Surgery Current Research 2022, Vol. 12, Issue 7, 001-002 Opinion

Using a Spinous Process Clamp Guide, Place the Cortical Screws

Carlo Alberto *

Editorial Office, Surgery: Current Research, Belgium

Corresponding Author*

Carlo Alberto
Editorial Office, Surgery: Current Research, Belgium
E-mail: surggenopen@peerjournal.org

Received: 3-Jul-2022, Manuscript No. SCR-22-20025; **Editor assigned:** 5-Jul-2022, Pre QC No. SCR-22-20025 (PQ); **Reviewed**: 17-Jul-2022, QC No. SCR-22-20025 (Q); **Revised**: 19-Jul-2022, Manuscript No. SCR-22-20025 (R); **Published**: 27-Jul-2022, doi: 10.35248/2161-1076.22.12(7).398

Abstract

Background and objective: For patients with osteoporosis, the Cortical Bone Trajectory (CBT) technique offers an alternative method of lumbar spine fixation. Placement of CBT screws with more accuracy could increase mechanical stability and decrease complication rates.

Methods: To evaluate the cortical screw's accuracy, 4 lumbar specimens with T12-S1 were employed. By combining the vertebrae and screws from the preoperative and postoperative CT scans, the SPC-guided planned screws were compared to the actual inserted screws. The SPC guide was placed in the proper position in accordance with preoperative preparation to enable K-wire drilling along the intended path. According to Gertzbein and Robbins categorization, the screw accuracy was assessed using pre- and post-operative 3D-CT reconstructions. To assess SPC-guided agreements for CBT screw placement, Bland-Altman plots and Intraclass Correlation Coefficients (ICCs) were used.

Conclusions: The SPC guide was able to put cortical screws with more accuracy than preoperative planning screws and screws that were actually implanted.

Keywords: Cortical bone trajectory • Robot-assisted surgery

Introduction

A cutting-edge technique called a Cortical Bone Trajectory (CBT) offers a different method for inserting pedicle screws during lumbar spinal surgery. The cranio-caudal and medial-lateral paths via the pedicle are the entry points for the cortical screw trajectory, which begins at the interarticular lateral section at the level of the inferior border of the transverse process. Due to its cranial and lateral screw trajectory, which is able to boost the fixation screw's strength and reduce the likelihood of loosening, the CBT approach maximizes the contact of the cortical bone surface with the screw threads and improves the fixation strength. Additionally, the trajectory's characteristic has the benefit of limiting muscle dissection and preventing considerable exposure of the cephalad facet joints, resulting in a minimally invasive surgical operation.

The precision of cortical screw placement using 3D printed guides, 3D fluoroscopy-assisted navigation technology, and robot-assisted screw implantation has been documented in earlier investigations. Although 3D printed guides offer precise navigation, there are a number of conditions that must be taken into account, such as high cost, a demand on human resources, and complete removal of the facet joint capsule and paraspinal soft tissue. Furthermore, intraoperative screw localization is evaluated by CT scans in 3D navigation and robot-assisted surgery, which could expose patients to greater radiation. In this study, the first application of the Spinous Process Clamp (SPC)-guided cortical screw placement was described, and the device's precision was assessed. The SPC guide was a tool that provided cortical paths for patients needing spinal fusion between the L1 and S1 segments through an attachment to the spinous process of the surgical segment vertebral body through a unique tooth-like clamp. Planning modifies the location and posture of the SPC guide during the surgery in accordance with the preoperative 3D-CT model to ensure that the screw was inserted precisely along the cortical pathway.

Methods

For this investigation, the China Capital Medical University provided four lumbar specimens from cadavers that had been formalin-fixed and had T12-S1 segments. All cadaver specimens that did not have a history of spinal surgeries, congenital spinal deformities, pars defects, metastatic spinal lesions, trauma, or infection were included. The interspinous and supraspinous ligaments were still present despite the thorough stripping of the paravertebral soft tissue on the lamina, pars interarticularis, and facet joint. All prepared samples were kept in a refrigerator at a temperature of 20 °C until they were warmed to room temperature and used. Following the cortical trajectory planning, 48 screws were inserted from L1 to S1. Two spine surgeons at our facility with considerable CBT screw placement experience completed every screw placement. Preoperative planning and real lumbar specimens with screws implanted were used to quantify screw characteristics such as Lateral Angle (LA), Cranial Angle (CA), and Distance Between Screw Tip (DBST). LA was defined as the angle between the cortical screws' axis and the vertebral body's symmetry axis. The distance between two screw points, measured from 3D CT reconstructions, was designated as DBST, and CA was defined as the angle between the cephalad endplate line and the axis of the cortical screws.

Discussion

In order to increase the fixation strength, the Cortical Bone Trajectory (CBT) screw technique was described. It maximizes the screw thread's contact with the cortical bone. The beginning point, pedicle medial wall, pedicle lateral wall, and vertebrae cortex or cephalad endplate were included in the correct placement of CBT screws to engage the pedicle and vertebral body through the four-point cortical bone. Numerous cadaver studies have shown that employing 3D printed guide templates during lumbar spine surgery increased the precision of the cortical screw. According to other researchers, technologies for 3D navigation and robot-assisted surgery have been developed to increase the precision and security of screw placement.

These new screw insertion techniques did have certain drawbacks, though. For the 3D printed guide template to have intimate contact with the spinous process and lamina, the paraspinal muscles, ligaments, and facet joint capsule had to be removed. Both the high price of the guide plate and the length of time required for shipping must be taken into account. Contrarily, both 3D navigation and robotic aid systems call on intraoperative computed tomography, which exposes patients and operating room workers to more radiation. So, as a reusable, practical, and quick guidance for CBT screw placement, we created the SPC guide.

This study used the SPC guide to initially describe the precision of cortical screw insertion. Four L1-S1 vertebrae-containing lumbar spine specimens in total had 12 screws implanted in each specimen for a total of 48 screws. Our findings showed that the use of the SPC guide during the insertion of cortical screws could result in the accurate and safe execution of preoperative screw planning. The planning screw's (93.8%) clinically acceptable screw placement (equivalent to grade A and grade B screws) was comparable to the implanted screw's (83.3%) accuracy ($p=0.242$). It was clear that the SPC guide was securely fastened to the spinous process throughout the screw implant process because the incidence of proximal Facet Joint Violation (FJV) for planned screws (1.2%) was comparable to that of inserted screws (6.3%) ($p=0.617$).

From the superimposed 3D reconstruction of the screw and vertebrae before and after surgery, the deviation of the planning screw and the inserted screw were measured. According to the modified Gertzbein and Robbins approach, the precision of the CBT screw placement was assessed as follows: Grade A, no perforation; Grade B, 0mm-2 mm; Grade spine, planning the SPC guide to implant the screw while the entire spine is visualized allows for the most precise avoidance of the screw thread penetrating the outer cortex of the pedicle vertebral body. The planned K-wire that was to be introduced into the vertebrae through the SPC guide was much thinner than the screw model, which may be the cause of the three planning screws that were recorded as grade B.

The strategy was employed to reduce the incidence of perforations even though the pedicle along the cortical pathway could insert a planned K-wire but was still too thin to introduce a CBT screw. The reason for grade B or C screw placement was that a K-wire based guide through an SPC guide had a high chance of bowing since its diameter was too small to maintain straightness.

Nerve root irritation, spinal cord injuries, disc degeneration, vascular, and biomechanical defects are caused by the direction of the cortical screw perforation, which includes the caudal pedicle, medial pedicle, anterior and lateral walls of the vertebral body, and cephalad endplate. There were various possible explanations for the screw variation in the axial plane. In order to achieve correct navigation, it was first important to establish that the clamp at the head of the SPC guide rode on the spinous process adjacent to the operative vertebral body. One of the most important variables in figuring out the lateral angle is altering the knob height. The spinous process was blocked since the knob was closer to it, increasing the lateral angle of the screw. The worst case scenario was that insufficient trochoid motion during screwing can result in pedicle or pars fracture, and caudal or medial deviation can put neural tissue at risk. To give enough room between the screw tail and the spinous process at the expense of the lateral angle, the knob can be moved away from the spinous process. Second, because the entrance site is on the isthmus ridge, the tip of the K-wire is probably slipping laterally as the initial screw hole is being made. Because of this, lateral perforation was the direction of inserted screws that was used the most.

In the sagittal plane, cephalad endplate led to disc degeneration, cranial deviation caused proximal Facet Joint Violation (FJV), and caudal deviation put neural tissue at risk. The current investigation showed that cephalad endplate deviation was the most frequent deviation, followed by caudal perforation deviation. Before surgery, the anchor site for the SPC guider with clamp was planned and pinched into the spinous process. Then, based on preoperative planning, the cranial angle of the guide's column was adjusted. Finally, a K-wire was stabbed into the spinous process through the column and checked with lateral imaging. The clip and spinous process will move in an adequate amount throughout this procedure, and the post's caudal inclination will angle up as a result of gravity, which could result in cephalad endplate perforation.

Through the use of preoperative and postoperative 3D-CT reconstructed vertebrae and screws superimposed, parameters of any deviation of inserted screws tips from planned screws were measured. Our findings showed that there was no statistically significant variation in the spacing between the tips of planning screws and inserted screws. The cortical screw deviation parameter, which was measured with 3D models created from CT scans, was chosen to be the screw tips. The location is constant with a tiny variance since the screw entry point serves as the anchor for screwing the screw. The screw tip is the ideal indicator for measuring the screw deviation because the deviation of the screw direction during the insertion process would finally expand at the screw tip.

There are several restrictions on this study. The preoperative cortical screw parameter was used to manually adjust the SPC guide, which increased the deviation during screw insertion. Second, the study's limited sample size makes it difficult to assess screw accuracy, and the conclusions drawn are unreliable and unrepresentative. Third, additional clinical research is required to assess the efficacy and safety of screw insertion using the SPC guidance. Finally, fractures of the spinous process may result from forcing the SPC guide to be adjusted.

Conclusion

This cadaveric investigation concludes by demonstrating how the effect of gravity on the SPC guide can result in a rise in the cranial angle of the screw. It will lessen the penetration of the caudal pedicle wall, which can cause major neurological issues, even though it may increase the incidence of penetration of the cranial pedicle wall and the cephalad endplate of the vertebral body. The screw that the SPC navigator envisioned is lateral and has a greater abduction angle since it is constrained by the spinous process. Although it will lessen damage to the medial wall that causes nerve root destruction and enhance damage to the pedicle or lateral wall of the vertebra. The SPC guiding screws are placed precisely and minimize significant deviations in key directions. In the future, further clinical outcomes will be required to corroborate the imaging and clinical effects.

Cite this article: Alberto C. Using a Spinous Process Clamp Guide, Place the Cortical Screws. Surg Curr Res. 2022, 12 (7), 001-002