Suprasacral Parallel Shift for Lumbosacral Plexus Blockade

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Indications for lumbosacral (LS) plexus blocks: surgical anesthesia for hip and proximal thigh procedures in fragile patients with severe cardiac comorbidity and increased risk with exposure to general or spinal anesthesia; perioperative opioid-free analgesia for hip and proximal thigh procedures; proximal approach for blocking terminal nerves, such as proximal femoral nerve block.

State of current literature: indications established for many years; data of high quality and validity scarce (primarily based on case reports, letters, and feasibility reports); more research urgently needed.

LS plexus: network of nerve branches innervating entire lower limb, including hip; LS plexus blocks typically unilateral rather than bilateral; indicated for anesthetizing hip joint, ligaments, and capsule; considering lumbar and sacral plexuses as separate entities useful; sacral plexus primarily innervates posterior of hip; lumbar plexus innervates anterior, medial, and lateral hip.

Terminal nerves: femoral and obturator nerves innervate hip joint; lateral femoral cutaneous nerve innervates lateral thigh; all 3 nerves closely related to psoas major muscle.

Psoas major muscle: originates in lumbar paravertebral region and extends to minor trochanter; 2 layers apparent when viewed from medial side; anterior layer attached to vertebral bodies and intervertebral discs; posterior layer attached to transverse processes to level of fifth lumbar vertebral body (L5); layers form pocket opening toward neural foramina; lumbar spinal nerves exit neural foramina and enter pocket; plexus stays in pocket to transverse process of L5; plexus exits muscle at L5 and runs in compartment at back of psoas along with LS trunk (upper part of sacral plexus; originates from L4 and L5).

Needle insertion: with insertion low in psoas compartment, single injection can anesthetize lumbar plexus and upper part of sacral plexus; high insertion (between transverse processes L2-L3 or L3-L4) does not anesthetize LS trunk because nerves “sandwiched” between anterior and posterior layer of psoas; psoas deviates laterally at L5.

High approach to lumbar plexus block: insert needle between transverse processes of L2-L3 or L3-L4; use loss of resistance, electrical nerve stimulation, or ultrasonography to guide advance; inject local anesthetic (which spreads between layers of psoas major and covers lumbar plexus nerves).

Ultrasoundographic technique for high approach: patient in lateral position; curved low frequency probe placed parasagittally in lumbar region; visualize transverse processes of L2, L3, and L4 and their acoustic shadows; advance needle between transverse processes of L3-L4, to 2 cm anterior to back of transverse process.

Challenges: avoiding bony contact difficult; target lumbar plexus cannot be visualized; technique advanced and difficult to perform.

Shamrock lumbar plexus block technique: expected to improve effectiveness, safety, and ease of performance; patient in lateral position; curved array probe placed above iliac crest, which allows visualization of L4 transverse process and 3 surrounding muscles; lumbar plexus can be visualized by tilting probe; good visualization of needle and lumbar plexus target obtained with advance of needle; lumbar artery branches can be visualized and avoided; needle inserted just lateral to lumbar plexus; protocol has been accepted for trial comparing Shamrock technique in healthy volunteers to determine which approach best.

Low approach: block in psoas compartment, together with LS trunk; insert needle between transverse processes of L4-L5 or between L5 and upper margin of sacral bone; local anesthetic spreads behind muscle.

Needle insertion at L4-L5: never described with ultrasound (US) guidance; psoas compartment block — refers to placement in space behind psoas major muscle; blind technique; Chayen et al reported good outcomes.

Needle insertion between L5 and sacral bone: few reports in literature; new US-guided technique — place patient in lateral position; rotate probe to obtain sagittal view; advance needle with loss of resistance through intertransverse ligament and LS ligament; local anesthetic spreads to include S1 spinal nerve.

Suprasacral parallel shift: study comparing Shamrock technique and suprasacral parallel shift now completed; 2 techniques equally effective for blockade of terminal nerves of lumbar plexus and moderately effective for lateral cutaneous nerve; parallel shift moderately effective for LS trunk; new technique not effective for LS trunk; anesthesia more complete when lumbar plexus block combined with selective sacral plexus block; in parallel shift technique, both ligaments must be penetrated to prevent epidural spread of local anesthetic (particularly important for fragile patients).

Sacral plexus: primarily originates from L4, L5, and S1, and less so from S2 and S3; exits greater sciatic foramen; covered by piriformis muscle; constitutes majority of hip innervation; blockade possible with use of electrical stimulation; can be combined with lumbar plexus block for hip surgery; US guidance can be used.

Educational Objectives

The goals of this program are to improve outcomes of patients receiving lumbosacral plexus nerve blocks and the management of endocrine disorders commonly encountered in the perioperative setting. After hearing and assimilating this program, the clinician will be better able to:

1. Explain the indications for lumbosacral plexus nerve blocks.
2. Visualize the anatomy of the lumbosacral plexus.
3. Use ultrasonographic guidance to perform lumbosacral plexus blocks.
4. Evaluate patients with endocrine disorders in the perioperative setting.
5. Provide perioperative management of patients with endocrine disorders.

Faculty Disclosure

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, members of the faculty and planning committee reported nothing to disclose.
Parasacral parallel shift technique: simple and effective technique; probe placed on iliac bone line; parallel shift made until US hits greater sciatic notch; sacral plexus visualized; local anesthetic spreads around sacral plexus to produce effective blockade; comparison with Mansour pivot technique planned

Anesthesia for higher incision: region between iliac crest and greater trochanter innervated by lateral cutaneous branches of subcostal and iliohypogastric nerves, which originate from 12th thoracic vertebra (T12) and L1; L1 part of lumbar plexus but beyond reach of lumbar plexus block; requires separate block. Fascia transversalis plane block: probe placed in axial view on iliac crest, and abdominal muscles visualized; needle advanced until tip on deep side of transversus abdominis below transversalis fascia; local anesthetic spreads across aponevrosis and covers deep side of quadratus lumborum (QL) Transmuscular QL blockade: developed to obtain cranial spread to thoracic paravertebral space and anesthesia of abdominal wall; lower volume of local anesthetic spreads on deep side of QL and anesthetizes iliohypogastric and subcostal nerves Ultrasonographic technique: patient in lateral position; curved array probe visualizes QL; aim needle at deep corner between QL and psosas major, below transversalis fascia; local anesthetic spreads on deep side of QL to anesthetize nerves

Increasing effectiveness and safety of LS plexus blocks: real-time image fusion to visualize and guide needle advancement by synchronous US and magnetic resonance imaging (MRI) guidance under development; US cannot penetrate bone; synchronous MRI allows target visualization and accurate needle guidance to deep and complex targets

Suggested Reading


Perioperative Endocrinology: The Internist’s Perspective

Guillermo E. Umpierrez, MD, Professor of Medicine, Division of Endocrinology and Metabolism, Emory University School of Medicine, and Director, Clinical Research Unit and Endocrinology Section, Grady Health System, Atlanta, GA

Case presentation 1: 22-yr-old patient with multiple trauma; has ruptured spleen requiring surgery; has history of Graves disease, but poorly compliant (off medication for 2 yr); presents with florid hyperthyroidism, manifested by exophthalmos, goiter, bruit, heart rate 180 bpm, elevated free thyroxine (T4), and suppressed thyrotropin (TSH)

Thyroid storm: rare complication affecting 1 in 10; mortality 20% to 30% if not diagnosed; always follows precipitating event, eg, trauma, surgery; diagnosis—no simple method available; excessive circulating thyroid hormones present; characterized by exaggerated symptoms of hyperthyroidism, including fever, cardiac arrhythmia, and altered mental status; literature of poor quality; in general, scoring system that totals number of risk factors used in diagnosis, with score over 40 or 45 indicating storm; severe symptoms most important (in case study, mental status and arrhythmia)

Severe hyperthyroid vs thyroid storm: cannot be reliably distinguished clinically; if thyroid storm suspected, treat as such; management—closely monitor patient in intensive care unit (ICU); block synthesis and effects of thyroid hormones

Antithyroid medications: propylthiouracil (PTU) and methimazole block formation of thyroid hormones (give as soon as possible); T4 has 7-day half-life, so effects must be blocked with β-blockers; block release with iodine; methimazole preferred over PTU; for storm, give methimazole 60 mg/day in divided doses; if not storming, 20 to 40 mg sufficient

Iodine: decreases release of T4 and triiodothyronine (T3); given antithyroid medication before iodine; administer for few days during perioperative period or hospitalization; several preparations available, including Lugol’s solution

Decrease conversion of circulating T3 to T4: any β-blocker effective; glucocorticoids not routinely used unless patient hypotensive

Critically ill patient: consider plasmapheresis to immediately remove effects of thyroid hormone

Case presentation 2: patient with type 1 diabetes and hyperthyroidism scheduled for bypass surgery; has small goiter; takes basal bolus for diabetes, antihypertensive medication, and levothyroxine (eg, Levothroid, Synthroid, Tirosint); T4 low and TSH elevated

Evaluation: low T4 and elevated TSH indicate primary hyperthyroidism; in type 1 diabetics, always consider hypothyroidism, especially with hypopitremia or myopathy; measure TSH in every patient with type 1 diabetes

Preoperative management: start thyroid hormones at low dose and titrate up to avoid precipitating ischemic event; proceed with surgery unless severe condition, eg, myxedema coma, pericardial constricitions or effusion, present; mild to moderate hypothyroidism well tolerated

Case presentation 3: patient on prednisone 7.5 mg/day for several years (to treat lupus) presents for surgical repair of hip fracture; no evidence of Cushing disease noted; need for surgery dictates treatment as adrenal crisis; stress conditions begin before surgery because of trauma

Production of cortisol: normally, hypothalamus stimulates pituitary, and pituitary produces adrenocorticotropic hormone (ACTH); ACTH stimulates cortisol; process controlled by feedback loop; prednisone suppresses secretion of corticotropin-releasing hormone (CRH) from hypothalamus and ACTH from pituitary; suppression lasts several weeks; absence of oral corticosteroids or increased stress precipitates adrenal crisis; patient needs 6 mo of replacement for any acute adrenal condition

Replacement dosage: good data not available; speaker recommends 50 to 100 mg preoperatively; dose continued 2 to 3 times daily during perioperative period

Evaluation for adrenal insufficiency: use cosyntropin (Cortrosyn) ACTH stimulation test; cortisol measured at baseline, then at 30 min and 60 min; alternatively, 30- and 60-min measurements may be replaced with one 45-min measurement; response >9 μg/dL above baseline, or any value >18 μg/dL, rules out adrenal insufficiency; conversions—1 mg dexamethasone equal to 5 mg prednisone or 20 mg hydrocortisone

Etomidate: possible cause of acute adrenal insufficiency; blocks 11-β-hydroxylase and conversion to cortisol

Case presentation 4: 53-yr-old patient presents for elective pancreatectomy (has 3 cm-pancreatic mass); patient has 8-yr history of type 2 diabetes, poorly controlled

Current recommendations for management: administer insulin, intravenously if patient critical, subcutaneously if not; oral agents not used in hospital setting; new data suggest oral agents possibly acceptable in some patients; basal bolus vs sliding scale insulin—randomized controlled trial indicates superiority of basal bolus (associated with better control of blood glucose and fewer complications)
New recommendations: give single dose (0.2-0.25 U/kg) of insulin, with corrections as needed; start basal bolus when patient able to eat

Oral agents: good data lacking; in United States, used to treat 18% of patients with type 2 diabetes; dipeptidyl peptidase-4 (DPP-4) inhibitors — 4 drugs currently available; in pilot study, efficacy of single dose of sitagliptin (with corrections) found to be similar to that with insulin therapy in patients with blood glucose <180 mg/dL; additional studies of oral agents ongoing

Medical therapy after discharge: no good guidelines available; newly published data — if hemoglobin A1c (HbA1c) <7%, discharge patient on predishension regimen; for HbA1c 7% to 9%, discharge patient with oral medications and half dose of basal insulin given in hospital; for HbA1c >9%, discharge with basal bolus therapy

Trends in diabetes care: simplify therapy in hospital setting; use single-dose basal insulin; oral agents acceptable for certain patients

Hyperthyroidism review: storm cannot be differentiated from severe hyperthyroidism; in presence of fever and altered mental status with tachycardia, treat as storm; transfer patient to ICU and start treatment; use PTU only in first trimester of pregnancy; in all other cases, use methimazole (40-60 mg sufficient); give β-blockers and iodine

Hypothyroidism review: starting dose 1.6 μg/kg; cancel surgery only for severe myxedema; in cases of ischemic heart disease, correct hypothyroidism slowly

Adrenal insufficiency review: many patients receiving exogenous corticosteroids and unable to mount acute response to stress; patients under stress require treatment; individualize dosages; always use hydrocortisone in acute setting (other medications useful for long term)

Diabetes review: do not use sliding scales alone (associated with increased risk for complications); use single-dose basal therapy, with supplements as needed; use dosage of 0.2 or 0.25 U/kg per day, with supplements as needed

Oral agents review: role in hospital setting changing; DPP-4s sufficient for patients with mild to moderate hyperglycemia

Factors that predict good glucose control in hospital setting:
duration of diabetes — greater than vs less than 5 yr; admission HbA1c — indicates level of patient’s glucose control; 7.5% is threshold number; admission blood glucose — threshold number 180 mg/dL; if below 180 mg/dL, DPP-4 acceptable

Suggested Reading


Acknowledgments

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Estimated time to complete the educational process:

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1. Select the true statement about lumbosacral plexus blockade.
   (A) Indicated for proximal block of terminal nerves
   (B) Preferred anesthesia for young healthy patients
   (C) Associated with increased need for perioperative opioids in patients undergoing hip and proximal thigh procedures
   (D) Typically bilateral

2. Which of the following statements about the innervation of the lumbosacral plexus are true?
   1. The sacral plexus primarily innervates the lateral hip
   2. The lumbar plexus innervates the anterior and medial hip
   3. The femoral nerve innervates the hip joint
   4. The obturator nerve innervates the hip joint
   (A) 1, 2 (B) 3, 4 (C) 1, 2, 3 (D) 2, 3, 4

3. Which of the following is an accurate statement about the shamrock technique for lumbar plexus blockade?
   (A) Requires prone positioning
   (B) Is more difficult to perform than other high approaches
   (C) Allows visualization of the needle and lumbar plexus
   (D) Facilitates higher surgical incisions

4. Select the true statement about the suprasacral parallel shift technique.
   (A) It is superior to the trident technique for blocking terminal nerves of the lumbar plexus
   (B) When performing the block, it is important to penetrate only the first ligament
   (C) It is moderately effective for blocking the lumbosacral trunk
   (D) Addition of selective sacral plexus block to lumbar plexus block does not improve anesthesia

5. Which of the following is the best choice for blockade of the iliohypogastric and subcostal nerves?
   (A) Lumbar plexus block
   (B) Sacral plexus block
   (C) Transmuscular quadratus lumborum block
   (D) Fascia transversalis plane block

6. Which of the following statements about thyroid storm is true?
   (A) Propylthiouracil and methimazole are equally safe and effective treatments
   (B) Must be carefully differentiated from hyperthyroidism before treatment is initiated
   (C) Requires administration of β-blockers to block the effects of circulating T4
   (D) Iodine should always be given before antithyroid medications

7. All the following statements about hypothyroidism are true, EXCEPT:
   (A) Low T4 combined with high thyrotropin (TSH) indicates primary hypothyroidism
   (B) Surgery should be delayed in hypothyroid patients until T4 levels are normalized
   (C) TSH levels should be measured in every patient with type 1 diabetes
   (D) Treatment should begin with low replacement dosages

8. Choose the true statement about adrenal insufficiency.
   (A) A response >9 μg/dL on the adrenocorticotropic hormone (ACTH) stimulation test rules out adrenal insufficiency
   (B) Exogenous steroids suppress cortisol for ≤1 wk
   (C) Propofol is frequently implicated as a cause of adrenal insufficiency
   (D) Only patients showing signs of Cushing disease require prophylactic steroid treatment prior to surgery

9. Which of the following is true about hyperglycemia in the perioperative setting?
   (A) Patients should be transitioned from insulin to oral medications as quickly as possible
   (B) Dipeptidyl peptidase-4 inhibitors are effective for patients with blood glucose levels ≤240 mg/dL
   (C) A starting dose of 0.5 U/kg per day of insulin is recommended
   (D) A basal bolus insulin regimen is associated with fewer complications than a sliding scale

10. All the following are predictors of good glucose control in the hospital setting, EXCEPT:
    (A) Insulin dose at time of admission <50 U daily
    (B) A duration of diabetes <5 yr
    (C) Admission blood glucose <180 mg/dL
    (D) Admission hemoglobin A1c <7.5%

Answers to Audio Digest Anesthesiology Volume 57, Issue 36: 1-B, 2-D, 3-A, 4-C, 5-B, 6-A, 7-B, 8-D, 9-D, 10-A