



No Association Between Intrauterine Contraceptive Devices and Musculoskeletal Hip Joint Pain

Nathan H. Varady, M.D., M.B.A., Paul Abraham, M.D., Michael P. Kucharik, B.S., Christopher T. Eberlin, B.S., David Freccero, M.D., Eric L. Smith, M.D., and Scott D. Martin, M.D.

Purpose: To investigate the association between intrauterine device (IUD) use and hip pain, orthopaedic visits for hip pain, and arthroscopic hip surgery. **Methods:** This was a retrospective cohort study of patients aged 18-44 years old using either IUDs or subdermal implants for contraception in a large commercial claims database (MarketScan) from 2012 to 2015. All patients had at least 12 months of continuous enrollment both before and after contraceptive placement. Patients with a history of hip pain or surgery were excluded. The primary outcome was new hip pain. Secondary outcomes included visiting an orthopaedic or sports medicine provider for a hip complaint, intra-articular hip injection, and arthroscopic hip surgery. Outcomes were analyzed with Cox proportional-hazard models. **Results:** We identified a total of 242,383 patients, including 216,541 (89.3%) with IUDs and 25,842 (10.7%) with subdermal contraceptive implants. In time-to-event analysis, IUDs (vs implants) were not associated with increased risk of new hip pain diagnoses (hazard ratio [HR] 0.95, 95% confidence interval [CI] 0.87-1.03, $P = .21$). In contrast, both age ($P < .001$) and region ($P < .001$) were associated with increased risk of new hip pain. Similar results were seen for the secondary outcomes, including risk of orthopaedic visits for hip complaints (HR 1.06, 95% CI 0.83-1.35, $P = .63$), intra-articular injections of the hip (HR 0.94, 95% CI 0.63-1.41, $P = .77$), and hip arthroscopy procedures (HR 1.13, 95% CI 0.53-2.40, $P = .75$). **Conclusions:** In this study, we found no evidence that IUDs were associated with hip pain or surgery. **Level of Evidence:** Level III, retrospective cohort.

The number of patients presenting with hip pain concerning for acetabular labral pathology and/or femoroacetabular impingement is on the rise.¹⁻⁶ While the etiology of these patients' pain often can be ascertained with physical examination and diagnostic imaging, there remains a considerable number of patients for whom the source of symptoms remains unclear.⁷⁻¹³

Moreover, radiologic musculoskeletal abnormalities are present in as many as 50% of asymptomatic, prearthritic individuals.^{10,14-18} Thus, the appropriate correlation of imaging abnormalities and patient symptomatology is a challenge presented to physicians and speaks to the art of clinical medicine.

These challenges can be particularly pronounced among premenopausal women due to the number of gynecologic etiologies that can mimic musculoskeletal disease. For instance, ovarian cysts, pelvic inflammatory disease, pelvic adhesions, leiomyomata, adenomyosis, and endometriosis, among others, can all present similarly to musculoskeletal hip pathology in some patients.^{8,9,19-21} In most cases, these symptoms arise secondary to the pelvic inflammation associated with these conditions.^{12,19,22-24} To avoid unnecessary arthroscopic hip surgery, it is thus critical to identify and/or rule out all possible gynecologic causes of hip pain.

Interestingly, although local pelvic inflammation states are a well-known source of potential hip pain,^{12,19,22-24} intrauterine devices (IUDs), which predominantly feature an inflammatory mechanism of

From the Department of Orthopaedic Surgery, Massachusetts General Hospital/Harvard Medical School (N.H.V., P.A., M.P.K., C.T.E., S.D.M.); Department of Orthopaedic Surgery, Boston Medical Center (D.F.); and Department of Orthopaedic Surgery, New England Baptist Hospital (E.L.S.), Boston, Massachusetts, U.S.A.

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Address correspondence to Michael P. Kucharik, B.S., Department of Orthopaedic Surgery, Massachusetts General Hospital/Harvard Medical School, Boston, MA 02114. E-mail: mikekucharik@gmail.com

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Table 1. Baseline demographic factors overall and between patients with intrauterine devices (IUDs) and subdermal implant contraceptives.

	Contraceptive Type		Total (N = 242,383)	P Value
	IUD (N = 216,541)	Implant (N = 25,842)		
Age				
Mean (SD)	32.1 (6.9)	24.6 (5.8)	31.3 (7.2)	<0.001
18-24	37444 (17.3%)	16298 (63.1%)	53742 (22.2%)	<0.001
25-34	94758 (43.8%)	7523 (29.1%)	102281 (42.2%)	
35-44	84339 (38.9%)	2021 (7.8%)	86360 (35.6%)	
Region				
North Central	51242 (23.7%)	6902 (26.7%)	58144 (24.0%)	<0.001
Northeast	33012 (15.2%)	2359 (9.1%)	35371 (14.6%)	
South	72271 (33.4%)	11148 (43.1%)	83419 (34.4%)	
West	54286 (25.1%)	4643 (18.0%)	58929 (24.3%)	
Unknown	5730 (2.6%)	790 (3.1%)	6520 (2.7%)	
year				
2011	47868 (22.1%)	1661 (6.4%)	49529 (20.4%)	<0.001
2012	55864 (25.8%)	6016 (23.3%)	61880 (25.5%)	
2013	63145 (29.2%)	9025 (34.9%)	72170 (29.8%)	
2014	49664 (22.9%)	9140 (35.4%)	58804 (24.3%)	

SD = standard deviation; y = years

action, are unknown to be a cause for hip pain in some prearthritic women.²⁵⁻²⁷ This question is of particular importance, due to the growing number of women using IUDs as their method of contraception, now the most common form of contraception in the world.²⁸⁻³⁰ In fact, it is possible that some of the increasing burden of hip pain and resultant arthroscopic hip surgery in women could be explained by the rising rates of IUD use. The purpose of this study was to investigate the association between IUD use and hip pain, orthopaedic visits for hip pain, and arthroscopic hip surgery. We hypothesized that patients with IUDs would report greater rates of hip pain and surgery compared with patients with other forms of contraception. Second, we hypothesized that any direct hip or pelvic pain causing effect, if present, may be more pronounced for those with copper IUDs due to their direct inflammatory mechanism of action.^{25,26}

Methods

We used the Truven MarketScan Commercial Claims and Encounters Database from January 1, 2011, to September 30, 2015, for this study. The MarketScan database is a premier commercial-claims database with data from more than 350 unique carriers. The database has several key strengths, including the availability of granular data for all inpatient and outpatient services, longitudinal patient tracking, detailed enrollment files to exclude patients who may have lost/switched insurance coverage and fallen out of the database, and comprehensive outpatient drug information. The database contains more than 250 million unique patients

and had at least 40 million covered individuals each year of the study period.

This was a retrospective cohort study of patients 18-44 years old using either IUDs or subdermal implants for contraception. Subdermal contraceptive implants were chosen as a control group to serve as an active comparator to IUDs, given that they are another highly effective form of long-acting contraception that require a procedure to initiate. However, they are not local to the pelvic region (typically implanted in the arm), and therefore have no direct mechanism of causing hip pain based on location alone. By using a control group with similar indication and patient predilection, we help to minimize unmeasured confounders. For all patients, their most recent contraceptive method was examined, and the date of insertion was considered the index date. All patients had to have at least 12 months of continuous enrollment both before and after contraceptive placement. This was required so that baseline patient factors could be collected over the year before contraception placement, as well as to require at least some amount of time for hip-related outcomes to develop. Critically, any patients with any evidence of hip pain or surgery in the year before contraceptive placement were excluded, as were patients who used both forms of contraception within a year of the index initiation.

Additional demographic factors collected included age, geographic region, contraceptive use history (including previous use of oral contraceptives, implants, and IUDs), year of insertion, and medical comorbidities. To assess the association between IUD placement and

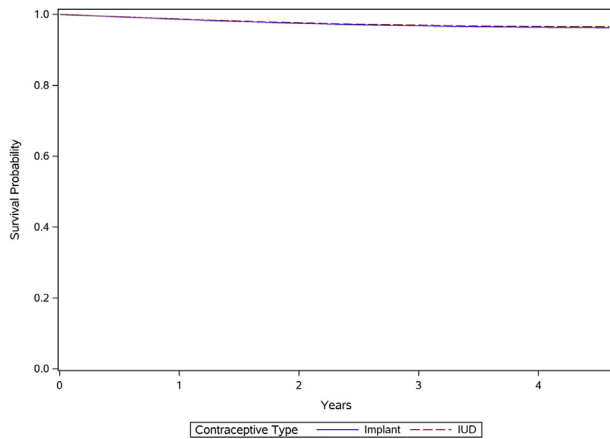


Fig 1. Survival curves for time remaining free of hip pain after insertion of either an intrauterine device (IUD) or subdermal implant for contraception. The appearance of only one curve is due to the substantial overlap in hip pain-free survival between contraceptive methods.

potential spurious musculoskeletal hip issues, we examined 4 outcomes. The primary outcome was the development of hip joint pain. Secondary outcomes included visiting an orthopaedic or sports medicine provider for hip pain, undergoing intra-articular hip injection, and undergoing arthroscopic hip surgery. Patients were followed until the occurrence of each respective outcome or database drop out. In addition, we performed a sensitivity analysis comparing copper versus hormonal IUDs and implants. Although both categories of IUDs (copper and hormonal) primarily work through a foreign body effect, causing a local inflammatory reaction that is toxic to sperm and ova and impairing of implantation,²⁵⁻²⁷ the copper IUD is believed to provide additional contraceptive benefit by increasing the inflammatory response,^{25,26} whereas hormonal IUDs may help thicken cervical mucus resulting in blockage of the upper genital tract.^{25,31} As such, we hypothesized that any direct hip or pelvic pain causing effect, if present, may be more pronounced for those with copper IUDs.

Statistical Analysis

Baseline patient demographic factors were presented as n (%) and mean (standard deviation) and compared with χ^2 or *t* tests, as appropriate. Outcomes were analyzed using a time-to-event approach with Cox-proportional hazard models. In addition to the exposure of interest (contraceptive method), Cox models were adjusted for age, geographic region, and year of insertion. Censoring events are described as mentioned previously. Adjusted survival curves are plotted at the reference levels observed in the data. All statistical analyses were performed in SAS, version 9.4 (SAS Institute, Cary, NC), *P* values were 2-sided, and *P* < .05 was considered significant.

Given this database contains only deidentified, Health Insurance Portability and Accountability Act-compliant information, this study was exempt from institutional review board approval (Partners Protocol #2019P001872).

Results

We identified a total of 242,383 patients, including 216,541 (89.3%) with IUDs and 25,842 (10.7%) with subdermal contraceptive implants. Mean (standard deviation) age across all patients was 31.3 (7.2) years. In general, subdermal implant patients were younger and more likely to live in the South and North Central United States, whereas IUDs were common in the West (Table 1). In addition, the relative use of implants was more common as time progressed. Overall, 7,688 (3.2%) patients experienced hip pain in the follow-up period, 1,175 (0.5%) saw an orthopaedic surgeon or sports medicine specialist for that pain, 427 (0.2%) underwent intra-articular hip injection, and 92 (0.0%) underwent hip arthroscopy.

In time-to-event analysis adjusting for age, geographic region, and calendar year, IUDs (vs implants) were not associated with increased risk of hip pain diagnoses (hazard ratio [HR] 0.95, 95% confidence interval [CI] 0.87-1.03, *P* = .21) (Fig 1). In contrast, increasing age (HR 1.03 per additional year, 95% CI 1.03-1.04, *P* < .001) and region (Northeast vs South: HR 1.26, 95% CI 1.17-1.34, *P* < .001) were associated with risk of hip pain.

Similar results were seen for the secondary outcomes. Specifically, IUDs, relative to subdermal implants, were not associated with increased risk of orthopaedic visits for hip pain (HR 1.06, 95% CI 0.83-1.35, *P* = .63), intra-articular injections of the hip (HR 0.94, 95% CI 0.63-1.41, *P* = .77), or hip arthroscopy procedures (HR 1.13, 95% CI 0.53-2.4, *P* = .75).

In sensitivity analyses comparing copper versus hormonal IUDs and subdermal implants, copper IUDs were associated with a slightly lower risk of hip pain. Specifically, there was lower risk of developing hip pain in patients with copper IUDs versus hormonal IUDs (HR 0.94, 95% CI 0.88-0.999, *P* = .048) and copper IUDs versus subdermal implants (HR 0.90, 95% CI 0.81-0.995, *P* = .04), whereas there was no significant difference in risk of developing hip pain between hormonal IUDs and subdermal implants (HR 0.96, 95% CI 0.88-1.05, *P* = .33).

Discussion

The most important finding of this study was the lack of association between IUDs and hip pain, which was in contrast to our hypothesis. Identifying and ruling out non-musculoskeletal causes of patients' symptoms is critical to avoiding unnecessary orthopaedic surgery. While there are many gynecologic pathologies that can

occasionally present with symptoms consistent with musculoskeletal hip pain, whether contraceptive IUDs are associated with this clinical presentation was unknown. In this study, we found no evidence that IUDs are associated with hip pain or surgery compared with another common implantable contraceptive method.

Specifically, we found no difference in rates of hip arthroscopy, intra-articular hip injections, visits with orthopaedic or sports medicine providers for hip complaints, or any hip pain diagnoses, when compared with an implant control group. We chose patients with contraceptive implants as our control group because, like IUDs, contraceptive implants are implantable long-acting contraceptive devices but not local to the pelvic region and would therefore have no direct mechanism of causing a local inflammatory reaction that could lead to hip pain. Despite disproving our initial hypothesis, the aforementioned findings are useful to both the orthopaedic surgeon and gynecologist in their evaluation of hip pain of unknown etiology in premenopausal women. Moreover, we found that increasing age and region were significantly associated with risk of hip pain. Increasing age and its association with hip pain is unsurprising, as increased age has been shown to be associated with an increased incidence of osteoarthritis.³²⁻³⁴ As for regional bias, the Northeast region was associated with increased risk of hip pain, which is likely due to access of health care.^{35,36}

To explore potential hormonal/systemic effects, we then compared copper IUDs with hormonal IUDs and hormonal subdermal implants. Interestingly, in this analysis, we found a very small reduction in risk of hip pain for copper IUDs compared with the hormonal contraceptive methods. Multiple possibilities could explain these results, including treatment decisions or the hormonal effects themselves. For instance, while all patients had no hip pain for at least a year before the initiation date, it is possible that a small fraction of patients received hormonal rather than copper IUDs specifically due to their ability to treat other conditions that may be associated with hip pain (e.g., endometriosis^{19,22}). Alternatively, previous work has shown that hormonal contraception can be associated with pelvic girdle pain,^{37,38} which could be presenting as hip pain for a small number of patients. Consistent with this possibility, we found no difference in risk of hip pain between subdermal implants and hormonal IUDs (i.e., hormonal vs hormonal), while copper IUDs had significantly lower risk of hip pain compared with each of the hormonal methods. While the effect sizes are small, and these findings appear to be unrelated to the IUDs themselves, future work should continue to investigate the role (if any) of hormonal influences in the development of musculoskeletal pain.³⁹⁻⁴¹ While evidence directly linking hormonal contraceptives with musculoskeletal pain is limited, several studies have

shown a possible correlation between hormonal fluctuations and development of pain.³⁹⁻⁴¹

Anecdotally, we had seen many young women with IUDs and symptoms highly consistent with acetabular labral pathology in our high-volume hip arthroscopy practice who went on to have unimpressive magnetic resonance imaging and/or arthroscopic findings. Given the well-established mechanisms of all IUDs to work by causing a local pelvic inflammatory state,²⁵⁻²⁷ it was highly plausible that IUDs may have been playing a role in some of these symptoms. Nevertheless, the finding that there was no association between IUDs and hip pain in this large, national sample is encouraging because it suggests that many young women are not receiving unnecessary arthroscopic hip surgery related to their contraceptive device.

Although IUDs do not appear to be a major contributor to hip pain, improving our diagnostic techniques and identifying potentially new etiologies of disease remains a vitally important task, particularly in young, active women, who suffer from both chronic pelvic pain and chronic hip pain syndromes in high rates.⁹ Since both of these syndromes have highly variable clinical presentations,⁹ it is important for orthopaedic specialists to rule out gynecologic causes of pain and for gynecologic specialists to rule out musculoskeletal causes of pain in this patient population. Nevertheless, anecdotally, many patients without classic presentations for either condition and unimpressive orthopaedic and gynecologic imaging continue to report to orthopaedic specialists with hip pain. This highlights the need for more research on clinical mimickers of hip pain, which has been noted to be a challenging diagnosis for orthopaedic surgeons, primary care physicians, and gynecologists alike.⁴²⁻⁴⁴

Arthroscopic hip surgery and IUDs are both becoming increasingly common. To avoid surgery that may ultimately prove unbeneficial to the patient, ruling out alternative etiologies of hip pain is paramount. While many gynecologic pathologies have the potential to imitate musculoskeletal symptoms in select patients, IUDs do not appear to be a major risk of false-positive musculoskeletal hip pain. Moving forward, IUD-related symptomology may not need to be a major consideration in the differential diagnosis of hip joint pain.

Limitations

There are many aspects of the MarketScan database that make it an excellent method for studying this question: a very large, national sample to study the relatively rare outcome of hip arthroscopy; longitudinal tracking of patients with detailed records of all contraceptive methods; and a sample of commercially insured individuals, under which most women of childbearing age fall. Still, this study is not without limitations. First,

it is a retrospective, observational study and subject to all limitations therein, including the possibility of uncontrolled confounders. However, by using an active comparator of similar indication, adjusted analyses, and an array of sensitivity analyses, the likelihood of our results being due to confounding is lessened. To address potential bias, we attempted to minimize selection bias by implementing a control group with similar indications without a mechanism for direct hip pain. However, it is always possible that differences between patients in both groups may confound results with unforeseen selection bias. Moreover, as with almost all databases, we were unable to review any written history or physical exam information, which would have been another way to mitigate selection bias. Next, we were focused only on potentially idiopathic hip pain that providers may have suspected to be of musculoskeletal nature. This study did not assess the relative safety of IUDs versus implants across all outcomes, and it is possible there may be differences in infection rates or other complications between approaches. Nevertheless, any such complications do not appear to mimic musculoskeletal pathology, which was the focus of the current work. Finally, due to incomparability of initiation dates and the inability to determine pill consumption, this study could not analyze oral contraceptives, which may be able to be investigated in future institutional studies.

Conclusions

In this study, we found no evidence that IUDs were associated with hip pain or surgery.

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