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Research Article

Assessing the Efficacy of Superior Hypogastric Nerve Block as a Possible Treatment Option for Bladder Pain Syndrome

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Abstract

Introduction: Chronic pelvic pain (CPP), and its subtype of interstitial cystitis/bladder pain syndrome (IC/BPS) can be debilitating and difficult conditions to treat. A new treatment modality being explored is the superior hypogastric (plexus) nerve block (SHPB). While previously indicated to relieve conditions related to chronic abdominal and pelvic pain, there is a paucity of evidence for use in IC/BPS patients. We aim to explore the efficacy of SHPB therapy in this population.

Methods: This is a retrospective, single institution study including patients with IC/BPS or CPP who underwent SHPB during a 7-year span. Parameters analyzed include number of treatments, percentage of pain improvement after treatment, and multiple demographic and disease variables.

Results: A total of 30 patients (26 CPP; 4 IC/BPS) were included in the study and 80% completed pain scores after their first injection (n=24). Fourteen patients had >50% pain improvement (58.3%), 10 had >70% improvement (41.7%) and 5 patients had 100% improvement (20.8%) after their first injection. Greater pain improvement was seen in the multiple *vs*. single injection group (52.3% *vs*. 20.8%, p=0.013). There was no significant difference in pain improvement between CPP and IC/BPS groups (42.2% *vs*. 50.0%, p= 0.630).

Conclusion: SHPB may be useful as an alternative therapy for IC/BPS patients who have failed previous treatment options. Additional high-powered studies are needed to validate the safety and efficacy of SHPB in this population.

Keywords: Bladder pain syndrome; Interstitial cystitis; Superior hypogastric nerve block

Background

Chronic pelvic pain affects over 25 million women and accounts for nearly 20% of all outpatient appointments in secondary care [1-3]. This disorder carries a significant burden to both patients and health care systems and costs nearly $800 million annually related to diagnosis and treatment. Interstitial cystitis (IC), also known as bladder pain syndrome (BPS), is one of the many subtypes of chronic pelvic pain. This disorder is defined as "an unpleasant sensation (pain, pressure, discomfort) perceived to be related to the urinary bladder, associated with lower urinary tract symptoms of more than 6 weeks duration in the absence of infection or other identifiable causes" [4-7]. The etiology is poorly understood but believed to be multifactorial in nature. These factors include infectious and inflammatory causes, neurologic effects, and biochemical defects [8]. Both CPP and specifically IC/BPS can be exceptionally difficult to manage due to fluctuating clinical presentations, varying degrees of treatment response, and the lack of abundant evidence to support treatment options [7].

Treatment algorithms for IC/BPS typically begin with patient education and proceed in a step-wise fashion [7]. Although algorithmic therapy exists, most patients are optimally managed with a combination of therapies. A 2009 pilot study by Hanley et al. found significant success in a multimodal approach consisting of behavioral management, pharmacologic therapy, and endoscopic hydrodistension [9]. Multiple studies have demonstrated superior outcomes with the use of combination therapy [10,11]. Novel treatment modalities such as nerve blockades and epidural infusions have demonstrated promising results, although there is limited evidence to fully support their efficacy [12].

Of these therapies, one that is of particular interest is the superior hypogastric [plexus] nerve block (SHPB), or superior hypogastric (plexus) neurolysis (SHN). The superior hypogastric plexus is known to contain afferent pain fibers that affect many structures within the pelvis [13]. Both superior and inferior hypogastric nerve blocks have typically been indicated to relieve chronic abdominal or pelvic pain from disorders such as pelvic inflammatory disease, endometriosis, pain secondary to cancer, perineal pain, and prostatitis [14]. SHPB has demonstrated promising results in the treatment of pelvic pain [15-21]. In the recently published systematic review evaluating interventional treatments for pelvic pain, SHPB proved effective in many studies, but warranted further research to adequately assess this therapeutic option [20]. Bhatnagar et al. demonstrated 50% to near complete pain relief lasting from a range of several weeks (1-8 weeks)

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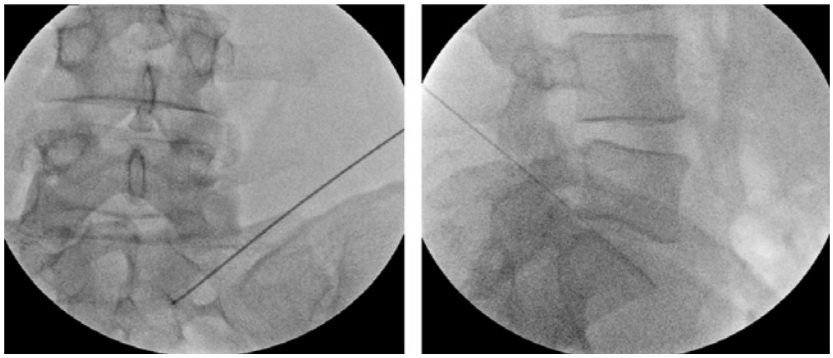

Figure 1: Fluoroscopic images of superior hypogastric nerve block injection. I. Anteroposterior view of lumbosacral region with spinal needle. II. Lateral view of lumbosacral region with spinal needle.

to lifetime relief [21]. While there is abundant evidence to support hypogastric plexus blockade in the pelvic pain population, the literature for use in IC/BPS is primarily limited to several small case series, case reports, and a single randomized controlled trial [24-27]. However, these limited studies have all suggested optimistic results.

This study aims to evaluate pain improvement among patients who have received SHPB for either CPP or IC/BPS. Our primary outcome is to assess the percentage of pain improvement after injections among these two study populations. Secondarily, we aim to delineate any differences among patients who received a single injection versus multiple injection, as well as comparing additional disease and management variables.

Methods

This is a retrospective, single institution study assessing the efficacy of superior hypogastric nerve blocks for pelvic pain and IC/BPS. The therapy being studied was administrated by Cooper University Hospital's Department of Anesthesiology/Pain Management. Institutional review board approval was obtained through Cooper University Health Care (IRB number 20-519).

All SHPB procedures performed from July 1st 2013 until July 1st 2020 at Cooper University Hospital or Cooper University Surgery Center were included by screening for the current procedural terminology (CPT) code associated with the procedure (CPT Code 64517). The procedure consists of trans-lumbar injections under fluoroscopic guidance in a sterile procedure suite, under local anesthesia or monitored anesthesia care (MAC). A 22-gauge 7-10 inch curved spinal needle was placed bilaterally to the midpoint of the superior articular process of the L5/S1 level and carried down to the anterolateral position of the vertebral body under fluoroscopic guidance. Once the position of the needle was placed along the anterolateral portion of the vertebral body, intravenous contrast was administered to confirm the location of the targeted spinal nerves which were the right and left hypogastric plexus (Figure 1). Upon confirmation of no evidence of intrathecal or intravascular spread via contrast, as well as negative aspiration for heme and cerebrospinal fluid, a mixture of 20mL of 0.25% preservative free bupivacaine with 40mg of Kenalog was administered. Depending on physician preference, some may choose to omit the administration of steroid to reduce the risk of adverse effects.

Inclusion criteria consisted of both males and females >18 years of age, and a pre-procedural diagnosis of painful bladder syndrome, interstitial cystitis, or chronic pelvic pain. This was found by searching the following international classification of disease (ICD) codes; ICD-9 code 595.1, ICD-10 code N30.10, and ICD-10 code N30.11 respectively. Patient charts were excluded for all other pre-procedural diagnoses (including but not limited to pelvic pain secondary to "cancer pain") or inadequate patient responses to pain assessment after injections.

Data collection was strictly limited to the following defined variables: age at first injection, gender, duration of pain, procedure date, preoperative diagnosis, number of injections, pre-procedural pain score (on a scale of 0-10 with 0 being no pain and 10 being worst pain), percentage improvement after each injection (from 0-100% with 0 being no improvement and 100% being complete improvement), whether the patient has been seen by a urologist or urogynecologist in the past, if the patient has had alternative treatments (consisting of either cystoscopy, bladder instillations, or pelvic floor physical therapy), use of specified medications (narcotics, neuropathic pain medications, nonsteroidal anti-inflammatory drugs (NSAIDs)) and duration of medication use. Of note, the medication data collected was abstracted from charts without specified timelines and correlation with their SHPB injections. Physical therapy trial (non-pelvic floor) was also recorded.

Pre-procedure pain scores were extracted from pre-operative documentation associated with the procedural date. Patient reported "percent improvement" after injections was extracted from post-operative documentation. For patients that received more than one injection, if "percent improvement" was not documented, results were approximated to 50% if it was not their last injection. This number was based on a standardized algorithm created by the institution's pain management physicians consisting of "continue injections if pain was >50% improved". If "complete improvement" was documented with no exact percent improvement reported, 100% improvement was used for data analysis. If the terminology of "no improvement" was documented without a specified percentage, 0% was used.

Statistical analysis evaluated post-procedural pain improvement (reported as a percentage) between study groups *via* two separate comparisons; patients with CPP and IC/BPS primarily, and patients

receiving one injection versus multiple injections secondarily. Results were analyzed using Independent T test, Mann Whitney U test and chi square tests (χ^2) as appropriate. Comparisons of alternative treatment modalities between groups were also analyzed using chi square tests and independent T tests. Descriptive analysis including means with standard deviations, medians with interquartile range, and percentages were also performed. Although the study could not be adequately powered given the limited sample-size of this retrospective case series, a two-sided 5% significance level (p=0.05) was utilized to detect a difference among the compared groups.

Results

Patient demographics and characteristics

Data from 30 patient charts (12 males and 18 females) was included based on the criteria previously listed. Of the total study population, 26 patients had the diagnosis of CPP (86.7%) and 4 with IC/BPS (13.3%). The outcomes assessed were compared primarily between pre-procedural diagnosis groups (pelvic pain and IC/BPS) and secondarily between single injection versus multiple injection groups (i.e., by number of treatments). Overall, 19 of the patients included received a single injection, and 11 patients had two or more. Descriptive demographics of these separate groups are reported in Table 1 and 2 respectively, with no significant difference among either of the groups.

Table 1: Demographics and variables among two study groups; pelvic pain and interstitial cystitis/Bladder pain syndrome (IC/BPS).

	Pelvic Pain			IC/BPS			P-value
	N	n	Percent (%)	N	n	Percent (%)	
Sex	26			4			
Male		10	38.50%		2	50.0%	1.000
Female		16	61.50%		2	50.0%	
# of Treatments	26			4			
One		18	69.20%		1	25.0%	0.126
Greater than one		8	30.80%		3	75.0%	
Seen by Urologist	26	10	38.50%	4	3	75.0%	0.290
Seen by Urogynecologist	26	5	19.20%	4	2	50.0%	0.225
Alternative Therapies	26	12	46.20%	4	3	75.0%	0.598
Cystoscopy	26	9	34.60%	4	3	75.0%	0.274
Bladder Instillations	26	0	0.0%	4	0	0.0%	
Pelvic floor physical therapy	26	3	11.50%	4	0	0.0%	1.000
Duration of Pain	26			4			1.000
<12 months		1	3.80%		0	0.0%	
≥12 months		25	96.20%		4	100.0%	
Narcotics used	26	19	73.10%	4	3	75.0%	1.000
Neuropathic pain medications used	26	15	57.70%	4	3	75.0%	0.632
NSAIDs used	26	22	84.60%	4	4	100.0%	1.000
Duration of NSAID Use	21			1			1.000
9-11.9 Weeks		1	4.80%		0	0.0%	
≥12 Weeks		20	95.20%		1	100.0%	
Physical therapy (non-pelvic floor)	26	18	69.20%	4	2	50.0%	0.568

Primary outcome (Pelvic Pain *vs.* IC/BPS)

Both study groups showed similar findings in pain improvement. There was no significant difference in pain improvement percentage (mean per patient) in patients diagnosed with CPP versus IC/BPS (42.2% *vs.* 50.0%, p=0.630) (Figure 2). There were also similar findings in comparing additional management and treatment modalities among the groups (Figure 3). The only notable difference in management consisted of 75% of patients with IC/BPS undergoing cystoscopy as part of their workup, as opposed to 34.6% of patients with pelvic pain. Pharmacotherapy usage and duration, including narcotics, did not vary significantly among the patient populations (Figure 3). Both study groups had a high percentage of patients that used narcotics throughout their disease course (73.1% of patients with CPP and 75% of patients with IC/BPS, p=1.000).

Secondary outcome (Single Injection *vs.* Multiple Injections)

Overall, 36.7% (n=11) of patients received multiple injections (>1) and 63.3% (n=19) received only a single injection independent of pre-procedural diagnosis. Of patients who received single versus multiple injections, an increased mean pain improvement was seen in the multiple injection group (52.3% *vs.* 20.8%, p=0.013) (Figure 4). Additional therapies and management for these two groups did not significantly differ. Single versus multiple injections patients revealed similar usage of pharmacotherapy, with no difference in narcotics (73.7% *vs.* 72.7%, p=1.000), neuropathic pain medications (57.9% *vs.* 63.6%, p=1.000), or NSAID use (78.9% *vs.* 100.0%, p=0.268) (Figure

Table 2: Demographics and variables among patients undergoing a single injection versus patients undergoing more than one injection.

	Pelvic Pain			IC/BPS			P-value
	N	n	Percent (%)	N	n	Percent (%)	
Sex	19			11			0.063
Male		5	26.3%		7	63.6%	
Female		14	73.7%		4	36.4%	
Seen by Urologist	19	8	42.1%	11	5	45.5%	1.000
Seen by Urogynecologist	19	5	19.20%	11	1	9.1%	0.215
Alternative Therapies	19	12	46.20%	11	4	36.4%	0.450
Cystoscopy	19	9	34.60%	11	4	36.4%	1.000
Bladder Instillations	19	0	0.0%	11	0	0.0%	
Pelvic floor physical therapy	19	3	11.50%	11	0	0.0%	0.279
Duration of Pain	19			11			1.000
<12 months		1	5.3%		0	0.0%	
≥12 months		18	94.7%		11	100.0%	
Narcotics used	19	14	73.7%	11	8	72.7%	1.000
Neuropathic pain medications used	19	11	57.9%	11	7	63.6%	1.000
NSAIDs used	19	15	78.9%	11	11	100.0%	0.268
Duration of NSAID Use	13			9			1.000
9-11.9 Weeks		1	7.7%		0	0.0%	
≥12 Weeks		12	92.3%		9	100.0%	
Physical therapy (non-pelvic floor)	18	11	61.1%	11	9	81.8%	0.412
Pelvic pain diagnosis	19	14	73.7%	11	8	72.7%	1.000

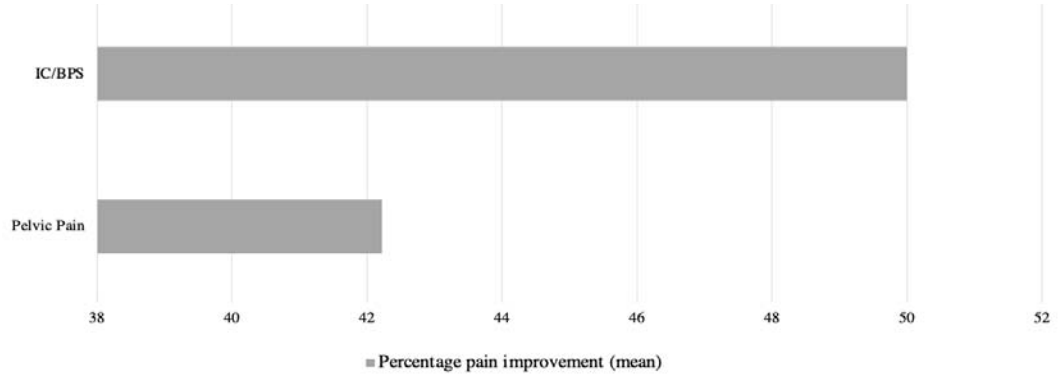

Figure 2: Mean improvement of pain as compared by diagnosis. Interstitial cystitis/Bladder pain syndrome (IC/BPS) mean pain improvement among patients compared with mean pain improvement among pelvic pain patients.

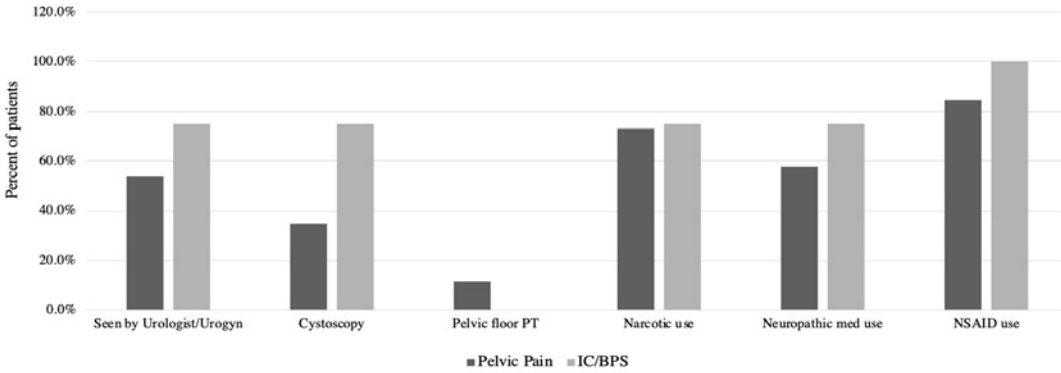

Figure 3: Additional therapies and management as compared by diagnosis (Interstitial cystitis/Bladder pain syndrome (IC/BPS) and pelvic pain); seen by specialists, undergoing cystoscopy, undergoing pelvic floor physical therapy (pelvic floor PT), narcotic use, neuropathic medication use, non-steroidal drug use (NSAID).

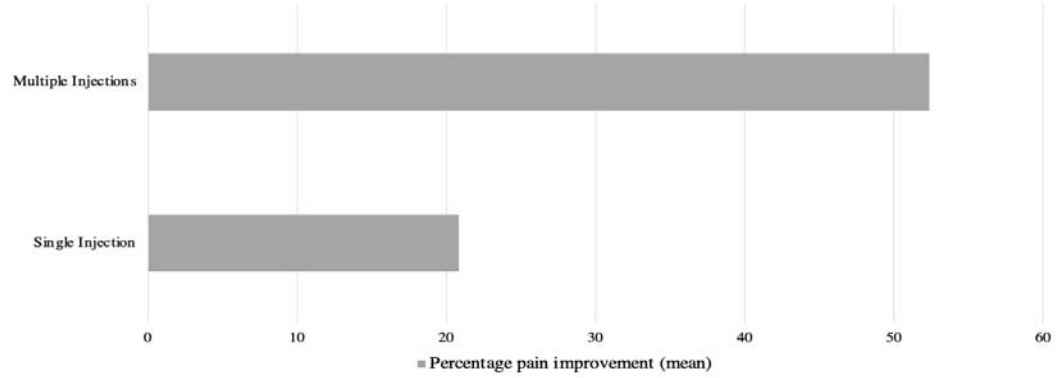

Figure 4: Mean improvement of pain as compared by number of injections.

5).

Additional findings

Among all patients who reported their pain percentage after their first injection (n=24), more than half of this population had >50% improvement after their first injection (n=14, 58.3%), 41.7% of patients had >70% improvement, 25.0% had >90% improvement, and 5 patients had 100% improvement (20.8%) (Figure 6). These results excluded 6 patients whom had no quantitative or quantifiable percent reported after their first injection. When focusing on those patients reporting higher pain improvement rates (>50%) after their first injection, a larger proportion used medical therapy at some point in their regimen, in addition to the injections, when compared to those with less pain improvement (Figure 7).

Discussion

In this study, both patient groups demonstrated similar findings in pain improvement after SHBP, with IC/BPS patients showing slightly more favorable improvements. The majority of all patients had some degree of improvement in pain.

Regardless of pre-procedural diagnosis, many patients reported

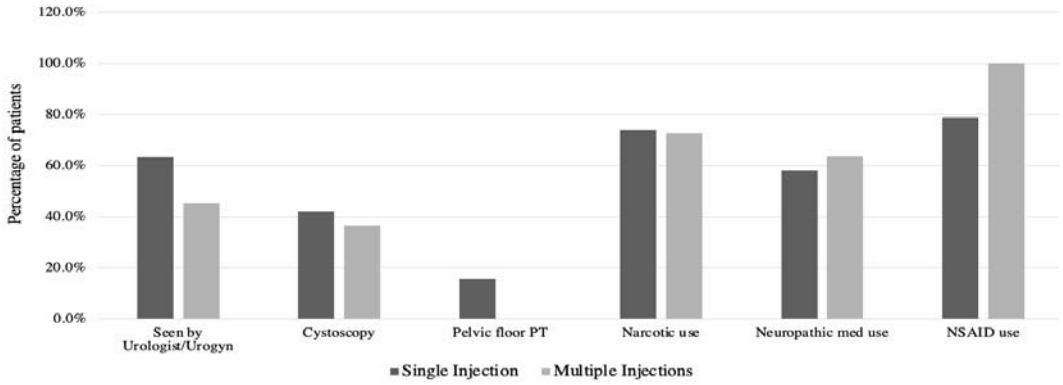

Figure 5: Additional therapies and management as compared by number of injections; seen by specialists, undergoing cystoscopy, undergoing pelvic floor physical therapy (pelvic floor PT), narcotic use, neuropathic medication use, non-steroidal drug use (NSAID).

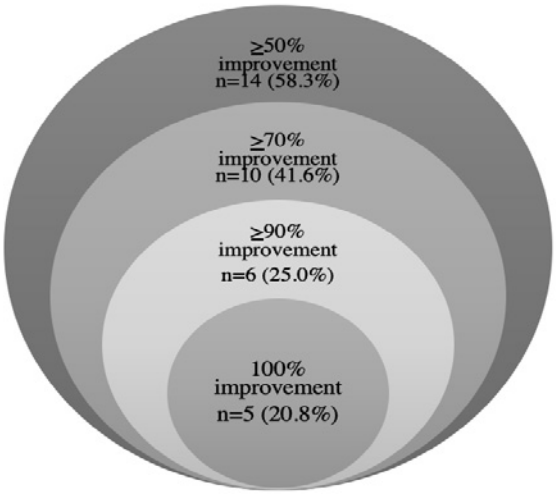

Figure 6: Patients with greatest pain percentage improvement after first injection (n=24). Comparing number of patients with greatest pain improvement after first injection.

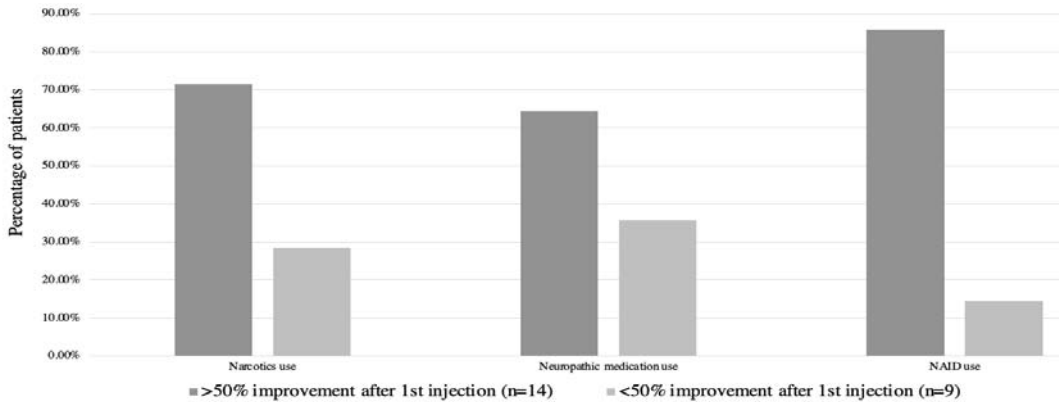

Figure 7: Medication use for patients among patients with varying pain improvement after first injection.

favorable subjective outcomes. Although no significant difference was seen between patients diagnosed with CPP or IC/BPS, the similarity of these findings suggests SHPB may be a useful modality for both conditions. Both study groups showed comparable demographics, as well as similarities in additional management and therapies used. Given the construct of these paralleled disease and patient characteristics, it could be derived that IC/BPS patients may benefit from SHPB as a treatment option, as the majority of prior research supporting the use of SHPB in CPP patients has been promising [14-18].

Our secondary outcome focused on patients receiving a single

injection for their treatment and those returning for multiple injections. Our findings were consistent with the logical prediction that patients with greater pain improvement would return for repeat injections. Although assumed, the statistical significance of this value is still clinically relevant in showing the number of patients that desired to pursue additional treatments, which again may support the use of SHPB for either condition.

Many additional findings in this study can be explored further. When looking at supplementary pharmacotherapy used in the patients studied, no statistically significant differences were seen between either of the two conditions. Narcotic consumption remained high among both conditions (70.4% of CPP patients, 100% of IC/BPS patients). Although our study was not designed to assess the duration or quantity of narcotic use in our study population, based on past research SHPB could offer a solution in helping to decrease it. Prior studies have consistently shown that SHPB can reduce medication use, specifically opioids [22-24]. Given our study sample's narcotic use is likely an accurate reflection of patients with these disease conditions, any additional benefit injectable therapy could offer such as decreasing opioid use warrants further exploration.

Of the studies that exist on this topic the majority are broadly based around SHPB for use in patients with pelvic pain, specifically cancer related pain. A major strength of our study was the focus on a very select group of patients with a strict exclusion criteria (cancer patients). This limited our sample size but strengthened the precision of our study design in attempt to reduce heterogeneity. The disease and patient demographics in this study also accurately reflects the complexity of patients diagnosed with IC and non-malignant pelvic pain. Another strength was the location and timing of this study. All participants were patients of a large academic institution with specialized physicians. The length of this study, which spanned 7 years, also helped to capture the evolution and alternative therapy options in these groups.

The limitations of this study consist of the small sample size obtained through this retrospective design. The data collected was only gathered at a single institutional site which limits the generalizability of the findings and procedure's efficacy to a larger patient population. The study results were also limited given the lack of any objective findings, but this is a common obstacle when observing pain related outcomes. Perhaps both a limitation and strength, our results also likely underestimated the true efficacy of this therapy. As described earlier, to compensate for missing data points or a failure to follow up, if a patient received additional injections and a specific pain percentage improvement was not reported or recorded, an improvement percentage of 50% was used. This was a conservative approach to allow inclusion of patient data without overestimating the impact of the therapy, but it may have also underestimated its efficacy.

Overall, although the primary outcome did not find a significant difference in pain improvement when comparing CPP to IC/BPS patients, this injectable therapy was found to provide relief to a majority of the patients included in the study. The similarity of disease variables and alternative treatments used among the groups could support a more clinically relevant conclusion of this therapy having a similar affect for both conditions. Given these findings, in conjunction with prior research that has shown promising results in mostly pelvic pain populations, SHPB could be considered as a treatment option for patients with IC/BPS who have failed initial therapies.

Conclusion

In this study, there was a similar efficacy in pain improvement with SHPB among IC/BPS and pelvic pain patients. Given the similarity of the two conditions, SHPB may be useful as an alternative therapy for IC/BPS patients who have failed previous treatment options as evident in prior research. Additional high-powered studies are needed to validate the efficacy of SHPB in this population.

Participation in Study

D Smith: Protocol/project development, data collection, manuscript writing/editing; R Patel: Data collection, manuscript writing/editing; K Hunter: Data analysis; M Sabia: Protocol/project development, manuscript writing/editing; K Ganguly: Data collection, manuscript writing/editing; J Sehdev: Data collection, manuscript writing/editing; L Lipetskaia: Protocol/project development, data collection, manuscript writing/editing.

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