



LUNDS
UNIVERSITET
Medicinska fakulteten

Uppdaterad individuell studieplan för Simon Götestrand, 8002263955 diarienummer Stud 2015/5115

Forskarstuderande
Simon Götestrand

Personnummer
8002263955

Epostadress
simon.gotestrand@med.lu.se

Antagningsdatum
2015-11-01

Projektnamn
Magnetic resonance imaging of the wrist at 7T with focus on
intrinsic and extrinsic ligaments

Huvudhandledare/Main supervisor/
Mats Geijer

Biträdande handledare/Co-supervisor(s)/
Anders Björkman

Institution/Department/
Institutionen för kliniska vetenskaper, Lund

Sektion/Section/
Sektion V

Forskarutbildningsämne/Subject/
Klinisk medicin

Inriktning/Focus area/
Diagnostisk radiologi

Doktors- eller licentiatexamen/PhD or Licentiate degree/Hel- eller deltid/Full or part time studies/
Doktorsexamen Halvtid

Planerad studietaktivitet/Planned study activity
VT2017 0%
HT2017 0%
VT2018 0%

Ursprunglig projektplan/

Wrist ligament injuries are a common clinical problem, both with and without concomitant wrist fractures. In cases where a fracture of the distal radius or carpal bones is present, treatment is often focused on the fracture and the possibility of a concomitant ligamentous injury may be left unattended. With no fracture visible on radiographs patients are often subjected to immediate mobilization, thus overlooking potential wrist ligament injuries that may cause subsequent problems.

The most important wrist ligaments are the triangular fibro-cartilage complex (TFCC), stabilizing the distal radius and ulna; the scapholunate ligament (SLL), stabilizing the scaphoid and lunate bones; and the lunotriquetral ligament (LTL), stabilizing the lunate to the triquetrum. An injury to any of these structures has a high risk of progression into severe osteoarthritis. Early recognition and treatment is essential to prevent progression into further articular degeneration.

Wrist arthroscopy is the golden standard for diagnosing wrist and carpal pathology. Several imaging techniques have been used in diagnosing ligament injuries of the wrist. However, as most imaging techniques have failed to convey reliable and comprehensive results, the gold standard in diagnosing ligament injuries is at present still wrist arthroscopy, and it also serves as a therapeutic modality.

Radiographs are unable to visualize the ligaments themselves and have to rely on an assessment of carpal bone alignment in order to detect ligament injuries. CT refines this assessment but is nonetheless limited in visualizing soft tissue injury of the wrist and is inferior to MRI in assessing soft tissue injuries.

Arthrography is difficult to assess with a large overlap between pathologic findings and age-related changes, and the results from arthrography have a low correlation to arthroscopic findings.

The use of MR imaging of the wrist and carpus in evaluating soft tissue injuries has, when compared to larger joints, lagged behind due to technical limitations in visualizing the small and intricate structures of the wrist.

MR technology is in continuous evolution and while most conducted studies have used lower field strengths (i.e. 1,5 T or less), more recent published data have suggested improved accuracy for detecting wrist and carpal pathology using a field strength of 3T.

A good knowledge of the normal anatomy is the requisite for detecting pathological changes. The appearance of the normal wrist anatomy is well known with 3T MRI. There are, however, few prior studies on the appearance of normal wrist anatomy at 7T.

The aims of the current study are to investigate the diagnostic possibilities of 7T MRI in the diagnosis of wrist ligament injury and compare the technical potential with 3T MRI and arthroscopy.

Uppdaterad projektplan/Updated project plan for your individual study plan/

PROJECT 1 – COMPARISON BETWEEN 3D AND 2D IMAGING OF LIGAMENTOUS INJURY IN THE WRIST

Aim: To determine the diagnostic value of a 3D sequence in diagnostic imaging of ligamentous wrist injuries at 3T. Wrist arthroscopy will serve as reference.

Subjects: Forty patient with suspected ligamentous wrist injury, scheduled for arthroscopy and ten healthy volunteers. **MR imaging:** Standard sequences for diagnostic imaging and an optimized 3D sequence at 3T.

Image review: Four musculoskeletal radiologists will review all image sequences separately from each other. Suspected ligamentous injury will be graded according to criteria agreed on beforehand.

PROJECT 2 – NORMAL WRIST ANATOMY: LIGAMENTS □

Aim: To compare image quality and delineation of ligamentous anatomic structures between 3T and 7T imaging.

Patients: Eighteen healthy volunteers between 20 and 50 years of age, with six research subjects from each decade and an even mix between men and women. **MR Imaging:** Sequences with similar parameters will be evaluated on 3T and with 7T MRI. **Image Review:** Four musculoskeletal radiologists will review all image sequences separately from each other. Structures will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand. Primarily the TFCC, SLL and LTL, clinically important structures, will be evaluated.

PROJECT 3 – NORMAL WRIST ANATOMY: CARTILAGE, BONE, MUSCLES, NERVES □

Aim: To compare image quality and delineation of anatomic structures other than ligamentous between 3T and 7T imaging. **Patients and MR imaging:** The same studies as in Project 1 will be evaluated. **Image Review:** As in Project 1. Anatomic structures such as the delineation of cortical and trabecular bone, joint cartilage, the median nerve etc will be evaluated.

PROJECT 4 – SUSPECTED LIGAMENTOUS WRIST INJURY □

Aim: To compare image quality, delineation of TFCC, SLL and LTL, and diagnostic accuracy in suspected ligamentous wrist injury between 3T and 7T imaging.

Patients: Forty patients scheduled for wrist arthroscopy due to suspected SLL or TFCC damage will be examined with 3T and 7T MRI. **MR Imaging:** As in Project 1. **Image Review:** A number of normal cases from Project 1 will be included. Structures will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand. Primarily clinically important structures such as the TFCC, SLL and LTL ligamentous structures will be evaluated. Other injuries will also be recorded. Artefacts will be graded.

Arthroscopy: Wrist arthroscopy will be performed by senior consultants with extensive experience in wrist arthroscopy according to the normal clinical routine, with ligament injuries graded according to clinically used classification schemes by Palmer and Geissler. The outcome of MRI at different field strengths will be compared with the arthroscopy results.

PROJECT 5 – SUSPECTED CARTILAGE INJURY □

Aim: To compare image quality, delineation joint cartilage, and diagnostic accuracy in diagnosing wrist cartilage injury after arthroscopy between 3T and 7T imaging.

Patients: Patients from Project 3 who have had wrist arthroscopy but not open wrist surgery due to suspected SLL or TFCC damage will be examined with 3T and 7T MRI to detect cartilage injury incurred during arthroscopy. **MR Imaging:** As in Project 1. **Image Review:** Joint cartilage will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand.

Halvtidskontroll/Date for half-time review/

0000-00-00

Ursprungliga planerade avhandlingsdelar

PROJECT 1 - NORMAL WRIST ANATOMY: LIGAMENTS □

Aim: To compare image quality and delineation of ligamentous anatomic structures between 3T and 7T imaging.

Patients: Eighteen healthy volunteers between 20 and 50 years of age, with six research subjects from each decade and an even mix between men and women. **MR Imaging:** Sequences with similar parameters will be

evaluated on 3T and with 7T MRI. Image Review: Four musculoskeletal radiologists will review all image sequences separately from each other. Structures will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand. Primarily the TFCC, SLL and LTL, clinically important structures, will be evaluated.

PROJECT 2 - NORMAL WRIST ANATOMY: CARTILAGE, BONE, MUSCLES, NERVES □

Aim: To compare image quality and delineation of anatomic structures other than ligamentous between 3T and 7T imaging. Patients and MR imaging: The same studies as in Project 1 will be evaluated. Image Review: As in Project 1. Anatomic structures such as the delineation of cortical and trabecular bone, joint cartilage, the median nerve etc will be evaluated.

PROJECT 3 - SUSPECTED LIGAMENTOUS WRIST INJURY □

Aim: To compare image quality, delineation of TFCC, SLL and LTL, and diagnostic accuracy in suspected ligamentous wrist injury between 3T and 7T imaging.

Patients: Forty patients scheduled for wrist arthroscopy due to suspected SLL or TFCC damage will be examined with 3T and 7T MRI. MR Imaging: As in Project 1. Image Review: A number of normal cases from Project 1 will be included. Structures will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand. Primarily clinically important structures such as the TFCC, SLL and LTL ligamentous structures will be evaluated. Other injuries will also be recorded. Artefacts will be graded.

Arthroscopy: Wrist arthroscopy will be performed by senior consultants with extensive experience in wrist arthroscopy according to the normal clinical routine, with ligament injuries graded according to clinically used classification schemes by Palmer and Geissler. The outcome of MRI at different field strengths will be compared with the arthroscopy results.

PROJECT 4 - SUSPECTED CARTILAGE INJURY □

Aim: To compare image quality, delineation joint cartilage, and diagnostic accuracy in diagnosing wrist cartilage injury after arthroscopy between 3T and 7T imaging.

Patients: Patients from Project 3 who have had wrist arthroscopy but not open wrist surgery due to suspected SLL or TFCC damage will be examined with 3T and 7T MRI to detect cartilage injury incurred during arthroscopy. MR Imaging: As in Project 1. Image Review: Joint cartilage will be graded on visibility, delineation and signal intensity according to criteria agreed on beforehand.

PROJECT 5 - SUSPECTED NERVE INJURY

Aim: To compare image quality, delineation of nerve structures, diagnostic accuracy in diagnosing nerve disease with 3T and 7T imaging in comparison with ultrasound and neurography.

Patients: Eighteen healthy research subjects from Project 1 and 20 patients with suspect injury of the median nerve will be included. Methods: All patients will be examined with neurography of the median nerve and wrist ultrasound with focus on the neural structures. MRI at 3T and 7T will be performed. Image Review: Anatomic structures with focus on the median, ulnar and radial nerves and branches will be evaluated. The ultrasound examinations will be evaluated by the examiner, and the neurography will be examined by a neurophysiologist.

Uppdaterade avhandlingsdelar/Updated plans for the thesis/

Planerat disputationdatum/Planned date for dissertation/

0000-00-00

Studiefinansiering

Doktoranden har en tjänst som ST-läkare vid VO Bild och Funktion i Lund, och kommer under doktorandperioden att övergå till en tjänst som avdelningsläkare. Doktoranden kommer att beredas forskningstid inom ramen för den kliniska tjänstgöringen, och kommer dessutom att söka anslag för ytterligare forskningstid. MR-undersökningarna ska finansieras med tillgängliga anslag, och anslag som kommer att sökas.

Resurser/Resources available/

Materiella resurser:

Arbetsplats finns tillgänglig för doktoranden i form av tjänsterum på kliniken som är utrustad med dator. Speciella datorer för utvärdering av bildmaterialet och utförandet av metaberkningar finns tillgängliga på kliniken. Magnetkameraundersökningarna som ingår utförs på modern MR-apparat utrustad med alla nödvändiga program för bildhantering och bearbetning. All metodik finns därmed och är i drift i form av modern och avancerad radiologisk utrustning samt all nödvändig mjukvara. Artroskopi, ultraljudsundersökning och neuroradiografi utförs med kliniskt använd utrustning.

Personella resurser:

Doktoranden har som stöd i sitt arbete medarbetare som är välmeriterade när det gäller såväl klinisk diagnostik, radiologiska tekniker, forskningshandledning, databearbetning och statistiska analyser.

Doktoranden kommer att beredas tid för att delta i kongresser och seminarieverksamhet för att tillgodogöra sig nödvändiga kliniska och tekniska kunskaper. Schemalagda samtal kommer hållas med huvudhandledaren var 3:e vecka.

Handledningsplan/Plan for supervision/

Huvudhandledaren docent Mats Gejjer, ÖL vid sektionen för skelettradiologi, Bild och Funktion, Skånes universitetssjukhus, Lund har kontinuerlig kontakt med doktoranden. Huvudhandledaren stöds i sina åtaganden vid frånvaro av bihandledaren Isabella Björkman–Burtscher ffa avseende aktuella praktiska problem i samband med datainsamling och –analys.

Bihandledaren docent Anders Björkman, ÖL vid handkirurgiska kliniken, Skånes universitetssjukhus, Malmö har kontinuerlig kontakt med doktoranden samt deltar aktivt i planerings- och utvärderingsmöten.

Bihandledaren docent Isabella Björkman–Burtscher, ÖL vid sektionen för neuroradiologi, Bild och Funktion, Skånes universitetssjukhus, Lund har kontinuerlig kontakt med doktoranden och deltar aktivt i planerings- och utvärderingsmöten.

Handledningen kommer att ske i enlighet med Medicinska fakultetens riktlinjer för högskolepedagogik.

Huvudhandledaren har genomgått LUs högskolepedagogiska utbildning.

Den kontinuerliga kontakten kommer att bestå av regelbundna möten för

- planering och uppföljning av projekten
- genomgång av materialet
- genomgång av litteratur
- planering och genomgång av manuskript
- feedback och genomgång av progress

Genomsnittlig handledningstid per vecka uppskattas till 1–2 timmar.

Förväntningar på handledare och doktorand/ Expectations on the supervisor and PhD student/

Nästa uppföljning av studieplanen/ Next follow-up of the study plan/
0000-00-00

Allmän ämneskompetens

Litteratur/Literature/

Tillämplig litteratur består främst av aktuella artiklar som finns tillgängliga via sjukhusbiblioteket och universitetsbiblioteket.

Obligatoriska kurser/Compulsory courses/

Forskningsetik (1,5 hp)

Introduktionskurs (1 hp)

Muntlig kommunikation (1,5 hp)

Portfolio (12 hp)

Tillämpad statistik I (1,5 hp)

Tillämpad statistik II (3 hp)

Vetenskaplig kommunikation (1,5 hp)

Ytterligare 1 valfri

Planerade valbara kurser/Planned elective courses/

Publikationer/Plans for publications to be included in the thesis/

Övriga publikationer/Other publications/

Planerad utbildning i undervisning/Planned teacher training/

Undervisning/Planned teaching/

Planerade administrativa aktiviteter/Planned administrative activities/

Vistelse vid annat lab/Planned research visits to other labs/

Övriga interaktioner med forskningssamhället, samarbeten/Other interactions with the research community; collaborations/

Konferenser/Conferences/

Seminarier/Seminars/

Övriga utbildningsmoment/Other educational activities/

Planerad samverkan med det omgivande samhället/Planned interaction with the surrounding community/

Planerade aktiviteter som involverar etiska frågeställningar/Planned activities involving ethical considerations/

Planerade aktiviteter relaterat till karriärsutveckling/Planned activities related to career development/

Avvikelse rapport/Deviation report/Deviation report

Övrigt/Comments/

Studieplanen godkänd av

Doktorand Simon Götestrand, 2016-12-15

Huvudhandledare Mats Geijer, 2016-12-15

Biträdande prefekt fu Karin Jirström, 2017-01-11

Ovan listade personer har godkänt den individuella studieplanen i ett lösenordsskyddat elektroniskt system. Studieplanen godkänns först av doktorand och skickas sedan vidare i systemet för godkännande av huvudhandledare och sedan till biträdande prefekt med ansvar för forskarutbildningen. I alla steg i processen kan handledare och biträdande prefekt välja att tillstyrka eller avstyrka planen. Om planen avstyrks går den tillbaka i flödet till doktorand/handledare med kommentarer. När doktorand, handledare och biträdande prefekt har godkänt planen är det sista steget i processen att denna pdf-fil genereras med deras respektive namn samt datum för godkännandet. Den godkända studieplanen arkiveras sedan digitalt i databasen för individuella studieplaner vid medicinska fakultetens kansli.