MRI of the knee cost-efffective use

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CHAPTER 1

Introduction

1. Introduction

In The Netherlands every year approximately 300,000 knee injuries occur [1]. An injury to the knee is the second most common problem of the musculoskeletal system for which patients consult their general practitioner (48 per 1000 per year) [2]. Between the ages of 16 and 45 years the prevalence of knee complaints in primary care is 27 per 1000 [2]. Most of these injuries heal spontaneously, but in a minority of cases (18%) these complaints last more than four weeks and about 90,000 patients are referred to an orthopedic surgeon each year [2,3]. Because of the high prevalence of knee injuries in primary care several guidelines for general practitioners were issued in 1998 [4-6].

Approximately 20,000 arthroscopies are performed in patients aged between 16 and 45 years [7]. Arthroscopy offers direct visualization of all intra-articular structures with high diagnostic accuracy [8], the possibility to examine the stability of the knee under anesthesia and the possibility to perform a therapeutic procedure in the same session. However, arthroscopy is an invasive procedure that needs hospitalisation and comes with high costs, the risk of complications and the sick leave afterwards.

The complication rate of arthroscopy is reported to be between 0.56 and 8.2% [9-12]. Sherman at al. [12] found 126 serious complications in 2640 arthroscopies. Complications were: infection, hemarthros, adhesions, effusion, cardiovascular complications, neurological complications, sympathetic reflex dystrophia and broken equipment.

The percentage of non therapeutic arthroscopies varies and is being estimated between 27 and 61% [13-15]. In 12,000 (66.3%) out of 18,000 arthroscopies performed in The Netherlands in patients aged between 16 and 45 years no therapeutic procedure was registered. The number of arthroscopies per 100,000 inhabitants varied between regions in The Netherlands from 323 to 409 [16].

These two issues led the Dutch Orthopedic Society (NOV) in cooperation with the Centraal Begeleidingsorgaan voor de Intercollegiale Toetsing (CBO) to organize a consensus meeting with regards to arthroscopy of the knee [16]. This consensus concerns patients aged between 16 and 45 years with at least four weeks of knee complaints. The consensus was that it is useless to conclude an examination with an arthroscopy if not at least one of the following clinical criteria is met at physical examination: substantial joint effusion (more than bulging sign), passive extension deficit of at least 10°, passive flexion deficit of at least 20°, instability (ie, positive varus and valgus stress, Lachman, anterior and posterior drawer, and Pivot test results), a positive result of at least one meniscal provocation test (ie, McMurray, Apley, or squat test), and atrophy of at least 2 cm relative to the contralateral leg measured 15 cm above the medial joint line. Furthermore the consensus states that the clinician, after history taking, physical examination and if necessary diagnostic imaging, almost always can decide his treatment-strategy. For that purpose a purely diagnostic arthroscopy is not necessary.

Five years after this consensus meeting, in 1997, the percentage of purely diagnostic arthroscopies had risen from 66.3% to 72.9% ($p < 0.05$) [7].

Magnetic Resonance (MR) imaging was not taken into account in the consensus. In studies evaluating the diagnostic accuracy of MR, using arthroscopy as standard of reference, MR proved to have a high accuracy in detecting intra-articular knee pathology [17-21]. Other studies demonstrated that MR can be used in patients with knee complaints to limit the number of diagnostic arthroscopies and reduce costs [13-15, 22-27]. These studies all have three important shortcomings. All of these studies used intermediate outcome parameters, like diagnostic accuracy or therapeutic impact of MR in stead of clinical outcome parameters: 'impact on health' [28]. The 'impact on health' can be studied by following patients in time, using clinical outcome measures, like function and symptoms of the knee, to evaluate success or failure of diagnostic and therapeutic strategies. The second shortcoming of the aforementioned studies is that costs and savings were calculated using charges or fees and not the real cost-prices of procedures. Moreover, often only the medical costs and not the non-medical or productivity costs were taken into account in the analyses. The third shortcoming of the studies is that patients were not randomly assigned to the treatment strategies, thus introducing bias.

We started a prospective multicenter study in one academic and two teaching hospitals in The Netherlands with the purpose to evaluate the cost-effectiveness of MR imaging performed to exclude the need for arthroscopy in patients with nonacute knee symptoms and high clinical suspicion of intra-articular knee abnormality. To this end all consecutive patients aged 16-45 years, who had had knee symptoms (specifically pain, swelling, instability, and/or locking) for at least 4 weeks (nonacute) and were referred to one of the three participating hospitals were eligible for the study. All included patients underwent a standardized physical examination. Based on this physical examination, according to guidelines by the Dutch Orthopedic Society, patients were divided in two groups: patients with high and patients with low clinical suspicion on intra-articular knee pathology. All patients underwent MR imaging. MR was classified as being positive (ie, arthroscopy indicated on the basis of the MR findings) or negative (ie, arthroscopy not indicated on the basis of the MR findings alone). Patients with high clinical suspicion and positive MR result underwent arthroscopy. Patients with high clinical suspicion and negative MR result were randomized; half of these patients underwent arthroscopy and the other half was treated conservatively for at least three months. was assigned for diagnostic arthroscopy. All patients with high clinical suspicion were clinically evaluated at six months and costs were calculated in order to perform a cost-effectiveness evaluation. Patients with low clinical suspicion and positive MR result underwent arthroscopy. Patients with low clinical suspicion and negative MR result were conservatively treated. These patients were not clinically evaluated after six months.

This thesis describes the cost-effictiveness study and several substudies, using the same patient population. In chapter 2 we assessed the effectiveness of MR imaging in selecting patients with nonacute knee symptoms for arthroscopy of the knee.
In chapter 3 we discuss effectiveness and costs of MR imaging triaging these patients. In chapter 4 we determine in patients with nonacute knee symptoms and normal standardized physical examination the fraction of MR imaging studies showing arthroscopically treatable intraarticular pathology, thus evaluating whether one safely can refrain from MR imaging. In chapter 5 we discuss whether radiographs are needed when MR imaging is performed for nonacute knee symptoms anyway. The impact of bone bruise on presentation and short term course of knee complaints and the relation between bone bruise and (peri-)articular derangement is assessed in chapter 6.

1.1. References

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