

The frequency of referral for MRI by the general practitioner in patients with traumatic knee complaints: retrospective cohort study

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Submitted

ABSTRACT

Background: In general practice the use of magnetic resonance imaging (MRI) is advocated in diagnosing traumatic knee complaints. However, MRI is not recommended by the Dutch college of General Practitioners (GPs). The aim of this study was to examine the frequency of knee MRI referral by the GP in patients with traumatic knee complaints in 2011, 2012 and 2013.

Methods: This was a cohort study with data originating from the Integrated Primary Care Information (IPCI) database, a longitudinal database of electronic medical records of GPs in The Netherlands. Included were patients aged 18 to 45 years, diagnosed with knee complaints due to a trauma. Excluded were patients with a chronic internal knee trauma in the past or with known osteoarthritis of the knee, patients who visited the emergency department for current knee complaints, and patients in whom the knee trauma was more than six months ago. The main outcome was the referral for knee MRI by the GP, secondary outcomes were referral to physiotherapy or an orthopaedic surgeon.

Results: In total, 303, 300 and 187 patients with traumatic knee complaints were included in 2011, 2012 and 2013 respectively. In 2011 50 (17%) of these patients were referred to an MRI, in 2012 35 (12%) and in 2013 18 (10%). Of the patients with traumatic knee complaints about one fifth was referred to a physiotherapist and one third to an orthopaedic surgeon.

Conclusions: From 2011 until 2013, yearly 10 to 17% of the patients with traumatic knee complaints were referred to an MRI by their GP.

INTRODUCTION

Knee complaints are a common musculoskeletal disorder seen by a general practitioner (GP). The incidence and prevalence of knee complaints in the Dutch general practice are respectively 20 and 30 per 1000 person/years.¹ Some of these knee complaints have a traumatic cause. The incidence of knee complaints due to trauma (excluding fracture) in the Netherlands is estimated at 5.3 per 1000 person/years and the prevalence is 6.8 per 1000 persons in general practice.¹ For a GP, the exact diagnosis in patients with a traumatic knee complaints can be complicated.²⁻⁵ A diagnostic dilemma might be one of the reasons for a GP to refer patients with traumatic knee complaints for magnetic resonance imaging (MRI). However, there is some debate about the additional value of MRI in primary care in these patients. The guideline for traumatic knee complaints from the Dutch college of General Practitioners does not recommend MRI referral by the GP because of lack of evidence of its benefit for the patient.⁶ Recently published studies provide evidence that routine MRI referral by the GP in patients with traumatic knee complaint did not improve clinical outcomes and was not cost-effective compared to usual care.^{7,8} In contrast, earlier studies showed that MRI prior to an orthopaedic appointment compared with referral to an orthopaedic specialist without prior MRI did reduce medical costs and improve knee function.⁹⁻¹¹ At present it is unclear how often GP's request MRI in patients with a traumatic knee complaint. Therefore the aim of this study was to identify the proportion of MRI's requested by the GP in patients aged between 18 and 45 years presenting with traumatic knee complaints in general practice. In addition, the medical consumption e.g. referral to physiotherapy or an orthopaedic surgeon was assessed.

METHODS

Study design and data source

This cohort study used data from the Integrated Primary Care Information (IPCI) database, a longitudinal database of electronic medical records from Dutch GPs. Currently, about 1,500,000 patients are followed from over 600 participating GP's in the Netherlands.¹² Demographic information and the medical history of the patient (symptoms, diagnoses, referrals, laboratory findings, hospitalization) are included in the IPCI database.¹³ The study was approved by the Governance Board of the IPCI database.

Study population

Inclusion criteria

The present study included patients aged between 18 and 45 years diagnosed with traumatic knee complaints between 1st January 2011 and 31st December 2013. Exclusively patients of GPs who used a specific electronic medical record system (HetHis system) in their practice were

included because this system contained an accurate documentation of MRI's requested by the GPs. Consultations for knee complaints were identified based on the International Classification for Primary Care (ICPC) codes for knee complaints (ICPC code L15), sprain of the knee or knee distortion (ICPC code L78), and acute injury of the meniscus or knee ligaments (ICPC code L96). Eligible patients were selected through an electronic search on these codes within the IPCI database. Patients were included if they had (a) 12 month history prior to the first occurrence of the code, and (b) a follow-up of at least 6 months after diagnosis.

We manually reviewed each medical record to determine if the knee complaints were due to a trauma. During manual review, the case was labelled as "traumatic knee complaint" when the record explicitly stated that *a trauma* occurred or that *a false step, sprain, rotation, fall, contusion and/or distortion* occurred. The case was labelled as "no trauma" when the record explicitly stated that *no trauma* occurred, when the record stated that the knee complaints *gradually emerged*, were caused due to *overload*, or the cause of the knee complaints was *unknown*. Remaining cases were labelled as "unclear". Two researchers (IAA and NMS) independently assessed the first 20 medical records as a trial for validation of the definitions. After consensus was reached on the definitions, the remaining medical records were assessed by IAA or NMS. In case of doubt, decisions were made based on consensus with a third person (PAJL). If the patient visited the GP more than once for the same episode of knee complaints, this was counted as one episode. If a patient had more registered episodes of knee trauma's during the 6 months follow up, only the first episode of knee trauma was assessed.

Exclusion criteria

Excluded from the study were patients diagnosed with a chronic internal knee trauma (IPCI code L97) and/or osteoarthritis of the knee (ICPC code L90) in the registered history. We also excluded patients that went to the emergency department before going to the GP for the same episode of knee complaints.

Outcomes

The main outcome was the proportion of MRI referrals by the GP in patients with traumatic knee complaints. The secondary outcome was the medical consumption, e.g. pain medication, X-ray referral and referral to physiotherapy or orthopaedic surgeon. Furthermore age, sex, ICPC code, duration of knee complaints at consultation, history of knee complaints, and the occasion (sport/work/home/traffic/other) and mechanism (rotation/fall/bump/other) of the trauma were assessed.

Statistical analysis

The patient characteristics, frequency of traumatic knee complaints and the provided healthcare on traumatic knee complaints were described over the years 2011, 2012 and 2013 using descriptive statistics. The differences in the provided healthcare between 2011, 2012 and 2013 were

analysed using the Pearson chi-square ($P < .05$) in the crosstabs procedure. The associations of candidate predictors with MRI referral by the GP were assessed with multivariable logistic regression analysis (Enter method) presenting ORs (95% CI), with an association of $P < .05$ determined as a significant association. Candidate predictors were selected based on expert opinion (PL, SBZ, NS). A correlation matrix was made of the dependent and independent variables to check for multicollinearity. All analyses were performed using SPSS version 21 (SPSS Inc., Chicago, IL).

RESULTS

Figure 1 shows the flow chart of the inclusion process. There were in total 189,152 patients registered in the selected practices in the IPCI database in the period 2011 to 2013; in 2011 there were 164,173 patients, in 2012 171,564 patients and in 2013 there were 166,034 patients. Of the 189,152 patients, 2,695 patients had knee complaints and were screened manually. Of these 2,695 patients, 790 patients were identified as knee complaints due to a trauma.

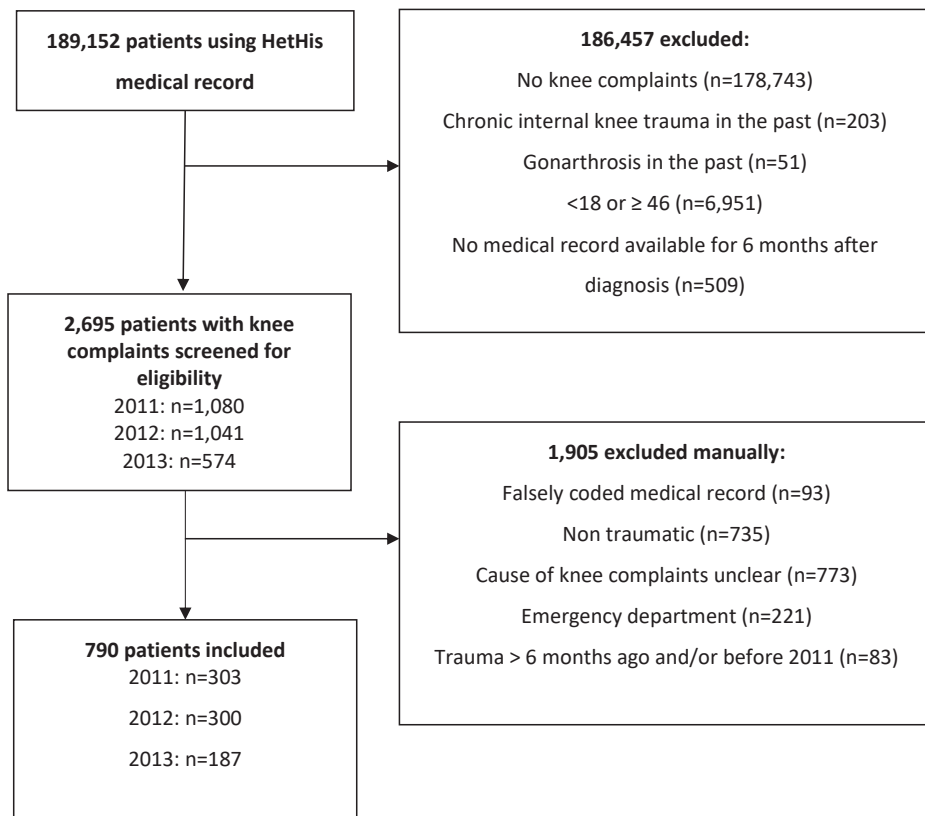


Figure 1 The flowchart of the inclusion process

The characteristics of the included patients are presented in Table 1. The cohort contained 442 males (56%). The mean age was 31 (SD 9), and the mean duration of the knee complaints at consultation was 13 days (SD 23). The majority of traumatic knee complaints occurred during sports 248 (31%) and a rotational trauma was the most frequently registered mechanism of the trauma (n= 214; 27%).

Table 1 Patient characteristics (N=790)

	All patients		2011 (n=303)		2012 (N=300)		2013 (N=187)	
	n*		n*		n*		n*	
Age; mean (SD)	790	31 (9)	303	31 (9)	300	32 (9)	187	31 (9)
Sex; number of males	790	442 (56)	303	171 (56)	300	163 (54)	187	108 (58)
Duration of complaints in days; mean (SD)	487	13 (23)	177	13 (23)	183	13 (26)	127	13 (18)
History of knee complaints	788	423 (53)	302	161 (53)	299	171 (57)	187	91 (49)
Traumatic	308	263 (33)	115	95 (31)	173	109 (36)	121	59 (32)
Non-traumatic	308	45 (6)	115	20 (7)	173	18 (6)	121	7 (4)
Occasion of trauma	503		196		190		117	
Sport		248 (31)		101 (33)		87 (29)		60 (32)
Work		10 (1)		5 (2)		3 (1)		2 (1)
Home		70 (9)		19 (6)		25 (8)		26 (14)
Traffic		36 (5)		7 (2)		22 (7)		7 (4)
Other ¹		139 (18)		64 (21)		53 (18)		22 (12)
Mechanism of trauma	746		289		281		176	
Rotation		214 (27)		82 (27)		79 (26)		53 (28)
Fall		195 (25)		70 (23)		74 (25)		51 (27)
Bump		26 (3)		7 (2)		13 (4)		6 (3)
Other ²		311 (39)		130 (43)		115 (38)		66 (35)

All values are presented as number of patients (%), unless otherwise stated. IQR: Inter Quartile Range. Missing values range up to 38%. *Number of available observations. ¹For example: trauma during stairs ascending/descending, walking with the dog, gardening, etc. ²A false step, sprain, contusion / distortion.

Provided healthcare

The policy of traumatic knee complaints for 2011, 2012 and 2013 is presented in Table 2. The amount of MRI referrals by the GP was 50 (17%), 35 (12%) and 18 (10%) in 2011, 2012 and 2013, respectively. There was no significant difference between in the amount of MRI referrals by the GP during the study period (P=.06).

For 86 (28%) patients in 2011, for 84 (28%) in 2012 and for 45 (24%) patients in 2013 pain medication was prescribed. The amount of X-ray referrals was 34 (11%) in 2011, 41 (14%) in 2012 and 20 (11%) in 2013. Of the patients with traumatic knee complaints, 65 (22%), 61 (20%) and 35 (19%) were referred to a physiotherapist, 105 (35%), 103 (34%) and 65 (35%) were referred to an orthopaedic surgeon and 7 (2%), 6 (2%) and 5 (3%) received another kind of referral in 2011, 2012

and 2013 respectively. There were no differences in any of the medical consumption outcomes between the years 2011 and 2013.

Table 2 General practitioners' policy on traumatic knee complaints (n=790)

	2011 (n=303)	2012 (n=300)	2013 (n=187)	
Primary outcome				
MR scan referral	50 (17)	35 (12)	18 (10)	.06
Secondary outcomes				
Follow-up appointment GP	51 (17)	49 (16)	26 (14)	.67
Advice*	126 (42)	127 (42)	70 (37)	.54
Wait and see	63 (21)	64 (21)	47 (25)	.50
Pain medication	86 (28)	84 (28)	45 (24)	.54
X-ray referral	34 (11)	41 (14)	20 (11)	.53
Physiotherapy referral	65 (22)	61 (20)	35 (19)	.77
Orthopaedic surgeon referral	105 (35)	103 (34)	65 (35)	.99
Other kind of referral ¹	7 (2)	6 (2)	5 (3)	.89

All values are presented as number of patients (%). Combinations of general practitioners' policy in one patient are possible. MR: magnetic resonance. *Cooling, take rest, exercises or leg elevation. ¹other kind of referral such as ultrasound of the knee

Timing of the MRI referral

In 58 patients (57%) the MRI referral was within the first week after the first GP consultation for the traumatic knee complaints (figure 2). In 12 patients (12%) the MRI referral was in the second week, in 6 (6%) patient in the third week, in 5 patients (5%) in the fourth or fifth week and in 16 patients (15%) the MRI referral was after the fifth week.

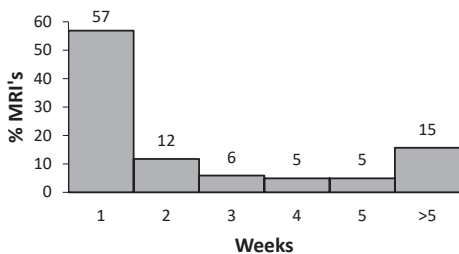


Figure 2 Timing of the MRI after the first consult to the GP

Associations with MRI referral

Being male (OR 2.26; 95%CI 1.25, 4.08) and a longer duration of knee complaints (OR 1.01; 95% CI 1.01, 1.02) were associated with a referral for MRI by the GP (Table 3).

Table 3 Multivariate associations with MR imaging referral by the general practitioner

	MR group (n=63)	No MR group (n=422)	OR (95% CI)
Age; mean (SD)	31 (8)	31 (9)	1.00 (0.96, 1.03)
Sex; number of males (%)	45 (71)	223 (53)	2.26 (1.25, 4.08)*
Duration of complaints in days; mean (SD)	22 (40)	12 (19)	1.01 (1.01, 1.02)*
History of knee complaints; n (%)	35 (56)	222 (53)	1.06 (0.61, 1.83)

MR: magnetic resonance. SD: Standard Deviation. OR: odds ratio. CI: confidence interval. Nagelkerke r^2 = .065.
*($P < .05$)

DISCUSSION

Study results

Studying the medical records of GP's, we identified 790 patients aged 18 to 45 years visiting their GP with traumatic knee complaints during 2011 to 2013. The GP referred about one in eight patients to an MRI. In contrast with the hypothesis of an increase in MRI's during the last decade due to improved accessibility, there was a trend seen towards a decrease in MRI's requested by the GP during the study period. The trend towards a decrease of MRI's might be induced by the publication of the guideline for traumatic knee complaints from the Dutch college of General Practitioners, in which an MRI referral by the GP is not recommended. It might also be explained by changes in the reimbursement of MRI after referral by the GP in patients with traumatic knee complaints. The National Health Care Institute of the Netherlands stated in 2010 that healthcare insurers should reimburse MRI after referral by the GP for indications described in the guideline. The guideline describes that MRI might play a role in the transmural setting in case indications for surgery are distinguished, or within specific subgroups of patients. However, nowadays, there is still no consensus on indications for surgery or characteristics of specific subgroups. There are signs that during the study period healthcare insurers did not compensate all patient for the cost for knee MRI after referral by the GP, which may have led to a decrease in referrals for MRI.

The secondary outcomes of our study showed that of the patients with traumatic knee complaints, the GP referred about one in three patients to an orthopaedic surgeon and about one in five patients to a physiotherapist during 2011 to 2013. The guideline for GPs stated that although physiotherapy may contribute to the recovery of the knee function after a meniscus or cruciate ligament injury, there is insufficient evidence about the effectiveness to recommend it. Evidence from recent published studies pleads more and more for conservative treatment; in patients with degenerative meniscal lesions surgery is just as effective as conservative treatment and surgery comes with side effects.^{14,15} Furthermore, a recent systematic review showed no difference between surgical management and conservative treatment in patients with anterior cruciate ligament injuries in patient-reported outcomes of knee function at two and five years after injury.¹⁶ The recommendation for physiotherapy in the guideline for GPs needs to be revised based on these findings. Also, the guideline for GPs recommends to refer the patient to an orthopaedic

surgeon in case of persistent limitations or instability of the knee in function of daily living, sports or during work. However, the evidence for the benefit from surgery for any such subgroup is lacking and the Dutch guideline for orthopaedic surgeons recommends anterior cruciate ligament reconstruction only in patients with symptomatic instability or persistent giving way who are not improving after physical therapy.¹⁷ Consensus should be reached about indications for surgery in patients with traumatic knee complaints.

Comparison with existing literature

In a prospective observational cohort study (HONEUR) conducted in 2001 to 2003 in patients aged 12 years or above consulting their GP with knee complaints for the first time, 351 of the 1068 included patients (33%) reported a traumatic onset of the complaints.¹⁸ In our results, 790 of the 10,409 patients (total amount of patients using HetHis medical system minus the total amount of patients with no knee complaints) identified with knee complaints were classified as having a traumatic onset, which comprises 7.5%. The lower proportion of traumatic knee complaints in our cohort can mainly be explained by the restriction in age from 18 to 45 years.

Also, patients with recurrent complaints for which the GP was not consulted within the last three months were included in the HONEUR study as well. In a subgroup of the HONEUR cohort, in patients with traumatic knee complaints, about one third was referred to physiotherapy and one fifth was referred to an orthopaedic surgeon.¹⁹ The percentage referral to secondary care in the HONEUR cohort might be an underestimation, since these patients received an MRI for study purposes and thereby were reassured, knowing that they would be informed in case of fracture or severe injury seen on MRI. Little is known about the number of MRI referrals by the GP for traumatic knee complaints. In a study evaluating 12 years of open access to MRI services at a London teaching hospital, 1798 scans for spine, knee and brain performed following GP referrals between 1994 and 2005 were reviewed.²⁰ A gradual increase in the number of requests over the time period was seen, in contrast with our results. However, the GPs referral as a percentage of the total MRI workload did not increase during the study.

Strengths and limitations

This is the first study giving insight in the proportion of MRI referrals by the GP in patients with traumatic knee complaints. By screening the medical records of the GP, an objective picture of daily practice is obtained about the proportion, the change over time, the timing and possible predictors of an MRI referral by the GP in these patients.

There are a few restrictions to this study. A population selection was made by including only patients of GP's using HetHis medical system in their practice. Unfortunately, fewer patients could be admitted in 2013 than in 2012 and 2011 because HetHis medical system was no longer supported and replaced by other electronic systems in 2014. This may have biased the results towards a non-significant decrease of MRI referrals. Also, since a GP's registration system was used, underreporting because of not granting a (right) diagnosis code related to knee complaints,

or the lack of description to assess if the knee complaints were traumatic or non-traumatic is possible. However, this had no influence on the primary aim of this study to identify the proportion of MRI's requested by the GP if a traumatic cause was registered.

Implications for research and practice

In most cases, the GP seems to comply to the guideline recommendation not to refer to MRI. However, this does not appear to be sufficient for all patients with traumatic knee complaints. It remains unclear based on what criteria the GP and patient tend towards MRI. Future research should focus on what drives the patient and GP to make an MRI after a knee trauma. Also, future research needs to distinguish measurable indicators to identify patients with traumatic knee complaints who may benefit from surgery, to be able to be more conclusive about which patients need referral to an orthopaedic surgeon.

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