Shoulder Traction Device for Enhanced Conventional Fluoroscopy During Cervical Spine Operations

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Abstract

Conventional biplanar fluoroscopic imaging of the cervical spine is commonly used during cervical spinal surgery. We designed an intraoperative traction device to prevent shoulder superimposition on the cervical fluoroscopic imaging. During surgery at the stage of fluoroscopic examination, an operator can apply traction via the traction band of the device. This device is safe and easy to use, and can be preoperatively fitted to patients. Fluoroscopic images obtained with the new traction device were definitely superior compared with images obtained without the traction device. This device may be useful in cases with difficult fluoroscopic imagination of the lower cervical spine.

Key words: cervical fluoroscopy, spinal surgery, cervical fluoroscopic imagination

Introduction

Specific procedures are frequently performed on the cervical spinal segment in the practice of neurosurgery and spinal surgery.1,3,4,7) Real-time fluoroscopic visualization of the cervical spinal region is a very important step during such surgical interventions.1,3,7) Real-time image guidance based on cervical fluoroscopic examination is necessary for determination of the vertebral levels, evaluation of the implant position, observation of dislocation and facet locking, and establishment of the cervical curvature.2,5,6,8) However, such examination cannot always easily simultaneously visualize all cervical vertebral levels. Optimum examination should demonstrate all cervical intervertebral levels and the bony structure of the corpus including C2 and C7. This problem is due to superimposition of the shoulder on the fluoroscopic visualization of the cervical spine in some patients. For example, in cervical disk operations, the intervertebral disk level should always be determined after dissection and reaching down to the spinal column. The level determination process is generally based on fluoroscopic examination, but can also be achieved with lateral cervical radiography after marking of the level with a metallic needle inserted into the intervertebral disk space. The procedure is sometimes difficult because of individual anatomical characteristics such as short neck. The shadows of the shoulders are sometimes superimposed on the imaging of the cervical vertebral column. Consequently, we sometimes cannot obtain optimum imaging of the cervical column during surgery.

We have designed an intraoperative traction device to prevent such difficulties with shoulder superimposition during fluoroscopic examination. This device is simple and safe to use. We describe the general characteristics of this device and general principles of use during surgery.

Materials and Methods

This device is mainly constructed of plastic and consists of three parts (Fig. 1). The device can be produced in different sizes to fit individual body size. The device consists of two similar shoulder apparatuses and the traction apparatus. The traction apparatus is a flexible strip shape for balanced pulling down of the shoulder apparatuses. The long traction strip is connected with the shoulder apparatuses bilaterally. The two shoulder apparatuses are also connected on the anterior and posterior aspects of the body. The anterior connector is a flexible short strip. The posterior connector is a metallic apparatus allowing separate movement of each part during pulling down using the traction strip. This device can be used in the supine and prone positions. A simple head rest can be used for stabiliza-
tion of the head during traction. If the patient is treated in the prone position, this device may be used with Mayfield head fixation.

The general principles of use of this device are as follows. All parts of the device are kept under the sterile covers during surgery. The traction apparatus is positioned at the foot side in the non-sterile field. During surgery at the stage of fluoroscopic examination, an operator should apply the required amount of traction via the traction band of the device. Traction should be applied equally to each side of the patient. During application of the traction, the fluoroscopy machine should be activated for a short time, then the application of traction should be stopped. Figure 2 shows pretraction and posttraction fluoroscopic images of the patient. The traction balance between the right and left sides is the key point. Coordination of traction and activation of the fluoroscopy machine is also important. The maximum traction period and the pushing of the fluoroscopic x-ray button are very important issues. These two actions must be done in the same period of time. The same operator can perform traction and machine activation during surgery. In our department, the technician controls the fluoroscopy machine and the resident performs traction. The resident says “shoot” during traction to tell the technician to activate the fluoroscopy machine.

**Results**

The shoulder traction device was used in 10 patients who underwent anterior surgery for cervical disk herniation in 8 cases and cervical trauma in 2 cases. Eight patients were male and two were female with mean age 52.8 ± 9.2 years. Conventional biplanar C-arm fluoroscopic images showed the C5 level in 5 patients and the C6 level in 5 patients before using the traction device. The mean number of observed vertebrae was 5.5 ± 0.52 before using the traction device and 6.9 ± 0.31 after using the traction device. The mean increase in the number of visualized vertebrae was 1.4 ± 0.51.

**Discussion**

Conventional biplanar fluoroscopic imaging of the cervical spine is very important during spinal surgical procedures. Fluoroscopic imaging is often used during the anterior approaches of the cervical spine, and provides a safe and reliable method for the determination of intervertebral disk level and the corpus of the vertebra. There is common consensus for the necessity of fluoroscopy in spinal surgery. Conventional biplanar fluoroscopy may be helpful in the determination of disk level during surgery. The fluoroscopic examination of the patients during surgery is not totally risk-free in terms of producing radiation. Therefore, the imaging time should be as short as possible. Unnecessary and repetitive use of fluoroscopy should be avoided. Use of the cervical traction device may decrease the need for repeated conventional fluoroscopy because of the higher success rate in visualization of the cervical spine. Operating room staff will also avoid radiation exposure.

Conventional cervical fluoroscopy can visualize the C1-T1 vertebrae under optimum conditions. However, this may not always be possible. The main reason is the higher shoulder superimposed on the lower cervical spine. In these patients, withdrawal of the arms downwards, and simultaneous imaging is a practical method. However, the results obtained by this method may not always be adequate. In addition, during surgery, the patient's arms are covered with sterile cotton and this may adversely affect the use of this method. Intraoperative arm traction may be difficult because of an intravenous catheter in-
serted in the patient’s arm, placement of the patient’s arm on the arm holder by the anesthesiologist, presence of a device around the arm to measure blood pressure, and additional sterile drapes.

Adequate and balanced traction of the arms to the opposite direction of the head may reveal the optimum fluoroscopic image during the operation. Our new traction device covers the shoulders of the patients. The device has two strips connected with the shoulder apparatus to provide traction to the shoulders of the patients, thus allowing the operator to move the shoulders in the opposite direction to the head. The device is easy to use during surgery because of the covering of the shoulders and the long distance from the operation site. We found that this traction device could easily demonstrate the lower cervical region. Fluoroscopic images obtained with the new traction device were definitely superior compared with images obtained without the traction device.

**Conflicts of Interest Disclosure**

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices in the article.

**References**


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