Impaired spinal stability in fractures and metastases of the thoracolumbar spine

Summary

Part 1: Impaired spinal stability due to (osteoporotic) vertebral fractures (OVF)

In the first part of this thesis we evaluate the impact on outcome of alternative diagnostic and therapeutic strategies in (osteoporotic) vertebral fractures with a special focus on the elderly.

In chapter II we analyse the role of the fracture liaison service (FLS) in reducing subsequent fracture risk in the elderly patients (>85 years of age). We show that the subsequent fracture incidence for the first 2-years of follow-up is comparable and 19% ($p = 1.0$) in both the FLS attenders and non-attenders group. Of the patients aged 50–85 years, compliance with the screening and treatment program is 72% ($p < 0.05$), with only 51% persistent in the prescribed therapy at 2 years. Therefore the advantage of a FLS in reducing subsequent fracture risk in patients > 85 years seems to be limited. And in practice a large proportion of these patients are not screened. The elderly with osteoporosis-related fractures should perhaps not be thought of as 'average elderly' but rather as 'frail' for a holistic managment of these elderly population, indicating that additional/personalized strategies are needed for this group.

In chapter III we systematically review the use of minimal invasive percutaneous cement augmentation in symptomatic osteoporotic vertebral fractures (OVFs), with special focus on the elderly. Using data from RCTs and prospective non-RCTs comparing percutaneous vertebroplasty (PV) or percutaneous kyphoplasty (PKP) with conservative treatment or sham procedures. We show that in contrast to current guidelines based on results of two RCT's published in 2009, pooled results indicate significant painrelief and functional improvement up to 12 months of follow-up for percutaneous cement augmentation compared to conservative treatment. We conclude that in the frail elderly with (sub-)acute OVF, with severe pain despite early conservative measures, focal tenderness and edema on MRI-scans concordant with the level of the fracture, when no absolute contraindications are present, percutaneous cement augmentation is safe and effective and can be offered to hasten return to normal function and bypass the consequences of prolonged immobilization.

In chapter IV we investigate treatment outcomes of traumatic thoracolumbar spine fractures managed with another minimal invasive technique: posterior percutaneous pedicle screw fixation technique (PPSF). We show that minimal invasive treatment strategies are faesible with good overall functional outcome, while minimizing pain, blood loss and morbidity PPSF may represent a useful strategy for treating osteoporotic thoracolumbar fractures in the older patient. Recent studies show that percutaneous

pedicle screw fixation combined with vertebroplasty provides a safe and effective option for the treatment of severe osteoporotic thoracolumbar compression fractures.

Part 2: Impaired spinal stability due to spinal bone metastases (SBM)

The aim of this part of the thesis is focused on analysing the predictive power of existing prediction models in the new era of treatment for spinal bone metastases (SBM). We try to guide personalized medicine by development of a digital user-friendly nomogram. Moreover, attempt to provide additional prognostic information, by use of radiomics features.

In chapter V we aim to externally validate two prediction models and to demonstrate whether these can be generalized for patients treated in different centers. Secondary we try to identify additional prognostic factors predicting survival in patients with SBM. With this first external validation study, we show modest predictive capacity for the validated two prediction models by van der Linden and Bollen, with a slightly better performance for the Bollen model. Since the field of treatment options has changed for metastatic spine disease, the existing scoring systems have become outdated for the actual situation and there is room for improvement for achievement of patient tailored care.

In chapter VI we focus on development of radiomics features for predicting 6 month survival probability for SBM patients. We find no added discriminative effect of radiomics signatures in the prediction of survival in patients with SBM. We state that here is still significant room for improvement necessary regarding the reproducibility of radiomics results, the assessment of clinical utility and open science.

In chapter VII we aim to guide patient tailored treatment by development of a prediction tool with a user-friendly digital interface that could be used to reliably estimate the 1, 3, and 6-months survival for patients with SBM. The digital version of the present nomogram can make predictions at any given time point as low as half a month. Besides the survival probability, it also provides the confidence interval of the predicted survival probability and a personalized survival curve, which gives the health care provider more insights to determine the optimal therapeutic strategy for a patient. The personalized survival curve could serve as a good starting point for shared decision making between patients and provider.