

## Spinal Instability and the Log-rolling Maneuver

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**Immobilization of the spine is of prime concern during transportation of trauma patients to prevent neurologic compromise. In an attempt to study certain techniques of prehospital thoracolumbar spine immobilization, we radiographically evaluated the motion of the thoracolumbar spine in a volunteer with a stable spine, a cadaver with an unstable thoracolumbar spine, and a patient with a T12-L1 fracture dislocation. Both the backboard and the Scoop stretcher offered adequate stabilization for thoracolumbar spine instability. The logroll maneuver presented the greatest possibility for movement of the spine at the unstable thoracolumbar segment.**

With improvement in extrication techniques and emergency medical procedures, more people with extensive injuries from motor vehicle accidents are reaching the emergency rooms in salvageable condition. Techniques of moving patients with spine fractures are designed to protect neurologic function (2, 3). We studied some of these techniques by looking at the stability offered the spine by a backboard and the Ferno-Washington scoop style stretcher, and the motion of the spine using the log-roll maneuver.

### MATERIALS AND METHODS

In the first study, a healthy young adult female volunteer was log-rolled by experienced trauma personnel of the Emergency Department at the University of Missouri Health Sciences Center. Anteroposterior radiographs were taken of the volunteer in the supine and in the left lateral position (log-rolled 90°).

A fresh cadaver was then obtained and an unstable thoracolumbar segment at L1-2 was produced by sharply dividing all ligaments and facet joints posteriorly, and the annulus and disk anteriorly. The spine was put through ranges of motion and noted to be extremely unstable in all planes of flexion, extension, lateral bending, and shear forces. Having verified the instability we then used standard methods of transportation and immobilization, taking radiographs with each maneuver to determine the movement of the spine.

A fully trained emergency medical team from the Miami Fire and Rescue Department was present and positioned the cadaver as they would normally perform at an accident scene. The four-man emergency team placed the cadaver in the supine position and then log-rolled appropriately to place the cadaver on the spine board. Radiographs were obtained with the cadaver in

the rotated position and then AP and lateral radiographs were obtained with the cadaver on the spine board.

The ability of the Ferno-Washington scoop stretcher to immobilize the unstable thoracolumbar segment was evaluated by having the Fire and Rescue team place the cadaver in the supine position and then transfer the cadaver to the X-ray table using the device appropriately. AP and lateral radiographs were taken.

A 38-year-old male with a recent T12-L1 fracture dislocation was log-rolled in the radiology suite while undergoing angiography for suspected traumatic aortic aneurysm. Appropriate AP and lateral radiographs were taken.

### RESULTS

**Normal Spine.** Figure 1 reveals the marked scoliotic deformity which occurred when the volunteer was rolled from the supine (Fig. 1A) to the lateral position (Fig. 1B).

**Cadaver.** The results of the log-roll maneuver with the cadaver at the apex of the roll revealed an anteroposterior displacement of L1 on L2 of 2.1 cm, lateral displacement of 5 mm, and 30° rotation through the L1-L2 fracture site (Figs. 2A & 2B).

After placing the cadaver on the backboard and securing it appropriately, the anteroposterior displacement was fully corrected with the lateral and rotatory displacement being unchanged from the log-roll maneuver. An angulation of 3° was present at the fracture site (Figs. 3A & 3B).

The results when the cadaver was immobilized on the scoop stretcher revealed a lateral displacement of 7 mm with no rotatory displacement (Fig. 4A). Anteroposterior displacement of 6 mm with 10° angulation was present (Fig. 4B).

**Patient.** The movement occurring when the patient was log-rolled is illustrated in Figure 5. Noted was no change in position of the spine in the anteroposterior plane (Fig. 5A), but a lateral displacement of 7 mm occurred (Fig. 5B).

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FIG. 1A. Normal volunteer in supine position.



FIG. 1B. Note the scoliosis produced when the normal spine is log rolled.

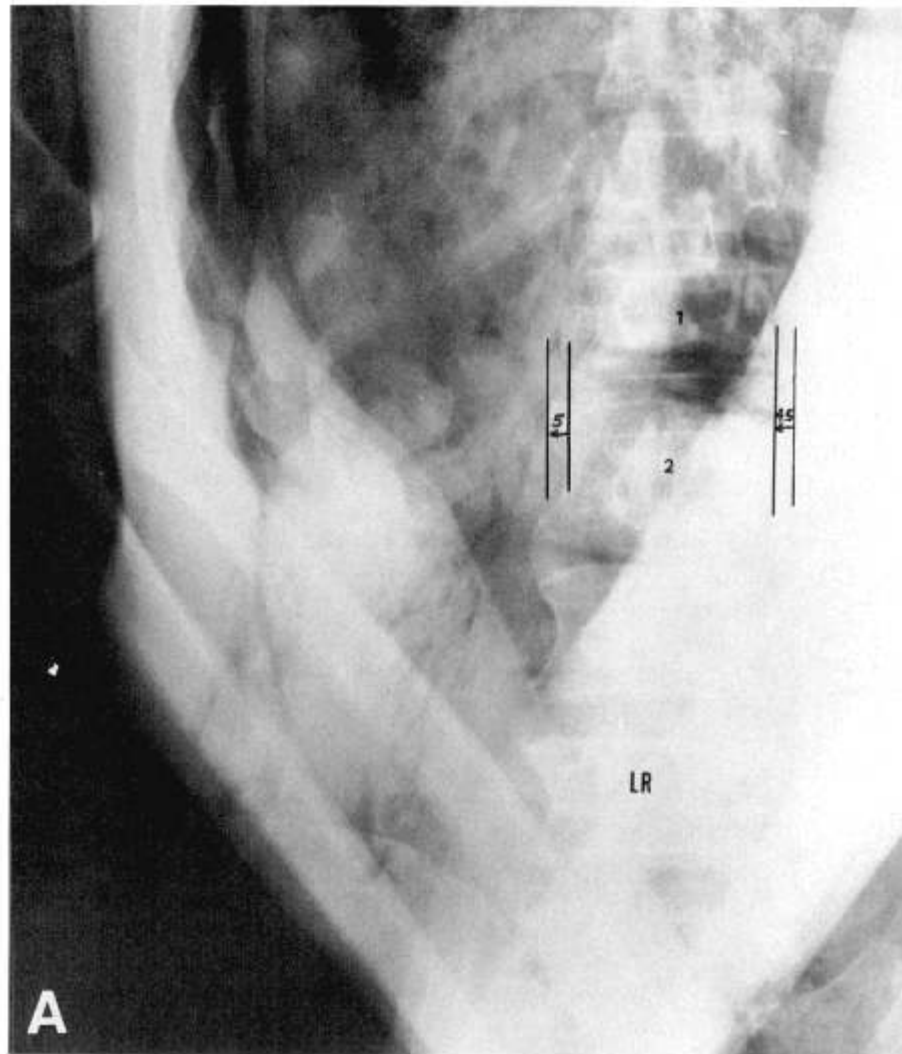


FIG. 2A. AP radiograph taken with the cadaver rolled to approximately 45°, which allows placement on a spine board, reveals a lateral displacement of 5 mm as well as a 30° rotational displacement through the L1-2 unstable thoracolumbar segment. This signifies an important potential for torsional instability at the unstable segment.

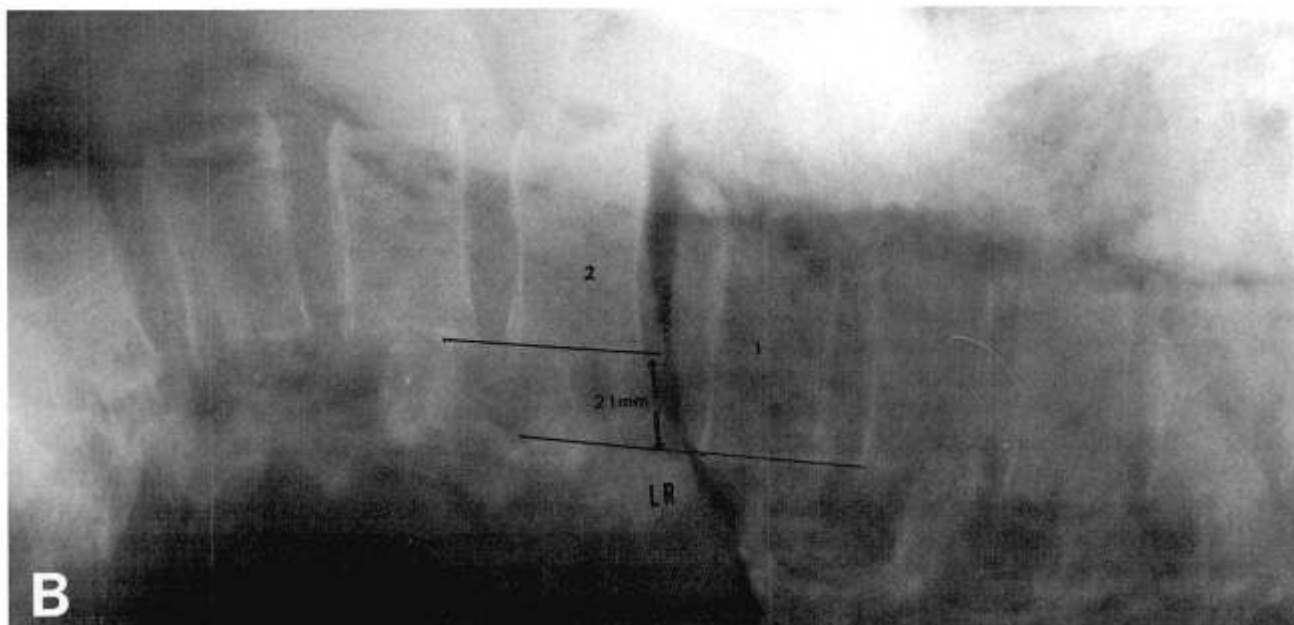


FIG. 2B. Lateral radiograph of the spine taken during the log-roll maneuver reveals an anteroposterior displacement of 21 mm. The spinal canal is completely occluded with this maneuver.

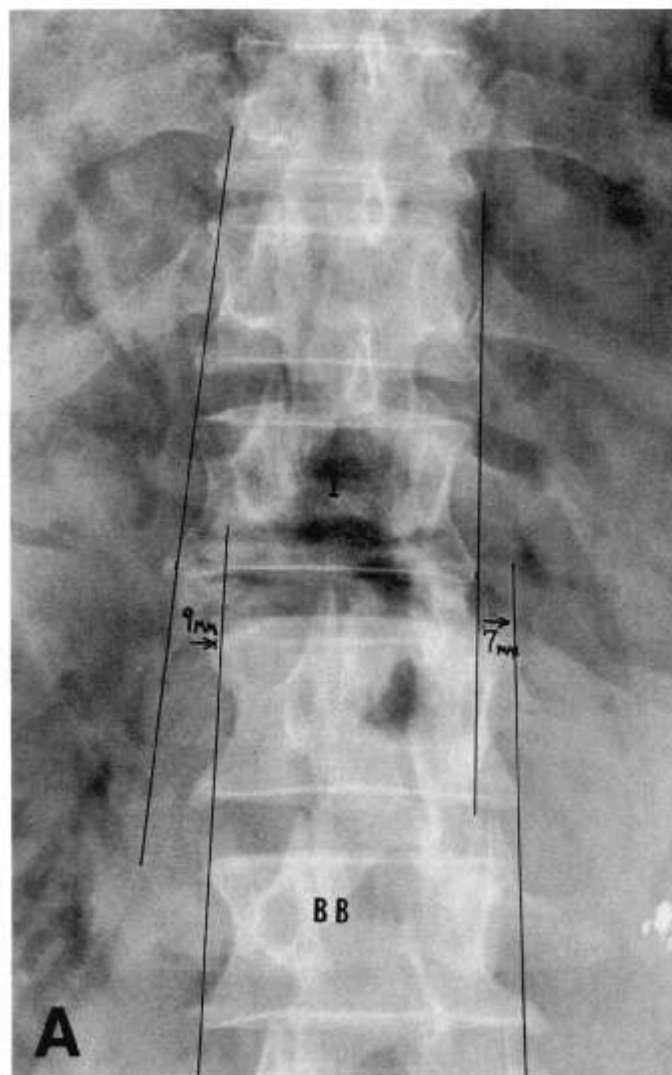


FIG. 3A. AP radiograph of the lumbar spine with the cadaver on the backboard reveals lateral displacement of 7 mm with a 30° rotational displacement at the L1-2 segment.

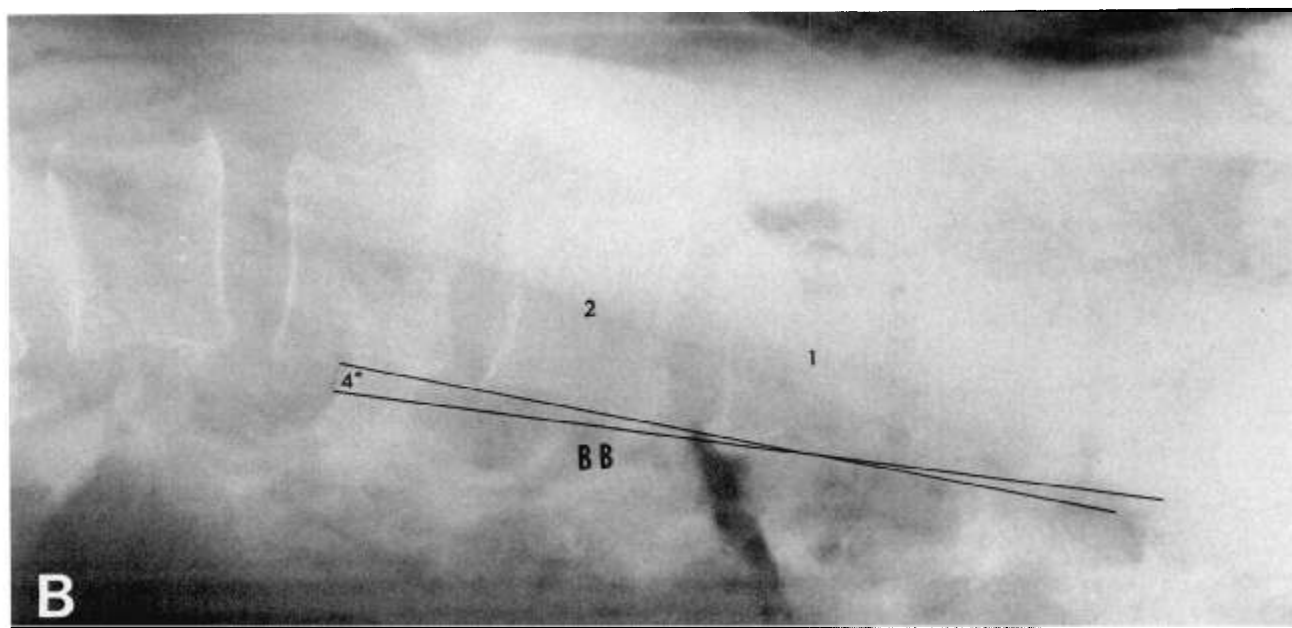


FIG. 3B. Lateral radiograph of the spine on the backboard reveals the spine to have a 4° angulation at the unstable segment with no anteroposterior displacement.

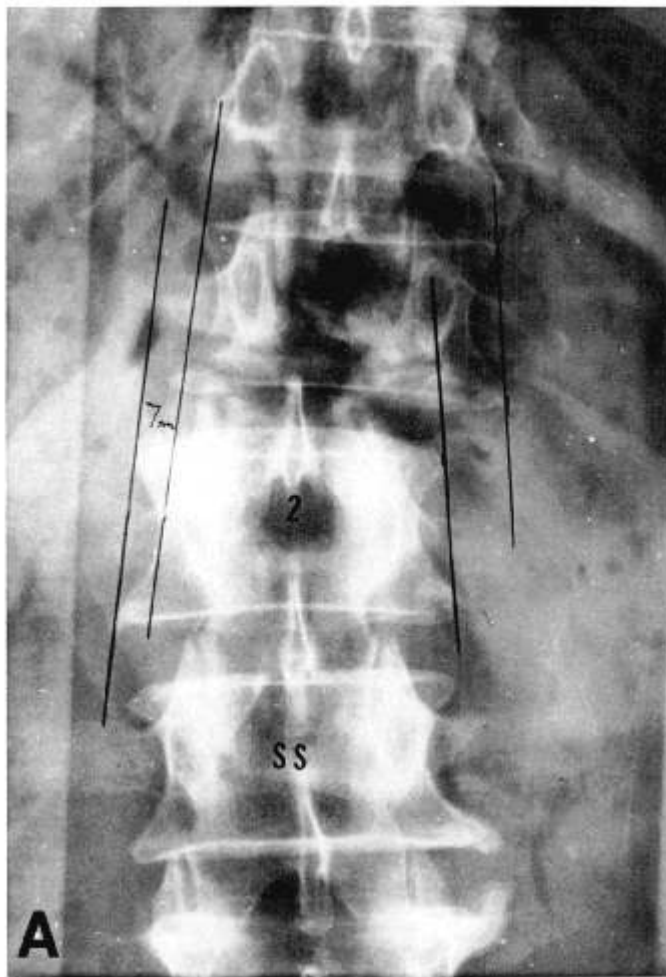


FIG. 4A. AP radiograph of the lumbar spine on the scoop stretcher reveals a 7-mm lateral displacement with no distraction or angular displacement.

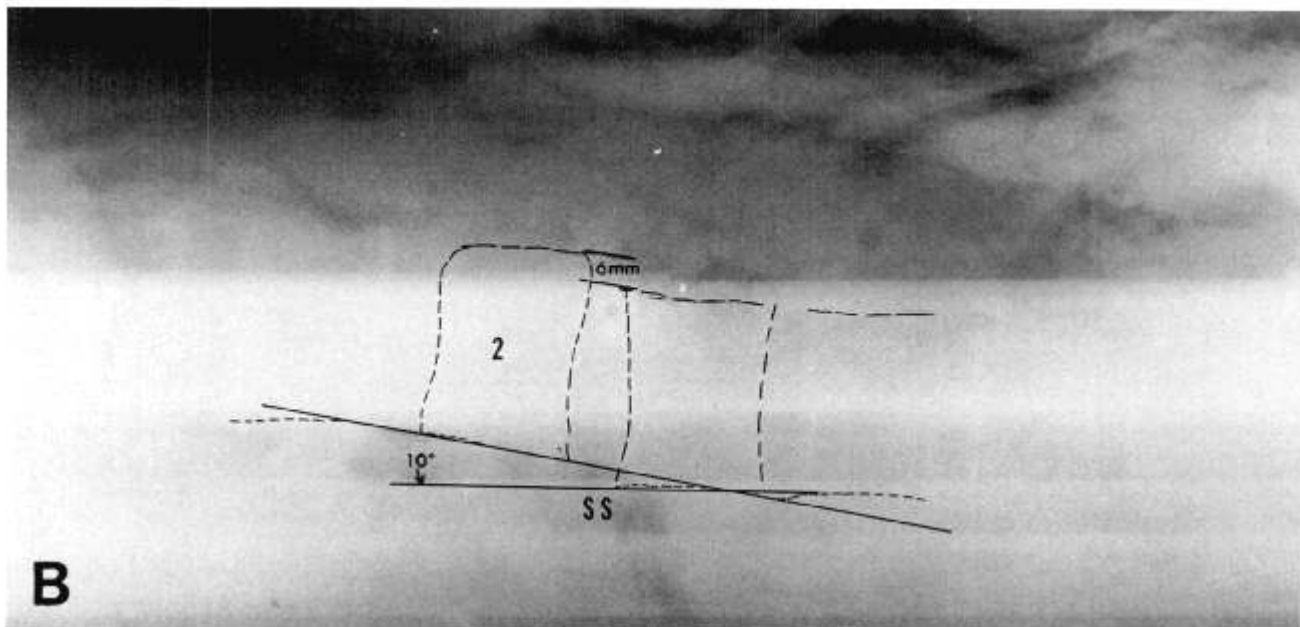


FIG. 4B. Lateral radiograph of the thoracolumbar spine on the scoop stretcher reveals an angular displacement of 10° at the unstable segment with an anteroposterior displacement of 6 mm.

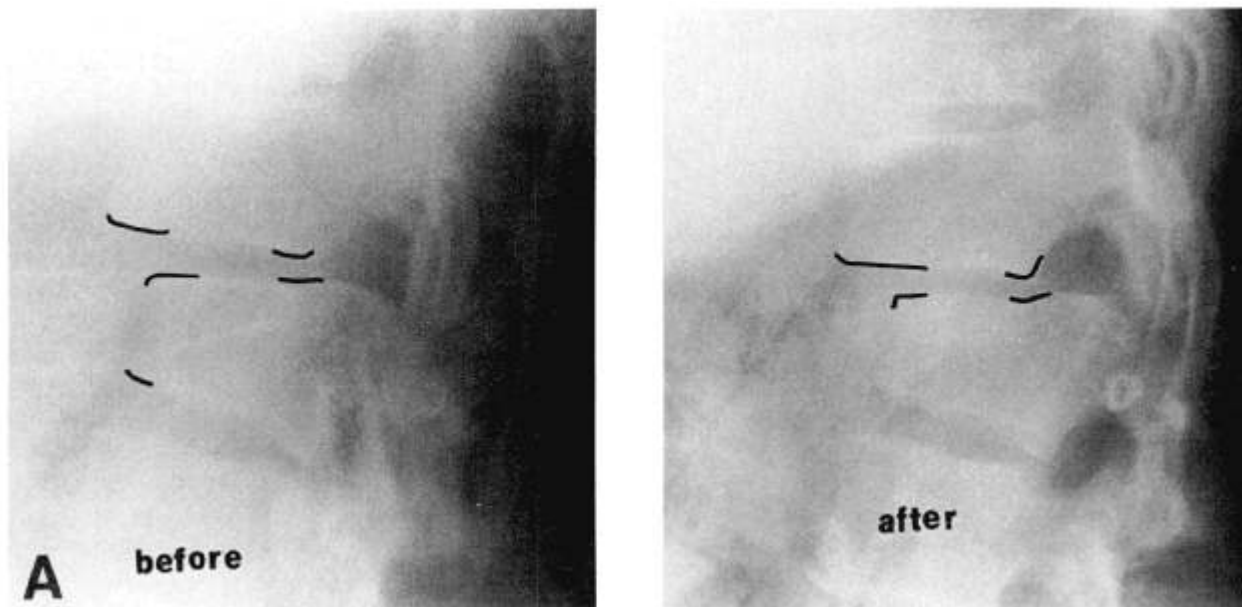


FIG. 5A. Analysis of the radiographs in turning the patient from supine to the lateral position revealed no AP displacement.

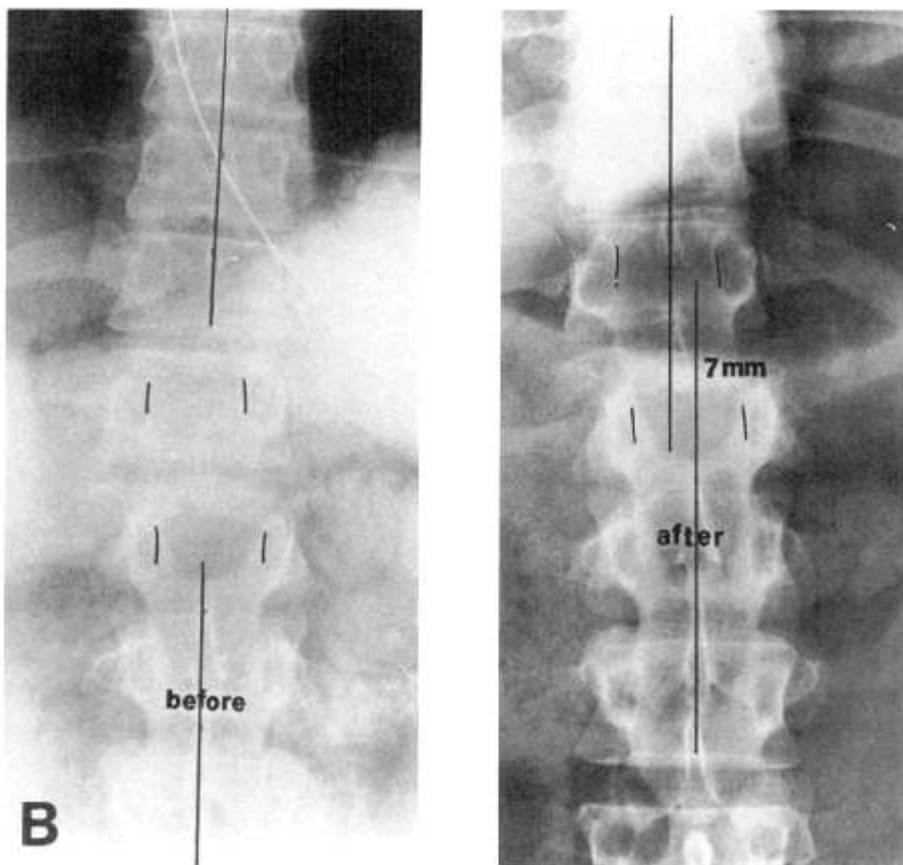


FIG. 5B. Turning from the supine to the lateral position results in a 7-mm lateral displacement at the unstable segment.

**DISCUSSION**

A very important finding from this study was the substantial displacement produced through the unstable segment by the supposedly safe log-roll maneuver. Even when performed by trained personnel, extreme motion was noted to occur which could lead to neurologic com-

promise. This finding could be anticipated by an analysis of the normal volunteer and was also seen in a patient with an unstable spine fracture. It is evident that the spine board and scoop stretcher offer acceptable immobilization of the unstable spine fracture in the supine position. The problem arises with the log-roll maneuver.

With 2.1 cm of anteroposterior displacement noted in our study, patients that are normal may sustain neurologic compromise and patients with neurologic deficit may be further compromised.

Several institutions use the log-rolling method routinely to move their patients with lumbar fractures after arrival at the hospital (1). In view of the findings reported here, one must be aware that the potential for substantial motion at the unstable segment exists and must be protected. We found few reports on which to base guidelines for prehospital care of spine injuries. We offer no

definitive solutions, but want to point out potential problem areas which must be addressed by further research.

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