CHAPTER 10

GENERAL DISCUSSION

In recent decades, a great deal of effort has been put forth to improve care for geriatric hip fracture patients. Orthogeriatric care models and a shift away from treating displaced femoral neck fractures with osteosynthesis and towards arthroplasty are some examples of these improvements for patients. [1, 2] Despite these efforts, mortality and morbidity after hip fracture remain high. [3, 4] This chapter addresses remaining knowledge gaps and new questions generated by our findings as well as future research perspectives for these often frail patients.

Part I: (Hemi) arthroplasty

In the first part of this thesis, we focused on performing arthroplasty in hip fracture patients with the aim of reducing the percentage of re-operation. The preferred type of fixation of a hip implant (either cemented or uncemented) is still widely debated despite the growing evidence in favour of using cement. In the late 1950s, Sir John Charnley started using polymethylmethacrylate (PMMA) bone cement to fixate the hip prosthesis in the bone. [5] Although PMMA cement has stayed the same, cementation technique has greatly changed over the last 60 years. Cleaning the bone, retrograde insertion and pressurisation are part of these developments. [6] The original cementation technique had a high risk of periprosthetic osteolysis and implant failure. PMMA debris was present in these osteolytic areas; therefore, it was concluded that cement was the cause of the failure and 'cement disease' was recognised as a new entity. [7] The latter coincided with, and likely caused, a vast increase in uncemented implants. From the 1970s on, uncemented components were developed. Occurrence of bone cement implantation syndrome (hypoxia, hypotension and loss of consciousness at the time of cement pressurisation) further stimulated the trend towards use of uncemented implants. [8]

Today, uncemented prostheses are preferred globally, although this choice is not evidence-based. [9–13] Both the register study (Chapter 2) and the randomised controlled trial (Chapter 3) in this thesis identify uncemented stems as a risk factor for revision and major local complications (periprosthetic fractures and dislocation) in hip fracture patients. Recent literature [14] and national guidelines [15, 16] all endorse our findings and advise use of cemented implants in hip fracture patients. Despite this evidence, the register study in Chapter 2 shows that in the Netherlands, 34% of hemiarthroplasties and 57% of the total hip arthroplasties are placed without cement. This predominance in the use of uncemented implants is higher than in other European countries: in the UK, Wales and Northern Ireland, 27% of hemiarthroplasties were uncemented, in Norway 22%, and in Sweden, only 5%. [17, 18]

The register study in Chapter 2 also found that a posterolateral approach is a risk factor for revision. This finding is in accordance with national guidelines [15, 16] and recent publications [19, 20] that advise against the use of the posterolateral approach in hip fracture patients. Despite the evidence, a large percentage of Dutch orthopaedic surgeons do not adhere to these guidelines: 55% of patients are treated using a posterolateral approach (Chapter 2). The reason for this low implementation rate might be that the new Dutch guidelines were published only a year before the end of our study, which included patients from 2007 until 2017. The old guidelines [21] had no preference as to surgical approach. In contrast to the current Dutch guidelines, data from the Norwegian register indicate that a posterior approach results in less pain, fewer walking problems and better QoL than a lateral approach. [22] A more recent trend is the use of dual mobility cups to reduce the dislocation rate present in a posterolateral approach; this seems logical, but has yet to be evaluated. [23]

Finally, there can be valid reasons to deviate from protocol and use a uncemented stem or a posterolateral approach in specific circumstances, such as the experience of a surgeon or a centre or the specific needs of a patient. Nevertheless, for 57% of hip fracture patients to receive an uncemented total hip is, in our opinion, unexplainable.

Future perspectives

More research on the best fixation technique for hip fractures will not yield new insight. Effort should be spent on improving implementation of the new guidelines amongst hip fracture surgeons. A feedback of registry outcome to individual surgeons is a good tool to accomplish this goal. Changes to practice may be met with scepticism, but can be made with the appropriate training and implementation strategy. [24–26]

More research should be conducted on the best approach in both total and hemiarthroplasty in hip fracture patients. The anterior approach should be included in these analyses. Even as more evidence becomes available, surgeons will continue to have their own opinions and preferences on the best approach in their hands. Although these opinions have some basis in truth, they need to be validated with rigorous analysis of data. Data are available from the Dutch Arthroplasty Register (LROI), with sub-analyses and feedback to groups of surgeons on their performance with respect to the benchmarks. Only then will patient outcomes improve.

Part II: Predictors of mortality, delirium, quality of life and daily life functioning after a hip fracture

The number of hip fractures is expected to increase, placing a heavy burden on health care costs. Thus, it is important to establish prevention programmes and to target care programmes to specific patient groups. For the latter, it is necessary to be able to predict outcomes for specific patient groups. In this thesis, we also aimed to predict mortality, delirium, quality of life and daily life functioning after hip fractures based on pre-fracture characteristics in a relatively large cohort of hip fracture patients.

The one-year mortality rate for patients who sustain a hip fracture is high, and patients living in a nursing home when the fracture occurs have the highest mortality rate. [27] The Almelo Hip Fracture Score (AHFS) aims to identify patients at intake who have a higher risk of mortality. Chapter 4 showed that the AHFS was valid in an external validation. The knowledge of mortality risk can be used to inform doctors, patients and families who have to make difficult choices on whether a patient, considering his comorbidities, should be operated on or receive non-surgical pain relief without a surgical procedure. [28]

In addition to focussing on the hip fracture itself, identifying the group of hip fracture patients at high risk for delirium early after hospital admittance can improve overall outcome in these patients. Some interventions exist to prevent delirium in high-risk patients, such as monitoring anaesthetic depth with Bi Spectral Index (BIS) and multi-component interventions (like oxygen therapy, fluid intake management, pain relief management and avoidance of polypharmacy) [29, 30] Since some of these interventions are expensive, they should be targeted only to patients at high risk for developing delirium. By 2012, 37 risk prediction models for delirium had already been published. [31] However, most of these prediction models are not applicable to hip fracture patients or require too much time and specific skills (e.g. APACHE II, MMSE scores) to be used in daily clinical practice. [32–34] A prediction model should be simple and quick. The RD score, presented in Chapter 5, meets these requirements and has good reliability and validity. With slight changes, namely adding some risk factors and changing the cut-off point, the reliability and validity could be improved even further. However, external validation of this new delirium prediction model should be conducted prior to implementation.

Prophylactic treatment with haloperidol did not reduce the incidence of delirium in hip fracture patients (Chapter 4). The Dutch guidelines on delirium advise use

of non-pharmacologic measures as the standard to prevent delirium and only to consider using prophylactic medication in high-risk patients. Only low-quality evidence exists for the preventive use of haloperidol, which might have an effect on the depth and duration of the delirium. [35, 36] More research is needed on whether pharmacologic prophylactic treatment should be started and what treatment is most effective.

The physical domain of Health Related Quality of Life (HRQoL) and Activities of Daily Living ((i)ADL) declined in the first three months after a hip fracture (Chapters 7 and 8). These data indicate the enormous impact a hip fracture has on a patient's life. Younger age, lower ASA classification, higher pre-fracture level of mobility, intracapsular fracture and treatment with osteosynthesis (compared to arthroplasty) predicted larger decline in HRQoL. Older age, living with a partner pre-fracture, living at home pre-fracture, and walking independently pre-fracture predicted larger decline in (i)ADL. Interestingly, the most vulnerable patients were not the ones who experienced the greatest decrease in HRQoL and (i)ADL scores. Therefore, we hypothesise that healthier hip fracture patients have more to lose and therefore, this patient group requires attention. This hypothesis is strengthened by the results of the Trondheim hip fracture trial, in which comprehensive geriatric care had the greatest positive effect on younger patients with a higher pre-fracture (i)ADL level. [2] In this thesis, we evaluate a decline in patients' outcome parameters (HRQoL and (i)ADL) between the pre-fracture state and the 3 months post-operative state. Analysing the change score between the pre-intervention and post-intervention states identifies those patients who declined most in their HRQoL and (i)ADL. These patients will probably benefit most from targeted care, such as home-based rehabilitation and comprehensive geriatric care. [2, 37] Using a change score between the pre-fracture and the post-fracture state will not identify those patients with the lowest HRQoL and (i)ADL. Analysing this change score data will give clues on how best to shape policy to improving outcomes for the most vulnerable patients.

Future perspectives

Machine learning techniques combining encrypted data on thousands of patients from different sources (e.g., nursing home files, general practitioner files, hospital data, biomarkers, arthroplasty databases) will generate prediction models on outcomes such as mortality, ADL and HRQoL. These machine learning algorithms place a certain probability on outcomes and can thus be used in clinical decision-making by both the physician as well as the patient, who can decide whether he or

she accepts the risk to realize the benefit. [38] Machine learning appears to have a higher predictive accuracy than multivariate regression models (such as the ones presented in this thesis), because machine learning algorithms can use complex (non-linear) relations within data. [39] But the validity of the prediction will always depend on the validity of the data source. For that matter, also real-world data (i.e., national registry data) is biased compared to a careful constructed cohort: there can be selection bias and confounding by indication. Or, as Kilkenny put it, 'Garbage in – Garbage out'. [40] Nevertheless, these national registry data are essential in comparing outcome data. This will improve patient outcome after interventions.

More papers are reporting prediction models, but these are often based on small cohorts. Van Meenen et al. found 37 post-operative delirium risk prediction models, and Karres et al. compared six different prediction models for mortality. [31, 41] Developing new prediction models from existing cohorts will generate more publications but is probably of less added value for patient care. It is more important to select existing models that are valid, easy, fast and inexpensive and to evaluate these models in external cohorts. [31, 42]

When comparing data, agreement must be reached on the best available outcome score that is valid and easy to score. European guidelines have designated the EQ5D score as the preferred outcome measurement for HRQoL. [43] The Barthel index and FIM score are the most used ADL scores; therefore, researchers are advised to use them as outcome parameters in future studies. [44] Uniform outcome data enables patients and insurance companies to compare delivered care between hospitals (assuming case mix is taken into account). To achieve that, outcome parameters should be measured after every hip fracture. In the Netherlands, measuring outcome in survival has been abandoned by the health inspection since 2015. Instead, re-operation, a mobility score (based on the Parker mobility score) and the Katz-ADL score have been implemented as standard outcome measurements. [45] Surgeons must provide ADL data from all their hip fracture patients pre-fracture and 3 months post-fracture to the Dutch Hip Fracture Audit (DHFA). This database is not fully linked to the LROI database or to hospital electronic patient files. Problems with data collection also render the mobility and ADL scores far from being valid in this hip fracture patient population. Caution is needed so as not to overload clinicians and patients with administrative paperwork.

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