Comparison between conventional and robotic-assisted TKA in fast track recovery regarding the short-term postoperative period

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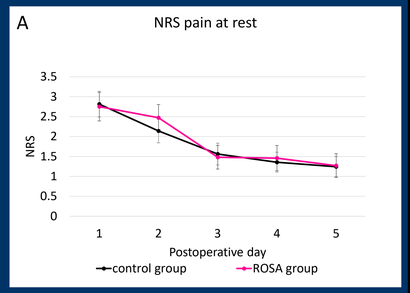

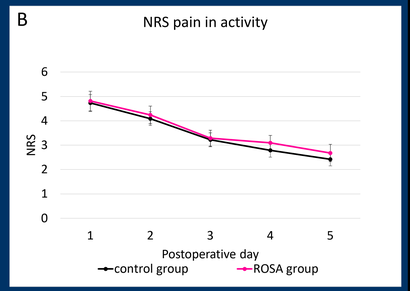

Figure 1: (A) Postoperative rest pain, (B) exercise pain

INTRODUCTION

In the context of fast track programs in knee arthroplasty, a shortened convalescence and a faster functional recovery without increased mortality or morbidity as well as a significant reduction of the length of stay, up to outpatient surgery, could be achieved following defined, evidence-based treatment principles.

In Germany, the introduction of such concepts in arthroplasty has risen in the last years. Advanced additional techniques, like robotic-assisted surgery, and their role are increasingly being investigated. In a retrospective study, we compared two groups of patients with primary TKA implantation after introduction of the fast track program before and after the Implementation of robotic-assisted surgery with the ROSA System to investigate the short-term effects on the quality of care.

METHODS AND MATERIALS

This is a retrospective study comparing a conventional surgery (control) and a robotic-assisted (ROSA) surgery group (n = 100 per group). Both groups included patients from a fast track recovery program including participation in a patient seminar, treatment on a dedicated fast track ward, peri-/intraoperative administration of tranexamic acid and dexamethasone, omission of a tourniquet, peripheral pain catheter, and redon drainage, use of local infiltration anesthesia (LIA), and early mobilization 2-6 h postoperatively. The only difference was the implementation of robotics.

Hb drop (g/dl) postoperatively, postoperative pain score (VAS) at rest and in exercise, oral morphine equivalent dose (mg), inpatient length of stay (days), surgery duration (min) and mechanical axis measurements postoperatively were collected. Paired T-Test was conducted for statistical significance. For the varus-valgus angles a paired t-test was conducted for the absolute values.

RESULTS

Postoperative blood loss was not statistically significant with a Hb drop of 2.2 g/dL (95% CI; 2.0-2.4) in the ROSA group compared to the control group with 2.2 g/dL (2.0-2.3). The length of stay was also the same in both groups (6,54 days with 95% CI 6,33-6,74 in the control group vs 6,78 with 95% CI 6,54-7,02). At each time point, there was no significant difference in postoperative pain score (VAS) between the groups. The oral morphine equivalent dose was lower in the ROSA group at 42.99 mg (29.11-56.87) compared to the control group at 58.46 mg (47.47-69.45), but this was not statistically significant, as well.

Operative duration appeared significantly increased in the ROSA group (p-value < 0,01) with 83.65 min (95% CI 79.18 -88.12) compared to control group with OP duration 71.59 min (95% CI 68.87 - 74.31).

The postoperative measurements of the mechanical leg axis showed a higher consistency of the results, which can be seen in the attached dot-violin plot (Figure 2), demonstrating a statistical significance, as well (p-value =.0,026)

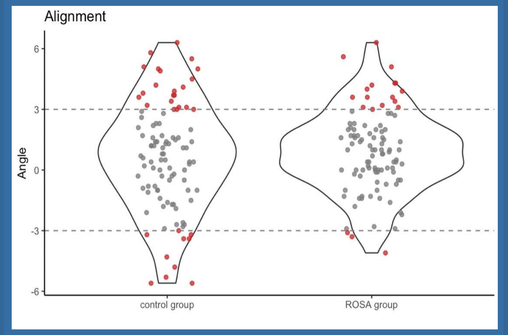

Figure 2: Dot-Violin Plot with outliers marked in red presenting Mechanical Alignment. (varus > 0, valgus < 0)

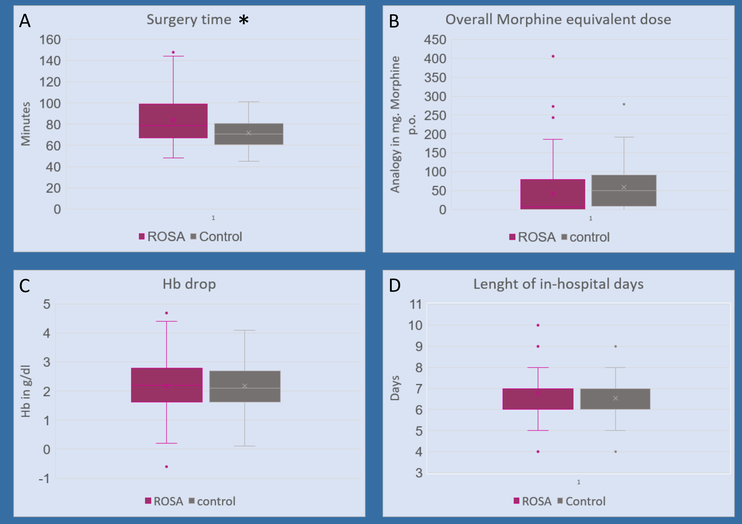

Figure 3: (A) Surgery time (min)*, (B) overall morphine equivalent dose (mg), (C) Hb drop (mg/dl), (D) length of hospital stay (days)
(* = p<0.05, paired T-test).

DISCUSSION

The implementation of robotics in TKA in a fast-track concept led to significantly higher surgery time, which can be explained from the prolonged learning curve of the robot and the extra surgery steps, including tracker placement and landmarks. Regarding blood loss, length of stay, pain level and opiate consumption there does not seem to exist any statistically significant difference. It is a single center study with established fast-track program and standardized procedures for more than five years and highly trained and experienced surgeons and staff, which seems to be the main reason for the above.

On the other side, the postoperative mechanical alignment of the robotics group demonstrated statistically significant higher consistency and less variation. Moreover, robotics tend to eliminate valgus outliers, complying with the goals of the surgeons. Regarding the varus knees, the surgeons tend to operate leaving a residual varus alignment of 1° - 3°. Therefore most of the varus “outliers” were in fact intended and not far further from the surgeons’ goal.

In view of the above reasons, more multicenter studies are needed after solid implementation of robotics, as well as prospective studies with appropriate patient numbers regarding also the long-term outcome quality, so that we can conclude about the benefits of robotics in TKA.

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