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occur within 1 to 12 hours of exposure, while edema of the tracheobronchial tree occurs between 4 and 12 hours. High concentrations induce pseudomembranous changes in the airways, and may result in airway necrosis. The clinical course is frequently complicated by secondary bacterial pneumonias. Our patient’s initial ophthalmic and ongoing pulmonary symptoms are consistent with exposure to a vesicant such as mustard gas.

The majority of medical reports regarding exposure to mustard gas describe the respiratory symptoms of soldiers involved in various military conflicts, including World War I and the Iran-Iraq war. None of these reports, however, has described bronchiolitis obliterans resulting from exposure to mustard gas or among civilian populations specifically targeted by chemical warfare. We suggest that bronchiolitis obliterans should be considered in patients with respiratory symptoms who have a history of possible exposure to mustard gas.

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Sudden Death Due to Neck Blows Among Amateur Hockey Players

To the Editor: While most cases of sudden death among athletes have been linked to a diverse group of cardiovascular diseases,1 we have also reported sports-related sudden deaths triggered by innocent-appearing blows to the chest.2 Here we expand the clinical profile of sudden death among athletes to include blunt blows to the neck during competitive ice hockey.

Methods. We assessed our prospective autopsy-based national registry of sudden cardiovascular deaths in young athletes, 1992 to 2002, composed of cases initially identified from a variety of sources including news media reports (and then subsequently tracked).

Results. Of the 370 trained athletes who died suddenly of defined cardiovascular-related causes,1 6 cases were selected...
for the present study group. Ages were 9 to 30 years (median, 17); all were male.

During competitive ice hockey, blunt and nonpenetrating blows were delivered to the exposed right (n=4) or left lateral or posterolateral neck area (n=2), just under the mandible between the helmet and neck guard. Fatal blows were inflicted by the puck in 5 (a slap-shot in 4 and a deflected shot in one); 4 events occurred during play on the ice while one individual was sitting on the team bench. The other athlete was struck by a fist during an altercation. Each collapsed immediately and resuscitative efforts were unsuccessful.

At autopsy, death was attributed to dissection and rupture of the vertebral (n=4) or internal carotid (n=1) artery (precise location was unresolved in 1), leading to massive sub-
arachnoid hemorrhage with rapid accumulation of blood within basilar cistern, Sylvian fissures and ventricles, and brainstem herniation (FIGURE). In no individual was a cerebral aneurysm identified.

Comment. The scenario of virtually instantaneous death during ice hockey competition in which high-velocity blows to the neck (inflicted by pucks or fist) caused rupture of a major artery has been unappreciated. The precise mechanism by which death occurred is uncertain. Although it is possible that a blow to the neck may directly cause arterial rupture, it is also possible that it can result from reflex hyperextension and rotation of the head (triggered by an unexpected blow). The vertebral artery courses through the foramina transversarium, firmly fixed anatomically at 3 points, and vulnerable to dissection in these areas. Rapid head motion could cause arterial rupture at the rigid anchor points, instantaneously producing massive hemorrhage into the subarachnoid space, increased intracranial pressure, brainstem herniation, and termination of cardiorespiratory function (Figure). Indeed, nonfatal vertebral artery dissections have been reported with hyperextension of the neck in other sports, including football, wrestling, gymnastics, and boxing.3-5

Our novel cases, in which blows to the neck by hockey pucks produced subarachnoid hemorrhage, underscore the broad spectrum of causes and mechanisms that may be responsible for sudden death on the athletic field. Awareness of such risks to young athletes is crucial for developing an informed public and formulating protective measures to enhance the safety of sports activities.

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