REVIEW ARTICLE

Arthroscopy of the Hip Joint

Indication, Technique, Results

Oliver Rühmann

SUMMARY

Introduction: It is the aim of this study to demonstrate which disorders of the hip joint can and should be treated by hip arthroscopy.

Method: The technique and results of hip arthroscopy in different indications are evaluated and presented by means of a selective analysis of the literature, together with the author's own experience.

Results: Arthroscopy of the hip is a successful procedure for the treatment of loose bodies, traumatic and degenerative lesions of the acetabular labrum, ligamentum capitis femoris, and cartilage, femoroacetabular impingement, synovial disorders, and septic arthritis.

Discussion: The published studies attain a level of evidence IV. Although no data on the long-term outcome are available, it can be concluded that hip arthroscopy has become an important option for treatment of disorders of the hip. As an established component of the treatment algorithm, hip arthroscopy closes the gap between conservative and invasive procedures.

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Key words: arthroscopy, joint diagnosis, surgery, hip prosthesis, orthopedic treatment

The frequency of arthroscopic procedures of the hip has risen continually in recent years (1–4). If the operator's technique is good, arthroscopic surgery of the hip joint offers all the known advantages of endoscopic surgery.

Clinical experience, however, shows that the therapeutic options of hip joint arthroscopy are not generally known. The assumption is therefore that patients are having invasive procedures (arthrotomy, pelvic osteotomy and femoral osteotomy, joint endoprosthesis), although minimally invasive arthroscopy is a promising alternative treatment option.

This article represents an attempt to assess – on the basis of the published literature and the author's own results – which disorders of the hip joint can and should usefully be treated by using arthroscopic techniques.

Method

The article is based on publications on the topic (selective literature review) and the author's own experiences with 403 hip arthroscopies (6/1993 to 11/2007, of which 96% after 2000) (*figure 1a–c, figure 2, figure 3*).

The author's own surgical results come from a retrospective study of 85 hip arthroscopies that were undertaken between 06/1993 and 01/2003, in 79 patients aged 14 to 68. Follow-up examinations were conducted over 20 months (modified Larson score) (5) (definition, see discussion section and *table* legend).

The author did a continual search on PubMed (search terms: hip arthroscopy, technique, diagnosis, therapy, results, scores, groin pain, osteoarthritis, cartilage, loose bodies, labrum, ligamentum teres, femoroacetabular impingement). The largest available studies for all these topics and disorders were included (*box 1*).

Results

Indications and contraindications

Indications for hip arthroscopy include loose bodies, injuries or degenerative changes to the labrum or the ligamentum capitis femoris (ligamentum teres) or the cartilage, femoroacetabular impingement, synovial disorders or infections of the joint (2, 4, 5, 8–21).

Known contraindications for arthroscopy include localized or generalized inflammation, bone tumors close to the joint, and reflex dystrophy.

Especially for hip arthroscopy, absolute contraindications include acetabular protrusion (insufficient

Klinik für Orthopädie, Unfallchirurgie, Sportmedizin, Agnes-Karll-Krankenhaus Laatzen/Klinikum Region Hannover, Laatzen: Prof. Dr. med. Rühmann

FIGURE 1

a: The two compartments of the hip joint that are to be treated arthroscopically

b: Peripheral compartment: arthroscopy without joint distraction at 40-50 degree bend, moving freely, lateral aspect

c: Central compartment, arthroscopy with joint distraction, lateral aspect

distraction of the joint) and advanced coxarthrosis as relative, recent acetabular fractures, as well as extensive capsule ruptures (extravasation of joint fluid).

Coxarthrosis

In 1991, Villar in a prospective study described a 60% improvement in complaints in the Harris hip score in 40 patients with arthritis, 6 months after hip arthroscopy with débridement of the cartilage (19). Sustained improvements were seen in slight and moderate arthroscopic changes, whereas pronounced wear and tear affected the result negatively.

Dienst et al. (2, 4) showed for their patient cohort that the therapeutic effect over a year hardly differed from the result after one month. The increase in the Harris hip score, one month after arthroscopy, was 13 points; a year postoperatively, the score reached 14 points. Subjectively, 39% of patients reported an improvement after one month and 32% after one year.

Other authors also concluded that in patients with coxarthrosis, arthroscopic interventions can be expected to result in an improvement. Increases in the Harris hip score of 14% to 83% were reported for a postoperative follow-up of up to 26 months (9, 18, 22).

In the authors' patients, 36% had grade 3–4 chondromalacia according to Outerbridge (Outerbridge classification of cartilaginous damage: 1° intact surface – soft, swollen; 2° superficial tears; 3° deep tears, fragmentation; 4° complete loss of cartilage, exposed bone) on the acetabular surface of the joint and in 27% on the femoral head. Even in such high-grade cartilaginous damage, it was possible to lessen the symptoms, and the Larson score rose by 18% (table).

Lesions of the ligamentum capitis femoris

According to the published literature, lesions of the ligamentum capitis femoris (LCF) are detected only rarely on magnetic resonance imaging (MRI). Byrd and Jones reported arthro-MRIs in 40 patients (23). Two ligamentous ruptures were confirmed on arthroscopy; five further ones were not detected on MRI (sensitivity 29%). The author's own investigations are consistent with these results. None of the eight arthroscopically detected lesions of the LCF were pre-diagnosed via MRI (13).

The results after arthroscopic resection of the ligament are dependent on the accompanying pathologies. Gray and Villar reported poor results in patients with concomitant advanced coxarthrosis (12). In patients with isolated LCF rupture or in whom the associated pathological changes were treated arthroscopically, good results were achieved. In the 23 patients in the study reported by Byrd and Jones, the Harris hip score increased by 43% (24). In the author's own patient cohort, pathological changes of the LCF existed in nine cases, especially in patients with dysplasia of the hip and coxarthrosis (figure 4). Preoperative symptoms, such as groin pain and a "locked" joint, were resolved in 56% of cases (20% increase in Larson score) (table).

Labral lesions

Diagnostically, MRI scanning with intra-articular contrast medium (arthro-MRI) is superior to conventional MRI (13, 25, e1, e2).

By using arthroscopic partial labral resection, good results can be achieved in up to 78% of cases, especially in patients with traumatic injuries without additional degenerative changes (10).

Similar rates of success and worse results in degenerative labral lesions have also been described elsewhere (8, 13, e3–e10). Labral lesions were seen in 40% of cases. Partial labral resection yielded good results in 57% of cases (23% increase in Larson score) (table).

Femoroacetabular impingement

Sampson reported that femoroacetabular impingement resolved in almost all cases (16). In most patients, a 95% pain reduction was achieved within 12 months postoperatively. In the 32 patients operated by Sadri et al., follow-up examination after a minimum of 24 months showed an increase of 39 points in the Womac score and 82% of patients expressed satisfaction (15). Wettstein and Dunst achieved good results in 15 arthroscopically treated patients (20): the Harris hip score increased from 60 to 92 points, nine months postoperatively (table).

FIGURE 2

Positioning of patient, personnel, and equipment in the operating theater

Loose bodies

Since loose bodies and pathological substrate are removed during arthroscopy, good results can be achieved, and preoperative intra-articular impaction and locking resolved (2). The author found and removed loose bodies in 17% of cases, which yielded an improvement in symptoms and a 20% increase in the Larson score (5) (*table*).

Necrosis of the femoral head

Byrd and Jones treated four patients with necrosis of the femoral head by using arthroscopy and achieved poor results in three of the patients with higher grade necrosis (9). Only those patients with lower-grade necrosis, in whom loose bodies were removed simultaneously, achieved a 20 point increase in the Harris hip score (*table*).

Osteochondrosis dissecans

The author knows only of case reports about this disorder, which affects the hip joint only rarely. Hip arthroscopy can be used to remove the dissectate and to work on the dissectate bed (e11). He has treated two patients by removing the dissectate, and microfracturing or retrograde drilling, achieving good results. The Homburg based working group around Dienst achieved a very good result in one patient. The dissectate was removed and the lesion treated by microfracturing.

Synovial disorders

Partial synovectomies were done in 80% of the patients included. In 49%, the result was an improvement (20% increase in Larson score) (*table*). In four cases, arthroscopic evacuation in chondromatosis was performed (*figure 5a–d*).

Empyema/septic coxarthrosis

The author has used arthroscopy to treat five cases of hip joint empyema (flushout, synovectomy; two cases: application of a drainage system; three cases: application of antibiotic sponges). In four cases, the infection was treated successfully in this way. Others have also reported good results for arthroscopic treatment for infections of the hip joint (2, e12, e13).

Complications

Dienst and Kohn conducted a comprehensive literature search with regard to complications of hip arthroscopy and included their own results into their analysis (2). Neural damage (pudendal nerve, ischiadic nerve, femoral nerve, lateral femoral cutaneous nerve) was documented in 2.1% (18/841) of arthroscopies. With the exception of a sensory deficiency in the area relating to the lateral femoral cutaneous nerve, the neurological symptoms subsided in all cases within eight weeks after the operation. In 0.3% (2/640), injuries to the cutaneous vasculature in the area of the portals were reported, and in 0.6% (4/689), soft tissue injuries (external genitals, trochanteric region). Further documented complications include instrument fractures (0.7%: 5/754) and extravasation of fluid (9.1%: 7/77).

Figure 3:

Arthroscopy of peripheral compartment, right hip, ventral region, part of femoral head (FH), edge of acetabular labrum (L)

Figure 4:

Arthroscopy of central compartment, left hip, degenerative rupture of ligamentum capitis femoris (LCF) and degenerative changes to the femoral head (FH) in coxarthrosis

Discussion

The scientific publications from which results of hip arthroscopy for the different indications can be deduced reach evidence level IV. They are non-randomized case series without clearly defined control groups or comparison groups (comparison of preoperative and postoperative condition), and the patients were included prospectively or retrospectively.

No gold standard has been developed to evaluate hip arthroscopic procedures. In this context it is problematic that the Harris hip score, which is used most often (9, 10, 19–21), was developed to evaluate treatment results in patients with arthritis and has not been evaluated for other pelvic pathologies. Further to the intensity of pain (44 points), the Harris hip score includes function (47 points) and mobility (9 points) in the overall assessment. The Larson score (IOWA hip score), which is also in use, assesses function with 35 points, pain intensity with 35 points, gait with 10 points, and mobility of the hip joint with 20 points (8).

As a matter of principle, hip arthroscopy is indicated only if the resulting arthroscopic-surgical measures are to be expected as a consequence. An exception can be sensible if after taking a medical history, after obtaining

TABLE

Results – Hip arthroscopy

Authors	Year	Number	Follow-up in months	Result	Study design	Level of evidence
Coxarthrosis						
Villar (19)	1991	40	6	60% increase, Harris hip score	Case series, prospective	IV
Dienst et al. (4)	1999	6	6	14% increase, Harris hip score 32% pain reduction	Case series, retrospective	IV
Byrd and Jones (9)	2000	38	24	14% increase, Harris hip score	Case series, prospective	IV
Rühhmann et al. (5)	2003	23	20	18% increase Larson score 46% pain reduction	Case series, retrospective	IV
Sozen et al. (18)	2004	13	11	62% improvement in Harris hip score	Case series, retrospective	IV
Jerosch et al. (22)	2006	22	26	82% increase, Harris hip score	Case series, retrospective	IV
Lesions of the ligamentum capitis femoris						
Byrd and Jones (24)	2004	23	2.4	43% increase, Harris hip score	Case series, retrospective	IV
Gray and Villar (12)	1997	20	24	Persistent symptoms in arthrosis	Case series, retrospective	IV
Kashiwagi et al. (e44)	2001	1	1	Complaint free, free mobility	Case report, retrospective	IV
Kusma et al. (e45)	2004	1	0.3	Complaint free	Case report, retrospective	IV
Rühhmann et al. (5)	2003	9	1.6	20% increase, Larson score 56% of impactions and groin pain eliminated	Case series, retrospective	IV
Labral lesions						
Conn and Villar (10)	1998	37	12	78% of patients had improved	Case series, retrospective	IV
Farjo et al. (11)	1999	28	34	71% very good or good – without arthritis 21% very good or good – with arthritis	Case series, retrospective	IV
Byrd and Jones (9)	2000	23	24	27% increase, Harris hip score	Case series, prospective	IV
Santori and Villar (17)	2000	58	42	67% of patients had improved	Case series, retrospective	IV
Rühhmann et al. (5)	2003	34	20	23% increase, Larson score 57% of patients had improved	Case series, retrospective	IV
Saw and Villar (e3)	2004	6	–	Professional footballers: 5 complaint free, fully fit	Case series, retrospective	IV
Yamamoto et al. (21)	2005	10	96	All patients with hip dysplasia 28% increase, Harris hip score 100% of mechanical symptoms eliminated	Case series, retrospective	IV
Awan and Murray (e4)	2006	10/22	44	26% increase score	Case series, retrospective	IV
Streich et al. (e10)	2007	31	34	Visual analogue scale: reduction from 6.0 to 2.7 23% increase, Harris hip score 22% Larson score	Case series, prospective	IV
Femoroacetabular impingement						
Sadri et al. (15)	2006	32	> 24	39% increase, Womac score 82% patient satisfaction	Case series, prospective	IV
Sampson (16)	2005	?/158	12	Most patients pain free	Case series, retrospective	IV
Wettstein and Dienst (20)	2006	15	9	32% increase, Harris hip score	Case series, retrospective	IV
Philippon et al. (e24)	2007	45	19	93% return to professional sports	Case series, retrospective	IV
Loose bodies						
Byrd and Jones (9)	2000	6	24	34% increase, Harris hip score	Case series, prospective	IV
Rühhmann et al. (5)	2003	14	20	20% increase Larson score 71% of patients had improved	Case series, retrospective	IV
Necrosis of the femoral head						
Byrd and Jones (9)	2000	4		2 × implantation of total endoprosthesis of the hip after 5 months 1 × deterioration 1 × improvement (20% Harris hip score)	Case series, prospective	IV
Synovitis						
Holgersson et al. (e27)	1981	7		Recommendation: early arthroscopy in juvenile chronic arthritis	Case series, retrospective	IV
Ide et al. (e28)	1991	3		Temporary reduction of pain without improvement in joint function in chronic polyarthritis	Case series, retrospective	IV
Byrd (e26)	1998	1		Clear improvement in pain in chronic polyarthritis	Case report, retrospective	IV
Klapper et al. (e29)	1998	2		Good hip function, improvement of complaints	Case series, retrospective	IV
Rühhmann et al. (5)	2003	68		20% increase, Larson score	Case series, retrospective	IV

Harris hip score: 44% intensity of pain, 47% functionality/activities, 9% mobility; Larson score: 35% intensity of pain, 35% functionality/activities, 20% mobility, 10% gait; visual analogue scale: subjective patients' assessment of the intensity of pain on a scale of 1 to 10; Womac score: 21% intensity of pain, 71% functionality/activities, 8% mobility.

BOX 1

Technique of hip arthroscopy

The acetabular labrum is the dividing line between the central and peripheral compartments in hip arthroscopy (1, 2, 6, 7). The central compartment is the weight bearing part of the hip joint, with the corresponding joint surfaces of acetabulum and femoral head.

The peripheral compartment comprises the non-weight bearing part of the femoral head and the femoral neck up to capsule insertion (*figure 1a–c, figure 3*). For arthroscopy of the central compartment, using an extension table to distract the femoroacetabular joint is required (1, 2, 7). The portals are inserted under radiographic guidance with a C-arm and monitor image intensifier (*figure 2*). Arthroscopy to the peripheral compartment is done subsequent to the central compartment without joint distraction, while the joint remains bent and flexible (*figure 1, b; figure 3*).

The required distraction of the joint cavity of 10–15 mm (overview, avoiding iatrogenic damage to the joint) can be achieved if the patient is positioned correctly, without the risk of stretching a nerve. A distraction period of 2 hours is regarded as non-critical (1–3, 5).

The author by default uses a lateral and anterolateral portal for arthroscopy of both compartments. Dependent on potential pathological findings and individual maneuverability, additional portals may be required (anterior, posterolateral, distal lateral, proximal lateral) (1, 5).

BOX 2

Case study

● History:

A 38-year-old female patient has had intermittent groin pain for 23 months. She has problems climbing stairs and after sitting down for prolonged periods. Her right hip feels locked or gives way; acute onset after sports activity with possible rotation trauma, conservative therapeutic measures (physiotherapy, electrotherapy) have been unsuccessful.

● Finding on examination:

Normal pelvic position, no muscular deficit, groin pain on pressure, positive stress test of the labrum, negative apprehension test, free range of movement.

● Hip radiograph, right hip joint in two planes:

Low-grade dysplasia, initial arthritic changes.

● Arthro-MRI:

Anterolateral labral lesion, no clear indication of a lesion of the ligamentum capitis femoris (LCF), initial cartilaginous damage, low-grade dysplasia; in the context of contrast medium application, intra-articular instillation of local anesthesia with clear reduction in pain according to duration of effect (positive local anesthesia test).

● Hip arthroscopy:

Anterolateral labrum flap lesion, LCF complex lesion, chondromalacia 2° acetabulum/femoral head, synovitis; partial labral and LCF resection, partial synovectomy.

● Result:

5.1 years postoperatively: no pain, no locked joints, no giving way, sports activities possible without limitations; 59% increase in Larson score.

Figure 5:

- a) Preoperative radiograph, left hip: chondromatosis, b) Arthroscopy of peripheral compartment, left hand side: exposure and evacuation of chondrome,
- c) Arthroscopically removed chondromes; d) Intraoperative radiological documentation of the complete removal of chondromes, arthroscope in the peripheral compartment

the results from the investigation, and after imaging hip pain cannot be explained adequately and is refractory to treatment, or if hip arthroscopy is used as a decision-making aid for further surgical or conservative approaches (2, e14). A positive local anesthesia test can also contribute to defining an indication because a reduction in pain after intra-articular application points at joint pathology.

In addition to conservative measures, invasive operations (arthrotomy, pelvic or femoral osteotomy, joint endoprosthesis) are widely used and have become accepted for arthritic changes of the hip joint. Arthroscopic operations to the hip joint are currently still a much more rarely practiced surgical method. In orthopedic clinical practice, however, a common problem is posed by persistent problems with the hip joint that have been unsuccessfully treated conservatively, in patients with only moderate arthritis. Without hip arthroscopy, the treatment algorithm has a gap between conservative and open surgical treatment especially in these, often young, patients.

Arthroscopic measures include débridement of the cartilage, with removal of loose or unstable osseous fragments and treatment of accompanying pathological changes (labral and LCF lesions) (*figure 4*). Intermittent, "stabbing" groin pain may indicate arthroscopically treatable accompanying lesions. Short term or exacerbating symptoms may be regarded as prognostically favorable factors for successful arthroscopic treatment (2, e15). The flushout effect and potential positive effects of joint distraction (secondary capsular contracture) should also be discussed in this context.

By way of adding balance to the satisfactory results reported in the literature, readers are reminded that no long-term results exist and prospective studies comparing

the spontaneous course are lacking. In advanced coxarthrosis, hip arthroscopies are therefore indicated only in exceptional cases.

Not only hip luxations, but also lesser causes – such as rotation trauma – may lead to a rupture of the LCF. According to the literature, this is not a rare ligamentous injury, at 9% (5, 13, 14, 24, e14–e21).

Atraumatic, mostly degenerative LCF lesions have been described in particular in connection with coxarthrosis and hip dysplasia (2, 5, 12, e21). Coxarthrosis was present in 15 (47%) of the 32 LCF lesions that the authors have found in 221 hip arthroscopies (*figure 4*).

In addition to groin pain, patients often report mechanical symptoms ("locked" hip, impacted hip, "jumping" joint, hip "giving way"). On clinical examination, a common finding is groin pain on pressure, pain on stress to hip flexion-internal rotation, or merely impaired movement. There is no typical finding that directly hints at ligamentous damage (2, 3, 12, 24, e21).

LCF ruptures are easily accessible for arthroscopic diagnosis and treatment.

If a labral lesion exists, patients often report a history of intermittent, stabbing groin pain. Occasionally, a "clicking" of the hip joint, a sensation of a locked joint, or "giving way" phenomena (short-term instabilities with the hip joint giving way uncontrollably). On clinical examination, groin pain on pressure may be an identifying feature. The impingement test, which results in stress to hip flexion-internal rotation, exposes the labrum to shearing and compression forces. The resultant pain can be reduced by moving the joint into a 45 degree bend while simultaneously retaining abduction. The apprehension test can provoke pain by overextension, abduction, or external rotation, because it places shearing

stress on the anterosuperior margin of the joint socket and thus the cartilage and labrum in this region.

Currently, arthroscopic treatment consists mainly of resecting the damaged parts of the labral cartilage. However, initial attempts at arthroscopic refixation or suturing have been undertaken (e22).

Femoroacetabular impingement (FAI) is caused by repeated collision of the femoral head and the edge of the socket (acetabulum). In the so-called Cam-FAI, an abnormally shaped femoral head with a greater radius rubs against the socket, resulting in labral and cartilaginous lesions in the anterosuperior joint region. Distinction needs to be made from the Pincer-FAI, which is mainly due to an acetabular abnormality (labral degeneration owing to repeated compression, cartilaginous lesions in the posteroinferior acetabular region) (e23).

Pain typically develops on sitting down for prolonged periods, crossing the symptomatic leg. The impingement test for lesions of the labrum may be positive. On radiography, a protrusion will be found at the anterolateral transitional zone from femoral head to neck.

Arthroscopic treatment consists of labral resection for complex lesions and creation of a concave indent on the transition between femoral head and neck by smoothing the area with a trephine; reported results have been good (15, 16, 20, e24).

Hip arthroscopy may be useful in necrosis of the femoral head to treat concomitant pathologies (removal of loose bodies, débridement of the defect) and to assess cartilaginous conditions directly. Arthroscopically, controlled drilling of the necrotic area is possible, while safely avoiding acetabular cartilaginous injuries. Palliative arthroscopic measures do not make sense as no improvement is to be expected (9, 13, e18, e25).

In addition to direct inspection, hip arthroscopy in synovial disorders enables the taking of samples and synovectomy. For reactive synovitis and rheumatic-type disorders, good results have been described, and the same is true for pigmented villonodular synovitis (e9, e26–e29).

In bacterial infections, hip arthroscopy allows the confirmation and determination of the causative strain, flushout, débridement, synovectomy, and administration of drainage systems, antibiotic chains, and antibiotic sponges. The trauma caused by surgery is less pronounced after arthroscopy, and postoperative arthrofibroses are rarer. If the bone is involved, periarticular tissues are affected, infections have developed after open procedures, recurrent infections are present, or if fistulas develop, arthrotomy is required.

It may be assumed that iatrogenic damage to labrum and cartilage has not been sufficiently documented, but probably occur especially at the start of the learning curve (2). An adequate operative technique (exact positioning, joint distraction, positioning of portals) and bearing in mind indications and contraindications help avoid serious complications in hip arthroscopy; the extent of iatrogenic damage can thus be reduced to a minimal extent.

Arthroscopy of the hip joint has become an established but more rarely used procedure. It is technically more demanding and requires more effort than arthroscopy of many other joints, and the learning curve is therefore longer even for experienced surgeons.

The high technical demands and the additional effort involved are a function of the positioning, the portals, and the maneuvering in the joint deep under the skin.

The indication exists especially in mechanically effective changes to the joint (loose bodies, labral lesions, femoroacetabular impingement, cartilaginous injury, pathologies of the ligamentum capitis femoris), but also in synovial disorders and bacterial arthritis. In exceptional circumstances, hip arthroscopy may also be useful for purely diagnostic reasons.

If absolute contraindications (recent acetabular fractures, extensive capsular ruptures) and relative contraindications (acetabular protrusions, advanced coxarthrosis) are observed and if the technical procedure is done with an adequate degree of skill, complications are rare.

Further to conservative measures and invasive operations – such as arthrotomies, pelvic and femoral osteotomies, and joint endoprostheses – hip arthroscopy as a treatment option is a standard component in the treatment algorithm for disorders of the hip joint.

Conflict of interest statement

The author declares that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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Corresponding author

Prof. Dr. med. Oliver Rühmann
 Chefarzt Klinik Orthopädie, Unfallchirurgie, Sportmedizin
 Agnes-Karll-Krankenhaus Laatzen/Klinikum Region Hannover
 Hildesheimer Str. 158
 30880 Laatzen, Germany
 oliver.ruehmann@krh.eu

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