SPONDYLOLYSIS

Isthmic spondylolysis is considered to represent a fatigue fracture of the pars interarticularis of the neural arch. There is a relatively high incidence of radiographically identified spondylolysis in the general population, but the vast majority of these lesions probably occur without associated symptoms.

Symptomatic pars lesions appear to be particularly a clinical problem in adolescents, especially adolescent athletes. The optimal diagnostic and treatment algorithms are not well identified in the current literature. Multiple imaging studies may have a role in the diagnosis of a pars lesion, and treatment seems likely to require at least relative rest and physical rehabilitation with consideration of bracing or, rarely, surgical intervention depending on the clinical context.

Spondylolysis can be defined as a defect in the pars interarticularis of the vertebral arch. This defect is seen relatively often in radiographic studies and may either occur asymptomatically or be associated with significant low back pain (LBP).
Wiltse Lysis and listhesis in 1976
Type I: dysplastic—congenital abnormalities of L5 or the upper sacrum allow anterior displacement of L5 on the sacrum.
Type II: isthmic—a lesion in the pars interarticularis occurs.
This is subclassified as (a) lytic, representing a fatigue fracture of the pars,
(b) elongated but intact pars, and
(c) acute fracture.
Type III: degenerative
Type IV: traumatic—acute fractures in vertebral arch other than the pars.
Type V: pathological—due to generalised or focal bone disease

Epidemiology and natural history
The incidence of spondylolysis in the caucasian population has been reported to be about 3–6%.

This varied within subgroups of the population,
6.4% for caucasian males,: 2.3% for caucasian females,
2.8% for African-American males,

There was no significant change in these rates with increasing age from 20 to 80 years old.

The vast majority of spondylitic defects occur at L5 (85–95%), with L4 being the next most common.
Radiographically visualised spondylolysis is associated with spondylolisthesis about 25% of the time.
The natural history of spondylolysis, Fredrickson[2] prospectively studied 500 first grade students with plain radiographs and performed several smaller studies within their population. They found an overall incidence of spondylolysis of 4.4% at age six. This increased to 5.2% by age 12 and 6% by adulthood.
The study of Fredrickson seem to support the idea that a pars lesion is the result of repetitive stress to this region, an issue relevant to the assessment of athletes with spondylolysis and considered in more detail below. The incidence of spondylolysis seems to be higher in the young athletic population than in the general population. In young female gymnasts using plain radiographs and found spondylolysis in 11%, representing an almost five fold increase compared with the rate of 2.3% for the general caucasian female population.
Divers, weight lifters, wrestlers, and gymnasts had disproportionately higher rates within this group.

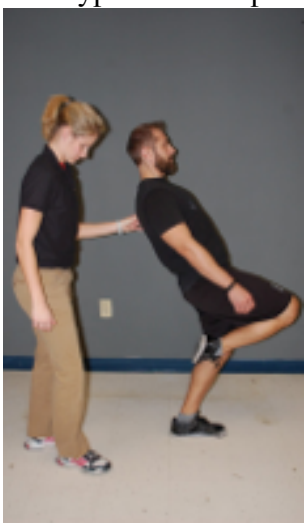
In only two (4%) of their patients did the degree of slip progress >20% over the follow up period. They also found no clear predictive variables associated with slip progression.
In her study of 255 patients followed for at least 20 years, Saraste [3] noted a mean slip progression of 4 mm with only 11% of adolescents and 5% of adults progressing more than 10 mm. Fredrickson [2] also noted that progression was uncommon in general and they did not see progression in any patient after the age of 16.

Pathophysiology
The lesion of the pars interarticularis in spondylolysis is generally considered to result from mechanical stress to that portion of the neural arch.
Wiltse suggested that most cases of isthmic spondylolysis should be considered fatigue fractures caused by repetitive load and stress rather than a single traumatic event,
although a single traumatic event may result in completion of the fracture already developing.

Clinical presentation
1. complaint of focal low back, with radiation of pain into the buttock or proximal lower extremities noted occasion

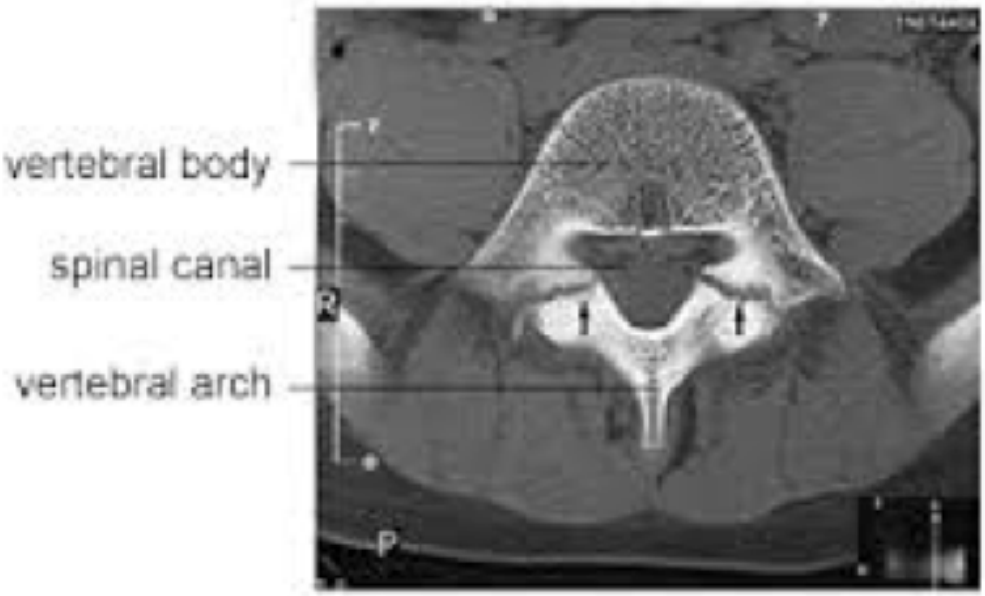
2. The onset of pain can be gradual or start after an acute injury, and mild symptoms can be present for some time with an acute worsening after a particular event.

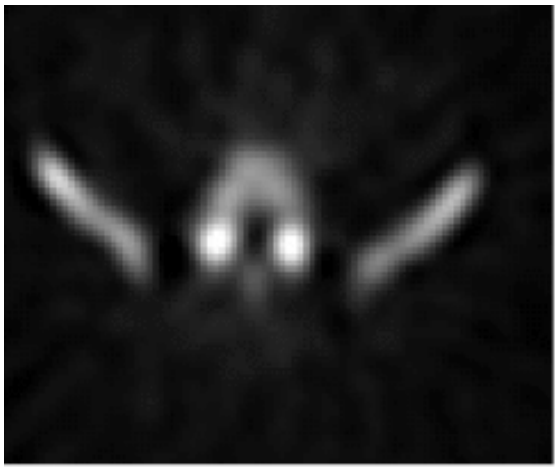
3. A hyperlordotic spine with hamstring tightness.

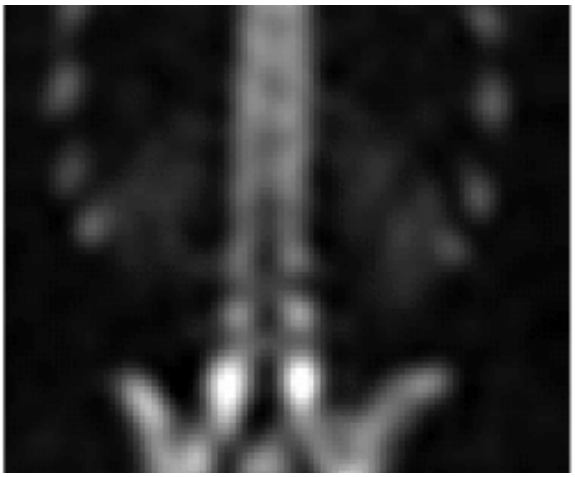


The only possible pathognomonic finding noted in the literature is reproduction of pain by performing the one legged hyperextension manoeuvre (the patient stands on one leg and leans backwards).

Diagnostic imaging
1. Xray: A collar or a broken neck on the “Scotty dog” seen in lateral oblique radiographs. About 20% of pars defects seen on plain radiographs can be identified on oblique
views only







2. Saifuddin [4] used CT scans
3.The problem of the limited sensitivity of plain radiography has become more apparent in several studies using radionuclide imaging, particularly single photon emission computed tomography (SPECT), and this type of imaging has been shown to oVer many advantages over isolated plain radiographs.
4. MRI may also be more sensitive than plain films but needs further study

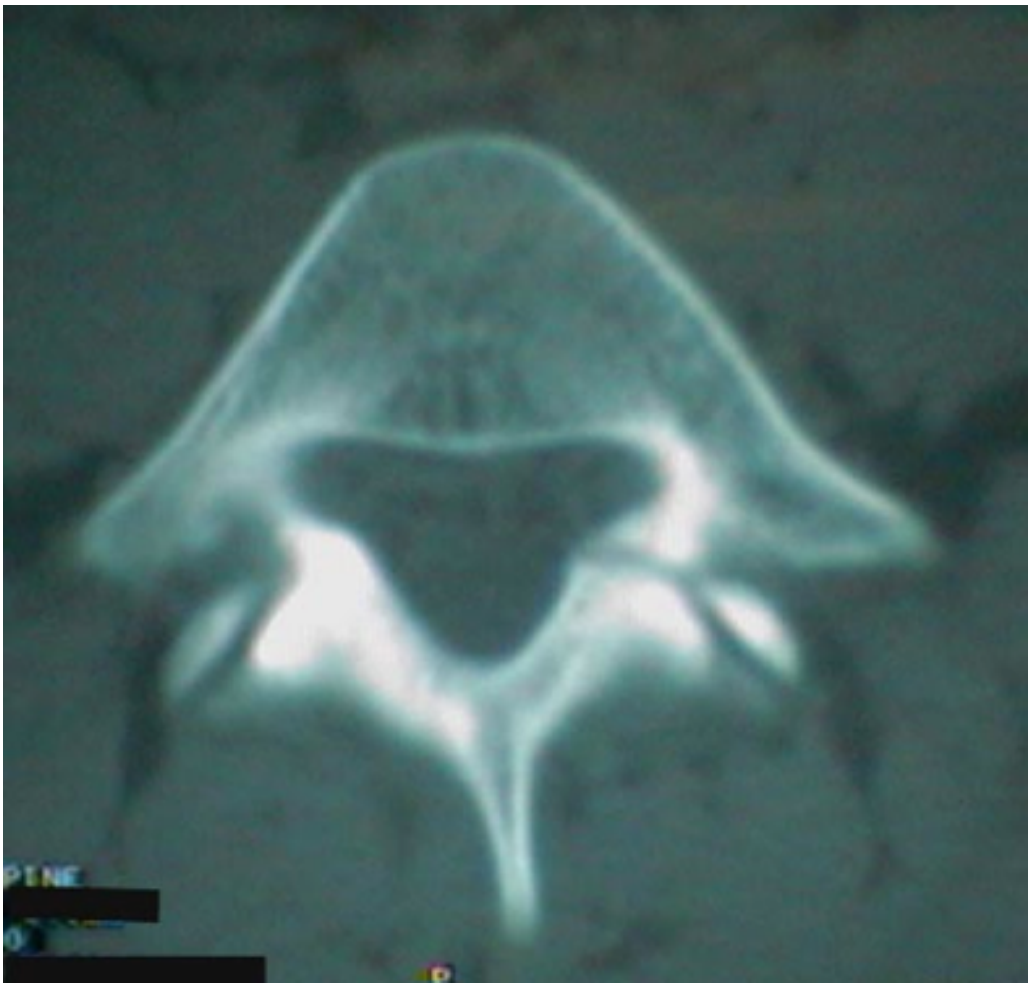
Elliot [5] similarly reported a patient series assessed by bone scan and plain radiography. They found that two of their nine patients with positive bone scans had normal radiographs and that nine patients with spondylolysis on plain radiographs had normal bone scans. They felt that a bone scan could potentially identify pars lesions before they appeared on plain radiographs and that a negative bone scan with positive plain films made it unlikely that the pars lesion was causing symptoms.

Although planar bone scan appears to be more sensitive for detecting pars lesions than plain films, several studies have suggested that SPECT is more sensitive. As mentioned above, the studies by Elliot and Lowe [6] suggested that radionuclide imaging may be helpful in identifying symptomatic pars lesions.

Lusins [7]t found a propensity for SPECT to be positive in patients with spondylolysis and a recent injury compared with patients with spondylolysis and more long standing symptoms.
Raby [8] compared the results of SPECT scanning with clinical outcome following surgery for spondylolysis. They found that the patients who became pain free after surgery all had positive

SPECT scans before the operation, whereas those with continued symptoms had negative scans.

Subtypes of Lysis [Hermon]
1. Stress reaction: Intraosseous edema without cortical
2. Stress fracture: Disruption of trabecular of the pars without a bony gap
3. Pseuadarthrosis: With a gap: nonunion of the pars.



Treatment

Steiner[9] assessed bony healing and clinical outcome in 67 patients with spondylolysis or low grade spondylolisthesis who were treated with an anti-lordotic modified Boston brace. All the patients were diagnosed and followed using plain radiography, and 25 of them underwent a planar bone scan. They followed a treatment regimen of brace use for 23 hours a day for six months followed by a six month weaning period. 78% had good to excellent clinical results

Blanda[10] reported on a similar study of 82 athletes with spondylolysis and/or spondylolisthesis. The diagnosis was based on plain radiography or bone scan with plain radiography for follow up, and treatment consisted of activity restriction, bracing, and physical therapy. 96% of the patients with only spondylolysis having good or excellent clinical results and 37% of these patients showing radiographic union.

Katoh [11] studied 134 patients under 18 who were diagnosed with spondylolysis by plain radiography. All were subsequently evaluated by CT before and after treatment, and treatment consisted of relative rest only (S Katoh, personal communication). Healing was noted in 62% of the early stage defects while none of the terminal defects healed. Blanda [10] found much higher healing rates for unilateral pars defects than for bilateral lesions.

Surgery

Surgical treatment is used only for symptomatic cases were all conservative methods failed to show any effect. Approximately 9-15% of cases of symptomatic spondylolysis undergo surgery. The main indications include

intractable pain, progressive slip, development of neurological deficits and segmental spine instability. Surgical procedures typically attempt a direct repair of the pars which is sometimes accompanied by a fusion procedure.

Specific surgical techniques, such as translaminar screw fixation, cerclage wiring loop and pendiculolaminar hook screws, preserve segmental motion by repairing the isthmic defect .

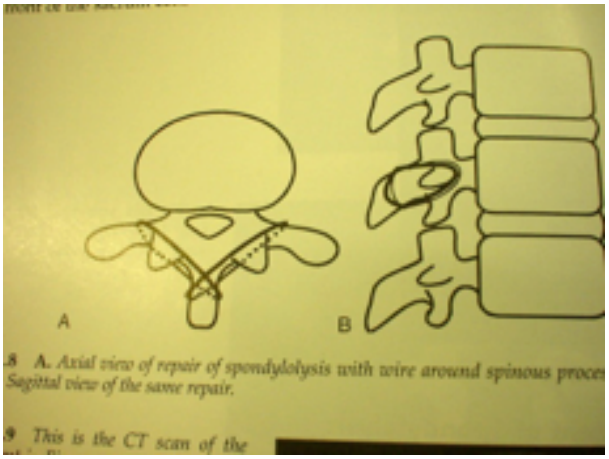
Types

Bucks: Screw fixation from inferior facet to the pedicle + bone graft the defect. Reported 95% healing

Bradford: Tension band wiring around the transverse process and spinous process. Reported 92% success

Morscher: Sublaminar Hook and wire.

Hodgson: Pedicle screw and wire



8 A. Axial view of repair of spondylolysis with wire around spinous proce Sagittal view of the same repair.

9 This is the CT scan of the

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