Superior Hypogastric Plexus and Ganglion Impar Block

48

Amitabh Gulati, Sushma Bhatnagar, Neal Rakesh, Arash Yousefi, and Carolina Hernandez-Porras

Contents

Superior Hypogastric Plexus Block

Introduction

The visceral afferent branches of the pelvis, the sympathetic efferent fibers of the aortic plexus, and the splanchnic nerves form the superior hypogastric plexus.

A. Gulati (✉)
Memorial Sloan Kettering Cancer Center, Department of Anesthesiology and critical care, New York, NY, USA
e-mail: gulatia@mskcc.org

S. Bhatnagar
Onco-Anesthesia and Palliative Medicine, AIMS, New Delhi, India

N. Rakesh
Anesthesiology and Critical Care, MSKCC, New York, NY, USA

A. Yousefi
Neurology, Mount Sinai Downtown, New York, NY, USA

C. Hernandez-Porras
Palliative Care, Instituto Nacional De Cancerologia, Mexico City, Mexico

Indications

This blockade can be used for either malignant or benign pelvic pains, but studies have shown higher success rate in malignant conditions. Specifically, patients with cervical or bladder cancers have shown pain reduction with this procedure. There is evidence showing greater effectiveness in individuals over the age of 59 compared to younger patients. The procedure has shown a decrease on the visual analogue pain score in approximately 70% of the cancer patients. The group of patients successfully treated with this procedure have shown a 22% reduction in mean opioid use compared to the failure group.

Contraindications and Complications

Superior hypogastric plexus block can be performed safely with rare, but serious, complications. The blood supply to the anterior spinal cord is less likely to be compromised at this level, consequently, several neurological complications are less likely to occur compared to more cephalad blocks, such as the

D. Jankovic, P. Peng (eds.), *Regional Nerve Blocks in Anesthesia and Pain Therapy*,
https://doi.org/10.1007/978-3-030-88727-8_48

celiac plexus block. Nonetheless, given the ganglion is anterior to the psoas, psoas hematoma is a known complication. Furthermore, proximity to the L4, L5, and S1 nerve roots lend to the possibility of neural injury, especially with neurolytics.

Bilateral neurolysis, which may lead to complete sympathectomy of pelvic organs, may result in sexual dysfunction in men and should be avoided. Other possible complications include subarachnoid or epidural injections, nerve injury, or damage to structures such as the kidneys or urethra or muscular injury.

Critical Anatomy

The superior hypogastric plexus is a retroperitoneal plexus, located at the level of the lower third of the L5 and upper third of the S1 vertebrae. The superior hypogastric plexus contains both sympathetic and parasympathetic fibers. Sympathetic fibers innervate all pelvis organs except the ovaries and fallopian tubes. The inferior mesenteric ganglion and lumbar splanchnic nerves also contribute to the plexus with the fibers that travel with aorta. Visceral afferent fibers of the pelvic organs travel through the plexus and enter the spinal cord with the lumbar or sacral nerve roots.

Equipment and Patient Preparation

The procedure does not require any special monitoring. Supplemental oxygen, an AMBU bag, suction, ACLS drugs, and other resuscitation equipment must be available for emergencies. Peripheral IV access is not necessarily needed for this procedure. The patient should receive 1 g cefalexin/cefazolin or 1 g vancomycin for prophylaxis, and antiseptic techniques must be used before and during the procedure. The procedure will be performed under fluoroscopic guidance. The patient will be placed in a prone position. A 22 or 25-gauge, 7-in. needle will be used for the injections. Two to 3 mL of 1–2% lidocaine will be used for skin analgesia. Ten milliliter of 0.25–0.5% ropivacaine or bupivacaine, with 40–80 mg of particulate steroid (i.e. 40 mg/mL Triamcinolone), will be used for temporary blockade. Six to 8 mL of 10% phenol, or 8–10 mL of 50–100% ethanol, unilaterally will be injected for neurolysis.

Step-by-Step Technique

Fluoroscopy Technique

Classic or Posterolateral Approach

1. Patient is placed in a prone position, with the head turned to one side. When using a C-arm, Lumbar lordosis can be reduced using a pillow under the lower abdomen.
2. When the lower L5 and upper S1 endplates are squared in the AP view the transverse process is located ~10–15 mm lateral to the spinous process.
3. The needles will be inserted lateral to the right and left transverse process.
4. Needles are inserted 30-degree caudad (off the medial sagittal plane) and 45-degree obliqued.
5. After contacting the lower border of the outer third of the transverse process, the needle is removed 30 mm and redirected caudally.
6. A lateral view is necessary to verify the needle depth relative to the vertebral body.
7. The medial path is continued cautiously, avoiding the intervertebral disc.
8. Lateral position is proceeded until 1–2 mm before the end of the intervertebral disc, then the needle is connected to a 3- or 5-mL syringe for loss of resistance.
9. Needle path is verified in an AP view (Fig. 48.1).
10. Needle placement is verified by applying 2–3 mL of nonionic contrast under dynamic fluoroscopy in lateral plane (Fig. 48.2).
11. In patients with L5 mega-apophysis, or Bertolotti Syndrome, the procedure can be performed in the L4–L5 intervertebral space.
12. An AP X-ray is taken to visualize retroperitoneal contrast spread on the right and left sides.

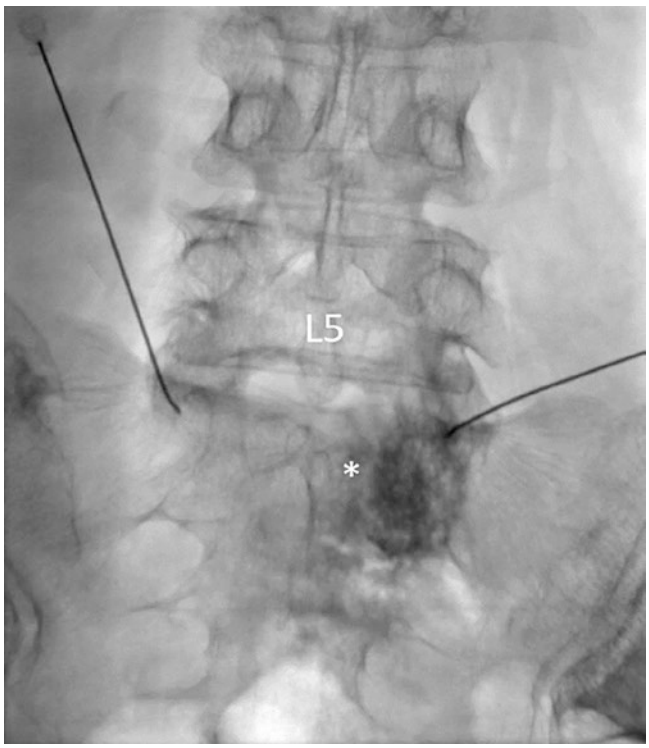

Fig. 48.1 AP view of bilateral needle placement for superior hypogastric plexus block under fluoroscopic guidance. (*) shows adequate left side spread which does remain lateral to the midline in an amorphous shape not following the contours of the psoas or organs (such as bowel)

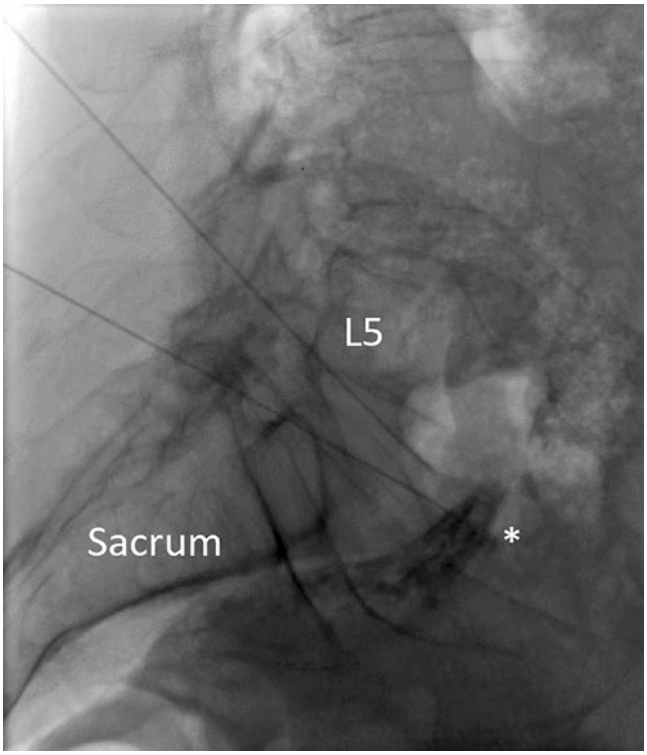

Fig. 48.2 Lateral view of bilateral needle placement for the superior hypogastric block under fluoroscopic guidance with good anterior spread along the sacral promontory (*)

13. Neurolysis is performed by injection of 8–10 mL of 10% phenol on each side. Diagnostic block is performed by using 0.25% bupivacaine with a similar volume.

Transdiscal Approach

1. Patient is placed in a prone position, with the head turned to one side. When using a C-arm, Lumbar lordosis can be reduced using a pillow under the lower abdomen.
2. The spinous process must be placed in the middle of the image by squaring off the lower L5 and upper S1 endplates in an AP view.
3. By using an oblique view, the superior articular process of S1 should be visualized.
4. A 22 gauge spinal needle will be introduced through the oblique view in the caudal part of the intervertebral disc.
5. After advancing 3–5 cm (depending on the patient's morphological characteristics), a clear lateral view must be taken, which is crucial while advancing the needle through the disc. In a perfect lateral view the intervertebral foramen would be seen as a unique round image, while the L5 and sacrum are squared off.
6. If the needle touches the L5 root the patient may complain of pain as the needle advances. The needle can be retracted 5 mm, and a lateral view can be obtained to confirm the needle position at the entry of the foramina. If the needle is touching the root, the needle tip should turn up or down to avoid the root. If the needle enters the intervertebral disc, the patient will experience discogenic pain, which can be mitigated by injecting 0.5 mm lidocaine and advancing the needle.
7. The needle is advanced to the lateral third or the middle of the disc and then is connected to a 3- or 5-mL syringe for loss of resistance. Loss of resistance indicates that the needle has reached retroperitoneum. In order to prevent the needle from potentially puncturing the bowls, if resistance is not felt after advancing 3 cm, a lateral view should be obtained.
8. 1–2 mL nonionic contrast must be applied while visualizing the anterior spread of the contrast in a linear fashion over the anterior surface of the L5–S1 intervertebral discs.
9. In addition, 5–10 mL of air can be injected and visualized in the lateral view along the anterior sacrum body.
10. Retroperitoneal contrast spread can be visualized with an AP radiograph. If bilateral spread is not visualized, an additional 5 mL of air and 2 mL of contrast can be applied.
11. Transdiscal needles can achieve a more medial injectate distribution which is especially important in cancer patients with extensive retroperitoneal tumoral activity.
12. In a diagnostic block, 15 mL of bupivacaine 0.35% can be applied. Neurolysis can be done with 10–15 mL of 10% phenol. In a bilateral transdiscal approach, 8–10 mL of 10% phenol or alcohol can be applied with each needle.

CT Guided

1. Patient is placed in a prone position, and in order to reduce lumbar lordosis a pillow can be placed under the lower abdomen.
2. A topogram of the lumbosacral region should be obtained before the procedure, unless the CT software helps with needle path.
3. The needle trajectory must be planned prior to starting the procedure. The distance and angulation from the skin to the inferior border of the transverse process should be measured with a CT ruler in sagittal plane (distance *b*). The external laser beam can provide the skin entrance needle point but cannot provide the distance from the spinous process or the needle angulation. In order to measure angulation, the paravertebral distance from the anterolateral margin of the L5 vertebrae and the psoas major should be measured in axial plane. The distance should be calculated by measuring the distance between the L5 spinous process and distance *b*.
4. Needles are introduced in the planned direction. In order to confirm direction and depth, multiple low X-ray dose CT can be obtained if needed.
5. After the needle tip reaches the anterior vertebral body of the sacrum or the L5 (depending on the needle angulation)

air and contrast will be applied, followed by a new CT to confirm the location.
6. Air and contrast should not be visible in any of the foraminal levels. In the case that they are visible, the needle tip should be slightly advanced, followed by the application of more contrast until the spread is visible at the retroperitoneum. Phenol should not be applied without this confirmation.
7. After confirming air and contrast spread in retroperitoneum, 8–10 mL of 10% phenol will be applied through each needle. Alternatively, 8–10 mL of alcohol can be applied for this procedure. In the final reconstruction, contrast-air-lytic agent distribution should be visualized.

Tips

- Given the cost and difficulty of phenol injection due to its high viscosity, 8–10 mL of 50–100% ethanol can be used as an alternative to phenol for neurolysis.
- Increasing the caudal tilt can improve visibility if the iliac wing obstructs the view.
- Given the amount of caudal and lateral tilt required for this procedure, longer needles may be needed, especially for obese patients.

Radio-Frequency Lesioning

In a case report, pulsed radio-frequency (PRF) of the superior hypogastric plexus was performed for a patient with interstitial cystitis. She received two sessions of PRF at 6-month intervals, with a frequency of 2 Hz and a width of 20 ms for 120 s. The authors reported that following the treatment her pain improved for more than 2 years.

Other reported radio-frequency ablations studies are performed with classic techniques, using 20-gauge, 10 cm cannulas, and 10 mm active tip RF needles.

High quality literature supporting radio-frequency use for PRF in the sympathetic nervous system, particularly for superior hypogastric plexus, is limited.

Retroperitoneal location of the SHPB and its proximity to the aortic bifurcation makes this procedure challenging and supports further cadaveric studies to confirm the feasibility of RF in this case.

Ganglion of Impar Nerve Block

Introduction

The ganglion of impar is the most caudal ganglion of the sympathetic chain which innervates the lower pelvic structures. A pair of paravertebral sympathetic chains are fused close to the sacrococcygeal junction and form this ganglion in the retroperitoneum. The ganglion supplies the sympathetic and visceral innervation of the lower third of the rectum, including the vagina, vulva, urethra, and coccyx. The ganglion of impar mediates the pain from these structures through its sympathetic nervous system, making it a suitable target for pain relief. Perineal pain produced by pelvic tumors can be worsened by defecation. Opiate-induced constipation can increase perineal pressure and discomfort and can place these patients in a vicious cycle. The ganglion of impar receives the visceral pain of the pelvic structures through the sympathetic fibers. The pain is then transmitted to the sympathetic trunk, sacral nerve roots, and spinal cord and finally terminates in the brain.

Indications

The ganglion of impar lock has been shown to be effective in many benign and malignant conditions. Perineal and coccygeal pain, originating from tumors or post-radiation and post-surgical changes of the perineal structures, have been safely improved with this block. It has shown benefits in treating radiation-induced prostatitis or proctitis. Coccydynia, resulting from degenerative changes, trauma, or infection, can also be treated with this block. Nonmalignant conditions, such as post-herpetic neuralgia, rectal tenesmus, vulvodynia, cystitis, and idiopathic perineal and coccygeal pain, can also be treated with this block.

Critical Anatomy

The ganglion of impar is a solitary retroperitoneal ganglion that is about 5 mm long. It is a midline structure located anterior to the coccyx and posterior to the rectum. Its position may vary from the level of the sacrococcygeal junction to the second coccygeal vertebrae.

Equipment and Patient Preparation

The procedure does not require any special monitoring. Supplemental oxygen, an AMBU bag, suction, ACLS drugs, and other resuscitation equipment must be available for emergencies.

The procedure will be performed under fluoroscopic guidance. The patient will be placed in a prone position. A 25-gauge, 2- to 3.5-in. needle will be used for the injections. Four milliliter of 1–2% lidocaine or 0.25–0.5% ropivacaine or bupivacaine will be used for local anesthesia. 0.5–1 mL of particulate corticosteroid (i.e., 40 mg/mL triamcinolone) will be used as an adjuvant for this block.

Step-by-Step Technique

Fluoroscopic-Guided Approach

1. Patient is placed in a prone position, with the head turned to one side. When using a C-arm, lumbar lordosis can be reduced using a pillow under the lower abdomen.
2. The sacrococcygeal region is prepped and draped sterilely.
3. The junction between the S5 and first coccygeal vertebrae is located in both the anterior-posterior (AP) and lateral positions, using fluoroscopy.
4. The skin and subcutaneous tissue overlaying the sacrococcygeal junction is anesthetized with local anesthetics using a midline entry point which has already been identified via fluoroscopy.
5. Under fluoroscopic guidance in the lateral view, the needle is inserted and advanced to the sacrococcygeal disc.
6. Needle advancement is continued through the sacrococcygeal disc until the needle tip is located anterior to the sacrococcygeal ligament.
7. 1–2 mL of contrast is injected to confirm the needle tip position in the retroperitoneal space (Fig. 48.3).
8. If the needle is in the correct position, contrast spread will produce a "reverse comma" shape in the lateral view. The AP view must not show any vascular or epidural spread (Fig. 48.3).
9. Aspiration should be done prior to injection for any blood or CSF.

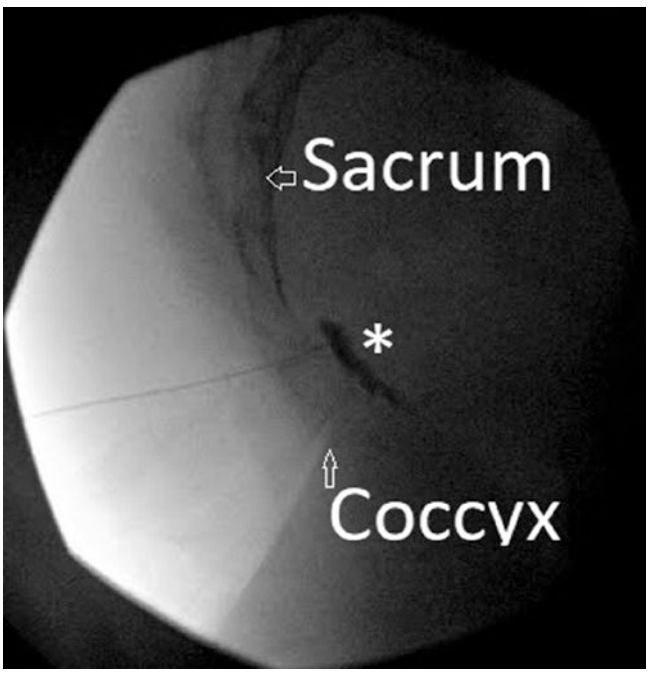

Fig. 48.3 Lateral fluoroscopic view of ganglion of impar block. (*) showing good anterior sacral spread of contrast agent, comma sign

CT-Guided Approach

The procedure can be performed with CT guidance. In an axial CT section of the sacrococcygeal disc, the needle trajectory from sacrum to the sacrococcygeal junction is planned off midline on both the sides. In order to prevent accidental rectal puncture and to have a better view of the sacrococcygeal junction, if rectal gas or stool obscures the view, a para-sagittal, CT-guided approach can be used.

Tips

- After traversing the sacrococcygeal ligament, a loss of resistance may be felt.
- Long-term relief may be achieved with chemical ablation, pulsed radiofrequency, or cryoablation.
- Prolonged pain relief has been shown to be achieved with 25–100 U of botulinum toxin.
- A calcified or fused sacrococcygeal disc may occasionally prevent the access to the ganglion. In these circumstances, a different approach such as the ano-coccygeal or intra-coccygeal approach may be selected. In this approach, a needle is inserted through the ano-coccygeal ligament and advanced against the sacrum and coccyx to contact the ventral coccyx. This approach has higher risk of rectal perforation and infection.

Safety Considerations

- The needle must not advance too far from the anterior surface of the coccyx, as rectal preformation is possible due to the proximity of the rectum and coccyx.
- It is possible that the needle breaks while traversing the disc since the disc is rigid and a small-bore needle is used for the procedures.
- If the sacral nerve roots are in proximity of the ganglion of impar, they may be damaged in the case of ganglion ablation. This proximity can be identified prior to the procedure with motor testing identifying gluteus spasms.

Post-procedure Management

The patient must be informed about the expected results and potential complications of the procedure. Some of the potential complications include rectal perforation, bleeding, nerve injury, parasympathetic denervation, infection, discitis, and epidural spread of the injectate.

Suggested Reading

Choi JW, Kim WH, Lee CJ, Sim WS, Park S, Chae HB. The optimal approach for a superior hypogastric plexus block. Pain Pract. 2018;18:314–21. https://doi.org/10.1111/papr.12603.

Datir A, Connell D. CT-guided injection for ganglion impar blockade: a radiological approach to the management of coccydynia. Clin Radiol. 2010;65:21–5. 20103417.

Khosla A, Adeyefa O, Nasir S. Successful treatment of radiation-induced proctitis pain by blockade of the ganglion impar in an elderly patient with prostate cancer: a case report. Pain Med. 2013;14(5):662–6. https://doi.org/10.1111/pme.12065.

Kim JH, Kim E, Kim BI. Pulsed radiofrequency treatment of the superior hypogastric plexus in an interstitial cystitis patient with chronic pain and symptoms refractory to oral and intravesical medications and bladder hydrodistension: a case report. Medicine (Baltimore). 2016;95(49):e5549.

Kraima AC, van Schaik J, Susan S, van de Velde CJ, Hamming JF, Lakke EA, DeRuiter MC. New insights in the neuroanatomy of the human adult superior hypogastric plexus and hypogastric nerves. Auton Neurosci. 2015;189:60–7. https://doi.org/10.1016/j.autneu.2015.02.001. PMID: 25704391.

Kroll CE, Schartz B, Gonzalez-Fernandez M, Gordon AH, Babade M, Erdek MA, Mekhail N, Cohen SP. Factors associated with outcome after superior hypogastric plexus neurolysis in cancer patients. Clin J Pain. 2014;30(1):55–62. https://doi.org/10.1097/AJP.0b013e3182869d68.

Le Clerc QC, Riant T, Levesque A, Labat JJ, Ploteau S, Robert R, Perrouin-Verbe MA, Rigaud J. Repeated ganglion impar block in a cohort of 83 patients with chronic pelvic and perineal pain. Pain Physic. 2017;20(6):E823–8.

de Leon-Casasola OA. Critical evaluation of chemical neurolysis of the sympathetic axis for cancer pain. Cancer Control. 2000;7(2):142–8. https://doi.org/10.1177/107327480000700204. PMID: 10783818.

Lim SJ, Park HJ, Lee SH, Moon DE. Ganglion impar block with botulinum toxin type A for chronic perineal pain - a case report. Korean J Pain. 2010;23:65–9. https://doi.org/10.3344/kjp.2010.23.1.65.

Malec-Milewska M, Horosz B, Kolęda I, et al. Neurolytic block of ganglion of Walther for the management of chronic pelvic pain. Wideochir Inne Tech Maloinwazyjne. 2014;9(3):458–62. https://doi.org/10.5114/wiitm.2014.43079.

Noor NA, Urits I, Viswanath O, Alexandre L, Kaye AD. Radiofrequency ablation of the splanchnic nerve and superior hypogastric plexus for chronic abdominal pain status post-abdominal surgery. Cureus. 2020;12(12):e12189.

Oh CS, Chung IH, Ji HJ, Yoon DM. Clinical implications of topographic anatomy on the ganglion impar. Anesthesiology. 2004;101:249–50.

Plancarte R, Amescua C, Patt RB. Presacral blockade of the ganglion of Walther (ganglion impar). Anesthesiology. 1990;73:A751.

Plancarte R, Amescia C, Patt R, Aldrete JA. Superior hypogastric plexus block for pelvic cancer pain. Anesthesiology. 1990;73(2):236–9.

Stogicza AR. Superior hypogastric plexus block – transdiscal approach. In: Stogicza AR, Mansano AM, Trescot AM, Staats PS, editors. Interventional pain. Cham: Springer; 2020.

Warfield CA, Bajwa ZH. Principles and practice of pain medicine. 2nd ed. New York, NY: McGraw-Hill; 2004.

Zacharias NA, Karri J, Garcia C, et al. Interventional radiofrequency treatment for the sympathetic nervous system: a review article. Pain Ther. 2021;10:115.