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Technical Note. Device to Facilitate MR Imaging of Patients in Skeletal Traction

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MR imaging is increasingly used for the evaluation of patients with acute spinal injury because of its ability to noninvasively demonstrate parenchymal alterations involving the spinal cord as well as alterations involving surrounding osseous, soft-tissue, and ligamentous structures [1–4]. The presence of epidural hematomas, disk herniation, or other epidural structural alterations that may cause narrowing of the cord or effacement of nerve root sleeves can be readily appreciated. Early demonstration of changes in cord contour or MR signal intensity is increasingly important for patient management and for continuing investigative studies. The beneficial effect of early large doses of methylprednisolone in selected patients with acute spinal cord injury has recently been demonstrated [5]. There have also been recurrent indications that early mechanical stabilization and relief of cord compression may contribute to improved quality of long-term survival [6–8].

Initial management of patients with acute spinal injury may require placement of spinal traction for reduction and maintenance of satisfactory alignment. A system that permits safe and efficient MR imaging of patients with acute spinal injury while in traction has been devised and is the subject of this report.

Materials and Methods

The mechanism used to maintain traction in the MR environment consists of an aluminum frame supported at its base by two posts that rest on the floor and by two contoured arms that mount on and bolt to the frame of the patient platform section of the MR scanner (GE 1.5-T, Signa; Milwaukee) (Fig. 1). The top vertical component of the frame fits adjacent to the immovable portion of the top of the patient platform and supports a crossbar to which is welded a nylon pulley mounted on a brass pin. The entire aluminum frame weighs about 1.4 kg. It is attached to the MR platform only when needed and instillation requires less than 30 sec. A series of weights (1–13.6 kg) has been fabricated by casting lead in stainless steel containers. A brass hook is anchored into each weight.

The patient to be imaged arrives in the MR area on a Stryker frame in halo traction consisting of a titanium halo that has been positioned with titanium skull pins. With the assistance of the attending surgeon, the patient is transferred to the mobile patient platform section of the MR scanner, which has been undocked from the magnet. The patient is positioned so that his or her feet enter the magnet first. With the weights removed and the attending surgeon maintaining traction tension by hand, the patient is moved to the magnet, where the aluminum traction mechanism described above is attached to the platform. Mechanical traction is established with a nylon rope that attaches by a brass hook to the halo traction device. The rope passes over the pulley of the traction mechanism and is attached to lead weights of the previously determined amount. A 5-in. round surface coil is then placed at the anatomic region to be imaged and monitoring devices or respiratory support appropriate for the patient are secured. Weights are then temporarily removed, with the surgeon again maintaining traction on the rope as the patient is advanced into the scanner.

Results

Ten patients with acute spinal cord injury had MR imaging with this device while in traction. All patients were imaged immediately after stabilization and reduction of fracture or dislocation in the emergency room. In all cases, image quality was identical to or superior to that obtained in patients imaged in a routine manner. There were no metal imaging artifacts and movement artifacts were minimized in part because of the traction. All patients tolerated traction during the MR procedure without difficulty, and the feet-first positioning within the magnet caused no patient distress or problem with positioning.

Discussion

As MR imaging is increasingly utilized for the clinical and research evaluation of acute spinal injury, a variety of techniques and materials have been developed for imaging patients in MR-compatible cervical braces and orthoses [9]. Because of the frequent necessity for skeletal traction to

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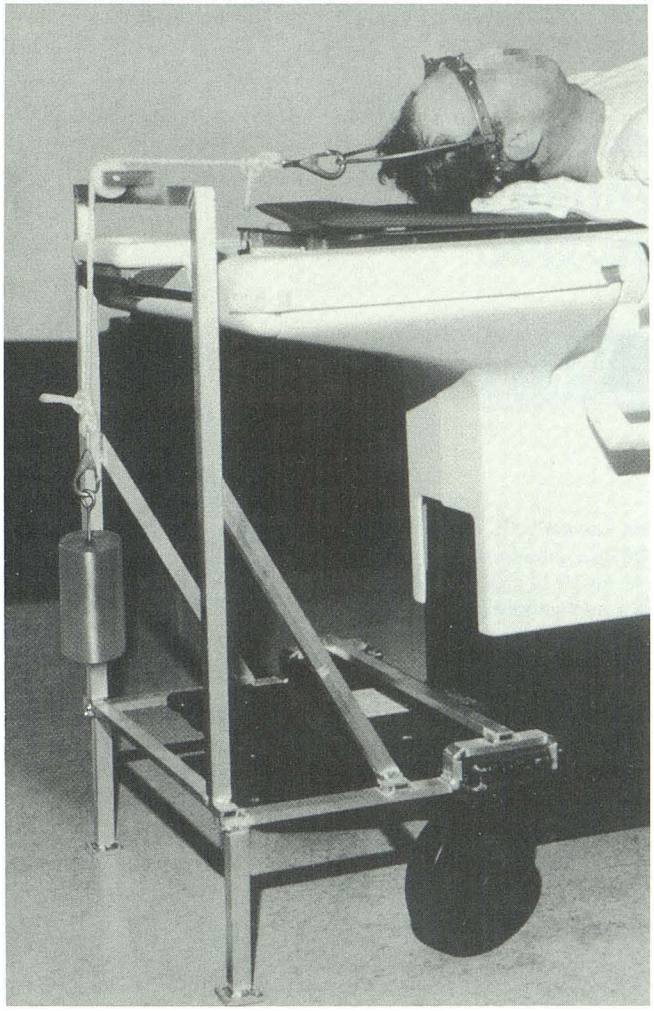

Fig. 1.—Frame is positioned on patient platform section of MR scanner with patient maintained in traction. An additional segment of rope is attached as patient is advanced into scanner.

reduce osseous dislocation, an efficient system must be available for MR imaging of patients in whom traction must be maintained. The light weight and simple design of the traction mechanism described here allows its attachment to the MR imaging platform in less than 30 sec and has prompted its rapid incorporation into our imaging procedure for patients with acute spinal injury. Total time in the magnet is essentially unchanged from that of other patients with suspected cervical myelopathy. The presence of a neurosurgeon is requested at our institution both for the transfer of the patient between the Stryker frame and the mobile MR patient platform, and for reapplication of traction following the patient's transfer. The device has not interfered with image acquisition or quality, and in none of the patients has myelography been necessary prior to initial clinical management decisions or surgical intervention. The availability of monitoring techniques, respiratory support [10], bracing and orthotic devices [9], and techniques for MR imaging of patients while in traction [11] permits the efficient, noninvasive imaging of essentially all patients with acute spinal injury.

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