Posterior screw fixation is a standard procedure for spinal instrumentation; however, screw insertion carries the risk of injury to neuronal and vascular structures.

Approach by way of the pedicle.

The traditional MI transpedicular thoracic discectomy approach can be further refined and enhanced by stereotactic navigation to expand the limitations of the MIS technique allowing for an increased number and types of patients eligible for minimally invasive surgery. Therefore, Minimally invasive tubular microdiscectomy with stereotactic navigation is a novel, safe, and effective improvement in feasibility from the traditional minimally invasive transpedicular thoracic discectomy technique [1].

Despite its usefullness, pedicle screw placement maneuvers had some complications. Nerve root, spinal cord injury, vascular injury, Cerebrospinal fluid fistula, visceral injury, pedicle fracture were some complications that mostly related to pedicle screw malpositioning. Among those complications, the nerve injury due to pedicle screw malpostioning was a common complication that was faced by spine surgeons [2] [3].

Pedicle screws are currently placed with open free hand and minimally invasive techniques assisted with either fluoroscopy or navigation. Screw placement accuracy had been investigated with several methods reaching accuracy rates from 71.9% to 98.8%.

A systematic review and meta-analysis was conducted to focus on the pedicle screw insertion accuracy with or without the assistance of image-guided system, and the variance among the different navigation systems. Comparative studies were searched on pedicle screw insertion accuracy between conventional and navigated method, and among different navigation systems. A total of 43 papers, including 28 clinical, 14 cadaveric and 1 model studies, were included in the current study. For clinical articles, there were 3 randomized clinical trials, 4 prospective comparative studies and 21 retrospective comparative studies. The incidence of pedicle violation among computer tomography-based navigation method group was statistically significantly less than that observed among the conventional group (OR 95% CI, in vivo: 0.32-0.60; in vitro: 0.24-0.75 $P < 0.01$). Two-dimensional fluoroscopy-based navigation system (OR 95% CI, in vivo: 0.27-0.48; in vitro: 0.43-0.88 $P < 0.01$) and three-dimension fluoroscopy-based navigation system (OR 95% CI, in vivo: 0.09-0.38; in vitro: 0.09-0.36 $P < 0.01$) also obtained significant reduced screw deviation rate over traditional methods. Between navigated approaches, statistically insignificant individual and pooled RR values were observed for all in vivo subgroups. Pooled estimate of in vitro studies show that computer tomography-based and three-dimension fluoroscopy-based navigation system provided more accurate pedicle screw insertion over two-dimension fluoroscopy-based navigation system. Our review showed that navigation provided a higher accuracy in the placement of pedicle screws compared with conventional methods. The superiority of navigation systems was obvious when they were applied to abnormal spinal structure. Although no strong in vivo evidence has detected significantly different pedicle screw placement accuracy among the three major navigation systems, meta-analysis revealed the variance in pedicle screw insertion accuracy with different navigation methods [4].

1)

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2)

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