

Anterior Electronic Hip Pain Drawings Are Helpful for Diagnosis of Intra-articular Sources of Pain: Lateral or Posterior Drawings Are Unreliable



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Purpose: The purpose of this study was to determine the accuracy of electronic hip pain drawing to diagnose intra-articular source of pain in nonarthritic hips, defined by response to an intra-articular injection. **Methods:** A retrospective assessment was performed in consecutive patients who had an intra-articular injection completed within a 1-year period. Patients were classified as responders or nonresponders to intra-articular hip injection. A positive injection was defined as greater than 50% hip pain relief within 2 hours after injection. Electronic pain drawings collected before injection were then evaluated according to the hip region marked by the patients. **Results:** Eighty-three patients were studied after applying inclusion and exclusion criteria. Anterior hip pain on drawing had a sensitivity of 0.69, specificity of 0.68, positive predictive value (PPV) of 0.86, and negative predictive value (NPV) of 0.44 for intra-articular source of pain. Posterior hip pain on drawing had a sensitivity of 0.59, specificity of 0.23, PPV of 0.68, and NPV of 0.17 for intra-articular source of pain. Lateral hip pain on drawing had a sensitivity of 0.62, specificity of 0.50, PPV of 0.78, and NPV of 0.32 for intra-articular source of pain. **Conclusion:** Anterior hip pain on electronic drawing has a sensitivity of 0.69 and specificity of 0.68 for intra-articular source of pain in nonarthritic hips. Lateral and posterior hip pain on electronic pain drawings are not reliable to rule out intra-articular hip disease. **Level of Evidence:** Level III, case-control study.

Introduction

Pain drawings are an effective instrument for patients to visually represent their symptoms.¹ Location of pain described by the patient has historically been used as an indicator of intra-articular or extra-articular abnormality of the hip. Utilization of electronic pain drawings in orthopedic practices is increasing, given recent advances in telemedicine.²

Pain drawings have demonstrated variable diagnostic accuracy throughout different orthopedic specialties. Arner et al. reported that pain drawings for hand

pathologies have a false negative rate of 4% and are particularly useful to rule out diseases.³ Post and Fulkerson compared the knee pain drawings with physical examination in patients with patellofemoral pathology, and the physician diagram included all or some of the pain zones marked by the patient in 88% of the knees.⁴ Poulsen et al. reported the pain drawing distribution in patients with symptomatic hip osteoarthritis.⁵ The greater trochanter area was marked by 77%, the groin area by 53%, the anterior and lateral thigh by 42%, the buttock area by 38%, and the knee area by 17% of the patients with hip osteoarthritis.⁵ Arnold et al. studied the pain diagrams of patients with significant relief after intra-articular hip injection and reported that central groin and peritrochanteric areas were marked by 73% and 44% of patients, respectively.⁶

The accuracy of electronic pain drawings to differentiate intra-articular vs extra-articular hip pathologies in nonarthritic hips is not well understood. The purpose of this study was to determine the accuracy of electronic hip pain drawing to diagnose intra-articular source of pain in nonarthritic hips, defined by response to an intra-articular injection. The hypothesis was that anterior hip pain on pain drawing is predictive of an intra-articular source of pain.

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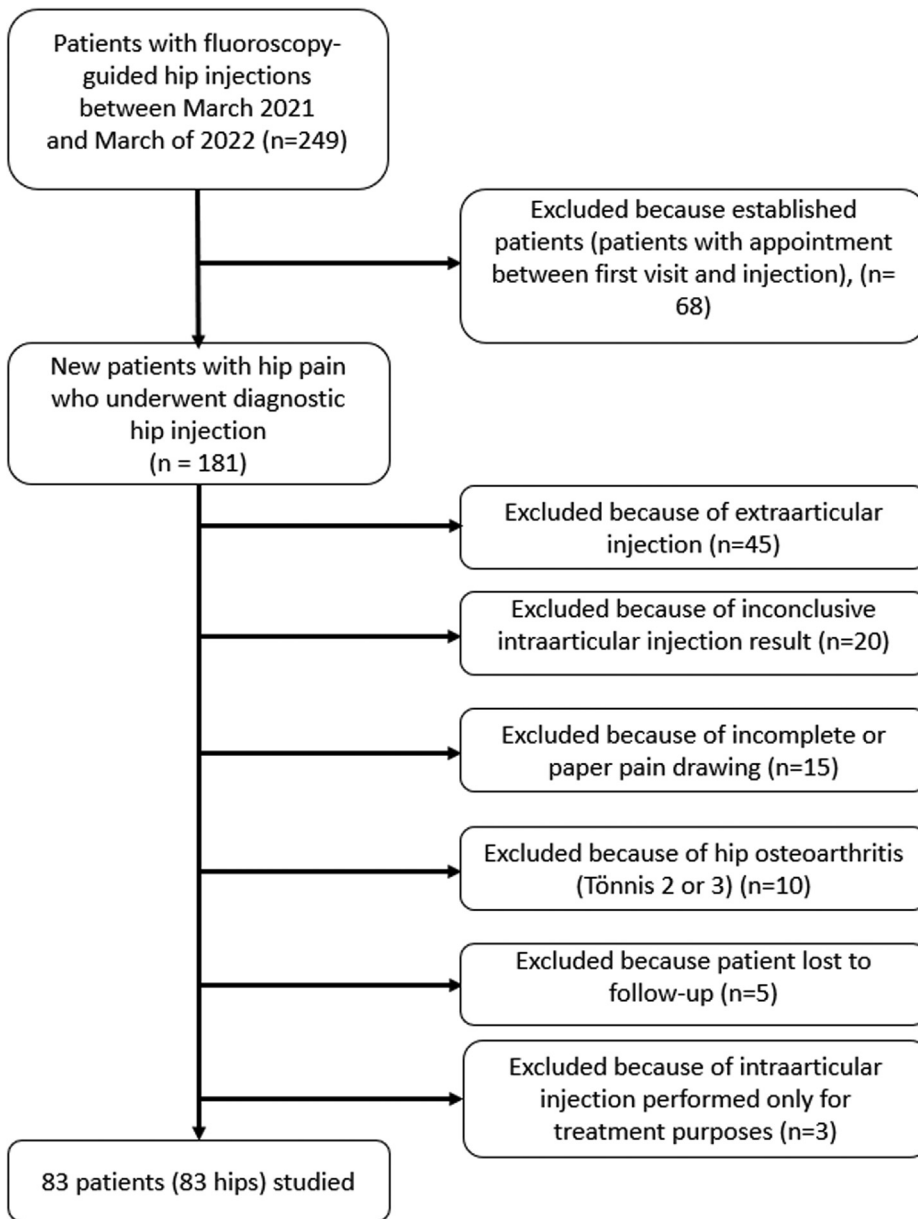


Fig 1. Flowchart of patient selection.

Methods

This study was carried out in an urban academic tertiary-care orthopedic facility and was approved by the hospital's institutional review board. A retrospective review was performed in consecutive patients who had fluoroscopy-guided injections completed between March 2021 and March 2022. New patients with hip pain who underwent injection as part of the diagnostic process were included. Exclusion criteria were established patients (patients with any appointments between first visit and injection), extraarticular injection, inconclusive intra-articular injection result per chart review, incomplete or paper pain drawing, hip osteoarthritis

(Tönnis 2 or 3), patient lost to follow-up after injection, or intra-articular injection performed only for treatment purposes. Every new patient assessed in the practice completed an electronic questionnaire, which included a pain drawing section, before their first visit (Fig 1).

Results of intra-articular hip injections were measured as responder versus nonresponder, in terms of pain relief. Prior to receiving the injection, each patient was instructed to observe the effect of the intra-articular injection on pain relief in the first 2 hours after injection. If patients experienced more than 50% pain relief, they were classified as responders.⁷ If patients indicated less than 50% relief in the first 2 hours following injection, they were classified as

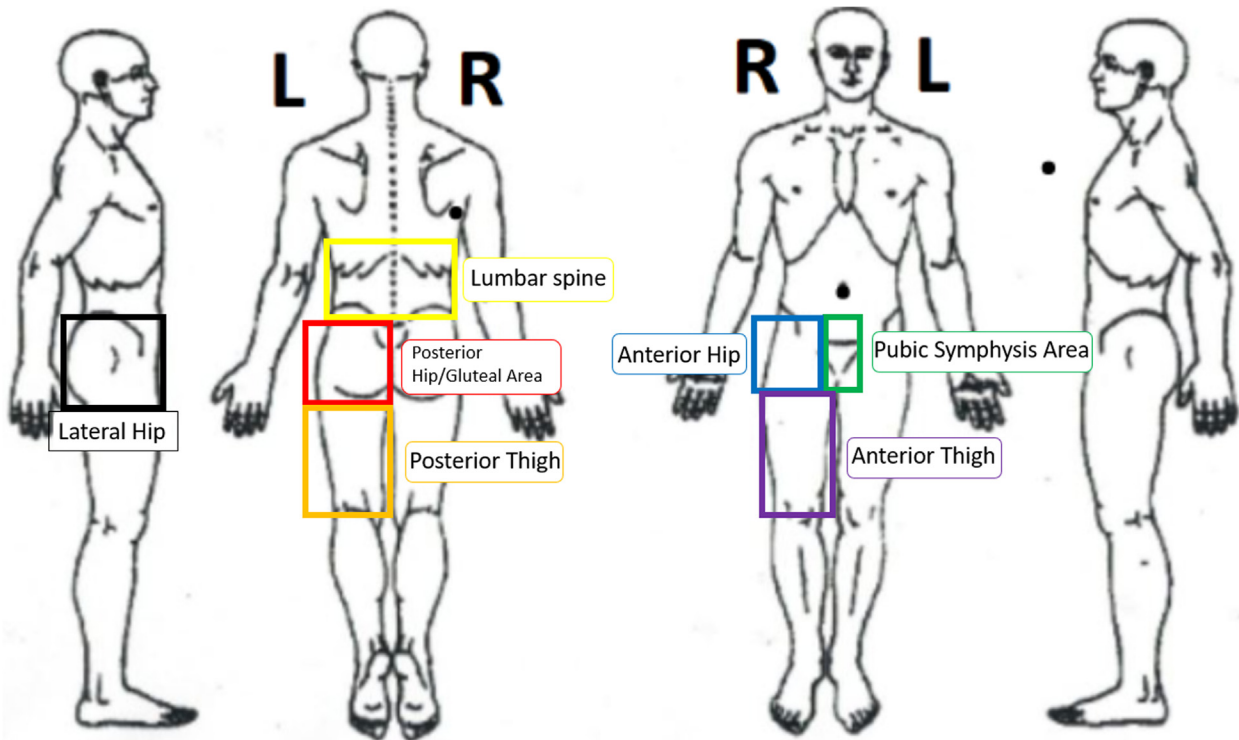


Fig 2. Regions of pain defined for electronic pain drawing: anterior hip, anterior thigh, lateral hip, posterior thigh/gluteal, posterior thigh, distal to the knee, pubic symphysis, and lumbar spine.

nonresponders. Pain relief after intra-articular injection was assessed in a follow-up appointment at 1-2 weeks after injection. All diagnostic intra-articular hip injections were performed by a musculoskeletal-trained radiologist. The patient was placed supine, and the intra-articular compartment was accessed under fluoroscopy guidance. All patients received 5 mL of bupivacaine 0.25%, and methylprednisolone was additionally injected in some patients.

Pain drawings were digitally completed by the patients before their first visit. Regions of hip marked were classified as anterior hip, lateral hip, posterior hip/gluteal region, anterior thigh, and posterior thigh. Additional regions marked were lumbar spine, pubic symphysis area, and distal to the knee (Fig 2).

Statistical and Reliability Analysis

The “N-1” Chi-squared test for difference of proportions was performed using MedCalc v19.2.1 software. This test was used to establish the significance of any noted difference in proportion of areas of pain marked on drawings between patients with positive and negative injections. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of different areas marked on pain drawings for positive intra-articular hip injection were also determined using MedCalc v19.2.1 software.

Results

From 249 consecutive patients who had fluoroscopy-guided hip injections, 83 patients/hips were studied after applying inclusion and exclusion criteria (Fig 1). The intra-articular injection was performed on average 17 ± 40 days after the first visit. The responder group was composed of 61 patients, and the nonresponder group was composed of 22. The average age in the responder group was 46 ± 15 years, and the average age in the nonresponder group was 48 ± 13 years (Table 1). Anterior hip pain on drawing had a sensitivity of 0.69, specificity of 0.68, PPV of 0.86, and NPV of 0.44 for symptomatic intra-articular hip disease. Posterior hip pain on drawing had a sensitivity of 0.59, specificity of 0.23, PPV of 0.68, and NPV of 0.17 for symptomatic intra-articular hip disease. Lateral hip pain on drawing had a sensitivity of 0.62, specificity of 0.50, PPV of 0.78, and NPV of 0.32 for symptomatic intra-articular hip disease (Table 2).

Anterior hip area was marked by 69% (42/61) of the responders, and by 32% (7/22) of the non-responders ($P = .0026$) (Table 1). Posterior hip area was marked by 59% (36/61) of the responders, and 77% (17/22) of the nonresponders ($P = .1345$) (Table 1). Lateral hip area was marked by 62% (38/61) of the responders, and 50% (11/22) of the nonresponders ($P = .3298$) (Table 1).

Table 1. Patient Demographics and Distribution of Marked Regions on Pain Drawings

	Responder	Nonresponder	<i>P</i> Value
Number of patients	61	22	
Age (at time of injection) (mean \pm SD) (years)	46 \pm 15	48 \pm 13	
Female/Male patients, <i>n</i>	42/19	12/10	
Anterior hip pain on drawing, <i>n</i> (%)	42 (69%)	7 (32%)	.0026
Posterior hip pain on drawing, <i>n</i> (%)	36 (59%)	17 (77%)	.1345
Lateral hip pain on drawing, <i>n</i> (%)	38 (62%)	11 (50%)	.3298
Low back pain on drawing, <i>n</i> (%)	27 (44%)	7 (32%)	.3292
Pubic symphysis area pain on drawing, <i>n</i> (%)	13 (21%)	1 (5%)	.0869
Pain distal to the knee on drawing, <i>n</i> (%)	5 (8%)	4 (18%)	.1951

Discussion

Anterior hip area markings on electronic pain drawing are more accurate for intra-articular source of pain than markings at the lateral and posterior hip. Sixty-nine percent of the patients with response to the intra-articular injection marked the anterior hip area on electronic pain drawings. In addition, 68% of the nonresponders did not mark the anterior hip area on electronic pain drawings. This frequency is found similar to a study by Arnold et al., which used a diagram in which patients could mark predetermined areas around the hip joint to reflect their pain location.⁶ Those authors reported that 73% of patients with significant relief after intra-articular hip injection mark the central region of the anterior hip.⁶ The same authors found that 15% patients without significant relief with intra-articular injection mark the anterior hip area on pain drawing.⁶ In contrast, the present study demonstrated that 32% of nonresponding patients marked the anterior hip area on pain drawing. This difference may be explained by the fact that Arnold et al. used pain drawings with predetermined small areas that limited patients' options to mark their pain. In our experience, predetermined areas for patients to mark their symptoms would not reflect the presentation of most patients with hip pathology. The hip is a deeply located joint, and the symptoms are not be point-localized, except for patients with lower body-mass indices.

In the present study, anterior hip pain drawing had a PPV of 86% for intra-articular source of pain and a NPV of 44%. The discrepancy between the NPV and

PPV is explained by the population studied and the influence of disease prevalence on PPV and NPV. This study was performed in a tertiary center specialized in hip pathologies with a high prevalence of symptomatic intra-articular hip diseases, thus explaining the low NPV.

Fifty-nine percent of patients with response to intra-articular injection marked the posterior hip area on their pain drawings (Fig 3). Intra-articular pathologies have been reported to cause posterior and lateral hip pain.^{8,9} Extra-articular abnormalities in association with intra-articular abnormalities are frequent and could also explain the high prevalence of posterior and lateral markings on pain drawings of patients with positive intra-articular injection. Poulsen et al. reported that 38% of patients with symptomatic hip osteoarthritis marked the buttock area on pain drawings.⁵ According to Arnold et al., from patients who had relief with intra-articular injection, 37% marked the posterior iliac crest area, while 25% of patients marked the sciatic notch and sacroiliac joint area on pain drawing.⁶ The difference in patient population might explain the higher prevalence of posterior hip drawings in the current study.

Utilization of electronic pain drawings is increasing given recent advances in telehealthcare. Boudreau et al. compared the level of agreement between paper and electronic (i.e., tablet) pain drawings in individuals with chronic neck pain.¹⁰ Those authors report a high intraclass correlation coefficient (0.92) between electronic and paper pain drawings in patients with chronic neck pain.¹⁰ Despite the advancements in telehealthcare, the physical examination with in-person assessment is the foundation for the diagnosis of hip diseases. The results of the present study need to be correlated with physical examination tests that assess for intra-articular, extra-articular, and posterior hip abnormalities. In the present study, established patients with appointments between the first visit and injection were excluded to minimize the time between the patient's self-reported pain drawing and the intra-articular injection, considering the possibility of a change in the pain pattern with time.

Table 2. Diagnostic Performance of Three Different Hip Regions Marked on Pain Drawings for Symptomatic Intraarticular Disease

	Anterior Hip Pain	Posterior Hip Pain	Lateral Hip Pain
Sensitivity	0.69	0.59	0.62
Specificity	0.68	0.23	0.50
Positive Predictive Value	0.86	0.68	0.78
Negative Predictive Value	0.44	0.17	0.32

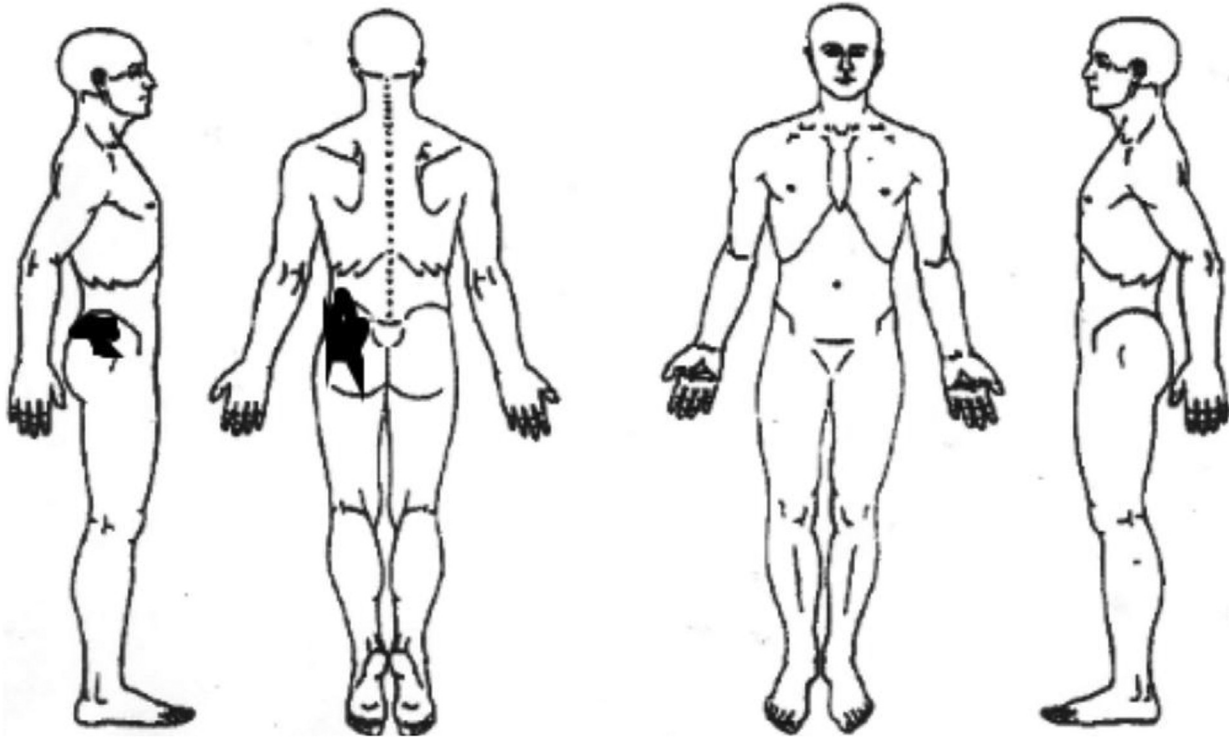


Fig 3. Pain drawing marked electronically by a 50-year-old female patient with hip pain and positive intra-articular injection. Patient marked the lateral and posterior hip regions, as opposed to the anterior hip.

In our practice, intra-articular injection tests and magnetic resonance imaging (MRI) are performed concomitantly in all patients with hip pain. The intra-articular injection with anesthetic is routinely used in place of a contrast media to obtain images similar to MRI arthrograms. In the present study, the level of pain relief with intra-articular injection was used as the indicator of an intra-articular source of pain instead of the MRI findings, considering that labral tears and other intra-articular abnormalities are frequent in asymptomatic individuals.¹¹

Limitations

This study is not without limitations. The population studied may not represent less specialized orthopedic practices, and the PPV and NPV are affected by the prevalence of intra-articular pathologies. A second limitation is that the type of electronic device on which patients completed the pain drawings is not recorded in this study, and differences in accuracy may occur among different devices. Another limitation is the lack of a power calculation for this study.

Conclusion

Anterior hip pain on electronic drawing has a sensitivity of 0.69 and specificity of 0.68 for intraarticular source of pain in nonarthritic hips. Lateral and posterior

hip pain on electronic pain drawings is not reliable to rule out intra-articular hip disease.

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