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SCIENTIFIC ARTICLE

Efficacy of intraarticular corticosteroid hip injections for osteoarthritis and subsequent surgery

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Abstract

Objective Our study aimed to determine the duration of pain relief from intraarticular hip corticosteroid injections and identify patient predictive factors on injection response. We also sought to determine the subsequent rate of hip surgery and whether severity of hip osteoarthritis or injection response correlated with the decision to undergo surgery.

Materials and methods All intraarticular hip steroid injections performed for osteoarthritis under fluoroscopic guidance at a single institution between January 2010 to December 2012 were retrospectively reviewed. Response was divided into three groups: no relief, immediate (≤ 2 weeks of pain relief), and continued (> 2 weeks of pain relief). Presence of hip surgery for osteoarthritis performed within 2 years following injection was obtained. Correlation between patient characteristics with injection outcome and hip surgery was analyzed.

Results Of 78 patients, a total of 82 injections were analyzed. For injections, 19.5% (16/82) showed no response, 47.6% (39/82) showed immediate response, and 32.9% (27/82) showed continued response. There was no significant correlation between injection outcome with age, Tönnis grade, BMI, or duration of symptoms. In total, 48.7% had hip surgery within 2 years after initial injection. There was a significant association between Tönnis grade and surgery, with higher Tönnis grades correlating with decision to undergo surgery ($p = 0.002$).

Conclusions Gender, age, BMI, duration of symptoms, and radiographic severity of disease do not predict injection response. Due to high surgical rates and poor response, intraarticular hip steroid injections may be less effective in the long term, and surgical management may be considered earlier.

Keywords Hip injection · Hip replacement · Tönnis grade · Osteoarthritis · Fluoroscopy

Introduction

Hip osteoarthritis (OA) affects one in four people by the age of 85 [1]. Many studies have demonstrated the short-term efficacy of intraarticular corticosteroid hip injections (CSI) for a painful hip [2–5]. Despite this, only 56% of orthopedic surgeons surveyed thought that hip CSIs were therapeutically useful [6]. Furthermore, the quoted duration of pain relief is highly variable in the literature and may be related to specific patient characteristics. Qvistgaard et al. found that in 101

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patients, only 56% responded to methylprednisolone injections at 14 days, whereas Subedi et al. found that 82% responded to steroid injections at 6–8 weeks of follow-up [4, 7]. Given this variability, identifying patient characteristics that can predict a therapeutical injection response may be useful for guiding patient management.

Currently, few studies have examined predictive factors for a positive intraarticular hip CSI response. Prior studies have focused on radiographic severity and injection response [2, 5, 7, 8]. For example, Plant et al. was one of the first to conclude that the degree of pain relief was not influenced by radiographic severity or by the direction of migration of the femoral head [5]. Besides radiographic severity, two other studies have looked at other potential predictive factors such as duration of symptoms and BMI [8, 9]. Flanagan et al. found that those who had symptoms for more than 5 years were less likely to experience benefit from a hip CSI [9]. Robinson et al. found no significant relationship between BMI and hip CSI response after statistical corrections [8].

Very few studies have looked at subsequent rate of hip surgery following a hip intraarticular CSI. Chang et al. found that earlier hip replacement may reduce cost and increase quality of life by 6.9 years, as painful hip OA is associated with high costs of custodial care [10]. The purpose of this study was to evaluate the rate of hip replacement or resurfacing in our cohort of patients following intraarticular hip CSIs for OA, and whether severity of hip OA or injection response correlated with the decision to undergo surgery. In addition, we sought to determine the duration of pain relief for hip CSIs, and to identify potential patient-specific predictive factors such as age, gender, BMI, radiographic severity, and duration of symptoms on injection response and subsequent need for operative intervention. We hypothesized that the rate of hip replacement or resurfacing will be greater than 50% within 2 years of injection, with more severe OA correlating with the decision to undergo surgery. In addition, we believed that the duration of pain relief will be negatively correlated with age, female gender, radiographic severity, duration of symptoms, and BMI.

Materials and methods

Following institutional review board approval, we performed a retrospective cohort study of all intraarticular hip CSIs performed for hip OA done under fluoroscopy at a single institution between January 2010 and December 2012, reviewed from patient records. Self-reported pain relief responses following an injection were documented in the electronic medical records at follow-up clinic visits. Response was divided into three groups; no relief, immediate response, and continued response. Immediate response was defined as ≤ 2 weeks of pain relief and continued response was defined as > 2 weeks of pain relief. In total, 78 patients were identified with a total of 82 hip CSIs for hip OA. Hip OA was diagnosed with plain radiography. Patients with hip avascular necrosis or those lost to follow-up after hip injection were excluded. For bilateral hip CSIs, both hips were used for analysis independently. For multiple injections, only the most effective injection was used for analysis.

Information regarding age, gender, duration of symptoms, BMI, Tönnis grade (severity of joint space narrowing based on radiographs), and injection response was collected [11]. Presence of hip resurfacing or replacement for OA performed within 2 years following last injection on the ipsilateral side was also collected. Duration of symptoms was measured from the time of initial hip pain to date of injection. Tönnis grading on preoperative radiographs was performed by four fellowship-trained musculoskeletal radiologists. Mild, moderate, and severe arthritis correlated with Tönnis grade scores of 1, 2, and 3 respectively (Table 1). Tönnis grade was measured using these standard definitions and summarized by Philippon et al. and Troelsen et al. [12, 13].

All intraarticular hip CSIs were performed under the guidance of board-certified, fellowship-trained musculoskeletal radiologists at a single institution. During all injections, the patients were positioned supine with the knee slightly internally rotated. Under fluoroscopic guidance, an anterior approach was used with the target needle tip at the lateral aspect of the femoral head/neck junction. A 22-G spinal needle was used for all injections with the intraarticular position confirmed by injection of 2–3 cc of contrast medium Iohexol (Omnipaque™) 180 or Iothalamate meglumine (Conray®) 60. A total of 1 cc of 80 mg of methylprednisolone and 5 to 10 cc of 0.5% ropivacaine was then injected into the hip joint. This technique followed similar published protocols [7].

Statistical analysis

The relationship between age, gender, BMI, complaint time, and Tönnis grade with respect to injection outcome was assessed using logistic ordinal regression; the relationship of these variables with respect to need for surgical intervention was assessed using logistic nominal regression. Correlation between injection outcome and need for surgical intervention was assessed using logistic nominal regression. Significance was defined as $p < 0.05$. All analyses were performed with SPSS version 21 (Armonk, NY, USA).

Results

There were a total of 82 hip injections in 78 patients, of which 75.6% (59/78) were female (Table 2). Average age at time of injection was 64.4 years (range, 41–94 years old). The average

Table 1 Tönnis grade definition

Grade	Description
0	No signs of OA
1	Mild: increased sclerosis of the head and acetabulum, slight narrowing of the joint space, slight lipping at the joint margins
2	Moderate: small cysts in the head or acetabulum, increasing narrowing of the joint space, moderate loss of sphericity of the head
3	Severe: large cysts in the head of acetabulum, severe narrowing of the joint space, severe deformity of the head, necrosis

Grades 0–3 describe increasing severity of OA

age for females was 64.4 years (range, 41–94 years old) and males 64.6 years (45–88 years old). For injection response, 19.5% showed no relief, 47.6% showed immediate response (≤2 weeks of pain relief), and 32.9% showed continued response (>2 weeks of pain relief) (Fig. 1). There was no significant correlation between injection outcome with age, Tönnis grade, BMI, or duration of symptoms (Table 3). More males obtained immediate or continued relief from hip CSIs than females, 95.0 vs. 74.1% respectively, but this did not reach statistical significance ($p = 0.06$).

Of all the patients, 48.7% (38/78) of patients had hip resurfacing or replacement within 2 years after initial injection for OA. Of those having surgery, 13.2% (5/38) underwent hip resurfacing while 86.8% (33/38) underwent total hip replacement (Fig. 2a–c). There was a significant association between Tönnis grade and surgery ($p = 0.002$), with higher Tönnis grade correlating with the decision to undergo surgery. There was no significant association between age, gender, BMI, duration of symptoms, and injection outcome with decision to undergo hip surgery (Table 3).

Discussion

Hip OA is a degenerative condition of the joint cartilage that may cause stiffness and joint pain. In our study, with regard to duration of pain relief for hip CSIs, our study found close to 70% of patients received less than or equal to 2 weeks of relief suggesting that most hip CSIs responses are short-lived. Similarly, McCabe and colleagues found in a review of five trials that the treatment effect size of hip CSIs was transient and declined as soon as 1-week post-injection [14]. Other studies suggest that injections may provide up to 2 or 3 months of pain relief [2–5]. For example, Qvistgaard et al. found that 56% of patients responded to steroids at 2 weeks compared to Deshmukh et al. who concluded that 71.4% of patients reported pain relief 2 weeks after hip CSIs [4, 15]. In contrast to prior studies, Flanagan et al. found that there was no difference in injection benefit between saline, bupivacaine only, or bupivacaine with triamcinolone [9]. However, patients were biased toward a negative result, as they would be prioritized for hip surgery if pain worsened after an injection. The differences observed in the percentage of patients receiving benefit may be related to the specific population being studied, characteristic of the hip joint such as an atrophic pattern, or phasic nature of OA [4, 5, 16, 17].

In contrast to our initial hypothesis, patient characteristics such as age, Tönnis grade, BMI, gender, and duration of symptoms did not correlate with injection outcome in our study. This finding is consistent with the conclusions of Deshmukh et al. who found that neither gender nor age were independent predictors of pain relief following a hip CSI in a retrospective review of 217 patients [15]. Robinson et al. also found that BMI did not correlate well with hip injection response in a cohort of 120 patients [8]. Similarly in the knee joint, Jones et al. were unable to identify any predictive factors of pain relief following a steroid knee injection, suggesting that injection response is difficult to predict in both the hip and knee [17].

Table 2 Patient characteristics

Variables	*n* (%)
Gender	
Male	19 (24.4)
Female	59 (75.6)
Body mass index (kg/m^2)*	
< 30 (normal to overweight)	55 (72.4)
≥ 30 (obese)	21 (27.6)
Total	78(100)

* Two patients did not have a measured body mass index.

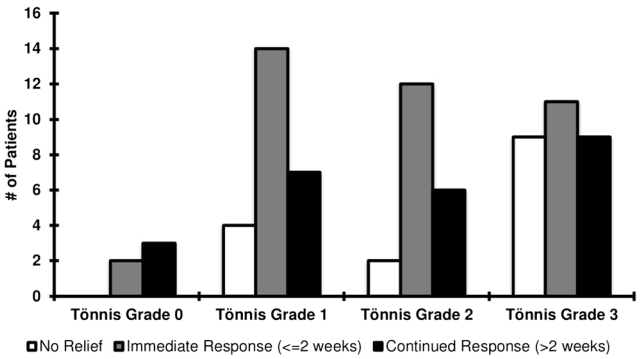

Fig. 1 Relationship between severity of hip OA and injection response

Table 3 Relationship between injection response and surgery to age, gender, BMI, and complaint time

	Age	Male gender	BMI	Duration of symptoms
Injection outcome	$p = 0.70$	$\boldsymbol{p = 0.06}$	$p = 0.34$	$p = 0.55$
Subsequent surgery	$p = 0.40$	$p = 0.99$	$p = 0.85$	$p = 0.45$

BMI body mass index

In our study, more males obtained a pain relief response from intraarticular hip CSIs than females. These differences may be related to increased baseline pain, as Perrot et al. found that women with hip OA at baseline had higher pain ratings then men [18]. Studies found that these gender differences may result from discrepancies in ability to cope with pain and women having greater expression and sensitivity to pain rather than more severe disease [19, 20]. Hip joint mobility may also be a contributing factor. Lewis et al. found that increased hip flexion and adduction in females with CAM-type femoral acetabular impingement may cause a smaller CAM lesion to be more symptomatic than in males [21].

Although the majority of patients receiving no relief fell into the Tönnis grade 3 group (Fig. 1), our study found that radiographic severity does not correlate with steroid injection response. This is in agreement with multiple studies that concluded imaging findings do not correlate with response to hip CSIs [2, 5, 7, 8]. In contrast, a review by Deshmukh et al. found that patients with moderate or severe OA were 2.16 and 3.94 times respectively more likely to experience pain relief compared to patients with mild OA [15]. These differences observed may be attributed to the pattern of arthritis not easily detected on plain radiographs. Plant et al. reported that the atrophic pattern of arthritis may be less responsive to injections when compared to hypertrophic or mixed bone responses [5]. Further, Deshmukh et al. suggested that OA is a phasic disease and related to joint effusion as reported by other studies, which may all contribute to the variability of injection responses [4, 5, 15–17]. Overall, these results suggest that response to intraarticular hip CSIs is difficult to predict based solely on radiographs.

We initially hypothesized that more than 50% of patients would undergo hip replacement or resurfacing within 2 years after their initial injection. The rate of surgery found in our study was just shy of 50%, however the high surgical rate suggests that hip injections do not provide any long-term benefit. One other study in the United Kingdom found that at 42 months after a therapeutic hip injection, 70% of patients went on to have a hip replacement [22]. Studies have shown that earlier referral and surgical intervention, before severe hip pain and functional limitation occurs, improves quality of life and post-operative functional outcome and pain [23–25]. These findings suggest that for many patients, perhaps surgical intervention should be considered much earlier in the disease process.

The study had a number of limitations. First, along with the limitations of a retrospective study, patients lost to follow-up after a hip CSI could not be contacted soon after an injection and thus were excluded from the study. This may serve as a potential source of bias should these patients have a higher predisposition to operative versus nonoperative management than the rest of the cohort. One other study contacted patients 6–8 weeks after an injection, however did not investigate other potential predictive factors for injection relief such as gender, duration of symptoms, BMI, or age [7]. Second, patients with continued pain after hip CSIs may have pain generators

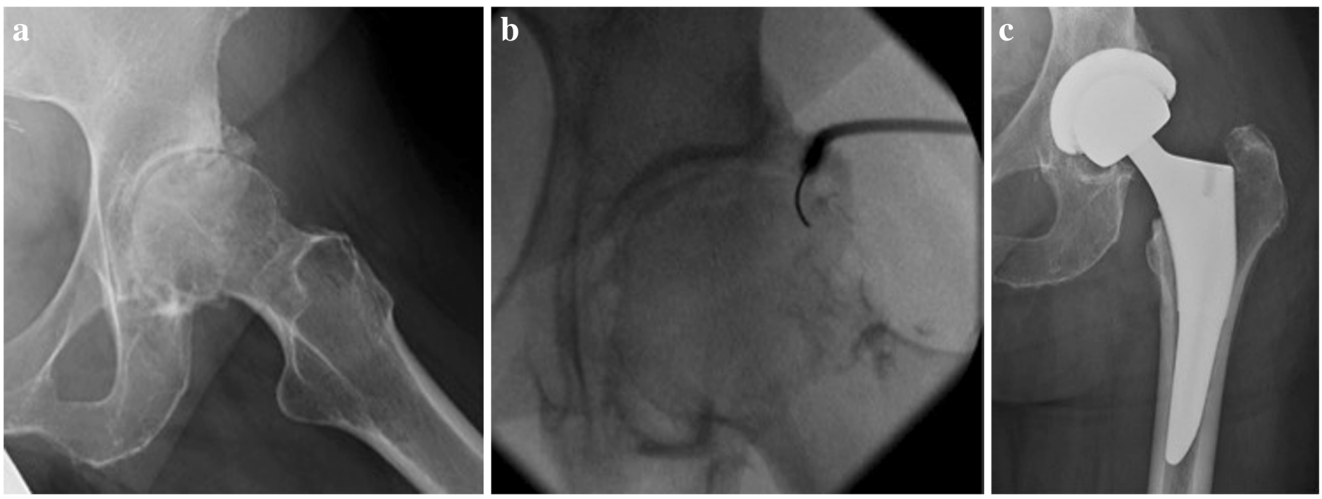

Fig. 2 **a** 71-year-old female with Tönnis grade 2 OA. **b** Injection with moderate response. **c** Total hip replacement occurring < 2 years later

outside of the hip, such as back, SI joints, or spine that may have influenced the injection response for some of our patients. Last, repeated grading of severity of hip OA based on Tönnis grade was not performed, so the intra- and inter-rater reliability between radiologists within our study are not known, though this is likely to be fairly consistent. In another study, the intraobserver and interobserver reliability for Tönnis classification has shown to be good (kappa 0.61 to 0.80) [26].

In conclusion, age, gender, Tönnis grade, BMI, and duration of symptoms to steroid injection did not predict injection outcome. We found that overall, the pain relief gained from intraarticular hip CSIs is short-lived, with close to half of patients eventually undergoing hip surgery within 2 years regardless of injection response. Given these high subsequent surgical rates across all groups, intraarticular hip CSIs may be less effective and physicians should consider surgical management earlier in certain patients who fail to achieve response.

Compliance with ethical standards

Institutional review board approval for this study was obtained. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of interest Each author certifies that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing agreements, etc.) that might pose a conflict of interest in connection with the submitted article.

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