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PERCUTANEOUS
FIXATION IN TRAUMA

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Introduction

Treatment method of post-traumatic vertebral fractures is still contradictory. Surgical treatment of thoracic and lumbar vertebral fractures depend on various factor. Treatment method and outcomes may vary depending on type of fracture, neurological injury, overall state of the patient and associated injuries. According to AO-Magerl classification, Type B and C fractures require surgical intervention, while a substantial part of Type A fracture, which is not associated with neurological damage, may be treated with conservative therapy and they do not require surgical treatment.^{4,10}

Corset and/or bed rest, which are known as conservative methods, challenges adaptation to treatment and results painful improvement period and progressive and permanent kyphosis at the end of treatment.^{1,7}

Conservative treatment is a challenging process in the part of patient. For some conditions, patient may get well with protective therapies. Conservative therapy may not be an option for some patients who are obese or have medical history of deep vein thrombosis or bronchopulmonary disease. Some young patients may refuse resting or inactive life. Conventional open surgery may not be appropriate for this group of patients due to possible risk

of blood loss, complication, delayed improvement and long hospitalization period. Minimal invasive procedure is the alternative treatment which is developed for this group of patients.⁸ Long-term retractions leads to muscular ischemia during conventional open surgery.

History

Pedicle procedure for thoracolumbar fractures was first introduced by Roy-Camille in 1963.⁹ Use of pedicle screws with conventional open surgery had been a recognized method for treatment of non-stable vertebral fractures. Magerl introduced pedicle screw procedure with percutaneous method in 1977.⁴ Magerl used pedicle screws, which were placed with percutaneous approach, for temporary fixation and the screws were removed at advanced stages of the treatment. Percutaneous pedicle screw has been increasingly used within last two decades, thanks to the advancing surgical technique and equipment.

Advantages

Minimal invasive procedures have been increasingly used for vertebral fractures within last two decades. There are many publications which document

efficiency of transpedicular screws, which were placed with percutaneous approach, in fractures of vertebral column. In a study, Kim et al. reported that in comparison with open surgery, percutaneous transpedicular screw placement leads to less injury in paraspinal muscles.³ Ischemia results from increased intramuscular pressure secondary to use of retractors and atrophy develops secondary to iatrogenic denervation of muscle. Fibro-fatty degeneration can be easily determined with magnetic resonance imaging (MRI) and it causes postoperative clinical failure.

There are studies which demonstrate that percutaneous transpedicular screw fixation leads to less blood loss, shorter hospitalization and milder postoperative pain.^{3,11} Similar to the open surgery, minimal invasive method ensure sagittal balance of the patient and thus, the fracture site is stabilized. In addition, complications of long lasting open surgeries can be avoided.

In a meta-analysis of literature conducted by Chaichana et al., authors presented totally 166 cases with post-traumatic thoracolumbar fractures in nine different series.² For patients undergoing percutaneous transpedicular screw fixation, complications included non-union of fracture in 3 patients, wound site infection in one patient and misplacement of screw in one patient. Mean duration of surgery was 91 minutes and the reported mean blood loss was 95 milliliters. Late kyphosis was observed in none of patient during clinical follow-up. Merom et al. compared ten patients who underwent conventional open surgery or percutaneous transpedicular screw fixation and they did not report a statistically significant difference although they reported that for patients operated with percutaneous technique, duration of operation was shorter, blood loss was less, morbidity rate was lower, hospitalization period shortened and postoperative pain level was far lower.⁶ Percutaneous transpedicular screw fixation offers best benefit to group of elderly patients. Elder patients have less tolerance to prolonged surgical procedure and blood loss and thus, percutaneous technique is an alternative of open surgery in this group of patients.

Disadvantages

In addition to above specified advantages, the system has some disadvantages including low fixation rate, late-onset kyphosis and non-healing fractures.⁴ Patients with post-traumatic neurological deficit and requirement of decompression are not eligible for percutaneous transpedicular screw fixation. Moreover, the method is not appropriate for kyphotic patients with sagittal imbalance. Mariscalco et al. reported that radiation exposure is far more during percutaneous transpedicular screw fixation in comparison with conventional open surgery.⁵

Surgical Procedure

The surgical position of percutaneous transpedicular screw fixation is similar to that of classical open surgery. Before incision is made, pedicles should be appropriately imaged during anteroposterior scopic imaging. The incision should be made over transverse process of the level where screw will be placed. Jamshidi needle is advanced to the pedicle. On the anteroposterior scopic images, Jamshidi needle should be at 9 o'clock position for left pedicles and at 3 o'clock position for right pedicles. Guide wire is advanced through Jamshidi needle and pedicle is reached. Guide wire should be kept in place until screw fixation is completed, since the guide wire facilitates the procedure.

For percutaneous transpedicular screw fixation, the common difficulty is usually faced when rod is placed. Skin incision should fit the length of rods. One should be careful to place screws at same place, if possible, in order to place rod more easily and depth of the screw heads should be aligned. Appropriate inclination of rod will ensure that rod is easily advanced through the screw head, particularly the one located at center of the system.

Patient selection is a factor influencing success rate of percutaneous transpedicular screw fixation. Selection of patients, who are not morbidly obese and for whom short-segment instrumentation will be sufficient, will minimize manipulation problems which may occur during percutaneous transpedicular screw fixation.

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