Systematic Review

Management of Chronic Post-Herniorrhaphy Pain: A Systematic Review

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Background: Chronic post-herniorrhaphy inguinal pain (CPIP) is a significant complication following inguinal hernia repair, affecting 2-5% of patients with severe pain. The condition is characterized by persistent pain lasting more than 3 months and often involves neuropathic mechanisms caused by nerve damage or inflammatory responses. CPIP exerts a substantial impact on patients' quality of life, and the management of the condition remains controversial and challenging.

Objectives: To evaluate recent literature on various interventions for treating chronic inguinal pain after inguinal hernia repair, including the outcomes thereof, and to suggest an evidence-based algorithmic approach to managing post-herniorrhaphy chronic pain.

Study Design: Systematic literature review with qualitative data synthesis.

Setting: Published studies from January 2012 to February 2023 of patients with chronic post-herniorrhaphy inguinal pain.

Methods: A systematic review was conducted under PRISMA guidelines, analyzing studies published throughout a period of 11 years and 2 months from the MEDLINE/PubMed and EMBASE databases. The review included randomized controlled trials, prospective and retrospective studies, case series, and case reports focusing on CPIP treatments. We collected the demographic data (gender, age), main etiologies, and specific treatments applied in each study. Based on the reviewed evidence, we propose an algorithmic approach to managing patients with CPIP.

Results: The review incorporated 10 studies involving 152 patients, who were predominantly male (88.2%) with an average age of 49.7 years. Treatment approaches were classified into 3 main categories: nerve blocks or pulsed radio frequency, neurectomy, and neurostimulation/ablation techniques. Nerve blocks demonstrated the highest efficacy (up to 98.1% pain relief), followed by neurostimulation and ablation (approximately 92.8%). Neurectomy, though reported widely, showed variable success and higher invasiveness.

Limitations: A publication bias might have been present due to the inclusion of studies published only in English. The included studies also had heterogeneous methodologies. Additionally, we excluded gray literature, which could have caused publication limitation.

Conclusions: Despite significant advances in the understanding of CPIP, there remains no universally accepted treatment algorithm. Minimally invasive techniques, including nerve blocks, pulsed radio frequency, and neurostimulation, show promising results and should be prioritized before clinicians resort to such surgical interventions as neurectomy. This review highlights the need for multidisciplinary evaluation and proposes an evidence-based treatment algorithm to optimize CPIP management.

Key words: Chronic post-herniorrhaphy pain, inguinal pain, nerve blocks, neurectomy, pain management, systematic review, hernia repair, chronic groin pain

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Chronic post-herniorrhaphy inguinal pain is a sequela of hernia surgery that impacts patients' quality of life considerably (1). The incidence of moderate to severe postsurgical pain develops in 2%-5% of patients after inguinal herniorrhaphy (2); however, the exact etiology of this complex pain is unknown and its management controversial (3).

Chronic postoperative inguinal pain (CPIP) is defined as pain or discomfort that occurs after inguinal hernia repair and lasts longer than 3 months (2). Empirically, CPIP has been classified as neuropathic pain and is considered an effect of inguinal nerve damage, which typically leads to injured sensory nerves.

The nerves involved in CPIP are the ilioinguinal nerve (IIN), the iliohypogastric nerve (IHN), the genital branch of the genitofemoral nerve (GFN), and, rarely, the lateral femoral cutaneous (LFC) nerve. These nerves can be damaged by either partial or complete transection, stretching, contusion, crushing, electrical damage, or by being caught in the suture used in open repair or the tacks used in laparoscopic repair. Secondary nerve damage can also occur as a result of adjacent inflammatory processes, such as granuloma, or because of excess fibrotic reaction or mesh encasement. Nerve damage can occur during surgery, causing altered ectopic electrical activity and abnormal neural function, leading to chronic inguinal pain. In turn, this issue can cause spontaneous pain, dysesthesia, and hypersensitivity, such as allodynia, hyperalgesia, and hyperpathia (3,4).

Other patients have reported experiencing non-neuropathic pain associated with myofascial etiology. These cases are usually related to the tension of the anchor suture and typically have good short- to medium-term outcomes. Evaluation should be multidisciplinary and should take place in specialized centers for establishing CPIP-specific evidence for optimal analgesic treatments (5).

CPIP is one of the clinical problems that occurs most frequently after inguinal hernia surgery. Despite over 2 decades of research and numerous publications, no evidence exists to develop CPIP-specific treatment algorithms. Nonsurgical treatment has been employed with increasing frequency in the management of CPIP, with the aim of being pragmatic and minimally invasive (Table 1).

The role of surgery for patients with chronic groin pain is controversial, and due to the variety of surgical methodologies adopted by surgeons worldwide, data are highly confusing and difficult to interpret. Moreover, the current treatment regimens for chronic groin pain have shown limited success, and their long-term benefits and quality of life effects remain uncertain (7).

Study Rationale

In daily practice, there is a paucity of nonsurgical options for CPIP. Recent decades have seen the publication of various treatment options for inguinodynia patients from surgeons' point of view but rarely from anesthesiologists' perspectives. Most reports on the subject are retrospective case series with poorly defined diagnostic criteria for chronic pain, and interventional treatment options for post-herniorrhaphy pain vary greatly (8).

Objectives

The aim of this review was to evaluate recent literature on various interventions for treating chronic post-herniorrhaphy inguinal pain, including their outcomes, and to suggest an evidence-based algorithmic approach to managing chronic pain after hernia repair.

Study Design

Systematic literature review with qualitative data synthesis.

Setting

Published studies from January 2012 to February 2023 of patients with chronic post-herniorrhaphy inguinal pain.

Methods

Information Sources and Protocol Registration

With the use of the Medical Subject Heading (MeSH) Major Topic, a systematic review of biomedical literature published from January 2012 to February 2023 was conducted in the following databases: MEDLINE/PubMed and EMBASE.

This study was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses statement (PRISMA), providing a completed checklist (9).

This review has not been registered in the PROSPERO protocol.

Search Strategy

We used the following search terms: ((((herniorrhaphy[MeSH Major Topic])) AND (chronic pain[MeSH Major Topic])) OR (postherniorrhaphy chronic pain[MeSH Major Topic])) OR (persistent postsurgical inguinal pain[MeSH Major Topic]). The search was limited to documents published in English.

Eligibility Criteria and Study Selection

Documents that met the inclusion criteria were studies that contained assessments of groin pain that persisted after herniorrhaphy in adult patients, and articles that described the etiologies and management of chronic post-herniorrhaphy pain. We performed an initial selection of relevant articles based on titles and abstracts and obtained full-text versions for the data extraction. The selected studies were narrative reviews, systematic reviews, observational studies (prospective and retrospective), randomized controlled clinical trials, and case reports.

Documents that met the exclusion criteria were as follows: studies with only one estimate of pain prevalence; studies with poorly or undefined follow-up intervals; studies with incomplete follow-up; studies not including pain as an endpoint; post-herniorrhaphy quality-of-life evaluation studies; or studies describing only surgical techniques.

Data Collection Process, Data Items, and Quality Assessment

We collected the demographic data (gender, mean age), study design, length of follow-up, number of included and evaluated patients, description of specific treatments applied in each study, and the outcome of the intervention. Data are expressed as mean, frequencies, and percentages as appropriate. All data from reports were collected in a Microsoft Excel (Microsoft Corporation) database. For dispersion, we collected standard deviation and range when appropriate. Due to the heterogeneity in the included articles, we did not rate the quality of evidence with standardized method. Two independent reviewers screened each record.

Table 1. *Medical treatment and interventional strategies commonly used for the treatment of chronic post-herniorrhaphy pain. Adapted from Jensen EK, 2020 (6).*

Pharmacotherapy (Monotherapy or Combined Medications)	Antiepileptics (e.g., gabapentin, topiramate), antidepressants (e.g., amitriptyline, nortriptyline), NSAIDs, opioids, topical (e.g., lidocaine, capsaicin)
Nerve Blocks	Local anesthetic with or without steroids
Chemical Neurolysis	Alcohol, phenol
Electrical Neurolysis	Nerve cryoablation (cryoanalgesia), radiofrequency nerve ablation (conventional/ cooled/pulse radiofrequency)
Electrical Neuro-Stimulation	Spinal dorsal column, DRG, peripheral nerve
Surgical Approaches	Neurolysis, neurectomy, surgical revision/decompression, mesh removal, stitch removal

DRG: dorsal root ganglion

Risk of Limitations Across Studies

A publication bias could have been present due to the inclusion of studies published only in English. We have included only studies published in the medical literature, and we have excluded gray literature, which could have caused publication limitation. The included studies also had heterogeneous methodologies.

Results

Employing the previously described search strategy, we initially found 245 articles. Figure 1 shows the flowchart for the article selection. Ultimately, a total of

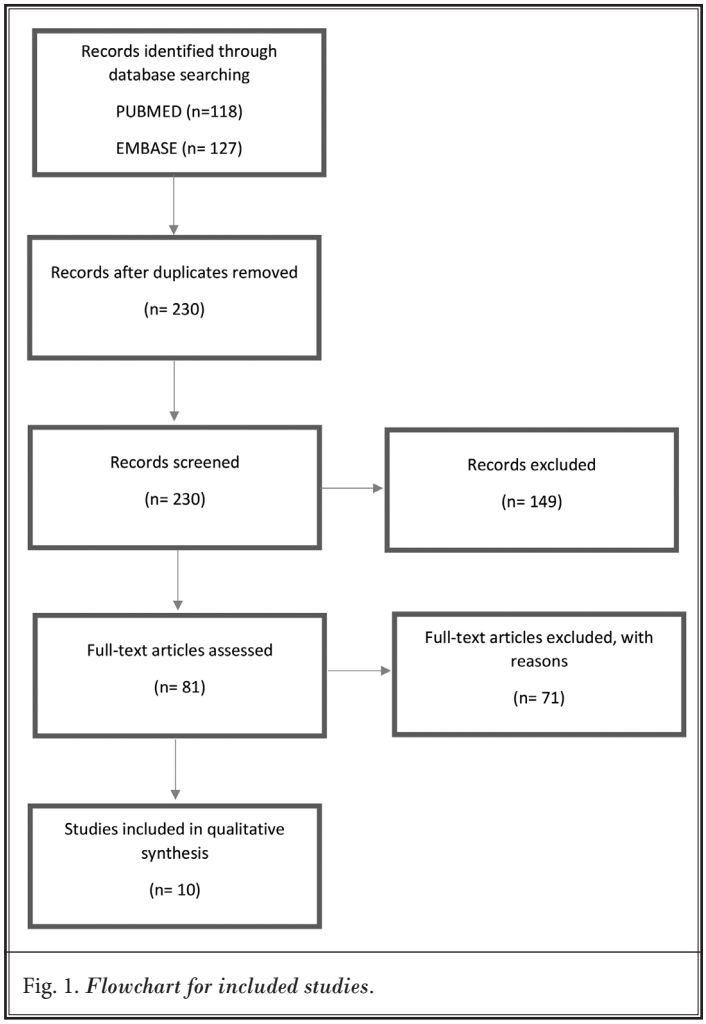

Fig. 1. *Flowchart for included studies.*

10 studies were included in the qualitative analysis: one controlled clinical trial (14 patients), 2 prospective studies (30 patients), 2 retrospective studies (48 patients), one cross-sectional study (54 patients), 3 case reports (3 patients), and one case series (3 patients). A total of 152 patients with CPIP were screened in this study (Table 2).

Most (88.2%) of the patients included in the studies were male. The average age of the patients was 49.7 years (Table 3). All the included patients had undergone surgery for inguinal hernia. The main etiology observed in almost all the articles was neuropathic pain. Only 2 studies had analyzed other causes, such as encapsulated effusion, scrotal wall edema, orchitis, hydrocele testis, restricted motion of the spermatic cord at the reconstructed deep inguinal ring, varicocele, scar sutured into the pubic tubercle, shrinking mesh, accumulative mesh or mesh plug, recurrent hernia, cyst of the spermatic cord, and epididymal cyst.

Pain evaluations were performed using common scales, such as the visual analog scale (VAS), the numeric rating scale, quantitative sensory testing, Neuropathic Pain in 4 Questions (DN4 questionnaire), structured pain interview, and the Inguinal Pain Questionnaire. The scale most frequently used in the included articles was the VAS.

The prevalence of chronic post-herniorrhaphy pain according to the articles selected for this review was highly variable; the estimated mean was 30%. According to the selected articles, the most commonly affected nerve was the ilioinguinal.

The time between surgery and the development of chronic pain was recorded in only 8 of the 10 included articles; the average was 6 months, ranging widely between one month and 4 years. In all patients, conservative therapies were ineffective.

Complementary tests such as ultrasound, computed tomography, or magnetic resonance imaging (MRI) were performed on the patients to determine the cause of their pain. The follow-up on the patients after they received any treatment was very heterogeneous, varying from 7 days to 36 months.

After the 10 articles included in this review were analyzed, treatments were sorted into 3 main categories: neurectomy, blocks, and radio frequency/ablation. The number of patients treated with each technique is specified in Table 4.

Table 2. *Characteristics of included studies*.

Author	Year	n	Article	Treatment Management	Results (Percentage of Relief from Pain)
Wijayasinghe N, et al (13)	2016	14	Randomized controlled trial	TP-blockade with 10 mL of 0.25% bupivacaine or normal saline	Pain reduction was 63% (44.1%-73.6%) after bupivacaine compared with 36% (11.6%-49.7%) for placebo; $P = 0.003$
Thapa D, et al (14)	2016	One	Case report	Pulsed radiofrequency (42°C, 4 cycles of 120 s each)	Pain relief between 63% and 100%
Chen DC, et al (15)	2013	20	Prospective study	Laparoscopic retroperitoneal triple neurectomy: IIN, IHN, and GFN, removal of mesh and fixation material, and herniorrhaphy revision	Pain relief in all patients (effective in 20/20, 100%)
Lee KS, et al (16)	2019	10	Retrospective study	Ultrasound-guided microwave ablation of IIN, IHN, and GFN	Pain relief 91.7%
Elahi F, et al (17)	2015	3	Case series	Peripheral nerve stimulation	Pain relief 70%
Narita M, et al (18)	2017	One	Case report	Laparoscopic retroperitoneal triple neurectomy	Pain relief 100%
Thomassen I, et al (19)	2013	38	Retrospective study	Ilioinguinal/iliohypogastric nerve blocks	55% of patients no longer reported neuropathic pain
Bjurström MF, et al (20)	2017	10	Prospective study	Laparoscopic retroperitoneal triple neurectomy	20% complete pain relief; 80% incomplete pain relief
Choudhary J, et al (21)	2018	One	Case report	TP-blockade	Pain relief 100%
Bischoff JM, et al (22)	2013	54	Cross-sectional study	Triple neurectomy	Pain intensity declined from 6 to 3
Total		152			

Three articles (involving a total of 85 patients) describe the use of neurectomy to treat chronic post-herniorrhaphy pain, specifying the following techniques: laparoscopic retroperitoneal triple neurectomy of the IIN, IHN, and GFN, with removal of mesh and fixation material, and herniorrhaphy revision. Only one article referred to triple neurectomy, and that article did not specify whether the procedure was laparoscopic.

Another 3 articles (involving a total of 53 patients) described the block technique for the treatment of chronic post-herniorrhaphy pain. In this technique, a transversalis fascia plane block was inserted between the rectus abdominis muscle and its aponeurosis, with the employment of steroids (triamcinolone acetonide) and local anesthetic (bupivacaine 0.25%) and the guidance of ultrasound or a nerve stimulator. The injection site was located one inch medial and one inch inferior to the anterior superior iliac spine.

The other 2 articles (involving a total of 13 patients) described procedures such as microwave ablation or peripheral nerve stimulation. In this category, 10 patients were treated with ultrasound-guided microwave ablation of the IIN, IHN, and GFN. Three were treated with peripheral nerve stimulation, using 2 sets of 8 contact electrodes (2 x 8 compact, 3778; Medtronic Neuromodulation). Neurostimulator parameters were 1.0 millivolts in amplitude, 300 pulse widths, and 80 hertz frequencies, and placed over the IHN and the IIN.

Both the articles and the number of patients treated with blocks were inferior to the number of patients treated with neurectomy; however, pain relief reached 98.1% in those who were infiltrated.

Table 3. *Demographic characteristics of patients included in the study.*

		Gender	Average Age
Total Number of Patients	152	136 male 16 female	49.7 years

Table 4. *Results of chronic postoperative inguinal pain management in the included studies*

Treatment	n	Number of Patients who experienced Pain Relief After Treatment	Results
Neurectomy	85	21; 100% pain relief 64 heterogeneous	24.7% complete pain relief with neurectomy
Blocks or PRF	54	14; 63% pain relief 38; 55% pain relief one; 100% pain relief one; 63-100% pain relief (PRF)	98.1% pain relief between 55% and 63%
STIM or Ablation	13	10; 91.7% pain relief (ablation) 3; 70% pain relief (STIM)	92.8% pain relief between 70% and 91.7%
Total Patients	152		

PRF, pulsed radiofrequency; STIM, nerve stimulation.

Discussion

Postoperative pain after inguinal hernia surgery is common, and that pain generally responds well to conservative treatment. In most cases, postoperative groin pain disappears within 6 to 8 weeks; however, approximately 1.5% of patients develop severe, persistent, and disabling pain beyond 3 months that is not attributable to another cause. Post-herniorrhaphy neuralgia might be diagnosed in such cases (10). The main risk factors are being male, being young, and having previous pain (11).

The management of chronic post-herniorrhaphy pain has been heterogeneous and has mainly involved surgery. Neurectomy (open or laparoscopic), mesh removal, or surgical revision have been the treatments published most frequently in the literature, mainly in surgery journals. An analysis of 11 articles showed that Liem L et al (1) offered the first attempt to develop a clinical guide for chronic inguinal pain but always did so from a surgical point of view. Very few articles have dealt with the non-surgical treatment of post-herniorrhaphy pain.

Our systematic review revealed that laparoscopic triple neurectomy was the technique employed in most of the published cases; in most of the articles, however, the neurectomy was performed without prior diagnostic blockade. It is noteworthy that, in turn, neurectomy was the technique with the poorest medium-term results.

One-third of the patients in the published articles were treated with one of the IIN or IHN blocks and blocks of the fascial plane or tender points, with a very high percentage of effectiveness (98.1% in pain reduction). One patient had been treated with pulsed radio frequency, and another 13 had been treated with nerve stimulation or microwave ablation techniques, with an effectiveness in pain reduction of approximately 92.8%. These techniques are less invasive, less expensive, and more effective than surgical treatment, according to the analyzed literature. Nevertheless, only 3 patients were treated with nerve stimulation.

The IIN is the inguinal nerve most commonly identified during open hernia repair. In a meta-analysis of 11 small, randomized trials, 1031 patients underwent open Lichtenstein repair with or without prophylactic ilioinguinal neurectomy (12).

It is interesting to note that most authors, as is the case in this review, found that the IIN was the nerve most frequently affected. In our pain clinic, however, in a series of 76 patients with neuropathic CPIP followed for more than one year, we found that the genitocrural nerve was the primary nerve involved in almost 70% of cases (diagnosed based on clinical examination and diagnostic blocking) (Fig. 2).

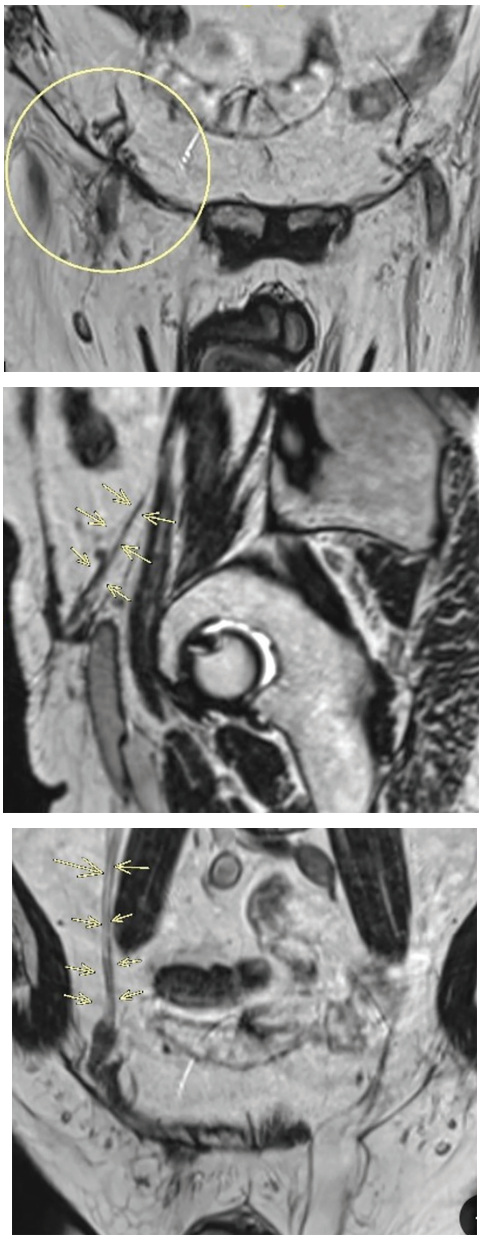

Fig. 2. *Magnetic resonance imaging of genitocrural nerve.*

The difficulty in agreeing on the follow-up time until pain relief was one of the limitations of the current study. The follow-up time differed widely depending on the type of study, varying from 7 days to 36 months. The studies included in this systematic review mainly used the VAS to assess the patients' level of pain and at least included a review of the patients one month after the procedure or surgery. The percentage of pain relief used for the conclusions was the one we used for each article analyzed.

Evidence-Based Management Algorithm

Despite taking the previously mentioned actions, we did not find a sequential diagnostic and therapeutic algorithm for managing patients with CPIP based on clinical evidence.

In clinical practice, a careful physical examination by both the surgeon and the pain specialist, along with imaging tests administered through such means as ultrasound and MRI (Fig. 2), can provide a fairly accurate diagnosis in most cases. Once causes of pain that may require surgical treatment (e.g., hernia recurrence, infection) have been ruled out, the patient should be referred to a pain specialist.

Anesthetic and corticosteroid blocks have been shown to be associated with the best results in the management of these patients, as has pulsed radio frequency. Therefore, these techniques should be considered as the first options for interventional treatment once the affected nerves have been confirmed by physical examination (hyperalgesia, allodynia, Tinel's sign) and a diagnostic block has been performed.

In obstinate cases, it would be logical to consider a percutaneous neurectomy (cryotherapy or thermal radio frequency) prior to the surgical technique.

Lastly, in the small number of cases that remain resistant to treatment, neuromodulation with the dorsal root ganglion or percutaneous electrodes is a good palliative option.

Along these lines, we propose an algorithm to facilitate clinical decision-making in cases involving patients with inguinodynia following inguinal hernia surgery (Fig. 3).

Limitations

A publication bias might have been present due to the exclusion of studies published in any language other than English. The included studies also had heterogeneous methodologies.

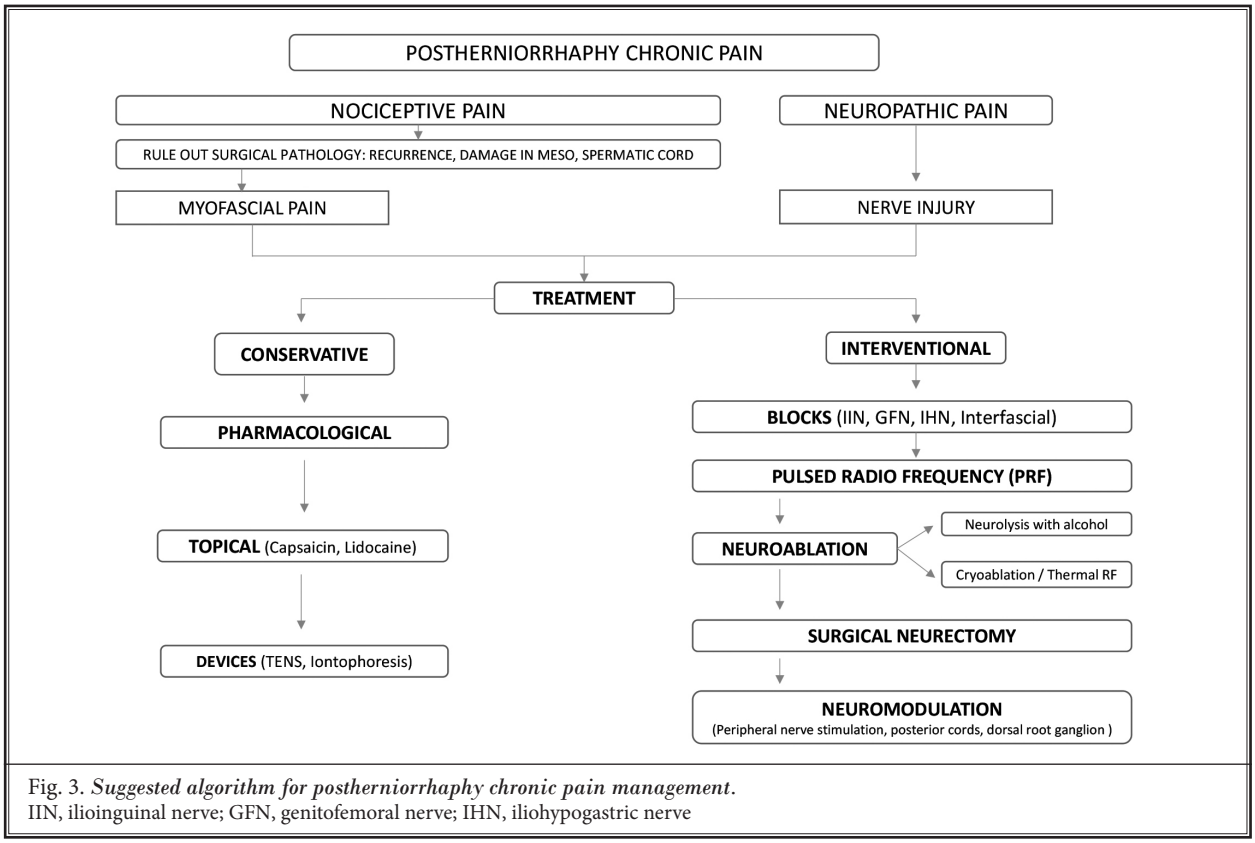

Fig. 3. *Suggested algorithm for postherniorrhaphy chronic pain management.*
IIN, ilioinguinal nerve; GFN, genitofemoral nerve; IHN, iliohypogastric nerve

Conclusions

CPIP is a common sequela of hernia surgery, and the management of this problem is not well protocolized. We systematically reviewed interventional procedures published in the literature for treating this pathology, and the results indicated that the most effective treatment to reduce pain was the use of nerve blocks, followed by radio frequency, ablation, and peripheral stimulation. Most publications come from the surgical field, and the treatment perspective is very oriented toward neurectomy. However, neurectomy should not be considered as a first-line treatment for post-hernioplasty pain due to the procedure's invasive nature and variable success. We have proposed an evidence-based algorithmic approach for managing CPIP.

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