

Does the use of robotic guidance and navigation reduce the incidence of pedicle screw revisions?

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Background

Various computer-based guidance systems have been devised to reduce costly screw-related complications, yet their clinical effectiveness has never been comparatively assessed in a meta-analysis. We aimed to evaluate the incidence of clinically relevant pedicle screw revisions among robot-guided, navigated, and freehand spinal instrumentation.

Design

Systematic review and met-analysis of the literature

Methods

Controlled trials comparing either robot-guided, navigated or freehand spinal instrumentation for any indication, and that specifically reported the proportion of patients that experienced pedicle screw revisions were included. Estimates were pooled using random-effects meta-analyses. Sensitivity analyses including zero-event trials and assessing per-screw incidences were carried out.

Results

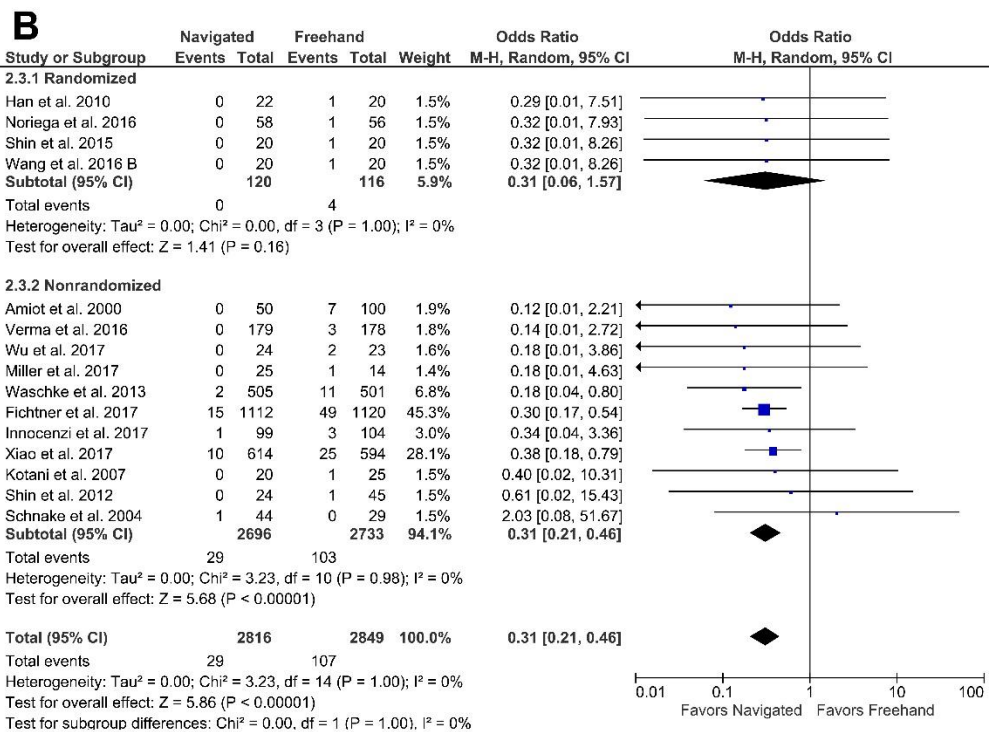
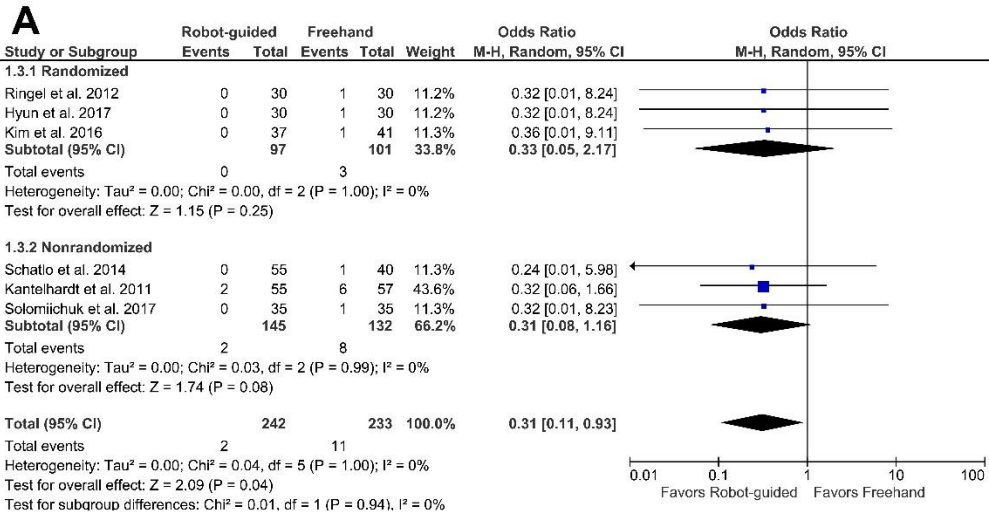
Among 37 studies (7095 patients), intraoperative revisions in robot-guided (OR: 3.6, 95% CI: 0.7 – 19.4, $p = 0.14$) and navigated (OR: 1.5, 95% CI: 0.3 – 7.2, $p = 0.64$) procedures were comparable to freehand. While postoperative revisions were reduced in robot-guided (OR: 0.3, 95% CI: 0.1 – 0.9, $p = 0.04$) and navigated (OR: 0.3, 95% CI: 0.2 – 0.5, $p < 0.001$) procedures, statistical significance was lost in sensitivity analyses for robotic guidance, but not for navigation. The pooled incidence of malpositioned screws requiring postoperative revision was 2.1%.

Conclusions

Based on the currently available data in the peer-reviewed literature, computer assistance in the form of robotic guidance or navigation has the potential to reduce the incidence of costly and clinically relevant postoperative revisions for screw malposition. It is essential to further investigate on a higher level of evidence if the clinical benefits of computer-assistance warrant the high acquisition and

maintenance costs inherent to these systems. For that reason, the European Robotic Spinal Instrumentation (EUROSPIN) Trial has been set up.

Meta Analysis of Revision Surgery for Malpositioned Screws



Pooled Results

Endpoint	No. of patients	Pooled absolute risk No. (%)	Pooled odds ratio (95% CI)	
			vs. Freehand	Robot-guided vs. Navigated
Intraoperative screw revision				
Robot-guided	125	11 (8.8%)	3.5 (1.8 – 6.8)	1.1 (0.6 – 2.1)
Navigated	1927	157 (8.1%)	3.2 (2.4 – 4.4)	
Freehand	2116	57 (2.7%)	-	
Postoperative screw revision				
Robot-guided	274	2 (0.7%)	0.2 (0.1 – 0.8)	0.8 (0.2 – 3.4)
Navigated	3200	29 (0.9%)	0.3 (0.2 – 0.4)	
Freehand	3583	118 (3.3%)	-	

95% CI = 95% confidence interval of the odds ratio

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Disclosures

Conflict of Interest: M.S. declares having received travel and presentation compensation from Mazor Robotics, Ltd. in the past. The other authors declare that the article and its content were composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Grants and Support: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.