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MR imaging of the knee in primary care

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CHAPTER 9

Summary and general conclusion

Samenvatting en algemene conclusie

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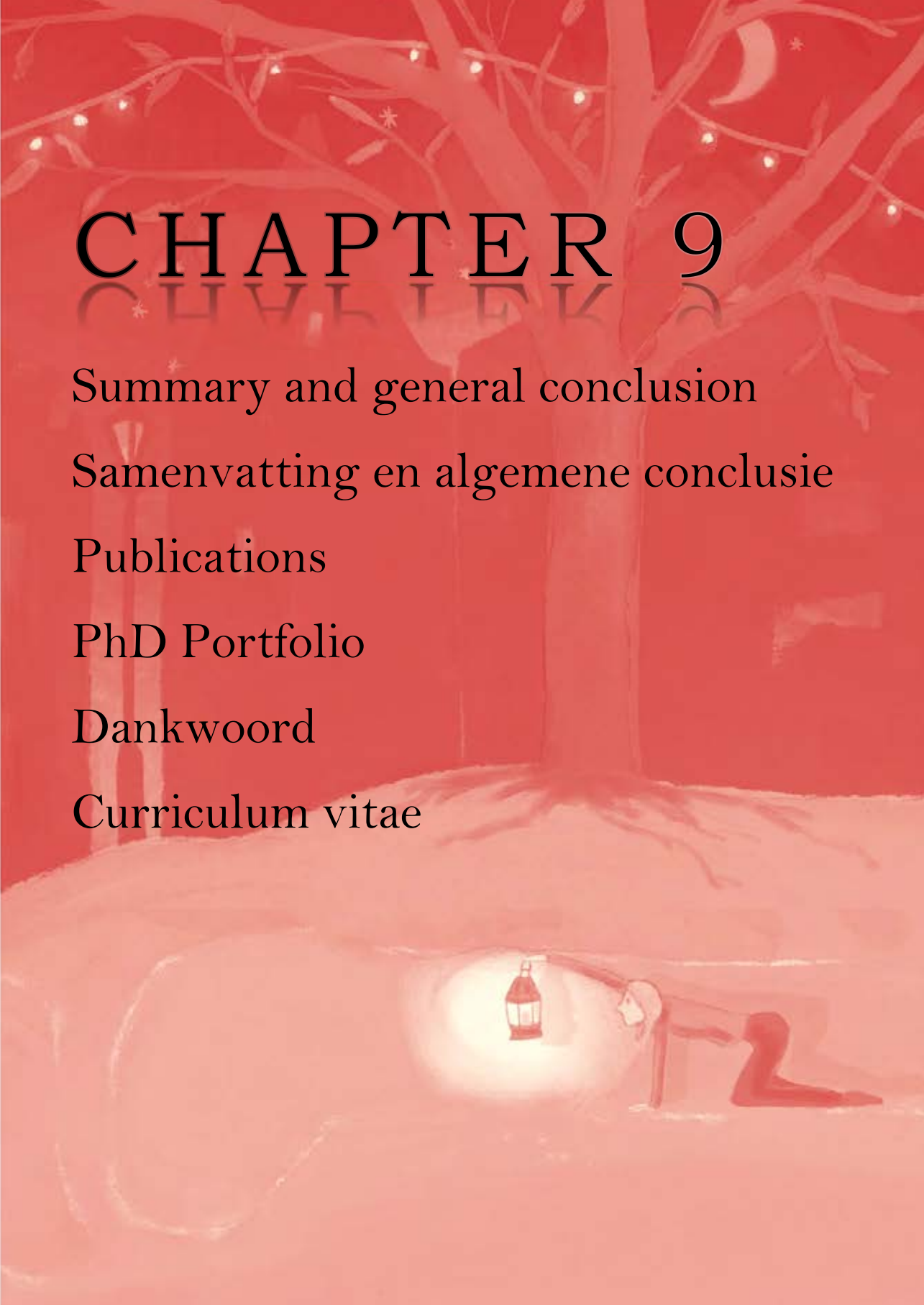

Summary and general conclusion

The aim of this thesis was to determine the added value of MR imaging in primary care for patients with knee complaints. To this end, we conducted a randomised controlled trial including patients with knee complaints after a recent trauma, aged 18-45 year. In chapter 2 we presented the research protocol of the TraumAtic Complaints of the Knee – LUMC and Erasmus MC (TACKLE) Trial. Furthermore, a study was performed to assess the added value of MR imaging in early knee osteoarthritis.

MR findings, associations and predictive values

In chapter 3 we described the MR findings as observed in the TACKLE trial's cohort and the associations with clinical outcome measures. Almost 40% of the patients had one or more positive MR findings potentially requiring further evaluation by an orthopaedic surgeon, mostly being an anterior cruciate ligament rupture in 22% and/or a traumatic meniscal tear in 15%.

A marked finding, considering our young population (<45 years old), was the relative high frequency (17%) of horizontal degenerative meniscal tears. These tears were not associated with any clinical outcome measure (impaired knee function and/or pain) while this was true for the traumatic meniscal tears. A horizontal tear is believed to be of a degenerative origin for which therapeutic options often lack.[1] Our opinion is to regard a horizontal meniscal tear even in young adults with a recent knee trauma, as an incidental finding on the knee MR scan, and not to interpret this finding as a cause of the patient's knee complaints.

Furthermore, the longer the duration of complaints, the less MR abnormalities were present and the less knee specific symptoms were reported. This finding can be explained by the natural recovery of patients in which bone bruises resolve, effusion diminishes and injuries to the meniscus and ligaments heal. Another possible explanation is that earlier consultation was achieved by patients with more severe complaints, resulting in a shorter period from trauma to MR imaging.

In chapter 4 a short, simple and straightforward clinical prediction rule for a negative MR was presented identifying patients with a high probability of negative MR findings, justifying initial treatment in primary care.

Seven predictors were identified consisting of information being easily obtainable in only a few minutes during history taking. These predictors were a 'non-sports related trauma', 'no severe pain during twisting or pivoting of the weightbearing knee', 'squatting below 90° possible', 'no direct pain after trauma', 'three months or longer complaints' and 'presence of a musculoskeletal comorbidity'. The prediction rule showed a high discriminative ability and was also validated in another cohort in general practice, with comparable performance. With the presence of 3 or more predictors, the pre-test probability to have a negative MR raised from 61% to a post-test probability of 82%. The clinical prediction rule supports the General Practitioner (GP) to maintain the majority of patients in primary care for a watchful waiting policy, without the use of MR imaging.

Chapter 5 covered a study on the added value of MR imaging in patients returning to sports after a knee trauma. The results of this study showed that, at the first consultation in general practice after a knee trauma, 62% of the patients aged 18-45 years had not returned to sports. At 6-weeks follow-up this percentage was 41% and after 3 months this was 25%. These results emphasise the impact that a knee trauma can have in patients aged 18-45 years, formerly being active in sports.

Several patient characteristics, trauma characteristics and baseline severity of knee complaints were associated with return to sports during follow-up. Higher odds ratios for a failure to return to sports were seen in patients with a higher age, in patients reporting more pain in the previous 48 hours, in patients with a sports-related trauma, and in patients who reported effusion during the past week.

Adding MR findings to these characteristics did not improve the prediction to return to sports at 6-weeks or at 3-months follow-up. Therefore, a combination of patient characteristics, trauma characteristics, and the reported pain and effusion is, without MR, sufficient to predict return to sports within 3 months in these patients.

Cost-effectiveness of MR imaging in primary care

The cost-effectiveness analysis presented in chapter 6 showed that an early MR scan requested by the GP neither improved health outcomes, nor saved costs in patients aged 18-45 year with traumatic knee complaints. This was a surprising conclusion, since we hypothesised opposite effects when we designed this study. No reduction in referral rate

was seen towards an orthopaedic surgeon in the MR group, and moreover, a non-significantly higher proportion of patients underwent an arthroscopy in the MR group (22% in the MR group compared to 16% in the usual care group). Furthermore, more physical therapy sessions and more absent workdays were reported in the MR group. From the ancillary analyses it can be appreciated that a selected subgroup of patients might exist for which MR imaging is cost-effective, this was the subgroup of patients of which the GP intended to refer to an orthopaedic surgeon or the an MRI scan. However, the characteristics of this subgroup needs to be evaluated in a future study. Overall we concluded that MR imaging was not cost-effective in patients presenting with traumatic knee complaints in primary care.

Added value of MR imaging in primary care regarding clinical outcomes

In chapter 7 the non-inferiority analyses were presented. MR imaging was both not inferior, but also not superior, to usual care concerning knee-related daily function measured with the Lysholm scale. Also, MR imaging did not improve the scores on the Knee Osteoarthritis and Injury Score (KOOS) which includes the subscales knee pain, knee symptoms, function in daily living, sport and recreation, and quality of life. Nevertheless, patients in the MR group more often perceived themselves to be recovered and more often reported to be satisfied during the 1-year follow-up. Considering the absent improvement on knee pain and function over 12 months, together with the higher healthcare costs in the MR imaging group, made us conclude that MR imaging had no added value in primary care for patients aged 18-45 years presenting with traumatic knee complaints.

MR imaging in early knee osteoarthritis

In chapter 8 we evaluated the added value of MR imaging for patients suspected to develop knee osteoarthritis, although the conventional radiograph was negative at baseline in these patients. After 5 years, radiographic osteoarthritis developed in 28% of the participants. On the baseline MR scan we observed more cartilage defects, osteophytes, bone marrow lesions, effusion and meniscal pathology in patients developing radiographic knee osteoarthritis compared to patients that did not develop radiographic osteoarthritis, This resulted in statistically significant higher odds ratios for these MR-findings ranging from 1.7

to 3.1 for the development of radiographic knee osteoarthritis. We combined these MR features into a prediction model, resulting in moderate sensitivity and specificity rates for the development of radiographic knee osteoarthritis.

A possible explanation for the moderate performance of the prediction model using MR findings in knee osteoarthritis could be the choice of the outcome: radiographic knee osteoarthritis diagnosed on conventional imaging after 5 year. Radiography is known to have several disadvantages, including the inability to detect small changes, and the poor correlation with knee function and pain.[2] Patients clinically already suffering from knee osteoarthritis often still have no radiographic features of osteoarthritis. Whether incident radiographic knee osteoarthritis, determined on repeated posterior-anterior views of the femorotibial joint, was the ideal outcome is therefore questionable. However, this outcome still remains the gold standard regarding imaging in knee osteoarthritis.[3]

We think MR imaging should not be used in primary care to diagnose early knee osteoarthritis, also because of the lack of therapeutic options.

Implications for practice

One of the most interesting results from the TACKLE trial was the absent reduction of referrals towards an orthopaedic surgeon in the MR group, and an even higher rate of arthroscopies in this group without improvement of health outcomes. A possible explanation could be the low a-priori chance of a patient having a clinically relevant MR finding. A better preselection of patients using the predictors described in chapter 4, enables MR imaging to be a more efficient diagnostic tool resulting in higher positive predictive values. We are not the first to illustrate the importance of the a-priori chance of clinically relevant findings in knee MR imaging. Another study with a computer based model analysed the cost-effectiveness of MR imaging for meniscal tears in various combinations with patient history and physical examination. Using MR imaging to confirm a negative physical examination led to a 2-2.3 higher rate of unnecessary surgeries in their decision model.[4] Therefore GPs should not request an MR scan to confirm anticipated negative MR findings, an often mentioned advantage accredited to MR imaging based on its high negative predictive value.[5-9] Besides leading to higher (potentially unnecessary) healthcare costs, it is known that negative results often fail to reassure patients.[10,11]

Another issue is the natural recovery of patients. In the usual care group of our study the same improvement on knee function and knee pain was seen over 12 months as in the MR imaging group. On the other hand, in our trial patients were more satisfied in the MR imaging arm (chapter 7), underlining the complexity of the effects of additional diagnostic test for patients seeking medical attention for their knee complaints in primary care.

In our randomised controlled trial we experienced difficulties including enough patients to reach our desired sample size. One of the reasons for the short falling inclusion rate in the TACKLE trial noticed by the GPs was the demanding patient not willing to be randomised with only a 50% chance to receive an MR scan. Patients regularly insisted on a fast diagnosis with MR imaging, for which they may have believed chances were higher on an earlier recovery from their knee complaints. Also, in the current economic climate patients have little time to allow for a naturally recovery to occur, aggravated by the social pressure from employers in which work absenteeism is undesired.

Overcoming these expectations is challenging for GPs who only have a limited amount of time. Explaining the balance of limitations and benefits of MR imaging is time-consuming, considering the consequences of false positive scans, degenerative or incidental findings and the self-limiting injuries, potentially leading to unnecessary surgery with the associated risks and costs. The results of the MR scan may confuse the patient and/or the general practitioner due to findings not being related to the patient's symptoms.

Referral to MRI should be clinically driven, with MR imaging not being indicated for patients in whom the result would not alter treatment.

Unanswered questions and future research

In the TACKLE trial, all patients presenting with traumatic knee complaints were eligible for inclusion, hence eligible for MR imaging of the knee. We aimed to include a wide range of patients with traumatic knee complaints as seen in primary care, without pre-selecting patients based on unknown factors. In our trial we did not collect data on physical examination by the GP, since quantification of this data using valid knee tests was difficult with 150 general practitioners involved. However, we did collect data on the GP's preference for referral to MR imaging or to an orthopaedic surgeon. In exploratory analyses (chapter 6) MR imaging was cost-effective in the subgroup of patient with ≥4 weeks of

complaints of which the GP preferred to refer to MR imaging and/or to an orthopaedic surgeon. This subgroup analysis was not predefined and had a low statistical power, with a small number of patients in this subgroup (n=94).

Therefore, it remains unknown whether referral to an orthopaedic surgeon ór to MR imaging is the best approach in patients for which the GP has a high suspicion of clinical relevant findings. Future research should aim to identify this subgroup and to analyse the cost-effectiveness and knee specific outcomes in these patients selected by the GP. A randomised controlled trial would be the best option, with new inclusion criteria based on the GPs intrinsic factors. An observational study would be a less effective option, since the GP's preference for further management of the knee complaints is not equivalent with the actual performed management, in which the patient's preference is also considered.

Until the time that such a subgroup is identified we have shown that currently, for the entire population seeking medical attention of the GP for knee complains, MR imaging does not contribute to an improved clinical outcome nor to cost containment.

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