

Introduction Robotic assisted surgery is continuously getting more common in spinal surgery. Many studies have already shown an improvement in the accuracy of pedicle screw placement and a decrease of surgical revisions. Up to now only a few studies exist regarding the learning curve and the time needed for robotic assisted spinal fusions. This prospective and comparative study focussed on the learning curve compared to the standard surgical procedure. Material and

Methods:

Single-center prospective data collection of all performed spinal fusions, whether standard open (SO) or robotic assisted (RAS, Mazor X Stealth Station, Medtronic), over a period of 10 months. Evaluation of time needed for robotic registration and pedicle screw placement, amount of blood loss, x-ray dose, and complications. Learning curve for the time needed per screw over the performed surgeries was calculated using linear regression in SPSS.

Results:

142 non-randomized patients were included of whom 80 (age 63 ± 14 years) underwent RAS surgery and 62 (age 58 ± 21 years, $p=0.131$) underwent standard (SO). The average number of implanted screws for SO was 6 ± 4 , and for RAS 7 ± 3 ($p=0.470$). No differences in blood loss per screw SO 82 ± 60 ml, RAS 97 ± 68 ml could be found ($p=0.174$). X-ray dose (cGYm²) per screw was for SO with 168 ± 137 higher as for RAS 108 ± 130 ($p=0.010$). There was no sig. difference for time for pedicle screw placement per screw (SO 8.0 ± 4.7 min, RAS 7.5 ± 3.8 min, $p=0.541$). Specific complications for robotic surgery were all technical difficulties and occurred in 16% ($n=13$). The linear regression showed a significant decrease for time needed for screw placement over time ($r=-0.376$, $p=0.001$). The time per screw in the 1st quarter of surgeries was with 9.0 ± 2.9 min nearly twice as much compared to the time needed in the last quarter (5.5 ± 2.7 min, $p=0.001$). In addition, the time for RAS screw placement of the last quarter was significant lower, compared to SO ($p=0.004$).

Discussion:

During the 10-month period using RAS, the learning curve showed reduction for both, time needed for robotic registration and X-ray dose. The blood loss seems comparable. The time for screw placement decreased significantly and finally the screw placement via RAS became faster than for SO. Nevertheless, the time required for patient positioning is still an add-on in the RAS and therefore the incision-suture time is still comparable to the standard open procedure. The higher the number of inserted screws the more advantageous the robotic assisted procedure gets. During the learning period substantial time deviations as well as technical complications must be expected.