Accuracy of screw placement in navigated percutaneous iliosacral screws

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Introduction: Isolated injuries of the sacral bone are rare. In most cases they are combined with additional injuries of the pelvic ring. The pathomechanism of these injuries are usually high velocity accidents or falls from large heights. The computer-assisted implantation of iliosacral screws (SI-screw) becomes more important in the treatment of dorsal pelvic ring fractures. The advantage of the minimal-invasive screw placement is the reduction of the non-union and deep wound infection rate. Another advantage of computer-navigated SI-screw placement is the reduction of intraoperative radiation for the patient and the surgical staff. The purpose of this study was to analyze the position of navigated iliosacral screws.

Methods: In the study group 74 screws (49 patients) were included and radiologically analysed. All screws were implanted using 3D-navigation (BrainLAB Vector Vision, Brainlab, Feldkirchen, Germany). Navigation was always executed with the same 3D c-arm (ARCADIS Orbic 3D, Siemens, Erlangen, Germany) and navigation system. We determined the grade of perforation and angular deviation in the postoperative CT-scans in all screws. The classification was performed according to Smith et al in 4 grades. Grade 0 implies no perforation and grade 1 a perforation less than 2 mm. Grade 2 correlates a perforation of 2-4 mm and grade 3 a perforation of more than 4 mm. Furthermore the intra- and postoperative complications as well as the body-mass-index, the comorbidities and the duration of radiation were documented. The statistical analysis was executed using Microsoft Excel 2003.

Results: The mean age of the 49 patients was 42,2 years ± 18 (16–79 years). 28 male and 21 female patients were included. 25 patients received a single iliosacral screw in S1. In 19 cases a screw in S1 and S2 was placed on the same side. Four patients got bilateral SI-screws in S1 and another patient received bilateral screw placement in S1 as well as an additional screw in S2. Nineteen patients received additional surgery during the same operation. The mean operation time was 100 min ±103 (20–540 min). The isolated time for SI-placement was 50 min ± 20 (20–93 min). The mean radiation time was 3 min ± 1,7 (0,9–7,4 min) (n = 28). Altogether 84% of the screws showed an intraosseous position (grade 0). In the axial plane 7 screws perforated ventrally, 5 screws penetrated the adjacent neural foramen. In the frontal plane the screws showed greater variations, 61% deviated less than 5° (grade 0). In the study group 5 screws needed surgical revision because of either malplacement or postoperative pain. There were no infections or neurological complications. In the screws, which perforated the cortical bone or the neural foramen, no statistical correlation to the body-mass-index (BMI) could be shown.

Conclusions: The computer-assisted implantation of iliosacral screws is a safe method in relation to screw perforation. It shows a high security and accuracy concerning the ventral and dorsal cortical perforation. There is a frequent angular deviation in the frontal view without appearance of screw perforation or mechanic, neurologic and angiologic complications. The minimal-invasive procedure shows a low postoperative revision rate.