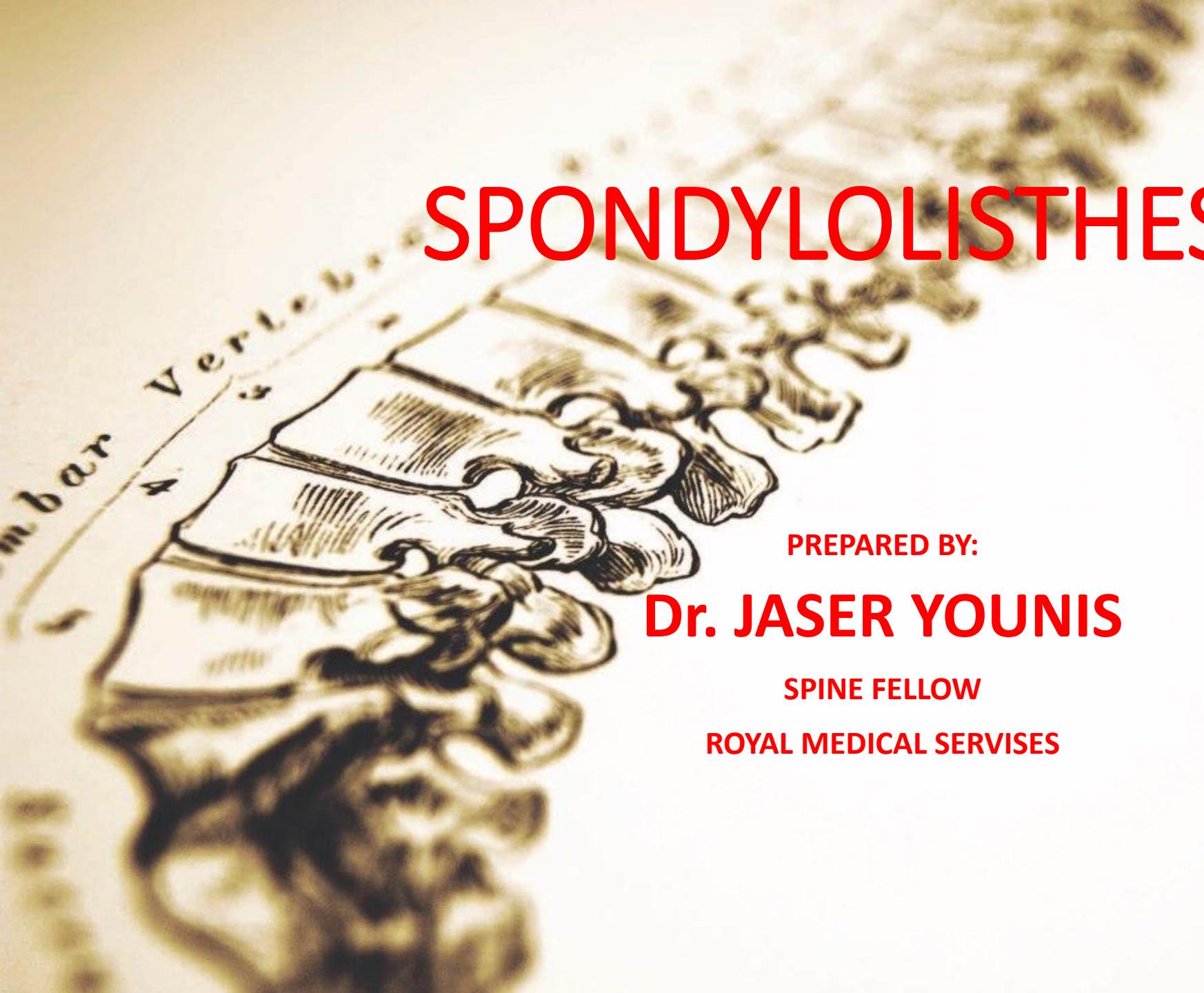
PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=fgpv2jyExIY&list=PLuBRb5B7fa_embZp8jWG_hG8_o1JXLEeo&index=5



SPONDYLOLISTHESIS

PREPARED BY:

Dr. JASER YOUNIS

SPINE FELLOW

ROYAL MEDICAL SERVISES

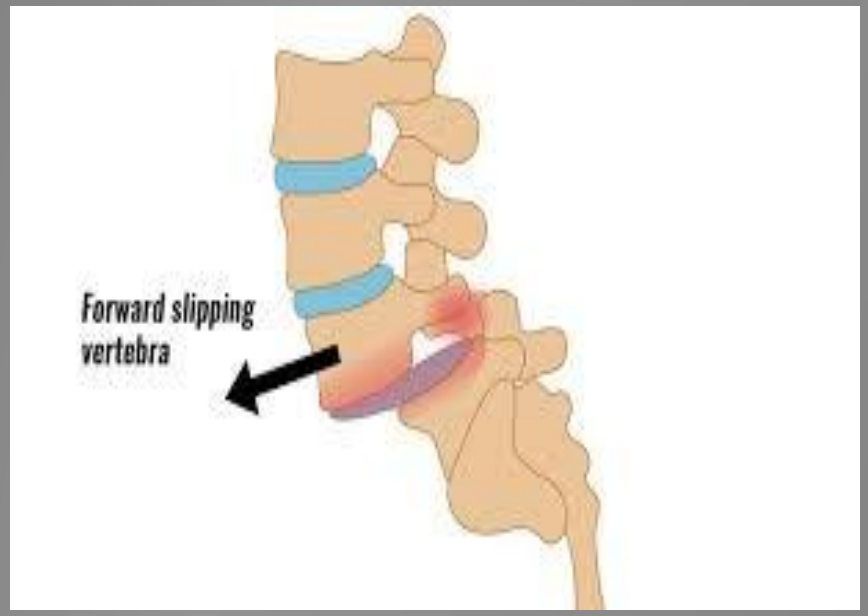
HISTORICAL ASPECTS

- In 1782, Herbiniaux, a Belgian obstetrician, noted a bone prominence in front of the sacrum that caused problems in delivery.

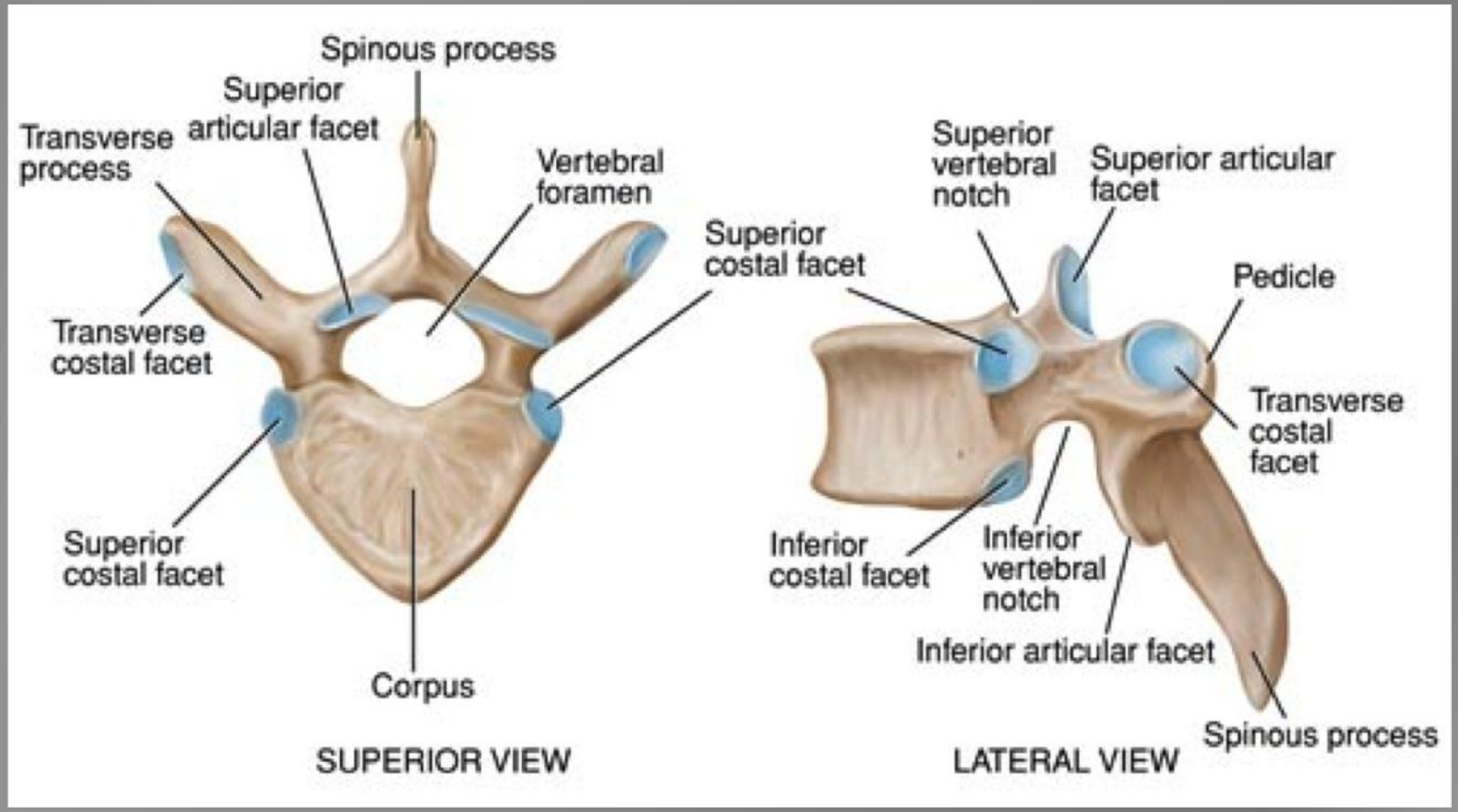
- In 1854, Kilian coined the term spondylolisthesis, derived from the Greek spondylos, meaning “vertebra,” and olisthenein, meaning “to slip.”

DEFINITION

• Spondylolisthesis is defined as the forward slippage of one vertebra on its adjacent caudal segment.



RELEVANT ANATOMICAL STRUCTURES



BASIC THINGS

- Pars interarticularis: portion of bone between superior and inferior articulating processes and the thinnest part of the neural arch

- Facet joint: the contact junction between the inferior articular process of one vertebra and the superior articulating process of the vertebra below it

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- Lamina: the portion of the neural arch between the articular processes and the spinous process

- Pedicles: thick bony struts that connect the vertebral body with the posterior elements

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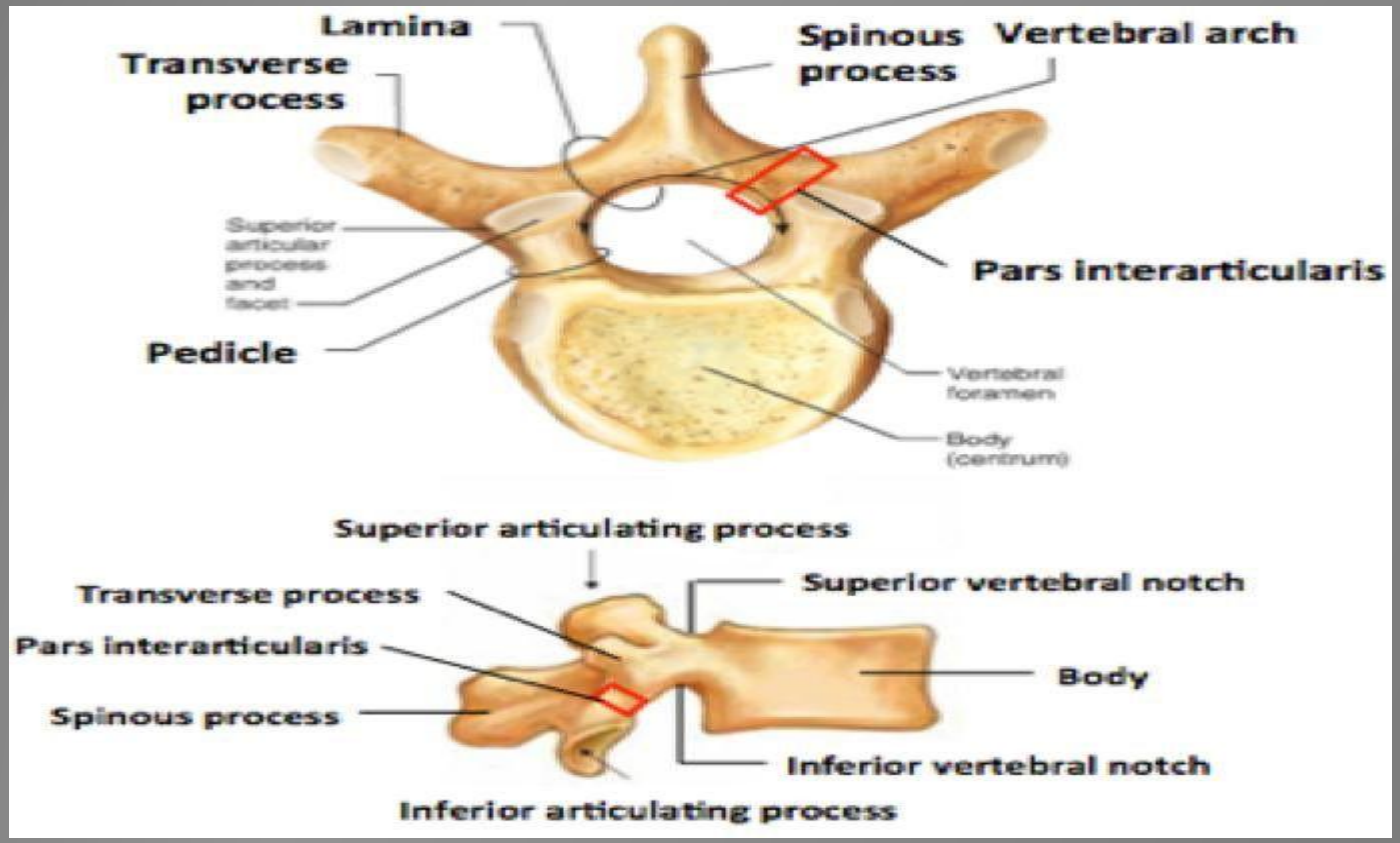
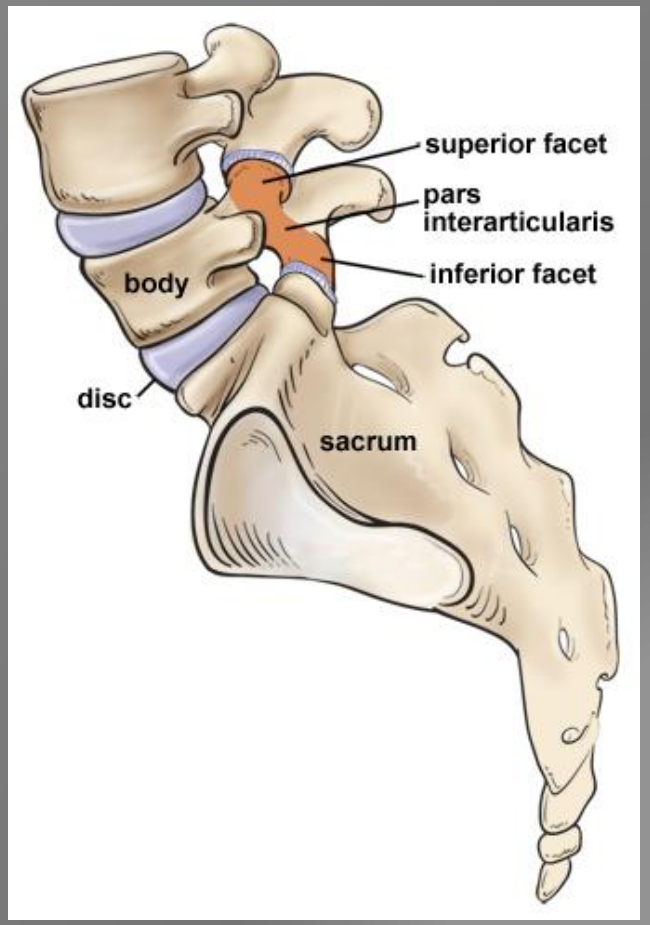

Lamina
Transverse process
Spinous process
Vertebral arch
Superior articular process and facet
Pars interarticularis
Pedicle
Vertebral foramen
Body (centrum)
Superior articulating process
Transverse process
Superior vertebral notch
Pars interarticularis
Body
Spinous process
Inferior vertebral notch
Inferior articulating process


superior facet
pars interarticularis
inferior facet
body
disc
sacrum

EPIDEMIOLOGY

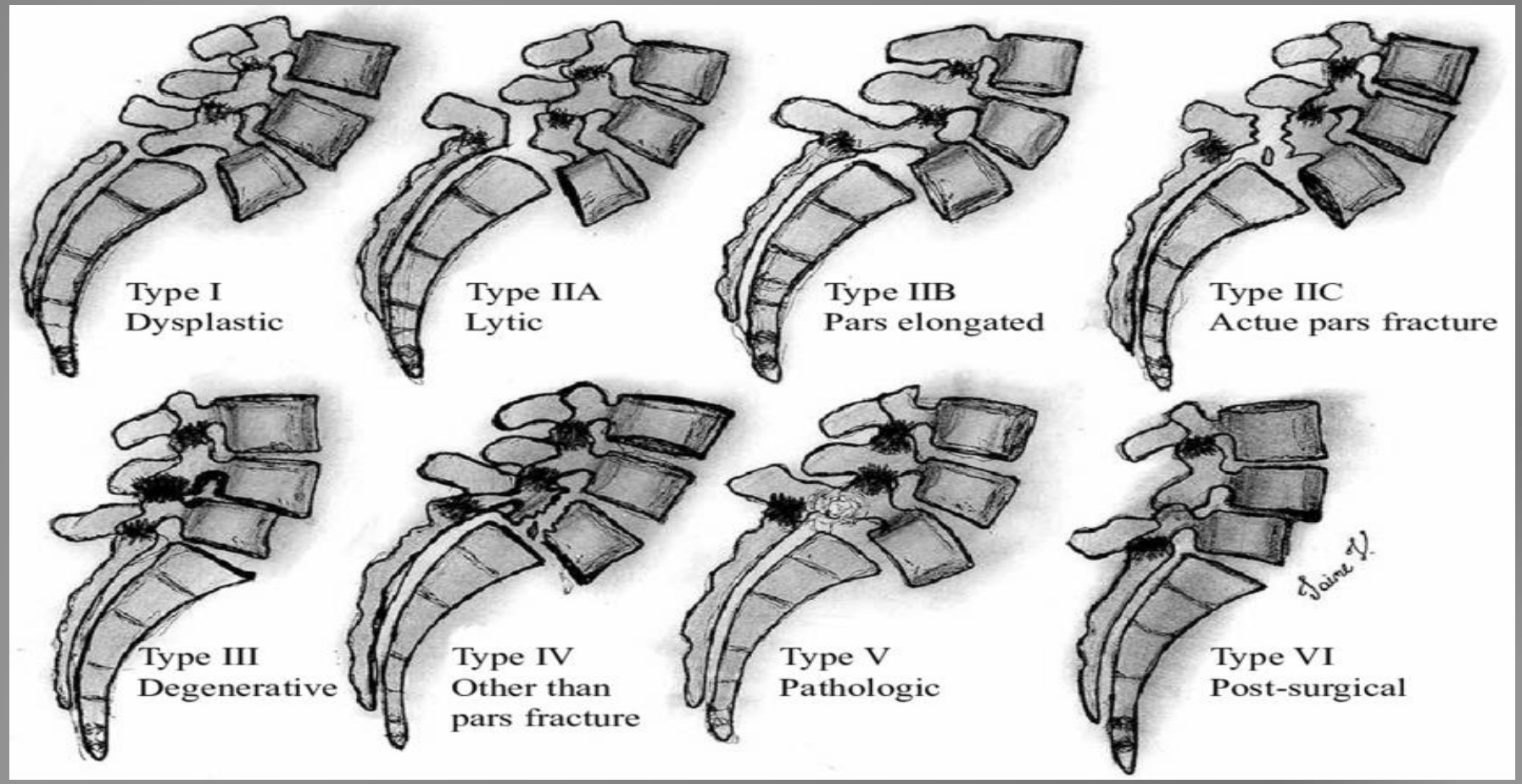
- Incidence: 6% in general population
- Male:female ratio: 2:1, slippage more in females.
- Incidence in children <6years: 2.6%
- Ethnicity: more common in Caucasians than Blacks; eskimos of Alaska reported incidence upto 50%.
- Genetic and familial assosciation: 26% of patients with isthmic spondylolisthesis had first degree relatives with same disease.

CLASSIFICATION

• **Wiltse , Newman and Macnab** (Based on a mixture of etiological and topographical criteria) :

- **type I (dysplastic/congenital):** secondary to an abnormal neural arch
- **type II (isthmic):** secondary to a lesion involving the pars interarticularis
  - **subtype a (lytic):** secondary to stress fracture
  - **subtype b (elongated pars):** result of multiple injury/healing events leading to elongation of the pars
  - **subtype c (acute pars fracture):** secondary to a single event and is rare
- **type III (degenerative):** result of chronic instability and intersegmental degenerative changes
- **type IV (post-traumatic)**: fracture in a region other than the pars leading to slippage.
- **type V (pathological):** diffuse or local disease compromising the usual structural integrity that prevents slippage
- **type VI (iatrogenic)**

Wiltse, Newman and Macnab CLASSIFICATION



GRADING

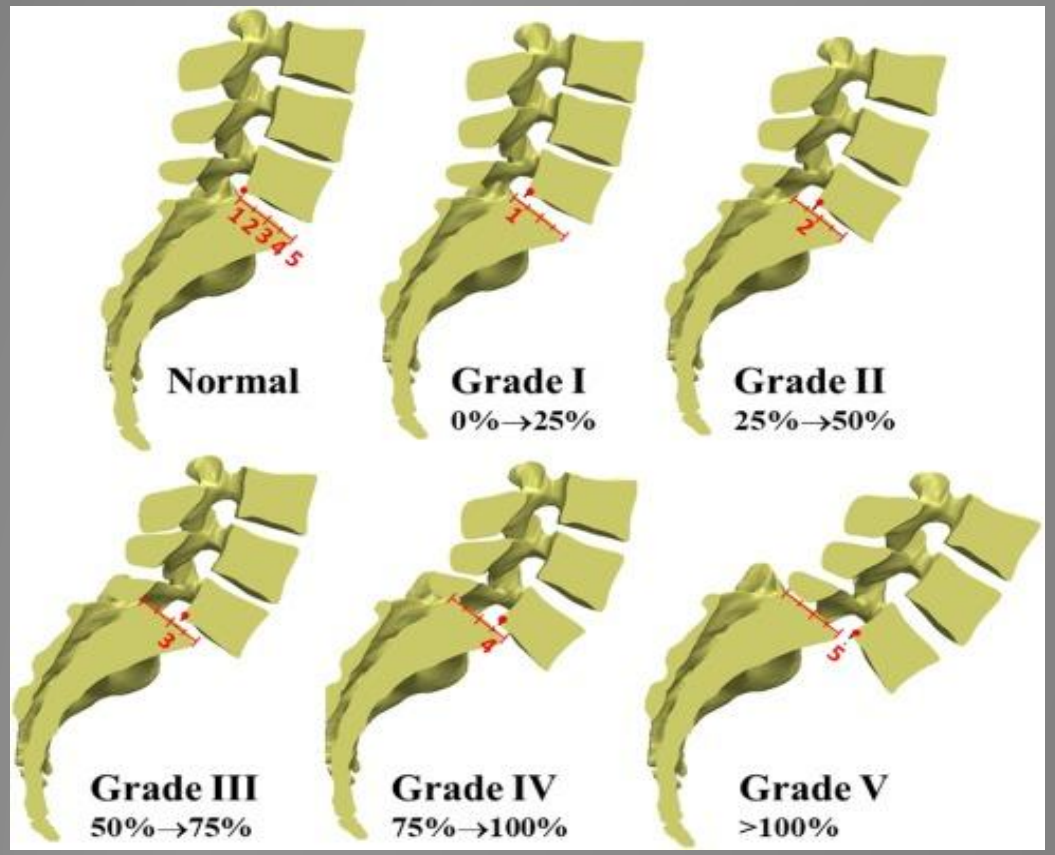
- Meyerding (based on percentage of slip in lateral radiograph) :

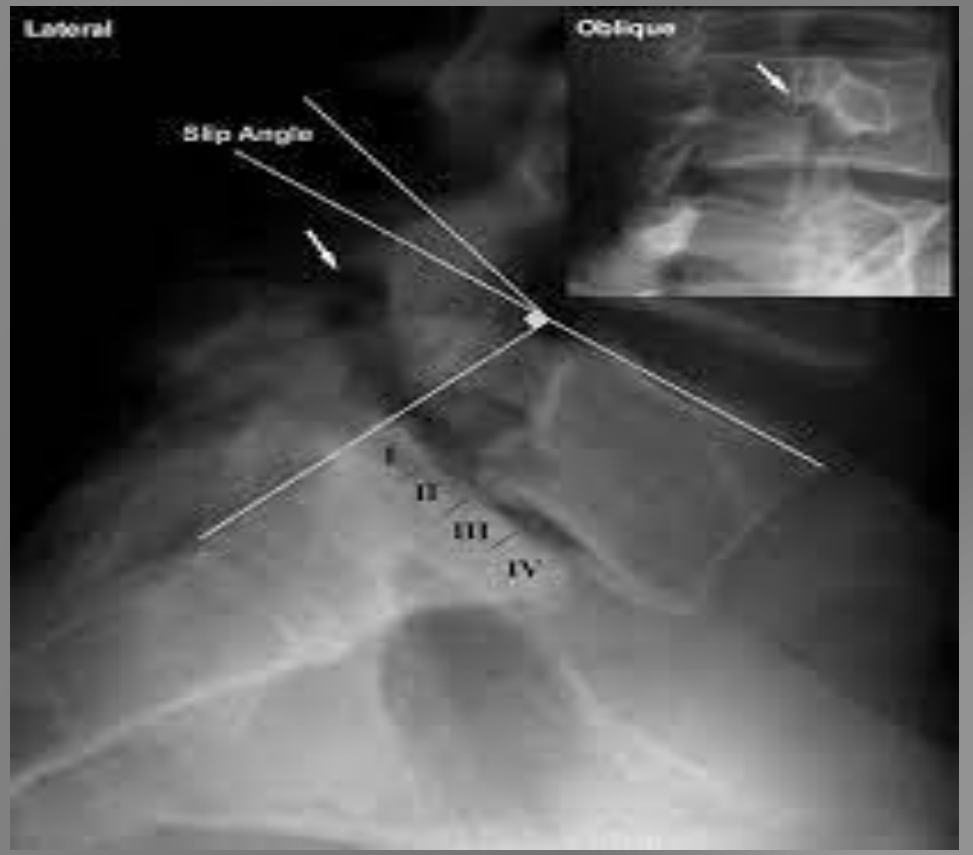
Table 2
The Meyerding classification of spondylolisthesis

Grade 1	1%—25% anterior translation
Grade 2	26%—50% anterior translation
Grade 3	51%—75% anterior translation
Grade 4	76%—100% anterior translation
Grade 5[a]	<100% anterior translation

[a] Grade 5 is commonly applied to 100% slip or spondylop-

Meyerding GRADING OF SPONDYLOLISTHESIS





NATURAL HISTORY

1)Dysplastic spondylolisthesis :

-Early age; usually asymptomatic

- Severe slip(9-15,seldom after 20)

-Risk of neurological complications

-Higher risk of slip progression-cauda equina syndrome as the neural arc is intact.

NATURAL HISTORY>>

2-ISHTHMIC SPONDYLOLISTHESIS :

No progression of slip	**Progression of slip •**
- < 10% displacement	- >25% slip
-Asymptomatic	- symptomatic
- No progression after adulthood	- Risk of slip progression
-No backache later in life	- Backache in later life

NATURAL HISTORY OF DEGENERATIVE SL

- Rare before 50
- further disc space narrowing continued in those without slip
- back pain improved (Autostabilisation)
- 83% of the pts with neurological signs and symptoms deteriorated

- Risk factors for the progression :

1)Young age at presentation

2)Female gender

3)A slip angle of > 10 degree

4)A high grade slip

5)Dome shaped or significantly inclined sacrum

CLINICAL EVALUATION

- Usually asymptomatic , Incidental finding in X ray.

- Symptoms depend on the severity of slip and is **caused by** :

1)Chronic muscle spasm

2) Tears in the Annulus Fibrosus of the degenerated discs.

3) Compression of the nerve roots.

CLINICAL EVALUATION>>>>

symptoms :

* In Children and Young adults :

- Back fatigue and back pain-on movement (Hyperextension)
- Sciatica – may occur in one or both legs

* In patients > 50 yrs:

- Backache ,Sciatica ,Pseudoclaudication d/t spinal stenosis,Other signs of nerve root compression- motor weakness

CLINICAL EVALUATION>>>>

- Symptoms due to Compression of central canal :

1. Bladder and bowel dysfunction
2. Bilateral leg symptoms

SIGNS

1- tight hamstrings

2-sensorimotor deficits

3-pain on backward bending and rotation (often facet joint pain)

4-pain on forward bending (often discogenic pain)

5- pain on extension from the forward bent position

6-limitation of walking distance

Examination

***ON INSPECTION:**

- Buttocks – Flat - Heart shaped.
- Lumbar hyperlordosis above the level of the slip
- Transverse loin crease
- Peculiar spastic gait

EXAMINATION :>>>>

***PALPATION :**

-Palpable step

-Tenderness over Pars defect

- Hamstring tightness on leg raising.

Examination >>>>

***MOVEMENTS :**

- Usually normal in young pts.
- May be – Hamstring + Paraspinal muscle tightness
- limiting forward bending and hip flexion

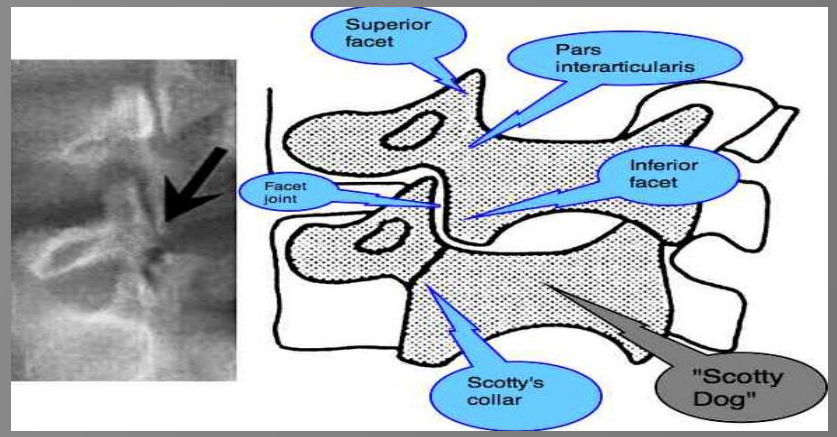
INVESTIGATIONS :

- **IMAGING Radiographs:**

1- AP view

2- Standing Lateral view including the hips.(15% of deformities spontaneously reduce on supine imaging.)

3- Oblique view: help in viewing pars interarticularis defect(decapitated scotty dog)



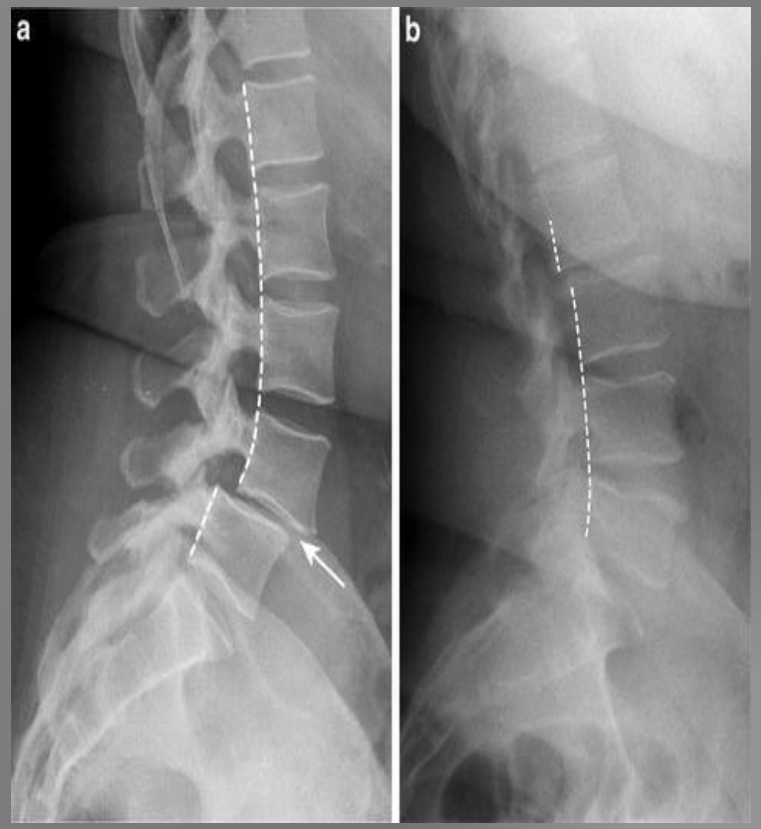
IMAGING Radiographs:>>>>

- Lateral flexion and extension views: determination of translational instability.

- Flexion-extension lateral views may reveal instability

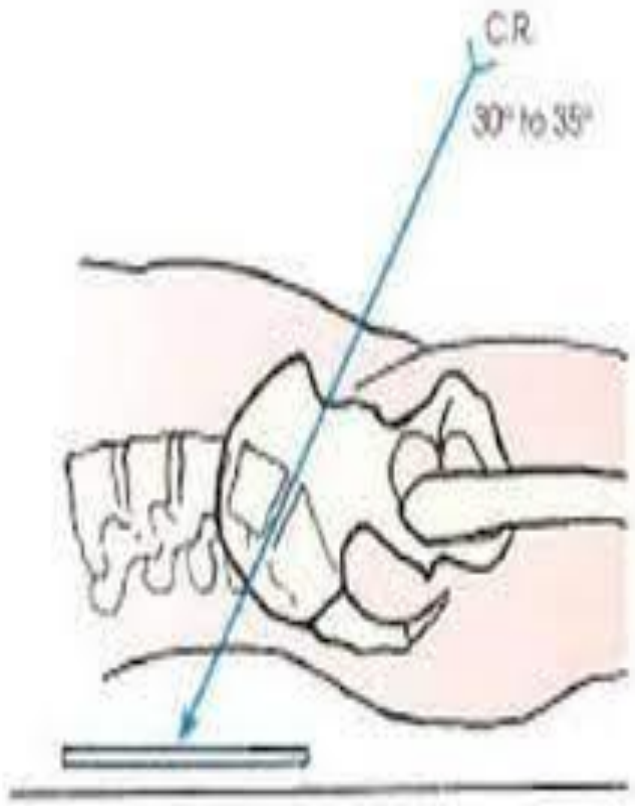
- Fegurson view depicts the L5 pedicles, transverse processes and sacral ala more clearly

LATERAL VIEW + LATERAL F/E VIEW



FERGUSON VIEW

Ferguson view



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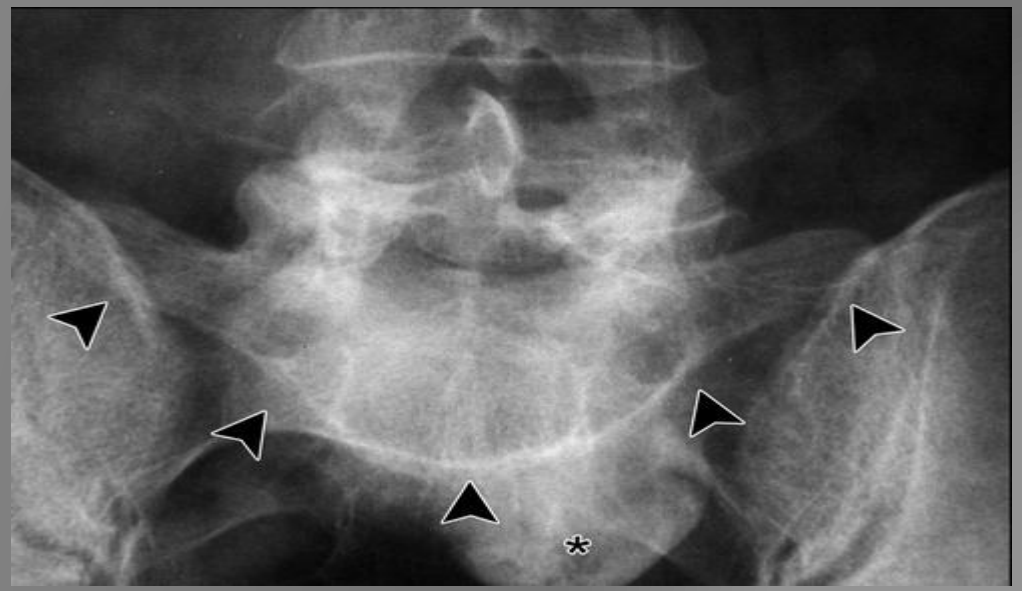
- INVERTED NAPOLEON’S HAT SIGN indicates the presence of bilateral spondylosis and significant spondylolisthesis. The dome of the hat is formed by the overlying body of L5 vertebra and the brim is formed by downward rotation of the transverse processes.



OTHER INVESTIGATIONS

- CT myelography
- MRI (indicated for the evaluation of spinal stenosis , facet overgrowth, hypertrophy of the ligamentum flavum, and, rarely, disc herniation, tumors, etc.)
- SPECT: most senstive for impending spondylolysis., Can determine the chronicity of lytic defect.

IMPORTANT RADIOLOGICAL PARAMETERS

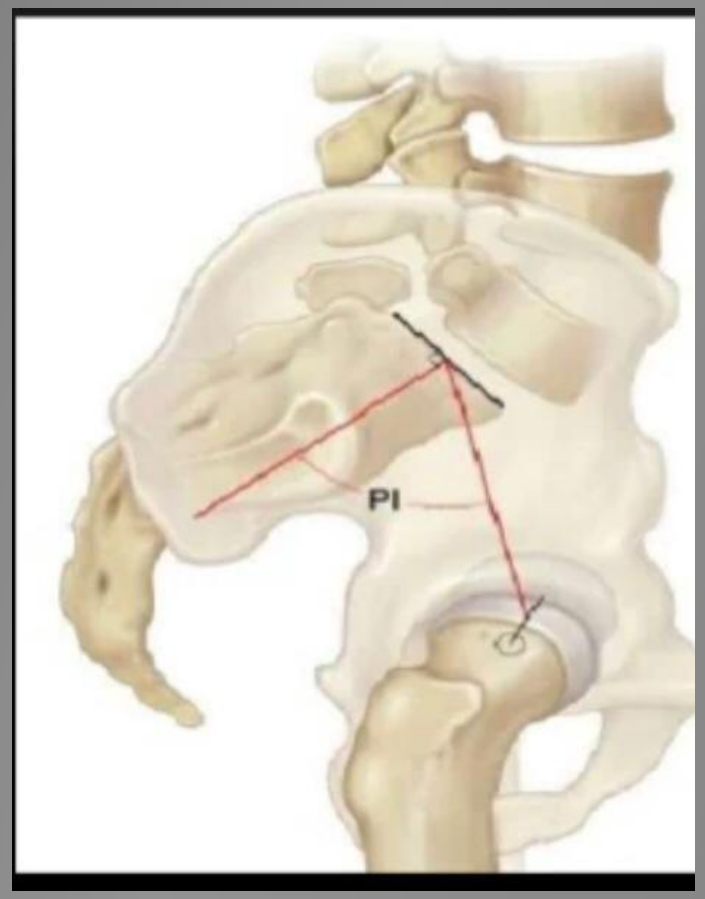
1- SLIP ANGLE:

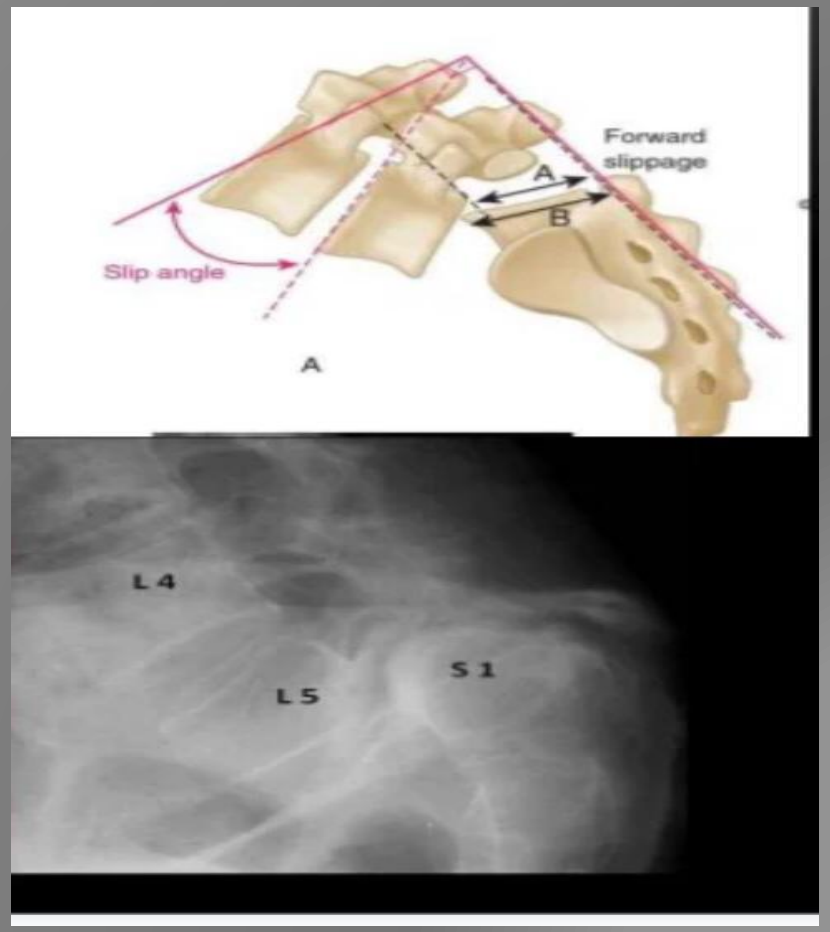
- The slip angle is measured from the superior border of L5 and a perpendicular line from the posterior edge of the sacrum
- Angle greater than 45 to 50 degrees associated with greater risk of slip progression, instability, and development of postoperative pseudarthrosis.
- It is the best predictor of progression os slip.

2-PELVIC INCIDENCE (PI)

- A line perpendicular to the midpoint of the sacral end plate is drawn. A second line connecting the same sacral midpoint and the center of the femoral heads is drawn. The angle subtended by these lines is the pelvic incidence •
- normal, ≈50 degrees)

PI + SA





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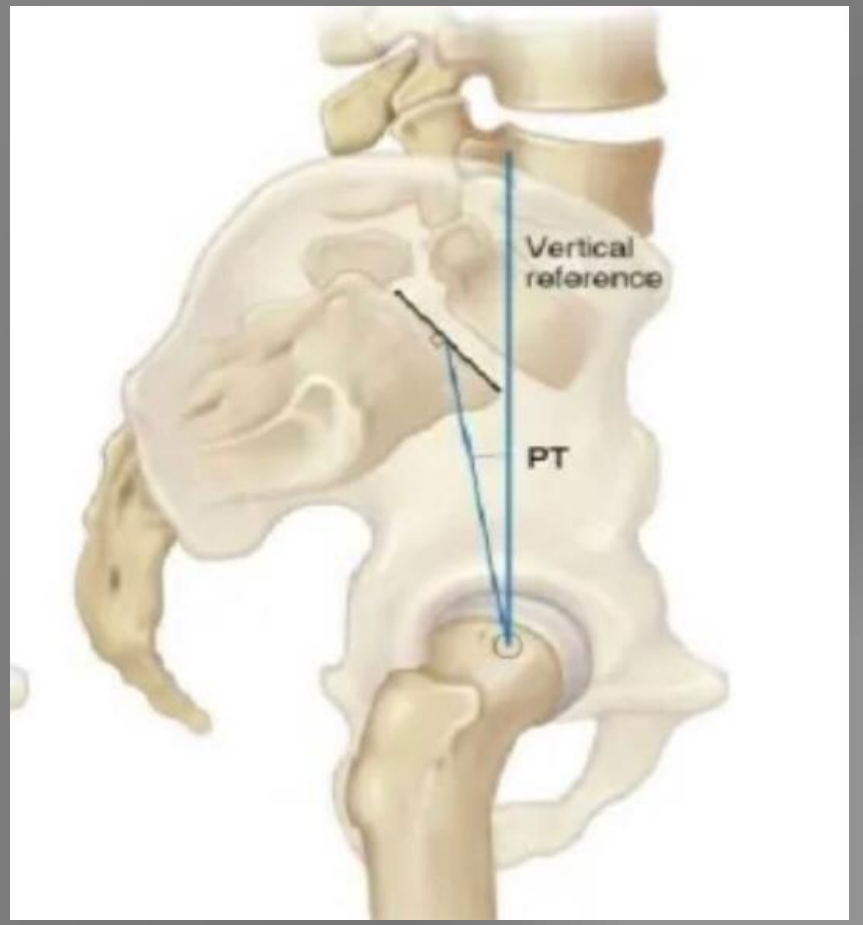
3- PELVIC TILT (PT) :

A line from the midpoint of the sacral end plate is drawn to the center of the femoral heads. The angle subtended between this line and the vertical reference line is the pelvic tilt.

4- SACRAL SLOPE(SS): A line parallel to the sacral end plate is drawn. The angle subtended between this line and the horizontal reference line is the sacral slope.

-Vertical sacrum (SS<100 degrees) is causes progression in slippage.

SS + PT



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5-ALPHA ANGLE L5 INCIDENCE • Alpha angle L5 incidence: A line from the midpoint of the upper end plate of L5 is connected to the center of the femoral heads. A second line perpendicular to the upper L5 end plate is drawn from the midpoint of the end plate. The angle subtended by two lines (α) is the L5 incidence

MANAGEMENT

- OPERATIVE
- NON OPERATIVE (CONSERVATIVE TTT)

MANAGEMENT PLANNING

- About 75% of the patients who are initially neurologically intact do not deteriorate over time. These are the patients who will respond to a conservative treatment.
- most patients (about 80%) with a history of neurogenic claudication or vesicorectal symptoms deteriorate with poor final outcome .
- In view of this, treatment is dependent on the presence of a neurologic deficit either caused by a foraminal or a central stenosis.

CONSERVATIVE TREATMENT

- **Directed at symptomatic relief .**

1- Rest

2- anti-inflammatory agents

3- lumbar corset

4- Physical therapy

5-abdominal strengthening exercises ,hamstring stretching , avoidance of extension exercises which will exacerbate the symptoms

OPERATIVE TREATMENT

- The mainstay of treatment is:

- Decompression
- Fusion (Instrumented VS Non instrumented)

INDICATIONS FOR SURGERY

1- Slip progression .

2- High-grade slip with significant lumbosacral kyphotic deformity causing sagittal imbalance

3-Neurological deficit .In most cases, the L5 nerve root is involved

4- Low back pain unresponsive to a prolonged course of conservative treatment

5- Radicular pain with associated nerve root compression on imaging studies that is not responsive to conservative treatment

General objectives OF SURGICAL TREATMENT

- Prevent further slip progression
- Stabilize the segment
- Correct lumbosacral kyphosis and restoring spinopelvic parameters
- Relieve back and leg pain
- Reverse neurologic deficits

ISTHMIC SPONDYLOLISTHESIS TREATMENT

FINDINGS	TREATMENT
Grade I	observation
Grade II	Asymptomatic: Observe Symptomatic: Activity modification Failed: Surgery
Grade III-IV	SURGERY

SURGICAL PROCEDURE FOR ISTHMIC SL

PROCEDURE	ADVANTAGES AND DISADVANTAGES	RESULTS
Defect repairs	Preserve motion Technically difficult	Variable 60-90%
Laminectomy (Gills)	Increase instability	Poor long term outcome abandoned
Posterolateral fusion (in situ)	Improved symptoms	Children Adult: variable
Reduction and fusion	Allow correction Add stability	Slippage >60% Slip angle >50 degree Age 12 to 30 (Bradford 1988)
Anterior and posterior fusion	Additional stability 360 degree fusion	Difficult surgery

DEGENERATIVE SPONDYLOLISTHESIS OPERATIVE TREATMENT

- OPTIONS :

1- Decompressive laminectomy

2- Decompression with posterolateral fusion

3- Decompression with instrumented

THE FUSION OPTIONS

1-achieve posterior column stability:(posterolateral intertransverse fusion (PLF)

2-achieve anterior column stability:(anterior lumbar interbody fusion (ALIF))

3-achieving a circumferential fusion : (posterior lumbar interbody fusion (PLIF))

4- transforaminal interbody fusion (TLIF)

N.B : no consensus of what constitutes optimal surgical treatment ,surgical option must be individualized

ROLE OF REDUCTION

high-grade spondylolisthesis causes lumbosacral kyphosis --- sagittal imbalance

- reduction procedure controversial
- high rate of neurologic complications
- reserved for patients with loss of global sagittal balance because of significant lumbosacral kyphosis
- circumferential fusion and stable fixation with iliac screws are strongly recommended to prevent slip progression and pseudarthrosis

COMPLICATIONS OF SURGICAL TREATMENT

- neurologic injury (0.3–9.1%)
- persistent nerve root deficits (2–3%)
- non-unions (0–39%)
- progressive slippage (4–11%)
- revision surgery (7.6%)

THANK YOU