

Minimally Invasive Spinal Osteosynthesis

Using robot-assisted 3D imaging with Artis zeego

Courtesy of Christian Raftopoulos, M.D.,
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Patient history

An 88-year-old female patient suffered from lower back pain. She was operated on before due to a traumatic fracture of L5 which required cementoplasty.

Diagnosis

Spinal instability in spinal cord from L4 – L5 – S1

Treatment

A spondylodesis of L4, L5 and S1 was planed for fixation of the spine under fluoroscopic and 3D image guidance. Intraoperatively, the robot-assisted C-arm is moved interactively to six preferred fluoroscopy positions in order to place, under 2D image guidance, two screws in each vertebra at L4, L5, and S1. These six C-arm positions are stored in the Artis zeego system and can be recalled and automatically revisited by the robot during the procedure. A frontal and lateral view is taken as a reference image (Fig 1a, b). The 6 needles are placed under fluoroscopic guidance from the stored C-arm positions. The exact position of the needles is reconfirmed by a 3D syngo DynaCT image using an 8-second run. 3D reconstruction of the spine and MPR slices visualize the depth and direction of the 6 placed needles. In this case, the cement in L5 poses a problem, thus, the needles need repositioning in order to put the trajectory for the screw more inward and create better stability of the

implant. Re-positioning of the selected needle was performed by recalling the stored C-arm position for this vertebra which drives automatically the robot into the exact position of the preferred fluroscopy view. After optimizing the location of the K-wire and final confirmation with 3D syngo DynaCT, the pedicle screws are implanted along the needles. The final positions of the pedicle screws are again verified by a syngo DynaCT acquisition before the metal bars on both sides of the spine are attached.

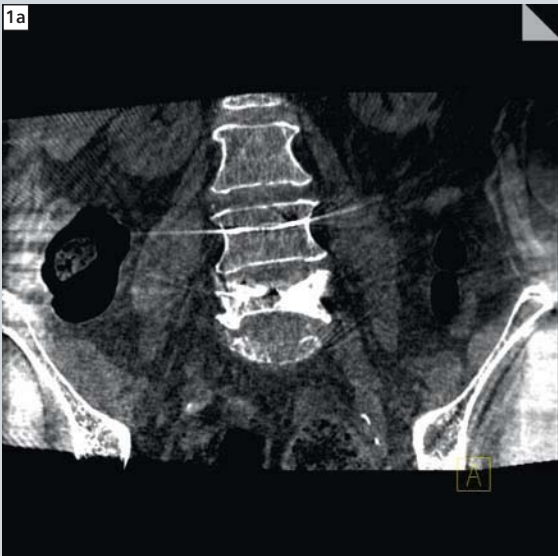
Comments

Intraoperative 3D imaging with syngo DynaCT can help to confirm the accurate position of the pedicale screws and to visualize special anatomical structures or artifacts due to prior interventions. It can re-ensure the correct progress of the intervention and might indicate necessary adjustments right in the OR. The unique robotic drive of Artis zeego allows surgeons to store specific fluoroscopic views which can be re-called during the procedure. This reduces both manual interaction and error and speeds up the workflow in the OR without losing flexibility.

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Dr. Raftopoulos verifies the progression of the procedure on the live fluoro monitors. The left monitor displays a reference image which was acquired at the beginning of the intervention. Besides the image itself, the exact position in which this image was taken is stored by the system, as well. During the procedure, Dr. Raftopoulos recalls this position and the robotic system automatically moves the C-arm to the same fluoroscopic angulation. In this way, Dr. Raftopoulos can directly compare the anatomy at the beginning of the procedure in the reference image with the actual anatomy in the live fluoro image on the right monitor. Note, that the angulation of the C-arm and, thus, the fluoroscopic views are exactly the same for the images on both monitors.



1 Intra-operative 3D syngo DynaCT images showing a lateral (a), frontal (b), and axial (c) view of the spine after the K-wires are placed. Such 3D reconstruction of the spine reconfirms visually the depth and the direction of the K-wires and might indicate necessary adjustments of the screw trajectories.

