



CHAPTER. The Parasacral Sciatic Nerve Block.

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INTRODUCTION

The first description of the Parasacral Sciatic Nerve Block (PSNB) is attributed to Mansour¹. In a 1993 letter he described conceptualizing and using a nerve block of the sciatic nerve at a point past the lateral edge of the sacrum, and caudad to the sacro-iliac joint. This point is within the more cephalad part of the greater sciatic notch and is described as the “parasacral position”. At this point sciatic nerve has passed out of the pelvis, and has entered the buttock region. The sciatic nerve then runs in an infero-lateral direction passing under maximus gluteus muscle and posterior to the hip joint. The sciatic nerve finally descends down the back of the thigh.

Mansour noted this nerve block could be described as a sacral plexus block because of the multitude of nerves that get blocked with the sciatic nerve injections. Some writers have done so. However this nerve block is always done with the sciatic nerve being the primary target, and the block firmly established as the *Parasacral Sciatic Nerve Block* (PSNB)^{2, 3, 4,5,6}.

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The term parasacral, in turn, is often misused, with meanings different to that inferred by Mansour. Mansour meant a space within the superior-medial corner of the greater sciatic notch and specifically deep to, the piriformis muscle. Some older literature has misused the term “parasacral” meaning any buttock approach to the sciatic nerve, for example Labat, Winnie, and Raj technique type sciatic nerve blocks. That is now considered incorrect use of the term parasacral.

In the period of 1952, before electrostimulation was available, Daniel Moore the “giant” of American regional anesthesia recommended the Labat technique for blocking the sciatic nerve⁷. He, at that time, used patient reports of paresthesia to confirm needle tip placement upon or within the sciatic nerve. The only available long acting local anesthetic of the era was tetracaine. Combined with femoral nerve block they achieved 90% success for awake surgery of the foot and lower leg. To be both safe and successful Moore emphasized the need for all anesthesiologists performing regional anesthesia to have knowledge of the involved anatomy, and to follow established practice principles when attempting a nerve block. That Moore wisdom is as relevant now. Even when using joint electrostimulation and ultrasound imaging, the anesthesiologist still needs knowledge of the involved anatomy, and to follow general good anesthesia practice protocols.

The description of the parasacral sciatic block by Mansour was a major advance in regional anesthesia. Mansour was fortunate to have electro-stimulation to assist confirmation of needle tip position. Success rates, as some define them, then jumped to over 95% for sciatic nerve blocks.

Successfully achieving *awake surgery* after any nerve block is a good indicator means that that the correct combinations of nerves were targeted to *match* the surgical tissues injured and pain from where the tourniquet was applied. It also means the local anesthetic was technically correctly injected onto the nerves following nerve location. If additional sedation or general anesthesia becomes needed during surgery, the benefits of doing the peripheral nerve blocks still remains very large. Achieving fully awake surgery is seldom a specific medical goal. However the regionalist anesthesiologist who has limited experience of handling patients awake during surgery following his or her own nerve blocks will be deprived of the rich learning derived from correlating the subtle patient surgical feedback with the subtle things the anesthesiologist observed during the nerve block. The parasacral sciatic nerve block is rich in subtle observations that can be made from the plethora of accompanying nerves and the heterogeneity of the large sciatic nerve’s substructures.

Neuraxial blocks although also classified as regional anesthesia techniques, share very little with peripheral nerve blocks. Using peripheral nerve blocks achieve the double benefit of avoiding both (a) general anesthesia, and (b) neuraxial anesthesia. The single most profound side effect of neuraxial anesthesia, although with rate of one in hundreds of thousands of cases, is paraplegia. Peripheral nerve blocks are rarely associated with nerve injury of small degree. However destruction of a complete major nerve or full plexus destruction, associated with a peripheral nerve block, occurs at a rate of less than one in many millions of cases. Peripheral nerve blocks offer the healthiest patients, and all patients, benefits of superior post-surgical analgesia. It is however with sickly and aged patients where peripheral nerve blocks clearly achieve additional second reductions in perioperative mortality.

The nerve block is most frequently paired with a parasacral sciatic nerve block (PSNB) is the psoas compartment block, sometimes called a lumbar plexus block. The PSNB has a documented (1) record of safety, (2) a reputation of being easy to perform, (3) of having high success rates.



The PSNB has popularity in Europe, South America, The Middle East, and Asia but has only enjoyed sparse usage in the USA. This author greatly likes this nerve block as it can be performed with a psoas compartment block within in one sterile field via two close injection points 10 centimeters apart.

No major complications are yet described associated with this nerve block. That may be due to the fact that it has predominantly been performed by most experienced regional anesthesia physicians. Obviously complications common to all nerve blocks such as local anesthetic toxicity and nerve injury could occur. However block specific complications related to deeper anatomical structures are a conceptual concern, and are good reasons why knowledge and training is needed to perform this nerve block. This is not a nerve block to be performed by the casual uninformed and inexperienced practitioner “giving it a try” and poking blindly with a long needle. An old teacher once said that “A fool with long needle can achieve anything”.

One last great feature of the PSNB is that its surface landmarks utilize only bone reference points. Landmarks that depend on skin-fold features or muscle edges can be variable and inaccurate. An additional good feature is that certain deep tissues landmarks of the PSNB clearly demarcate the zone where the sciatic nerve lies. Those features are defined part visually and part via electro-stimulation of the various nerves. Even in severely obese patient with poor deep tissue imaging the sciatic nerve can always be found, even if fully invisible itself.

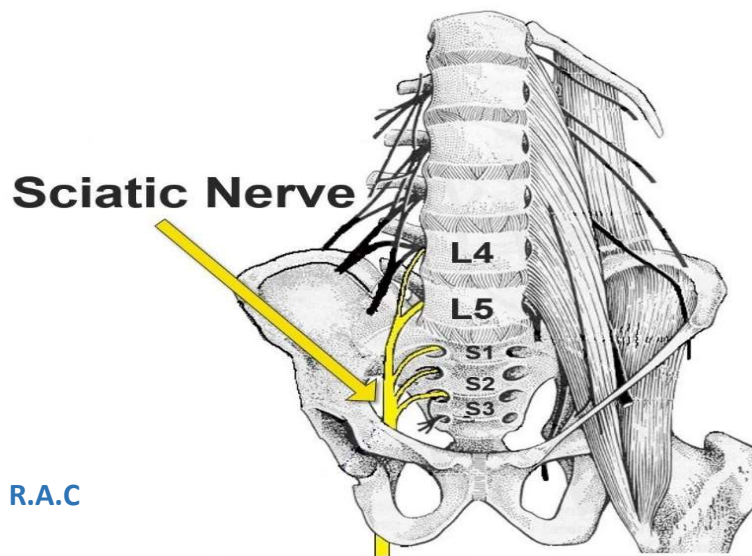


Figure 1. Anterior view of the bony pelvis, and the sciatic nerve roots.

ANATOMY

The sciatic nerve takes origin from the lumbo-sacral plexus nerve roots L4-5 and S1-3. It is the largest nerve of the human body by far. See figures number 1, 2 and 3. It's size is so large partly due to the mass of muscles supplied with motor axons, but mostly due to the very large number of sensory axons conveying foot and leg information. Together with the wrist median nerve, the sciatic nerve is the other major nerve that is dominantly sensory in its composition. That means a stimulating needle may touch and even move the nerve and no muscle twitch will result if the needle tip has touched only a fascicle with sensory fibers. Fascicles are always pure motor or pure sensory in character. By comparison the femoral nerve is nearly a pure motor nerve in its composition and a stimulating needle making nerve contact will always induce a muscle twitch. An alert and fully awake patient may report very subtle paresthesias when a stimulating needle touches a sciatic sensory fascicle. If a patient is sedated they will



not indicate these 4 sensory experiences. If paresthesia is ever intentionally being sought best success requires use of sharp tip needles rather than blunt nerve block needles. In modern practice with patient sedation, the anesthesiologist when placing a standard nerve block needle onto a normal sciatic sensory fascicle simply observes nothing. This is all the explanation why when using electrostimulation to verify needle tip position with sciatic nerve blocks, it is often only after a second needle adjustment that a motor response is elicited.

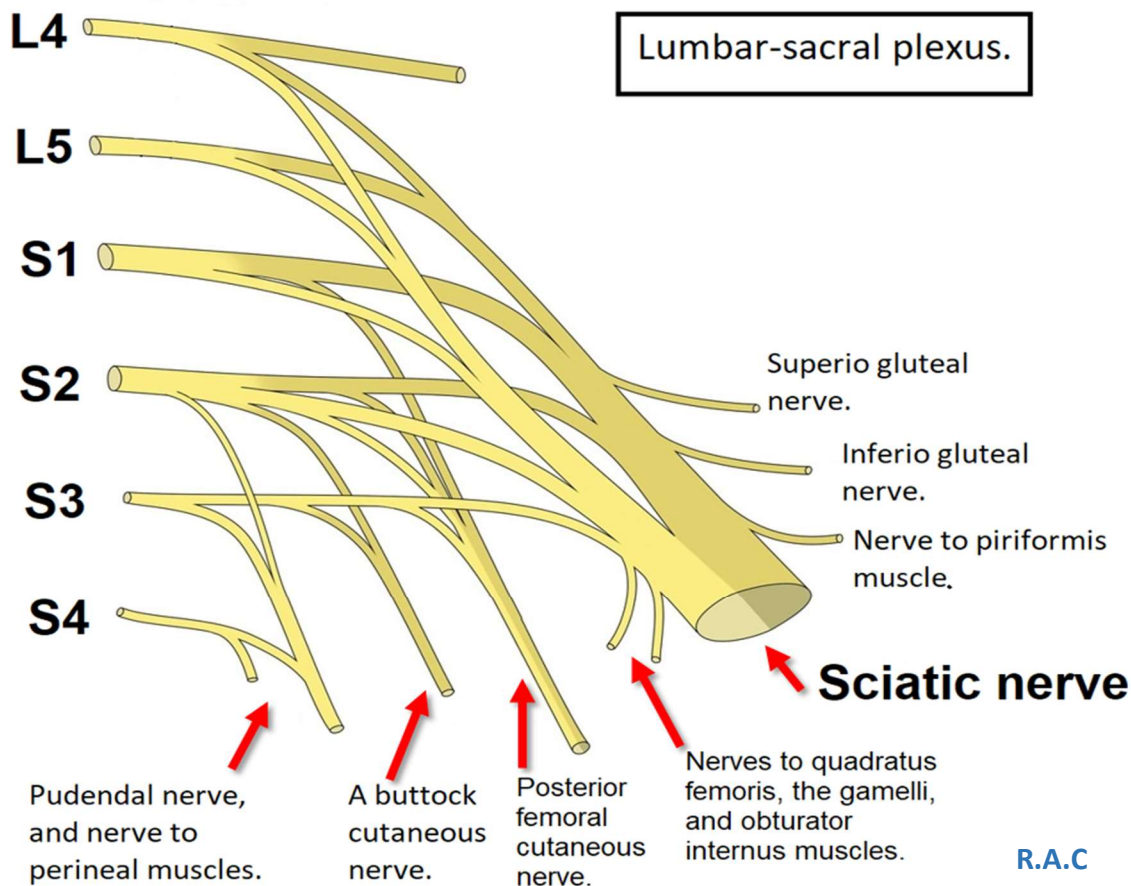


Figure no. 2. Terminal nerves of the lumbar-sacral plexus. Note the nerves that accompany the sciatic nerve to greater sciatic notch are named here.

This large amount of sensory information that is conveyed by the sciatic nerve is reflected in the sophisticated human bipedal abilities. That allows a ballerina to pirouette with precision on one toe to the music of Tchaikovsky. Such fine muscle control needs a large amount of proprioceptive information back from the foot and lower legs. The human sciatic nerve is also proportionately very large compared to that of quadrupedal animals. For example, a 50 kg ballerina has as large a sciatic nerve as an 800kg cow that just plods on four feet. Bipedal humans need more sensory information from their feet, than what quadrupedal cows, who cannot dance, need from their hind quarter hooves.

The first detailed description of the lumbar-sacral nerve plexus, and sciatic nerve was made in 1887 by AM Patterson⁸. He revealed greater details of the nerve structures in the greater sciatic foramen than had ever before been described. His descriptions were based on dissection of both fresh



cadavers and preserved cadavers. Patterson noted that the enveloping fascial layers of the sciatic nerve were substantially less tough and rigid in fresh tissue dissections than in preserved tissue dissections. Some older anatomical descriptions of various peripheral nerves, based on preserved cadaver dissections, have over-emphasized the nature of facial sheaths surrounding nerves and plexi, implying degrees of impenetrability by needles and imperviousness to drugs that is not seen clinically. That misunderstanding, in the pioneering era of regional anesthesia led to some dogmas being developed about “sheath blocks”. That is largely an abandoned concept now.

The sciatic nerve supplies all muscles below the knee, and the major sensory portion of the lower leg too. In the thigh it also supplies half of the adductor magnus muscle. The sciatic nerve also supplies sensations to the large posterior part of the **hip** and **knee** joint capsules and the associated muscles.

The sciatic nerve in the parasacral position has large number of **accompanying nerves**. These nerves make up most of the lumbar-sacral plexus. It is these accompanying nerves that make the parasacral sciatic nerve block clinically unique and useful. Accompanying nerves lies in close proximity to the sciatic nerve and can all be nerve blocked as well, if correct drug volumes are used. The accompanying nerves of the parasacral sciatic nerve are;

1. *Posterior cutaneous nerve of the thigh (PCNT)*. This is also known as the posterior femoral cutaneous nerve. Any sciatic nerve block performed at the level of the GT-IT line or more proximal will consistently block this nerve. The GT-IT line is a skin marking joining the positions of the greater trochanter (GT) and the ischial tuberosity (IT). Nerve blocks injected distal to the GT-IT line, e.g. the sub-gluteal sciatic block, and the popliteal fossa sciatic block etcetera, fail to block the PCNT due to that nerve then being physically separated from the sciatic nerve by the hamstring muscles.
2. *Pudendal nerve*. It is never desirable to block this nerve. It is however invariably blocked. Any patient observed numbness of the perineum or penile shaft is thus a temporary side-effect of a parasacral sciatic nerve block.
3. *Superior gluteal nerve*. This nerve lies immediately supero-lateral to the parasacral sciatic nerve, and supplies the gluteus minimus and gluteus medius, and tensor fascia iliaca muscles. Electro-stimulation of this nerve twitches the tensor fascia lata muscle on the most lateral aspect of the hip region, and indicates the stimulating needle tip is supero-lateral to the parasacral sciatic nerve.
4. *Inferior gluteal nerve*. This nerve supplies the gluteus maximus muscle. It lies medial to the sciatic nerve. Electrostimulation of the nerve shows muscle activity in the most medio-caudad zone of the buttock. That is distal to the point of the parasacral sciatic nerve injection and next to the gluteal cleft. During performance of parasacral sciatic nerve block such a twitch indicates the need to redirect the needle more towards lateral, in order to find the sciatic nerve.
5. *Nerve to the hamstrings*. This is actually a branch of the sciatic nerve. It already forms in the parasacral region, but accompanies the sciatic nerve in close proximity to until the sciatic nerve reaches very near the ischial tuberosity (IT). Thereafter the nerve to the hamstrings is separated from the sciatic nerve by hamstring muscles. A sciatic nerve block performed at the level of the GT-IT line or more caudad can never rely on a hamstring twitch as an indicator of correct nerve block needle tip position. The nerve to the hamstrings are

separated from the sciatic nerve. Drug injected onto the nerve to the hamstring muscles will not reach adequately the sciatic nerve. The block will fail. The nerve to the hamstrings is already embedded in hamstring muscles and dissociated from the sciatic nerve at the GT-IT line and more caudad. The sciatic nerve block injection would then fail.

- For the parasacral sciatic nerve block, a hamstring twitch is a perfect endpoint when positioning the nerve block needle. A fully successful sciatic nerve block, with all accompanying nerves follows consistently.
6. *Nerves to all the hip posterior joint capsule associated muscles.* These muscles in total are external rotators of the hip. They are the Piriformis, quadratus femoris, the superior and inferior gemelli, and obturator internus muscles. These muscles all get incised fully or partially with the posterior approach hip arthroplasty.

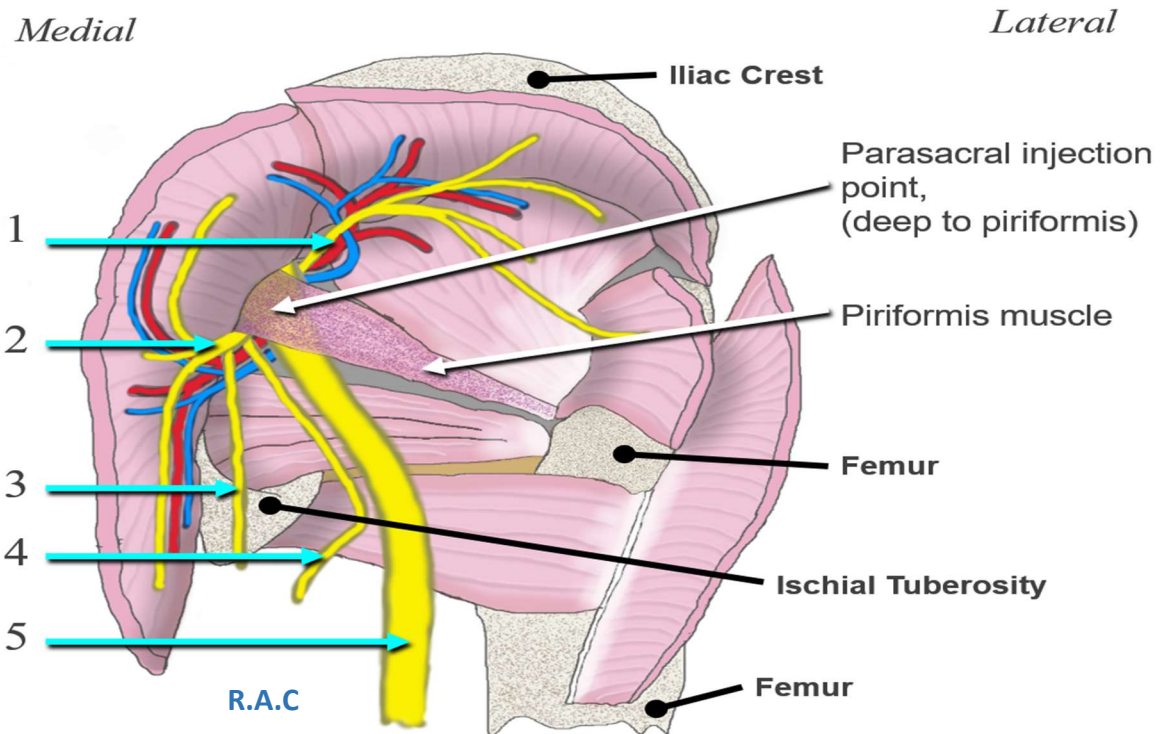


Figure no. 3. This is posterior view of the buttock region with the gluteus muscles reflected. The major of the nerves of the lumbar sacral plexus are identified. All the nerves emerge from deep to the piriformis muscle. No. **1** is the superior gluteal nerve. No. **2** is the inferior gluteal nerve. No. **3** is the pudendal nerve. No. **4** is the posterior nerve of the thigh. No. **5** is the sciatic nerve.

a) SECTIONAL ANATOMY.

There is much benefit for the regional anesthesiologist to study sectional anatomy views of the parasacral region. CT scans are used to prepare sectional anatomy drawings. CT scans define the sciatic nerve poorly in the parasacral region due to the sparsity of fat around the nerve at that point^{9, 10}. CT scans however define the surrounding muscles and bones very well. CT scans also differentiate the sciatic nerve poorly from lymph nodes and blood vessels.



Recognizing the piriformis muscle is key to locating all the other structures passing through the greater sciatic foramen. Distinct fascial planes visually separate the piriform muscle from the (superficial) posterior lying gluteal muscles and from the anterior lying viscera. On CT scan the sciatic nerve ranged in visual size from 0.7 to 1.3 cm wide. After passing caudad to the piriformis muscle inferior edge, the sciatic nerve passes posterior (superficial to) to the sacrospinous ligament. See figures numbers 4 to 7.

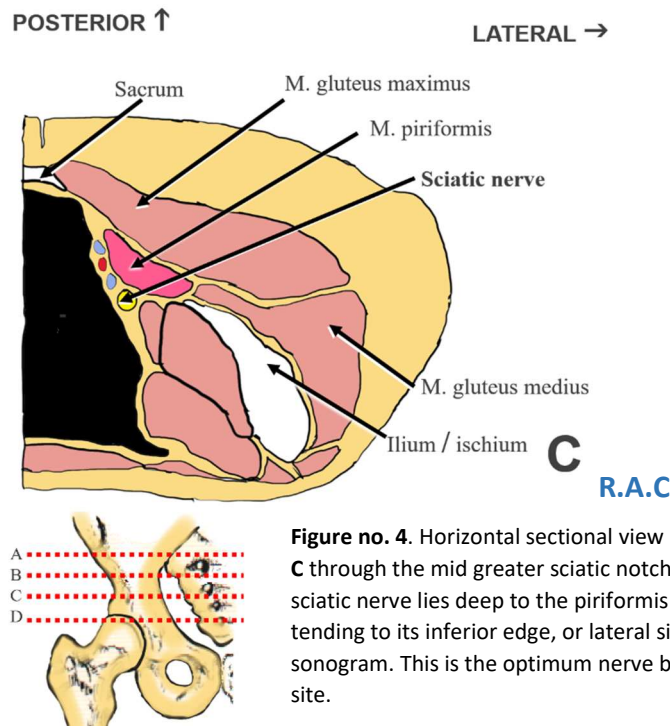


Figure no. 4. Horizontal sectional view of level C through the mid greater sciatic notch. The sciatic nerve lies deep to the piriformis muscle, tending to its inferior edge, or lateral side on sonogram. This is the optimum nerve block site.

In the parasacral sciatic nerve block sectional anatomy view; the following structures are seen;

(See figure number 4)

1. Skin and fat lies most superficial.
2. Muscles maximus gluteus and medius lies next, deep to the skin.
3. The bony sacrum is seen medial and close to the skin
4. The bony ilium-ischium plate is seen lateral and deep from the skin.
5. Piriformis muscle lies in the space between the two bony structures, deep to the glutei muscles. On ultrasound the piriform muscle is often wedge shaped, and tapering to a pointed edge on its caudad aspect (lateral edge on

sonogram image). The rule is the parasacral sciatic nerve lies “deep to two muscles”, the glutei and piriformis.

6. Immediately deep to piriformis muscle lies the sciatic nerve and its accompanying branches from the lumbo-sacral nerve plexus.
7. Interlaced with the nerves and lying deeper to them are the internal pudendal blood vessels.
8. Deep to the neurovascular structures lies peritoneum of the pelvis, and the pelvic contents including bowels.
9. Also far deep lie the internal iliac vessels.

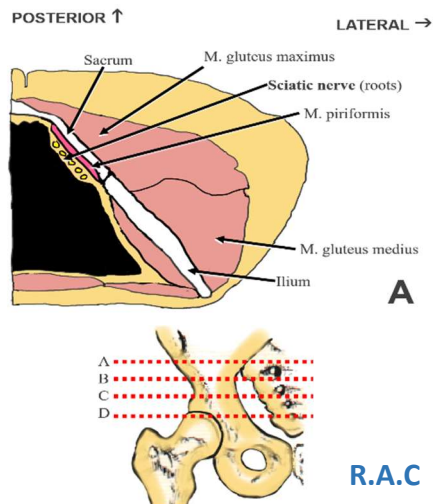


Figure no. 5. Horizontal sectional view of the pelvis at level **A**, cephalad to the greater sciatic foramen, through the sacrum and ilium. Note the continuity of the bone structures, as single line.

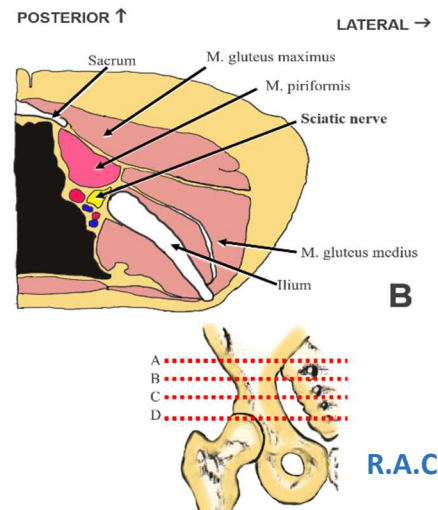


Figure no. 6. Horizontal sectional view of the pelvis at level **B** through the apex of the greater sciatic notch, or the parasacral point. The piriformis muscle is seen with the sciatic nerve. This view also produces a good parasacral sciatic nerve block.

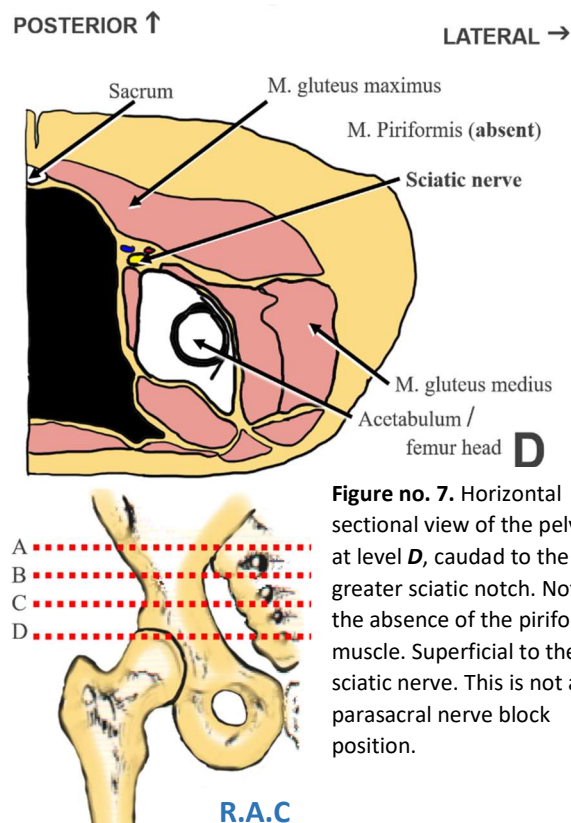


Figure no. 7. Horizontal sectional view of the pelvis at level **D**, caudad to the greater sciatic notch. Note the absence of the piriformis muscle. Superficial to the sciatic nerve. This is not a parasacral nerve block position.

Note in figure number 7, a sectional view caudad to the parasacral sciatic injection point, the sciatic nerve lies only under the gluteus muscles. The absence of the piriformis muscle indicates the injection site is too caudad to also co-block the accompanying nerves of the parasacral sciatic nerve block. This level “D” if used for a sciatic nerve block can still produce a functional sciatic nerve block for knee and lower leg surgery, but not for hip surgery. This injection point corresponds to the sciatic nerve block point as described by Winnie.

It is good for any person performing the parasacral sciatic nerve block to have studied sectional anatomical views through this area at different levels. A good anatomical understanding will provide (i) the confidence needed to perform this deep nerve block, (ii) the skill supplement to appropriately readjust the needle direction as structures are felt or identified, (iii) the wisdom to avoid anatomy

related needle complications, and (iv) the insight to timeously recognize rare unusual complications should they ever occur.

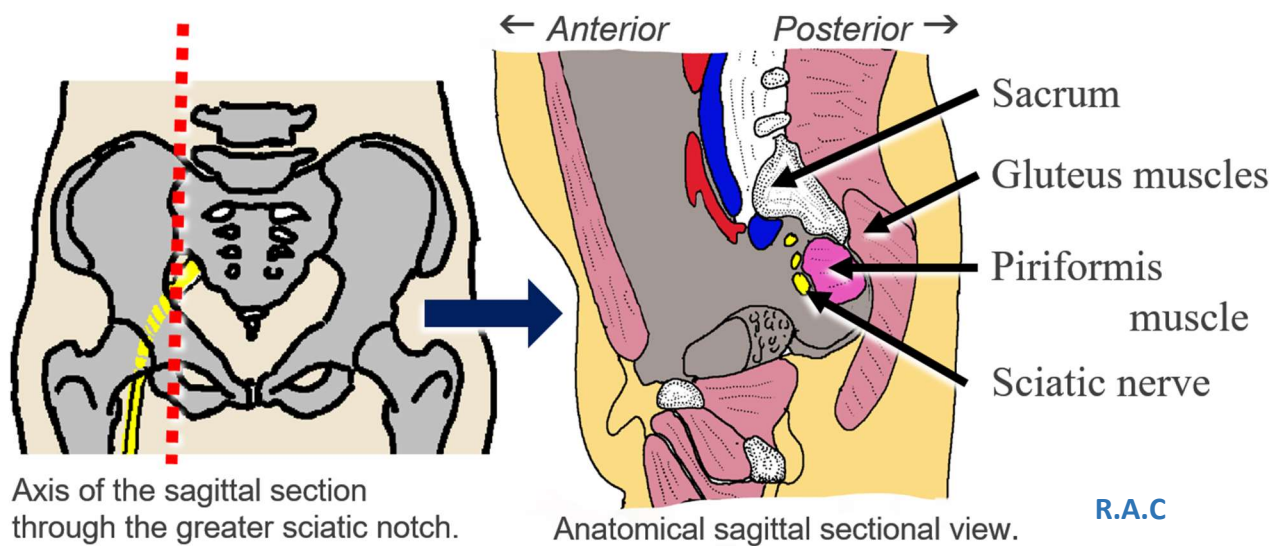


Figure no. 8. Sagittal section through the parasacral sciatic block injection point.

The sagittal sectional anatomy view, in figure number 8, through the parasacral sciatic injection point shows the intimate position of the sciatic nerve with the deep side of the piriformis muscle. The fact that pelvic visceral injury has never been described associated with this nerve block probably has many reasons, all discussed elsewhere. However one extra factor may lie in the fact that the sagittal plane skirts parasagittal latera to the visceral cavity.

b) BLOCKING THE OBTURATOR NERVE.

There is a question of whether the parasacral sciatic nerve block can also block the obturator nerve. See figure number 9.

The 1996 and 1997 reports from Canada by Morris, stated that the parasacral sciatic nerve block frequently causes an obturator nerve block. This is now seen as an erroneous interpretation of an observation. The claim could never be validated^{11, 12}. Figure number 10 showing just bare bones and nerves is derived from the report of Morris. Simplistically viewed, it may suggest a parasacral injection of local anesthetic could readily spread onto the obturator nerve. Morris identified some weakness of hip adduction was observed in 93% of his patients and interpreted that as evidence of an accompanying obturator nerve block to the sciatic nerve block. It was however noted that the weakening in adduction was not accompanied by a single case with a mapped area of sensation loss on the medial side of the thigh. Thirteen percent of the Morris patients did report a vagueness of sensation on the medial thigh, but retained full perception of skin touch.

In 2008 Valade from France injected latex into fourteen fresh preserved human cadaver parasacral sciatic nerves¹³. Valade demonstrated a range of distances between the parasacral injection point and the obturator nerve within the pelvis to be 2 to 4 centimeters (mean = 2.9 cm). In 22% of cases latex spread was deficient and considered incompatible with nerve block developing in clinical

situations. A cadaver study must always be considered very guardedly as a predictor of clinical outcomes. Valade's study suggested 82% success rates for blocking the obturator nerve would occur clinically. The cadaver flesh is very altered by death and chemical preservation. Also liquid latex is different to aqueous local anesthetic molecule solutions. In Valade's study the injected latex was mostly found to be intravenous, thus further suggesting Valade's study be disregarded.

Another French cadaver study by Jochum more accurately showed zero evidence of latex spread to the obturator nerve in four injections¹⁴. Jochum also did clinical studies to measure adductor weakness as evidence of any obturator block¹⁴. He found that a parasacral sciatic block alone showed a measured 1.3% adductor weakening in two thirds of the study patients, and zero

weakening in the others. A follow up specific obturator block caused a total of 80 % adductor weakening. Jochum pointed out that due to the extreme anatomical variability in the dermatomes associated with the obturator nerve obturator block success must never be measured via changes in sensation. Furthermore Jochum emphasized that all the adductor function of the hip is not controlled purely by the obturator nerve. The adductor magnus muscle receives some nerve supply via the obturator nerve and some via the sciatic nerve. The proportions of those two nerve supplies are also subject to inter-individual variation. Thus a parasacral sciatic nerve block might result in slight loss of adductor strength, without any obturator nerve block having occurred. Other studies on this matter confirm the parasacral sciatic nerve block does not block the obturator nerve¹⁵.

The obturator nerve has a path that is much more anterior and lateral. See figure number 10. The nerve lies on average 3.4 cm away from the lumbo-sacral nerve plexus¹⁶.

An awkwardly written, but honest, 2013 study by Ozturk from Istanbul, strongly suggested that if a parasacral block injection of 30 milliliter is used the success rate of obturator motor blocks is increased measurably¹⁷. The poor study design excluded the possibility of assessing the extent of contribution of the parasacral block to motor obturator nerve block. Notably the failure rate was still 25% in the more successful group. It was suggested that a larger than standard volume of drug can *sometimes* spread as far as the obturator nerve. It is noted that, that drug needs to spread far by use of

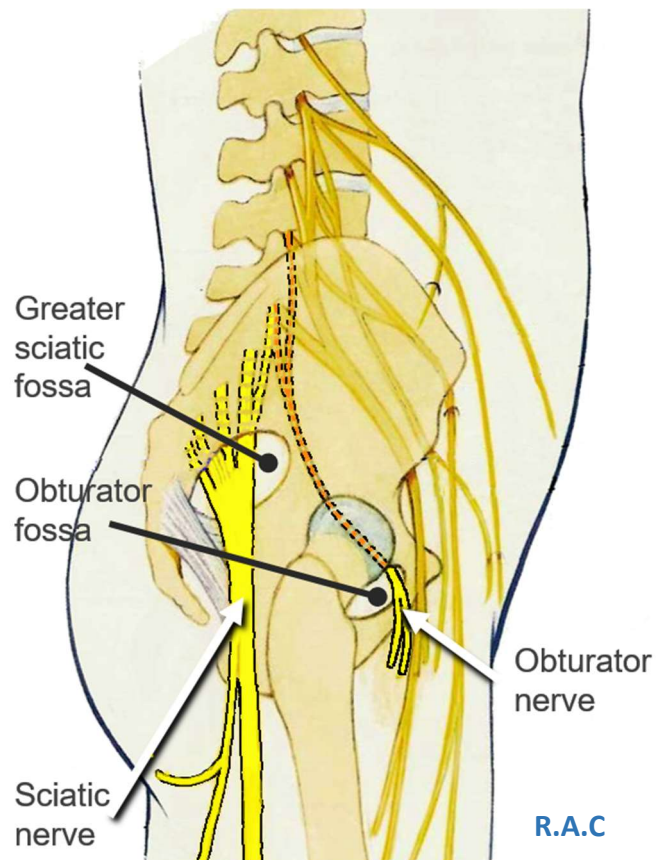


Figure no 9. Lateral view of the hip region. Obturator nerve has partial S2 origin, and enters the thigh via the obturator foramen towards anterior. The Sciatic shares a S2 origin and enters the buttock region via the greater sciatic foramen towards posterior.

added volume tends to be both (i) too diluted by interstitial fluids, and (ii) inconstant in its spread to reliably achieve obturator nerve block. Thus the nerves at the end of the spread zone tend to be inconsistently blocked. Also increasing the block volume can cause other secondary problems such as local anesthetic toxicity, especial when multiple blocks need to be combined. Also an excessive parasacral sciatic nerve block can cause autonomic blocks in the pelvis with bladder dysfunction (see later). Therefore it is not worth increasing the parasacral sciatic nerve block drug volume in order to achieve an obturator nerve block.

The recommendation is thus, if an obturator nerve block is critical to anesthesia success it should be blocked via more reliable means than using a parasacral sciatic nerve block. Use a specific and separate obturator block. The parasacral sciatic nerve block does not block the obturator nerve.

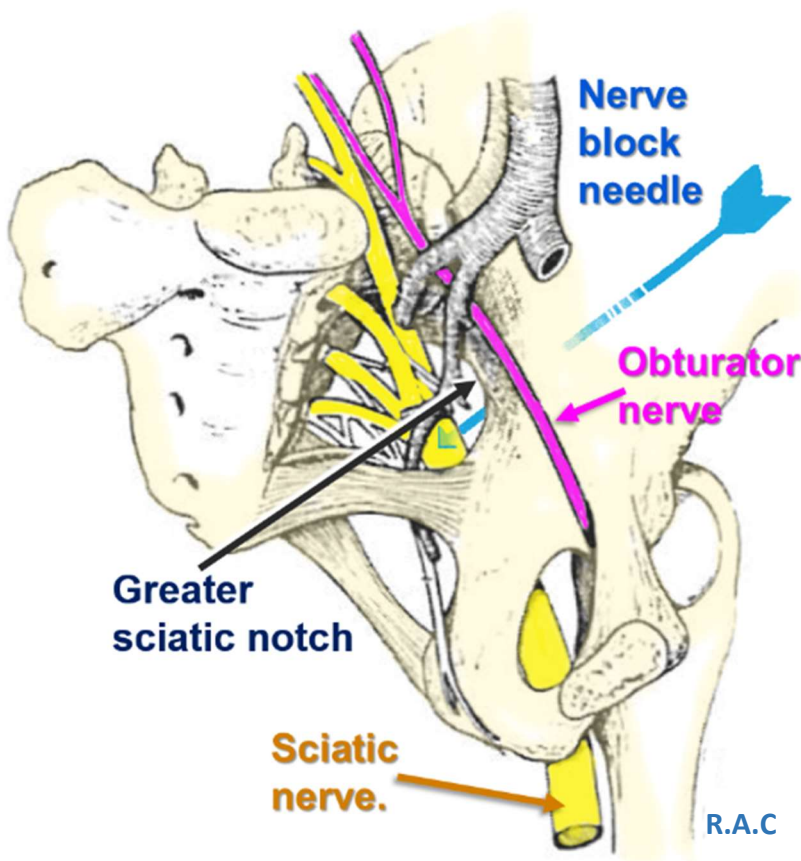


Figure no. 10. Internal view of the greater sciatic notch, from anterior. Note the nerve block needle approaches the parasacral sciatic from posterior and superficial to the greater sciatic. Note, the obturator nerve runs most of its course dissociated from the greater sciatic notch, and buried within the psoas muscle. There is no reason to believe that local anesthetic drug injected onto the parasacral sciatic nerve outside the pelvis has any free flow path to the obturator nerve lying within the pelvis. This illustration is deceptive and artificial in having all muscle and fascia removed in order to view the bones and nerves.

TECHNIQUE

The principle objective of the parasacral sciatic block is to make a local anesthetic injection where the sciatic nerve is most associated with the lumbar-sacral plexus. The approach is from posterior. See figure number 11. This is where the nerves just pass lateral to the lateral edge of the sacrum. This is also the point where the nerve exits the pelvis to enter the gluteal region. This is also the point at which most of the accompanying nerves branch away from the sciatic nerve, for

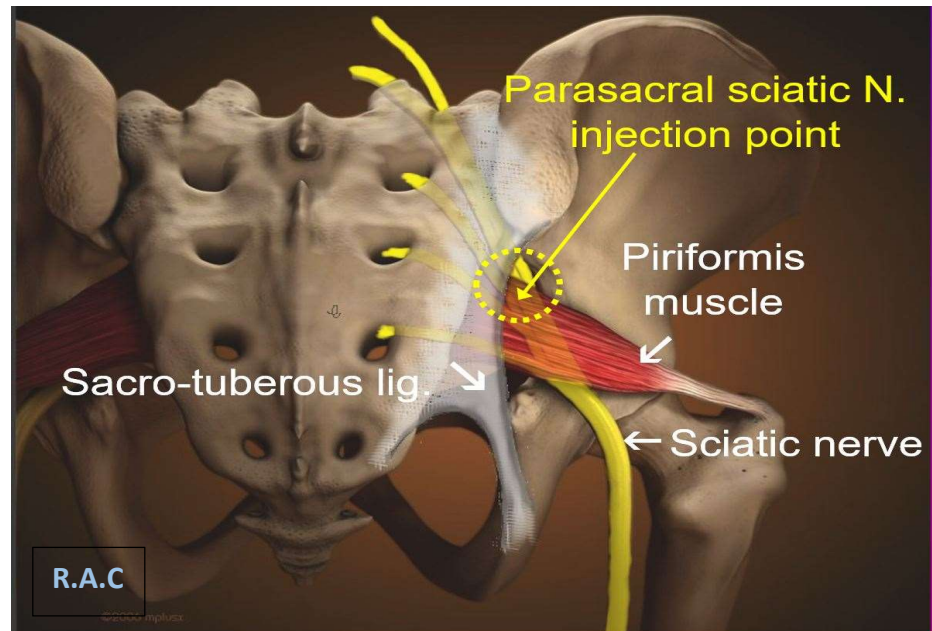


Figure no. 11. Posterior view of the sciatic nerve emerging from the pelvis, via the greater sciatic notch. The nerve lies anterior to, and deep to the piriformis muscle. The overlying gluteal muscles and skin have been removed.

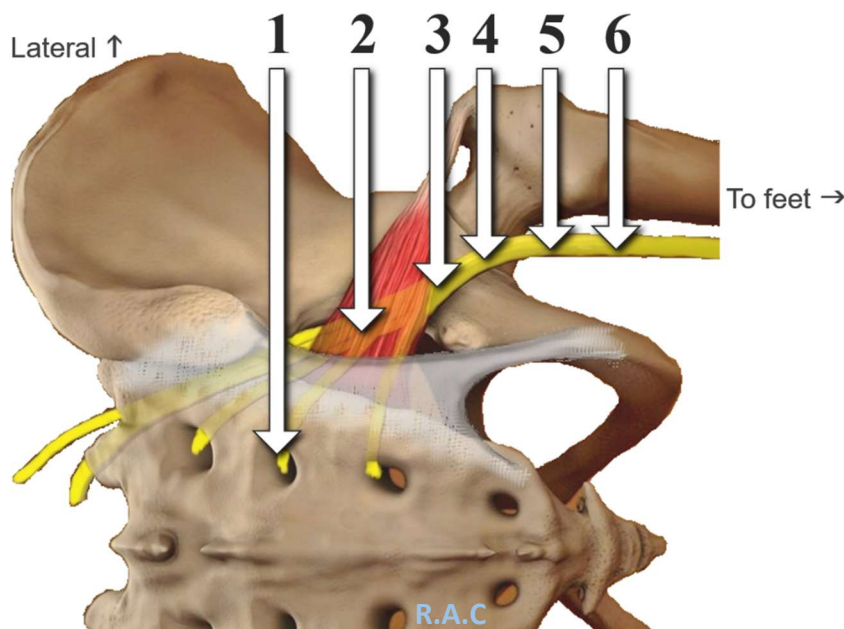


Figure no. 12. Posterior view of the pelvis and Sciatic nerve, and the different buttock region sciatic nerve block injection positions. No. 1 is the S2 root injection. No. 2 is the parasacral block. No. 3 is Labat's block. No. 4 is Winnie's block. No. 5 is the GT-IT line block of Raj. No. 6 is the subgluteal block.

example the superior gluteal nerve.

The sciatic nerve can still be effectively blocked, on its own, at many other points in the buttock. These are position described by Labat, Winnie, Raj and others. See figure number 12. Each position, however, for every centimeter more caudad than number 2, results in less of the accompanying nerves of the parasacral region being blocked as well. See figure number 2 for the accompanying nerves.



A variety of techniques have been used to locate the parasacral sciatic nerve for local anesthetic injection.

- i. **Electrostimulation-guided blind technique.** For experienced physician regionalists, success rates are a virtual 100%. The technique is easy once the concepts are learned, and the anatomy can be visualized blindly. Catheters can also be inserted. This author's deepest nerve block with vertical inserted needle the sciatic nerve was found at 16 centimeters from the skin. This is a backup technique in the presence of extreme obesity hindering ultrasound imaging. The PSIS and GT can always be identified by palpation.
- ii. **Ultrasound-guided technique,** (combined with electro-stimulation). This is a deep block and in obese patients the sciatic nerve is often not recognizable. The ultrasound does however aid the nerve block positively in all but extreme cases of obesity. The ultrasound helps place the needle tip immediately under the pectineus muscle to explore that region with an electro-stimulating needle. The piriform muscle can however always be identified visually, with experience. With deep blocks of 5 to 8 cm deep to the skin, and steep descending needles, the needle tip may be invisible. Tissue distortion induced by needle movement in a dynamic image may then still be a useful indicator of needle tip position. With very deep blocks with a target region exceeding 8 cm from the skin, at least the proximal needle can still be seen and used as a direction pointer. The electro-stimulation and muscle twitches will indicate when the needle tip has been advanced far enough. Electrostimulation must always be combined with the ultrasound guidance to verify precise needle tip position. This author has not yet experienced an impossible parasacral sciatic nerve block for technical reasons related to patient obesity. The author has worked in very obese communities.
- iii. **Loss of resistance technique.** This is not a recommended technique. This should only be done by special experts in this matter. Such an anesthesiologist will; (i) have experience of blocking the parasacral sciatic nerve with other methods, (ii) have experience using loss resistance techniques with some other nerve blocks, (iii) will have good judgement at estimating the depth of the sciatic nerve from skin in any patient, and (iv) will know what fascias and muscle layers to expect. This can be done in the unavailability of a nerve stimulator and an ultrasound machine. The needle should be blunt like a Tuohy needle. Success rates will be about 90% at best. This technique may have a place when providing crisis rescue medical care in extreme circumstances without resources, like war zones and earthquake zones. The risks and benefits must be judged in context of the triage circumstances and workload conditions.



i. **LANDMARKS OF THE PARASACRAL SCIATIC NERVE INJECTION POINT.**

The recommended patient position is the lateral position, surgical side up, and with the upper hip flexed. The lower leg may be straight or flexed. The hip flexion stretches out the excess buttock flesh, making the intervention easier. This block can be performed in the fully prone patient. See figure number 13 and 23.



Figure no. 13. The parasacral sciatic nerve block being injected in the prone position.

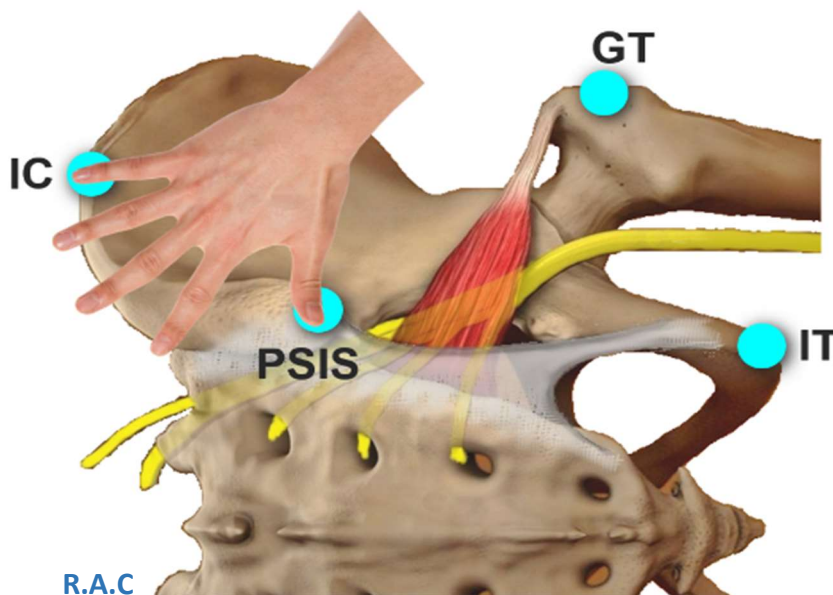


Figure no. 14. The bony landmarks of the parasacral sciatic nerve block.

- Identify the **Greater Trochanter (GT)**. The GT is the most lateral bone in the hip region, and uppermost bone as the patient lies. Mark the overlying skin.
- Identify the **Ischial Tuberosity (IT)**. It is the most caudad bone of the torso. It is also the bone a person sits on. Mark the skin point that will correspond to where the IT would be seen by a person standing behind the patient. Do not mark the most caudad flesh over the

IT as it may be very displaced to caudad if the patient has a large and flabby buttock. If correctly marked it will lie 3 to 6 centimeters more caudad than the bony GT. The IT point should lie in a transverse plane about 3 to 5 cm caudad to that of the GT.

- Mark the highest, most cephalad, point on the **Iliac Crest (IC)**. It will lie in the mid-axilla line.
- Identify the **Posterior Superior Iliac Spine (PSIS)**. Place the most 5th finger of a relaxed open hand onto the IC point. Swing the hand so that a line from that 5th finger-tip to the thumb tip, is at 45 degrees to the inter-iliac-crest line (Toufrier's line), and towards medial. The distance from IC to PSIS is about 15 to 18 cm in average adults. See figure number 14. The thumb should be overlying a subtle skin dimple. The dimple overlies the PSIS. PSIS is a bony prominence that can be seen in extreme underweight patients. See image number 44. Palpate the flesh

as at that point and a small boney prominence of the PSIP. Mark the skin over the PSIP. See figure number 14.

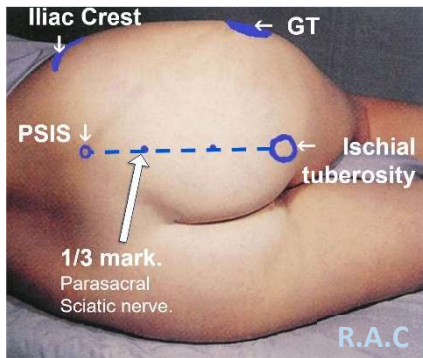


Figure no. 15. The parasacral sciatic nerve block injection point.

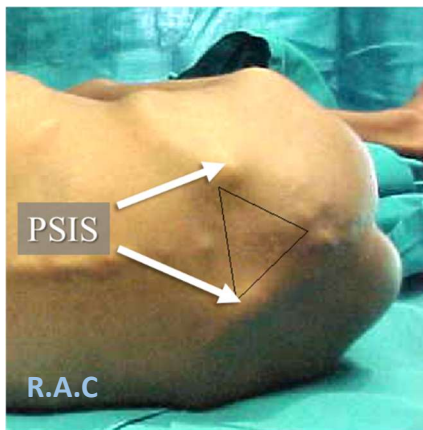


Figure no. 16. See how prominent the posterior superior iliac spine (PSIS) is, in an emaciated patient.

- Join the PSIS and IT marks with a line. See figures number 15 and 16. Note the line deviates at its IT end by zero to two centimeters towards lateral. Any deviation to medial suggest the landmarks are incorrectly identified. Then mark a point at one third of the distance of that line, caudad to PSIS. This rule can apply equally to five foot tall ladies and seven foot tall men. The “one third rule” is the most practical rule. This point is the parasacral sciatic nerve block needle insertion point if using only electrostimulation guidance. This point is also the point where the transducer should likely find the best image to perform the nerve block.

- Mansour originally recommended to descend towards the GT, by “*almost three finger breadths*” along the line descending from PSIS¹⁸.
- Other later clinicians refined that measurement to mean six centimeters. Rozov and Gaertner in France in 2004, studied Mansour’s landmark in 75 patients all undergoing parasacral sciatic blocks. Based on experience they chose to study a distance of 6 centimeters caudad to PSIS as the injection point. In 61% of patients it was perfect, and in the other 39% the distance was too short, with the mean best distance then being 8.7 cm (range 7.1 to 10.1 cm) for that 39% group. They found poor correlation between the measured ideal injection point caudad to the PSIS and patient height. They, predictably, found strong correlation between the depth of the nerve plus below skin and patient Body Mass Index (BMI).
- This author however prefers a measurement of 1/3 of the length of the PSIS-IT line. This rule, per experience, has been found to work well for ladies of 5 foot tall, men of six and a half feet tall, and in children. The limitation of this rule is that the variation in excess flesh about the ischial tuberosity makes it easy to make a marking error over the skin overlying the IT. This will result in PSIS-IT line that is too long, making the 1/3 distance too long too. Ideally the IT skin marking must assist making the PSIS-IT line be correct for direction. However the IT mark must overlie the IT as if the IT bone is visible being viewed from posterior. That will ensure the correct length of the marked PSIS-IT line.
- CONCLUSION. In very short or very tall adults, and in children use the “1/3 of the PSIS-IT line” distance caudad to PSIS to mark the injection point. In modest weight and normal adults the “1/3 of the PSIS-IT line rule” is however also accurate enough to use initially before readjusting the needle. In large obese

buttocks in average height adults it is perhaps wiser to only use the 6 centimeter rule.

Mansour originally described that the needle should be directed *perpendicular* to the skin¹⁸. Some non-clinician researchers have misapplied that rule when doing concept injections on computer CT images and directed the computer needle image needle far too medial³¹. In this author's experience in most patients "perpendicular to skin" in a patient in the lateral position has usually translated to identical to "direct to anterior", but not always. It must also be noted that with a patient in the lateral position "direct to anterior" is also often not the equivalent of "horizontal". Commonly the patient lies slightly rolled forward, and direct to anterior may result in a needle aimed 5 to 15 degrees below horizontal. This author considers aiming direct to anterior is important.

ii. **HOW TO IDENTIFY WHERE "DIRECT TOWARDS THE PATIENT'S ANTERIOR" IS. PATIENT.**

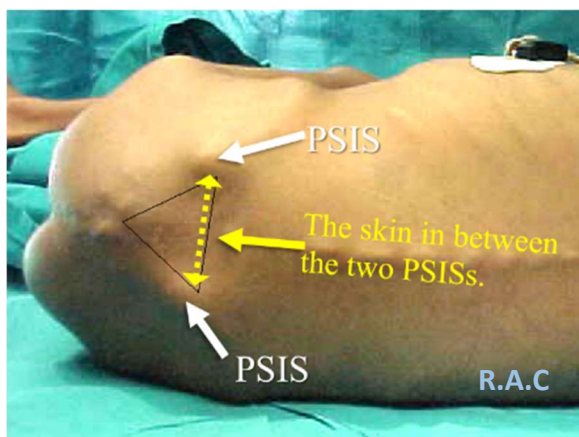


Figure no. 17. An underweight child's PSISs are prominent. Note the vertical angle of the skin between the PSISs, relative to the true perpendicular plane, as an indicator of any forward tilt of the subject's pelvis.

One can then best judge how far forward the patient's pelvis is rolled. One can then next judge the true needle direction towards the patient's anterior. Commonly the needle is aimed to slightly below horizontal relative to the table, when being aimed in the true anterior direction of the patient. See figure number 18, for an example of this.

The best way to judge how far forward the patient is rolled over is to examine the plane of flesh between the two PSISs. The flesh between the PSISs never has excess adipose tissue nor is it ever floppy and prone to sag as the more distal buttock region is. See figure 17 of the baby. How vertical the plane of the flesh between the two PSIS points is, is an accurate indicator of how far forward, or not, the patient is rolled in the lateral position.

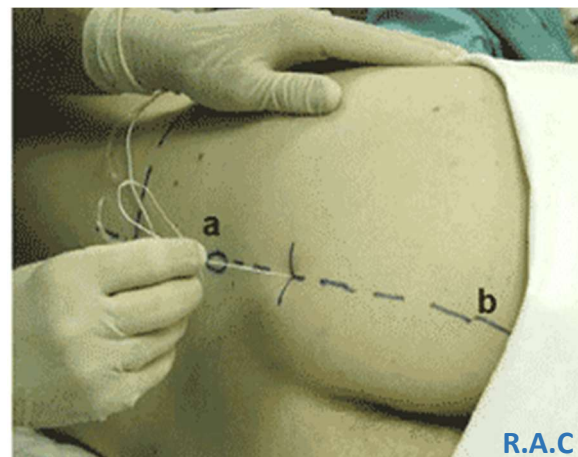
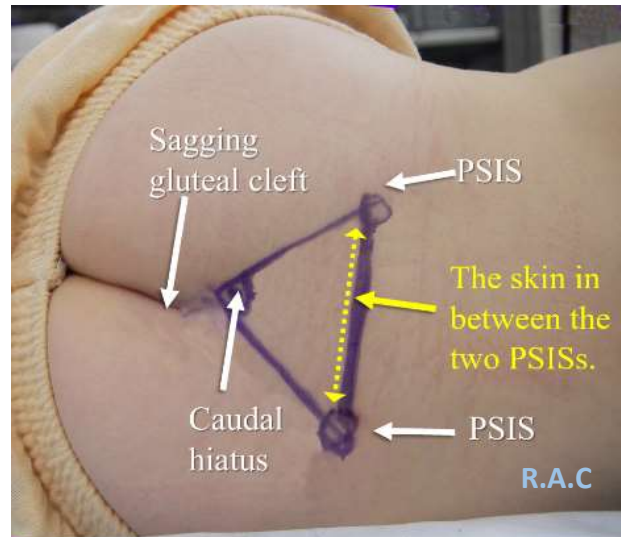


Figure no. 18. Parasacral sciatic block in a patient lying in the lateral position, and slightly rolled forward. The needle is directed straight towards the patients anterior, even though aimed below horizontal. The feet are to the right in image. Note the needle has made contact with the sciatic nerve at a depth of 8 centimeters.



Do not trust any other markings based of fleshy points such as inter-gluteal cleft as a marker of the midline when the patient is in the lateral position. Do not trust any fleshy part of the buttock as a reference point for needle directions. This is most true in the most overweight patients. See figure number 19. Use only bony reference points for regional anesthesia, where ever possible.

Figure no. 19 (to right). A slightly overweight adult female in the lateral position. The PSISs can either be tentatively identified by subtle dimples over-lying them, but are otherwise always readily palpable. Correct identification of the two PSISs is confirmed if they form a perfect triangle with the sacral hiatus. Note that the inter-gluteal cleft is sagged slightly to the ground, relative to the fixed position of the caudal hiatus (sacral hiatus). It can also be observed that the wide bony female pelvis of this patient has slightly rotated clockwise relative to the patient's lumbar spine. This does not occur in patients with a narrow bony pelvis such as a male subject.



iii. HOW TO ADVANCE THE NERVE BLOCK NEEDLE.

Always use needle electrostimulation, whether using ultrasound guidance as well or not. When making needle direction adjustments the needle tip position changes, should not exceed 2 to 4 millimeter each time, for this large nerve. The deeper the needle tip is, the smaller the angle changes must be, when making needle direction changes. The needle tip must never be adjusted by a distance greater than the width of the targeted nerve. A large direction adjustment can result in the nerve being skipped across and missed, and with no usable information being obtained.

(a) With a pure electro-stimulation technique to find the nerve, set the stimulator to the fastest twitch rate available. Five Hz of twitches is ideal. With a single shot nerve block needle set the current to 1.2 to mAmp initially. Once a twitch is found use finer needle tip position re-adjustments and systematically reduced the current to under 0.6 mAmp. Do this until a suitable muscle contraction is still being obtained at a current of 0.5 mAmp or less. Then inject the drugs.

(b) When using ultrasound guidance to assist with looking for the nerve location, use electro-stimulation only to verification the exact final needle position. Set the nerve stimulator twitch rate at one Hz to minimize tissue movements. Set the nerve stimulator current at 0.5 to 0.6 mAmp. Do not re-adjust the stimulator again. As soon as suitable twitch is found commence injecting drugs.



When initially advancing the needle be observant for (i) the needle touching bone, and (ii) for seeing any muscle cyclic contractions anywhere in the hip, buttock, thigh, legs or feet regions.

Touching bone may mean the needle tip is; (i) too caudad, (ii) too medial, or (iii) too lateral. Review the landmarks, and needle direction.

- If the PSIS and IT markings are correct, the needle inserted on the PSIS-GT line, and the needle path is direct to anterior consider the needle then to be too cephalad. Redirect caudad to find the greater sciatic notch.
- If the needle seems to be aimed towards medial and the bone contact is shallow, example at 3 to 5 cm, then likely the sacrum is being touched. Then redirect BOTH a bit more too caudad and more to lateral.
- If the needle seems to be aimed towards lateral and the bone has been met at great depth, example at 6 to 12 cm, then likely the ilium-ischium is being touched. Then redirect the needle tip both just towards medial.

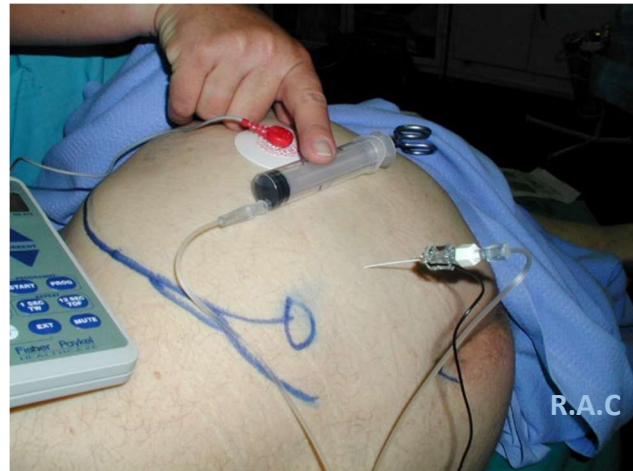


Figure no. 20. Patient in lateral position, with head to left. Sciatic nerve located about 6 cm caudad to PSIS and 11 cm deep. Note the needle insertion point was perhaps 1 to 1.5 centimeters too medial. This resulted in the needle final direction being slightly towards lateral, instead of direct to anterior.

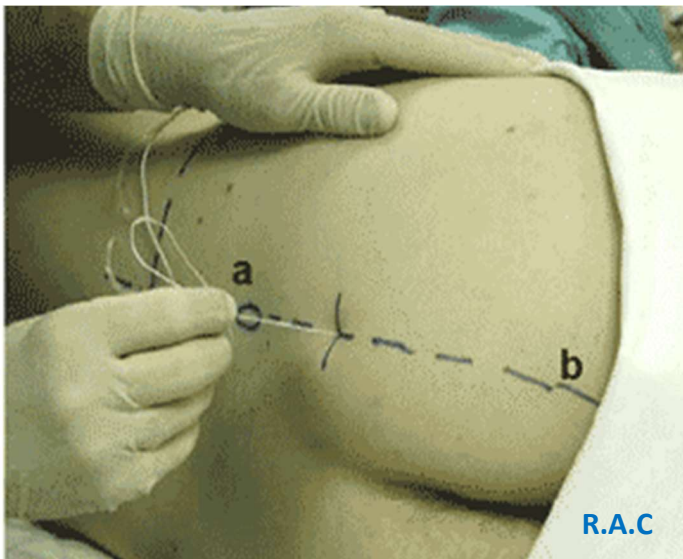


Figure no. 21. Parasacral sciatic block in a patient lying in the lateral position, and slightly rolled forward. The needle is directed straight towards the patients anterior, even though aimed below horizontal. The feet are to the left in image. Note the needle has made contact with the sciatic nerve at a depth of 8

Also reassess how far forward the patient is tilted. A needle directed through the parasacral injection point and mistakenly kept true horizontal will then in fact be being directed slightly toward lateral of the patient. If a patient is rolled forward slightly directing the needle towards the patient anterior will require the needle be aimed slightly below horizontal. See figure number 21.

iv. **OBSERVING THE MUSCLE TWITCHES.**

1. Stimulation of the **superior gluteal nerve** produces muscle contractions in the upper outer quadrant of the buttock from the tensor fascia lata muscle. The muscle's contractions are very obvious. This nerve lies lateral and superior to the sciatic nerve. Redirect the needle tip slightly more medial and caudad. See figure number 22.
2. Stimulation of the **inferior gluteal nerve** produces obvious muscle movement of the maximus gluteus muscle. This is observed in the infero-medial quadrant of the buttock. The muscle's contractions are very obvious. This nerve lies medial to the sciatic nerve. Redirect the needle tip slightly more lateral.
3. Any other muscle contraction of the hamstrings, lower leg muscles and any foot movement indicates successful placement of the needle tip onto the sciatic nerve.

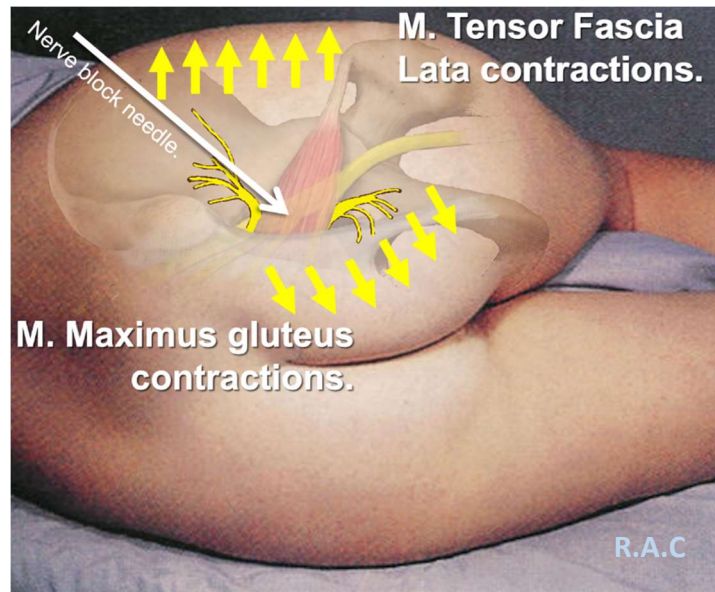


Figure NO. 22. The two main buttock muscle twitches sometimes observed during parasacral sciatic nerve blocks.

In a sense, the needle tip only has to explore an arc of positions in between finding a tensor fascia lata twitch and maximus gluteus twitch to find the sciatic nerve in the middle.

Is there a very best motor twitch?

- Numerous studies of various sciatic nerve blocks have been done analyzing whether the final stimulation, and injection of drug, of either the tibial nerve component or of the common peroneal component results in a faster onset and more complete sciatic nerve block. There is a very strong consistency showing using the common peroneal nerve muscles (foot dorsi-flexion) if used as marker of sciatic nerve localization corresponds with a suggestion of poor block effects overall. This has been done on virtually all sciatic nerve location blocks from that of Labat in mid-buttock region to the popliteal fossa. Typical study protocols utilize assessments done 30 minutes after drug injection and do not assess the final clinical picture with results observed under and after surgery.
- One parasacral sciatic nerve block study by Hagon using diluted local anesthetic demonstrated a massive success difference in success when a tibial nerve component muscle twitch (foot plantar flexion) responses was intentionally chosen over that of a peroneal nerve component muscle twitch (foot dorsi flexion)¹⁹. Hagon defined failure is imperfect evidence of motor paralysis or lack of total sensation loss at thirty minutes after injection in segment of the foot.



Success was seen in 79% of tibial nerve injections and 17% of peroneal nerve injections. Hagon failed to provide evidence of nerve block success at any later period or after surgery. With the low minimum stimulating currents used it is likely many injections were within the epineurium.

- There is various evidence that suggest the common peroneal nerve has a tougher and thicker epineurium than average nerves. This will have effects. First it would slow drug diffusion into the peroneal nerve if the drug was injected into the tibial nerve. Second the thickened epineurium would retain sub-epineural drug more, if injected within the common peroneal nerve, thus slowing diffusion onto the tibial nerve. In the author's experience, and as reported by many other researchers, the parasacral nerve block is clinically exceptionally successful, compared to all other sciatic nerve block positions. So Hagon's study although performed very well is only flawed in that it used a measure time point too soon to reflect actual clinical results later in time. The fact diluted drugs were used further slowed down the block developing, and exaggerated the false failure rate recorded. It is very certain that Hagon's final clinical outcomes would have been much better than what the study methodology measurements indicated. The only value of Hagon's study is that it underlines the other observations that the common peroneal nerve is different physiologically to most other nerves. This correlates with the fact that the common peroneal nerve is also the nerve most commonly injured nerve in relation to leg surgery, even without direct mechanical injury, and even without nerve blocks. Even Hagon was at a loss of words to explain his study observation.
- In summary it matters not which portion of the parasacral sciatic nerve is injected onto for a nerve, clinical results are finally excellent regardless. This author confidently recommends using the first twitch discovered of the sciatic nerve to indicate correct needle position with no need to redirect to preferentially select any subcomponent of the sciatic nerve. Clinical results will be excellent regardless.

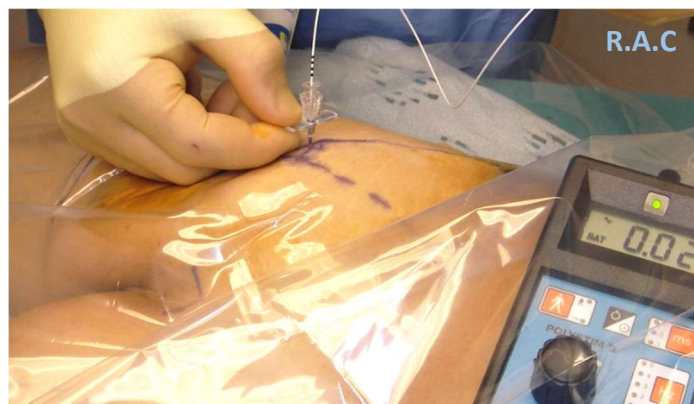


Figure no. 23. Parasacral sciatic nerve block in patient lying prone. The feet are to the left. Note the needle has made contact with the sciatic nerve 8 centimeters deep directly anterior to insertion point.

v. ALTERNATIVE APPROACHES TO BLOCKING THE PARASACRAL SCIATIC NERVE.

Some alternative approaches have been described. They are generally of little merit in routine patient care, but will be discussed. It is a true-ism that that conceptually any nerve with a length of 10 cm can have a plethora of different nerve block approaches conceptualized. At every centimeter point along the nerve's length, a nerve block technique can be designed from each of the four quadrants. That would equate to thirty to forty approaches to the sciatic nerve in the buttock region. There are more truths. An outstanding expert will a few times in a career need to perform a once off very novel nerve block approach in a one unique patient whose pathology and personal anatomy do not permit a standard technique to be utilized. The expert will also have sufficient intimate anatomical knowledge to be able to blindly see the course of the nerve in their minds. Then a very novel nerve first time block approach may serve the needs of that unique moment.

1. **Le Corroller** conceptualized a lateral approach to the parasacral sciatic nerve for use in a patient in the supine position²⁰. A cadaver study and a Computed Tomography (CT) study was done, but clinical utility was not assessed. This theoretical approach will however have very long skin to nerve distances averaging twelve centimeters, and being up to seventeen centimeters in some. The mean distance to bowel was twenty centimeters. Obese patients were not assessed, in whom greater distances would have been measured. It was

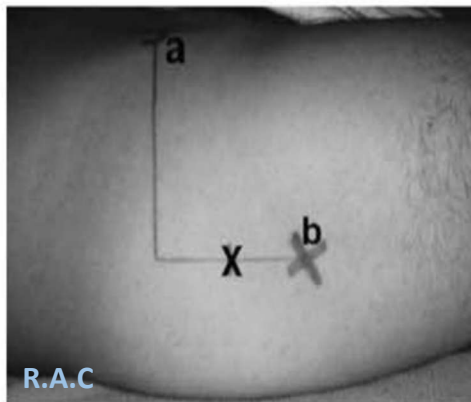


Figure no. 25. Le Corroller's original landmark photo. Mark "a" is the Anterior Superior Iliac Spine (ASIS,) mark "b" is the Greater Trochanter (GT), and mark "x" is the needle insertion point. The subject is lying supine and the photo is taken from lateral. The needle must be aimed 12 degrees below horizontal and directly towards medial.

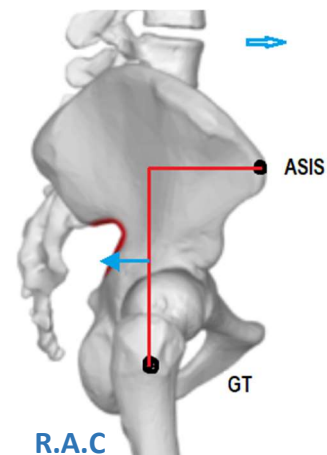


Figure no. 24. Le Corroller's lateral approach.

also observed that the sciatic nerve is slightly more flattened in the parasacral position compared to all other positions thus increasing its target size. The limitations of this Le Corroller approach are; (i) the nerve lies far too deep to use of ultrasound needle guidance, (ii) although the nerve is reachable with needles of 15 centimeter long in 80% of average patients, sufficiently long needles for use in obese patients do not exist, and (iii) the ability to observe maximus gluteus contractions will be impaired. The only advantage of using this Le Corroller approach is that a parasacral position nerve block can be performed in supine patients where repositioning them to the lateral decubitus position would cause too much pain.

This approach is not recommended in routine cases. The skin markings are too complex, and thus one is more prone to make an error in patients of varying muscularity and degrees of obesity.

2. **Merchan** conceptualized another alternative set of landmarks for the parasacral sciatic nerve block and had 98% nerve block success in forty patients having a sciatic nerve block²¹. Merchan had no complications. The sacral hiatus (SH) is one of the landmarks. He joined the posterior superior iliac spine (PSIP) to the SH with a line drawn on the skin. Then at the midpoint of that line he drew a second line perpendicular to the first in a lateral direction, and of equal length to the first. The needle is inserted at the end of the second line direct towards anterior, in a sagittal plane. See figure number 26. Merchan claimed a 90% success rate with the first needle pass. Review of this blocks anatomy and comparing it to the landmarks of the blocks of Labat and Winnie clearly indicate it is a not true parasacral sciatic nerve block, per Mansour's concepts. Merchan's injection point is simply too far infero-lateral to reliably block all the accompanying nerves of a true sacral plexus. The injection point is more caudad than a Winnie sciatic nerve block injection point. It is noted this technique has never been popular. The Merchan technique block has more surface landmarks than Mansour's approach. That also itself to more possible inaccuracies. Thus Merchan's approach is strongly not recommended as a parasacral sciatic nerve block.

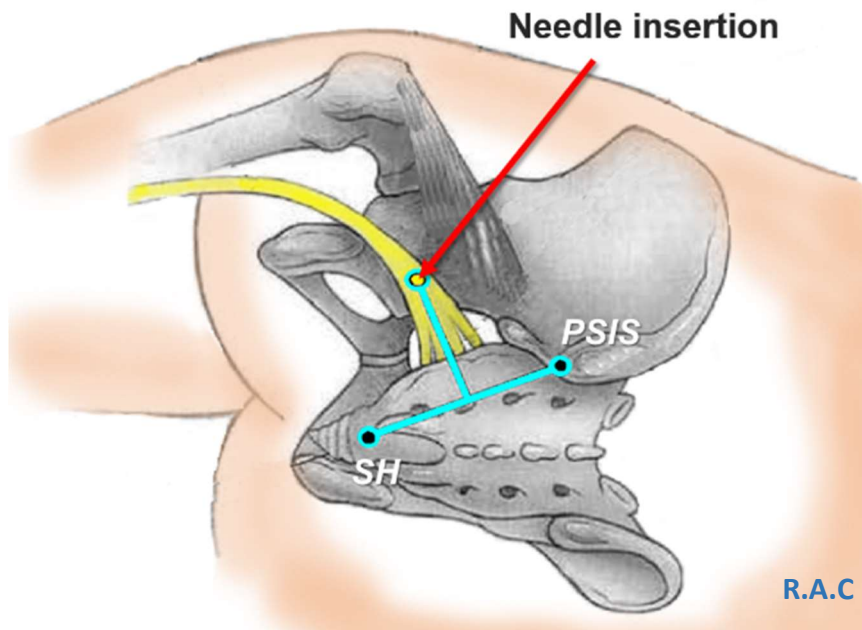


Figure no. 26. Merchan's landmarks. SH is sacral hiatus. PSIS is posterior superior iliac spine.

vi. ULTRASOUND GUIDANCE OF THE NERVE BLOCK NEEDLE.

The first published description of the use of ultrasound guidance for performing the parasacral sciatic nerve block came in 2009 from Ben-Ari²². He described performing seventeen consecutive cases, all successful and without complication. They used a curved low frequency transducer held transverse across the patient's buttocks on the line from PSIS to GT. They glided the transducer caudad from the PSIS until they could identify the hyperechoic boney sacrum medial in image and the boney ilium lateral in image. Fine adjusting of transducer tilting was then used to optimize the image of the sacral plexus and gluteal blood vessel. They report virtually never seeing the piriformis muscle. That strongly suggest Ben-Ari were only visually identifying the sciatic nerve beyond the point it emerged from under the piriformis muscle. The sonograms accompanying the published description confirm that this is not a true parasacral sciatic nerve block, as conceptualized by Mansour. This author identifies the piriformis muscle always. Regardless Ben-Ari's publication is a milestone in the development of regional anesthesia.

In 2012, from the United Arab Emirates, Taha tried to describe the ultrasound imagery of the parasacral sciatic nerve block better²³. He commenced scanning the posterior surface of the ilium immediately cephalad to the greater sciatic notch. The bone(s) form a solid line across the sonogram running from shallow to deep. The deeper end is the lateral side. See figures numbers 27, 28, and 29. The curved transducer is held transvers across the long axis of the body. The transducer is next slowly glided more caudad until the boney line breaks. A visual gap or loss of hyperechoic line in the middle is now seen. This is the cephalad apex of the greater sciatic notch. The bony hyperechoic line still seen on the lateral side of the sonogram, which he identifies as the Posterior Border of the Ischium (PBI). Taha continues to glide the transducer further caudad seeking primarily to define the PBI. Taha then uses the PBI as a visual reference point to find the sciatic nerve. Sometimes he sees the hyperechoic sciatic nerve immediately medial to the PBI, sometimes superficial to the PBI, and sometimes superficial to the PBI with a muscle (gamellus superior) between the bone and the nerve. He may identify the piriformis muscle lying lateral to

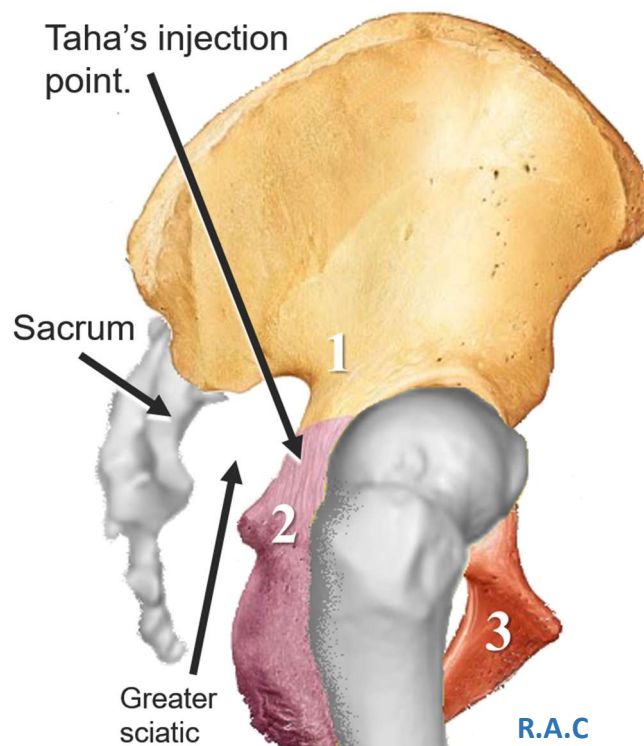


Figure no. 27 Components of the hip bone (in color) viewed from full lateral. Number 1 is the ilium. Number 2 is the ischium. Number 3 is the pubis. Taha was focused on identifying the posterior edge of the ischium in the greater sciatic notch.



the sciatic nerve, and but never over the sciatic nerve. The limitation of Taha's technique is that the sciatic nerve is blocked too far caudad and distal to the branching off of the superior gluteal nerve away from its association with the sciatic nerve. It is a better technique to aim to block the sciatic nerve deep to the piriformis muscle, which will represent a transverse plane about 2 centimeters more cephalad.

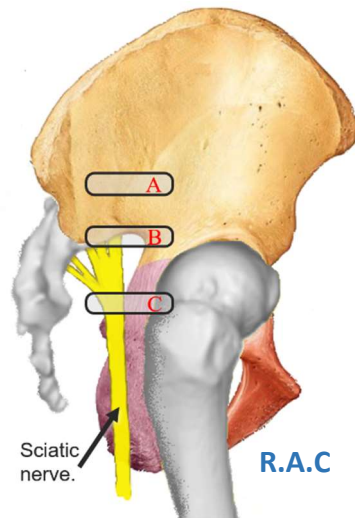


Figure no. 28. Taha's ultrasound transducer positions, as viewed from full lateral. See Taha's ultrasound views A, B and C in figure no. 25.

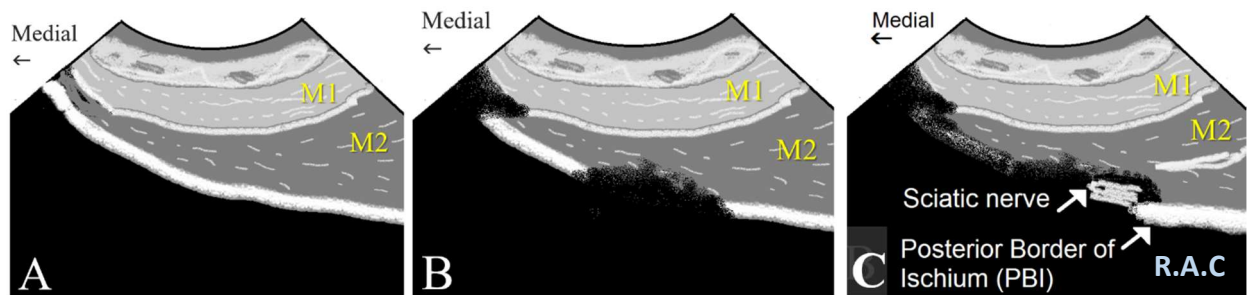


Figure number 29. Ultrasound images prepared from Taha's images. In image **A** the transducer is the starting position over the ilium and caudad to PSIS, as in figure no. 24. Observe the long continuous hyperechoic bone surface of the ilium and sacrum. In image **B** the transducer has moved caudad to just enter the greater sciatic notch. Note the interruption in the hyperechoic bone line. In image **C** the sciatic nerve is seen in close association with the PBI and no piriformis muscle is seen. **M1** is gluteus maximus muscle, and **M2** is gluteus medius muscle.

Bendtsen from Denmark in 2011 described a very promising ultrasound guided technique²⁴.

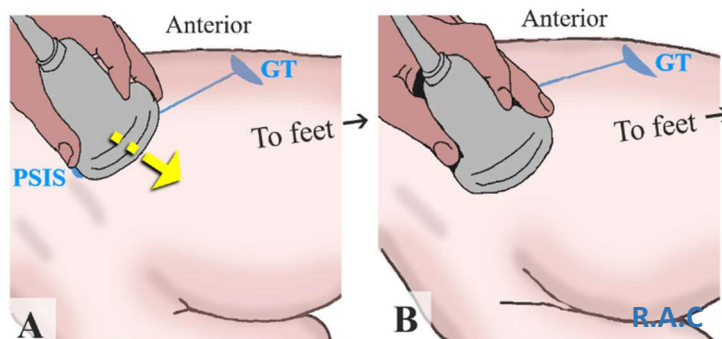


Figure no. 30. Bendtsen's parasacral parallel shift. This is a posterior view of the buttocks of a subject lying in the lateral position. In image **A** the transducer is placed immediately caudad to PSIS in the skin marked line and aligned with the line. In image **B** The transducer is moved infero-medial to PSIS but still aligned parallel to the skin line.

Bendtsen drew a skin line from PSIS to GT, and placed the ultrasound transducer on it, parallel to it. The transducer just touched PSIS with its cephalad edge. That is position **A** in figure number 30. Next the transducer was glided sideways towards both caudad and medial, retaining the parallel alignment with the PSIS-GT skin line. Bendtsen called this movement a "parasacral parallel shift". The end point is position **B** in figure number 30. Position **B** is found when the sciatic

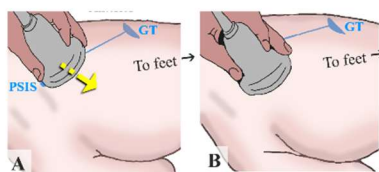
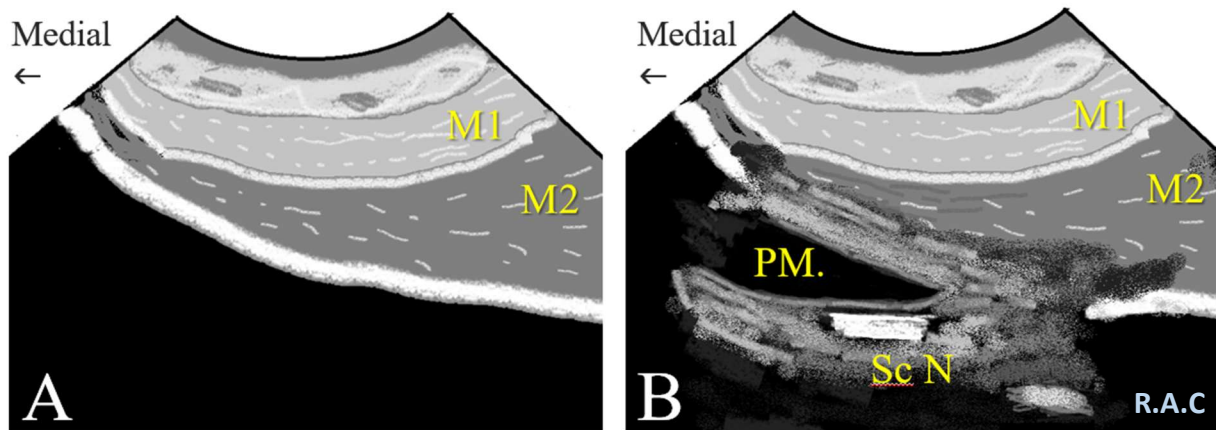


Figure no. 31. Ultrasound images, prepared from Bendtsen's report. Note in image B, how the piriformis muscle is recognized and identified, and that the sciatic nerve lies deep to it, and is well visible. M1 is the maximus gluteus muscle. M2 is the gluteus medius muscle. PM is the piriformis muscle.

nerve can be recognized in its in-axis view, at a point lying deep to the piriformis muscle. See image number 27. The first major advantages of this technique is that the injection point is deep to the piriformis muscle, thus ensuring local anesthetic is deposited sufficiently proximal to block all the lumbar-sacral plexus nerves, specifically the superior gluteal nerve. The second advantage is that the sciatic nerve is view in axis, which is parallel to the nerve in its length. A slight rotation of the transducer to align more perfectly parallel to the nerve axis perfectly creates the most perfect nerve image. The needle can be introduced to the nerve off plane if the nerve is shallower than 5 cm, but using an in-plane approach is better for the deeper nerves.

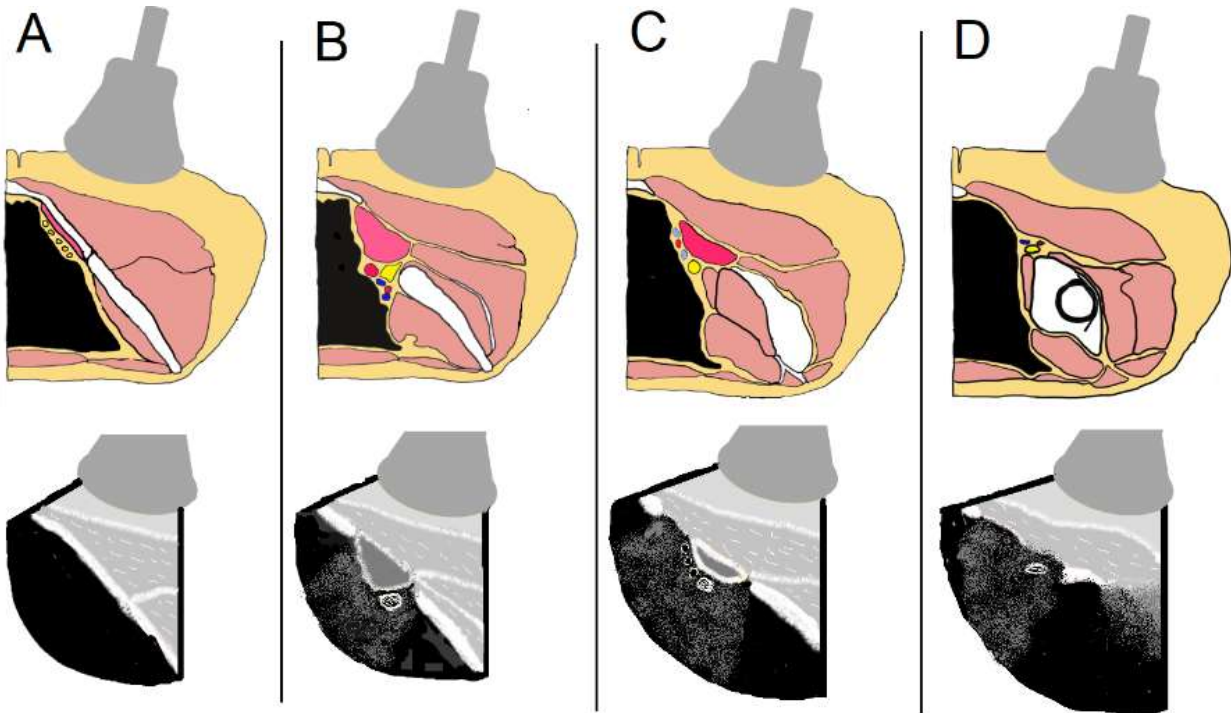
In this author's experience, with any attempted ultrasound viewing of the sciatic nerve where it lies deeper than 6 centimeters from the skin, the sciatic nerve is often impossible to recognize. Then rotating the transducer to lie parallel to the nerve's length, so that it is viewed in-axis, very often makes the nerve easily recognizable. Note with a curved transducer when viewing a deep



sciatic nerve in-axis typically only 1 to 2 cm of the nerves length is visible. This is because only the nerve section being pinged by the most perpendicular sound waves will manage to reflect sound waves back to the transducer forming an image.

An added comment, if the needle tip during an ultrasound guided nerve block is invisible due to the steep angle of descent of the needle, and maybe even the sciatic nerve itself too is invisible or doubtfully defined, there are a few things to be considered;

- It does not matter that the needle tip is invisible. The block then depends on electrostimulation guidance and confirmation with a then partially blind nerve block technique. The proximal shaft of the needle that is visible can act as a pointer to direct the needle, even semi blindly, into the region that is expected to contain the sciatic nerve.
- The fact the ultrasound can reveal structures associated with the sciatic nerve allows the region to be explored with the needle. The primary structure to be identified is the piriformis muscle. Aim at any structure beneath the muscle demonstrating a hyperechoic nature. Sometimes the gluteal blood vessels are also recognizable. More often they are not. Explore all the spaces between the blood vessels and superficial to the blood vessels with a stimulating needle.
- It is not an absolute prerequisite to see the sciatic nerve to be able to block it.
- It is strongly desirable to identify the piriformis muscle confidently if the sciatic nerve is absolutely not recognizable. This author has never failed to perform this block using ultrasound guidance. It was always possible to see the bony long line. It is always possible to next more caudad identify the loss of bony continuity representing the cephalic apex of the greater sciatic trough. It is always possible to discern within that cephalic end of the sciatic notch a muscle different and usually darker than the overlying gluteal muscles. That is the piriformis muscle. The use of an electro-stimulating needle then helps conclude the nerve block.
- Even patients with a Body Mass Indexes (BMIs) exceeding 50 have been successful been given ultrasound guided parasacral sciatic nerve blocks. It is admitted however that success required an experienced eye, an experienced hand and a lot of very subtle adjusting of transducer angles and tilting to seeking to win the fleeting subtle deep imaging sought after.



R.A.C

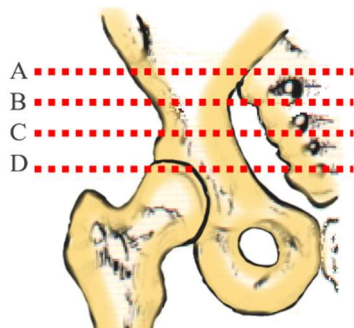


Figure no. 32. Horizontal sectional views through the pelvis and the matching ultrasound images. Section **A** is through the sacrum and ilium, at the lower end of the sacro-iliac joint. See the continuous sloping bone line. Section **B** is through the most cephalad part of the greater sciatic notch. See the break in continuity of the bony line. Piriformis is the dark muscle under the gluteii. The hyperechoic sciatic nerve is under piriformis muscle, tending to its lateral edge. Section **C** is a centimeter further caudad and represents the most ideal view. The bony line gap is a bit larger. Piriformis is well defined and the sciatic nerve is often also most easily seen. Section **D** is at the bottom of the greater sciatic notch. It is beyond the piriformis muscle, which is no longer seen in the image. It approximates the Labat sciatic nerve injection point.

See image number 32. This author starts the caudad slide of the transducer along the PSIS-GT line from cephalad to caudad. Start one centimeter above the “1/3 point” marking. That is at level A in figure number 32. It is immediately cephalad to the greater sciatic notch. Initially a bony plain spreads across the entire ultrasound image. See figure number 32 image “A”. If the continuous white line is not seen, the transducer position is adjusted by moving more cephalo-medial until this solid white line is found on screen.

Next scan towards caudad to where a deficiency first develops in the white line’s middle. That is can level “B”. This is where this author most intensely seeks all the targeted structures. The piriformis muscle is very consistently observed. It is characteristically darker than the glutei and featureless. The gluteii muscles have many tiny little linear tissue features structures within them. Tilt the transducer gently in various directions continuously, testing to optimize the muscle imaging. The piriformis muscle is always noted. Level “C” can also work for parasacral sciatic nerve block.



vii. **FLUOROSCOPIC GUIDANCE OF THE INJECTING NEEDLE**

Physicians diagnosing and treating the piriformis syndrome favor using fluoroscopic guidance when making injections to the sciatic nerve, and piriformis muscle. The reasons for this is because those doctors have (i) familiarity with the fluoroscopy equipment which is used daily in the rest of their practice, and (ii) have availability of fluoroscopic equipment in their daily practices.

Benzon from Chicago did an extensive cadaver study, reviewed the literature, designed a technique and tested it clinically²⁵. See figure number 33. With fluoroscopy identify the lower border of the sacro-iliac joint. Then direct the injection needle 1 cm caudad and 2 cm to lateral from the first point. That will correspond exactly with Mansour's injection point for the parasacral sciatic nerve. Verify final position of the needle on the nerve using needle electro-stimulation. After injecting onto the nerve withdraw the needle 6 millimeters to inject into the piriformis muscle. Read Benzon's report for fuller details on treating the piriformis syndrome. See figure 55.

Anesthesiologists providing nerve blocks for surgery do not need to learn the fluoroscopic technique. Pain physicians injecting steroids etcetera into the piriformis muscle and around the sciatic nerve however could safely and appropriately utilize the earlier described standard anesthesia techniques of parasacral sciatic nerve injection, if so choosing.

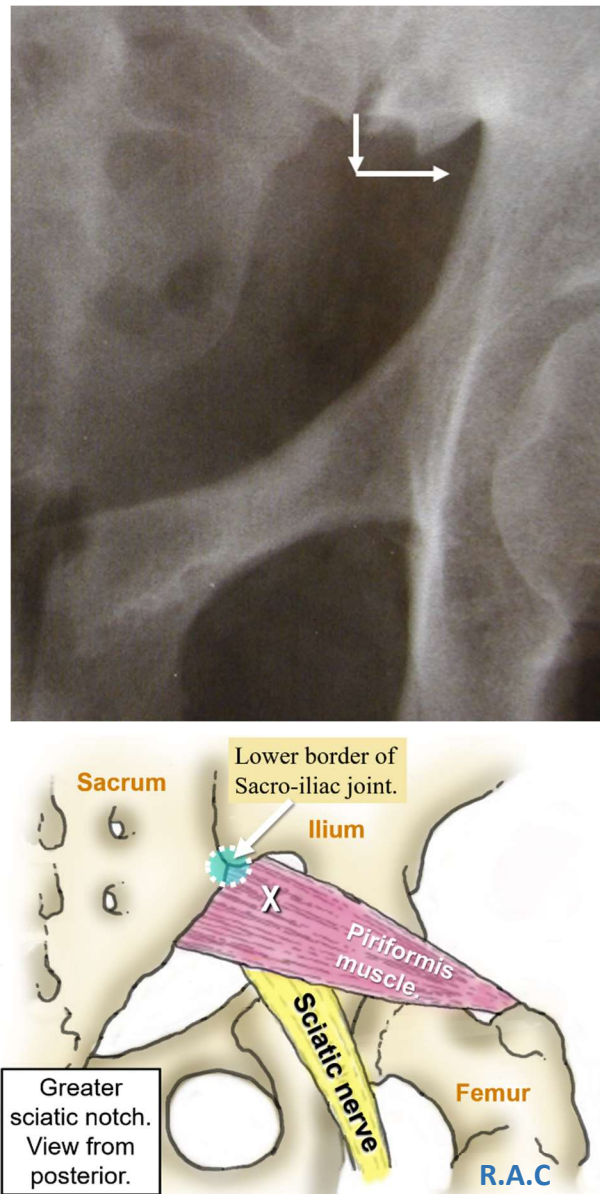


Figure no. 33. Benzon's fluoroscopic injection point for the parasacral sciatic nerve when treating piriformis syndrome.

DRUGS and DOSES

This has been relatively little studied. One big dosing challenge is that the parasacral sciatic block is often combined with one to three other blocks. That means the considered maximum allowable local anesthetic total has to be apportioned between the individual blocks.

De Visme in a study used only 10 ml of 1.33% lidocaine with adrenaline (epinephrine) for the parasacral sciatic block²⁶. He compared a combined psoas compartment block, an iliac crest block, and a parasacral sciatic block (nerve block group), with a spinal block group. All patients were undergoing surgery for hip fractures. The psoas compartment block was injected with 30 ml of local 1.33% lidocaine anesthetic. It was observed that more of the nerve block group patients had incomplete anesthesia in the greater trochanter region, than the spinal anesthesia group. This observation is possibly due to slowness of the lateral cutaneous nerve of the thigh to develop nerve block (psoas compartment block). The lateral cutaneous nerve supplies sensation to the skin over the greater trochanter. The increased pain in the greater trochanter region is most likely due to failure to block the superior gluteal nerve accompanying the parasacral sciatic nerve block. The superior gluteal nerve supplies all the large muscles attaching the greater trochanter and the bone those muscles attach to. This study thus strongly suggests that 10 ml of local anesthetic is too little for a parasacral sciatic nerve block to achieve a complete somatic lumbar-sacral plexus block.

Souron in 2000, showed that 20 ml of contrast marked local anesthetic had a perfect spread after injection, when injected for a parasacral sciatic nerve block following Mansour's technique. It showed block all nerves within 1 ½ cm of the needle tip would be bathed in drug. See figure number 34.

Another researcher, Amin, favored injecting 15 ml of 0.75% ropivacaine, but had no interest in blocking the accompanying nerves of the lumbar-sacral plexus as he used the block purely for lower leg surgery³⁴. He did not report any evidence of nerve block of the nerves accompanying the parasacral sciatic nerve. For purely a sciatic nerve block the 15 ml volume was fully satisfactory. The motor block lasted a mean duration 192 minutes, for 40 patients.

Other researchers mostly report using 20 ml of local anesthetic as a standard adult dose²⁷.

Helayel, from Brazil, did a superb dose finding study³⁵. The effective dose, as per study protocol at 30 minutes after injection was 24 milliliter for 0.5% ropivacaine, and 22 milliliter for 0.5% bupivacaine with adrenaline. This was also 5 to 6 milliliters less than that needed for the comparative more distal sciatic nerve blocks also studied. Although the parasacral sciatic block was studied they did not assess the accompanying nerves of the lumbar-sacral plexus for nerve blockade. This is very compatible with the general rule of using 20 milliliters of local anesthetic for clinical purposes, where there is much longer period before the patient is subjected to the first surgical incision. This supports the general impression of the parasacral block being a fast onset reliable block for the sciatic nerve.

This author has always used 20 ml of local anesthetic, combined with an iliac crest block, and a psoas compartment block produced 100% early post-operative analgesia following hip joint and femur neck surgery. The two times the author used 40 ml of local anesthetic for the PSSNB additional



Figure no. 34. Spread of local anesthetic injected into the parasacral space. (Souron 2000. RAPM. 25;2:208-12)



autonomic block was suggested. Both the two patients lost the ability to empty their bladders for about 20 hours.

Author anecdotal experience and published evidence suggest that 20 ml of local anesthetic for the average adult is the perfect drug volume for the parasacral sciatic block whether it is desired to block the accompanying nerves or not.

WHAT DRUG AND DRUG CONCENTRATION SHOULD BE USED?

As an example the author reports personal practices. In a hypothetical case of an 80 kg, ASA 1-4, adult male undergoing posterior approach revision hip arthroplasty, in the lateral position, the following anesthesia plan would be used. No contra-indications are assumed to exist.

- Pre-anesthesia peripheral nerve blocks would be done.
- Iliac crest infiltration block – 7 ml of 0.5% bupivacaine with adrenaline (epinephrine). Iliac crest expected to be pain free for 6 to 9 hours after surgery.
- Psoas compartment block at the L2 level – 40 ml of 0.5% ropivacaine. A main dose supplement of 30 ml of 0.5% ropivacaine to be injected three to four hours later, then followed with an infusion of 0.2% ropivacaine at 12 ml per hour.
- Parasacral sciatic nerve block – 20 ml of 0.5% bupivacaine with adrenaline (epinephrine). Hip posterior region expected to be pain free for 8 to 18 hours after surgery. There after the posterior hip pain is expected to be mild enough to respond well to an intense multimodal analgesia therapy plan. This author would only use a parasacral catheter (plus the psoas catheter) in patients at special risk for developing hyperalgesia. An example of a hyperalgesia risk patient would be one being all of (i) marijuana smoker, (ii) tobacco smoker, (iii) pre-operative opiate user, (iv) a history of any allodynia in the preceding year in that same leg, and (v) having tattoos.
- Intra-operative or preoperative administration of ketamine 50 mg total.
- Intra-operative general care would preferentially be light general anesthesia with airway management. Many other plans could be made workable as well.
- Ketorolac 60 mg IM at start of surgery, thereafter 30 mg IV per 6 hour times four doses, thereafter 30 mg IV per 8 hours times 3 days. Fixed doses.
- Acetaminophen 1000mg IV intraoperative thereafter maximum oral dosing x one week. Fixed doses.
- Use opiates of personal preference as rescue analgesia, on demand only. PCA is acceptable. Cease using day time opiates after four days after surgery. Cease all use of opiates after 8 days after surgery.
- The patient's expected pain scores to be zero for six hours after surgery. After that pain is expected to average 2 and never reach 4 over the following seven days.

CONTINUOUS PARASACRAL INFUSIONS. This is well reported as feasible and successful^{21,27}.

Use of catheters to provide continuous parasacral block maintenance infusions is well established^{28,29}. Use ropivacaine 0.2% at 5 to 10 ml per hour.



COMPLICATIONS and SIDE-EFFECTS

A *complication* is an unexpected and largely unpredictable consequence of the nerve block that has potential for permanent harm. A *side-effect* is an expected, although undesired, consequence of the nerve block that should have no permanent consequences. Some possible complications and side-effects will be discussed;

1. **Disturbances in urinary ability-(Very rare. Avoidable).** The nerve supply to the perineum, the urinary bladder and urinary tracts, and the various sphincters is very complex. Only four cases are known of a problem.
 - Helayel reported two female patients who received bilateral parasacral sciatic nerve blocks with standard volumes of local anesthetic, and who became incontinent of urine afterwards³⁰. The patients leaked urine freely and had no awareness of full bladder or any urge to urinate. Examination revealed perineal numbness. Helayel gives detailed report on the potential nerves involved in this. It is likely fully explained by the bladder having unopposed parasympathetic sensory input, due to the blocked pudendal nerves carrying the inhibitory sympathetic portion of the bladder urethra autonomic nerves. This urinary incontinence has never been reported elsewhere following single parasacral sciatic nerve blocks and it thus is highly likely due to the reported unusual practice of the two patients having had bilateral sciatic nerve blocks.
 - This author has also had two patients who were inadvertently injected forty milliliter of local anesthetic solution, 0.75% ropivacaine, onto a unilateral parasacral sciatic nerve. Both of these patients developed an inability to urinate for about 30 hours after the surgery and nerve block. The surgery had no association with the bladder. The problem was managed by temporary bladder catheterization. After the first event there was only passing thought that the inability was related to the nerve block. After the second event occurred at a later date it, was then strongly considered that the very large volume of local anesthetic, forty milliliters, was to blame. The local anesthetic had likely spread sufficiently into the retro-pelvis to include substantial parasympathetic autonomic block. This would eliminate the bladder ability to contract to urinate. There was also the standard pudendal nerve and thus a sympathetic block too. Subsequent diligent restriction of block drug volume to 20 milliliter correlated with no further recurrences of the bladder event.

In conclusion, if a bilateral parasacral sciatic block is planned, regardless of drug volume to be injected a prophylactic bladder catheterization should be provided to the patient. If only a unilateral parasacral sciatic block is planned, an ipsilateral perineal nerve block is normally expected, and it has no effect on bladder function. Finally never exceed injecting 20 ml of local anesthetic for a PSSNBs. Also never inject less than 20 ml if the accompanying nerves need to be blocked as well.

2. **Numb penis (Common. Harmless).** In this author's experience no female has ever complained of having a numb hemi-perineum from the pudendal nerve block. It was either thus undiscovered, or discovered and not reported. However a number of males have reported discovery of a numbness in half of their penises and scrotums. They found it very distressing. The patients were all younger men in a virile age, rather than aged men. It is thus advised that when performing a parasacral sciatic



nerve block on patients they need to be informed about the discovery of a numb perineum, and that it is temporary and harmless.

3. **Pudendal nerve injury (unreported- unlikely).** This is an undescribed problem in the published literature.

- An injury to the pudendal nerve was once alleged to have happened to one of the author's patients. One adult lady patient with severe complex regional pain syndrome (CRPS) related to multiple surgeries for congenital club foot had a disturbance associated with a parasacral nerve block. During performance of the parasacral nerve block, the lady suddenly reported a disturbing nerve-stimulator induced sensation in her pudendal nerve distribution. Repositioning of the needle tip slightly to lateral identified the sciatic nerve and the nerve block was completed successfully. A saphenous nerve block was done as well. The nerve blocks were combined with general anesthesia for the thigh tourniquet. The lady was an ASA1 patient. After surgery the patient awoke and reported severe pain in the surgical foot. All muscles of the sciatic nerve were fully paralyzed and all dermatomes of the sciatic nerve and saphenous were fully insensate. It was decided to repeat the sciatic nerve block in the popliteal fossa. The nerve was readily located with nerve stimulator and local anesthetic injected. There was no alteration to the pain reported to be in the foot. It was now considered that the reported foot pain was spontaneous pain from a central location, perhaps the spinal cord. Fifty milligrams intravenous ketamine, with one milligram midazolam was administered. The response was dramatic and the lady subsequently had a pain free night. She did however retain mild discomfort in her ipsilateral pudendal nerve distribution for about ten weeks. An opposing colleague caring for the patient after surgery argued that the pudendal nerve had been injured during the sciatic nerve block. As the lady's foot surgery healed over a few months, her original foot CRPS-hyperalgesia, and her pudendal nerve area dysesthesias all resolved as well. The pudendal nerve disturbances were finally considered related to physiological spreading of her field of CRPS to adjacent nerve fibers, and not due to nerve block instrumentation. Both the pudendal and sciatic nerves share a S2 root source. See figure number 35. It is noted that nerves corresponding to skin-muscle areas manifesting allodynia and hyperalgesia are very sensitive to touching by instrumenting needles. Thus just touching the already hypersensitive pudendal nerve with the nerve block needle simply induced a greater than usual sensation. With complex Regional Pain syndrome patients it is also seen that adjacent uninjured tissues commonly manifest allodynia and hyperalgesia when CRPS develops. This patient's pain in her pudendal nerve distribution that became temporarily more apparent after the nerve block is thus probably not a parasacral sciatic nerve block

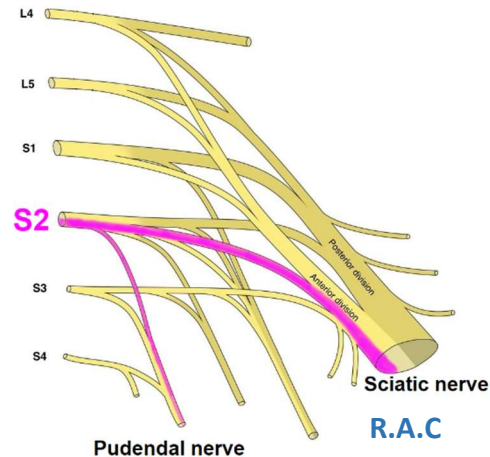


Figure no. 35. The shared S2 nerve root of the sciatic nerve and the pudendal nerve.



complication, and more likely related to her pre-existing foot CRPS as well as her tenth surgery to the foot in the heel and lateral areas (S2 dermatomes).

4. **Bowel injury (Unreported. Unlikely).** This is a hypothetical potential injury has never been reported. O'Conner studied MRI views on 10 volunteers and inserted theoretical needles into the image obtained, on computer³¹. O'Conner found the theoretical first needle insertion only met the nerve plexus in 50% of cases. She also demonstrated that pelvic and intestinal viscera, lie about 2.5 centimeters deeper than the nerves and as close as within 1.5 centimeters sometimes. O'Conner noted that clinical reports lack description of vascular and visceral injuries during clinical performance of this nerve block. O'Conner postulated that needle penetration likely does occur when the nerves are missed, but that visceral and vascular needle punctures deep within the pelvis seldom manifest as a clinical problem and are largely uneventful. This, she postulated, is why such severe complications remain unreported.
 - This author feels that the expanse of motor containing nerves is wide enough to result in an electro-stimulating needle passing into the cephalad end of the greater sciatic notch highly inducing some muscle contraction, thus indicating the depth of the nerve plexus. Then at that depth the needle position is readjusted to locate the sciatic nerve specifically. This all strongly reduces the likelihood of a needle advancing beyond the depth plane of the nerves.
 - Secondly, nerve blocks are performed with relative blunt needles, not sharp hypodermic type needles. Viscera are hard to penetrate and readily yield to blunt needles without penetration occurring.
 - Thirdly the track of the needle on many sectional anatomical studies of the pelvis suggest a nerve block needle would pass lateral to, and thus outside of the visceral pelvic cavity.
5. **Hypotension (minimal).** In patients with hip fractures using a psoas compartment block combined with a parasacral sciatic block patient mild hypotension did occur²⁶. The hypotension was however significantly less that seen in a matching study group receiving spinal anesthesia. Thus, severe hypotension is not a typical complication of PSSNBs.
6. **Wastes time (surgeon complaint).** The time taken to perform a nerve block is similar in principle to the time taken to perform surgery. Both interventions are patient care. Nerve blocks do take some minutes time to perform, a matter surgeons routinely complain about. The cost of any intervention in money, labor and time, must be balanced against the patient's gain from the intervention. Surgeons do complain about the time taken by anesthesia related interventions. One study showed that despite a nerve block combination group, including a parasacral sciatic nerve block, taking 9 minutes longer than compared to performing spinal blocks, the total operating room time was fifteen minutes shorter in the nerve block group²⁶. This correlates with numerous other studies consistently showing the extra time taken to perform general nerve blocks is more than recovered during other periods of operating room time. Patients having had nerve blocks whether with general anesthesia was added in or not, all consistently achieve sufficient wakefulness after completion of the surgery to leave the operating sooner than patients who received pure general anesthetic. Therefore nerve block time need never be considered wasting of surgical time. The extent of time saved in the awakening phase after surgery usually exceeds the time spent performing the nerve block before the surgery.
7. **Block failure (uncommon).** Hagon studied whether using the tibial nerve component or the common peroneal portion of the sciatic nerve as identifier of correct needle tip location for injection, was better than using a tibial nerve component endpoint³². Hagon concluded that injecting 30 ml of drug onto the common peroneal nerve portion produced an 83% failure rate versus a 21% failure rate when injecting onto the tibial nerve portion. Hagon's results are starkly different from all other reports and seemingly erroneous. Hagon's study's errors are (i) the study was prematurely aborted when numbers studied



were too low, (ii) their pre-surgical assessment of failure and criteria defining failure were too strict, and (iii) no indication was given of the final actual clinical results. All other reports generally rate the parasacral sciatic block as highly successful, implicitly saying there is no likely difference in injecting onto either portion of the sciatic nerve.

- Ripart's study of 400 cases reported only 6% failures at the 30-minute assessment period⁴¹.
- Gaertner reported 100% clinical success in 75 cases regardless of the motor twitch used as indicator of nerve needle contact²⁷. Two injections (3%) were made on a piriformis twitch (hip abduction), 53 injections (71%) on a tibial nerve component muscle twitch, and 20 injections (26%).
- Cuvillon's studied 75 cases comparing single injection parasacral sciatic nerve blocks to double injection Winnie technique sciatic nerve blocks⁴². Although the double injection Winnie block started show evidence of nerve block first by ten minutes, results were identical and 100% successful at 60 minutes for both blocks.
- Considering the totality of published evidence, including the author's personal experience, this block is characterized as being one of the MORE successful peripheral nerve blocks generally. Failure is rare. Single injection is the recommended technique for the parasacral sciatic nerve block.

8. **Hard to learn.** When one looks at the buttocks from posterior, as a novice it seems there are no cues or reference points as to where the sciatic nerve may lie, nor even where the greater sciatic notch is. The truth is there are number of potential bony reference points that can all contribute to defining the critical anatomical locations with skin markings. The most specific bony points are the posterior superior iliac spine (PSIS) and ischial tuberosity (IT), but also the iliac crest (IC) and greater trochanter (GT). Few other blocks have so many immovable landmarks. Landmarks that rely on muscle edges, skin creases, and etcetera are always at risk of the markings being different in individuals with widely differing physiques. All reports from learners and experienced practitioners is that the parasacral sciatic block is easily learned as any other landmark-based electrostimulation-guided block. Using ultrasound guidance for this block is a most valuable additive aid to the landmarks and electrostimulation. Using the ultrasound is not however intuitive. The ultrasound user must have general experience with other nerve blocks. They must be familiar with a curved transducer and the different forms of tissue structure resolution. They must also have mastery of the very subtle handling movements that can make deep structures appear or disappear with single degrees of transducer position change. The ultrasound user must also learn to comprehend what minimal image features can fully mean. It is a case of altering the expectations of what to see, and learning how to see. Mastering the land marks and electrostimulation technique can be mastered in a handful of cases. Mastering the core ultrasound skills takes many cases under appropriate expert tutelage. Beyond that point, an ultrasound aided parasacral sciatic nerve block is easy to do, even in large obese buttocks. This author considers the total combine use of (1) landmarks, (2) electro-stimulation, and (3) ultrasound guidance is the optimum standard for performing this nerve block. The block is reasonably easy to learn for this standard.
9. **General complications.** No regional anesthesia procedure is ever fully free of the complications of the infrequent local anesthetic toxicity and the rare true nerve block induced nerve injury. Ripart from France studied 400 parasacral sciatic blocks prospectively, and the blocks were done by a range of physicians, all without ultrasound guidance⁴¹. No single complication occurred. The success rate after the nerve block was 94%, before rescue or supplementary blocks, or maneuvers were needed. The success rate for novices and experts was very similar, suggesting the block is easily learned. The available reported experience of the parasacral sciatic nerve block, together with this author's



experience suggest the block is remarkably devoid of complications. This author has never had a serious patient complication in performing about 250 parasacral nerve blocks personally, per best recall. The veterinary experiences of the parasacral plexus (sciatic) nerve block also reports zero observed complications³³.

In summary then, the parasacral sciatic nerve block must be considered as generally as safe as any other peripheral nerve block, and safer than some. There are also no records of any calamitous complications such as death or permanent leg paresis or other.

ADVANTAGES AND DISADVANTAGES OF THE PARASACRAL SCIATIC NERVE BLOCK.

ADVANTAGES.

1. Feasible in obese patients. Amin compared (i) anterior approach, (ii) peri-trochanteric lateral approach, and (iii) posterior parasacral approach sciatic nerve blocks³⁴. Nerves were localized using surface landmarks and needle electrostimulation. Amin noted that obesity made some anterior and lateral approach blocks exceedingly difficult or impossible. However obesity was never an unsurmountable problem in parasacral blocks. This concurs with author's experience. If a sciatic nerve block needs to only include the posterior cutaneous nerve of the thigh, for example for knee surgery involving a posterior incision, the recommend approach is the GT-IT line block as described by Raj. In the event of severe obesity making that block exceptionally difficult it is suggested that a parasacral approach then be considered. Generally that far cephalad in the buttock region is less afflicted by excessive adipose tissue than the more distal and middle buttock regions.
2. The block is easy. Comparing landmark based electro-stimulation guided anterior, lateral and parasacral blocks, Amin considered the parasacral approach the easiest of that group³⁴. This author too feels that with modest experience, good understanding of the anatomy that it is an easy nerve block.
3. The block is reliable with only a single point injection. Helayel reported good experience and a study that the parasacral sciatic block is more reliable with single injection technique than all more caudad sciatic nerve blocks whether performed with double of single injection techniques³⁵.

DISADVANTAGES.

- A. Patient is required to lie in the lateral position with well flexed upper hip. That may be difficult for the patient with hip or leg injuries. This author recommends use of micro-dose ketamine with small dose midazolam, (e.g. 50 mg ketamine plus 1 to 1½ mg midazolam for an average adult) during positioning of such an injured patient.
-



INDICATIONS

1. **General advantages of peripheral nerve blocks in critically ill patients.** For this patient group peripheral nerve blocks firstly offer advantage over general anesthesia alone. The peripheral blocks may be the sole anesthetic, but will still retain all advantages even if combined with general anesthesia. When combined with nerve blocks, Light general anesthesia with airway control is superior to deep sedation without airway control. The general anesthetic can be minimal, thus allowing for preservation of hemodynamic physiology and near immediate full recovery upon completion of the surgery. Peripheral nerve blocks also offer advantages over neuraxial blocks by virtue of; (i) inducing less hemodynamic changes, (ii) being usable in anticoagulated patients, and (iii) having zero risk of causing paraplegia.

- Chen described using the parasacral sciatic nerve block combined with a fascia iliac block for an awake surgical repair of a hip fracture³⁶. The aged patient had significant airway and cardiorespiratory disease, as well as ankylosing spondylitis handicapping performance of neuraxial blocks. General anesthesia and complex airway management was avoided.
- Petchara from Thailand in 2015 described retrospectively his experience in a group of 70 aged patients all with hip fractures. He used a combined psoas compartment block and parasacral sciatic nerve block³⁷. The drug injected for each of the major blocks was a 20 milliliter solution containing 0.25% levobupivacaine and 1% lidocaine. An additional supplementary local anesthetic infiltration was made in the planned surgical incision line. There were no immediate perioperative deaths. Only seven percent needed supplementary analgesia immediately after surgery, and 46% needed zero opiates in the first 24 hours. Sixty nine percent were on antithrombotic therapy before the surgery. There were no nerve block associated hemorrhage events, nor any clinically apparent thrombo embolic events after surgery. All nerve blocks were performed by one anesthesiologist, being the only one with appropriate expertise. In Petchara's opinion for aged patients needing surgery for hip fractures general anesthesia was acceptable in uncomplicated cases. Petchara felt neuraxial anesthesia was the better choice if avoidance of general anesthesia was considered advantageous. Neuraxial anesthesia has the advantage of the expertise for that is widely spread amongst anesthesiologists. When anticoagulation prohibited neuraxial anesthesia then he considered combined peripheral nerves, as described in his report, as the ultimate best choice for the patient. Clearly however the technical expertise for such nerve blocks is not a standard anesthesia skill.
- Asao from Japan used the parasacral sciatic block plus a psoas compartment block for the sole anesthetic in four patients between 83 years and 97 years old. All of them had severe heart failure, with combinations of valvular disease and coronary artery disease³⁸. The surgery was for hip fractures. Asao considered peripheral nerve blocks significantly safer advantageous than general and spinal anesthesia for these specific patients.



Surgery to the hip joint, for example for arthroplasty can utilize approaches from (i) anterior, (ii) from lateral and (iii) from posterior^{39, 40}. Each approach has very different effects in causing posterior hip pain after surgery. In this author's own experience relating to hip arthroplasty surgery;

- a) **ANTERIOR APPROACH hip arthroplasty.** If the primary anesthetic is neuraxial or general anesthesia then the posterior hip pain after surgery is minimal. The mild posterior pain is well treatable with oral (or IV) non-sedating medications such as NAIDs and acetaminophen. The rest of the post-surgical pain being anterior, lateral and deep is best managed with a psoas compartment nerve block, or related blocks. A sacral plexus block such a parasacral sciatic nerve block, in addition to psoas compartment block, is only needed for planned awake surgery. Attempting an anterior approach hip arthroplasty as awake surgery under psoas compartment block alone is not generally feasible due to the operative posterior pain from retractor induced discomfort. In this last situation the amount of supplementary sedation and analgesia that will be needed to ensure a restful patient will degenerate into an intravenous anesthetic without airway management.
 - **SUMMARY:** A parasacral sciatic nerve block would be excessive therapy for the average patient if used only to supplement post-surgical pain control. A parasacral sciatic block must however be used in combination with a psoas compartment block and iliac crest block if awake surgery is planned. Awake surgery is however, generally not recommended due to the general discomfort of having both legs in traction.
- b) **LATERAL APPROACH hip arthroplasty.** The muscles supplied by the superior gluteal nerve (foremost the gluteus medius, gluteus minimus, and tensor fascia lata), will be sufficiently surgically injured to require a parasacral sciatic nerve block both for awake surgery (zero to minimal sedation-analgesia) and post-surgical analgesia.
 - Fully awake surgery under peripheral nerve blocks only will require additional iliac crest blocks and a psoas compartment block. Post-surgical pain will initially be zero. If the sciatic block is done with bupivacaine of 0.33% or stronger the block will last long enough that the post block posterior pain will be well manageable with non-sedating analgesics like NAIDs and acetaminophen. It is however recommend that the major pain still be treated with a psoas compartment continuous infusion.
 - If the primary anesthetic is a general anesthetic or a neuraxial block, the additional use of a psoas compartment block alone will provide worthwhile post-surgical analgesia, but barely so. In the absence of a parasacral sciatic nerve block, and only using a psoas compartment block morphine PCA usage will be reduced about 50% and nausea will be less. However patient pain score will be reported as similar to that of patients with zero nerve blocks, but using more morphine.
 - Accordingly a parasacral sciatic block is advised be performed routinely (combined with a psoas compartment block) with lateral approach hip arthroplasty surgery.
- **POSTERIOR APPROACH hip arthroplasty.** This is one of the most painful orthopedic surgeries. Surgical incision involves the posterior joint capsule and the muscles lying immediately posterior to the hip joint, namely obturator internus, the gamelli, piriformis and quadratus femoris. Posterior approach hip pain is so severe it is mandatory to



include a parasacral sciatic nerve block together with the other peripheral nerve blocks, if any nerve blocks are being done at all. Use of a psoas compartment block alone is clinically useless and pointless as it will not result in any lowering of pain scores. The reduction in morphine PCA usage, versus no nerve blocks at all, will be about 25% only. Any pain intervention, like a nerve block is considered not worth doing if it lowers morphine PCA consumption by less than 50%. Supplementary non-sedative analgesics such as NSAIDs, and acetaminophen, even if combined with other lower efficacy balanced analgesia non-opiate drugs will not provide broad enduring pain relief of the posterior hip pain after surgery.

- The posterior approach for hip arthroplasty is much more painful than using a lateral approach, and very much more painful than using an anterior approach. The anterior approach's benefits are reduced chance for posterior hip dislocation after surgery, and significantly the least pain after surgery of the three approaches. The penalty for performing an anterior approach is significant increased technical difficulty for the surgeon and a restricted surgical access to the hip joint. The posterior approach is the generally reserved for repeat hip joint surgery. The posterior approach is never used as a primary approach.
- Due to the severity of pain of posterior hip joint surgery it is highly recommended that post-surgical pain be controlled via continuous psoas compartment block, a single shot iliac crest block (or subcostal nerve block equivalent), and a parasacral sciatic nerve block. Inject either levobupivacaine 0.6% or bupivacaine 0.5% to maximize nerve block duration. Using only ropivacaine 0.5% provides a block of too short duration to produce relevant post-surgery analgesia, in this scenario

For many physicians, in the pre-ultrasound era, the parasacral sciatic nerve block technique was the choice technique of all proximal sciatic nerve blocks^{41, 42}. "Proximal sciatic nerve block" in this context means a sciatic nerve block in the buttock region. The parasacral sciatic block was favored for reasons of (i) its high success rates, and (ii) relative ease of performance. The rejected techniques were those of Labat and Winnie in the mid- buttock region. The GT-IT line block described by Raj, a superb electrostimulation guided technique in the buttock region, was largely still undiscovered in that era. See the summarizing comments of this chapter.

CONTRA-INDICATIONS

Contraindications for performing the parasacral sciatic nerve block are general and logical. There is none specific and unique to this nerve block. Refer to standard textbooks. Some examples would be; (i) lack of expertise with regional anesthesia, (II) lack of the specific anatomical knowledge of the parasacral region needed, (iii) lack of experience with this nerve block specifically (iv) lack of general patient consent for surgery and anesthesia, and (vi) gross sepsis at the site of needle insertion.



SUMMARY

This author makes the following recommendations on best choice of sciatic nerve blocks.

- A. Nerve stimulator and surface landmark guided techniques;
 - For surgery in the **hip and pelvic region**; Use the **parasacral sciatic** nerve block.
 - For surgery involving the posterior aspect of the thigh and knee joint capsule; Use the GT-IT line sciatic nerve block. The parasacral sciatic block can be the second option.
 - For surgery of the lower leg, ankle and foot; use the GT-IT line sciatic nerve block.
- B. Ultrasound guided techniques;
 - For surgery in the **hip and pelvic region**; Use the ultrasound guided **parasacral sciatic** nerve block.
 - For surgery involving the posterior aspect of the thigh and knee joint capsule; Use the ultrasound guided GT-IT line sciatic nerve block. The parasacral sciatic block can be the second option.
 - For surgery of the lower leg, ankle and foot; use the ultrasound guided popliteal fossa sciatic nerve block (combined with distal trans-sartorius saphenous nerve block within one skin preparation field, with the surgical leg down in a lateral patient position). The GT-IT line sciatic nerve block is a high suitable alternative. The parasacral sciatic block can be the third option.

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