

Accuracy of Pedicle Screw Placement with Three Different Guided Techniques in Adolescent Idiopathic Scoliosis: Retrospective Study of 1,385 Screws

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INTRODUCTION:

Pedicle screwing is widely utilized for posterior spinal fixation in spinal deformity correction. Although free hand technique using fluoroscopy is most popular with its reasonability, it has a steep learning curve to master this technique. CT navigated and robot-assisted techniques were developed to improve the accuracy of pedicle screw placement, and decrease the risk of malpositioned pedicle screws. The purpose of this study was to evaluate the superiority of robot-assisted pedicle screw placement compared with free hand technique and CT navigated technique in terms of accuracy, surgical time, and blood loss.

METHODS:

From 2010 to 2022 in our university hospital, three different pedicle screw insertion techniques, free hand technique with fluoroscopy and CT guided navigation technique, and robot-assisted technique, had been used consecutively for correction surgery of adolescent idiopathic scoliosis. The patient number was 23 cases for free hand technique with fluoroscopy, 21 cases for CT guided navigation technique, and 22 cases for robot-assisted technique. The accuracy of pedicle screw placement, surgical time, and blood loss had been retrospectively evaluated using postoperative CT scan and medical record and Gertzbein and Robbins classification.

RESULTS:

Average of surgical time for each group was 362 min, 329 min, and 311 min, respectively. Average of blood loss was 860 ml, 692 ml, and 595 ml, respectively. The accuracy of 472 screws, 443 screws, and 470 screws were evaluated and graded into 5 grades (Grade A-E). We defined Grade A and B (pedicle breach < 2mm) as acceptable, and acceptable rate of each group was 78%, 82%, and 86% (concave side) and 87%, 89%, and 92% (convex side), respectively. Two cases in free hand technique needed revision surgery.

DISCUSSION AND CONCLUSION:

Although there was not statistical significance, surgical time using robot-assisted technique was shorter than free hand technique although it needed registration time. The accuracy of pedicle screw placement in concave side using robot-assisted technique was significantly better than that of free hand technique ($p < 0.05$). System used is semiautomatic robot-assisted system and it doesn't require long time to the planned screw position. Robot-assisted technique may produce better outcomes especially in small and deformed pedicle in scoliosis.

