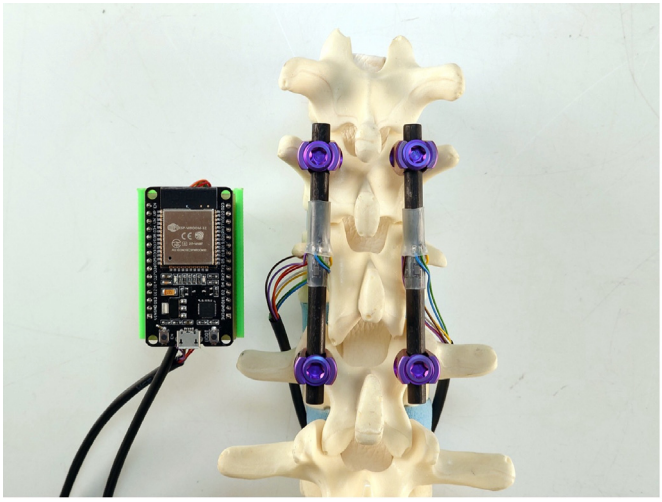

FIG. 2

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Comparison between robot-assisted and conventional pedicle screw placement

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INTRODUCTION: The placement of pedicle screws is a crucial step in spinal surgery. Precise positioning is essential for the stability and pullout strength of the screws. Robot-assisted placement promises higher accuracy and an improvement in postoperative outcomes. The aim of this cohort study is to compare the accuracy of screw placement using a robot versus the conventional method. The primary endpoint was the screw placement according to the Gertzbein-Robbins classification.
METHODS: In a single-center, retrospective cohort study, 105 patients who were operated on with the aid of a robot were compared to 115 patients who underwent conventional surgery. Adults requiring dorsal instrumentation for degenerative diseases and fractures were included. Ethics committee approval was obtained.
RESULTS: In the robot cohort, the placement of screws according to the Gertzbein-Robbins classification Grade 0 was achieved in 93.33% of cases (n=98) compared to 78.76% (n=91) in the comparison group (p=0.007). The relative risk (RR) was 0.3139 (95% CI 0.1412-0.6978, p=0.005). The number needed to treat (NNT) was 6.862 (95% CI 4.229-18.191). The clinical outcome based on the McNab scale also showed significant improvements (OR: 0.544, 95% CI 0.326-0.909, p<0.020). Additionally, blood loss, length of hospital stay, and intraoperative radiation dose were significantly lower in the robot cohort (p<0.05).
DISCUSSION: Robot-assisted pedicle screw placement increases the accuracy of screw positioning and is associated with reduced blood loss and faster recovery. Moreover, the medical staff is exposed to less radiation. These results support the use of robot assistance as a promising method in spinal surgery.

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Preoperative automated screw planning in lumbar and thoracic spine surgery: Three-year single center experience and correlation analysis

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BACKGROUND: Automated pedicle screw planning in spine surgery has been available for a few years with intent to facilitate and accelerate preoperative planning in instrumentation cases. Here we analyze the deviation between automated and actual implant sizes.
METHODS: In a single center analysis, all thoracic and lumbar spine instrumentation cases with preoperative automatic screw planning were reviewed from 1/2021 – 1/2024. Automated planning (widely established navigation software) without manual correction was compared to actual implants used by the surgeon. Automated and manual planning were performed by one of two experienced surgeons also performing the surgery. Standard statistical methods were applied.
RESULTS: Out of a total 988 spine surgeries during the study period, 103 thoracic and lumbar instrumentation surgeries including 296 segments were performed. 89.3% were elective cases. Degenerative, infection, tumor and trauma cases were almost equally distributed. 72.8% were performed in percutaneous technique, 17.5% with Carbon-PEEK implants. Preoperative automated screw planning (ASP) was performed for all cases with a total 694 pedicle screws. Notably, ASP suggested different sizes in the same vertebra in up to 30%, in these cases the longer ASP was included in statistics. Average screw diameter was 5,25 mm for ASP compared to 5.98 mm actual implant size (AIS). Average length was 46.5 compared to 46.9 mm respectively. Pearson and Eta correlation analysis revealed a strong positive correlation and relationship between ASP and AIS with r=0.743 and η=0.752. A significant linear relationship between groups was found (p<0.001, F=199.247).
DISCUSSION: Automated screw planning offers realistic screw dimensions; however, margins seem conservatively calculated, especially regarding screw diameter. Asymmetric screw proposals for the same vertebra rarely match surgical reality and experience.

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Current state and future perspectives of spinal navigation and robotics - An AO spine survey

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OBJECTIVE: The use of robotics in spine surgery has gained popularity in recent years. This study aims to assess the current state of navigation and robotics in spine surgery and raise awareness of their educational implications across the AO Spine regions.
METHODS/MATERIAL: An online questionnaire comprising 27 questions was distributed to AO spine members between October 25th and November 13th, 2023, using the SurveyMonkey platform (https://www.surveymonkey.com; SurveyMonkey Inc., San Mateo, CA, USA). Statistical analyses (descriptive statistics, Pearson Chi-Square tests) and generation of all graphs were performed using SPSS Version 29.0.1.0 (IBM SPSS Statistic).
RESULTS: We received 424 responses from AO Spine members (response rate = 9.9 %). The participants were mostly board-certified orthopedic surgeons (46 %, n=195) and neurosurgeons (32%, n=136) with an equal distribution from academic/non-academic institutions (50 %, n=212). While 49% (n=208) of the participants reported occasional or frequent use of navigation assistance, only 18 % (n=70) indicated the use of robotic assistance for spinal instrumentation. A significant difference based on the country"s median income status (p<0.001) and the respondent"s number of annual instrumentation procedures (p<0.001) has been observed. While 11 % (n=47) of all surgeons use a spinal robot frequently, 36 % (n=153) of the participants stated they don"t need a robot from a current perspective. Most participants (77%, n=301) concluded that high acquisition costs are the primary barrier for the implementation of robotics.
CONCLUSION: Although the hype for robotics in spine surgery increased recently, robotic systems remain non-standard equipment due to cost constraints and limited usability. Spinal navigation appears to have a broader international utilization.

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