Pre-existing osteoarthritis remains a key feature of arthroscopy patients who convert to total hip arthroplasty

Renuka M Vesey ,[1,2] Catherine J Bacon,[1,2] Matthew J Brick[2]

[1]Faculty of Medical and Health Sciences, The University of Auckland, Auckland, New Zealand
[2]Orthosports North Harbour Ltd., Millennium Institute of Sport and Health, Auckland, New Zealand

Correspondence to
Renuka M Vesey, Faculty of Medical and Health Sciences, The University of Auckland, Auckland 1010, New Zealand; research@orthosports.co.nz

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ABSTRACT

Objectives To determine the rate of conversion to total hip arthroplasty following ipsilateral hip arthroscopy by a single surgeon in New Zealand and to describe patient-related and surgical characteristics of patients who converted.

Methods A retrospective cohort analysis of hip arthroscopy patients with 2 years of minimum follow-up identified the total hip arthroplasty conversion rate using the New Zealand National Joint Registry. Prospective data collected from patients who subsequently converted to hip arthroplasty included: sex, age at arthroscopy, body mass index, side of hip arthroscopy and arthroplasty, duration of symptoms and patient-reported outcome measures. Imaging (Tönnis grade and lateral centre-edge angle) and surgical findings (labral, ligamentum teres and osteochondral pathology) along with the arthroscopic procedures performed were also documented.

Results Sixty-six out of 1856 (3.56%) primary hip arthroscopies were followed by an ipsilateral hip arthroplasty during the follow-up period (mean 87±29 months). Most patients had pre-existing osteoarthritis and/or chondral lesions (n=51). Dysplasia and over-resection of the acetabulum were also identified as contributing factors.

Conclusion Conversion rate by a high-volume surgeon in New Zealand was relatively low. Most patients had pre-existing osteoarthritis and/or chondral lesions that became apparent at arthroscopy. Dysplasia is also a factor to be cautious of when selecting patients for arthroscopy. Acetabular resection must be approached cautiously.

Level of evidence Level IV.

What are the new findings?

- Total hip arthroscopy conversion rate in New Zealand following arthroscopy by a single, high-volume surgeon is 3.56%.
- Most patients who converted had pre-existing osteoarthritis or chondral lesions.
- Half of the conversion patients who responded would do the arthroscopy again if needed on a different joint.

INTRODUCTION

End-point failure data for procedures such as anterior cruciate ligament (ACL) reconstruction and shoulder stabilisation are well recognised, with ACL graft rupture and shoulder redislocation respectively used as measures of the success and durability of these procedures. Hip arthroscopy is a much newer procedure and appropriate incidence of end-point failure data has not yet been established. There are many ways to categorise failure including conversion to total hip arthroplasty (THA), revision hip arthroscopy and patient-reported outcome measures (PROMs) such as patient satisfaction, improvement in symptoms and quality of life. Conversion to THA is often described in the literature; however, this endpoint has varying rates from 1% to 10%.[1 2]

In many cases, conversion to THA occurs within 18 months.[1] For these patients, hip arthroscopy constitutes extra pain, disability, cost and time off work as well as the potential to complicate further surgery.[3 4] Although an ideal conversion to THA would be zero, it is recognised that this is unlikely. However, an acceptable rate of conversion at 2 years, or 5 years, has not been established. Also, the satisfaction of patients who have converted to THA before 2 or 5 years is yet to be determined.

There are a number of risk factors which have been identified for conversion to THA. Patient-related factors contributing to failure include pre-existing chondral damage, osteoarthrosis, dysplasia, obesity, older age and female sex.[2 5–7] Surgery-related factors include under-resection of osseous deformity, over-resection of either femoral or acetabular side, capsular mismanagement and lower surgical volume.[8–10]

This study is unique in that it is a large single surgeon series within a country that has a compulsory national joint registry. This allows capture of every patient who converts to THA as travelling overseas for surgery in this country is extremely rare. The purpose of this study is to (1) determine the rate of conversion to THA after hip arthroscopy and (2) describe patient-related and arthroscopic characteristics of those who converted to THA.

METHODS

Patient selection

This study was a retrospective cohort analysis evaluating patients who converted to THA after hip arthroscopy, with a minimum follow-up time of 2 years. The prospective database of the senior author (MJB) was queried to identify all primary hip arthroscopies performed between 1 June 2005 and 3 August 2018. All patients who underwent primary hip arthroscopy for symptomatic intra-articular hip disorders and failed non-operative treatment were included in the study. Patients

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who converted to THA were identified by providing all unique National Health Index numbers to the New Zealand National Joint Registry. Patients were excluded if they had previous hip conditions such as osteonecrosis, Legg-Calve-Perthes disease, slipped capital femoral epiphysis, inflammatory arthritis or a hip fracture requiring fixation.

Surgical technique

All hip arthroscopies were performed with the patient under general anaesthesia in the lateral position using a McCarthy hip distractor (Innomed). Intraoperative findings and interventions in the central then peripheral compartments were recorded. Small anterior acetabuloplasty was performed for focal anterior overcoverage (rim trim). A more general acetabuloplasty was performed for lateral centre-edge angle (LCEA) >39°. Cartilage lesions were either debrided or microfractured, depending on the lesion size and type, and the date of surgery with a tendency to reduce use of microfracture after 2012. A femoral osteoplasty was performed for offset <8 mm or evidence of intra-articular deformation of the labrum with the flexion-adduction-internal rotation (FADIR) impingement test. The amount of resection was determined by the magnitude of the femoral cam deformity. The goal was to obtain a 'light bulb' shaped head–neck junction on multiple radiographic views and a negative FADIR. Objective goals were an alpha angle <50° and offset of >8–10 mm. Labral lesions were debrided, repaired or reconstructed with autograft iliotibial band (ITB) depending on the size and condition of the labrum. The interportal capsulotomy was partly repaired in stable patients, fully repaired in patients with borderline dysplasia and plicated in unstable patients: partial capsular repair involved two sutures closing 60% of the anterior capsulotomy; full capsular repair required three or four sutures to close the capsulotomy completely; capsule plication entailed removal of 2–3 mm of the lateral side of the capsulotomy using the radiofrequency wand then complete closure with asymmetric sutures, tightening the iliofemoral ligament portion of the capsule. Postoperative rehabilitation included a minimum of 2 weeks of partial weightbearing with crutches, increasing to 6 weeks for microfracture patients, patients with borderline dysplasia and instability patients. Early active motion was begun on postoperation day 1 with pendulum and circumduction exercises followed soon thereafter with a stationary cycle.

Measures

Body mass index (BMI) was calculated from height and weight at surgery, and classified based on internationally recognised cut-offs (>18.5 kg/m^2, underweight; 18.5 to <25 kg/m^2, normal; 25.0 to <30 kg/m^2, overweight; >30.0 kg/m^2, obese). Patients' duration of symptoms until surgery and the side that hip arthroscopy was performed was recorded in their clinical notes. Imaging findings included preoperative and postoperative LCEA described by Wiberg and Tönnis classification. LCEA was used to define frank dysplasia (LCEA <20°) and borderline dysplasia (LCEA 20°–25°). All measurements were taken by the same orthopaedic surgeon using a picture archiving and communication system computer program. Surgical findings: labral pathology was defined as full tear, partial tear, degenerative and/or unstable; ligamentum teres pathology was defined as degenerative, hypertrophy partial tear and/or ruptured; the International Cartilage Repair Society (ICRS) grade was used to describe chondral damage at the femoral head, acetabular rim and acetabular cartilage with pre-existing osteoarthritis was defined as widespread ≥grade 2 ICRS on the femoral head and/or acetabulum.[11] Iatrogenic acetabular over-resection was defined as a postoperative LCEA <25° or a reduction of the preoperative LCEA of ≥15°. Capsular mismanagement was defined as either failure to close capsulotomy completely or plicate the capsule in a patient with borderline dysplasia or hyperlaxity (Beighton's score >4/9).

Patients completed PROMs before and 6 months after arthroscopy. These PROMs included the international Hip Outcome Tool 12,[12] the Non-Arthritic Hip Score[13] and the Western Ontario and McMaster Universities Arthritis Index.[14] Postoperatively, patients were also asked 'Would you have the operation/treatment again if needed on another joint?' with options: definitely yes, probably yes, possibly not and definitely not.

Statistical analyses were undertaken using Microsoft Excel and IBM SPSS Statistics (V.26). Variables were checked for violation of assumptions of normality by visual inspection of distribution, analysis of skewness and kurtosis z-scores falling outside 95% confidence limits, and with Kolmogorov-Smirnov and Shapiro-Wilk tests of normality. Paired t-tests were used to analyse the difference between preoperative and postoperative PROMs. P values below 0.05 were considered statistically significant. Data are expressed as mean±SD of the mean, or as median (IQR) when assumptions of normality were severely violated. Only observed data were used and there was no imputation of missing values.

RESULTS

Between 1 June 2005 and 3 August 2018, MJB performed 1856 primary hip arthroscopies. During the follow-up period (87±29 months), there were 66 ipsilateral THAs (3.56%), with two patients having bilateral conversion. Median time to conversion was 29 (8–47) months. Half of the hips which converted did so within 2 years (53%) and the majority (86%) of replacements occurred within 5 years. The 2-year conversion rate was ≤4% of primary hip arthroscopies performed each year while the 5-year and total conversions vary from 0% to 17% (figure 1). Total percentage of conversion tends to decrease over the years, with 2006 having the highest conversion rate while 2005, 2007 and 2008 have no conversions to date (figure 1). The operation year that has the highest number of conversions is 2013, with 15 hips subsequently requiring THA (figure 1).

Patients who converted to THA were aged 26.4–67.6 years and all but three patients were younger than 60 years at time of arthroscopy. There were a similar number of both males and females who converted and right versus left hip operated on (table 1). BMI ranged from 18.33 to 38.58 kg/m^2. One patient was underweight, 22 were normal range, 17 were overweight and 8 were obese. Just over half of patients had symptoms for greater than 1 year prior to surgery (53%), many had symptoms for 4–12 months (42%) and only three patients had symptoms for 3 months or less (5%) (table 1).

Preoperatively, one patient had frank dysplasia and 11 patients were borderline dysplastic; however, following arthroscopy 22 hips were borderline dysplastic and 10 hips met our definition of iatrogenic over-resection of the acetabulum. Pre-existing osteoarthritis was evident at arthroscopy in a large number of hips (n=27), as were chondral lesions on the acetabulum/femoral head (n=25). Most patients had a Tönnis grade ≥1 (79%) and many had a Tönnis grade ≥2 (32%) (table 2). Additionally, the majority of patients had labral pathology (95%) and almost half (45%) had ligamentum teres pathology.

Patients underwent a range of procedures with the vast majority having a femoral osteoplasty (73%) and labral repair

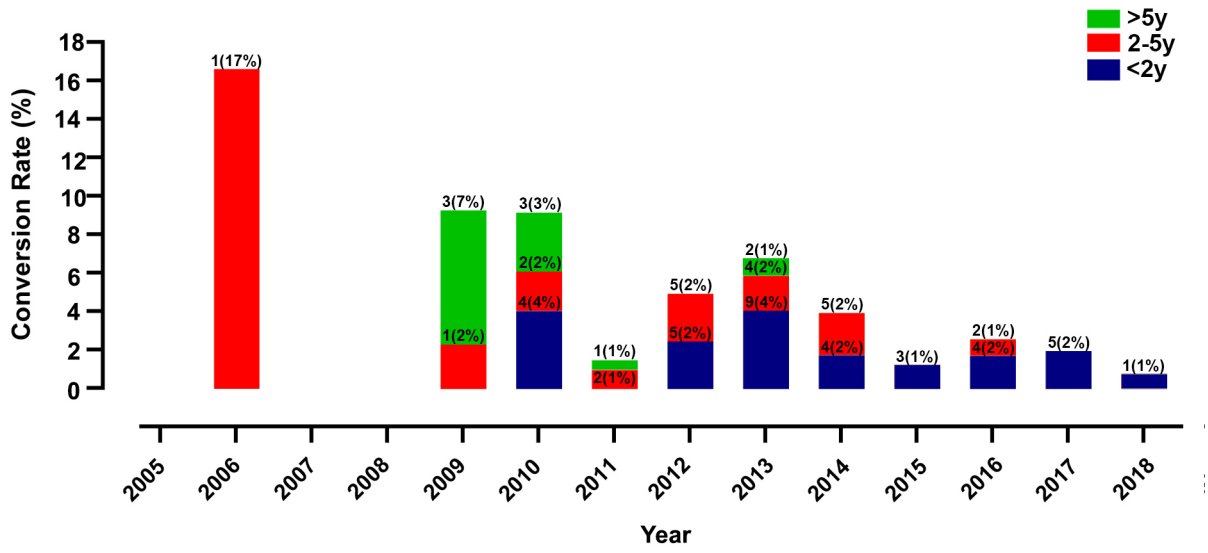

Figure 1 Total hip arthroplasty rate by year of arthroscopy. Rate of conversion is separated into the time to conversion with ≤2 years (blue), 2–5 years (red) and >5 years (green). Frequency and rate are displayed on top of each bar.

(65%) (table 3). A smaller proportion underwent microfracture (44%) and capsular repair (59%) (table 3). Fewer patients had acetabular resection, rim trim, labral resection or reconstruction, capsular plication, ligamentum teres partial excision, iliopsoas lengthening and ITB fenestration (table 3). Three patients had capsule mismanagement.

PROMs did not change significantly following hip arthroscopy (table 4). When patients who converted were asked if they would have the operation again if needed on a different joint, half of those who responded answered yes with 18% (n=12) selecting 'definitely yes' and 11% (n=7) 'probably yes', while 21% (n=14) indicated 'possibly not', 8% (n=5) 'definitely not' and 27% (n=18) did not respond to this item.

DISCUSSION

At 3.56%, our conversion rate by international standards is very low and by carefully analysing each of the 66 patients who have converted, we are able to highlight the important risk factors that may alert the surgeon and allow more accurate informed consent when discussing arthroscopic intervention with the patient. A novel aspect of this study is the consideration of surgeon-related factors as well as patient-related factors.

Time to conversion (median 23 (8–47) months) was slightly longer than previous conversion studies.[5] Scott *et al*[1] reported 84% of THA occurred within 2 years of the index arthroscopy, with 100% performed within 4 years in patients ≥65 years of age. This is in contrast to our findings where only 53% occurred within 2 years of the index procedure and 12% of replacements occurred after more than 5 years. However, our cohort's younger age may have contributed—almost all patients who converted were <60 years of age at the time of the index procedure. This could also be a factor which has contributed to our relatively low total conversion rate. Numerous studies have reported an association with older age and THA conversion rates.[6 9 15–18] It is suggested that patients older than 60 years are more likely to convert to THA,[16] while being younger than 40 years is independently predictive of increased survivorship/not converting.[15] Patients over 40 years of age who do not have strong features of either cam or pincer morphology often present with early osteoarthritis, thus the likelihood of poor results and later conversion increases.

Many studies have suggested BMI is a risk factor for conversion to THA.[6 7 17] In this study, patients' mean BMI was slightly higher than normal weight guidelines, with 25% of patients in the overweight category and 12% categorised as obese. Kester *et al*[3] reported a BMI of >30 kg/m^2 (obesity) was associated with a significantly higher rate of conversion to THA. It is unknown whether the body composition (relative proportion of fat to muscle mass) of patients with increased BMI influences THA conversion rates; however, it is worth noting that our hip arthroscopy patients tend to be more athletic than the population at large and may therefore have greater than average lean body mass contributing to weight.

At arthroscopy, the majority of patients were found to have femoral head chondral damage, and some had acetabular chondral damage. Previous studies have demonstrated a positive correlation with chondral damage and THA.[1 6 7 9 15 19] In a systematic review, Domb *et al*[20] noted conversion to THA was 23% among patients with osteoarthritis compared with 8% among non-arthritic patients. Femoral head lesions are associated with worse intra-articular hip pathology, which has been shown to double the rate of conversion to THA.[6] Furthermore, Larson *et al*[21] reported arthroscopy patients with advanced chondral damage and a 2 mm joint space narrowing on preoperative imaging did not improve in pain or function and had a greater rate of conversion to arthroplasty.

Table 1 Patient demographics (n=66)

Sex (female:male)	37:29
Age at arthroscopy (years)	48.3±7.6
BMI (kg/m^2)	25.8±4.3
Hip side (right:left)	37:29
Duration of symptoms	
≤3 months	3
4–12 months	28
>1 year	35

Data are frequencies or mean±SD.
BMI, body mass index.

Table 2 Imaging and arthroscopic findings (n=66)

Imaging	
Tönnis grade (%)	
0	14 (21)
1	31 (47)
2	20 (31)
3	1 (2)
LCEA (°)	
Pre	31±7
Post	28±5
Arthroscopic	
Femoral head ICRS grade (%)	
0	17 (26)
1	2 (3)
2	19 (29)
3	21 (32)
4	7 (11)
Acetabular rim ICRS grade (%)	
0	3 (5)
1	2 (3)
2	8 (12)
3	9 (14)
4	44 (67)
Acetabulum articular cartilage ICRS grade (%)	
0	8 (12)
1	18 (27)
2	18 (27)
3	8 (12)
4	13 (20)
Labrum pathology (%)	
Degenerative	26 (40)
Full tear	24 (36)
Partial tear	24 (36)
Unstable	3 (5)
Ligamentum teres pathology (%)	
Degenerative	19 (29)
Hypertrophy	10 (15)
Partial tear	7 (11)
Ruptured	2 (3)

Data are frequencies (percentage of total) or mean±SD.
ICRS, International Cartilage Repair Society; LCEA, lateral centre-edge angle.

In this study, almost a third of patients who converted had a Tönnis grade ≥2. Many studies have suggested a negative correlation between joint space and THA.[6 7 18 22 23] In a systematic review, patients with grade 2 Tönnis changes had a 40.5% conversion rate compared with 10.8% among a matched group with grade 0 or 1 Tönnis changes.[17] Philippon *et al*[22] also reported patients aged >50 years had a higher survival (avoiding arthroplasty) with a joint space >2 mm compared with <2 mm (90% vs 57% survival rate, respectively).

One of the patients who converted had frank dysplasia and 11 hips were classed as borderline dysplastic preoperatively. Although a small LCEA has been suggested as a risk factor for THA conversion following arthroscopy,[7] Giordano *et al*[18] did not demonstrate increased conversion rates in patients with borderline LCEA dysplasia. Patients >30 years of age who have borderline dysplasia and normal femoral offset may be more likely to be presenting with a 'failing' hip. In the senior author's experience, borderline dysplasia and hyperlaxity need meticulous capsule management, either full closure (in absence of microinstability) or capsule plication (for microinstability). One of our patients with borderline dysplasia had femoral head subluxation after arthroscopy involving ligamentum teres trimming and a minimal capsulotomy with minimal disruption of the static stabilisers—previously described in a case report by Mei-Dan *et al*.[10] As the capsulotomy was minimal and confined to the superior border of the iliofemoral ligament, a repair was judged unnecessary at the time. Although age and early osteoarthritis may have also contributed to this conversion, since this case the senior author performs labral repair in patients with borderline dysplasia using a small crescentic capsulotomy, followed by a watertight complete repair or plication.

Table 3 Arthroscopic procedures performed (n=66)

Procedure	%
Acetabular resection	15 (23)
Rim trim	11 (17)
Femoral osteoplasty	48 (73)
Microfracture	29 (44)
Labral repair	43 (65)
Labral partial resection	5 (8)
Labral reconstruction	2 (3)
Capsule repair	
Partial	26 (40)
Complete	13 (20)
Capsule plication	4 (6)
LT partial excision	9 (14)
Iliopsoas lengthening	2 (3)
Sciatic neurolysis	2 (3)
ITB fenestration	1 (2)

Data are frequencies (percentage of total).
ITB, iliotibial band; LT, ligamentum teres.

In our cohort, acetabular over-resection was documented in 11 patients while no patient had femoral over-resection. Performance of acetabuloplasty and femoral osteoplasty has been associated with conversion to THA.[9] A full acetabular rim resection was performed in 15 patients while a further 11 had a smaller anterior resection. Although causation cannot be established, emerging literature has found that acetabular rim resection dramatically increases the contact pressures through the hip joint, with a cadaveric study demonstrating a 300% increase in the acetabular base contact pressure with 6 mm of rim resection.[24] Aggressive osteoplasty as well as unrepaired capsulotomy and labral resection can contribute to iatrogenic hip instability requiring conversion.[8] As described above, capsular mismanagement contributed to conversion for three patients. Perets *et al*[19] found that the conversion group was significantly more likely to have undergone capsular release and labral debridement rather than repair. Finally, surgical experience may also contribute to

Table 4 Patient-reported outcome measures prior to and 6 months after arthroscopy

	Prearthroscopy	Postarthroscopy	P value
NAHS (n=29)	53.72±18.30	63.28±23.60	0.09
iHOT12 (n=19)	35.63±22.22	32.89±26.96	0.67
WOMAC (n=26)	39.35±20.01	36.27±23.07	0.57

Data are mean±SD.
iHOT12, international Hip Outcome Tool 12; NAHS, Non-Arthritic Hip Score; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

conversion likelihood. Although our number of conversions was too low to detect annual changes of statistical significance, this trend has been documented by Philippon *et al*[22] who found fewer conversions in patients who had segmental labral reconstructions after the surgeon was more experienced with the procedure.

Patient symptoms are also an important characteristic to consider prior to undergoing arthroscopy. The majority of patients who converted had pain for greater than 1 year prior to their arthroscopy. Previous research has suggested a greater duration of preoperative symptoms predicts higher failure rates, including conversion to hip arthroplasty.[21] Rather than improvement followed by decline, PROMs did not improve significantly following hip arthroscopy in this cohort. Despite that, half of the patients who responded to the questionnaire stated they would do the operation again if needed on a different joint. These data are interesting as conversion to THA may be considered a failure/endpoint but it does not necessarily align with patient's perception of hip arthroscopy failure.

Limitations

As data are from a high-volume hip arthroscopy orthopaedic surgeon, results may not be generalisable to patients treated at low-volume hip arthroscopy centres which tend to have a higher rate of conversion to THA.[5 13 25] Additionally, there are limitations inherent to any retrospective case series analysis; however, since data were collected prospectively, recall or selection biases are minimal. Finally, although important features/characteristics were highlighted, we were unable to demonstrate any associations with THA due to the lack of comparison group. A prospective study of rates of conversions comparing those who convert with those who do not and with long follow-up is warranted.

CONCLUSIONS

To conclude, conversion rate by a single surgeon in New Zealand was relatively low at 3.56%. Most patients had pre-existing osteoarthritis and chondral lesions that became apparent at arthroscopy. Dysplasia also warrants caution when selecting patients for arthroscopy and acetabular resection should be minimised.

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Contributors MJB conceived the study idea. CJB coordinated the data collection. CJB and RMV carried out the statistical analyses. RMV wrote the manuscript with input from all authors.

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Patient consent for publication Not required.

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ORCID iD

Renuka M Vesey http://orcid.org/0000-0003-1277-8998

REFERENCES

1 Scott EJ, Bedard NA, West C, *et al*. Outcomes of hip arthroscopy in the Medicare patient: a growing population. *Iowa Orthop J* 2019;39:89–93.
2 Baron JE, Westermann RW, Bedard NA, *et al*. Is the actual failure rate of hip arthroscopy higher than most published series? an analysis of a private insurance database. *Iowa Orthop J* 2020;40:135.
3 Kester BS, Capogna B, Mahure SA, *et al*. Independent risk factors for revision surgery or conversion to total hip arthroplasty after hip arthroscopy: a review of a large statewide database from 2011 to 2012. *Arthroscopy* 2018;34:464–70.
4 Konopka JF, Buly RL, Kelly BT, *et al*. The effect of prior hip arthroscopy on patient-reported outcomes after total hip arthroplasty: an institutional registry-based, matched cohort study. *J Arthroplasty* 2018;33:1806–12.
5 Malahias M-A, Gu A, Richardson SS, *et al*. Hip arthroscopy for hip osteoarthritis is associated with increased risk for revision after total hip arthroplasty. *Hip Int* 2020;3:112070002091104.
6 Ashberg L, Close MR, Perets I, *et al*. Do femoral head osteochondral lesions predict a poor outcome in hip arthroscopy patients? A matched control study with minimum 5-year follow-up. *Arthroscopy* 2019;35:419–31.
7 Perets I, Chaharbakhshi EO, Mu B, *et al*. Hip Arthroscopy in Patients Ages 50 Years or Older: Minimum 5-Year Outcomes, Survivorship, and Risk Factors for Conversion to Total Hip Replacement. *Arthroscopy* 2018;34:3001–9.
8 Harris JD, McCormick FM, Abrams GD, *et al*. Complications and reoperations during and after hip arthroscopy: a systematic review of 92 studies and more than 6,000 patients. *Arthroscopy* 2013;29:589–95.
9 Redmond JM, Gupta A, Dunne K, *et al*. What factors predict conversion to THA after arthroscopy? *Clin Orthop Relat Res* 2017;475:2538–45.
10 Mei-Dan O, McConkey MO, Brick M. Catastrophic failure of hip arthroscopy due to iatrogenic instability: can partial division of the ligamentum teres and iliofemoral ligament cause subluxation? *Arthroscopy* 2012;28:440–5.
11 Brittberg M, Aglietti P, Gambardella R. ICRS clinical cartilage injury evaluation system-2000. Third ICRS Meeting, 2000:28.
12 Griffin DR, Parsons N, Mohtadi NGH, *et al*. A short version of the International hip outcome tool (iHOT-12) for use in routine clinical practice. *Arthroscopy* 2012;28:611–8.
13 Christensen CP, Althausen PL, Mittleman MA, *et al*. The nonarthritic hip score: reliable and validated. *Clin Orthop Relat Res* 2003;406:75–83.
14 Barr S, Bellamy N, Buchanan WW, *et al*. A comparative study of signal versus aggregate methods of outcome measurement based on the WOMAC osteoarthritis index. Western Ontario and McMaster universities osteoarthritis index. *J Rheumatol* 1994;21:2106–12.
15 McCarthy B, Ackerman IN, de Steiger R. Progression to total hip arthroplasty following hip arthroscopy. *ANZ J Surg* 2018;88:702–6.
16 Rogers MJ, Adeyemi TF, Kim J, *et al*. Understanding preoperative demographics and risk factors for early revision surgery in patients undergoing hip arthroscopic surgery: a large database study. *Orthop J Sports Med* 2019;7:232596711984957.
17 Schairer WW, Nwachukwu BU, McCormick F, *et al*. Use of hip arthroscopy and risk of conversion to total hip arthroplasty: a population-based analysis. *Arthroscopy* 2016;32:587–93.
18 Giordano BD, Kuhns BD, Perets I, *et al*. Acetabular morphologic characteristics predict early conversion to arthroplasty after isolated hip arthroscopy for femoroacetabular impingement. *Am J Sports Med* 2020;48:188–96.
19 Perets I, Chaharbakhshi EO, Shapira J, *et al*. Hip arthroscopy for femoroacetabular impingement and labral tears in patients younger than 50 years: minimum five-year outcomes, survivorship, and risk factors for reoperations. *J Am Acad Orthop Surg* 2019;27:e173–83.
20 Domb BG, Gui C, Lodhia P. How much arthritis is too much for hip arthroscopy: a systematic review. *Arthroscopy* 2015;31:520–9.
21 Larson CM, Giveans MR, Taylor M. Does arthroscopic FAI correction improve function with radiographic arthritis? *Clin Orthop Relat Res* 2011;469:1667–76.
22 Philippon MJ, Utsunomiya H, Locks R, *et al*. First 100 segmental labral reconstructions compared to the most recent 100: the role of surgeon experience in decreasing conversion to total hip arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2020;28:2295–301.
23 Philippon MJ, Briggs KK, Carlisle JC, *et al*. Joint space predicts THA after hip arthroscopy in patients 50 years and older. *Clin Orthop Relat Res* 2013;471:2492–6.
24 Bhatia S, Lee S, Shewman E, *et al*. Effects of acetabular rim trimming on hip joint contact pressures: how much is too much? *Am J Sports Med* 2015;43:2138–45.
25 Sochacki KR, Jack RA, Safran MR, *et al*. There is a significant discrepancy between "Big Data" database and original research publications on hip arthroscopy outcomes: a systematic review. *Arthroscopy* 2018;34:1998–2004.