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Short Communication

The Use of Navigation In Minimal Invasive Spine Surgery (MIS)

Abdulrazzaq Alobaid, MD, FRCSC*

Kuwait Institute for Medical Specialization (KIMS), P.O. Box 1160, Surra 45712, Kuwait

***Corresponding author**
Abdulrazzaq Alobaid, MD, FRCSC
Chief of Spine Surgery
Chief of Orthopedic Casualties
Alrazi Hospital-Kuwait
Chairman of Faculty Orthopedics & Post
Graduate Training
Kuwait Institute for Medical Specialization (KIMS)
Orthopedic Spine Surgeon-Canadian Board Certified
P.O. Box 1160, Surra 45712, Kuwait
E-mail: dralobaid@hotmail.com

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Spine surgery is among the surgical specialities that is evolving tremendously and rapidly. The advancements in technology and diagnostic tools opened new era of spine surgery. The rapid growth in the implant industry delivered novel techniques, at the same time more confusion on the proper choice of surgical technique or implant. Although there is no consensus on the gold standard on many spine procedures, it's acceptable to say that the conventional open techniques are the most widely used by spine surgeons. One of the issues of spine instrumentations is screw mal position that was as high as 42% in some reports.[1]

The advancement of spine surgery and the better knowledge in spine anatomy, biomechanics, imaging, and implants introduced a new concept of less invasive "key hole surgery" that's called minimal invasive spine surgery "MIS". The newer techniques promises less soft tissue injury during surgery and faster post-operative recovery. One of the major concerns with MIS is the increasing radiation exposure for both the staff and the patient.[2] to overcome this concern, computer-assisted navigation was introduced not only for reducing radiation exposure, but also to improve accuracy of implant position. Navigation has been used for brain surgery in the early 1990s.[3] This technology utilizes stereotactic technique where the surgical instruments are guided to the pathologic target and it was frame-based navigation. The advancement of technology delivered frame-less systems, when combined to MIS techniques it should lower the radiation exposure and increases accuracy.[4,5] In a systematic literature review and meta-analysis,[6] it was clearly shown that the use of computer-assisted navigation significantly lowers the risk of pedicle perforation for the navigated screw insertion compared with non-navigated insertion for all spinal regions.[7]

There are different techniques of navigation, but in general it utilizes a real-time three dimensional visualization of patient's spinal anatomy. To achieve this, a meticulous exposure of the bone is required for better accuracy. However, if this technique is done utilizing intra-operative CT scan it would eliminate this time consuming step by performing intra-operative automated registration without the need of point and surface matching facilitating the use of computer-assisted MIS navigation.

The instruments with intra-operative CT navigation need to be verified and usually there is a reference frame inserted percutaneously into the posterior superior iliac spine. The image acquisition follows by performing a 3D spin. The images will be reconstructed and unlike the other common modalities used in open navigation procedures, the registration process is done automatically without the requirement of calibration as the CT or 3D images are directly downloaded to the machine. The surgical procedure will be initiated by determining the trajectory of the pedicle after verifying the trajectory in the surgeon monitor and making a small skin incision that is appropriate for the size of the utilized navigated instruments. The navigated instrument will be inserted using life navigation. The navigated awl, tap, screw insertion can be performed using real time navigation.[8]

Navigation in spine surgery requires special training and it has a learning curve but helps reduce radiation exposure especially in cases where visualization is an issue, making the utilization of this technology helpful in many procedures especially in obese patients, revision cases and cases with complex spinal anatomy. A survey based study was conducted to evaluate the attitude of spine surgeons towards using computer-assisted navigation.[9] This study showed that only 11% would use it routinely. Those surgeons are the high volume surgeon at busy medical centers. The most common cited reasons by surgeons for not using navigation were inadequate training, lack of equipment and high costs. This would be expected when introducing any new technology or surgical techniques.

In conclusion, with the newer available systems it can be safely stated that computer-assisted MIS navigation can aid the surgeons to safely navigate complex spinal anatomy, and more accurately completing the procedure of pedicle screw fixation with complete avoidance of radiation exposure to surgeons while increasing accuracy.[4,5]

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