Clay-shoveler’s Fracture During Indoor Rock Climbing

PAUL E. KALOOSTIAN, MD; JENNIFER E. KIM, BS; PETER A. CALABRESI, MD; ALI BYDON, MD; TIMOTHY WITHAM, MD

abstract

Indoor rock climbing is becoming more popular for people of all ages. Despite the tremendous interest in this competitive sport, participants are made aware of the dangers associated with participating. The authors present the first reported case of a clay-shoveler’s fracture at the T1 spinous process during indoor rock climbing. They describe the management and natural history of this fracture and discuss management strategies for this increasingly popular recreational sport.

A 14-year-old competitive indoor rock climber presented with acute-onset midline thoracic pain at T1 while indoor rock climbing. He reported no recent falls or trauma but stated that the pain came on abruptly while rock climbing. On examination, he was neurologically intact except for significant tenderness to palpation at the T1 spinous process. Magnetic resonance imaging demonstrated a minimally displaced T1 spinous process fracture with evidence of significant surrounding muscular edema, suggesting an acute fracture. He was treated conservatively with anti-inflammatory drugs, complete climbing restriction, and rest. He continued to have focal upper back pain at the level of the fracture over the next 4 months. He was unable to climb for 4 months until his pain resolved after conservative treatment of climbing restriction, pain control, and rest.

This is the first documented case of a clay-shoveler’s fracture sustained in a pediatric patient directly attributable to indoor rock climbing.

The authors are from the Department of Neurological Surgery (PEK, JEK, AB, TW), and the Department of Neurology (PAC), The Johns Hopkins Hospital, Baltimore, Maryland.

The authors have no relevant financial relationships to disclose.

Correspondence should be addressed to: Paul E. Kaloostian, MD, Department of Neurological Surgery, The Johns Hopkins Hospital, Meyer 7-109, 600 N Wolfe St, Baltimore, MD 21287 (paulkaloostian@hotmail.com).

doi: 10.3928/01477447-20130222-31

Figure: Sagittal T2-weighted magnetic resonance imaging showing a T1 avulsion fracture of the spinous process (arrow).
Rock climbing has gained popularity in the adolescent and adult populations as a recreational and competitive sport. Since the 1894 publication of the first climbing guide, this component of mountaineering has transformed into a distinct athletic sport practiced by many around the world. However, the dangers of climbing have been well documented, and tragedies, such as the first ascent of the Matterhorn in 1865, when 4 climbers fell to their deaths after a rope broke, serve to underscore the inherent risks. Since that time, improvements in indoor and outdoor rock climbing have made the sport more popular and safe.

Few studies document the safety of rock climbing, and indoor rock climbing in particular. Reports mostly include extremity injuries, such as finger avulsions, scaphoid fractures, tibial fractures, knee and ankle injuries, and lumbar compression fractures. The extremity injuries are mostly due to the trauma of the climb, whereas the lumbar injuries are seen mostly after a significant fall. No reports of an avulsion fracture of the spinous process, known as a clay-shoveler’s fracture, sustained during a sudden maneuver have been documented in the literature. Neurosurgeons and orthopedic surgeons must be aware of this type of spinal injury, especially in light of the increasing number of participants in this sport.

**Case Report**

A 14-year-old boy presented with acute-onset focal midline upper thoracic pain centered over the T1 spinous process. He was a competitive indoor rock climber and had been bouldering, or climbing without a rope over a crash pad, that day. As described by the patient, he was reaching around an overhanging hold when he noted an acute, severe pain over the region of the T1 spinous process. His symptoms were initially managed conservatively, but the focal pain continued over the next few weeks, prohibiting him from active participation in rock climbing. After 3 to 4 weeks, he presented to an orthopedic surgeon, who could ascertain no abnormality but recommended that plain radiographs be obtained. Those radiographs showed no obvious pathology. After another 3 weeks, a second orthopedic evaluation revealed limited range of motion of the cervical spine and point tenderness at T1, and magnetic resonance imaging showed a nondisplaced T1 spinous process fracture (Figure 1). He was treated conservatively with climbing limitations and rest, and his pain gradually resolved over the next 4 months as the fracture healed.

**Discussion**

Clay-shoveler’s fractures classically occur at the lower cervical or upper thoracic vertebrae. The fracture itself is an indirect consequence of an abrupt hyperflexion, extension, or rotation of the neck. The force of muscle and ligamentous disturbance is transmitted through the supraspinous ligaments and results in an avulsion fracture of the spinous processes. These fractures are stable and are treated conservatively, without the need for surgical intervention. However, if the injury extends into the laminar regions, care must be taken to rule out spinal instability and nerve root or spinal cord damage. Clay-shoveler’s fracture became a clinically recognized occupational injury in the 1930s, named for laborers who incurred whip-like pulls along the supraspinous ligaments while shoveling clay over their shoulders. In more recent years, several case reports have illustrated the same avulsion fractures in the context of motor vehicle collisions and sports injuries. One report described a power lifter who sustained an avulsion fracture of the C7 spinous process after forcibly contracting his upper back muscles to control a heavy weight. Another report described multiple upper thoracic spinous process fractures in an amateur golfer, presumably caused by shear forces from the trapezius and rhomboid muscles. A similar fracture seen in a volleyball player was also attributed to the deceleration forces transmitted along these muscles and the ligamentum nuchae. However, the current report is the first of a clay-shoveler’s fracture seen in a competitive indoor rock climber.

Previous studies have reported significant injuries to the fingers during competitive rock climbing, noted to be due to overuse of the finger joints and tendons. Wyatt et al reported 19 rock climbers (combination of indoor and outdoor) and noted the following injury patterns: 15 from falls to the ground, 1 from a fall hitting a rockface but held by a rope, 2 from a fall while rappelling, and 1 from pulling up without a fall. Specific injuries in that study included 2 distal fibula fractures, 2 calcaneal fractures, 2 scaphoid fractures, 2 lumbar spine compression fractures from falling, 2 talus fractures, 1 tibial fracture, 1 Maisonneuve fracture, 3 ankle injuries, 1 knee injury, 1 low back soft tissue injury, and 1 A2 pulley finger injury. In terms of injury site, the fingers were by far the most vulnerable to overuse and strenuous injuries, followed by shoulder, elbow, other, wrist, and forearm. For fall-related injuries, ankle injuries had the highest incidence rate, followed by hand/wrist, low back soft tissue injury and fracture, lower-limb fracture, and upper-limb fracture.
The abovementioned injuries notwithstanding, rock climbing seems to be a generally safe sport. Improvements in climbing equipment and technique have decreased the risks to the climber; accordingly, injuries are more likely if the safety equipment at indoor climbing walls is in poor condition. Climbing more frequently and at a higher performance level are the main factors associated with predicting injury from climbing. One study of both indoor and outdoor climbers demonstrated that fall-related injuries were relatively rare but occurred among participants of all levels. However, outdoor climbers who attempt an ascent at the upper limit of their abilities fall more often and have an associated higher risk of injury.

Despite the safety of rock climbing, injuries occur. Neurologic or orthopedic surgeons are rarely involved in treating these patients, but as this sport grows in popularity, the surgeon must be aware of the potential spinal injuries that can result from this sport. It has been documented that misdiagnosis and delays in treatment occur due to unfamiliarity with climbing injuries. With this knowledge, surgeons will be able to deliver the most appropriate care in a timely manner. Although this care will most likely be nonoperative, a precise, timely diagnosis and explanation of the natural history and possible protective measures will be critical in educating the patient and preventing future injuries.

REFERENCES