आधुनिक मतानुसार गृहसी
SCIATICA

Derivation:

The word sciatica (si-at-ik) is derived from the Latin word "Siatricus" which is also derived from 'ischadiakas' in its Greek origin, which means pertaining to located near the ischium as the sciatic nerve or vein (Dorland's Medical Dictionary)

Definition:

1. According to Dorland's Medical Dictionary - Sciatica is a syndrome characterised by pain radiating from the back into the buttock and into the lower extremity along its posterior and lateral aspect and most commonly causes by the prolapse of intervertebral disc, the term is also used to refer to pain any where along the course of the sciatic nerve.

2. According to Stedman's Medical Dictionary - Sciatica is the neuralgia of the sciatic nerve, felt at the back of the thigh usually due to herniated lumber disc, but occasionally to sciatic neuritis.

3. According to Brain's Disease of the Nervous System - The term Sciatica has come to be applied to a benign syndrome characterised specially by pain beginning in the lumber region and spreading down the back of one lower limb to the ankle, usually intensified by coughing and sneezing and associated with little weakness or sensory loss, but some times with diminution or loss of ankle jerk.

The term Sciatica is sometimes used as the synonym of Sciatic neuritis (Neuritis means inflammation of a nerve). But now the term has ceased to serve a useful purpose. Similarly neuralgia means the paroxysmal pain extending along the course of one or more nerves. In Sciatica this type of pain is often experienced. The causative factor of this pain may be other than the Sciatic neuritis. So attributing Sciatica as Sciatic neuralgia seems more appropiate than as Sciatic neuritis. Lumbago and Sciatica, though separate entities, are often associated. Lumbago is pain in the lower part of the back whereas Sciatica is pain in the distribution of Sciatic nerve. Most of the time sciatica is preceded by Lumbago. So very often the term “Lumbago-Sciatic- Syndrome” is used. Therefore in brief it can be said that Sciatica is the pain along the distribution of Sciatic nerve.

History of Sciatica:

Sciatica is a neuralgia of Sciatic Nerve. Which signifies some what indefinite pain in the area supplied by Sciatic Nerve. At first this condition was described by "Contugno" in 1770. But the terminology Sciatica came into use about the beginning of 19th century. In 1816-1833 a Paris neurologist "Lasegue" drew attention about the straight- Leg- Raising (S.L.R.) sign in the Sciatica.

Sciatic Scoliosis, a characteristic posture of the patient- with Sciatica was first described by charcot in 1888.

Some years ago Sciatic neuritis or Sciatica was considered to be an independent disease. But now it is not regarded as a separate entity rather a symptom (Davidson).

The Anatomy of Sciatic Nerve:

Sciatic Nerve is characterised by its largest diameter amongst all nerves in the human body and at its commencement it measures about 2 c.m. in diameter. It is also the largest branch of the sacral plexus.
It arises within the pelvic cavity behind the parietal peritoneum and pelvic fascia as the branch of the sacral plexus and terminates in the back of the thigh at a variable level by dividing into tibial and common peroneal branches.

The tibial part of Sciatic nerve derives its fibres from the ventral divisions of the ventral rami of L4, L5, S1, S2 and S3 spinal nerves. The common paroneal part of the Sciatic nerve derives its fibres from the dorsal division of the ventral rami of L4, L5, S1, S2 spinal nerves. Both the divisions are bound together by a common sheath.

The Sciatic nerve passes out of the pelvis through the greater Sciatic foramen, below the piriformis descends between the greater trochanter of the femur and tuberosity of the ischium into the gluteal region. From above down wards it lies on:

1. Ischial wall of the acelabulum and nerve to the quadratus femoris.
2. The obturator internus muscle with the two gemelli.
3. The quadratus femoris between the ischial tuberosity and greater trochanter of the femur.

The Sciatic nerve enters the thigh on the posterior surface of the adductor magnus and descends between it and hamstring muscles. Biceps femoris, semimembranosus and semitendinosus muscles are collectively called the hamstring muscles. Adductor magnus may be taken into account as one of the hamstring muscles. They form the principal muscles on the back of the thigh.

The arteria comitans nervi ischiadici, a branch from the inferior gluteal artery which represents the axial artery, supplies the Sciatic nerve Branches from perforating arteries also supply the Sciatic nerve

**Branches of Sciatic nerve**

A. **Articular branch**: These branches supply the hip joint.

B. **Muscular Branch**: These Branches supply the hamstring muscle (Semimembranosus, Semitendinosus, Biceps femoris, Adductor magnus).

C. **Terminal branch**: the Sciatic nerve usually ends half way down in the back of the thigh by dividing into these two terminal branches viz.

1. Tibial nerve and
2. Common peroneal nerve

1. **The Tibial/Medial Popliteal nerve**:

Tibial nerve is the larger terminal branch of the Sciatic nerve. The root value of the Tibial nerve belongs to the ventral divisions of ventral rami of L4, L5, S1, S2 and S3 Spinal nerves. In the upper part it is overlaped by the hamstring muscles. It reaches the medial side of the ankle joint where it lies in the interval between medial malleolus and medial margin of the heal.
Finally it ends by dividing into medial and lateral planter nerves. Tibial nerve runs along the back of thigh and through the middle of the popliteal fossa. In the popliteal fossa it is first concealed by the semimembranosus, but then comes to immediately deep to the popliteal fascia and passes obliquely across the posterior surace of the popliteal vessels to lie medial to them on popliteus deep to gastrocnemius and plantaris. It then passes deep to the tendinous arch of soleus and lies medial to the posterior tibial vessels in the intramuscular septum superficial to tibialis posterior. The nerve descends in this plane between flexor digitorum longus and flexor hallucis longus and crosses the posterior surface of the ankle joint.

The Tibial nerve supplies :-
- Muscles of the back of the leg and sole of the foot.
- Skin of the lower half of the leg, lateral side of leg and foot, and sole of the foot.

Branches of the Tibial Nerve :

(A) **Articular Branches**: These are namely superior medial genicular nerve, middle genicular nerve and inferior medial genicular nerve which is largest of the genicular nerves. All these nerves end in the knee joint. The Tibial nerve also supplies the ankle joint just before it divides into its terminal branches.

(B) **Muscular branches**: The muscular branch of tibial nerve supplies (1) Two heads of gastrocnemius (Lateral & Medial) (2) Soleus (3) Plantaris (4) Popliteus (5) Tibialis Posterior (6) Flexor digitorum longus (7) Flexor hallucis longus, muscle.

(C) **Sural Branch (S1 S2)**: Sura means calf of legs. So sural branch is that nerve which supplies the calf region of the leg. It is a cutaneous branch of tibial nerve. It lies on the lateral side of the cutaneous. Finally it goes to the lateral side of the foot and supplies the lateral margin of the foot and lateral side of the little toe.

On the back of the leg it is joined by the by the sural communicating branch from the common paroneal nerve. On the back of the leg it also communicates with posterior cutaneous nerve of the thigh on the lateral side of the foot, it communicates with the lateral branch of the superficial paroneal nerve.

(D) **Cutaneous Branch**: These branches are medical calcaneal nerves, supply the skin of the heel and medial side of the sole of the foot.

(E) **Terminal Branch**: The Tibial nerve ends by dividing into
1. Medial planter nerve and
2. Lateral planter nerve.

1. **The Medial planter nerve**: This nerve, homologous with median nerve in the hand, is rather larger than the lateral planter nerve. It passes forwards with the medial planter artery under cover of the flexor, retinaculum and abductor hallucis, to the interval between that muscle and the flexor digitorum brevis in the sole of the foot.
Branches :

(A) **Cutaneous branch**: The Cutaneous branches supply the skin of the medical part of the sole of the foot.

(B) **Articular branch**: These branches supply the articulation of tarsus and metatarsus.

(C) **Digital nerve of the great toe**: It supplies the medical side of the great toe and also provides a small twig to flexor hallucis brevis muscle.

(D) **Plantar digital nerve**: These are 3 in number.

1. First plantar digital nerve: Supply to first lumbrical muscle and to 1st and 2nd toes
3. Third Plantar digital nerve: It receives a communicating branch from lateral plantar nerve. It supplies the 3rd and 4th toes.

Each digital nerve after reaching the digits, gives out cutaneous, articular and dorsal branches. The cutaneous branches supply the skin as far as ball of each toe. The articular branches supplies the interphalangeal joints the dorsal branch is given out opposite the distal phalanx and it goes upward and ends by supplying the nail bed and structures around it.


(2) **The Lateral Plantar Nerve**: This nerve is smaller terminal branch of tibial nerve. It supplies the lateral side of the little toe, contiguous side of the 4th and little toe, Abductor digiti minimi, flexor digiti minimi brevis, flexor digitorum accessorius, Adductor hallucis, 2nd, 3rd and 4th Lumbricals, Interossei muscles.

**Branches**: It has superficial and Deep branches.

Superficial branch again divides into lateral and Medical branches. Lateral branch supplies the lateral side of little toe, Flexor digiti minimi brevis third plantar interossei and fourth dorsal interossei muscles. Medial branch supplies the contiguous side of 4th and little toe and communicates with third plantar digital branch of medial plantar nerve.

Deep branch supplies the Adductor hallucis, 2nd, 3rd, 4th lumbricals, 1st, 2nd & 3rd dorsal interossei and 1st & 2nd plantar interossei muscles. This branch also sends twigs to distal intertarsal, tarso - metatarsal and intermetatarsal joints.

(2) **“The Common Peroneal Nerve”**: This nerve is one of the terminal branches of the Sciatic nerve. It is smaller than the Tibial nerve. Its fibres are derived from the dorsal division of the anterior primary rami of the L4, L5, S1 and S2 spinal nerves. It supplies the lateral and anterior surfaces of the leg, Dorsum of the foot, skin on the lateral side of the leg, skin on the greater part of the dorsum of the foot.

It runs along the medial border of the biceps femoris to the back of the head of the fibula.

It then curves forwards between the neck of the fibula and the upper fibers of the paroneous longus muscle which arises from it. Here the nerve divides into Superficial and deep paroneal nerves.

The common paroneal nerve is easily rolled under the finger on the back of the lateral condyle of the femur and of the head of the fibula and on the postero-lateral side of
the neck of the fibula. In all the positions, it may be damaged against the bone by a blow.

**Branches :**

(A) **Articular branch :**

These are 3 in number.

1. Superior lateral genicular nerve
2. Inferior lateral genicular nerve
3. Anterior tibial recurrent nerve

All these nerves end by supplying the knee joints.

(B) **Cutaneous branch :**

These are 2 in number.

1. Lateral cutaneous nerve of the calf of the leg- It supplies the anterior, posterior and lateral aspects of the upper part of the leg.

2. Sural communicating nerve or paroneal communicating nerve- This nerve arises from the common paroneal nerve in the popliteal fossa, often with the lateral cutaneous nerve of the calf. It joins with the sural nerve opposite the middle of the calf of the leg. It supplies the skin on the proximal two thirds of the posterolateral surface of the leg and the territory the sural nerve.

(C) **Terminal branch :**

1. Deep peroneal or anterior tibial nerve
2. Superficial peroneal or musculo cutaneous nerve

1. **The Deep peroneal Nerve:**

This nerve is the largest terminal branch of the common paroneal nerve. This nerve begins between the neck of the fibula and peroneous longus. It runs inferomedially on the fibula, deep to the extensor digitorum longus to join the anterior tibial vessels on the anterior surface of the interosseous membrane, lateral to tibialis anterior. It supplies the following areas:

1. **Anterior crural region :**
   Here it supplies the Tibialis anterior, Extensor digitorum longus, Extensor hallucis longus and peroneus longus.

2. **1st and 2nd Interossei.**

3. **Extensor digitorum brevis.**

4. **All tarsal articulations.**

5. **Metatarso phalangeal joint of 1st to 4th toes.**

6. **Contiguous sides of the great and 2nd toes.**

**Branches :** It has medial and lateral branches.

(A) **Medial Branch :** This nerve runs forward on the dorsum of the foot and lies on the lateral side of the arteria dorsalis pedis. It lies in the first intermetatarsal space.
It has 3 branches:

1. **A communicating branch** - It communicates with the medial branch of superficial peroneal nerve.

2. **An interosseous branch** - It supplies 1st dorsal interosseous muscle. It also gives articular filament for 1st metatarsophalangeal joint.

3. **Two terminal dorsal digital nerves** - These supply the contiguous sides of great and 2nd toes.

**B) Lateral Branch**

It gives three interosseous branches “which supplies all tarsal joints and metatarsophalangeal joints of 2nd, 3rd and 4th toes” and a muscular branch which supplies extensor digitorum brevis.

The deep peroneal supplies all muscles of the anterior compartment of the leg and extensor digitorum brevis. If the nerve is damaged dorsiflexion of the ankle and extension of the toes is lost and inversion is weakened. The condition leads to a “drop foot.”

(2) **The Superficial Peroneal Nerve**:

This is a smaller terminal branch of common peroneal nerve. This arises from the common peroneal nerve on the lateral side of the neck of fibula. It descends through the peroneal muscles, supplying them, it enters the superficial fascia at the junction of the middle and distal third of the leg and then gives the branches.

**Branches**: It gives 3 branches namely

1. **Muscular branch** - It supplies peroneus longus et brevis muscle

2. **Cutaneous branch** - These branch supply the following
   - Skin of the lower part of the front of leg.
   - Skin of the dorsum of the foot.
   - Medial side of the great toe.
   - Adjacent side of 2nd and 3rd toes, 3rd and fourth toes and 4th and 5th toes.

3. **Terminal branch** - It has medial & lateral branches
   - **Medial branch** - It gives 2 digital nerves
     1. One to medial side of the great toe and it communicates with Saphenous nerve
     2. Other communicates with medial branch of anterior tibial nerve and supply the contiguous sides of the 2nd and 3rd toes.

   - **Lateral branch** - It gives 2 dorsal digital nerves, one supplies the adjacent sides of the 3rd and 4th toes, and other communicates with the sural nerve on the lateral side of the foot and then supplies the contiguous sides of 4th and 5th toes.
Table No. - 9
Branches of Sciatic Nerve

**SCIATIC NERVE**
(Ventral rami of L₄, L₅, S₁, S₂, S₃)

<table>
<thead>
<tr>
<th>Articular branch (to hip joint)</th>
<th>Muscular branch to hamstring muscles</th>
<th>Terminal branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibial Nerve (Medial popliteal)</td>
<td><em>Common peroneal nerve</em></td>
<td></td>
</tr>
<tr>
<td>(L₄, L₅, S₁, S₂, S₃)</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Articular branch</th>
<th>Muscular branch to</th>
<th>Sural branch</th>
<th>Cutaneous branch</th>
<th>Terminal branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Superior medial</td>
<td>Gastrocnemius (S₁, S₂)</td>
<td>(medial calcaneal nerves)</td>
<td>(plantar nerves)</td>
<td></td>
</tr>
<tr>
<td>genicular nerve</td>
<td>2. Soleus</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Inferior medial</td>
<td>plantaris</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>genicular nerve</td>
<td>4. popliteus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Middle genicular</td>
<td>Tibialis posterior</td>
<td>6. flexor digitorum longus</td>
<td>7. flexor hallucis longus</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medial plantar nerve</th>
<th>Lateral plantar nerve</th>
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<table>
<thead>
<tr>
<th>Cutaneous branch</th>
<th>Articular branch</th>
<th>Digital nerve of great toe</th>
<th>3Plantal digital nerves</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Lateral branch</th>
<th>Medial branch</th>
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*Common peroneal Nerve*

<table>
<thead>
<tr>
<th>Articular branch</th>
<th>Cutaneous branch</th>
<th>Terminal branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Superior lateral</td>
<td>Lateral cutaneous of calf</td>
<td>Deep peroneal</td>
</tr>
<tr>
<td>genicular nerve</td>
<td>Peroneal unifying nerve</td>
<td>Nerve</td>
</tr>
<tr>
<td>2. Inferior lateral</td>
<td>Medial branch</td>
<td>Nerve</td>
</tr>
<tr>
<td>genicular nerve</td>
<td>Lateral branch</td>
<td></td>
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<tr>
<td>3. Anterior tibial recurrent</td>
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</table>

<table>
<thead>
<tr>
<th>Communicating branch</th>
<th>Interosseous branch</th>
<th>Two terminal dorsal digital nerve</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Three interosseous branches
Muscular branch to extensor digitorum brevis

*Superficial peroneal (Musculocutaneous) Nerve*

<table>
<thead>
<tr>
<th>Muscular branch to peroneus longus et brevis</th>
<th>Cutaneous branch</th>
<th>Terminal branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial branch (2)</td>
<td>Lateral branch (2)</td>
<td></td>
</tr>
</tbody>
</table>

(60)
THE ANASTOMOSIS OF SCIATIC NERVE

Gluteus medius
Gluteus maximus
Gluteus minimus
Superior gluteal nerve
Piriformis
Pudendal nerve
Nerve to obturator internus
Posterior cutaneous nerve of thigh
Sciatic nerve
Semitendinosus
Common peroneal nerve
Tibial nerve
Tendon of biceps femoris
Nerve to popliteus
Sural communicating branch
Sural nerve
Soleus
Popliteus
Medial calcaneal nerve
Flexor hallucis longus
Tibial nerve
Nerves to soleus and gastrocnemius

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Physiology of Sciatic Nerve

The Sciatic nerve is both motor and sensory in function. It supplies motor nerves to semitendinosus, semimembranosus, the long head of the biceps femoris and adductor magnus muscle. In addition to it, this nerve is also motor nerve to all muscles below the knee.

After complete interruption of the Sciatic nerve, there is paralysis of flexion of the knee which is carried out by the hamstrings and of all the muscles below the knee. Foot drop occurs as a result of paralysis of the anterior tibial group of muscles and of the paronei. The patient is able to stand and to walk, but drags the toes of affected foot and is unable to stand on his toes on the paralysed side.

The sensory distribution of the sciatic nerve lies entirely below the knee. After complete division of the nerve, light touch is the form of sensibility which is most extensively lost. Anaesthesia to cotton wool extends over the whole of the foot with the exception of a zone about 1.5 inches wide along the inner aspect extending about 2 inches distal to the internal malleolus, this area being supplied by Saphenous nerve on the leg the area of anaesthesia to light touch includes the outer aspect, roughly from the midline in front to the midline behind as far up as 2 inches below the upper end of the fibula. Analgesia to pin prick is less extensive than anaesthesia to light touch below the two areas approximately coincide, but above, the area of analgesia is less extensive than that of anaesthesia by 2 or 3 inches. Appreciation of pressure and of vibration is lost over whole of the foot, with the exception of the proximal two thirds of the inner aspect and postural sensibility and appreciation of passive movement are lost in the toes.

The knee jerk is unaffected, but the ankle jerk is lost and so also is plantar reflex. Vasomotor and trophic changes are usually conspicuous after complete division of the Sciatic nerve. The leg is congested and swollen, especially when it is allowed to hang down. The skin is dry and sweating is lost over the foot expect along the inner border, where it is supplied by the Saphenous nerve. Perforating ulcers may develop on the sole.

The Sciatic nerve may be damaged as a result of fractures of the pelvis and femur and gun shot wounds of the buttock and thigh. In civil life one of the commonest causes of Sciatic nerve lesion is a misplaced injection given too far medially in the buttock, while there is evidence that rarely the nerve may undergo entrapment or compression as it traverses the Sciatic notch. It may be compressed within the pelvis by neoplasm or by foetal head during delivery. The common paroneal nerve is much more susceptible to injury than the tibial, complete division of the whole nerve is rare.

Causes of Sciatica

The causes of Sciatica are grouped under 3 broad headings viz.:

(1) Affections of Sciatic nerve, nerve roots and lumbo sacral plexus.
(2) Extra neural disease.
(3) Pre-disposing factors.

(1) Affections of Sciatic nerve, nerve roots and lumbo sacral plexus :-

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A. Sciatic nerve
   • Trauma
   • Neuro fibroma
   • Penetrating Injury (like Injections)
   • Interstitial neuritis
   • Leprosy
   • Poly arteritis nodosa

B. Pressure or irritation in course of nerve:
   • Inflammation or malignant disease of pelvic viscera.
   • Injury to nerve itself
   • Tumours of nerve sheath
   • Peripheral neuritis

C. Cauda equina:
   • Neurofibroma or other tumours.
   • Backward protrusion of inter vertebral disc
   • Irritation of the meninges by haemorrhage, infection and intrathecal injections.
   • Hydatid cyst
   • Post herpetic neuralgia

D. Lumbar vertebrae:
   • Disc lesions
   • Pott’s disease
   • Spondylosis
   • Osteomyelitis
   • Tumours
   • Fractures and dislocations
   • Spondylolisthesis

E. Lumbo - Scral Plexus:
   • Cyst and tumours of pelvic adnexa and rectum
   • The uterus during labour
   • Pelvic inflammation (very rare)

F. Intra - Spinal Causes:
   • Prolonged intervertebral disc
   • Arachnoiditis
   • Intra- spinal tumour
   • Osteo- arthritis
   • Tuberculosis of lumbar spine
   • Malformation of the lumbar roots
   • Spin developmental narrowing of the lumbar canal

(2) Extra neural diseases:
A. Sacro-iliac joints:
   • Subluxation
   • Tuberculous and non-tuberculous arthritis
   • Ankylosing spondylitis

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• Spondyloarthropathies

B. Sacrum and other pelvic bones
  • Primary and Secondary neoplasm

C. Soft tissues
  • Gluteal bursitis
  • Fibrositis sacro sciatic band

D. Pressure or irritation at intervertebral foramina
  • Osteo arthritis
  • Spondylolisthesis
  • Ankylosing spondylitis
  • Paget’s disease

E. Prolapse of the intervertebral disc (P.I.D.)
  • This is the commonest cause of Sciatica and often occurs between L4-L5 and L5-S1 discs.
  • Occasionally an acute lumbar disc protrusion results in the sequestration of a portion of the disc.

3. Pre-disposing factors:
   A. Age: Degenerative changes in the intervertebral disc may appear as early as 20 years of age, but herniation is often precipitated by trauma such as twisting of the spine, lifting heavy weights while the spine is flexed as during child birth. The age incidence shows a peak with 35% of cases in the fourth decade.

   B. Sex: Between 75 to 80% of patients are male

   C. Strains of the muscles of the back.

   D. Chill: As by sitting on wet grass.

Thus causes of Sciatica are many and varied. Out of them three major cause are often seen, viz. disc protrusion, degenerative changes and hydration of the disc. Amongst these three factors, herniation of lumbar intervertebral disc is of most commonest type. Lumber disc protrusion is often the result of trauma, a history of which is obtainable, in at least half of all cases. The commonest type of stress is that which produced by lifting a heavy object in a bent forward position or by a fall in a similar posture. Since 75% of patients are in or beyond the fourth decade, it would appear that degenerative changes which begin in the prime of life predispose towards herniation but the syndrome is not uncommon in young adults.

Pathogenesis of Sciatica

As we know that Sciatica is neuralgia of Sciatic nerve, caused by the congestion of or pressure on the nerve root, the pathogenesis of this condition is concentrated on the implication of the nerve or its roots in one hand and extra neural lesions on the other hand.
So far as implication of the nerve or its roots is concerned, the pathological lesions in the intervertebral disc of lumbosacral region come into consideration the importance arises as these discs are the most weight bearing portions of the human body and maximum strain is laid on them.

According to the anatomical structures each disc consists of following 3 prominent parts-

1. **The nucleus pulposus** - A highly elastic semi-fluid mass compressed like a spring between the vertebral surfaces.

2. **The annulus fibrosus** - A outer small ring of fibrous tissue or encircling structure which surrounds and confirm the turgid central nucleus.

3. **The cartilage plate** - It separates the nucleus from the vertebral body.

The lesions may develop in any of the three constituents. Owing to man’s upright position the discs are subjected to constant strain for which they are not originally intended, so that degeneration in later life is commoner than in any other organ with corresponding loss of the normal cushing function.

The nucleus pulposus is the essential part of the disc and plays chief role in the pathological changes. In youth it presents a very marked elastic turgor, depending on the fluid content of the tissue, which seems to depend on the very high concentration of hyaluronic acid that serves to maintain the viscosity, With age this turgor gradually diminishes and is completely lost in various degenerations. As the nucleus loses its fluidity and becomes desiccated and solid, it loses its firmness and becomes fragile and easily torn. Later on whole disc swells and is converted into a sodden mass like lumps of porridge. The spinal curvatures of advancing age are the consequence of degeneration of the discs.

**The pathological changes of the discs are chiefly of two types.**

1. Herniation of the nucleus pulposus into the bodies of the vertebrae sometimes associated with spinal deformities and.

2. Posterior prolapse into the spinal canal.

**Herniation of the Nucleus Pulposus :-**

It is the combined result of the internal pressure of the Nucleus and weakening of the cartilage plate or the vertebral body by injury or disease. As a result of tearing of the cartilage plate, the turgid Nucleus Pulposus may bulge or rupture the Annulus Fibrosus. The vertebrae may be weakened by osteoporotic change as in osteomalacia, again allowing prolapse and ballooning of the nucleus.

**Protrusion of Disc :-**

The significant lesions are those to which the names of posterior herniation, protrusion and prolapse of the disc or its nucleus are attached. The posterior prolapse
occurs in the disc between the fifth lumbar vertebrae and sacrum (L5-S1) or between the fourth or fifth lumbar vertebrae (L4-L5). Prolapse between third and fourth lumbar vertebrae also cannot be ruled out. A disc protrusion compresses the spinal nerve which is running to the foramen one segment below, the fourth lumbar disc the fifth lumbar nerve, and the fifth lumbar disc the first sacral nerve. Sometimes protrusions occur from two or more discs. The compressed nerve becomes swollen and tense. Occasionally an acute lumbar disc protrusion results in the sequestration of a portion of the disc which acts as a major space-occupying lesion in the lumbar canal, involving multiple spinal nerves in the cauda equina.

The protrusion has the same reasons as herniations, loss of turgor of nucleus pulposus or loss of elasticity of annulus fibrosus or none of them but damage of annulus and posterior longitudinal ligaments by trauma. The annulus fibrosus and posterior longitudinal ligaments are supplied with several nerve fibres. Low back pain may be produced due to tearing of either of these structures or stretching of the torn ligaments by the herniated nucleus pulposus.

In brief the pathogenesis may be brought about in one of the three ways.

1. A large mass of disc tissue may fill the canal and compress all the nerve roots.

2. Usually only a relatively small mass of extruded tissue enters the spinal canal, presses on the nerve roots, anterior or posterior, and stretches instead of displacing the relatively taut nerve in its strong dural sheath. Tension rather than pressure is the important factor in producing the pain.

3. In rare instances sudden displacement of a large mass may injure the roots.

Extra neural factors are also responsible for the production of Sciatica in the same mechanism as the neural factors. They lay on pressure either on the nerve root or on the nerve itself. There may be radiating irritation to the Sciatic nerve by these factors. Ultimately the nerve remain in the tense condition and in the first stage there may be back pain or so to say Lumbago. In the long run this back pain either alone or being associated with the predisposing factor produce Sciatica with the symptomatology of pain from lumbar and gluteal region to the outer border of the feet through back of the thigh and leg. The all total of the mechanism of these factors in producing Sciatica is shown in the following table in brief.
PATHOGENESIS OF SCIATICA

NEURAL FACTORS
- Herniation of nucleus pulposus
  - Pressure on the nerve root

- Protrusion of disc
  - Pressure on the nerve

- Injury to Sciatic nerve
  - Irritation of the nerve

- Other neural changes
  - Swelling of the nerve

  - Congestion of the Nerve

EXTRA NEURAL FACTORS
- Pressure on the nerve root
- Pressure on the nerve

PREDISPOSING FACTORS
- Referred irritation to the nerve

Tension of Sciatic Nerve

Back pain

Sciatica
CLINICAL FEATURES OF SCIATICA

The Sciatica syndrome is characterised by the pain beginning in the lumbo sacral region spreading down the buttock, postero-lateral aspect of the thigh and the calf to the outer border of the foot.

The onset may be sudden or gradual. In most cases the onset is subacute and Sciatica is frequently preceded by lumbar pain, known as "Lumbago" which may have occurred intermittently for years. Sudden severe low back pain is felt when the patient is bending. After two or three days of pain in the lumbar spine the pain radiates down the back of one leg from the buttock to the ankle.

In general the pain is intensified by stooping, sitting and walking. The patient is usually most comfortable lying in bed on the sound side with the affected leg slightly flexed at the hip and knee. The pain interferes with sleep when it is very severe and he may be able to obtain relief only by getting up and walking about. There is often a feeling of numbness, heaviness and deadness in the leg, especially along the outer side of the foot.

In Sciatica the pain is often possible to distinguish three elements.

(1) Pain in the back, aching in character and intensified by spinal movements.

(2) Pain deep in the buttock and thigh, also aching and gnawing in character and influenced by the posture of the limb. And

(3) Pain radiating to the leg and foot, momentarily increased by coughing and sneezing, which raises the pressure in the veins and the spinal subarachnoid space.

The signs associated with prolapse of an intervertebral disc may be divided into following two groups.

(1) Signs due to altered mechanics of lumbar spine.

(2) Signs due to pressure on the nerve root.

(1) Signs due to altered mechanics of lumbar spine:

- Spasm of the sacro-spinalis muscles causes the flattening of the lumbar curve.

- Scoliosis is often associated with Sciatica at the level of prolapsed disc, the lumbar spine being flexed towards the affected side, less frequently towards the opposite side.

- There may be a tender spot at the level of the fifth lumbar transverse process.

- Some rigidity of the lumbar spine is usually present.

(2) Signs due to pressure on the nerve root:
These depend on the particular involved root.

A. When lumbar 4th root is involved or compressed:
This disc is less commonly prolapsed than the others. These causes

- Weakness of inversion of the foot.

- Weakness of quadriceps muscle.

- Knee jerk is diminished.
• Sensory loss over the medial aspect of the leg.
• Plantar reflex is flexor.

B. When the 5th lumbar root is compressed :

• Pain spreads from the outer aspect of the leg to the dorsum or the inner border of the foot
• Weakness of dorsiflexion of the toes, eversion of the foot and peronei.
• Ankle jerk is preserved. Knee jerk may be exaggerated, partly as a reflex result of the pain and partly owing to hypotonia of the hamstrings, the antagonists of the quadriceps.
• Sensory loss over the dorsum of the foot and lateral aspect of the leg over the fifth lumbar dermatome.
• Occasionally complete foot drop may occur.

C. When the 1st Saral root is compressed :

• Weakness of the eversion and plantar flexion of the root and small muscles of the foot and calf muscles.
• Pain radiates to the outer border of the foot.
• Blunting of light touch and pin prick over the outer half of the foot and three outer toes and lower part of the outer aspect of the leg.
• Ankle jerk is diminished or lost.
• Sensory loss over the outer border and sole of the foot.

A valuable sign of root pressure is limitation of flexion of the thigh on the affected side if the straight leg is raised. Stretching the Sciatic nerve by extending the knee with the hip flexed causes severe pain (Lasegue's Sign). If the third or fourth lumbar roots are involved Straight Leg Raising (S.L.R.) may be normal, but pain in the back may be induced by hyperextension of the hip with the knee flexed (Femoral Nerve Stretch Test)

There are muscular hypotonia and slight wasting not only of the muscles supplied by the Sciatic nerve, but usually also of the glutei and sometimes of all the muscles of the lower limb. There is tenderness on pressure in buttock and thigh.

In case of large central disc protrusions in lumbar region pain is sometimes bilateral though often more severe pain on one side, muscular weakness is more widespread, several tendon reflexes may be lost (e.g. one knee jerk and both ankle jerks), sensory loss is more extensive, indicating involvement of motor roots, and sphincter control may be impaired. This condition should be regarded as a neurosurgical emergency.

SPECIFIC TESTS FOR SCIATICA :

1. Straight Leg Raising sign (SLR) :

Prolapse of intervertebral discs occurs most commonly at the L4/L5 or L5/S1 level, producing compression of the L5 and S1 nerve roots respectively. Tension is put on these roots by flexing the hip with knee straight, so called Straight Leg Raising. Normally about 90 deg. of hip flexion should be possible when the root is stretched over a prolapsed disk S.L.R. will be restricted
• **Examination of S.L.R.** - Examine the patient lying supine with the knee flexed, check that passive hip flexion is normal.

• With the knee extended, raise the leg, on the unaffected side by lifting the heel with one hand while preventing. Knee flexion with the other hand. Note the range of movement.

• Repeat this on the affected side, asking the patient to report as soon as it is painful and where the pain or paraesthesiae felt.

2. **Bragard’s Sign** :- During SLR when the limit is reached, gently dorsiflex the ankle, there by applying further tension on the nerve root increases the pain.

3. **Laségue’s Sign** :-
Perfom straight leg raising and at the limit, flex the knee, reducing tension on the sciatic roots. Now further flex the hip to 90° gently extend the knee until pain is once again reproduced.

4. **Bowstring Sign** :-
These is another useful test and may be used to confirm nerve root irritation and to exclude malingering.

   In position of Laségue’s sign apply firm pressure with the thumb first over the hamstring nearest the examiner, than in the middle of the popliteal fossa and finally over the other hamstring tendon. Ask the patient which manoeuvre exacerbates the pain. This test is positive if the second manoeuvre is painful and if the resultant pain radiates from the knee to the back. If there is still doubt as to whether there is genuinely sciatic nerve root irritation, two other manoeuvres may be tried, namely the ‘flip’ test and the ‘sitting test’
5 Flip test - Ask the patient to sit with hips and knees flexed to 90° on the edge of the couch and test the knee reflexes. Then extend the knee, ostensibly to examine the ankle jerk. When there is genuine root irritation the patient will 'flip' backwards to relieve the tension. The malingering, distracted by attention to the ankle jerk test, may permit full extension of the knee, which is the equivalent of full 90° straight leg raising.

The accompanying neurological signs of L5 and S1 nerve root irritation include weakness of dorsiflexion of the great toe (extensor hallucis longus, L5), weakness of ankle dorsiflexion and inability to walk on heel (L5), loss of ankle reflex and inability to walk on tip-toe (S1), and numbness, paraesthesiae or hyperalgesia in the first interdigital cleft and lateral aspect of calf (L5), lateral border of foot and sole (S1).

Femoral roots - Disc prolapse at higher levels may involve the L2, L3 or L4 roots of the femoral nerve. The femoral nerve passes into the thigh anterior to the pubic ramus, and hip flexion or straight leg raising will relieve any tension on these roots. They are stretched by extending the hip with the knee flexed.

Femoral stretch test - Ask the patient to lie prone, or on the unaffected side if there is a painful flexion deformity of hip.
- Flex the knee slowly asking the patient to report onset of pain.
- If this fails to produce pain gently extend the hip with the knee still flexed.

If the test is positive pain radiates into the back and thigh Knee flexion alone may be sufficient to exacerbate pain and cause the patient to flex the hip to reduce tension on the nerve root. When limitation of hip extension is due to a hip lesion, knee flexion should have no effect on the pain.

The accompanying neurological signs of femoral nerve root irritation may include altered sensation over the anteromedial thigh and reduced knee jerk.
INVESTIGATIONS IN SCIATICA

1. **X-ray:**
   Straight X-ray of lumbo-sacral spine with sacro-iliac and hip joint should be carried out in all cases of Sciatica, since many causes of Sciatic pain are associated with bony changes visible in radiograms. Narrowing of the disc space with osteophyte formation at the margins of the vertebral bodies can be detected. Straight X-rays are not of great value in the diagnosis of herniated disc.

2. **Myelography:**
   It is required only if the diagnosis is in doubt or for purposes of localisation before operation. Myelography after the injection of an opaque fluid or air may demonstrate a filling defect, but is only indicated if the picture is usually severe. A herniated disc may be present in spite of a negative myelogram.

3. **Electromyography (EMG):**
   This is useful in the investigation of disorders of muscles and peripheral nerve. Needle electrode studies of muscles during voluntary contraction helps identify denervation and differentiates it from myopathic disorders. Many peripheral nerves can be stimulated electrically and conduction velocities in motor and sensory fibres measured separately. This studies may define the site of localised nerve compression.

4. **Nuclear Magnetic Resonance (NMR):**
   It is useful in assessment of root lesion.

5. **Computerized Tomography Scanning (C.T.Scan):**
   It helps in identification of a narrow canal, destructive lesions of vertebral bodies and posterior elements or presence of paravertebral soft tissue mass.

6. **Magnetic Resonance Imaging (MRI):**
   MRI provides the ability to produce longitudinal (sagittal) as well as axial sections of the entire spinal cord and, when available, is the optimal method of studying the spinal cord nerve rootlets and disc spaces.

7. **C.S.F. Test:**
   It may show increased protein with normal cell count in large protruded intervertebral disc.

8. **Histopathological Examinations of the Disc:**
   It may further confirm the diagnosis.

9. **Procaine Injection Test:**
   Fibrositis of glutei may be distinguished from Sciatica by the infiltration of procaine solution. Local and referred pain of fibrositis are abolished by this method.
DIFFERENTIAL DIAGNOSIS OF SCIATICA

Sciatica due to a lumbar disc protrusion must be distinguished from:

1. Compression of the nerve roots by a tumour within the spinal canal.

2. Inflammatory, degenerative and neoplastic lesions of the spine and pelvis involving the roots and.

3. Neoplasms of the pelvic viscera

In case of herniated disc followings are the principal points of distinction.

(1) The onset of symptoms is fairly rapid.

(2) The buttock and posterior aspect of the thigh are tender on pressure.

(3) There is slight muscular wasting.

(4) Sensory loss is slight.

(5) After the onset the course of disorder during the first month is stationary or tends to improvement.

In case of Sciatic compression followings are the cardinal points.

(1) The onset is usually gradual.

(2) The nerve is not tender on pressure.

(3) Muscular wasting is conspicuous.

(4) Sensory loss is more pronounced.

(5) These symptoms are progressive in nature.

In such cases the abdomen and pelvis must be thoroughly examined for sources of compression. The lumbar spine and pelvis should be X-rayed. Attention must be paid to the general condition of the patient, and inquiry, made for symptoms suggestive of a pelvic neoplasm and as to recent loss of weight. Rectal examination should not be omitted; and in women vaginal examination is advisable also. A complete examination of the nervous system is required to exclude tumours within the spinal canal and syphilis as a cause of Sciatic pain, and if these are suspected the C.S.F. should be examined, and if necessary a myelogram carried out.
Herniated disc requires to be distinguished from arthritis of the hip joint, from which Sciatica may be associated. In herniated disc, movements of the hip joint are painless, provided the Sciatic nerve is not stretched. The lower limb can be rotated and abducted without pain, whereas these movements are painful and often limited in arthritis of the hip. In the latter condition the ankle jerk is preserved. The diagnosis is confirmed by the X-ray.

Sometimes Sciatica and Femoral neuropathy seems obscure to be distinguished from each other. Femoral neuritis is usually due to the protrusion of intervertebral disc, but of upper lumbar spine. Pain is referred into the third and fourth lumbar dermatome. It is accompanied by wasting and weakness of the quadriceps and diminution or loss of the knee jerk. It may also be due to Diabetes (Diabetic amyotrophy) or to involvement of the nerve in inflammatory or neoplastic process is in the pelvis.

Fibrositis of the glutei may cause pain referred down the leg and on extending the knee with the hip flexed, but no sensory loss or diminution of the ankle jerk is present. In this case both local and referred pain are abolished by the infiltration with the procaine of the tender spots in the buttock.

The case of true Sciatic neuritis is now very rare and doubtful. Still then its occurrence can not be ruled out. When the investigations appear to exclude all other causes the diagnosis of true Sciatic neuritis should be accepted.

Congenital abnormalities of the lumbosacral junction, such as spondylolisthesis and sacralization of the fifth lumbar vertebrae, may cause low back pain. If occasionally fifth lumbar is compressed by these conditions, then true Sciatica may be there. This abnormality will be apparent in the X-ray film.

Vascular lesions within the distribution of femoral artery, such as atheroma and thromboangitis obliterans, are occasional causes of pain in the leg in middle age and later in life. But intermittent claudication is not always present in these cases. The diagnosis is readily established by diminution in the volume of the femoral, dorsalis pedis, or posterior tibial pulses. The syndrome of intermittent ischaemia of the cauda equina with pain, paraesthesia or weakness of the leg occurring only on exertion and relieved by rest can usually be distinguished from Sciatica, due to a single lateral disc protrusion, by myelography.

(1) Chronic Ligamentous strain and spinal instability cause pain on standing and towards the end of the day, with freedom from pain at the beginning of the day.

(2) Osteoarthrosis and degenerative disc disease in the lumbar spine cause typical symptoms of intermittent discomfort or pain in the lower back, short lived morning or immobility stiffness and gradual loss of mobility of the lumbar spine over years decades. The pain and stiffness are relieved by gentle activity but recur with excessive activity.

(3) Unremitting spinal pain of recent onset may also suggest infection or, in older patients, malignant disease when the history is of many years, duration, however, a serious organic cause is unlikely.
**PROGNOSIS OF SCIATICA**

In mild cases of Sciatica, the stage of severe pain lasts only two or three weeks and the patient recovers in a month or two, except that from time to time he may experience aching in the course of a nerve. Stooping may excite some pain in the affected leg.

In more severe cases there may be slight improvement after several weeks, but the condition then becomes stationary and the patient continues to suffer from considerable pain for a number of months. Recovery, however, ultimately occurs, except for the residual disabilities just mentioned. Recovery from symptoms may occur though the disc protrusion remains. For this reason, perhaps, relapses are common. In some cases they occur at frequent intervals, so that the patient is hardly free from pain over a period of several years. In other cases the second attack may be delayed until ten or more years after the first. Operation gives good results in 90% of cases operated upon, with a mortality rate of 1% or less. But even after operation a relapse may occur.

**TREATMENT OF SCIATICA**

In case of Sciatica two types of treatment are there viz conservative treatment and operative treatment. First of all or in mild cases conservative treatment is indicated. When this treatment fails or emergency arises due to acuteness of signs and symptoms operative treatment is indicated.

A. **CONSERVATIVE TREATMENT**:

About 70% of Sciatica patients require this type of treatment. Following steps are, in general, employed in order to carryout the conservative treatment.

1. **Analgesics**:
   Analgesics like Ibuprofen, Oxyphenbutazone, Piroxicam, Diclofenac sodium, Naproxen etc may be given according to the age and suitability of the patient.

2. **Bed rest**: Absolute bed rest should be taken on a firm mattress supported by fracture boards. Sitting position is to be prohibited. Compromise to leave bed even
for toilet purposes also sometimes is not allowed, because it may be the cause of failure of treatment.

Commonly fifth lumbar and 1st sacral roots are involved. In this case patient should be kept in supine position and no rotation of the spine is permitted. But in case of, disc protrusion involving the fourth lumbar root, lateral position with flexion of the hips is best suited to relax tension on the affected root and hence to relieve pain. Bed-rest is continued for two to four weeks, after which gradual mobilisation with back strengthening exercise is carried out over a further period of 10 to 14 days.

3. Immobilizing measures: When rest in the bed for two to four weeks has been tried and failed, immediate relief is sometimes given by application of a plaster jacket which fixes the lumbar spine in slight extension. Patient who is allowed to walk about, should wear the plaster for three months.

Alternatively many patients are relieved by the application of continuous lumbar traction for two or three weeks followed by the provision of a light lumbar support or corset which is worn for three months or longer. For lumbar traction 40 to 60 kg weight may be applied for 30 to 50 minutes intermittently.

4. Tranquillisers and Antidepressive Drugs: An overlay of depression and anxiety commonly occurs in patients with lumbar disc disease and as a result of tension in the lumbar muscles accentuates and perpetuates pain. In this condition antidepressive remedies and tranquillizing drugs such as Amytriptyline and Diazepam are particularly valuable in some patients.

5. Topical Analgesics: Topical Analgesics like Piroxicam Gel, Diclofenac sodium gel, Phenylbutazone cream etc are applied to the affected area for temporary relief of pain.

6. Local Heat or Cooling spray: Pain and spasm are sometimes relieved by the application of local heat or cooling spray to the paravertebral areas.

7. Sacral Epidural Injection: In some cases benefit may be derived from stretching the nerve roots by epidural injection at the sacral hiatus. The site of injection is painted with Iodine and anaesthetized with Procaine and a fine lumbar puncture needle is passed through the dorsal sacroccygeal ligament. Twenty ml. of 1 percent Procaine solution are first injected, and this is followed by an injection of normal saline, of which 80 ml. or more can usually be injected, the solution being at body temperature. Epidural injection yields relief of pain in about 50% of cases. Sometimes patients get completely and permanently relief. A second injection may be given after an interval of two or three days if necessary.

8. Physiotherapy: Physiotherapy in its various forms is merely palliative but graduated exercises are of value when the pain has gone.

B. OPERATIVE TREATMENT:

In the following conditions of Sciatica surgical operation is indicated.

1. Persistent Sciatica with neurological signs, unrelieved by conservative treatment.
2. Large central disc protrusions involving multiple roots.
If the sphincters are involved, then operation is obligatory.

In the patients whose symptoms do not respond to other measures.

In recurrent relapsing Sciatica.

From the outset if there is marked motor weakness like foot drop.

In chronic condition.

Manual worker in whom inability to do the necessary physical work may itself constitute an indication for surgery.

In the patient who has got gross and persistent symptoms of root compression, sufficiently severe to cause disability.

The usual operation is laminectomy with removal of protruding mass and freeing of nerve roots. At operation either herniation of Nucleus Pulposus, diffuse bulging of Annulus Fibrosus or adherence to nerve root may be found. In some cases pain may recur after successful operation. Patient should avoid going anything which causes pain and should lie down when pain begins. Probably not more then 10% of patients require surgery.

PREVENTIVE ASPECT

Correct sitting, standing and sleeping postures lessen the intradiscal pressure. Keeping trunk, muscles in optimal condition by regular exercise such as brisk walking, swimming, running etc.