

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

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Received: 28 September 2008 / Published online: 15 April 2009
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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”

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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 67.4. 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 Arthroscopie”, 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 ($n = 78$; 74.3%) of the surgeons’ centers performed 100–1,000 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 the 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 different 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%)

Table 1 Grading systems for arthroscopic classification of cartilage lesions

Author	Grade	Description
Outerbridge [18]	I	Softening or edema
	II	Fragmentation/tear <1/2 in. (~1.3 cm)
	III	Fragmentation/tear <1/2 in. (~1.3 cm)
	IV	Bare open laying subchondral bone
Insall [15]	I	Softening
	II	Deep fissures to the subchondral bone
	III	Fibrillation
	IV	Erosion and exposure of the subchondral bone
Ficat [11]	I	Chondromalacia, surface intact
	II	Chondromalacia, surface with tears or fibrillations
	III	Tear up to the subchondral bone
	IV	Complete ulceration
Casscells [6]	I	Superficial erosions (diameter <1 cm)
	II	Erosions without extension to the subchondral bone or diameter 1–2 cm
	III	Deep erosions up to the subchondral bone or diameter 1–2 cm
	IV	Complete defect or diameter >2 cm
Beguin [2]	I	Swelling and edema
	II	Deep superficial fissures
	III	Deep fissures
	IV	Complete defect with widely uncovered subchondral bone
Bently und Dowd [3]	I	Fibrillation/tear >0.5 cm
	II	Fibrillation/tear 0.5-1 cm
	III	Fibrillation/tear 1–2 cm
	IV	Fibrillation with widely uncovered subchondral bone >2 cm
Noyes und Stabler [17]	I	Intact cartilage
	Ia	Softening <1 cm
	Ib	Softening >1 cm
	II	Fibrillation/tear
	IIa	Fibrillation/tear <half slight of the cartilage layer
	IIb	Fibrillation/tear >half slight of the cartilage layer
	III	Uncovered subchondral bone
ICRS [5]	IIIa	Bone normal
	IIIb	Bone cysts or osteophytes
	0	Normal
	I	Nearly normal (superficial lesions, softening, fissures)
	II	Abnormal (lesions extending to <50% of cartilage depth)
III	Severely abnormal (lesions extending to >50% of cartilage depth)	
IV	Severely abnormal (complete defect)	

Table 1 continued

Author	Grade	Description
SFA [8]	Severe	The severity of cartilage degeneration is determined by a visual analogous scale [ranging 0 (normal) to 100 (severely abnormal, complete defect)]
	Size	Percentage (%) of cartilage degeneration within the joint surface
	A	Size (%) of grade I lesions $\times 0.14$
	B	Size (%) of grade II lesions $\times 0.34$
	C	Size (%) of grade III lesions $\times 0.65$
	D	Size (%) of grade IV lesions $\times 1.00$

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 intraoperatively 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.

Table 2 Items of the survey and possible answers

Question	Possible answers
How many knee arthroscopies do you perform in your clinic per year?	1 2–5 <5
How many arthroscopies are performed in your clinic every year?	<50 51–100 101–500 501–1,000 <1,000
Which grading system do you regularly use to classify cartilage lesions and defects?	No ICRS Outerbridge Insall Other
Which findings do you register regularly in the operations protocol?	Generally all joint surfaces differentiated between mean bearing zone and margin Generally all mean bearing zones Only severe lesions or defects Other
How do you perform the evaluation of cartilage lesions?	Verbal description Verbal description and draft Video photo Videotape Other
When do you perform a hook probing of the cartilage?	In general, all surfaces are probed by hook Probing by hook only in questionable findings Hook is seldom or never used Other instrument is used
How do you evaluate the size of lesions?	Calculation intraoperatively Measurement intraoperatively PC-measurement postoperatively Other Never
What is your opinion about the validity in differentiation of cartilage lesions between stages?	Sufficient Needs improvement Poor
	<ul style="list-style-type: none"> • 0–I • I–II • II–III • III–IV

Table 2 continued

Question	Possible answers
What is your opinion about intraoperative measurements to objectify cartilage lesions (for example by biomechanical measurements)?	Very useful Somewhat useful Not required We just perform cartilage measurements
If there were a practical device available to quantify cartilage lesions, when would you use it?	Always In questionable cases Never

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 ≤ 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. Ayrál 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.

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