

## **Part I – Introduction and Outline of this Thesis**

As described in **Chapter 1 (Part I)**, in this thesis we investigated the overdiagnosis and overtreatment of (nondisplaced) scaphoid waist fractures. We aimed to increase diagnostic efficiency and treatment functionality in three parts:

- 1) Improve efficiency and accuracy of acute scaphoid fracture diagnosis  
(**Part II** - Diagnosis of the [Suspected] Scaphoid Fracture);
- 2) Differentiate fractures that heal predictably from those that are at an increased risk of nonunion  
(**Part III** - Scaphoid Fracture Characteristics);
- 3) Investigate surgeon decision making with regards to the recommendation for prolonged cast immobilization  
(**Part IV** - Immobilization Duration of a Nondisplaced Scaphoid Waist Fracture).

In **Chapter 2** we presented a literature review of scaphoid anatomy. Great variability has been reported in literature on scaphoid osseous and ligamentous anatomy.

In **Chapter 3** risk factors and preferred management options for scaphoid nonunion and scaphoid nonunion advanced collapse (SNAC) were outlined through a systematic literature review. Proximal fracture location, displacement and delayed treatment were identified as risk factors for nonunion.

## **Part II – Diagnosis of a (Suspected) Scaphoid Fracture**

In Part II of this thesis, we focussed on the diagnostic pathway of patients presenting with clinical signs of a scaphoid fracture. We investigated strategies to improve diagnostic accuracy of radiographs and MRI and reduce the number of patients undergoing advanced imaging.

In **Chapter 4** a clinical prediction rule was designed to selectively initiate advanced imaging in patients with a suspected scaphoid fracture.

In **Chapter 5** a convoluted neural network (CNN) was trained to detect scaphoid fractures on radiographs, based on 300 patients reviewed for a possible scaphoid fracture.

In **Chapter 6** we evaluated patterns of signal change present among 267 MRI scans of patients with a clinically suspected scaphoid waist fracture.

## **Part III – Scaphoid Fracture Characteristics**

The correlation between fracture characteristics and clinical outcomes such as union rate has been well established. In Part III of this thesis, we aimed to identify recurring fracture patterns and investigate how they relate to displacement and comminution. This may aid in scaphoid fracture diagnosis and in recognizing and differentiating fractures that heal predictably from those that are at an increased risk of nonunion.

In **Chapter 7** 3DCT analysis revealed four dominant fracture patterns among 75 patients with an acute scaphoid fracture: proximal pole fractures (7%), transverse waist fractures (37%), oblique waist fractures (32%) and tubercle or distal pole fractures (12%).

In **Chapter 8** we used 3DCT analysis to investigate the correlation between fracture configuration (fracture location and comminution) and displacement in 51 proximal pole and waist fractures.

#### **Part IV – Immobilization Duration of a Nondisplaced Scaphoid Waist Fracture**

There is increasing evidence that CT-confirmed nondisplaced scaphoid waist fractures heal with shorter (<8 weeks) immobilization duration. In Part IV of this thesis, we identified potential barriers to adopting shorter immobilization times by investigating factors affecting surgeon decision making.

In **Chapter 9** we identified factors associated with surgeon recommendation for additional cast immobilization of a CT-confirmed nondisplaced scaphoid waist fracture through an international survey-based study.

In **Chapter 10** we identified clinical, radiological and psychosocial factors associated with continued immobilization of a nondisplaced scaphoid waist fracture among a prospective cohort of 46 patients.