# Life-Threatening Massive Subarachnoid Hemorrhage after Taekwondo-Associated Head Trauma

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Taekwondo is a Korean martial art that has gained worldwide popularity since the early 1980s, earning Olympic sport status when it was included in the 2000 Sydney Olympic Games.

There is an inherent risk of injury for practitioners of taekwondo, as with any contact sport. In a recent meta-analysis of injuries among taekwondo participants in 15 tournaments, Lystad et al. [1] reported an overall mean injury rate of 79.3 per 1000, or 8%. Head trauma is one of the most common injuries in both males and females receiving a blow during taekwondo matches [1]. However, most head injures and cerebral concussions are mild; serious head injuries are considered rare events under modern taekwondo rules [1,2]. The frequency of head injuries has declined since introduction of a rule requiring participants to wear protective helmets during fights [2].

Traumatic subarachnoid hemorrhage causing coma has never been reported in association with the modern practice of taekwondo. We present a case of traumatic injury to the vertebral artery causing life-threatening intracranial hemorrhage that occurred during a taekwondo match, and we stress the need to improve helmet protection features.

## PATIENT DESCRIPTION

A 23 year old man was urgently transferred to the Hadassah-Hebrew University Medical Center Emergency Department after suffering a severe head trauma during a taekwondo championship match. This previously healthy young man was kicked by the heel of the attacker with an axe-type offensive kick to his unprotected nuchal region. He collapsed instantly, developing acute respiratory arrest [Figure A]. He was intubated by paramedics who were present at the scene. They reported that his pupils were fully dilated and non-responsive to light, and no motor response to pain was evident (Glasgow Coma Score 3). Upon arrival at the emergency room, only distal motor response in the right leg was evident. Head computed tomography revealed massive subarachnoid and intraventricular hemorrhage focused on the posterior fossa cisterns and fourth ventricle, as well as signs of acute hydrocephalus [Figure B]. An urgent frontal ventriculostomy was placed. Elevated intracranial pressure was controlled by cerebrospinal fluid drainage and deep sedation. The patient was taken to the interventional neuroradiology suite for a cerebral angiogram to identify the source of hemorrhage. The diagnostic phase of the study confirmed a focal arterial dissection of the left vertebral-PICA junction [Figure C]. After evaluating the adequacy of collateral blood supply through contralateral vertebral artery, we proceeded with the endovascular occlusion of the left vertebral artery at the level of the PICA. Endovascular reconstruction of the PICA, which requires anti-aggregation therapy, was not feasible in this patient because we could not rule out the need for additional neurosurgical procedures.

Following the endovascular procedure the patient slowly regained consciousness. Cerebrospinal fluid drainage was required for an additional 2 weeks. The ventriculo-

**[A]** Picture taken at the precise moment of impact. Note the heel of the left leg of the attacker impacting the unprotected left posterior cervical region.

**[B]** Non-contrast head computed tomograph shows massive subarachnoid hemorrhage (arrow).

**[C]** Selective angiogram of the left vertebral artery shows the focal injury of the vertebral artery-PICA junction (arrow)

stomy was later removed and intracranial pressure remained clinically stable. A month after treatment the patient was discharged to a rehabilitation facility with only mild dizziness and gait ataxia.

## COMMENT

Sports injuries are one of the most common forms of injury in western society, with martial arts often cited on the list of high risk sports [1,2]. Treatment of sports injuries is medically complex, time consuming and expensive. Therefore, the implementation and evaluation of new injury preventive measures and strategies is of immense medical and financial importance.

In a recent meta-analysis of eight studies including 1405 injuries among 10,947 participants in 15 tournaments, Lystad and colleagues [1] reported an overall mean injury rate of 79.3 per 1000, and an incidence rate of 24.0 head and neck injuries per 1000 athletes exposed. Most head injuries are mild, the most common being contusion. However, up to 26% of all taekwondo injuries were considered "serious" in one study [3].

To protect themselves and others from head injuries, taekwondo participants must follow rules affecting offensive and defensive moves, and wear protective garments [1,2]. Based on videotape analysis of taekwondo championship matches, experts recommended that athletes, coaches and referees participate in safety education programs that provide a better understanding of head trauma, and that rules should be tightened and enforced to reduce traumatic injuries [1]. Such measures have reduced injuries in places where regulations are enforced.

Blunt trauma causing direct injury to intracranial arteries and leading to life-threatening subarachnoid hemorrhage is rare. However, this case illustrates the elevated risk of injury that is inherent to the practice of the martial arts. Based on our experience, we recommend that officials consider mandating participants to wear helmets that protect the entire head, including the occipito-cervical region, and that rules governing participant moves be reviewed.

Options for the management of vertebral-PICA injuries include endovascular or surgical vertebral artery sacrifice, as well as endovascular reconstruction of the vertebral artery, by means of stents, diverters, or the combination of stents and coils. Reconstruction is the preferred endovascular alternative when feasible [4]. Stenting is technically demanding but can preserve the parent vessel; however, it requires immediate administration of double-dose antiplatelet therapy. Stenting was not appropriate here, since combined antithrombotic therapy is not feasible in a patient requiring neurosurgical intervention for cerebrospinal fluid diversion [5]. In this case, once adequate collateral circulation was demonstrated, endovascular occlusion of the injured vertebral artery-PICA junction was considered the most appropriate treatment.

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## Capsule

### New vaginal gel effective against HIV infection

After 15 years of failed attempts to develop an effective anti-human immunodeficiency virus (HIV) vaginal gel, a clinical trial has shown that one containing an antiretroviral drug can cut HIV infection in women by more than 50% if used consistently. Abdool Karim and her colleagues at the Centre for the AIDS Program of Research in South Africa, in Durban tested the 1% vaginal gel formulation of the drug tenofovir. The 2.5 year study involved 889 South African women aged between 18 and 40 years who were HIV negative, sexually active and at high risk of HIV infection. Compared with women who used a placebo, the tenofovir gel reduced HIV infection in the group by 39% overall, and by 54% in women who used the gel most consistently before and after sexual intercourse

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