

# Precise guided implantation of pedicle screws by using the VENUS®navi instruments

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Neckar-Odenwald-Kliniken, Buchen

## Introduction

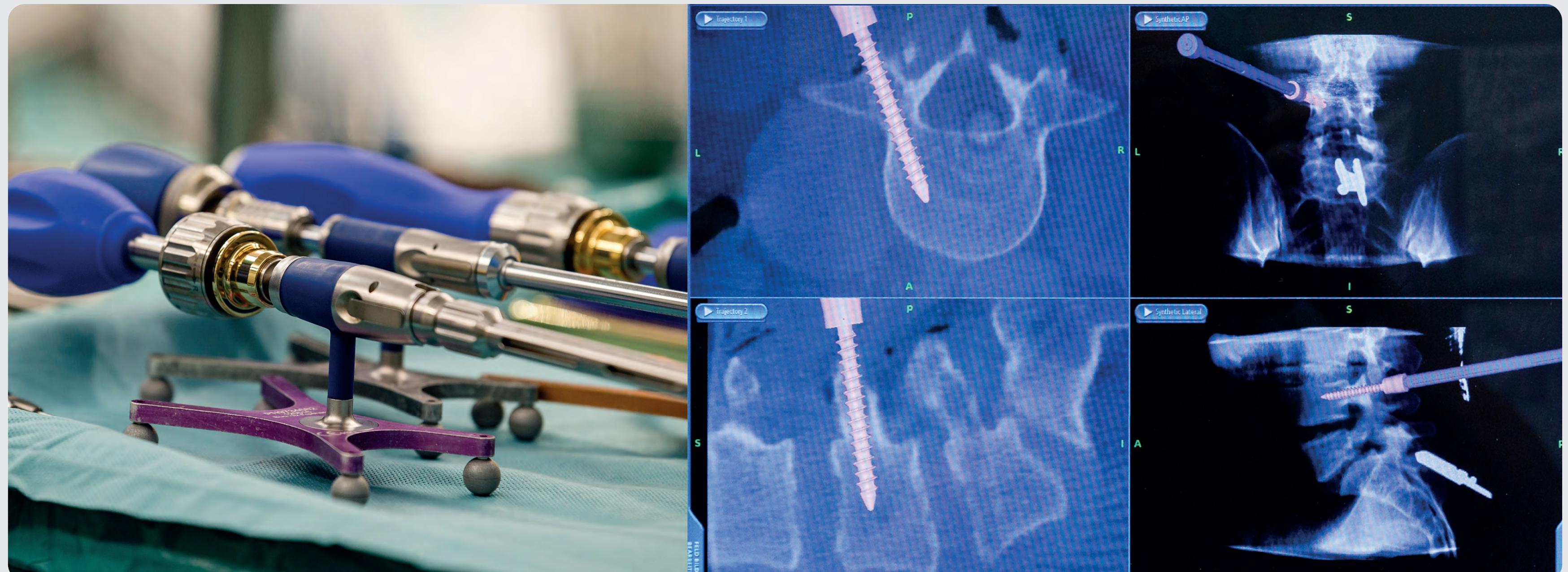
The aim of this work was to confirm highly accurate image-guided pedicle screw placement with navigated VENUS®navi instruments (HumanTech).

## Material and Methods

From October 2018 through November 2019, fourteen individuals (8 women, 6 men, average age 75.1 (49-89) years) with vertebral fractures, instabilities and/or spinal stenosis underwent navigated posterior pedicle screw instrumentation procedures performed in the Neckar-Odenwald Klinik Buchen.

A total of 92 image-guided pedicle screws were inserted in thoracolumbar and sacral vertebrae (T10-S1) using the VENUS®navi surgical instruments system (HumanTech).

For post-instrumentation evaluation, screw positions were categorized into six groups: 'intrapedicular', 'parapedicular lateral', 'parapedicular medial', 'paravertebral lateral', 'paravertebral cephalad', or 'paravertebral caudad'.

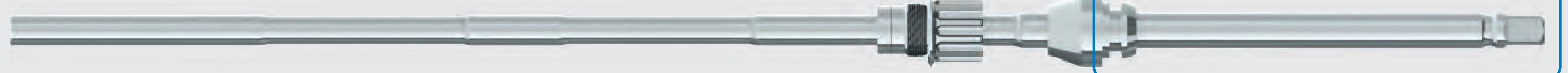


## VENUS®navi instruments

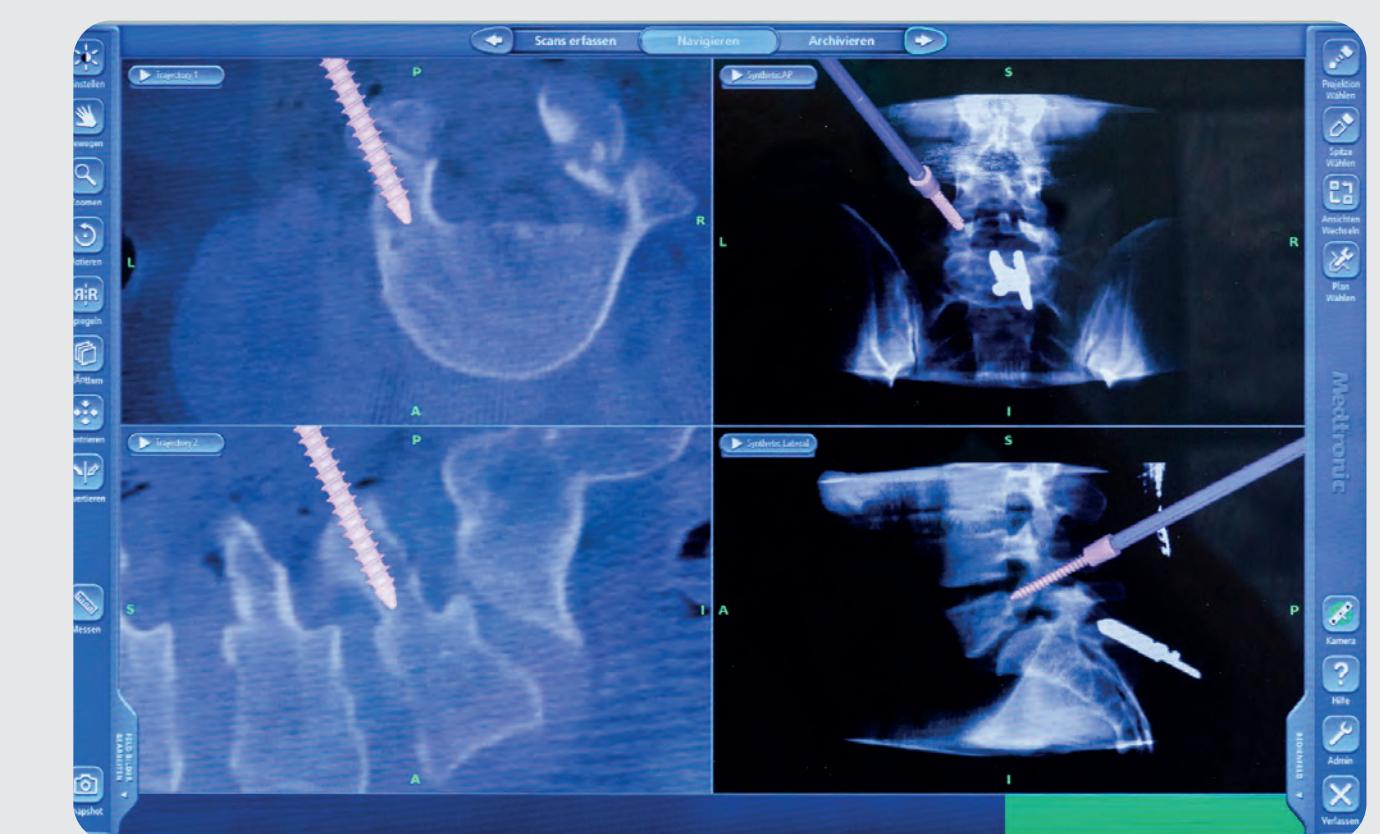
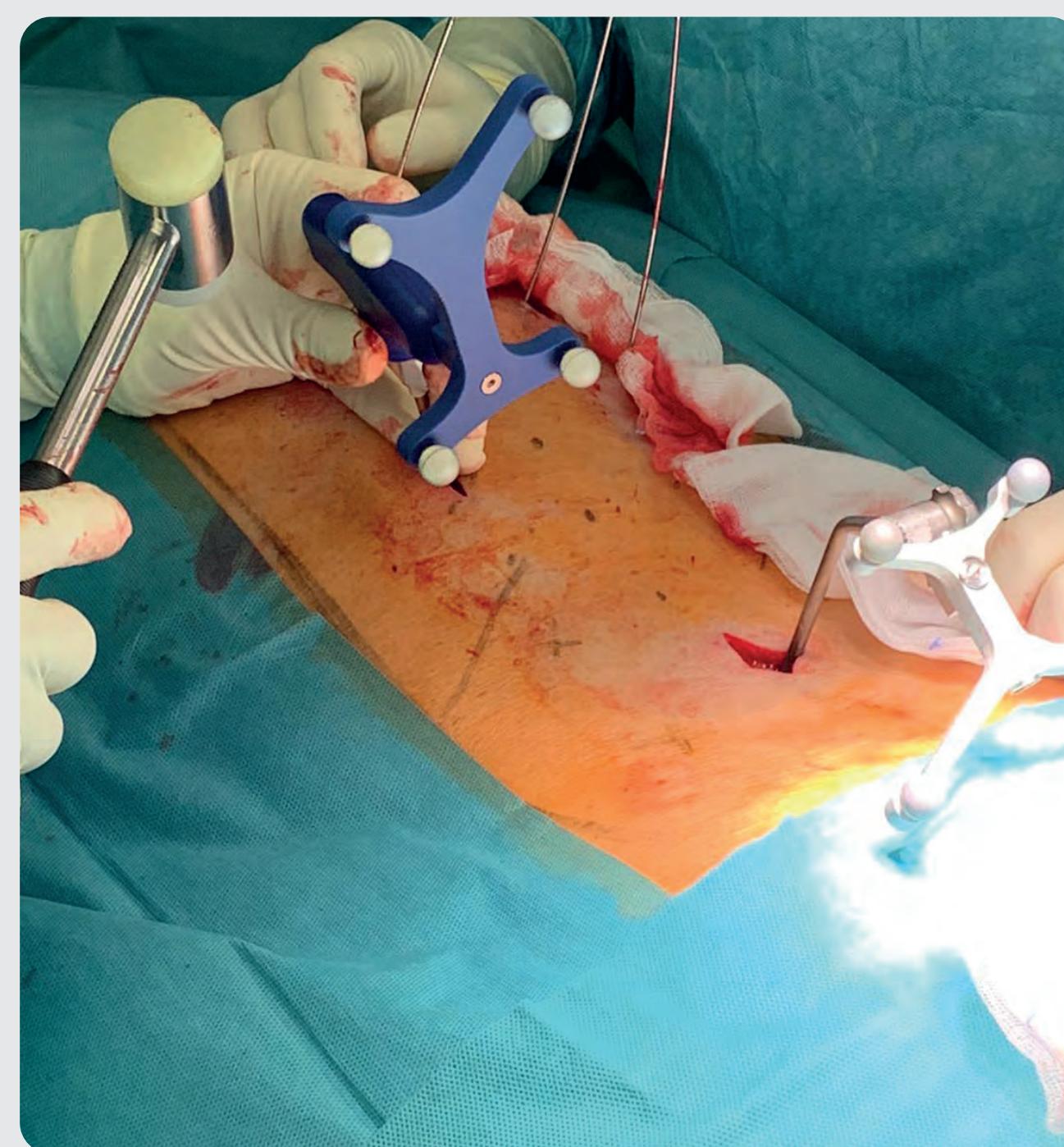
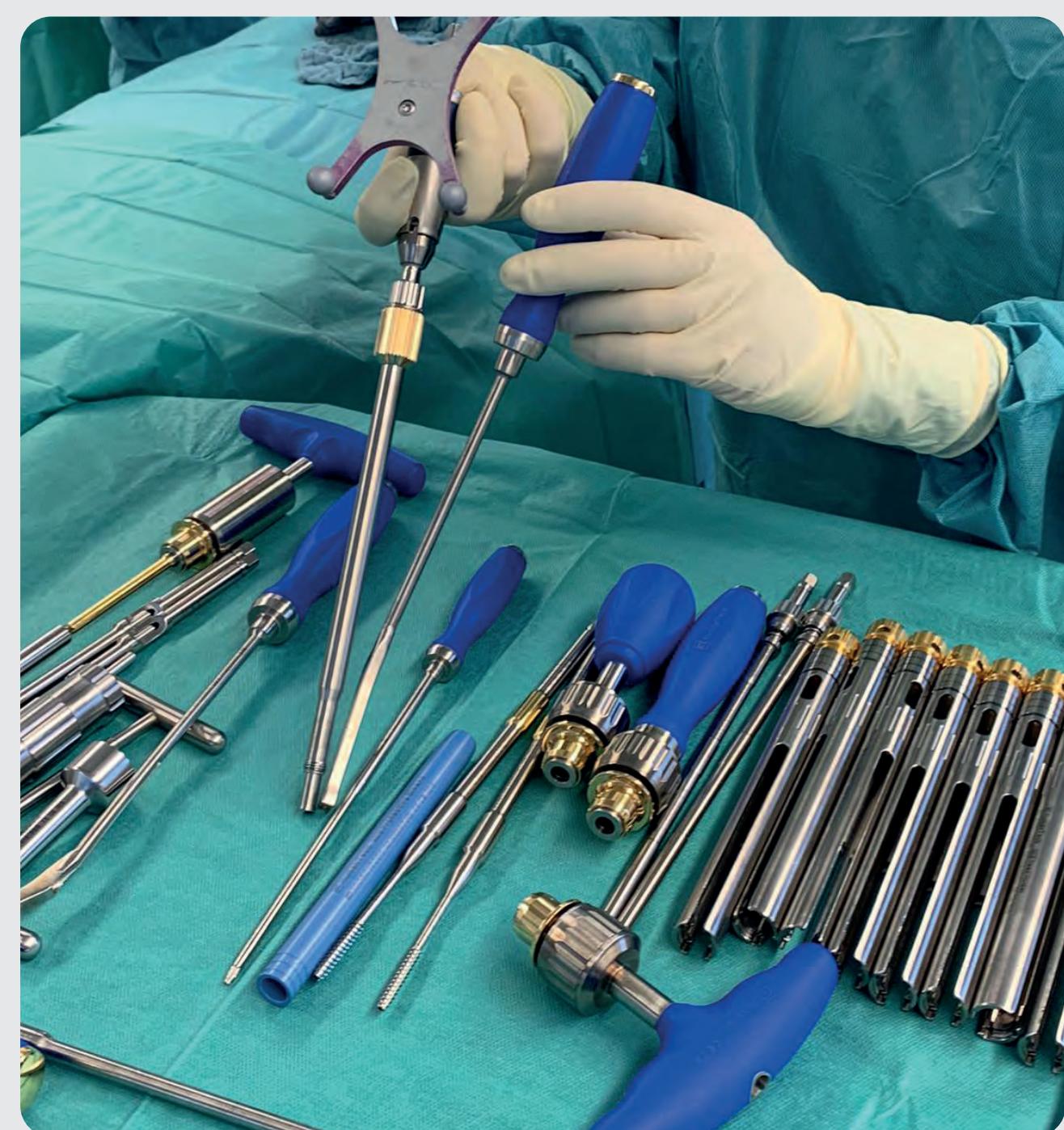
Cannulated Awl – Navi



MIS Polyaxial Screwdriver – Navi



## Surgical Technique



Surgeries were performed in prone position of the patient after placement of a 3D-fluoroscope(O-arm®)combined with an optical navigation system (StealthStation S7). Navigated instruments (awl, probe, thread cutter, screwdriver) were presented

to the infrared camera for registration purposes to allow real-time tool-tracking on the navigation unit's monitor. The reference frame was fixed to a spinous process in the caudad end of the surgical field after minimally invasive preparation. Then the initial 3D-scan was performed.

Through minimally invasive approaches, target vertebrae were instrumented with guide-wires using the navigated cannulated awl. After fluoroscopic verification of correct guide-wire positions, required screw dimensions were determined by simulating virtual screws into the initial 3D-fluoroscopy scan on the navigation unit's monitor using associated computer software. Finally, suitable cannulated pedicle screws were inserted with a navigated screwdriver under image-guided visual control.



## Results

All navigated pedicle screws (n=92) were securely implanted with navigated VENUS®navi instruments in combination with an optical 3D-navigation system allowing real-time image-guidance on intraoperatively acquired 3D-fluoroscopy data sets. All pedicle screw positions were reviewed independently by two surgeons and rated as 'intrapedicular' in all cases.

## Discussion

Malpositioning of pedicle screws is a common complication in conventional pedicle screw instrumentation procedures [13,4% (Laine); 23% (Rajasekaran); 28% (Gertzbein)\*].

By using VENUS®navi surgical instruments and a corresponding navigation system the proportion of misplaced pedicle screws could be considerably reduced as shown in this limited series of 92 navigated pedicle screws demonstrating an accuracy of 100%.

To confirm the results of the presented study and to increase evidence, more pedicle screw placements are needed to be performed by various surgeons using VENUS®navi surgical instruments and a corresponding navigation system. Furthermore, pedicle screw placement accuracy should additionally be investigated in conventional (non-navigated) spinal procedures.

\* Tian NF, Huang QS, Zhou P, Zhou Y, Wu RK, Lou Y, Xu HZ (2011) Pedicle screw insertion accuracy with different assisted methods: a systematic review and meta-analysis of comparative studies. Eur Spine J 20(6):846–859. doi:10.1007/s00586-010-1577-5