and research is needed to establish better criteria for causation.

Introduction

Headache disorders described here were previously referred to as *Headache associated with metabolic or systemic disease*. However, *Headache attributed to disorder of homoeostasis* was felt to capture more accurately the true nature of these headache disorders. Headaches caused by significant disturbances in arterial pressure and by myocardial ischemia are now included in this section. In addition, disorders of homoeostatic mecha- nisms affecting a variety of organ systems, including altered arterial blood gases, volume disturbances as in dialysis and disorders of endocrine function, are covered here. Headache attributed to fasting is also included.

10.1 Headache attributed to hypoxia and/or hypercapnia

Comments:

Headache occurs within 24 hours after acute onset of hypoxia with PaO_2 <70 mmHg or in chronically hypoxic patients with PaO_2 persistently at or below this level. It is often difficult to separate the effects of hypoxia and hypercapnia.

10.1.1 High-altitude headache

Diagnostic criteria:

A. Headache with at least two of the following characteristics and fulfilling criteria C and D:
   1. bilateral
   2. frontal or frontotemporal
   3. dull or pressing quality
   4. mild or moderate intensity
   5. aggravated by exertion, movement, straining, coughing or bending
B. Ascent to altitude above 2,500 m
C. Headache develops within 24 hours after ascent
D. Headache resolves within 8 hours after descent

Comments:

Headache is a frequent complication of ascent to altitude-occurring in more than 80% of cases. 10.1.1 *High-altitude headache* appears to be independent of an individual's previous history of headache, although patients with migraine may describe more severe headache that resembles their typical migraine attacks.

Acute mountain sickness (AMS) consists of at least moderate headache combined with one or more of nausea, anorexia, fatigue, dizziness and sleep disturbances. Acetazolamide (125 mg, two or three times daily) may reduce susceptibility to acute mountain sickness. Preventative strategies include allowing two days of acclima- tisation prior to engaging in strenuous exercise at high altitudes, avoiding alcohol and liberalising fluid intake. Most high-altitude headaches respond to simple analgesics such as paracetamol (acetaminophen) or ibuprofen.

10.1.2 Diving headache

Coded elsewhere:

1. *Migraine*, 2. *Tension-type headache*, 4.3 *Primary exer-tional headache*, 11.2.1 *Cervicogenic headache*, 13.6 *Supraorbital neuralgia*, 13.10 *External compression headache* and 13.11 *Cold-stimulus headache* precipitated by

diving are coded as those disorders.

Diagnostic criteria:

A. Headache, no typical characteristics known, fulfilling criteria C and D
B. Diving to depth below 10 m
C. Headache develops during diving and is accompanied by at least one of the following symptoms of CO_2 intoxication in the absence of decompression illness:
   1. light-headedness
   2. mental confusion
   3. dyspnoea
   4. flushed feeling in the face
   5. motor incoordination
D. Headache resolves within 1 hour after treatment with 100% O_2

Comments:

Hypercapnia (arterial PCO_2 >50 mmHg) is known to cause relaxation of cerebrovascular smooth muscle and lead to vasodilatation and increased intracranial pressure. There is some evidence that hypercapnia in the absence of hypoxia is associated with headache. The best clinical example of headache attributed to hypercapnia occurs in divers. Carbon dioxide may accumulate in a diver who intentionally holds his or her breath intermittently (skip breathing) in a mistaken attempt to conserve air, or takes shallow breaths to minimise buoyancy varia- tions in the narrow passages of a wreck or cave.

Divers may also hypoventilate unintentionally when a tight wetsuit or buoyancy compensator jacket restricts chest wall expansion, or when ventilation is inadequate in response to physical exertion. Strenuous exercise increases the rate of CO_2 production more than 10-fold, resulting in a transient elevation of PCO_2 to more than 60 mmHg. Diving headache usually intensifies during the decompression phase of the dive or upon resurfacing.

Mild nonspecific headache is also common in divers with decompression illness, and may be associated with musculos- keletal pain and, in more serious cases, with focal neurological and/or respiratory symptoms, loss of consciousness and/or cognitive deficits.

Headache in divers can also occur as a result of carbon monoxide intoxication which rarely contaminates divers' compressed-air supply if the air intake system is positioned in such a way as to gather improperly directed combustionengine exhaust. Such headache is coded as 8.1.3 *Carbon monoxide-induced headache*. Migraine, tension-type headache, primary exertional headache, cervicogenic headache, supraorbital neuralgia, external compression headache and cold-stimulus headache can occur during a dive, but diving in these instances should be considered a precipitating factor rather than the cause.

10.1.3 Sleep apnoea headache

Diagnostic criteria:

A. Recurrent headache with at least one of the following characteristics and fulfilling criteria C and D:
   1. occurs on >15 days per month
   2. bilateral, pressing quality and not accompanied by nausea, photophobia or phono- phobia
   3. each headache resolves within 30 minutes
B. Sleep apnoea (Respiratory Disturbance Index ≥ demonstrated by overnight polysomnography
C. Headache is present upon awakening

D. Headache ceases within 72 hours, and does not recur, after effective treatment of sleep apnoea

Comments:

Although morning headache is significantly more common in patients with sleep apnoea than in the general population, headache present upon awakening is a nonspecific symptom which occurs in a variety of primary and secondary headache disorders, in sleep-related respiratory disorders other than sleep apnoea (*eg*, Pickwickian syndrome, chronic obstructive pulmonary disorder), and in other primary sleep disorders such as periodic leg movements of sleep. A definitive diagnosis of 10.1.3 *Sleep apnoea headache* requires overnight polysomnography.

It is unclear whether the mechanism of 10.1.3 *Sleep apnoea headache* is related to hypoxia, hypercapnia or disturbance in sleep.

10.2 Dialysis headache

Diagnostic criteria:

A. At least 3 attacks of acute headache fulfilling criteria C and D
B. The patient is on haemodialysis
C. Headache develops during at least half of haemodialysis sessions
D. Headache resolves within 72 hours after each haemodialysis session and/or ceases altogether after successful transplantation

Comments:

Headache commonly occurs in association with hypotension and dialysis disequilibrium syndrome. The disequilibrium syndrome may begin as headache and then progress to obtundation and finally coma, with or without seizures. This syndrome is relatively rare and may be prevented by changing dialysis parameters.

As caffeine is rapidly removed by dialysis, 8.4.1 *Caffeine-withdrawal headache* should be considered in patients who consume large quan- tities of caffeine.

10.3 Headache attributed to arterial hypertension

Comment:

Mild (140-159/90-99mmHg) or moderate (160-179/100-109 mmHg) chronic arterial hyperten- sion does not appear to *cause* headache. Whether moderate hypertension *predisposes* to headache at all remains controversial, but there is little evidence that it does. Ambulatory blood pressure monitoring in patients with mild and moderate hypertension has shown no convincing relationship between blood pressure fluctuations over a 24-hour period and presence or absence of headache.

10.3.1 Headache attributed to phaeochromocytoma

Diagnostic criteria:

A. Intermittent discrete attacks of headache accompanied by at least one of the following and fulfilling criteria C and D:
   1. sweating
   2. palpitations
   3. anxiety
   4. pallor