

# Hip-Spine Syndrome: The Diagnostic Utility of Guided Intra-articular Hip Injections

DAVID R. MALDONADO, MD; BRIAN H. MU, BA; JOE ORNELAS, PHD; SARAH L. CHEN, BA; AJAY C. LALL, MD, MS; RAFAEL WALKER-SANTIAGO, MD; PHILIP J. ROSINSKY, MD; JACOB SHAPIRA, MD; BENJAMIN G. DOMB, MD

## abstract

Overlapping symptoms between hip and lumbar spine pathologies complicate diagnoses and treatments. The purpose of this study was to determine the utility of guided intra-articular hip injection in identifying the pain source in hip-spine syndrome. A search of PubMed and Cochrane databases yielded 9 studies. The mean values for sensitivity, specificity, positive predictive value, and negative predictive value of guided intra-articular hip injection were 93.6%, 95.0%, 98.8%, and 86.3%, respectively. Thus, in hip-spine syndrome, when a pain source cannot be elucidated, an ultrasound- or fluoroscopic-guided intra-articular hip injection may be a powerful and reliable diagnostic tool. [*Orthopedics*. 2020;43(2):e65-e71.]

undemanding test with high reported values for sensitivity and specificity in

*The authors are from the American Hip Institute (DRM, BHM, JO, SLC, ACL, RWS, PJR, JS, BGD), Westmont, and Rosalind Franklin University of Medicine and Science (BHM), North Chicago, Illinois.*

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*Correspondence should be addressed to: Benjamin G. Domb, MD, American Hip Institute, 1010 Executive Court, Ste 250, Westmont, IL 60559 (DrDomb@americanhipinstitute.org).*

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O ffierski and MacNab<sup>1</sup> were the first authors to present the term “hip-spine syndrome” in 1983. Since then, it has been used to describe patients with coexisting lumbar spine and hip pathologies. Disorders of the lumbar spine and the hip frequently coincide, producing significant pain and disability. Identifying the source of lower extremity pain in patients presenting with simultaneous hip and lumbar spine pathology is a challenging task for a physician.<sup>2</sup> This is particularly relevant to spine surgeons seeking to identify or rule out the contribution of the hip to a patient’s symptoms.

The recent increase in recognition of nonarthritic hip conditions, such as labral tears and femoroacetabular impingement, has led to greater awareness of the poten-

tial overlap in symptoms from the spine and hip.<sup>3</sup> Thus, in cases of ambiguous lower extremity pain, the potential involvement of the hip must be considered in the modern spine surgeon’s clinical decision making.

Radiologic findings are often minimal and are difficult to assign diagnostic value to; physical examination findings can produce a confused and inconsistent view of the patient’s condition.<sup>4</sup> To avoid delay in the proper diagnosis and treatment of patients with complex hip-spine syndrome, additional testing may be required. Intra-articular injection of local anesthetic with or without steroid has been shown to be useful both in short-term pain relief and in determining the contribution of a specific joint to a patient’s symptoms.<sup>5-10</sup> It is a simple and

discerning the source of pain for patients with atypical hip pain or concomitant hip and spine disorders.<sup>11-13</sup> This tool has been well studied in other joints, such as the shoulder,<sup>14</sup> but a unified perspective of the literature on diagnostic hip injection to differentiate between hip and spine pathology has not been described.

The question being asked for this review is “Among patients with hip-spine syndrome specific to osteoarthritis of the hip and lumbar spine disorders, is intra-articular injection (ultrasound-guided or fluoroscopy-guided) a reliable diagnostic technique for determining pain source?” The purposes of this systematic review were to evaluate the literature regarding guided hip intra-articular injection used to identify the source of pain in the setting of both hip arthritis and lumbar spine disorders and to determine the diagnostic power and reliability of this tool.

## MATERIALS AND METHODS

A systematic review of the available literature was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.<sup>15</sup>

### Eligibility Criteria

Studies meeting the following inclusion criteria were eligible for the review: sample size of more than 10 patients; adult patients older than 18 years; patients with hip-spine syndrome with concomitant hip and lumbar spine disorders; radiographs, ultrasound, computed tomography, or fluoroscopically guided intra-articular hip injections; clinical outcomes data; human studies; levels I, II, III, and IV evidence (according to the Oxford Centre for Evidence Based Medicine)<sup>16</sup>; articles published only in English; and publication in print or electronic journals. The exclusion criteria were as follows: review articles, basic science studies (except review article references), commentaries, case reports, cadaveric studies, or nonhuman studies;

studies concerning epidural, intramuscular, or other injections besides hip intra-articular; studies regarding unguided intra-articular hip injections or injections guided only by anatomical landmarks; and studies with patients with no concomitant hip arthritis and lumbar spine disorders.

### Information Sources

Two reviewers (D.R.M., B.H.M.) independently conducted database searches of both PubMed and the Cochrane Library in August 2018. The full texts of potentially eligible studies were obtained and reviewed for inclusion. The bibliography of each study was also reviewed to identify any additional literature. Differences between the 2 reviewers were discussed, and a consensus was reached.

### Search Terms

The following search terms were used as MeSH and/or keywords: “osteoarthritis, hip” AND “injection, intra-articular”; “hip” AND “spine” AND “injection”; “osteoarthritis, spine” AND “injection, intra-articular”; “lumbar, vertebrae” AND “injection, intra-articular”; “low back pain” AND “injection, intra-articular”; “hip-spine disease” AND “injection, intra-articular”; “hip-spine syndrome” AND “injection, intra-articular”; and “lumbar spine disease” AND “injection, intra-articular.”

### Study Selection

Database searches were performed by 2 independent reviewers (D.R.M., B.H.M.) using the inclusion and exclusion criteria. After removal of duplicates, the inclusion and exclusion criteria were applied to identify eligible articles. Two researchers (D.R.M., B.H.M.) independently screened titles and abstracts of the potentially relevant articles. Studies that met all criteria after this screening were then examined for full-text review. After full-text review, the final articles were selected for this systematic review.

### Data Collection

Data were collected and recorded in a piloted computer spreadsheet program (Excel 2013; Microsoft, Redmond, Washington). Extracted data included the following: authors, journal, country, year of publication, level of evidence, number of patients, study design, imaging modality used, injection product, sensitivity, specificity, positive predictive value, and negative predictive value.

### Study Quality

Two reviewers (D.R.M., B.H.M.) independently assessed the methodological quality of all included studies according to the Methodological Index for Non-Randomized Studies (MINORS) criteria.<sup>17</sup> All information used in this review was extracted from the articles. Risk of bias was assessed for each study. Levels of evidence were collected from each study.

### Synthesis of Results

Means for sensitivity (SN), specificity (SP), positive predictive value (PPV), and negative predictive value (NPV) among the studies, weighted by sample size, were calculated.

## RESULTS

### Study Selection

From the PubMed and Cochrane database searches, 397 and 38 studies were identified, respectively (**Figure 1**). Thirty-five studies were eligible for full-text review and 311 studies were excluded: 1 cadaveric study, 4 case report studies, 2 technical note studies, 11 review studies, and 293 irrelevant studies. After full-text review, 26 studies were excluded for the following reasons: 11 studies performed guided intra-articular injections in patients with hip arthritis but no lumbar spine disorders (patients with lumbar spine problems were excluded prior to hip injection) and 15 studies performed guided injections in patients with lumbar spine disorders but without hip arthritis. The study selection process is summarized in **Figure 1**.

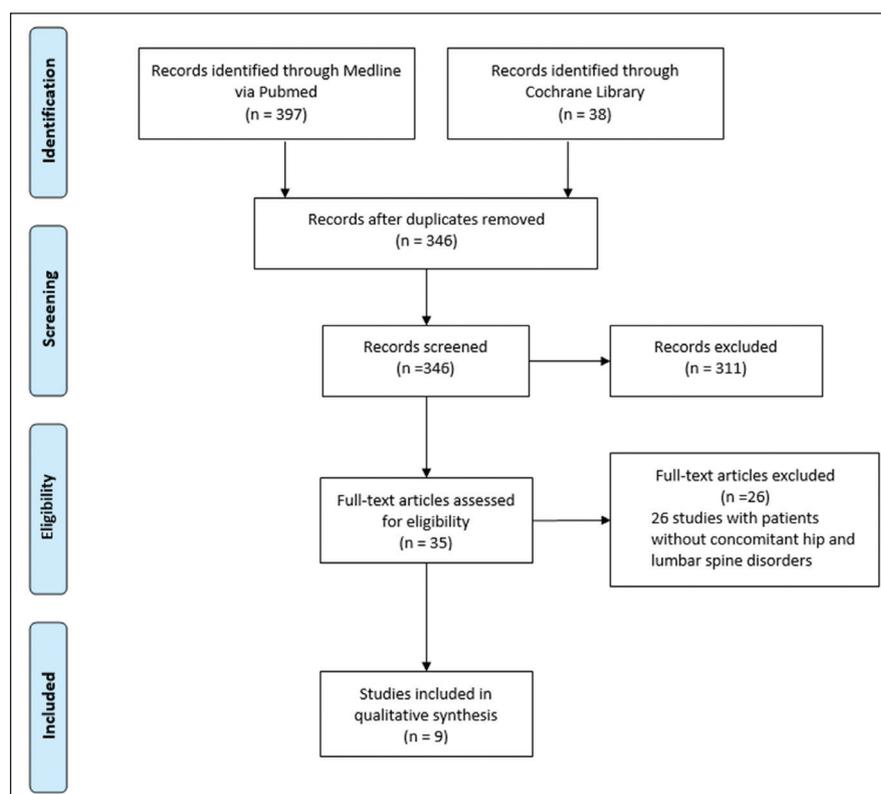
## Study Characteristics

The systematic review search retrieved 9 studies that were conducted between 1991 and 2016: 4 prospective studies and 5 retrospective studies, with 4 of the studies conducted in the United Kingdom and 5 in the United States. **Table 1** organizes each study's reported authors, journal, country study location, year, level of evidence, number of patients, study design, injection product, SN, SP, and PPV and NPV.

Regarding ethical considerations, 1 study recorded obtained written consent from each patient,<sup>18</sup> 3 studies received ethical approval from an institutional review board prior to being conducted,<sup>11,12,19</sup> and the remaining studies did not cite ethical considerations. None of the studies reported potential conflicts of interest. A total of 697 patients were involved. The studies were divided into 2 groups according to the diagnostic injection product used for intra-articular hip injection: studies that used only anesthetic (bupivacaine, lidocaine, bupivacaine hydrochloride, or ropivacaine) were placed in one group (anesthetic only group) and studies that used anesthetic with corticosteroids were placed in a second group (anesthetic with corticosteroids group). The anesthetic only group included 6 studies with a total of 363 patients<sup>6,10,12,18-20</sup> and the anesthetic with corticosteroids group included 3 studies with a total of 334 patients.<sup>8,11,13</sup>

## Study Quality

All studies included in this systematic review were nonrandomized. The MINORS instrument<sup>21</sup> was used to assess the methodological quality of each study. Mean score for the studies included in this systematic review was 12.33 of 16 points. Scores for nonrandomized and noncomparative studies can be understood as very low quality (0 to 4); low quality (5 to 8); moderate quality (9 to 12); and high quality (13 to 16).



**Figure 1:** Flow diagram showing the selection of studies for inclusion.

## Results of Individual Studies

The anesthetic only group included 6 studies and 363 patients.<sup>6,10,12,18-20</sup> Two studies<sup>12,19</sup> were retrospective, and 4 studies<sup>6,10,19,20</sup> were prospective. One of the common objectives was to use guided intra-articular hip injection to differentiate pain source in patients with both hip and lumbar spine arthritis. Physical examination and proper hip and lumbar spine radiography protocols were used to diagnose simultaneous findings of arthritis in all studies.

Five studies with a combined 321 patients reported patients' sex, of which 65.73% were female.<sup>6,12,18-20</sup> The same 5 studies reported patient age, and the mean age weighted by the studies' sample sizes was 51.74 years.<sup>6,12,18-20</sup> Studies described 5 different protocols for administration of the anesthetic injection.

One study used 10 mL of 0.25% bupivacaine,<sup>18</sup> 1 used 10 mL of 0.5% bupivacaine,<sup>20</sup> 1 used 3.5 mL of 2% lido-

caine plus 3.5 mL of 0.5% bupivacaine,<sup>12</sup> 2 used 10 mL of 0.5% bupivacaine,<sup>6,10</sup> and 1 used a median of 5 mL of 0.5% ropivacaine, 0.25% bupivacaine, or 1.0% lidocaine, depending on anatomical constraints.<sup>19</sup> For intra-articular localization, 6 studies used fluoroscopy-guided injections,<sup>6,8,11-13,20</sup> 1 used radiographs,<sup>10</sup> 1 used ultrasound,<sup>18</sup> and 1 used fluoroscopy or ultrasound.<sup>19</sup>

Positive response after guided intra-articular hip injection was specifically defined in 3 studies. One study defined positive response as 70% or greater relief of pain<sup>11</sup>; 1 study took 50% pain relief from the pre-injection pain after 30 minutes or less<sup>12</sup>; and 1 study grouped patients into achieving more or less than 50% pain relief 24 hours after the injection.<sup>19</sup> The remaining studies did not use any specific number or parameter to define positive response.

In the anesthetic with corticosteroids group, 3 retrospective studies were in-

Table 1

Study Characteristics

Study (Year) and Journal	Country	Level of Evidence	No. of Patients	No. F/M	Mean Age, y	Study Design	Imaging Modality	Injection Product	Sensitivity	Specificity	PPV	NPV
Yoong et al <sup>18</sup> (2012) <i>Skeletal Radiol</i>	UK	IV	138	94/44	68	Prospective	Ultrasound	10 mL of 0.25% bupivacaine	—	—	—	—
Krych et al <sup>19</sup> (2016) <i>Arthroscopy</i>	US	IV	96	71/25	37.6	Retrospective	Fluoroscopy or ultrasound	0.5% ropivacaine, 0.25% bupivacaine, or 1.0% lidocaine	—	—	—	—
Deshmukh et al <sup>11</sup> (2010) <i>J Arthroplasty</i>	US	IV	204	128/76	65.40	Retrospective	Fluoroscopy	5 mL of 0.5% bupivacaine + 1 mL (80 mg) of methylprednisolone	91.5%	100%	100%	84.6%
Ashok et al <sup>20</sup> (2009) <i>Eur J Orthop Surg Traumatol</i>	UK	IV	48	27/21	66	Prospective	Fluoroscopy	10 mL of 0.5% bupivacaine	97%	90.9%	97%	90.9%
Pateder and Hungerford <sup>13</sup> (2007) <i>Am J Orthop</i>	US	IV	83	45/38	63	Retrospective	Fluoroscopy	9 mL of 1% lidocaine + 1 mL (40 mg) of triamcinolone	100%	81%	97%	100%
Illgen et al <sup>12</sup> (2006) <i>J Arthroplasty</i>	US	IV	21	11/10	66.5	Retrospective	Fluoroscopy	3.5 mL of 2% lidocaine + 3.5 mL of 0.5% bupivacaine	—	—	95.2%	87.5%
Faraj et al <sup>8</sup> (2003) <i>Acta Orthop Belg</i>	UK	IV	47	27/20	57	Retrospective	Fluoroscopy	0.5% bupivacaine + triamcinolone	88%	100%	100%	85%
Crawford et al <sup>6</sup> (1998) <i>J Bone Joint Surg Br</i>	UK	IV	42	NA	NA	Prospective	Fluoroscopy	10 mL of 0.5% bupivacaine	96%	—	—	—
Kleiner et al <sup>10</sup> (1991) <i>J Rheumatol</i>	US	IV	18	8/10	68	Prospective	Radiographs	10 mL of 0.5% bupivacaine	88%	100%	100%	33%

Abbreviations: F, female; M, male; NA, not available; NPV, negative predictive value; PPV, positive predictive value; UK, United Kingdom; US, United States.

cluded with a combined total of 334 patients.<sup>8,11,13</sup> Two hundred (59.9%) patients were women and 134 (40.1%) were men. Mean age was provided by all of the studies, and the overall mean weighted by sample size was 63.6 years. The 3 studies aimed to determine the source of hip pain in patients with both hip and lumbar spine arthritis (hip-spine syndrome).<sup>8,11,13</sup> Three studies used physical examination and proper hip and lumbar spine radiography protocols to diagnose patients with simultaneous findings of hip and lumbar spine arthritis.<sup>8,11,13</sup> Different protocols were used in each study for intra-articular diagnostic hip injection. One study used 5 mL of 0.5% bupivacaine plus 1 mL (80 mg) of methylprednisolone,<sup>11</sup> 1 study used 9 mL of 1% lidocaine plus 1 mL (40 mg) of triamcinolone,<sup>13</sup> and 1 study used 0.5% of bupivacaine plus an unspecified quantity of triamcinolone.<sup>8</sup>

Regarding guided technique, fluoroscopy was used in all of the studies. Only 1 study mentioned specifically how positive response after intra-articular hip injection was assessed,<sup>11</sup> considering 50% pain relief from the pre-injection pain after 30 minutes a “positive response” and 50% pain improvement within 2 weeks following the injection a “delayed positive” that was also included in the “positive group” for results.

Values of SN, SP, PPV, and NPV were provided and extracted from each study.

### Synthesis of Results

In the anesthetic only group, 3 studies reported SN, SP, PPV, and NPV for guided intra-articular hip injection. One study reported 97%, 90.9%, 97%, and 90.9% for SN, SP, PPV, and NPV, respectively<sup>20</sup>; 1 study reported 95%, 87.50%, 95%, and 87.50% for SN, SP, PPV, and NPV, respectively<sup>12</sup>; and 1 study reported 88%, 100%, 100%, and 33% for SN, SP, PPV, and NPV, respectively.<sup>10</sup>

Another study reported PPV of 95.2% and NPV of 87.5%.<sup>12</sup> One study only reported SN of 96%.<sup>6</sup> The sixth study did not report SN, SP, PPV, or NPV.<sup>18</sup> Weighted by sample size, the mean values for the anesthetic only group were 95.1%, 93.4%, 97.2%, and 78.1% for SN, SP, PPV, and NPV, respectively. No major complications were reported regarding infiltration itself. One study reported 1 minor vasovagal reaction during the procedure, but the patient completely recovered by the conclusion of the procedure.<sup>12</sup> In the anesthetic with corticosteroids group, 1 study reported values of 91.5%, 100%, 100%, and 84.6% for SN, SP, PPV, and NPV, respectively.<sup>11</sup> The second study reported values of 100%, 81%, 97%, and 100% for SN, SP, PPV, and NPV, respectively.<sup>13</sup> The third study showed values of 88%, 100%, 100%, and 85% for SN, SP, PPV, and NPV, respectively.<sup>8</sup> When the studies were combined, the mean values were 93.1%, 95.3%, 99.3%, and 88.5% for SN, SP, PPV, and NPV, respectively. No infections or neurovascular complications were reported.

Among all studies in this review, the mean reported values weighted by sample size were 93.6%, 95.0%, 98.8%, and 86.3% for SN, SP, PPV, and NPV, respectively. The values were comparable between groups.

### DISCUSSION

This systematic review identified 9 level IV studies reporting the efficacy of

guided intra-articular injection of the hip in distinguishing between hip and spine-derived pain. Three studies used corticosteroid in addition to anesthetic,<sup>8,11,13</sup> and 6 used anesthetic alone.<sup>6,10,12,18,19,20</sup> Six studies used fluoroscopic guidance,<sup>6,8,11-13,20</sup> 1 used ultrasound,<sup>18</sup> 1 used either fluoroscopy or ultrasound,<sup>19</sup> and 1 used radiographs.<sup>10</sup> High values were reported for SN, SP, PPV, and NPV in identifying the hip as the source of lower extremity pain. Weighted by sample size, the mean values for SN, SP, PPV, and NPV were 93.6%, 95.0%, 98.8%, and 86.3%, respectively.

Hip pathology often occurs in combination with lumbar stenosis and back pain, which can make diagnosis and treatment for patients with these disorders difficult because symptoms of hip and spine disorders often overlap.<sup>22</sup> First introduced by Offierski and MacNab,<sup>1</sup> the term hip-spine syndrome is used to describe patients who have concomitant hip and lumbar spine disorders. In simple cases of hip-spine syndrome, a standard assessment that includes a careful history, physical examination, and plain radiographs of the hip and spine is sufficient to identify whether the patient's symptoms are caused primarily by hip or spine pathology.<sup>7-9</sup>

However, in complex cases of hip-spine syndrome, it is difficult to determine the source of pain, and additional diagnostic testing must be performed.<sup>3,4,23,24</sup> Guided diagnostic intra-articular hip injections serve as a reliable tool that can be used to clarify a patient's diagnosis and provide guidance for appropriate therapeutic options.<sup>25-30</sup> When diagnostic injections are performed without image guidance, they are often unreliable; up to 40% of blind hip injections are administered into the extra-articular space.<sup>31,32</sup> The aim of this systematic review was to evaluate the role and importance of guided diagnostic intra-articular hip injection in determining the pain source in the setting of complex hip-spine syndrome.

Previous studies have examined the use of intra-articular injection to identify various hip joint pathologies. A systematic review by Khan et al<sup>3</sup> reported that intra-articular hip injection is a useful tool in the diagnosis, therapy, and prognostication of femoroacetabular impingement. In the setting of other intra-articular hip pathologies such as labral tears and ligamentum teres ruptures, fluoroscopically guided intra-articular hip joint injections demonstrated a 90% accuracy rate in a study by Byrd and Jones.<sup>25</sup>

Diagnostic injections have also been used in other joints to differentiate between concomitant pathologies. Historically, this diagnostic tool has been used to differentiate between shoulder and cervical spine pathologies.<sup>14</sup> The use of guided intra-articular hip diagnostic injection was first reported by Kleiner et al<sup>10</sup> for the purpose of distinguishing between hip and referred lumbar spine pain in patients with coexisting hip and spinal arthritis. They reported a SN of 88% and a SP of 100%, comparable to the data provided by other studies included in the current review. The use of epidural injections for lumbar pathology in the setting of hip-spine syndrome is less well defined in the current literature.<sup>19,26</sup> Although the use of anesthetic and steroid combination has not been shown to be significantly more accurate, it has been reported to relieve pain for longer (up to 1 year) compared with an injection with only anesthetic (up to 1 week).<sup>21,32-35</sup>

Ultrasound-guided injections offer the following advantages compared with fluoroscopy-guided injections: no ionizing radiation exposure, greater accessibility, smaller equipment, greater accuracy of delivery, and the possibility of visualizing soft tissue structures.<sup>25,30</sup> Yoong et al<sup>18</sup> stated that the use of ultrasound is potentially more cost-effective and faster than the use of fluoroscopy and that it avoids inadvertent puncture of femoral vessels. Furthermore, Byrd and Jones<sup>25</sup> reported that in-office ultrasound-guided injections of the hip were more convenient and less painful

than fluoroscopic-guided, hospital-based injections.

### Strengths

This study followed the validated PRISMA method to conduct an exhaustive search of available literature relevant to the topic. Using multiple databases helped to ensure that the best-available evidence was presented. Combining the efforts of 2 independent reviewers limited the potential effects of errors or ambiguity in selecting articles for inclusion. Finally, evaluating according to the MINORS criteria confirmed the scientific rigor of the reviewed studies. The average MINORS score for the included studies was 12.33, indicating a high level of quality of evidence.

### Limitations

The authors acknowledge several limitations to this study. From a methodological standpoint, this review lacked evidence from high-quality randomized controlled trials. The studies presented in this review were all level IV and lacked a control group. In addition, the number of studies included was relatively low and many of these studies reported on relatively small samples. Another limitation stems from the fact that there were important variations between the intra-articular injection protocols used, the definition of a positive response to injection, and the tool used for guidance (ultrasound vs fluoroscopy).

### CONCLUSION

In patients with coexisting hip and lumbar spine disorders, when the pain source cannot be completely elucidated, ultrasound- or fluoroscopic-guided intra-articular hip injection may be a powerful and reliable diagnostic tool. Guided diagnostic intra-articular hip injections could be a part of the clinical protocol for any physician who specializes in the management and treatment of spine or hip pathologies.

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