REVIEW ARTICLE

Ganglion Impar Block and Neurolysis for Chronic Pain: A Review

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Abstract

Aim: This article aims to review the currently available evidence on the ganglion impar block (GIB) and neurolysis for management of chronic pain of malignant or nonmalignant etiology.

Introduction: Ganglion impar (GI) represents the fused termination of bilateral thoracolumbar sympathetic chains. It is a retroperitoneal structure, lying behind the rectum and ventral to the sacrococcygeal junction (SCJ) or coccyx. Ganglion impar provides sympathetic and nociceptive innervation to the perineum, coccyx, anus and distal urethra, rectum, vagina, and vulva. In this review, the indications, approaches, effectiveness and, complications of GIB are discussed based on the data from the current literature.

Results: We screened 18 full-text studies based on our search. Out of them, 2 were randomized controlled trials (1 each on GIB for chronic intractable coccydynia and phantom rectum pain), 15 were observational (prospective or retrospective) studies, and 1 was anatomic cadaveric study. These studies included were from 2004 to till date. Our review results inferred that (1) GIB appears to be a safe and effective technique for management of pain in patients with chronic coccydynia, chronic perineal and pelvic pain, not responding to the conservative measures; (2) both anatomic location of GI and technical feasibility favor the transcoccygeal approach (Co1–Co2) as the most suitable approach followed by the transsacrococcygeal approach.

Conclusion: Ganglion impar block improves pain and the quality of life in patients suffering from chronic intractable coccydynia, chronic perineal and pelvic pain of both malignant and nonmalignant etiology.

Keywords: Chronic pelvic pain, Chronic perineal pain, Coccydynia, Ganglion impar, Ganglion impar block, Neurolysis.

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Introduction

Ganglion impar (GI) (Ganglion of Walther) is a solitary ganglion representing fused termination of the bilateral paravertebral sympathetic chains. It is a retroperitoneal structure located behind the rectum. It usually lies in midline; however, it may lie paramedian to the sacrococcygeal joint (SCJ) or coccyx. Ganglion impar provides sympathetic and nociceptive innervation to the perineum, coccyx, anus, distal rectum, urethra, vulva, urethra, and vagina.[1] Since its first description by Plancarte et al. in 1990, GI block (GIB) has been employed for management of intractable coccydynia, chronic perineal pain (CPP), chronic prostatitis, chronic proctitis, and chronic pelvic pain of both malignant and nonmalignant etiologies.[2–8] Successful GIB has also been reported for management of postradiation enteritis pain, rectourethral fistula, pain in rectal area due to cramps, perineal sweating disorders, radiation-induced cystitis, and vulvodynia.[9–11] The GIB approaches described in the literature include "anococcygeal," "transdiscal sacrococcygeal," "paramedian sacrococcygeal," "transcoccygeal/intercoccygeal," "paracoccygeal cork screw," and their modifications.[1–11] Currently, the intercoccygeal approach is considered the most preferred owing to both technical feasibility as well as anatomic location of GI (closer to Co1–Co2 joint).[7,12,13] Interventional procedures targeting GI can be classified into *diagnostic* (local anesthetic), *therapeutic* (local anesthetic with corticosteroids, Botulinum Toxin Type A [BoNT A]), *neurolytic* (chemical neurolysis, cryoablation, or radiofrequency thermocoagulation), or *neuromodulation* (pulsed radiofrequency). The block can be either be performed blindly or image-guided in form of fluoroscopy, ultrasound, computerized tomography, or magnetic resonance imaging.[8,14–16]

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Search Criteria

We searched Medline, Embase, and the Cochrane Library from starting point till March 15, 2020. The following MeSH terms were searched in the title and the abstract: "ganglion impar," "ganglion impar block," "ganglion impar neurolysis," "coccydynia," "chronic perineal pain," "chronic pelvic pain," and "chronic pain." All possible references were thoroughly searched with no restriction of sample size done to include all possible studies. Randomized controlled trials (RCTs), prospective or retrospective observational studies, and case series published in English language were included in this review.

Review Results

Ganglion Impar Block/Neurolysis for Coccydynia

Sencan et al. in their RCT compared GIB with either LA alone or a combination of LA and corticosteroid for chronic coccydynia.[17] Significant reduction in pain score and Beck Depression Score was observed in both the groups at all follow-ups lasting 3 months. However, combination of LA and steroid was associated with significantly higher reduction in pain scores and Beck Depression Score compared to the LA alone at 1- and 3-month postprocedure.[17] The authors concluded that addition of steroids to LA for GIB leads to accumulation of the treatment response over a long period of time and should be used as an adjuvant when their use is not contraindicated.[17]

Le Clerc et al. conducted a retrospective analysis of 220 GIB with local anesthetic alone in 83 patients with chronic pelvic and perineal pain.[18] Repeated blocks up to a maximum of 3 at 1-month interval were offered with the objective to desensitize the patients. On intention-to-treat analysis, 75 and 62 patients required a second and third GIB, respectively. More than 85% of patients demonstrated a marked but transient response.[18] There was a significant reduction in visual analog scale (VAS) score after each block as well as VAS score before repeated blocks with decreased pain intensity over time. However, repeated blocks failed to exhibit any long-term benefits as evaluated by "patient global impression of change" at 1-month postprocedure.[18]

A cohort study evaluating the role of GIB in patients with chronic coccydynia was published by Gonnade et al. in 2017.[14] Thirty-five patients presenting to a tertiary care center in India with chronic coccydynia not responding to conservative treatment were subjected to a one-time fluoroscopic-guided transsacrococcygeal GIB (3–5 mL of 0.5% bupivacaine and 1 mL methyl prednisolone) by the "needle through needle technique." The authors found a statistically significant reduction in pain scores (7.90 ± 0.16 pre-procedure vs. 3.23 ± 0.14 6 months' postprocedure) and the Oswestry disability index (ODI; 48.97 ± 1.05 pre-procedure vs 26.16 ± 0.95 6 months' postprocedure) throughout the follow-up period lasting 6 months' postprocedure.[14] In a prospective observational study, Gunduz et al. found GIB (2 mL of 0.5% bupivacaine, 2 mL saline, and 40 mg methylprednisolone) to have a first injection success rate (defined as at least 50% pain relief) of 82% with pain relief lasting for a median of 6 months.[19] A second injection in nine patients coming for repeat treatment reinforced the pain relief for a median of 17 months.[19] Similar reduction in pain scores (by GIB with LA and steroid for chronic coccydynia) beginning at 1 hour and lasting 6 months' postprocedure was reported by Sencan et al. in 2018.[20] In addition, the latter did not find any effect of the coccygeal dynamic pattern (normal or immobile coccyx) on the treatment outcome.[20]

Demircay et al. retrospectively analyzed the effect of conventional radiofrequency (CRF) thermocoagulation for chronic coccydynia (not responding to conservative treatment and local injections for 6 months).[21] Ten patients responding to diagnostic block (80% reduction in pain score) with 10 mL of 0.25% bupivacaine were subjected to CRF (80°C for 120 seconds). About 90% of the patients had a successful result defined as 50% reduction in the verbal numeric pain scale (VNS) at 6 months' postprocedure. Radiofrequency thermocoagulation (RFT) was associated with significant reduction in VNS (8.70 ± 0.67 vs 2.90 ± 1.28 6 months' postprocedure) and improvement in the health-related quality of life (EQ50 4.40 ± 0.51 pre-procedure vs 6.60 ± 1.26 6 months' postprocedure).[21] The authors concluded that transcoccygeal/intercoccygeal CRF of GI is simple, relatively safe, and should be considered for chronic coccydynia not responding to conservative treatment for 6 months. Similar findings were observed by Kircelli et al. in their retrospective analysis of CRF for 20 patients with chronic intractable coccydynia.[1] Treatment success was observed in 100% (median 77.78%, 95% CI 55.56–88.89), 90% (median 70.71%, 95% CI 33.89–87.13), and 75% (median 75%, 95% CI 11.67–79.89) at 1-, 6-, and 12-month postprocedure, respectively.[1] Reduction in VNS was correlated with improvement in EQ-5D scores. The authors attributed their high success rate to observing concordant sensory electrical stimulation, beneficial diagnostic block, and lesioning at the site of "reverse comma sign with contrast injection" prior to CRF. Chen et al. recommended creating multiple lesions by clockwise and counter-clockwise rotation of the RF cannulas to increase the CRF efficacy.[22] Adas et al. conducted a retrospective observational study evaluating CRF in 41 patients with chronic intractable coccydynia of both benign (87.8%) and malignant (12.2%) etiology.[23] Treatment evaluation at 6 months' postprocedure revealed 90.2% patients had a successful outcome and 9.8% were deemed failures. Malignancy was found as the risk factor for procedure failure (60% failure in the malignant group compared with 2.8% in the benign group, $p = 0.04$). However, lower representation of malignant compared to benign etiology (12.2% vs 87.8%) in their patient population and higher initial pain levels in the malignant group might be responsible for greater representation of treatment failures in the malignant group.[23]

In a retrospective study, Sir et al. found both GIB and ganglion impar pulsed RF (GIPRF) to provide equally effective short-term (3 months) pain relief for chronic coccydynia.[24] However, only GIPRF (three cycles of 42°C for 120 seconds) was associated with long-term pain relief (6 months) and reduced risk of recurrence compared to GIB (2 mL of 0.25% bupivacaine with 40 mg triamcinolone acetate).[24] Also, patient satisfaction scores on the Linkert scale at 6 months were significantly better in the GIPRF compared to the GIB group. The authors hypothesized long-term changes in c-fos gene expression by PRF to be responsible for long-term antinociceptive effects observed in the GIPRF group.[24,25] Except for one case of hypotension and bradycardia in one patient in the GIB group, no other complication was observed in either group.[24]

Ganglion Impar Block for CPP

Ghai et al. in a prospective study evaluated the efficacy of ultrasound-guided GIB for patients with CPP.[8] Fifteen patients presenting with CPP either due to pelvic metastasis, Ca cervix, Ca rectum, or coccydynia were subjected to the transsacrococcygeal approach to GIB. The study found statistically significant reduction in pain score (8.53 ± 0.52 preblock vs 2.77 ± 1.77 postblock, $p < 0.001$) and improvement in the quality of life measures, i.e., the Karnowski performance status (54.67 ± 14.57 preblock vs 74.67 ± 15.06 postblock; $p < 0.001$) and linear analog scale assessment (20.20 ± 9.52 preblock vs 24.47 ± 8.94 postblock; $p < 0.001$) throughout the observation period (2 months' postblock).[8] They concluded ultrasound-guided GIB as a technically feasible and safe technique.

A prospective observational study assessing the efficacy of GIB or ganglion impar neurolysis (GIN) for CPP was published by Toshniwal et al. in 2007.[26] Sixteen consecutive patients presenting with CPP of either cancerous ($n = 10$) or noncancerous etiology ($n = 6$) were subjected to fluoroscopic-guided transsacrococcygeal GIN or GIB, respectively. Therapeutic block or neurolysis was conducted after a successful diagnostic block defined as 50% reduction in the

visual analog scale (VAS). Patients were prospectively followed for 2 months' postprocedure. One patient was lost to follow-up at 4th week. The authors reported significant reduction in VAS score after both GIN (4–6 mL of 8% aqueous phenol) and GIB (10 mL 0.25% bupivacaine and 40 mg of methylprednisolone acetate) at all follow-ups.[26] The block was performed in a single attempt in 13 of 16 patients and the authors concluded the transsacrococcygeal approach as a technically feasible and safe technique.

Usmani et al. in an RCT in 2018 compared CRF and PRF of GI for CPP of the nononcologic origin.[27] They found CRF to provide significantly better pain relief with 82% patients having excellent results at 6 weeks' postprocedure compared to the PRF. Pulsed RF failed to provide any significant pain relief beyond 24 hours postprocedure. The only complication observed included skin puncture site infection, which was comparable among the groups and resolved easily with oral antibiotics.[27] Efficacy of CRF of GI for CPP has been demonstrated by other authors in both prospective and retrospective studies.[28,29] Agarwal-Kozlowski et al. in 2009 published their results of CT-guided lateral approach GIB for perineal pain of both malignant and benign origin.[30] Forty-three patients underwent a total of 76 blocks (48 diagnostic GIB and 28 GI neuroablation). Nineteen patients having sufficient pain relief with GIB did not undergo neuroablation. Significant reduction in numerical rating scale (NRS) were observed at discharge (8.2 ± 1.6–2.2 ± 1.6, $p < 0.0001$) and at 4-month follow-up (8.2 ± 1.6–2.4 ± 1.4, $p < 0.0001$).[30]

Ghaffar et al. in their RCT compared efficacy of combination of CT-guided GIB (5-mL bupivacaine 0.5% with 14 mg/2 mL betamethasone) and pregabalin (150 mg BD) vs pregabalin (150 mg BD) alone for phantom rectum pain.[31] A total of 40 patients with phantom rectum pain after abdominoperineal resection with colostomy were randomly allocated into two equal groups. Outcome measures include NRS, the participant satisfaction reporting scale (PSRS), and the pain anxiety symptoms scale (PASS). NRS reduced significantly in both the groups at 1-week, 1-month, and 2-month postintervention.[31] Significant improvement in NRS was observed at 1 week and 1 month (but not at 2 months) in the GIB group compared with the pregabalin-alone group. PSRS Q2 (Did you agree with the treatment?) and Q5 (Assess your satisfaction level with your improvement since the treatment) were better in the GIB group than the pregabalin-alone group. Cognition items, anxiety items, and the total pain anxiety symptom scale were better in the GIB group than the pregabalin-alone group.[31] Combination of GIB and pregabalin was associated with improvement in pain and the quality of life without any procedure-related complication.

Ganglion Impar Block/Neurolysis for Chronic Pelvic Pain

Milewska et al. reported their results of GI neurolysis in nine patients with chronic intractable pelvic pain of both malignant ($n = 4$) or benign ($n = 5$) origin.[32] A total of 16 neurolytic blocks (anococcygeal approach) were performed after a beneficial prognostic block (with LA, steroid, and pentoxifylline). Neurolysis was effective in chronic pelvic pain of both malignant and benign etiology. The duration of pain relief varied from 4 weeks to 3 years. Four patients had complete and permanent cessation of chronic pelvic pain. None of the patient experienced any complication or significant procedure-related discomfort.[32] Ahmed et al. performed combined neurolysis of superior hypogastric plexus (SHGP neurolysis, posterior-median transdiscal approach with 10 mL 10% phenol in saline) and GI (transsacrococcygeal approach with 4–6 mL 8% phenol in saline) in patients with cancer-related pelvic, perineal, or pelvi-perineal pain.[33] All patients had sympathetically maintained cancer pain. Successful needle placement in a single attempt for SHGP and GI was achieved in 80 and 100% of patients, respectively. About 66.6% patients had successful block, defined as 50% reduction in VAS score. Significant reduction in VAS score and morphine consumption was observed at all follow-up measurements lasting 2 months' postprocedure, with maximum reduction (69.5% in baseline VAS score and 67.34% of baseline morphine consumption) observed at 1-week postprocedure. Six patients had complete pain relief, stopped morphine, and shifted to NSAIDs on demand. The only complication observed was transient paraesthesia (33.3%) and pain on injection (20%).[33] Similar reduction in pain score and morphine consumption by ultrasound-guided SHGP ($n = 18$) and GI ($n = 6$) was reported by Bhatnagar et al. in their observational study in patients with pelvic malignancies.[34]

Discussion

Ganglion impar block is indicated for management of sympathetically mediated and neuropathic perineal or pelvic pain.[2,7] The success of blockade depends upon accurately locating the ganglion.[4] Although classically described as lying anterior to SCJ, its location has been reported to vary greatly anywhere between anterior to SCJ to the tip of the coccyx.[5,6] A cadaveric study involving dissection of 50 sacra and coccyges under a surgical microscope found a significant relationship between the length of the coccyx (varying between 18.2 and 48.1 mm, mean 33.33 mm) and the distance of GI from the coccygeal tip.[7] Oh et al. also found the shape of ganglion to vary from oval (26%), irregular (20%), triangular (14%), elongated (10%), rectangular (8%), and U-shaped (8%), with its long and short diameters to vary from 1.8 to 4.4 mm and 0.7 to 2.5 mm, respectively.[7] The study represented diverse location of GI along the coccygeal length by a relative index varying from "0" lying at the SCJ (18% specimens) to "0.6" lying below the midpoint of the coccyx (2% specimens) with most, i.e., 26% specimens having GI at "0.3" (midpoint between above two points).[7] This index value corresponds roughly to the first intercoccygeal joint (ICJ1).[12,13] To be successful, the block needle should therefore be directed toward the ICJ1 rather than the SCJ.[7,12,13] Also, the ICJ1 is less likely to be fused (12% vs. 51% for SCJ) and more easily visualized fluoroscopically than the SCJ (bilateral sacral cornu might obstruct SCJ visualization).[12,35] Fluoroscopic visualization of ICJ1 is better as the first coccygeal cornu are angled cephalad and other coccygeal segments lack any cornu.[36] Rectal gas, impacted stool, and calcification may obscure the SCJ, making it difficult to visualize on AP and lateral fluoroscopic views. Lin et al. found ultrasound to be of assistance when SCJ visualization was difficult with fluoroscopy.[37] However, ultrasound cannot replace fluoroscopy as lateral fluoroscopy is still required to confirm the safe depth and monitor correct spread of injectate.[37] The propensity of the injectate to flow upward also favors a more inferior approach (ICJ1).[12] Thus, the ICJ1 approach to GIB results in excellent coverage with lower volumes of neurolytic agents compared to the SCJ approach (injectate flowing too far cranial to the GI).[36] Likewise, the second intercoccygeal approach requires larger volume of injectate.[36] The original anococcygeal approach as described by Plancarte et al. carries risk of injuring blood vessels or rectum, invasion by local tumor, is technically difficult, and has a high failure rate (20–30%).[3,26]

Local anesthetic (LA) alone is usually employed for diagnostic and prognostic purpose prior to a neurolytic or therapeutic GIB.[17] Local anesthetic alone block usually lacks a long-term therapeutic effect. The results of published literature on long-term efficacy

of LA alone GIB are mixed with some reporting lack of long-term efficacy and others showing duration of pain reduction lasting 3 months.[17,18] Bupivacaine, a longer-acting LA also blocks N-methyl D-aspartate (NMDA) receptors.[38] The NMDA receptor inhibition-associated blocking of central sensitization might be responsible for the long-term anti-nociceptive effect of bupivacaine for GIB.[17,38] The analgesic, anti-inflammatory, and neuromodulatory effects of corticosteroids supplement the therapeutic effect when added to LA.[17] Addition of steroids to LA although adds to the therapeutic value but lacks long-term effects requiring repeat injections.[1] Neuroablative procedures targeting ganglion impar can be chemical (alcohol, phenol) or thermal (cryoablation or CRF ablation). The branch from ventral ramus of the sacral nerve root has been found to run close to the ganglion in about 6% of patients.[7] Chemical neurolysis thus carries the risk of neuritis, neuralgia, and motor, sexual, bladder, and bowel dysfunction. Other rare but catastrophic complications reported in the literature include the cauda equina syndrome and conus infarction (by inadvertent intravascular injection of particulate steroids by an unguided GIB).[39] Radiofrequency ablation involves either thermal destruction by CRF or neuromodulation by PRF and produces small, well-localized lesions compared to chemical neurolysis. While CRF involves thermal destruction of pain-sensitive nerve fibers (A-d and C fibers), the intermittent bursts of high-frequency alternating current employed in PRF allow heat dissipation during the quiet period and target tissue temperature remains below the neurodestructive range (45–50°C).[27] Electromagnetic field-induced impairment of synaptic transmission, alteration of c-fos gene expression, and enhancement of descending serotonergic and noradrenergic are the proposed mechanisms behind PRF anti-nociceptive effects.[24,25,27,40,41] Cryoablation employs N_2O or CO_2 gas to cool the probe tip to −60°C to form an ice ball in the target tissue and is associated with a lower incidence of neuritis or neuroma formation.[4,21]

In patients desirous of long-term benefits but apprehensive about neurolysis, GIB can also be performed using BoNT-A.[42] The dose of BONT-A used for GIB is 80–100 U.[42] Botulinum Toxin type A causes chemodenervation by binding to presynaptic endings and inhibits secretion of acetylcholine. Botulinum toxin type A produces analgesia by peripheral (inhibiting neurogenic inflammation), spinal (inhibiting secretion of inflammatory mediators, suppressing expression of c-fos, and reducing activity of dorsal horn neurons), and cerebrocortical mechanisms (neuroplastic reorganization of excitatory and inhibitory mechanisms in the neuraxis including the cerebral cortex).[42,43] Botulinum toxin type A by blocking algesic neurotransmitters and avoiding destruction of nerve fibers produces reversible and transient analgesic effects.[42] This requires repeated blocks and considering its cost, GIB with BoNT-A is expensive.[42]

Conclusion

Ganglion impar block appears to be a safe and effective technique for management of chronic coccydynia, chronic perineal, and pelvic pain of both malignant and nonmalignant etiology, not responding to conservative measures. Addition of steroids as adjuvants supplements and prolongs the therapeutic effect of GIB, but still requires repeated injections. GI neurolysis, either chemical or thermal, appears to be safe and effective, provided employed after beneficial diagnostic block and obtaining concordant sensory stimulation prior to CRF. Ganglion impar block or neurolysis should be performed under image guidance to ensure correct placement, adequate coverage by the injectate, rule out any intravascular spread, and avoid catastrophic complications of rectal perforation, cauda equina syndrome, or conus infarction. However, more randomized controlled trials are required to substantially comment upon its safety and efficacy.

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