
Expert Opinions

Sports and Headaches

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In the United States, up to 3.8 million people per year have sports-related mild traumatic brain injury frequently followed by a variety of headaches. Headaches associated with sports (exertional, weightlifter's, and external compression headache) are also reviewed.

Key words: sports headache, posttraumatic headache, footballer's migraine, exertional headache, cough headache, weightlifter's headache

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There are a variety of headaches associated with sports. Beruto y Lentijo and Ramos made the first reference to an occipital neuralgic syndrome in 1821.¹ In the first major treatise on migraine in 1873, Liveing observed that headaches could be triggered by lifting heavy weights or "violent exercise, as running."²

The first football concussion crisis occurred over 100 years ago when a significant number of concussions and deaths resulted in recommendations to outlaw the game or at least make it safer.³ After he was kicked and hit in the head in the Army-Navy game of 1893 and a Navy doctor told him this could result in instant insanity or death, Reeves (later to be an admiral and "the father of carrier aviation") invented the first football helmet (a moleskin hat with earflaps).⁴

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Nichols and Smith, surgeons who were in charge of the Harvard football squad, performed the first epidemiological study of concussion in football during the 1905 season.⁵ "Cases of concussion were frequent, both during practice and games. In fact, but two games were played during the entire season in which a concussion of the brain did not occur. . . . Players who had concussion were at once carefully examined to exclude the possibility of middle meningeal hemorrhage. . . .the injured men were in every case compelled to go to the infirmary, where they remained over night. . . . Concussion was treated by the players as a trivial injury and rather regarded as a joke. The real seriousness of the injury is not certain. Our own experience with the after-effects of the cases if not sufficient for us to draw any definite conclusions, but from conversation with various neurologists, we have obtained very various opinions in regard to the possibility of serious after-effects." What have we learned about sports and concussion and headaches in the last century?

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CASE HISTORIES

Case 1.—This is a 16-year-old female who was the goalie in a soccer game when another player ran into her and she fell backward hitting the back of her head and she was dazed. She had fairly constant headaches since, described as a generalized pressure and throbbing with an intensity of 5-9/10 associated with nausea, light and noise sensitivity at times but no vomiting or aura. Stress, lack of sleep, and light made the pain worse. No prior history of headaches. Neurological exam was normal. There was bilateral greater occipital nerve tenderness. CT of the brain previously obtained in the emergency room was normal. Bilateral greater occipital nerve blocks were performed with 3 mL each of 1% lidocaine and she was placed on topiramate titrated up to 50 mg bid (mother declined amitriptyline) and baclofen prn.

The headaches resolved for 2 weeks following the blocks but then returned lasting about 8 hours per day. Baclofen did not help. Four weeks after the first visit, she was started on tizanidine and occipital blocks were performed again. When next seen 3 months later, the headaches had resolved for 1 month after the blocks, occurred for 1 day the next month, and then were daily for the next 4 weeks, lasting much of the day. Occipital blocks were performed. Topiramate was increased to 125 mg daily, which she stopped 3 months later. She had no headaches for the next 4 months and then mild headaches once a week the next 3 months relieved with ibuprofen.⁶

Case 2.—This is a 17-year-old male with a 2-year history of headaches occurring when weightlifting, hard coughing, or sneezing described as a severe generalized pounding lasting about 10-15 seconds followed by an aching for about an hour without associated symptoms. Magnetic resonance imaging (MRI) of the brain and cervical spine showed 10 mm of tonsillar ectopia with peg-like tonsils and diminished cerebrospinal fluid space in the region of the foramen magnum. The headaches resolved after posterior fossa decompression.

Questions.—What is the epidemiology of headaches after sports concussion? What types of posttraumatic headaches occur? What other nontraumatic

headaches are associated with sports? What is the prognosis and treatment?

EXPERT OPINION

Epidemiology of Sports Concussion and Headaches.—In the United States, 1.6 to 3.8 million persons per year sustain sports-related mild traumatic brain injury with many not obtaining immediate medical attention.⁷ The incidence of concussion among high school and college football players per 1000 games was 1.55 and 3.02, respectively.⁸ Females have more concussions in high school and college basketball and soccer (highest rates) compared to males. The rates per 1000 games for soccer are as follows: high school, males 0.59, females 0.97; college, males 1.38, females 1.80. Headache is reported in as many as 95% of high school and college athletes who sustain a concussion.^{9,10} In a National Football League Study from 2002-2007, there were 0.38 concussions per game.¹¹

In an internet-based prospective study reported during the 2008-2010 academic years of 7,780,064 athlete-exposures in 20 sports, there were 1936 concussions for an overall injury rate of 2.5 per 10,000 athlete-exposures.¹² In all gender comparable sports, girls had higher rates of concussions than boys. Headache was the most common symptom in 94.2%.

In a retrospective study of 400 adolescents (ages 13-18) seen at a regional concussion program with 286 due to sports injuries, females were most likely to report headaches than males (90% vs 79%).¹³ Headaches were reported in 77% of football players with one concussion vs 72% of males with one concussion from all other mechanisms and 89% of football players with two or more concussions vs 86% of males with two or more concussions from all other mechanisms.

According to the National Collegiate Athletic Association Injury Surveillance Program, of the 1670 concussions reported from the 2009-2014 academic years, headache was reported by 92.2%.¹⁴ Headaches were commonly reported by athletes in every sport with the lowest percentage of 75.0% in men's baseball and the highest of 100% in women's field hockey. Headache was reported by 87.8% of

men's football players. A higher percentage of women than men reported headaches within the same sports.

In a National Football League study, headache was reported by 56.1% of those who sustained concussions.⁴

Posttraumatic Headache Types.—There are few studies describing the types of headaches among athletes. In a study of 296 student athletes aged 12-25 years who sustained sport-related concussions, migraines occurred in 52, headache in 176, and no headache in 68.¹⁵ Females were 2.13 times more likely than males to report posttraumatic migraine characteristics. Those with migraine characteristics had prolonged symptom recovery including cognitive, neurobehavioral, and somatic symptoms. Only one patient reported migraine at 90 days. Concussion can exacerbate the frequency of preexisting migraine. In a retrospective study of 834 National Collegiate Athletic Association student athletes, 23.7% reported a history of migraine.¹⁶

In a retrospective study of 400 adolescents (ages 13-18) seen at a regional concussion program with 286 due to sports injuries, females were most likely to report headaches than males (90% vs 79%).¹³ There was no difference in the proportion of football players reporting headaches compared with male players of other sports. Posttraumatic headaches in children and adolescents commonly become chronic.¹⁷

Another study of high school and college athletes found that those with posttraumatic migraines had significantly greater neurocognitive deficits when compared with those who had concussions with nonmigraine headaches and controls.¹⁸

Little is known about the prevalence of migraine among retired National Football League players. A study of 10 with a mean age of 36.7 years found 43% had chronic migraine.¹⁹ Another convenience sample of 50 retired NFL players with a mean age of 45.5 years found a 1-year prevalence of migraine of 92%, 56% with episodic, and 36% with chronic.²⁰ The onset of the migraines was as follows: 4% before playing in the NFL, 48% while playing in the NFL, and 48% after retiring with a mean age of onset of 33.0 years (range of age of

onset of 12-63 years). The reason for the increased prevalence of migraine with late onset after playing is not certain. Possibilities include the following: concussions or subconcussive impacts causing brain injury causing later onset migraine; comorbid depression and anxiety (reported by 78% and 86% of subjects); chronic nonheadache pain (reported by 88%); and medication rebound with use of opioids 8 or more days per month for nonheadache chronic pain (reported by 25%).

According to the International Headache Society criteria, the onset of the headache should be less than 7 days after the injury to be considered posttraumatic.²¹ The less than 7-day onset is arbitrary, particularly because the etiology of posttraumatic migraine is not understood. Three months seems a more reasonable latency for onset than 7 days,^{22,23} although a small percentage of patients with new onset primary headaches will be misdiagnosed as having posttraumatic headaches.

Determining the type of headache is based on the clinical features of the headache, the physical (with attention to the head and neck) and neurological examination, and neuroimaging as indicated. *Migraine.*—Recurring attacks of migraine with or without aura can occur for the first time from mild head injury or preexisting migraine may be exacerbated. The frequency may be episodic (14 or fewer days per month) or chronic (15 or more days per month). It is possible to misdiagnose posttraumatic migraine as nausea (early on and in those with associated dizziness); light and noise sensitivity are common symptoms after concussion as well as migraine.²⁴

Medication Overuse.—There is a risk of developing medication overuse or rebound headaches from the frequent use of symptomatic medications such as opiates 8 or more days per month, over the counter medications 10 or more days per month, triptans more than twice per week, or butalbital combinations 5 or more days per month with the effect more pronounced in females.²⁵ Evidence suggests that NSAID use perhaps with a shorter half-life such as ibuprofen 15 or more days per month may result in medication overuse headaches.

Tension-Type Headache.—These headaches occur in a variety of distributions, including generalized, nuchal-occipital, bifrontal, bitemporal, cap-like, or headband. The headache, which may be constant or intermittent with variable duration, usually is described as pressure, tight, or dull aching. Temporomandibular joint injury can be caused by either direct trauma or jarring associated with the head injury. Patients may complain of temporomandibular joint area pain with chewing and hemicranial or ipsilateral frontotemporal aching or pressure headaches although the pain may be referred anywhere in the trigeminal and cervical complex.²⁶

Occipital Neuralgia.—This term is in some ways a misnomer because the pain is not necessarily from the occipital nerve and usually does not have a neuralgic quality. Greater occipital neuralgia is a common posttraumatic headache²⁷ and also is seen frequently without injury. The aching, pressure, stabbing, or throbbing pain may be in a nuchal-occipital or parietal, temporal, frontal, periorbital, or retroorbital distribution. Occasionally, a true neuralgia may be present with paroxysmal shooting-type pain. The headache may last for minutes, hours, or days and be unilateral or bilateral. Lesser occipital neuralgia similarly can occur with pain generally referred more laterally over the head with reproduction of symptoms by digital pressure over the nerve.

The headache may be the result of an entrapment of the greater occipital nerve in the aponeurosis of the superior trapezius or semispinalis capitis muscle or instead be referred pain without nerve compression from trigger points in these or other suboccipital muscles. Digital pressure over the greater occipital nerve reproduces the headache. Pain referred from the C2-3 facet joint²⁸ or other upper cervical spine pathology and posterior fossa pathology, however, may produce a similar headache.

Cervicogenic.—Posttraumatic headaches may be due to a neck injury sustained at the time of a concussion. Cervicogenic headache means that the pain is referred from neck structures including the lateral atlanto-axial joint, C1-2, and C2-3 facet joints.²⁸ Increased pain with hyperextension of the neck is consistent with this diagnosis. Imaging studies are often not helpful for the diagnosis.

Supraorbital and Infraorbital Neuralgia.—Injury of the supraorbital branch of the first trigeminal division as it passes through the supraorbital foramen just inferior to the medial eyebrow can cause supraorbital neuralgia.²⁹ Similarly, infraorbital neuralgia can result from trauma to the inferior orbit. Shooting, tingling, aching, or burning pain along with decreased or altered sensation and sometimes decreased sweating in the appropriate nerve distribution may be present. The pain can be paroxysmal or fairly constant. A dull aching or throbbing pain also may occur around the area of injury.

Scalp Lacerations and Local Trauma.—Dysesthesias over scalp lacerations occur frequently. In the presence or absence of a laceration, an aching, soreness, tingling, or shooting pain over the site of the original trauma can develop. Symptoms may persist for weeks or months but rarely for more than 1 year.

Footballer's Migraine.—The term "footballer's migraine" was originally used to describe headaches in adolescents or young men who had multiple migraines with aura attacks immediately triggered by minor blows to the head playing soccer, such as heading the ball or minor head trauma sustained with contact with another player.³⁰ Similar attacks can be triggered by minor head injury in any sport.

The most famous example of "footballer's migraine" was witnessed by 800 million viewers and occurred in American football. Late in the first quarter of Super Bowl XXXII on January 25, 1998, Terrell Davis, a 25-year-old running back for the Denver Broncos with a history of migraine with and without aura since age 7, was unintentionally kicked in the helmet by a Green Bay Packers defender. A few minutes later, he went to the sidelines with a migraine visual aura. Coach Shanahan sent him back in for one more play, which was a fake where Elway kept the ball and ran into the end zone. Davis was given his usual migraine medication, dihydroergotamine (DHE) nasal spray, on the sideline by the trainer. He went into the locker room and his severe headache was gone by the start of the third quarter with the benefit of the extra Super Bowl halftime minutes. When he returned for the second half, he had 20 carries for 90 yards, including the winning touchdown, and

won the game's most valuable player award. He had a Super Bowl-record three rushing touchdowns. A lesson: early treatment of your patient's migraine can result in them becoming Super Bowl MVP, being able to participate in sports, go to school, work, or a social outing rather than to bed or the emergency department.

Rare Headache Types.—Rarely, mild traumatic brain injury can cause an acute subdural hematoma or epidural hematoma especially in high-energy collisions occurring in sports such as motorsports (formula racing, rallying), boardsports (skateboarding and snowboarding), and skiing.³¹

Concussions can cause subdural hematomas due to tearing of the parasagittal bridging veins (which drain blood from the surface of the hemisphere into the dural venous sinuses), leading to hematoma formation within the subdural space. Headaches associated with subdural hematomas are nonspecific, ranging from mild to severe and paroxysmal to constant.³² Unilateral headaches usually are the result of ipsilateral subdural hematomas.

Rarely, concussion can also cause bleeding into the epidural space from a direct blow to the head, usually due to tearing of the middle meningeal artery producing a hematoma. The headaches of acute and chronic epidural may be unilateral or bilateral and can be nonspecific.

Rarely, head trauma can cause cluster headaches shortly after the injury and might be a risk factor for the later development of cluster headaches.³³ Trauma can also rarely cause a CSF leak through a dural root sleeve tear or a cribriform plate fracture and result in a low CSF pressure headache with the same features as a post-lumbar puncture headache.^{34,35} Headaches can be the only symptom of posttraumatic carotid and vertebral artery dissections. Cerebral venous thrombosis³⁶ and carotid-cavernous fistulas³⁷ are other rare causes.

Prognosis of Posttraumatic Headaches.—Although there are many studies of prognosis of posttraumatic headaches in civilians, there is little information on prognosis of headaches specifically in athletes. In the regional adolescent concussion program, females had a significantly longer recovery time than males (median, 80 days vs 34 days).¹³ Median time to

recovery was 22 days for football players with one concussion vs 23 days for males with one concussion from all other mechanisms and 36 days for football players with two concussions vs 40 days for males with two or more concussions from all other mechanisms. In a large prospective emergency study of children ages 5-18, many with sports-related concussion, a prior history of migraine is a risk factor for symptoms still present at 28 days.³⁸ Acute and subacute headaches are associated with worse clinical outcomes.³⁹

Although the studies do not report headache specifically, in the study of 1936 concussions of high school students in 20 sports,⁵ symptoms resolution was as follows: 40% (except for girls' swimming and girls' track), in 3 days or less, 22.8% in less than 1 week, and 55.3% in 1-3 weeks. In the NCAA study, the resolution of all symptoms took just a few days to a few weeks for most and symptoms resolved in 3 days or less for 35.7%.⁷ Among National Football League players, 83.5% returned to play in less than 7 days among those with no loss of consciousness and 57.4% of those with loss of consciousness.

Treatment of Posttraumatic Headaches.—There is a dearth of randomized placebo-controlled trials of medications for posttraumatic headaches.^{24,40} Only six studies, all done without controls, have been performed for the prevention of posttraumatic headaches. Three studies in civilians, which involved either monotherapy or combined therapy with propranolol, amitriptyline,^{13,41,42} or valproate,⁴³ showed efficacy, although a small study showed no benefit with amitriptyline.⁴⁴ In a survey of neurologists, 57% agree that "effective treatment is available for headaches lasting 3 months or more."⁴⁵

In a retrospective study of 400 adolescents with concussions (72% due to sports),¹³ 68 were given amitriptyline (median dose 25 mg daily, range, 10-100 mg; median duration 4 months) and 82% had a reduction in their headaches (23% had adverse events). Amitriptyline has been associated with sedation, weight gain, cardiovascular toxicity, and an increased suicide attempt rate in patients with depression.

There are side effects of other migraine preventive of medications worth recalling which may be quite significant in athletes. β -blockers may cause

exercise intolerance. Topiramate may cause cognitive side effects, depression, weight loss, and uncommonly kidney stones.

For collegiate and professional athletes who have returned to play, the physician should be familiar with prohibited substances. Most organizations utilize the World Anti-Doping Agency or similar guidelines which may prohibit the use of anabolic steroids, peptide hormones and growth factors, beta-2 agonists, hormone and metabolic modulators, diuretics and masking agents, stimulants, narcotics, cannabinoids, glucocorticoids, alcohol (in competition), and β -blockers (in certain sports).⁴⁶

There are anecdotal reports of posttraumatic tension and migraine-type headaches treated with the usual symptomatic and preventative medications used for nontraumatic headaches.^{47,48} The physician should be concerned about the potential for medication rebound headaches with the frequent use of over-the-counter medications, such as acetaminophen, aspirin, and combination products containing caffeine, and prescription drugs containing narcotics, butalbital, and benzodiazepines. In one survey, more than 70% of those with headache during the first year after mild traumatic brain injury used acetaminophen or an NSAID, which was usually not effective.⁴⁹ Habituation also is a concern with narcotics, butalbital, and benzodiazepines. Although chronic posttraumatic migraine may respond to onabotulinum toxin A, this treatment is not effective for cervicogenic headaches.⁵⁰ Posttraumatic chronic daily headache may respond to an intravenous DHE regimen.

No strong evidence from clinical trials supports the use of biofeedback, cognitive behavioral therapy, physical therapy and manual therapy, immobilization devices, and ice.⁵¹ A small study suggests benefit from cognitive behavioral training.⁵²

Occipital neuralgia may improve with local anesthetic nerve blocks, which are effective alone or combined with an injectable corticosteroid if patients do not respond adequately to local anesthetics alone (eg, 3 mL of 1% lidocaine or 2.5 mL of 1% lidocaine and 3 mg of betamethasone).^{27,53} Occipital nerve blocks can be effective for posttraumatic occipital neuralgia in adolescent⁵⁴ and adult

athletes⁵⁵ and for prevention of migraine.^{56,57} Botulinum toxin injection may also be effective.⁵⁸

Anecdotally, nonsteroidal anti-inflammatory drugs and muscle relaxants may also be beneficial. If there is a true occipital neuralgia with paroxysmal lancinating pain, baclofen, tizanidine, carbamazepine, gabapentin, or pregabalin may help. Physical therapy and transcutaneous nerve stimulators may help some headaches. A variety of other treatments have been proposed for refractory cases including pulsed radiofrequency therapy^{59,60} and occipital nerve stimulation.⁶¹

There are studies suggesting benefit from occipital nerve decompression, including one of 76 patients with complete benefit in 89.5% with patient selection based on complete but temporary improvement after an occipital nerve block.⁶² There remain questions about the efficacy of decompression because of differences in definitions and diagnosis of occipital neuralgia and suggestions for a sham surgery comparison group.

Various treatments have been proposed for cervicogenic headache. Physical therapy may be helpful.⁶³ In a randomized controlled trial of 60 subjects, pregabalin titrated up to as much as 450 mg daily as tolerated had a significant decrease in headache days.⁶⁴ Anesthetic blocks can provide temporary relief. C2,3 rami blocks may also be helpful.⁶⁵ Percutaneous radiofrequency neurotomy may be beneficial for pain arising from the C2-3 facet⁶⁶ although the evidence showing benefit is of poor quality.⁶⁷ There might be benefit from steroid injection into a symptomatic C1-2, C2-3 facet, or atlanto-axial.^{68,69} Patients with refractory pain not responding to all other treatments due to osteoarthritis of the lateral atlanto-axial joint might benefit from arthrodesis.⁷⁰

NONTRAUMATIC HEADACHES ASSOCIATED WITH SPORTS

Exertional Headaches.—Criteria.—According to the International Classification of Headache Disorders, 3rd edition (beta version) criteria,¹⁷ primary exertion headache requires fulfilling the following criteria:

“Headache precipitated by any form of exercise in the absence of any intracranial disorder.

Diagnostic criteria:

- A. At least two headache episodes fulfilling criteria B and C
- B. Brought on by and occurring only during or after strenuous physical exercise
- C. Lasting less than 48 hr
- D. Not better accounted for by another ICDH-III diagnosis”

Features.—Headaches may occur from sustained physical activity which may be bilateral in more than 50% of cases, often frontal or frontotemporal throbbing usually lasting a few minutes to 24 hours and occasionally 48 hours.⁷¹⁻⁷³ The headaches are usually not associated with nausea and vomiting although over 20% of migraineurs have migraine triggered by physical activity.⁷⁴ Can be evoked by various activities including running, rowing, tennis, swimming, and scuba diving. Risk factors are high altitude, hot weather, extreme exertion, and decreased fluid intake. Up to 50% may have a personal or family history of migraine and exercise can be a migraine trigger.⁷⁵ Those with primary exertional headaches are also more likely to have coexistent primary sexual headache or primary stabbing headaches.⁷⁶

Epidemiology.—The lifetime prevalence of primary exertional headaches has varied in different studies ranging from 1% in a Danish study,⁷⁷ 12% in a Norwegian study,⁷¹ 26% in an online survey of cyclists in the Netherlands,⁷⁸ and 30.4% among Taiwanese adolescents.⁷² An Iranian study is discussed below. The pathophysiology is poorly understood.

Secondary Causes.—The following are possible secondary causes which need to be excluded depending upon the clinical context with appropriate neuroimaging (MRI, magnetic resonance angiogram, or computerized tomographic angiogram), lumbar puncture, and cardiac testing as appropriate: subarachnoid hemorrhage, sentinel bleed, cervical arterial dissection, intracranial hypertension, spontaneous intracranial hypotension, cerebral venous thrombosis, pheochromocytoma, arteriovenous malformation, Chiari I malformation, cervical disc disease, and cardiac cephalgia (cardiac ischemia triggering a headache without chest pain).^{79,80}

Treatment.—Based on anecdotal data, indomethacin 25-50 mg can be tried 30-60 minutes before activity or on a regular basis 50-150 mg daily if the

headaches are frequent. β -blockers such as propranolol can be tried as a preventive with caveats as discussed as above under posttraumatic headaches. Gradual warm up to prevention exertional headache has been suggested.⁸¹

Prognosis.—There are limited prognostic data. One series of 93 patients found complete remission within 5 years in 32% and significant improvement or complete remission after 10 years in 78%.⁸²

Cough (Weightlifter’s) Headaches.—*Criteria.*— Primary weightlifting headache⁸³ is a headache triggered by a Valsalva maneuver (while an exertional headache is triggered by more sustained physical exertion) and falls under the International Classification of Headache Disorders, 3rd edition (beta version) criteria¹⁷ classification as a primary cough headache as follows:

“Description:

Headache precipitated by coughing or other Valsalva (straining) manoeuvre, but not by prolonged physical exercise, in the absence of any intracranial disorder.

Diagnostic criteria:

- A. At least two headache episodes fulfilling criteria BD
- B. Brought on by and occurring only in association with coughing, straining and/or other Valsalva manoeuvre
- C. Sudden onset
- D. Lasting between 1 second and 2 hours
- E. Not better accounted for by another ICHD-3 diagnosis.

Comments:

Primary cough headache is a rare condition, accounting for 1% or fewer of all headache patients consulting neurological clinics. However, one report found one-fifth of patients with cough seen in a chest medicine clinic had cough headache. Primary cough headache arises moments after the cough, reaches its peak almost immediately, and then subsides over several seconds to a few minutes (although some patients experience mild to moderate headache for 2 hours). It is usually bilateral and

posterior, and predominantly affects patients older than 40 years of age. There is a significant correlation between the frequency of cough and the severity of the headache. Associated symptoms such as vertigo, nausea, and sleep abnormality have been reported by up to two-thirds of patients with primary cough headache.

Although indomethacin (50-200 mg/day) is usually effective in treatment of primary cough headache, a few symptomatic cases have been reported to respond to this treatment. The syndrome of cough headache is symptomatic in about 40% of cases, and the majority of patients in whom this is so have Arnold Chiari malformation type I.”

Features.—In a population-based study, primary cough headache had a lifetime prevalence of about 1%.⁷⁷ Primary cough headache usually has an onset over the age of 40 years. The prevalence of headache predominantly triggered by weightlifting is not certain. A population-based study of exertional headache was performed in Tehran, Iran,⁵³ which included weightlifting headache as a type of exertional headache contrary to the definition as above. The 1-year prevalence of exertional headache was 7.3% (10% females and 5.4 males with a mean age of all subjects of 32 ± 12.1 years) and 20.4% reported headaches triggered by body building and lifting. None of the subjects had seen a doctor for their headaches. The features of headache triggered by body building and lifting were not reported separately from exertional headaches which, in total, were reported as being both pulsating and compressive, 68.4% bilateral and most frequent in the frontotemporal region, both pulsating and compressive with a duration of mostly 5 minutes to 24 hours and, in 8.2%, lasting 24-48 hours.

In a study of 74 patients with primary cough headache,⁸⁴ 66 patients had a duration of less than 30 minutes that was bilateral in 68% and 73% had more than one headache trigger. The cause of primary cough headache is not certain. Although one hypothesis for the cause of primary cough headache is posterior cranial fossa overcrowding,⁸⁵ weightlifter’s headache might be due to distension of the cerebral venous system.⁸⁶

Secondary Causes.—About 40% of cough headache patients have secondary causes that can be excluded with MRI of the brain with and without contrast for recurrent headaches. The most common secondary cause is Chiari type 1 malformation (CM1). Other secondary causes include the following: headache secondary to spontaneous intracranial hypotension; middle cranial fossa or posterior fossa meningiomas; posterior fossa dermoid tumor; medulloblastoma; pinealoma; chromophobe adenoma; brain metastasis or metastases; brain tumor not otherwise specified; midbrain cyst; posterior fossa arachnoid cyst; basilar impression; platybasia; os odontoideum; subdural hematoma; acute sphenoid sinusitis.

Symptoms from CM1 usually start in the second or third decade of life. Similar to case 2, in a series of 201 patients with CM1, 13.4% of headaches had onset only during Valsalva maneuver, effort, cough, sneezing, and laughing.⁸⁷ Of the entire cohort, the headaches were suboccipital-occipital in 29%, diffuse/nonpulsating in 74%, and pulsating in 23% and were worsened by Valsalva maneuver in 85%. Thirty-four percentage had short-lasting headaches and 41% had headaches lasting 3 hours to 3 days. The headaches were severe in 42%, moderate to severe in 50%, and mild in 7%. Migrainous-associated symptoms were reported by 38%. In symptomatic patients who do not have surgery, about 40% of those with cough headaches improved at follow-up.⁸⁸

When a first time thunderclap weightlifting headache occurs, subarachnoid hemorrhage should certainly be excluded as a cause.⁸⁹ Weightlifting can also trigger cervicogenic headache and migraine in some individuals.⁹⁰

Treatment.—There are no studies on treatment of weightlifter’s headache only but of primary cough headache, which typically responds to indomethacin. Of 16 patients treated with indomethacin, 10 responded completely, four had moderate improvement, and two had no response with doses of 50-200 mg with an average of 78 mg with a duration of treatment from 6 months to 4 years.⁹¹ Another study found that 44% of primary cough headache patients had a complete response and 29% a partial

response to indomethacin at doses of 25 mg 2 or 3 times per day.²⁷ Naproxen has also been reported as anecdotally effective.⁹²

Acetazolamide at maximum doses of 1125-2000 mg per day were found to be effective in four out of five patients with a mean maintenance dose of 656 mg daily.⁹³ Topiramate has been reported as effective in three patients at a dose of 50-100 mg,⁹⁴ and metoclopramide has been reported as effective in six males.⁹⁵ Lumbar puncture with drainage of 40 mL of cerebrospinal fluid was found effective in 6 out of 14.⁷⁰

Prognosis.—Primary cough headache is generally self-limited, with 50%-90% of patients in remission within 2 years.²⁷

External Compression Headache.—Can be caused by external pressure to the forehead and scalp such as a tight cap, football helmet, or swim goggles, occurring within 1 hour after onset of the pressure and resolving within 1 hour after the external pressure is relieved.^{14,96} The author has seen migraineurs who report external compression from a tight cap or sunglasses as a migraine trigger.

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