Unnecessary interventions for the management of hip osteoarthritis: a population-based cohort study

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Background: Patients aged 40–60 years who require total hip arthroplasty (THA) often first receive unindicated hip arthroscopy or magnetic resonance imaging (MRI). Our objective was to identify potentially inappropriate resource utilization before THA, specifically reporting on the proportion of patients aged 40–60 years who underwent hip arthroscopy or MRI in the year before THA.

Methods: We conducted a retrospective, population-based study at the provincial level. We retrieved data from the Canadian Institute for Health Information (CIHI). We included all Ontario residents who underwent an elective, primary THA for osteoarthritis between Apr. 1, 2004, and Mar. 31, 2016. We identified the rates and timing of patients who underwent an MRI or hip arthroscopy before their index THA.

Results: The percentage of patients who underwent an MRI before THA increased significantly over the study period, from 8.7% in 2004 to 23.8% in 2015. There was also a significant but variable trend in the percentage of patients who underwent a hip arthroscopy before THA.

Conclusion: Our results demonstrate a high, gradually increasing proportion of patients who received a hip MRI and a low but increasing proportion of patients who received hip arthroscopy in close proximity to THA. Multidisciplinary collaboration may improve knowledge translation and help reduce the rate of clinically unnecessary diagnostic and therapeutic interventions in this population of patients who require THA.

Contexte : Les patients de 40–60 ans qui doivent subir une chirurgie pour prothèse totale de la hanche (PTH) commencent souvent par être soumis à une arthroscopie ou une épreuve d'imagerie par résonance magnétique (IRM) non indiquées. Notre objectif était d'identifier les cas potentiels d'utilisation inappropriée des ressources avant la PTH, en faisant le point plus précisément sur la proportion de personnes de 40–60 ans ayant subi une arthroscopie ou une IRM de la hanche durant l'année précédant leur PTH.

Méthodes : Nous avons réalisé une étude de population rétrospective à l'échelle provinciale. Nos données proviennent de l'Institut canadien d'information sur la santé (ICIS). Nous avons inclus les cas de PTH primaire élective pour arthrose en Ontario entre le 1er avril 2004 et le 31 mars 2016. Nous avons établi le nombre de patients et patientes ayant subi une arthroscopie ou une IRM de la hanche avant leur PTH initiale et à quel moment elles ont eu lieu.

Résultats : Le pourcentage de patients et patientes ayant subi une IRM avant leur PTH a significativement augmenté au cours de la période de l'étude, passant de 8,7 % en 2004 à 23,8 % en 2015. On a également noté une tendance significative mais variable en ce qui concerne le pourcentage de personnes ayant subi une arthroscopie de la hanche avant leur PTH.

Conclusion : Nos résultats montrent une proportion élevée et graduellement croissante de personnes ayant subi une IRM de la hanche, et une proportion faible mais croissante de personnes soumis à une arthroscopie de la hanche peu de temps avant leur PTH. Une collaboration multidisciplinaire pourrait améliorer l'application des connaissances et contribuer à réduire le taux d'interventions diagnostiques et thérapeutiques superflues chez cette population de personnes qui doivent subir une PTH.

By the year 2026, it is estimated that more than 6 million people in Canada will have osteoarthritis (OA). In Ontario, the average personal productivity loss attributable to this disease is $11 553 per person per year.[1] Total hip arthroplasty (THA) is the gold-standard treatment for advanced OA. The annual demand for THA is expected to increase substantially, secondary to a rapidly growing population of older adults.[2,3] This operation represents a large economic expenditure in Canadian health care systems, which will continually increase proportionally with demand.[2]

Historically, performing THA in younger patients was avoided given high rates of early revisions and poor survivorship of earlier-generation THA implants.[4,5] However, with advances in THA materials and expectations that implants may have significantly better durability based on preliminary midterm outcome studies, THA is now seen as a viable option for this younger demographic. In fact, people in their fourth and fifth decades are projected to be the fastest growing demographic in both primary and revision THA, further contributing to increased demand for these procedures.[6]

However, the knowledge translation surrounding arthroplasty in for patients aged 40–60 years remains limited.[7] The historical perspective that these patients are not eligible for THA is often inappropriately applied to this population, resulting in extended courses of physiotherapy, use of oral analgesic agents, and serial intra-articular injections. In addition, these patients are often worked up and referred as potential candidates for arthroscopy as a temporizing procedure until they are thought to be eligible for THA. However, clinical studies have identified that the collective results of arthroscopy are poor in the presence of concomitant arthritis, although the knowledge translation around this message has also been poor. Inferior outcomes, as well as conversion to THA, have been reported following arthroscopy in patients with radiological evidence of advanced OA and increased age.[8–14] Consequently, resource utilization before arthroplasty remains disorganized and often contrary to established guidelines, leading to unnecessary expenditures.

Additional expenditures are also noted around the use of diagnostic imaging. In the knee, frequent use of magnetic resonance imaging (MRI) before total knee arthroplasty (TKA) has been shown to be an issue whereby many patients often present to an orthopedic surgeon with advanced cross-sectional imaging when cheaper and easily accessible plain radiographs would be sufficient.[15,16] We hypothesize that a similar resource utilization pattern is occurring in the hip. The proportion of patients managed with unindicated hip arthroscopy or MRI before undergoing surgery, and the proximity of these interventions to THA, is currently unknown at a population level. Therefore, the objective of this study was to identify potentially inappropriate resource utilization before THA, specifically reporting on the proportion of patients aged 40–60 years who underwent hip arthroscopy or MRI in the year before THA.

Methods

We conducted a retrospective, population-based cohort study using routinely collected administrative data sets held at ICES (www.ices.on.ca). We retrieved data from the Canadian Institute for Health Information (CIHI) including the Same-Day Discharge (SDS) and Discharge Abstract Database (DAD). We included all Ontario residents who underwent an elective, primary THA for OA between Apr. 1, 2004, and Mar. 31, 2016. We excluded patients younger than 40 years or older than 60 years at the time of THA, non-Ontario residents, those who had undergone a previous THA, and those with missing age, sex, or laterality data. Codes used to identify the initial cohort, study procedures, and data sets used in the current study are provided (Appendix 1, available at www.canjsurg.ca/lookup/doi/10.1503/cjs.001624/tab-related-content).

Baseline variables included age, sex, and Charlson Comorbidity Index score using a 2-year lookback period before the primary THA. We also recorded medical comorbidities including congestive heart failure (CHF), myocardial infarction, hypertension, diabetes, rheumatoid arthritis, and OA (recorded on index hospital record).

Data sources

Routinely collected health data from across Ontario is housed at ICES in a secure, coded form. All residents with access to publicly funded health care and insured services are recorded. Specifically for this study, data were retrieved from the Ontario Health Insurance Plan (OHIP), National Ambulatory Care Reporting System (NACRS), and CIHI's SDS and DAD. We used several ICES-derived cohort databases to capture comorbidities. Individual patient records across these data sets are linked using unique encoded identification numbers.

Procedures

We identified the rate and timing of patients who underwent an MRI or hip arthroscopy within 2 years before their index THA. We identified MRI and hip arthroscopy using OHIP physician billing codes, DAD, and SDS.

Statistical analysis

We reported baseline patient characteristics of the cohort using means (with standard deviations [SDs]), medians (with interquartile ranges [IQRs]), or proportions, where

appropriate. We used descriptive statistics to describe the number of MRIs and hip arthroscopies performed per year over the study period, as well as the timing of each outcome in relation to THA. We used the Cochrane–Armitage trend test to assess changes over time in the proportion of patients who received an MRI or hip arthroscopy before THA. We used logistic regression analysis to investigate predictors of MRI and hip arthroscopy. Patient age and sex were used as covariates. Values representing 5 or fewer patients were suppressed because of ICES privacy requirements. For all analyses, reported p values were from 2-tailed tests, where a value of less than 0.05 was considered statistically significant. We performed all analyses using SAS EG version 7.15 (SAS Institute).

Ethics approval

As ICES is a prescribed entity under section 45 of Ontario's *Personal Health Information Protection Act*, we did not require research ethics board approval or individual patient consent for this study.

Results

Our inclusion criteria identified 136 772 patients who underwent THA during the study window. Of these, 108 358 were excluded, leaving 28 414 patients in the study cohort (Figure 1). The mean age of patients was 53.47 (SD 5.15) years and 45.1% were female. In our cohort, 92.7% of patients had a diagnosis of OA on their index record. Patient demographics are summarized in Table 1 and Table 2.

Magnetic resonance imaging

Overall, 19.0% (n = 5405) of our cohort underwent a pelvic MRI before their THA. The median time from MRI to THA was 268 (IQR 143–441) days. Patient demographics are presented in Table 1. Eighty-eight percent of patients who underwent an MRI had an OA diagnostic code for their index THA procedure. The percentage of patients who had received an MRI in the previous year almost tripled over the study period, from 8.7% in 2004 to 23.8% in 2015 (p < 0.0001; Figure 2). Older patients were less likely to undergo MRI (odds ratio [OR] 0.957, 95% confidence interval [CI] 0.951–0.962) before THA. Furthermore, female sex was predictive of undergoing MRI before THA (OR 1.239, 95% CI 1.166–1.316).

Hip arthroscopy

In total, 136 patients (0.5%) underwent hip arthroscopy before their THA. The median time from hip arthroscopy to THA was 430.5 (IQR 290.5–549.0) days. Patient demographics are presented in Table 2. There was a statistically significant but variable trend in the percentage of patients who underwent hip arthroscopy before THA over the study period, from 0.31% in 2004 to 0.52% in 2015 (p = 0.02; Figure 2). Older patients were less likely to undergo hip arthroscopy (OR 0.86, 95% CI 0.835–0.886). Finally, female sex was predictive of undergoing hip arthroscopy before THA (OR 1.424, 95% CI 1.015–1.997).

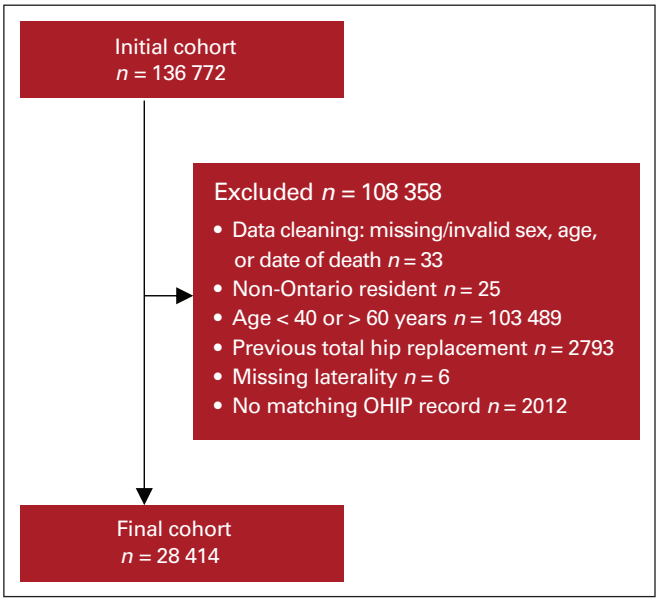

Fig. 1. Flow chart. See Related Content tab for accessible version.

Table 1. Patient demographics in MRI cohort

Characteristic	No. (%) of patients: No previous MRI n = 23 009	No. (%) of patients: Previous MRI n = 5405	p value
Age, yr, mean ± SD	53.66 ± 5.09	52.67 ± 5.32	< 0.001
Sex, female	10 182 (44.3)	2620 (48.5)	< 0.001
Income quintile†			
Q1 (lowest)	3643 (15.8)	799 (14.8)	0.009
Q2	4093 (17.8)	922 (17.1)	
Q3	4341 (18.9)	1040 (19.2)	
Q4	5091 (22.1)	1179 (21.8)	
Q5 (highest)	5746 (25.0)	1453 (26.9)	
Charlson Comorbidity Index, mean ± SD	0.15 ± 0.66	0.22 ± 0.86	< 0.001
Comorbidities			
Congestive heart failure	342 (1.5)	67 (1.2)	0.2
Hypertension	9317 (40.5)	2017 (37.3)	< 0.001
Diabetes	2642 (11.5)	522 (9.7)	< 0.001
Myocardial infarction	381 (1.7)	81 (1.5)	0.4
Rheumatoid arthritis	810 (3.5)	234 (4.3)	0.004
Osteoarthritis	21 562 (93.7)	4785 (88.5)	< 0.001

MRI = magnetic resonance imaging; SD = standard deviation.
*Unless indicated otherwise.
†Missing income quintile data for 107 (0.4%) patients.

Table 2: Patient demographics in arthroscopy cohort

Characteristic	No. (%) of patients: No previous arthroscopy *n* = 28278	No. (%) of patients: Previous arthroscopy *n* = 136	*p* value
Age, yr, mean ± SD	53.49 ± 5.14	48.87 ± 5.47	< 0.001
Sex, female	12 733 (45.0)	69 (50.7)	0.2
Income quintile†			
Q1 (lowest)	4421 (15.6)	21 (15.4)	0.5
Q2	4993 (17.7)	22 (16.2)	
Q3	5359 (19.0)	22 (16.2)	
Q4	6231 (22.0)	39 (28.7)	
Q5 (highest)	7167 (25.3)	32 (23.5)	
Charlson Comorbidity Index	0.16 ± 0.71	0.15 ± 0.57	0.9
Comorbidities			
Congestive heart failure	409 (1.4)	0 (0.0)	0.2
Hypertension	11302 (40.0)	32 (23.5)	< 0.001
Diabetes	3156 (11.2)	8 (5.9)	0.05
Myocardial infarction‡	≤ 470	≤ 5	0.4
Rheumatoid arthritis	1037 (3.7)	7 (5.1)	0.4
Osteoarthritis	26223 (92.7)	124 (91.2)	0.5

SD = standard deviation.

*Unless indicated otherwise.

†Missing income quintile data for 107 (0.4%) patients.

‡Exact values suppressed because of privacy requirements.

Discussion

The prevalence of hip OA and subsequent demand for THA is growing exponentially among younger adults, with a subsequently increased economic burden. Therefore, it is of utmost importance to identify if non-value-based interventions are being performed before the operation, which could exacerbate health care expenditures. We found that an increasing proportion of patients underwent an MRI before their eventual THA during our study period. Furthermore, there was a variable increasing trend in the proportion of patients who underwent hip arthroscopy before THA.

Although we identified a high rate of MRI utilization in our patient cohort, conventional radiographs of the hip remain the first-line imaging modality for monitoring the osseous changes of OA and abnormal femoral head morphology.[17] With mild radiographic evidence of OA, MRI is often not required as the pre-test probability of a labral tear and chondral wear is known to be high. Of note, most (88.5%) of our patient cohort who underwent an MRI had an OA diagnostic code for their index THA procedure, which occurred within 2 years of their MRI. Therefore, we assume a large proportion of our cohort likely had a diagnosis of OA before undergoing MRI or hip arthroscopy.

In their analysis of administrative records from a large American database, Bonazza and colleagues[18] illustrated that hip arthroscopy and MRI use were correlated and that

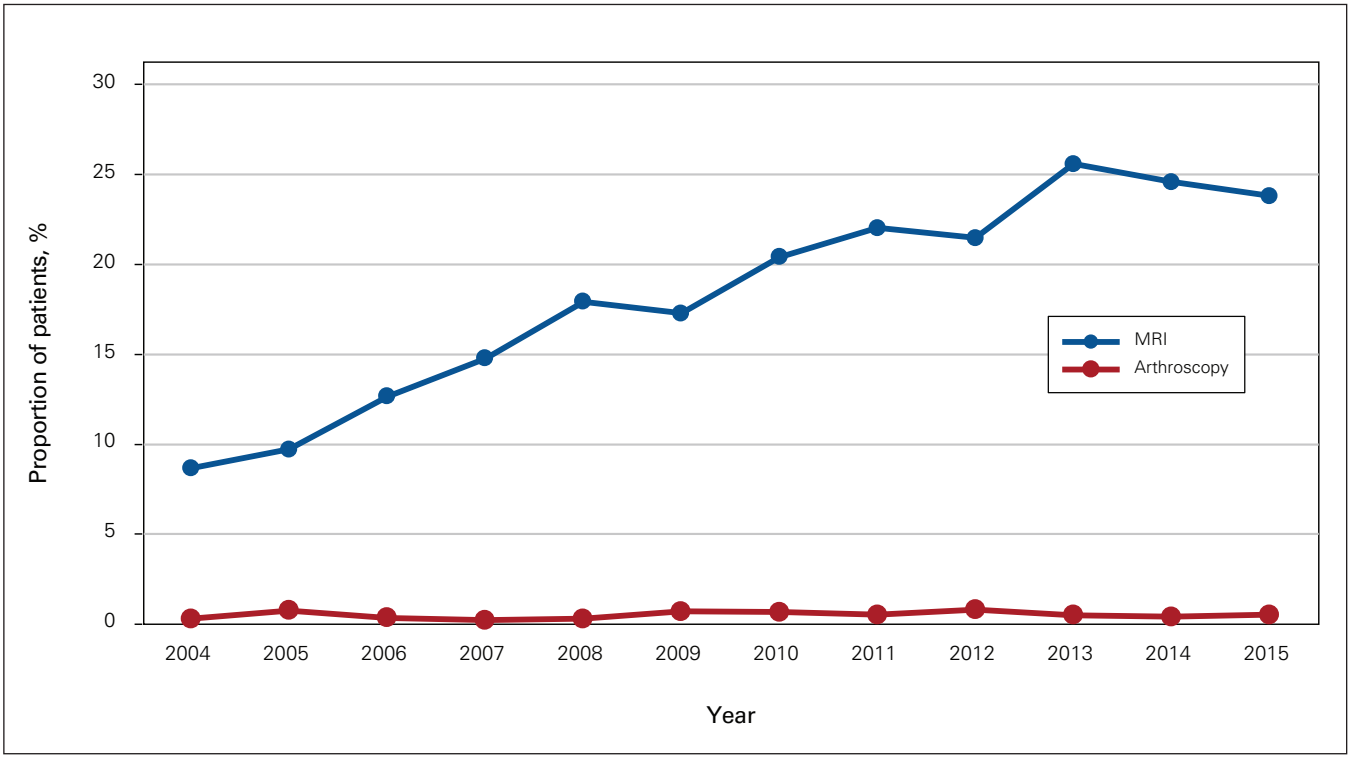

Fig. 2. Proportion of patients who received magnetic resonance imaging (MRI) or hip arthroscopy by fiscal year. Values representing 5 or fewer patients are suppressed because of privacy requirements; the proportion of patients who underwent arthroscopy ranged from 0 to the reported values for years 2004, 2005, and 2007.

the rate of hip arthroscopy tripled from 2008 through 2013. Furthermore, Sing and colleagues[19] looked at private-payer claims in the United States and found that the incidence of hip arthroscopy increased by 250% from 2007 to 2011. Clinicians may postulate that diagnosing a labral tear by ordering MRIs makes a patient eligible for hip arthroscopy. However, a labral tear with concomitant OA will likely not benefit from hip arthroscopy (similar to the knee, where patients with degenerative meniscal tears and OA do not benefit from knee arthroscopy).[9,12,20–22] Overall, MRI can incur further wait times for specialist consultation and impede access to MRI for patients with pathology more appropriate for this type of imaging. A similar finding was noted in the knee, with a recent study by Marsh and colleagues[15] identifying a similar pattern of MRI use in the knee before TKA in Ontario. They found that 23.2% (n = 32 989) of their patient cohort had an MRI in the 3 years before their TKA, a proportion that increased significantly each year, from 13.5% in 2007 to 26.5% in 2016.

The demographics of patients who received an MRI indicate that they were a slightly healthier cohort with lower proportions of diabetes and hypertension than the non-MRI group. They may have been considered suitable candidates for possible hip arthroscopy by the ordering physician, despite the presence of other negative prognostic variables. Fortunately, we did not find many patients with serious comorbidities, namely diabetes and hypertension, who were treated with hip arthroscopy, with only 8% and 32% of the arthroscopy group with these comorbidities, respectively. With a mean age of 52 years in the MRI group, hip arthroscopy would likely have been associated with inferior outcomes; similar negative postoperative outcomes would be expected among those who underwent hip arthroscopy, with an identified mean age of around 49 years.[13,20,23–27] Frank and colleagues[23] demonstrated age as a negative predictor following hip arthroscopy, showing that female and male patients older than 45 years scored significantly worse on postoperative patient-reported outcomes than those younger than 30 years. A systematic review of around 10 000 patients aged 40 years or older reinforced this point, showing that the rate of conversion to THA was 18.1% for patients aged 40 years or older and 23.1% for patients older than 50 years.[28] Some clinicians may be aware of this literature, as our logistic analysis showed that older patients were less likely to undergo MRI imaging or hip arthroscopy.

It appears the most significant finding of this study relates to knowledge translation around the role of arthroscopy in this patient population. We demonstrated high rates of MRI (19%) and low rates of subsequent hip arthroscopy (0.5%) in our population, which may suggest discordance between the providers who order the imaging and the surgeons performing hip arthroscopy in Ontario. With the advent of hip arthroscopy, there has been an overvalued importance placed on identifying labral tears, with the false perception that this makes patients good candidates for hip arthroscopy. This is reflected in the continually increasing rates of MRI observed in the years before eventual THA. It appears that the poor postoperative outcomes observed following arthroscopy in older patients with concomitant OA, regardless of labral integrity, are not widely known among referring physicians.[29] Further research should focus on identifying who is ordering unnecessary MRIs. Multidisciplinary collaboration and knowledge translation between care providers — including primary care physicians, surgeons, and radiologists — may be needed to lessen the use of MRI for these patients, much like the measures taken to reduce unnecessary knee MRIs. An additional focus is the potential benefit of early definitive THA to reduce societal costs associated with arthroscopy in patients with concomitant OA.[30] The performance of MRI with subsequent hip arthroscopy is costly. Resultant expenditures are further increased in the presence of pre-existing OA.[31]

Limitations

Our study is limited by potential inaccuracies in documentation and coding inherent to administrative databases. Furthermore, we were unable to determine if patients who had an MRI ordered had an existing diagnosis of OA. It is possible some patients had MRIs of their hips for reasons not related to OA. Instead, most of our patients had a diagnosis of OA on their index record, suggesting this was their indication for surgery. Given the large number of patients with a diagnosis of OA, it is plausible to assume that MRI and resultant arthroscopy for a large number of our cohort is not backed by evidence-based guidelines. Additional studies using prospective primary data collection from patients rather than administrative data are required to determine a more precise estimate of the rates of MRI and hip arthroscopy before THA.

Conclusion

Our results demonstrate that a high, gradually increasing proportion of people receive a hip MRI in close proximity to undergoing THA. We also demonstrated a low, but increasing proportion of people undergoing a THA who have evidence of a previous hip arthroscopy. Further research and multidisciplinary collaboration may improve knowledge translation and help reduce the rate of clinically unnecessary diagnostic and therapeutic interventions in this population of patients who will ultimately undergo THA.

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