Pitfalls of bungee jumping

Case report and review of the literature

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A case of cervical spine injury related to bungee jumping is presented. Surgical intervention resulted in resolution of the patient’s quadripareisis. The incidence of serious injury connected with this pastime is not inconsiderable, and it is recommended that safer jumping practices be followed. Inspection of bungee equipment and certification of instructors is now voluntary but should be mandated. Jumping heights should be limited and the use of air cushions encouraged.

Key Words • bungee jumping • cervical spine injury

Homo sapiens may be the only species in the animal kingdom that actively seeks out danger to produce an endocrine response, widely known as an adrenalin high. The survival value of this behavior is difficult to assess because the practice must frequently remove from the genetic pool those gene combinations that promoted daring and resourcefulness, thereby leaving the more timid members of the species to procreate more freely. Perhaps this danger-seeking behavior is merely an addiction to a physiological status that was part of quotidian life in prehistoric times.

In their quest for ever more spectacular means of achieving this flood of catecholamines to the brain, athletes have adopted the bungee jumping practiced by the natives of Pentecost Island in the New Hebrides of the South Pacific. These people were allegedly the first to hurl themselves off high wooden platforms with liana vines tied to their ankles. Under these conditions the shock of deceleration is great and serious injuries commonly occur. The sport soon spread through Western Europe and North America after the members of the Oxford Dangerous Sports Club in England tied themselves to strong elastic bands and jumped off the 75-m Clifton Bridge in Bristol on April Fools’ Day, 1979.1

Case Report

History and Examination. This 23-year-old man reported gradual onset of limb weakness and numbness over a 2-week period following a routine bungee jump in which the cord had been attached to an ankle strap. Equipment failure had not occurred and direct contact with the ground or platform was avoided. His symptoms remained stable for 2 months, at which point subacute deterioration occurred. Because spasticity in the form of clonus became noticeable to the patient and his weakness and paresthesia were more pronounced, he sought medical attention.

The patient’s medical and drug history were unremarkable. Systematic interrogation disclosed complaints of limb paresis, with the right side more affected than the left. A sensory level in the upper chest was described, but bowel and bladder function was thought to be normal. Neck pain was only moderate and radicular symptoms...
were absent. Physical examination confirmed the presence of an asymmetric quadriparesis, with strength varying from Grade 4 to 4+ on the Medical Research Council scale. Reflexes could not be elicited in the upper extremities, whereas sustained clonus was evident at the knees and ankles. A sensory level was detected at C-6 to all modalities of sensation. Magnetic resonance (MR) imaging revealed severe midline disc herniations at C5–7, with attendant posterior longitudinal ligament disruption (Fig. 1). Axial MR images demonstrated marked spinal cord compression (Fig. 2).

Operation and Postoperative Course. Surgical intervention was recommended, and a three-level discectomy (Smith–Robinson procedure) and autologous fusion were performed. The procedure was well tolerated, with the patient reporting symptomatic improvement within hours of his surgery.

Discussion

We can estimate some of the velocities and forces involved in bungee jumping by using simple physical principles, but the lack of exact data on the elastic properties of the bungee cords in use precludes the estimation of the all-important deceleration forces. For example, according to newtonian principles, the kinetic energy (0.5 mV^2) of a 70-kg human accelerating at approximately 9.8 m/second would, depending on variable drag forces, result in a velocity of approximately 30 m/second after a 5-second fall. Abrupt deceleration would subject the individual to a force of 32 kJ, which is almost 16 times greater than the force applied to the cervical vertebrae by the hangman’s noose. The potential for serious injury is therefore great. Fortunately for the bungee jumper, however, the elastic cords attaching the individual to the launch point start to elongate and progressively absorb the energy of the fall as the jumper reaches the end of the tether, so to speak. Eventually the cords begin to recoil and pluck the jumper back into the air. These forces have not been calculated but from observation they must be considerable.

Statistics on injuries are difficult to obtain but enthusiasts maintain that they are rare.1 However, at least seven fatalities had been reported in the United States by 1994. Injuries sustained ranged from quadriplegia and concussion to femur fracture and peroneal palsy.5-7 Not surprisingly, the rapid deceleration experienced by jumpers has resulted in a significant number of ocular hemorrhages.2 The causes of injury can be broadly classified into technician error and equipment failure. Hot air balloons, which are popular launch points, have been known to undergo undetected losses of altitude, reducing the jump height to less than the cord length. Balloon baskets carrying jumpers have tumbled to the ground; some jumpers have rebounded into platforms; others have had their necks lassoed by the recoiling cord. Perilous falls have also resulted from broken straps and harnesses. Perhaps the ultimate technical error occurred when a fairground worker took a lethal leap after neglecting to attach his rope to anything.3

There are no uniform state regulations governing bungee jumping, although it was temporarily banned in Florida and Massachusetts.7 In particular, state and local governments do not require inspection of bungee equipment or certification of instructors. As neurosurgeons, we

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**FIG. 1.** Sagittal MR image revealing a three-level disc herniation in a 23-year-old man who suffered injuries from bungee jumping.

**FIG. 2.** Axial MR image demonstrating large disc herniation and severe, crescentic cord compression from a bungee jumping injury.
should play an active role in promoting safer jumping practices, perhaps through the forum of ThinkFirst. Suggestions for regulations include limitations on jumping heights and compulsory use of air cushions, as well as multiple jumping cords.7 A greater proportion of injuries have occurred in jumpers who used ankle straps, and their use should be discouraged in favor of body harnessing. Clearly, it is an impossible task to eliminate completely the danger inherent in diving from a height. Levels of β-endorphins measured in novice jumpers in fact indicate that this unavoidable and indeed desired risk is the chemical currency of their euphoria.⁵

References

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