

ResOrthH Insights

Research in Orthopedics Herlev-Gentofte

**News and Insights from the
department of Orthopedic Surgery
at Herlev-Gentofte Hospital**



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Dear colleagues and collaborators,

Herlev and Gentofte Hospitals' Department of Orthopedic Surgery provides comprehensive care for a wide range of bone and joint conditions. At our Herlev location, we have a large orthopedic traumatology section with a special focus on pediatric fractures, as well as a referral unit for orthopedic infections. In Gentofte, we house a major section for hip and knee arthroplasty and serve as a referral center for hand/wrist surgery and shoulder/elbow surgery.

Our patients benefit from truly multidisciplinary care involving physiotherapists, nurses, administrative staff, surgeons, registrars, junior doctors, students and, when needed, colleagues from other specialties or hospitals. We are committed to delivering evidence-based treatment, and we consider it our responsibility to conduct research that addresses important clinical and scientific questions.

In this publication, we present a selection of our 2024 research contributions that have influenced our clinical practice. Each section includes a summary of what they consider to be key findings and meaningful additions to the existing literature.

Our scientific achievements are the result of the dedicated efforts of our clinical colleagues and research staff—especially our PhD students. In 2024, two PhD students successfully defended their theses, and their work is highlighted throughout these pages. At present, we have one PhD student in orthopedic traumatology, one in orthopedic infections, three in hand/wrist surgery, three in shoulder/elbow surgery and one in nursing research.

We warmly encourage all colleagues and students to participate in our scientific activities. Please feel free to reach out—contact details can be found throughout this publication. We welcome everyone with an interest in research and high-quality patient care.

Respectfully,



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Total Wrist Arthroplasty: An International Perspective



<https://herlevhospital.dk/rut>

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BACKGROUND

The traditional management of wrist arthritis consists of proximal row carpectomy (PRC), partial carpal fusions (excision of scaphoid and four corner fusion – 4CF) or radioscapholunate fusions, or, in the event of pancarpal arthritis, total wrist fusion, or eventually a Total Wrist Arthroplasty (TWA).

Severe destruction of the radiocarpal joint often implies the involvement of the distal radioulnar joint (DRUJ), which can occur in both inflammatory and non-inflammatory arthritides. Numerous reports have been published about the clinical outcomes after UH resection but have not explicitly concerned the combination of TWA with UH resection. Very little has been published on using UH arthroplasty in conjunction with TWA.

AIM

This study aimed to review the history of the development of TWA, review the literature on different designs, and discuss their pros and cons. It also reported results on the surgical treatment combining Wrist and DRUJ osteo- or inflammatory arthritis with either resection of the ulnar head or an Ulna Head Prosthesis (Figures 1 & 2).

STUDY DESIGN

Authors M. Boeckstyns and R. Gvozdzenovic analyzed 66 consecutive primary Remotion arthroplasties performed at Gentofte Hospital, Hellerup, Denmark, from 2003 to 2020, 23 in RA patients and 43 in non-RA patients. Data were collected prospectively and entered in a registry, including follow-ups after 6 months and yearly.

RESULTS

Forty-one patients were operated without any intervention at the DRUJ. However, one of these had a previous UH-resection. In 18, a UH-resection was done simultaneously with the TWA; five had a UH-replacement with the Stryker UH, and two had an Eclipse prosthesis (BioProfile, Grenoble, France). The cumulated implant survival in these three groups is shown in a Kaplan-Meier analysis, and the outcomes at 6 months, 2 years and final follow up. (1-16 years postoperatively).

IMPORTANT FINDINGS

- Both ulnar head resection and ulnar head replacement are feasible to address DRUJ problems in connection with TWA.
- It may be carefully concluded that ulnar head replacement may have some advantages, but the evidence is weak due to this group's low number of participants.
- Careful clinical and imaging examinations are mandatory, and treatment decisions must be based on the patient's needs and the level of function.

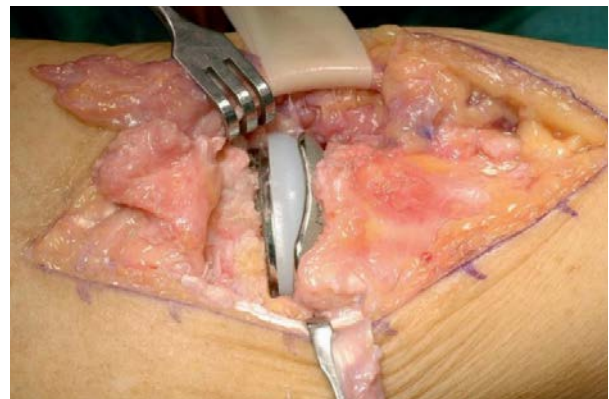


Figure 1. Minimal distal radius bone resection.

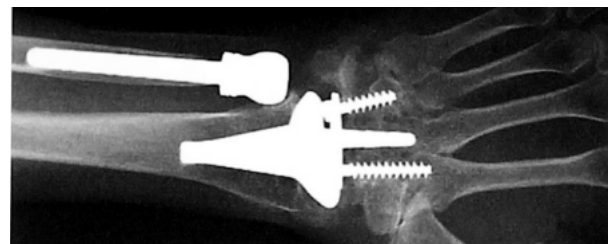


Figure 2. 14-year follow-up of a Wrist- and Ulnar Head Arthroplasty

Sampling for the diagnosis of orthopaedic surgical infections



<https://herlevhospital.dk/8ma>

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BACKGROUND

With optimal and uniform sampling, the possibility of detecting and identifying bacteria or fungi in all cases of infection (high sensitivity) increases, and that samples without detected microorganisms mean an aseptic condition (high specificity).

We have discarded Sonication due to low diagnostic value after evaluating 240 sonication samples, meaning that we rely on bacterial identification and resistance from growth in the lap in 2/5 and 16S-analysis (PCR) in our samples.

The current lack of rigor in sampling and sample handling, a compromising frequency of false negative and false positive samples is experienced, which unfortunately does not allow for a complete differentiation between infected and aseptic conditions.

The improved sample handling is expected to improve overall treatment and promote the execution of clinical studies of diagnostics and treatment.

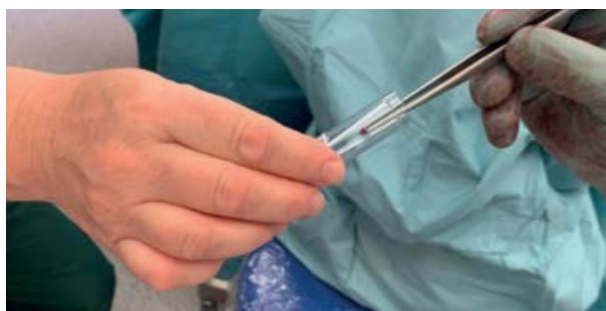


Figure 1. Prøven flyttes direkte fra patient til transportglasset.

AIM

To improve the perioperative sampling, which is the basis for the clinical collaboration between surgeon and microbiologist.

To motivate the surgeon to implement stringent sampling methods, which optimizes the microbiologist's ability to identify the agent and resistance pattern and thus to be able to recommend an optimal postoperative systemic treatment of the infection.

CONCLUSION

The aim of these recommendations is an increased focus on uniform handling of patients and their sample material in the event of suspected PJI, FRI and OM, as well as increased collaboration between the orthopaedic surgery and clinical microbiology departments in Denmark.

It is expected that standardised procedures can minimise the number of false test results and thus increase the certainty of the interpretation of the test results.

The perioperative sampling is the basis for the clinical collaboration between surgeon and microbiologist. The quality of the surgeon's sampling optimizes the microbiologist's ability to identify the agent and resistance pattern and thus be able to recommend an optimal postoperative systemic treatment of the infection.

We hope that in time a concrete nationwide guideline can be prepared based on these recommendations.

IMPORTANT FINDINGS

- Tissue samples from bone and joint infections are unfortunately handled differently between different orthopaedic departments.
- Consensus on sampling methods and -handling have shown good clinical results of treatment of bone and joint infections in other countries.
- A more unified tissue sampling- and handling is expected to result in better improved interpretation of results, improved clinical outcomes of treatment of bone and joint infections in Denmark and a better foundation for research and communication regarding bone infections.

Section for shoulder and Elbow Surgery



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BACKGROUND

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) has reported a higher risk of revision for stemmed TSA than for stemless TSA whereas the Danish Shoulder Arthroplasty Registry (DSR) has reported a higher risk of revision for stemless TSA than for stemmed TSA. We hypothesized that the conflicting results were related to the design of the glenoid component.

AIM

To compare the revision rates of stemmed and stemless humeral components in combination with either an all-polyethylene or a metal-backed glenoid component using data from both the AOANJRR and the DSR.

RESULTS

13,066 arthroplasties from AOANJRR and 2,882 arthroplasties from DSR were included. Australian data showed a 9-year cumulative revision rate of 18% for stemmed

TSA with a metal-backed glenoid component and Danish data showed a cumulative revision rate of 31% for stemless TSA with a metal-backed glenoid component. The 9-year cumulative revision rate for stemmed and stemless TSA used in combination with an all-polyethylene glenoid was 5% in both Australia and in Denmark. With adjustment for age, sex and design of the glenoid component there were no statistically significant differences in the risk of revision for stemmed and stemless TSA.



IMPORTANT FINDINGS

- This study has demonstrated the safety of using both stemmed and stemless TSA in combination with all-polyethylene glenoid components. Our use of stemmed and stemless TSA is based on bone quality of the proximal humerus, surgeon's preferences, costs, and availability.
- We do not use anatomical total shoulder arthroplasty (TSA) with a metal-backed glenoid component.
- We found no statistically significant differences in risk of revision of stemmed and stemless TSA if used in combination with an all-polyethylene glenoid component.
- We found a critically high risk of revision of metal-backed glenoid components if used in combination with a stemmed or stemless humeral component.
- This study demonstrated the advantages of collaboration between national registries, as we were able to identify the design of the glenoid component as an important confounder in the comparison of stemless and stemmed TSA.

Complications After Volar Locking Plate Fixation of Distal Radius Fractures: A Retrospective Study of 822 Patients



<https://herlevhospital.dk/1zi>

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BACKGROUND

With the current routine use of volar locking plates as the preferred surgical treatment method for distal radius fractures, the purpose of this study was to investigate the incidence of postoperative complications following surgery and, secondly, to investigate the correlation between demographic factors and the risk of complications.

AIM

We retrospectively reviewed all patients who had been surgically treated for a distal radius fracture with open reduction and internal fixation using volar locking plating and screws during a 3-year period. Relevant demographic information and all postoperative complications of the 822 patients eligible for inclusion were recorded, with a mean follow-up time of 2.8 years.

RESULTS

We identified an overall complication rate of 12.3% (101 of the 822 patients), with 4.8% defined as experiencing major complications and 7.5% defined as experiencing minor complications. The most frequent were complications leading to hardware removal, observed in 2.7% (n=22) of the patients; wound-related problems that did not require surgical revision, observed in 2.2% (n=18) of the patients; and carpal tunnel syndrome, observed in 1.9% (n=16) of the patients. Binary logistic regression modeling showed no correlation between demographic factors and the risk of complications.

"The most common complication (2.7%) was related to prominent plates or screws leading to hardware removal, such as this example with a plate prominent over Watershed's line, classified as a Soong grad 2".



IMPORTANT FINDINGS

- The treatment pendule for distal radius fractures is shifting towards a lower rate of surgical treatment in the elderly, despite surgical treatment being a predictable treatment.
- This study supports like other recent papers finding a low incidence of complications after surgical treatment for a distal radius fracture, in contrast to earlier publications.
- This study has included adult patients, and regardless of age, sex, fracture type, and time from trauma to surgery, no associated was found to an increased risk of complications.
- 12.3% overall incidence of complications was found after surgical treatment.
- 7.5% experienced minor and 4.8% major complications.

Implementation of outpatient hip and knee arthroplasty in a multicenter public healthcare setting



<https://herlevhospital.dk/jr9>

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BACKGROUND

Length of hospital stay after hip and knee arthroplasty is about 1 day in Denmark with few patients discharged on the day of surgery. Hence, a protocol for multicenter implementation of discharge on day of surgery has been instituted.

AIM

We aimed to describe the implementation of outpatient hip and knee arthroplasty in a multicenter public healthcare setting.

METHODS

We performed a prospective multicenter study from 7 public hospitals across Denmark. Patients were screened using well-defined in- and exclusion criteria and were discharged on day of surgery when fulfilling functional discharge criteria. The study period was from September 2022 to February 2023 with variable start of implementation. Data from the same centers in a 6-month period before the COVID pandemic from July 2019 to December 2019 was used for baseline control.

Inclusion criteria:

- Unilateral elective primary THA, TKA, or UKA
- Age 18–80

Exclusion criteria:

- Acute myocardial infarction, cerebrovascular accident, transient ischemic attack, or coronary atherosclerotic disease within last 3 months

- Unstable ischemic heart disease
- Ejection fraction < 40%
- Glomerular filtration rate < 60 mL/min/1.73 m²
- Chronic obstructive pulmonary disease with home oxygen
- Insulin-dependent diabetes mellitus
- Sleep apnea requiring mechanical treatment
- CFS ≥ 4 a
- 2 or more falls within last 3 months
- Body mass index < 18.5 or > 40
- Not interested in discharge on day of surgery

RESULTS

21% (CI 20–23) of all patients (eligible and non-eligible) were discharged on day of surgery with a range of 10–31% within centers. This was an additional 15% (CI 13–17, $P < 0.001$) compared with patients discharged in the control period (6% in 2019).



IMPORTANT FINDINGS

- We found it possible to perform outpatient hip and knee replacement in 21% of patients in a public healthcare setting.
- At Gentofte Hospital we increased our outpatient rate from 3% to 18% during the period.

CASE

Malunion of a clavicle fracture caused thoracic outlet syndrome of a professional violinist



<https://herlevhospital.dk/g4r>

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Clavicle fractures are a common injury in adults. Most patients are treated non-operatively with a good functional outcome. A very rare complication to this injury is Thoracic Outlet Syndrome (TOS) where the change position and accompanied callus formations creates a compression against the nerves and vessels passing under the clavicle leading to neurovascular compromise of the extremity. TOS is often a dynamic condition where the affection of the extremity is dependent of the position of the arm and may therefore be difficult to establish by para-clinic evaluations (e.g. CT, MRI and US). The treatment of TOS aims at reducing the pressure towards the nerves and vessels and spans from correction of posture by training to surgery with removal of callus and/or correction of the malunion of the clavicle.



Figure 1. Difference in colour and swelling following playing violin.

CASE

A 53 years old health female career violinist sustained a right-sided midshaft clavicle fracture by simple fall. The fracture was with an intermediary fragment and with approximately 1 bone-width of displacement and some shortening. The neurovascular status was normal at time of injury. The fracture was treated with a sling for 14 days and physiotherapeutic guided training. It healed well and 10 weeks following the surgery the patient started working again. As a violinist, the right arm carries the bow and during playing the shoulder is typically held in 90 degrees of flexion and 90 degrees internal rotation. After 10-15 seconds of playing, the arm started swelling, turned blue and she had loss of sensation (Figure 1). When she stopped playing the arm returned to normal.

She was evaluated acutely and ultrasound confirmed the finding of a DVT in v. axillaris distal to the fracture and anticoagulant treatment was started. Subacute MRI demonstrated a compression of the malunion and callus of the nerves and vessels between the clavicle and costa 1 (Figure 2). No other abnormalities were found and the diagnoses of TOS was made.

Following sufficient information, the patient opted for surgery with corrective osteotomy of the malunion and plate-fixation with removal of excess callus. The surgery was performed approximately 10 weeks following the initial fracture and the postoperative regime went without any problems and with no new excessive callus formation.

At 6 months follow up after surgery she had regained full function of the shoulder, had no pain and was playing violin full time again without any restrictions.

IMPORTANT FINDINGS

- TOS is a rare complication to clavicle fractures.
- Its impact on daily life depends on the needs of the patient.
- Treating surgeons should be aware of this complication and consider early treatment in selected patients.

Exchange of research environment at the Botnar Research Centre in Oxford



On a daily basis, I am doing a PhD at the Department of Orthopaedic surgery at Herlev and Gentofte Hospital and the University of Copenhagen.

For my exchange of research environment, I spent a month in Oxford at the Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences at the Botnar Research Centre in Oxford, which is a large organisation. The research centre is located next to the specialised hospital Nuffield Orthopaedic Centre and have researchers from numerous different educational backgrounds, making it possible for them to perform studies at a high scientific level with different perspectives.

During my stay, I collaborated with another doctor and PhD student on a validation project. During his PhD, he has developed a prediction model for the risk of serious adverse events after shoulder arthroplasties. With data from the Danish population, we performed a validation study of the model, which showed that that model performed very well. The project became an article, which was published in The Lancet Rheumatology on 31 July 2024. The model can provide information for patients and clinicians regarding risks, helping them in the decision process and is available here:

<https://www.ndorms.ox.ac.uk/news/new-prediction-model-could-help-inform-patients-of-their-risks-of-having-shoulder-replacement-surgery>.

I learned a lot from this collaboration, both regarding technical skills, science approach and from working in another research team.

Besides a great working experience, I learned about their traditional colleges as well. I went to a formal, which is a 3-course dinner in one of their big dining halls. Everyone

are wearing long dresses, suits and the Oxford students are wearing their capes. After dinner, everyone goes to their respective common room. For PhD students, that is the middle common room, where there was served cheese and port wine in an all covered mahogany room behind closed doors.

Everyone in Oxford were very polite, interesting and a lot of fun. It is hopefully not the last time we will work together.

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PhD candidates research



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PhD candidates are the pillar of our research unit. By the end of their employment, candidates have often published several papers within a specific research area. Research results are usually published in international journals, and they often lead to changes in our clinical practice. The candidates initiate prospective studies or randomized clinical trials which can determine if a new treatment is superior, equivalent, or inferior to our existing treatment. This is very important for evidence-based treatment and for a thoroughly introduction of new treatments. Two PhD candidates defended their thesis in 2024.

In April, Marc Nyring defended his thesis about shoulder arthroplasty for osteoarthritis with a special focus on the design of anatomical total shoulder arthroplasty components. He defined the minimal clinically important difference (MCID) for shoulder specific outcome scores which can be used as a measure of significant improvement after a shoulder arthroplasty procedure. He found that approximately 90% of patients who were treated with an anatomical total shoulder arthroplasty for osteoarthritis had a significant improvement one year after their operation. Based on data from the Danish Shoulder Arthroplasty Registry and in an international collaboration with the Australian Joint Registry he compared the risk of revision of stemmed and stemless humeral components used in combination with either a cemented polyethylene glenoid component or a screw fixated metal-backed glenoid component. Stemmed and stemless humeral components with a cemented polyethylene glenoid component had similar risk of revision whereas the metal-backed glenoid component had a very high risk of revision independently of the design of the humeral component. In a randomized clinical trial, Marc compares the stemless and stemmed humeral components with patient reported outcome and migration of the humeral component as outcomes.

Patients have been included and the 2-year follow-up results are expected to be published during 2026. The study is a collaboration between Herlev/Gentofte Hospital, Rigshospitalet and Skaane University Hospital, Lund.



In April, Marc Nyring defended his thesis.

RESULTS WHICH ARE USED IN OUR CLINICAL PRACTICE:

- 90% of patients who are treated with an anatomical total shoulder arthroplasty for osteoarthritis will have a significant improvement one year after their operation. Stemmed and stemless humeral components with a cemented polyethylene glenoid component have low risk of revision. This is clear and distinct messages that can be used to inform patients about their prognosis following surgery.
- We do not use metal-backed glenoid components in our department.
- The results from the randomized clinical trial will determine if stemmed or stemless humeral components will be our standard treatment in the future.

PhD candidates research



<https://herlevhospital.dk/c6c>

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In September, Ali Al-Hamdani defended his thesis about surgical treatment of comminuted intraarticular distal humerus fractures (AO/OTA type C2-C3). He showed that the standard treatment with open reduction and internal fixation had good outcomes in term pain-relief and improvement in range of motion, but the complication rate was high. He found that the modern alternative with an elbow hemiarthroplasty had similar results and risk profile as open reduction and internal fixation. To fully understand the benefit and harms of these treatments, Ali initiated a randomized clinical trial.

Patients were included from 2020 to 2024 and the 2-year follow-up results are expected to be published during 2026. In order to identify distal humerus fractures which may require elbow arthroplasty, Ali introduced a new classification system, the Copenhagen classification system. As a part of the obligatory change of research environment, Ali went to Rotterdam. In collaboration with the Dutch Arthroplasty Registry, he published a paper regarding revision total elbow arthroplasty and the need of centralization.

Elbow hemiarthroplasty for distal humerus fracture is a newer treatment which is not approved by the healthcare authorities (FDA) in the US. This leaves the thesis with an international perspective and great potential. The thesis is an example of how we want to introduce a new treatment. First, report the result of the existing treatment. Second, report the results of the new treatment for a small cohort to ensure that the treatment is not fundamental inferior to the existing treatment. Third, compare the treatments in a randomized clinical trial and, finally, follow the results of the treatment in a registry setting.



In September, Ali Al-Hamdani defended his thesis.

RESULTS WHICH ARE USED IN OUR CLINICAL PRACTICE:

- Even for the most complex distal humerus fractures open reduction and internal fixation can lead to good outcomes.
- If open reduction and internal fixation is deemed impossible, elbow hemiarthroplasty can be used with satisfying results for many patients.
- The results from the randomized clinical trial will determine if elbow hemiarthroplasty or open reduction and internal fixation is our standard treatment of comminuted intra-articular distal humerus fractures (AO/OTA type C2-C3) in the future.

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Research for the Present – and the Future

If you would like more information, or if you are interested in getting started with a small or larger research project, you are very welcome to reach out to us.

Please feel free to contact any of the individuals listed above, and we will get back to you as soon as possible.

We look forward to hearing from you and are happy to discuss your ideas, answer questions, or help you take the next steps toward your project.



<https://herlevhospital.dk/o4h>





**Herlev og Gentofte
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