Review of: "Application of a new percutaneous multi-function pedicle locator in minimally invasive spine surgery"

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This study examined the results of a new percutaneous multi-function pedicle locator for personalized three-dimensional positioning of a pedicle in minimally invasive spine surgery (MISS) without computer assisted navigation technology compared with those of the conventional freehand technique in MISS. The results showed the benefits of using this proposed locator in enabling orthopedic surgeons to quickly and safely complete personalized 3D positioning of the pedicle in MISS without computer-assisted navigation, as well as reducing intra-operative radiation exposure, lower costs and shorting learning curve for young orthopedists. The outcomes of robotic, navigation or any designed locators/3D-printed drill guide template assisted spine surgery could be evaluated as follows 1) Accuracy 2) Complications and revision 3) Radiation exposure 4) Learning curve 5) Cost-effectiveness. Some of these outcomes were evaluated in this study.

However, there are a number of concerns with this study which include the following:
1.Indication for this new percutaneous multi-function pedicle locator:
The levels of spine indicated for this new percutaneous multi-function pedicle locator in MISS was not mentioned in this study. Until now, robotic assisted spine surgery still has its limitation in application in cervical spine surgery.

2. Technique notes:

a. How to define the ML in the body surface of patients with severe deformity such as scoliosis?

b. How to make sure the PC*l* and PU*l* are identical?

c. How to make sure HL on the body surface of the patients was identical with H*l* in the lateral X-ray image?

d, Did any procedure can synchronize the pre-operation CT with X-ray image?

e. For pre-operation CT and X-ray examination, patients were in different position, supine and prone, respectively. This different position may make subtle mismatch in synchronizing the pre-operation CT with X-ray image.

f. The 2 angles measured in this study included the extroversion angle of a pedicle (namely angle α), which included the angle between M*l* and PC*l* through the pedicle in the CT image and the head or tail tilt angle (namely angle β) between PU*l* and H*l* in the lateral X-ray image. These 2 angles were calculated from 2 different images with different conditions. Therefore, synchronization of the pre-operation CT with X-ray image is a very important step to minimize the errors.

3. Outcomes:

a. Efficacy:

1) Time required for insertion of needles and the number of X-rays per patient should change to per screw for more appropriate consideration of numbers of needles placement while comparing the efficacy between locator technique and freehand technique.

2) The definition of time required for placement of needles in this study was “the period from the time when the first guide needle started to penetrate the skin from point P on skin to the time when standard X-ray fluoroscopy showed that every the needle tip was at the midpoint of the pedicle’s lateral edge, and meanwhile, the X-ray lateral fluoroscopy showed that every guide needle was on the extension line of the pedicle’s midline.” Actually, the period of time should be started from marking on the body surface to cover all the time spent for the placement of needles.

b. Radiation exposure:

1) Pre-operation CT should be considered as x-ray exposure of the patients, which is not needed in patients under freehand technique.

2) The number of X-rays per patient was 1.42 ± 0.58. However, every patient at least needed AP and lateral X-ray for confirmation the correct placement of needles with the aid of locator. It seemed unreasonable for the number of X-rays per patient under the figure of 2.

c. Accuracy:

This study did not show any evidence of accuracy while comparing locator technique and conventional freehand technique. Post operation CT is the best way to evaluate the accuracy of screw placement with or without pedicle penetration.

d. Revision and complication:

This study also did not show real data for needle or screw revision rate or any operation-related complication.

e. Learning curve: No learning curve study was shown in this study.

By falling to address these issues, the authors tend to overstate their findings (eg the abstract conclusion states that the study demonstrates “the potential benefits of using the locator included enhanced surgical accuracy, reduced operation time, alleviation of the harmful intra-operative radiation exposure, lower costs, and shortened learning curve for young orthopedists.”)

Percutaneous multi-function pedicle locator has the advantages of lower radiation exposure to surgical team members. Potential impact of teamwork on the learning curve of percutaneous multi-function pedicle locator assisted spine surgery is also concerned. The accuracy and complication and revision rate should be ascertained with more spine surgery experience.