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Ideas and technical innovation: a guide for the aligned perforation of vertebral pedicles

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Abstract This report presents a guide for aligned perforation of vertebral pedicles. In multi-segment fixation of the spine there are technical problems with the placement of aligned pedicular screws when using rods of a wider diameter. To overcome this problem, a device has been developed to aid the placement of aligned pedicular implants along the longitudinal axis of the spine. The device consists of a track along which flat metal tabs containing orifices slide in both directions. The proximal and distal pedicles are first perforated by the standard technique and Kirschner or Steinman wires are passed through the tabs, fixing the

device. The next step is the placement of the tabs in an appropriate position for the perforation of the remaining pedicles. These perforations can be made with drills or probes, according to the preference of the surgeon. After perforation, the Kirschner or Steinman wire is introduced in order to help fixate the device. This procedure is repeated until all pedicles have been perforated. The final steps involve the removal of the wires and of the device, and placement of the pedicular screws.

Keywords Vertebral pedicle · Spine fixation

Introduction

Vertebral spine fixation systems using the pedicle to anchor the implant have biomechanical advantages, as shown in various studies [3, 4]. This modality of vertebral instrumentation has been increasingly accepted in spinal surgery, with the consequent increase in indications for the use of pedicular screws in the surgical treatment of a large number of pathological conditions [1, 2].

The alignment of the screws is an important technical detail in situations where the screws are placed in more than two vertebrae, since screws poorly aligned in the longitudinal direction can lead to technical difficulties in the fixation of the rods of the system to the screws, with this problem increasing as the instrumentation area is expanded. Some alternative techniques have been proposed to overcome this problem, such as the development of polyaxial

screws, and connections between the rod and screw by means of adjustable bars [4].

In order to overcome the problems resulting from the placement of the pedicular screws, we developed a guide to help align the screws and to facilitate the application of spine fixation systems. This paper presents the guide developed for the aligned perforation of vertebral pedicles.

Surgical technique

The device consists of two flexible steel wires measuring 2 mm in diameter, to which sliding plates are fixed that contain orifices which permit the passage of perforation drills, or probes, used to make the orifices inside the pedicle (Fig. 1).

The guides can be produced in different sizes and modeled according to the sagittal plane profile of the vertebral

Fig. 1 Photograph illustrating the guide, which consists of tracks and tabs with central perforation (a). The guide can be modeled according to the sagittal contour of the vertebral segment (b). Initially, the proximal and distal pedicles are perforated and the device is fixed with Kirschner or Steinman wires (c). The tabs are positioned, the pedicles are perforated and the Kirschner wires are placed inside the pedicles through orifices in the tabs (d)

Fig. 2 Intra-operative photograph showing fixation of the guide, positioning of the tab (a) and perforation through its orifice (b)

segment. After choosing the optimal size of the guide, orifices are made in the proximal and distal vertebral pedicles of the instrumentation area, and the guide is positioned and fixed. After placement and fixation of the guide, the sliding plates are positioned for perforation of the vertebral pedicles, thus permitting the alignment of the screws (Fig. 1).

The proximal and distal vertebral pedicles of the instrumentation area are initially perforated using the surgeon's preferred technique. Kirschner or Steinman wires passing through the orifices of the sliding plates are then introduced inside the vertebral pedicles to fix the guide.

Fig. 3 Preoperative magnetic resonance image (a) of the case shown in Fig. 2. Postoperative radiograph in anterior-posterior view (b) and profile (c). Note the proper alignment of the screws (d)

Fig.4 Intra-operative photograph illustrating the guide with Steinman wires inside the tabs and vertebral pedicle (a), placement of the screws and rods (b), and the final aspect of the assembly (c)

Fig.5 Preoperative magnetic resonance image (a) of the case shown in Fig.4. Postoperative radiograph in anterior-posterior view (b) and profile (c)

The sliding plates are then positioned for perforation of the remaining pedicles. After perforation of all vertebral pedicles of the instrumentation area, the Kirschner or Steinman wires are removed and the screws are inserted into the vertebral pedicles (Figs.2, 3, 4, 5).

Comments

Aligned perforation of the vertebral pedicles in multi-segment fixations of the spine is a technical problem for surgeons, which increases when rods of a wider diameter are

employed in the fixation systems. Devices with a lateral connection between the screws and rods have been used to overcome this technical problem in some fixation systems.

The guide described has aided in the placement of aligned pedicular screws used for multisegment vertebral fixations. The development of polyaxial screws, or the experience of the surgeon, may make this device unnecessary. However, where the surgeon is less-experienced, and considering the high cost of polyaxial screws, the developed guide, which is simple and low cost, may be quite useful.

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