How valid is the arthroscopic diagnosis of cartilage lesions? Results of an opinion survey among highly experienced arthroscopic surgeons

Gunter Spahn · H. Michael Klinger · Gunther O. Hofmann

Abstract

Aim In general, arthroscopy is considered the "gold standard" for the evaluation of cartilage lesions. In this multicenter survey, we ascertained the general opinion of surgeons regarding arthroscopic cartilage diagnoses.

Method A total of 301 highly experienced arthroscopists (instructors of the AGA, the German-speaking society of arthroscopy) were contacted in writing with a request to complete the survey.

Results The data from 105 respondents (34.8% of those contacted) were used for the investigation. In the grading of the cartilage lesions, the Outerbridge classification was most frequently used (n = 87), followed by the ICRS protocol (n = 8) and the Insall score (n = 3). The majority (61%) of the arthroscopic surgeons felt that differentiation between healthy cartilage and low-grade cartilage lesions was simple. For differentiation between grade I and grade II lesions, and for differentiation between grade II and grade III lesions, 41.9 and 51.4%, respectively, thought that there was a "need for improvement". In the case of grade IV lesions, 70.5% of the surgeons thought that the diagnosis was valid. The respondents also judged the utility of incorporating objective measurements (e.g., intraoperative biomechanical tests): 13.3% (n = 14) responded that such measurements would be "very useful" and 61.9% (n = 65) responded that they would be "somewhat useful".

Conclusions Among surgeons, arthroscopy was not perceived to be as reliable as a "gold standard" for the diagnosis of cartilage lesions. The majority of experienced arthroscopists felt unsure of the results in general, or at least in some cases. A universal and definitive grading system for lesions appears to be needed. For questionable cases, measurement devices are needed for objective cartilage grading.

Keywords Cartilage · Arthroscopy · Grading

Introduction

Cartilage lesions have an annual incidence of nearly one million occurrences [7]. Cartilage lesions are often associated with knee pain and disability, as they are the initial lesions in the development of osteoarthritis.

The diagnosis of cartilage lesions can be made by MRI or arthroscopic evaluation. Clinical signs (pain, crepitation, effusion, decrease in movement) have a low predictive value and low specificity. Radiological pathologies (e.g., joint space narrowing, subchondral sclerosis, loose bodies) occur in the late stages of the disease [20].

MRI is the only non-invasive technique for the evaluation of cartilage defects. However, the validity of this technique strongly depends on the MRI technique and the radiologist's personal experience [12]. Drape et al. [9] found only a moderate interobserver validity (Kappa Index 0.80) for cartilage lesions. In routine practice, 1.5-T MRI systems are most commonly used (knee spool). The evaluation is similar to that used for arthroscopic classification [21]. Furthermore, artifacts such as a "magic angle effect"
can complicate valid evaluation. Small lesions (≤5 mm in diameter) can be overlooked [14]. Innovative techniques like turbo spins or dGEMRIC have a higher resolution and make it possible to measure cartilage volume and thickness exactly. However, these techniques currently are not generally available for routine use.

Arthroscopy is considered the most valid method for cartilage evaluation. There is a general consensus that arthroscopy is an invasive method and should only be performed with therapeutic intentions. “Diagnostic arthroscopies” should be an extremely rare exception. However, different kinds of cartilage treatment require exact intraoperative grading of the lesions.

Although several classifications (Table 1) have been proposed, arthroscopy has emerged as the method of choice in the diagnosis of cartilage lesions. The grading of cartilage lesions is based on descriptions of the evaluations.

The arthroscopic diagnosis is made by visualization and palpation by the hook. Low-grade lesions are represented by superficial fissures, irregularities, and cartilage softening. High-grade lesions manifest as deep fissures up to the subchondral bone, as flakes, or as a complete defect. However, there is still no consensus regarding the true validity of arthroscopy in the diagnosis of cartilage lesions [13].

In 1997, Jerosch et al. [16] conducted a study to determine the interobserver agreement in arthroscopic findings. The mean Kappa Index for cartilage lesions among 39 highly skilled arthroscopists was only 0.67. The best consensus was found in cases of intact cartilage; this is consistent with the results of Brismar et al. [4], who found a mean interobserver agreement of more than 80% for grade I or IV lesions but a poor agreement in cases of grade II or III lesions (65%).

To improve the arthroscopic diagnosis of cartilage lesions, objective biomechanical techniques for measuring chondromalacia were developed [10, 22]. Spahn et al. [19] created a device to measure degeneration within chondral areas using a near-infrared probe.

In general, there are a number of pitfalls in the arthroscopic diagnosis of cartilage lesions. Thus, this calls into question the generally accepted notion that arthroscopy is the gold standard for the diagnosis of cartilage lesions.

This study was undertaken to ascertain the general opinion among surgeons regarding arthroscopic cartilage diagnoses based on a multicenter survey.

Materials and methods

Study design

A total of 301 “AGA-Instructors” were contacted in writing with a request to complete the survey. The AGA (“Deutschsprachige Arbeitsgemeinschaft für Arthroskopie”, or “German-speaking society of arthroscopy”) is the largest arthroscopic society worldwide. “AGA-Instructors” are highly experienced surgeons and the society’s opinion leaders. The addresses of the instructors were available on the society’s website (http://www.aga-online.de). The survey included 10 items as listed in Table 2.

Results

General information

From a total of 301 surveys sent, 121 were returned. Of the returned surveys, 16 were filled out incompletely and excluded from evaluation. Thus, in this investigation, the data from 105 surveys (34.8%) were used.

The majority (n = 78; 73.3%) of the surgeons’ centers performed 101–1,000 arthroscopies per year: 40.0% performed 101–500, and 34.3% performed 501–1000. Less than 100 arthroscopies per year were performed in 12 of the surgeons’ centers (11.5%); 5 centers (4.8%) performed 50 or less, and 7 centers (6.7%) performed 51–100. More than 1,000 operations were done in 15 centers (14.3%).

In 30 of the surgeons’ centers (28.6%), there was 1 surgeon on staff who performed knee arthroscopies. In the majority of the centers (n = 59; 56.2%), 2–5 arthroscopists were active in the operations. In 15 centers (14.3%), more than 5 surgeons were active in arthroscopic surgery.

Grading and registration of cartilage lesions

In the grading of the cartilage lesions, the Outerbridge classification (n = 87; 82.9%) was most frequently used, followed by the ICRS protocol (n = 8; 7.6%) and the Insall score (n = 3; 2.9%). In 4.8% (n = 5), surgeons reported describing the lesions with both Outerbridge and the ICRS grading systems. Two surgeons did not report using any grading systems.

Surgeons who used different grading systems had no significantly differently opinions about their judgments regarding the validity of cartilage grading and the handling of the diagnostics.

Most of the surgeons (n = 92; n = 87.6%) reported registering all cartilage mean bearing zones as well as non-bearing margins. For eight surgeons (7.6%), only the mean bearing zones were reported to be evaluated. The rest of the surgeons (n = 5; 4.8%) handled never or seldom.

The evaluations of cartilage findings were recorded with verbal descriptions in the protocol by 70 surgeons (66.7%). A total of 22 surgeons (21.0%) reported making these descriptions with a draft. The use of video photos was reported by eight surgeons (7.6%). Only three (2.9%)
surgeons registered the cartilage lesions by videotape alone. The rest of surgeons registered the cartilage lesions by description and photo (1.0%) or by description and videotape (1.0%).

The arthroscopic hook was an important tool in cartilage grading among 102 surgeons (97.2%). This instrument was used regularly in 70.5%, while in 26.7% it was used only in questionable cases for cartilage evaluation. Only 2.7% reported seldom use.

The sizes of the cartilage lesions were calculated intra-operatively by 97.1% of surgeons \((n = 102)\). These surgeons always compared the lesion sizes using the hook graduation. Two surgeons (1.9%) measured the lesion diameters postoperatively by using PC software, and one surgeon did not do any size calculations.

Opinion about the validity of arthroscopic grading in cartilage lesions

The majority (61%) of the arthroscopic surgeons felt that the differentiation between healthy and low-grade destructed cartilage was simple, 21.9% believed that such differentiation “needed improvement”, and 12.4% believed that differentiation was poor.

A relative consensus was observed regarding the differentiation of deep cartilage defects (grade IV). In this case, 70.5% of the surgeons thought that the diagnoses of grade IV lesions were highly valid. For differentiation between grade I and II lesions or between grade II and III lesions, 41.9 and 51.4%, respectively, felt a “need for improvement”.

The surgeons also judged the utility of objective measurements (e.g., intraoperative biomechanical tests). The measurements were “very useful” for 13.3% \((n = 14)\) and “somewhat useful” for 61.9% \((n = 65)\). Only 24.8% \((n = 26)\) of the arthroscopists thought that such objective measurements were not required.
If a practical tool for objectifying cartilage lesions were available, most surgeons answered that they would use it: 16.2% \((n = 17)\) every time; 72.4% \((n = 76)\) in questionable cases; and 11.4% \((n = 12)\) never.

**Discussion**

This survey was undertaken to determine the opinions of surgeons regarding the use of arthroscopy in the diagnosis of cartilage lesions.

The diagnosis of cartilage lesions can be performed principally by MRI or arthroscopy. In general, arthroscopy is considered the “gold standard” because it provides a direct view of the cartilage and allows for palpation by hook probing. However, the validity of arthroscopy depends on the grading system, the experience of the arthroscopist, and good documentation in the operation protocol.

For grading of cartilage lesions, a wide variety of grading systems are used (Table 1). The grading systems summarize the specific results of the evaluation of cartilage lesions in different ways (depth, location, size, alone or in combination).

The Outerbridge grading system is still considered the “gold standard”. The original score was created for the description of cartilage lesions within the patella. For a long time, this grading system was most often used in arthroscopy with some modifications. The description of grade II and III lesions (diameter \(\leq 0.5\) in. for grade II lesions and diameter \(> 0.5\) in. for grade III lesions) was replaced by description of partial or complete lesions up to the subchondral bone.

The ICRS grading system arose from a consensus conference of the International Cartilage Repair Society, but it is still not considered the standard. The advantage of this system is the use of precise descriptions of cartilage lesions, allowing cartilage evaluations to become much
more comparable. One approach to address the inconsistent use of grading systems would be for surgeons to use one system to grade lesions in the different knee compartments but to supplement this with additional methods of registration (video prints or tapes, drawings, etc.).

The experience of the arthroscopist is another important factor in the validity of cartilage lesion grading. Ayral et al. [1] reported a poor coefficient of reliability (0.27–0.73) based on a review of the grading of cartilage lesions made by nine surgeons.

The majority of surgeons felt that the differentiation between intact and softened cartilage (grade I lesion) was easily performed. Also, the diagnosis of complete defects (grade IV lesions) in general did not appear to present any problems. However, the crux of the problem with arthroscopy seemed to be in the differentiation between low-grade and high-grade cartilage lesions. The majority of surgeons felt that the differentiation method was insufficient or that an improvement was needed. In these questionable cases, most reported that they would use additional measurement devices.

Conclusions

Among surgeons, arthroscopy was not perceived to be as reliable as a “gold standard” in the diagnosis of cartilage lesions. The majority of experienced arthroscopists felt unsure of the results in general or at least in some cases. A universal and definitive grading system for lesions is necessary. For questionable cases, measurement devices are needed for objective cartilage grading.

Acknowledgments We thank the AGA-Instructors for their cooperation.

References

1. Ayral X, Gueguen A, Ike RW, Bonvarlet JP, Frizziero L, Kalunian K, Moreland LW, Myers S, O’Rourke KS, Roos H, Altman R, Dougados M (1998) Inter-observer reliability of the arthroscopic quantification of chondropathy of the knee. Osteoarthritis Cartil 6:160–166. doi:10.1053/joca.1998.0108
2. Beguin JA, Heron JF, Sabatier JP, Locker B, Souquieres G (1982) Arthroscopy of the knee. Diagnostic value. 1005 cases. Nouv Presse Med 11:3619–3621
3. Bentley G, Dowd G (1984) Current concepts of etiology and treatment of chondromalacia patellae. Clin Orthop Relat Res October;(189):209–228
4. Brismar BH, Wredmark T, Movin T, Leandersson J, Svensson O (2002) Observer reliability in the arthroscopic classification of osteoarthritis of the knee. J Bone Jt Surg Br 84:42–47. doi:10.1302/0301-620X.84B1.11660
5. Britberg M, Winalski CS (2003) Evaluation of cartilage injuries and repair. J Bone Jt Surg Am 85-A(Suppl 2):58–69
6. Casscells SW (1978) Gross pathological changes in the knee joint of the aged individual: a study of 300 cases Clin Orthop Relat Res May;(132):225–232
7. Curl WW, Krome J, Gordon ES, Rushing J, Smith BP, Poehling GG (1997) Cartilage injuries: a review of 31,516 knee arthroscopies. Arthroscopy 13:456–460. doi:10.1016/S0749-8063(97)90124-9
8. Dougados M, Ayral X, Listrat V, Gueguen A, Bahauaud J, Beaufils P, Beguin JA, Bonvarlet JP, Boyer T, Coudane H (1994) The SFA system for assessing articular cartilage lesions at arthroscopy of the knee. Arthroscopy 10:69–77. doi:10.1016/S0749-8063(05)80295-6
9. Drape JL, Pessis E, Auleyler GR, Chevrot A, Dougados M, Ayral X (1998) Quantitative MR imaging evaluation of chondropathy in osteoarthritic knees. Radiology 208:49–55
10. Duda GN, Kleemann RU, Bluecher U, Weiler A (2004) A new device to detect early cartilage degeneration. Am J Sports Med 12:693–698. doi:10.1177/0363546503261725
11. Ficat RP, Philippe J, Hungerford DS (1979) Chondromalacia patellae: a system of classification. Clin Orthop Relat Res October;(144):55–62
12. Figueroa D, Calvo R, Vaisman A, Carrasco MA, Moraga C, Delgado I (2007) Knee chondral lesions: incidence and correlation between arthroscopic and magnetic resonance findings. Arthroscopy 23:312–315. doi:10.1016/j.arthro.2006.11.015
13. Friemert B, Oberlander Y, Schwarz W, Haberle HJ, Bahren W, Gerngross H, Danz B (2004) Diagnosis of chondral lesions of the knee joint: can MRI replace arthroscopy? A prospective study. Knee Surg Sports Traumatol Arthrosc 12:58–64. doi:10.1007/s00167-003-0393-4
14. Glaser C (2006) Imaging of cartilage. Radiologie 46:16–25. doi:10.1007/s00117-005-1287-x
15. Insall J (1984) Disorders of the patella. Churchill Livingstone, New York, pp 191–260
16. Jerosch J, Castro WH, de Waal Malefijt MC, Busch M, van Kampen GO (2007) Evaluation of cartilage defects in the knee: validity of clinical, magnetic-resonance-imaging and radiological findings compared with arthroscopy. Unfallchirurg 110:782–786. doi:10.1007/s00113-006-1225-z
17. Noyes FR, Stabler CL (1989) A system for grading articular cartilage lesions at arthroscopy 108. Am J Sports Med 17:505–513. doi:10.1177/036354658901700410
18. Outerbridge RE (1961) The etiology of chondromalacia patellae. J Bone Jt Surg Br 43-B:752–757
19. Phahm G, Llettenberg H, Kahl E, Klinger HM, Muckley T, Hofmann GO (2007) Near-infrared (NIR) spectroscopy. A new method for arthroscopic evaluation of low grade degenerated cartilage lesions. Results of a pilot study. BMC Musculoskelet Disord 8:47. doi:10.1186/1471-2474-8-47
20. Pham G, Wittig R, Kahl E, Klinger HM, Muckley T, Hofmann GO (2007) Evaluation of cartilage defects in the knee: validity of clinical, magnetic-resonance-imaging and radiological findings compared with arthroscopy. Unfallchirurg 110:414–424. doi:10.1007/s00113-006-1225-z
21. Vallotton JA, Meuli RA, Leyvraz PF, Landry M (1995) Comparison between magnetic resonance imaging and arthroscopy in the diagnosis of patellar cartilage lesions: a prospective study. Knee Surg Sports Traumatol Arthrosc 3:157–162. doi:10.1007/BF01565475
22. Vasara AI, Jurvelin JS, Peterson L, Kiviranta I (2005) Arthroscopic cartilage indentation and cartilage lesions of anterior cruciate ligament-deficient knees. Am J Sports Med 33:408–414. doi:10.1177/036354604268040