

THE MAN WITH PERSISTENT HEADACHES, FOLLOWING A REAR-END MOTOR VEHICLE ACCIDENT

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Case History

It is a bright, sunny Monday morning. A young 25-year-old plumber is stopped at a red light and strapped in with a seatbelt. He turns his head to the left side to look in some store windows when another car crashes into the rear of his car. He does not see the accident coming. The speed of the other vehicle was approximately 25 miles per hour. His rear fender is bent and a tail light is broken. He feels immediate pain in the back of his neck and feels “stunned” for a few seconds. Initially, he feels disoriented and cannot recall where he was driving. He gets out of his vehicle and feels a dull throb on top of his head. He declines the suggestion of an ambulance, but does decide to drive to a nearby emergency room and be evaluated.

At the emergency room, his blood pressure is 150/90 and pulse 98 bpm. He has a series of neck x-rays that are reported “normal except for some mild straightening, possibly related to muscle spasm.” Because his head continues to throb and he now has photophobia, he is sent for a computed tomography (CT) brain scan without contrast. The emergency room physician tells him, “Your CT brain scan is normal, so you don’t have anything seriously wrong. It looks like some of your neck muscles were strained, so they’ll hurt for a few days but then you should be fine. Take the rest of the day off and rest. I’m going to prescribe some naproxen sodium for you to take twice a day to help decrease the inflammation.”

The next day, the patient feels like he was “run over by a truck.” His neck is very stiff and the headache is now “all over.” He feels too ill to work. Over the next few days, the neck pain and headache persist. The naproxen sodium prescribed has not helped. He also feels irritable, has trouble sleeping, and has difficulty with attention and concentration, even trying to read the newspaper. His wife tells him he seems forgetful. At the end of the week, he sees his family doctor who tells him the injuries may last as long as 2 weeks. The young man is relieved to hear this. His primary-care physician gives him a muscle relaxant for his neck and says this will probably help with his sleep.

Three days later, the patient still does not feel well but he returns to work. The increase in activity tends to aggravate his headache so he takes three acetaminophen tablets every 4 hours, which just takes the edge off. He finds it difficult to do plumbing because of the awkward positions he has to get into, turning his neck, which aggravates the headache. At this time, he notices two distinct headaches that often overlap. He continues to have intermittent throbbing headaches on the top of his head that are associated with light and sound sensitivity and cause him to feel nauseated. Sometimes, he has to rest with these headaches. In between the severe headaches, he has a continuous dull pressure headache “all over, but worse in the back of my head and neck.”

The patient contacts his physician and states he is still having difficulty with headaches. He feels like the neck

pain may be somewhat better. He is sent for a magnetic resonance imaging (MRI) scan of his head and neck, which are both reported to be normal. He is again told he does not have anything serious. Nevertheless, the patient becomes worried. "If everything is okay, why do I still have all this pain, and I'm forgetting everything." He sees a personal injury attorney, who refers him to a chiropractor. After 6 months with chiropractic treatment, the patient does feel his neck has improved but the headache seems "untouched." He is referred to a pain specialist who gives him "steroid shots" in the back of his neck, which give him good relief for about 3 hours. In addition to the headache, the patient now starts feeling a lack of interest in his hobbies, low energy level, and difficulty sleeping. He wants to seek another medical opinion, perhaps at a headache clinic.

Questions on the Case

Please read the questions, try to answer them, and reflect on your answers before reading the author's discussion.

- How do you feel about seeing this patient?
- Was it significant that he was hit "out of the blue" and having his head turned?
- What would your diagnosis be?
- Could he have had a concussion or mild traumatic brain injury?
- How could he have even been injured and have persistent memory problems when his car showed only minor damage?
- How would you manage this case?
- What would be your treatment goals?
- What is the patient's prognosis? Will the headache ever go away?

Case Discussion

Approach to the Patient

The first question you should ask yourself is how you feel about seeing this patient. Patients with persistent headache following a mild head injury are often very difficult to manage because of the problems in evaluation and treatment of subjective symptoms, the unclear clinical picture, and minimal evidence of organic abnormality. There are also problems with possible legal issues, insurance difficulties, and decisions about disability. It is extremely important to realize that if you are carrying a bias into the evaluation and treatment situation, that you be aware of your feelings and perhaps transfer the patient to another physician who is more open to seeing this type of patient.

You have more than a headache when you decide to see a posttraumatic headache (PTHA) patient.

Diagnosis

It is important to clarify what kind of injury the patient had. PTHA is the most common symptom following a mild head injury. This patient, according to International Headache Society (IHS) guidelines, would have a chronic PTHA, since it has continued for more than 8 weeks after the injury. (Table 58-1 lists the diagnostic criteria of the IHS for acute and chronic PTHAs.) The author feels that chronic PTHA would be better defined as a headache lasting for more than 6 months.

Mild traumatic brain injury (MTBI) following a mild head injury (MHI) often causes disagreement as to definition. Obviously, an MHI does not always cause MTBI. Concussion has also been variously defined.

The most widely used definition of MHI has been an injury that causes a period of unconsciousness for less than 20 minutes, a Glasgow Coma Scale (GCS) score of 13 or greater (15 is normal or no abnormality), and a duration of posttraumatic amnesia less than 48 hours.

MTBI has been defined as a "traumatically induced physiological disruption of brain function" with at least one of the following: any period of loss of consciousness, any memory loss of events just before or after the accident, any alteration in mental state at the time of accident, or focal neurologic deficits that may or may not be transient. In addition, this type of injury cannot result in a loss of consciousness for greater than 30 minutes or have a GCS score of less than 13. It is important to note that MTBI may occur without loss of consciousness, although there is often a brief period of feeling "stunned" or confused, as reported by the patient in this case.

Concussion has also been variously defined. For many years, a concussion was considered to be a brief, reversible brain injury with transient loss of consciousness. We now recognize that loss of consciousness is not necessary for a concussion to have occurred or for development of post-concussion symptoms. For the purpose of classifying head trauma in sports, the American Academy of Neurology divides concussion into three grades.

Grade I:

1. Transient confusion
2. No loss of consciousness
3. Concussion symptoms or mental status abnormalities on examination resolve in less than 15 minutes

Grade II:

1. Transient confusion
2. No loss of consciousness
3. Concussion symptoms or mental status abnormalities on examination last more than 15 minutes

Grade III:

1. Any loss of consciousness, either brief (second) or prolonged (minutes)

Table 58-1. International Headache Society Diagnostic Criteria for Posttraumatic Headaches

5.1 Acute Posttraumatic Headache
5.1.1 Acute posttraumatic headache attributed to moderate or severe head injury
Diagnostic criteria:
A. Headache, no typical characteristics known, fulfilling criteria C and D
B. Head trauma with at least one of the following: <ol style="list-style-type: none"> 1. Loss of consciousness for > 30 minutes 2. Glasgow Coma Scale (GCS) < 13 3. Posttraumatic amnesia for > 48 hours 4. Imaging demonstration of a traumatic brain lesion (cerebral hematoma, intracerebral and/or subarachnoid hemorrhage, brain contusion and/or skull fracture)
C. Headache develops within 7 days after head trauma or after regaining consciousness following head trauma
D. One or other of the following: <ol style="list-style-type: none"> 1. Headache resolves within 3 months after head trauma 2. Headache persists, but 3 months have not yet passed since head trauma
5.1.2 Acute posttraumatic headache attributed to mild head injury
Diagnostic criteria:
A. Headache, no typical characteristics known, fulfilling criteria C and D
B. Head trauma with all the following: <ol style="list-style-type: none"> 1. Either no loss of consciousness, or loss of consciousness of < 30 minutes duration 2. GCS ≥ 13 3. Symptoms and/or signs diagnostic of concussion
C. Headache develops within 7 days after head trauma
D. One or other of the following: <ol style="list-style-type: none"> 1. Headache resolves within 3 months after head trauma 2. Headache persists, but 3 months have not yet passed since head trauma
5.2.1 Chronic posttraumatic headache attributed to moderate or severe head injury
Diagnostic criteria:
A. Headache, no typical characteristics known, fulfilling criteria C and D
B. Head trauma with at least one of the following: <ol style="list-style-type: none"> 1. Loss of consciousness for > 30 minutes 2. GCS < 13 3. Posttraumatic amnesia for > 48 hours 4. Imaging demonstration of a traumatic brain lesion (cerebral hematoma, intracerebral and/or subarachnoid hemorrhage, brain contusion and/or skull fracture)
C. Headache develops within 7 days after head trauma or after regaining consciousness following head trauma
D. Headache persists for > 3 months after head trauma
5.2.2 Chronic posttraumatic headache attributed to mild head injury
Diagnostic criteria:
A. Headache, no typical characteristics known, fulfilling criteria C and D
B. Head trauma with all the following: <ol style="list-style-type: none"> 1. Either no loss of consciousness, or loss of consciousness of < 30 minutes duration 2. GCS ≥ 13 3. Symptoms and/or signs diagnostic of concussion
C. Headache develops within 7 days after head trauma
D. Headache persists for > 3 months after head trauma

Adapted from Headache Classification Subcommittee of the International Headache Society, 2004.

Headaches are common after Grade I and Grade II injuries, and oddly enough, somewhat less frequent after a Grade III concussion.

A posttraumatic syndrome or postconcussive syndrome can follow these injuries. Symptoms would include headache, dizziness, difficulty with concentration and memory, trouble sleeping, irritability, and low energy level. Patients may present with several or all of these symptoms.

This patient may suffer from migraine and tension-type headaches in a combined pattern. Some of the headache symptomatology may also occur from injury to soft tissues of the neck or occipital nerve injury or inflammation.

Posttraumatic migraine headaches are not unusual. It is important to determine whether the patient had preexisting migraine (or other types of headache) prior to the trauma. Patients with posttraumatic migraine may have a genetic predisposition to the migraine complex and may report migraine in family members. If there is preexisting migraine, then head or neck injuries may increase the frequency and severity of these headaches. Cluster headaches have been reported, but are relatively rare.

Whiplash injuries, typically caused by motor vehicle accidents in a rear-end collision, may also result in PTHA. This patient noted pain immediately following the accident, and the headache also came on very suddenly. At times, the headaches occurred related to neck positioning in his job as a plumber. Whiplash refers to neck hyperextension followed by flexion, which occurs when an occupant of a motor vehicle accident is hit from behind by another vehicle. Headaches have been reported in up to 80% of individuals immediately following whiplash injuries. Most headaches following whiplash are tension-type headaches, often associated with cervical muscle injury, greater occipital neuritis/neuralgia, and possibly temporomandibular joint syndrome. Usually, the injury is a myofascial injury with damage to the muscle, ligaments, and deep connective tissue.

In a study by Sturzenegger and DiStefano, presenting symptoms after whiplash along with injury-related factors were examined. There was a higher frequency of multiple symptoms and more severe headaches associated with an unprepared occupant, a rear-end collision, or rotated head position at the time of impact. A rotated head position gives the neck a much more restricted range of motion and, therefore, the possibility of more severe injury. The use of seatbelts, the speed of the vehicles, and the amount of damage to the vehicles had no influence on symptoms or signs.

Management Strategies

Patients with PTHA require individualized assessment and management. A variety of methods have been useful. Although most physicians recognize the importance of medication, nondrug therapies, including biofeedback,

physical therapy, massage, and counseling, can also be helpful for many patients.

Patients with chronic PTHA may need to be placed on some type of preventative medication, usually an antidepressant. Not only do preventative medications decrease the use of narcotics and analgesics, but they may also allow other treatments (such as biofeedback or physical therapy) to be utilized more effectively. Using analgesic medication to decrease pain levels to a somewhat more tolerable level may enable the patient to function at a higher level. These should be prescribed judiciously and not given on a daily basis, which could possibly provoke a rebound headache situation. Tricyclic antidepressants such as nortriptyline or amitriptyline may be helpful, but unfortunately, these often have frustrating side effects such as weight gain, drowsiness, dryness of mouth, dizziness, and constipation. The newer antidepressants (selective serotonin reuptake inhibitors) such as fluoxetine, sertraline, and paroxetine are often just as effective and have fewer troublesome side effects. Bupropion has also been helpful. We have found divalproex sodium to also be very helpful in decreasing frequency and severity of chronic PTHA. A starting dose at 250 mg twice daily is reasonable, increasing to 500 mg twice a day if there is little response. Usually, higher doses of divalproex sodium have not been helpful in our experience. Dosing the antidepressants for PTHA is essentially the same as for the treatment of seizure disorders, although occasionally patients may respond to lower doses. Some of the new triptan medications might be useful for posttraumatic migraine, especially if it has the characteristics of a migraine and is not too atypical. Headaches associated with myofascial trigger points in the neck or upper back may respond to injections of local anesthetic (with or without steroid) injected into the tender areas. These are helpful, but typically only last 2 to 4 weeks.

Biofeedback, in combination with medication, has been beneficial for a number of patients. Learning relaxation skills and decreasing muscle tension can often help with headache control, tension, and stress.

Patients need to understand that total relief of headache is not usually a realistic goal in treating PTHA. The goal should be less frequent and/or less severe headache, along with increased ability to function in daily life activities.

Counseling may be helpful in patients who are open to this idea and who might benefit from support and education. Some of the issues involved with PTHA patients include depression, anxiety, frustration, excessive expectations, anger, unresolved grief or loss, and relationship difficulties. Pacing skills are often helpful. If depression is present, then antidepressants can be very helpful. We have seen a number of patients who have had chiropractic treatment, massage, and/or physical therapy that have been helpful when the headache is mainly related to cervical trauma. Heat or cold packs may give symptomatic relief.

The goal of using these therapies should be progressive improvement. If patients consistently attend chiropractic sessions or physical therapy and feel good when they are there, but come out with no change, then we usually recommend discontinuation. A prescribed home exercise program may be helpful, but occasionally will aggravate a headache problem.

Give the patient an explanation about the injury, along with the realistic goals, expectations, and prognosis. Even if the patient has a permanent PTHA, the headache can often be helped symptomatically. Unfortunately, the busy clinician is often unable to offer these patients the amount of time and energy that is needed for success.

Prognosis

In spite of appropriate evaluation and treatment, some patients will have persisting symptoms and develop chronic or permanent PTHA. Most improvements seem to occur in the first 6 months, but some patients do improve over the course of a year. Some guidelines to identify patients at risk for longer periods of incapacity have included the older patient, patients with previous head injury, persons who have been high achievers or in demanding occupations, and patients who have family or social stressors.

The natural course of most PTHA situations is one of improvement during the first year. Approximately 4 of 5 patients will recover without significant sequelae. Generally, PTHA persisting for more than 1 year, with no evidence of further improvement, will be a permanent headache situation.

There is often an attitude among insurance companies and some physicians that persistent PTHA is simply a manifestation of "accident neurosis" or malingering. Deliberate exaggeration of symptoms in patients involved in litigation is usually overestimated. Legal settlement does not necessarily bring a termination of symptoms or a return to work. We have noted that almost all of our adult outpatients have continued to have headache problems even one or more years following legal settlement. We should also keep in mind the idea that there may be more than just a headache. Other symptoms may persist and be bothersome, such as difficulty with attention, concentration, or memory.

Case Summary

This 25-year-old man had persistent headaches following a rear-end automobile accident. Headaches and neck pain are very common after rear-end collisions. By the time this patient came to our clinic, he was very frustrated and depressed. It is not unusual for patients with persistent

PTHA to have been to the emergency room, seen their primary-care doctor, had multiple scanning procedures of their head, and seen a chiropractor and even a lawyer as they continue to battle the headache. Our patient was advised that he most likely did have a concussion with some postconcussive symptoms and persistent headache. He was educated about the prognosis of this injury and started on a trial of divalproex sodium twice daily, with the goal of decreasing the frequency and severity of headache symptoms. The headache pattern began to break up in approximately 2 weeks. His medication dose was increased. Although he continued to have some intermittent headaches, he was able to work in a full-time capacity and move his head into various positions without precipitating a headache. A selective serotonin reuptake inhibitor helped his mood, sleep pattern, and energy level all to improve.

Overview of Posttraumatic Headache

There is increasing evidence to support an organic basis in the pathophysiology of MTBI. Organic changes may also play a role in the pathogenesis of PTHA, although the specifics are still uncertain. After both mild and severe head injuries, damage to cerebral nerve fibers and axonal degeneration are evident. In many patients, the cerebral circulation is slowed for months or even years after injury, which may coincide with prolonged posttraumatic symptoms. A recent study showed reduced cerebral blood flow in patients with chronic PTHA.

In most instances, neurologic dysfunction in head injuries is caused by acceleration or deceleration of the brain, rather than the impact itself. Rational forces may cause the most significant injuries by shearing of axons. This may explain why injuries with the head free (such as automobile accidents) are more damaging than injuries with the head fixed (such as sports injuries). Careful MRI examination may show areas of diffuse axonal injury at the gray–white matter margin, but MRI is usually normal.

Ironically, many of the symptoms following head injury are associated with mild rather than severe head injuries. In many cases, the incidence of headache is highest in those without loss of consciousness or posttraumatic amnesia. Little anatomic evidence exists to explain this phenomenon. Impact forces are considerable even in low-speed automobile accidents.

The trigeminal nerve or Vth cranial nerve is a complex nerve that carries sensation from the front or anterior two-thirds of the head, and supplies blood vessels that make up the trigeminovascular system, probably involved in migraine. Once the fibers enter the brainstem, some descend to the upper cervical spinal cord in the neck and make connection with the occipital nerve, primarily C2, which supplies sensation to the back of the head. In this way, any irritation to

structures innervated by the cervical sensory nerves can activate the trigeminal nucleus and result in referred pain to the anterior or frontal aspect of the head. This may explain how cervical muscular tenderness or myofascial trigger points might act as generators for both occipital and frontal headaches. Occipital nerve or trigger point blocks may relieve many different types of PTHA.

In discussing the forces generated in the head and neck as a result of whiplash, the convention is to use the unit G. One G is the force of acceleration due to the earth's gravity, or 32 feet/sec² (simply, 1 G is our weight). A fighter pilot begins to gray out at 6 G. One cannot raise the body or extremities against 8 G. If a 200-pound man is subjected to 8 G, then this is 8 × 200 pounds or 1,600 pounds. If a car is hit in the rear and accelerated to a speed of 10.8 miles per hour within the span of 100 milliseconds, then the car and the driver are accelerated to 5 G. An occupant in this situation would stand a 50–50 chance of sustaining a concussion.

Following traumatic brain injury, there is a cascade of destructive events, beginning with neuronal depolarization and potentially leading to cell impairment and destruction. Neuronal depolarization, excessive release of excitatory amino acids (mainly glutamate), excessive release of excitatory neurotransmitters (mainly acetylcholine), loss of calcium homeostasis, changes in endogenous opiates, reductions in cerebral metabolic activity, disrupted axoplasmic transport, and changes in blood-brain barrier integrity are some of the primary pathobiologic disturbances that may ultimately lead to neurologic deficits. Many of the proposed neurochemical changes that occur in migraine also appear to occur in traumatic brain injury.

Selected Readings

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Editorial Comments

No one could say it better than Dr. Packard himself: "You have more than a headache when you decide to see a post-traumatic headache patient." How true this statement is, and how important it is to have an open mind and positive attitudes in dealing with patients with PTHAs. Cases like this one tax the abilities of the best clinicians, as there are usually numerous physicians involved, many investigations and therapies, and the need to deal with insurance and legal

issues. Nevertheless, such is the job of the doctor taking on cases of this nature. The understanding of the neurobiology of PTHA is evolving, and the classification is significantly different than that offered by the IHS in 1988. For example, in the new *International Classification of Headache Disorders*, the PTHA must begin within 7 days of the injury. However, for chronic PTHA attributed to MHI, there must be "no loss of consciousness, or loss of consciousness of < 30 minutes' duration" and "symptoms and/or signs diagnostic of concussion," which in the current neurosurgery literature may mean only "dazed." Thus, a person with a very mild head or neck trauma indeed may meet the new IHS criteria for PTHA. What is important is the outcome for all concerned, especially the patient. This case teaches us a lot and is worthy of careful reading and reflection.

FINAL DIAGNOSIS:

Posttraumatic headache