

AANA JOURNAL COURSE

6

6 CE Credits*

Update for nurse anesthetists

Migraine development, treatments, research advances, and anesthesia implications

LTC Joseph O'Sullivan, CRNA, MS, AN, USA
Joseph T. McCabe, PhD
Bethesda, Maryland

The purpose of this course is to update anesthesia providers on the phenomenology and biological mechanisms underlying migraines. As experts in pain management who encounter this common ailment, anesthesia providers frequently are consulted to assist in patient care. Effective assessment and treatment of migraine will lead to better anesthesia management. Knowledge of preventive measures of surgical patients with migraine history can avoid events that can elicit a headache attack. The clinical implications of migraine disorder—

and each patient's preventive medication profile—is relevant to safe, accommodative anesthesia nursing care. Research advances in migraine treatment may profoundly improve our current pain relief measures. Adequate knowledge of the development, treatments, and research advances concerning migraine will improve patient care.

Key words: Anesthesiology, calcitonin gene-related peptide, migraine, trigeminal nerve, vasodilation.

Objectives

At the completion of this course, the reader should be able to:

1. Discuss triggering events for migraine onset.
2. Identify the major criteria in migraine diagnosis and factors in migraine development.
3. Describe the major preventive and acute pharmacological interventions for migraine.
4. Identify effective anesthesia management for people with migraine, including anesthesia precautions for preventive medications.
5. Describe the mechanism of action of the peptide antagonist BIBN 4096 BS and possible anesthetic and therapeutic uses.

Introduction

The International Headache Society defines *migraine headache* as a recurrent head pain that is described by patients as causing moderate to severe discomfort that lasts for hours. The pain often has a pulsating quality, is localized to one side of the cranium, and is associated with nausea, with or without photophobia and phonophobia.¹ Patients often report that the onset of migraine is related to a unique triggering event. Triggers can include emotional stress (including surgery),

traveling motion, flashing lights, certain foods, and physical activity.

Migraines are common ailments, and the impact on the individual is enormous in terms of pain, lifestyle disruptions, and disability. Severe migraines also have a societal impact that can lead to direct healthcare costs and indirect financial burdens to individuals and their families based on lost wages and absenteeism. The Global Burden of Disease Study, conducted by the World Health Organization, categorizes a day with severe migraine as being as debilitating as one spent as a quadriplegic.² In fact, studies that compared the overall functioning of migraineurs with control groups showed that chronic migraineurs have significantly lower levels of activity, exercise less, and have a higher level of sleepiness. When not experiencing head pain, objective measures find that migraineurs limit their physical activity and that they subjectively report they have less vigor.³ Decreased productivity further demonstrates the individual and societal burdens of migraine symptomatology. Furthermore, recent research suggests that migraine may be an independent risk factor for stroke, with a higher risk among oral contraceptive users.⁴

*AANA Journal Course No. 25: The American Association of Nurse Anesthetists is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center Commission on Accreditation. The AANA Journal course will consist of 6 successive articles, each with objectives for the reader and sources for additional reading. At the conclusion of the 6-part series, a final examination will be printed in the AANA Journal. Successful completion will yield the participant 6 CE credits (6 contact hours), code number: 27603, expiration date: July 31, 2006.

Age of onset and prevalence of migraines

Clinicians make a distinction between migraine attacks in terms of whether they are preceded by an *aura*. Although only experienced by 20% to 30% of migraineurs, auras are sensory experiences that herald the onset of an attack. Most commonly, auras are visual experiences in which the person sees bright lights or lines, although other effects, such as facial numbness, mild hemiparesis, and speech difficulty also may be experienced. Although few studies have addressed the age-specific incidence of migraine, previous findings, reviewed by Lipton and Stewart,⁵ indicate that the incidence of migraine is lower and occurs at an earlier age in males. Both sexes exhibit age differences when migraines are or are not accompanied by aura. The incidence for age of onset in males with auras is approximately 6 years at 7 per 1,000, whereas migraine without aura in males most frequently is first seen at 11 years with an incidence of 10 per 1,000. New cases of migraine were uncommon in men in their 20s. The age of onset in females with aura (14/1,000), in contrast, is approximately 13 years, and approximately 17 years (19/1,000) if there was no aura reported.⁵

The highest *prevalence* of migraines occurs between the ages 25 and 55 years. The prevalence is higher in women than in men with the ratio varying between 2:1 at 15 years, increasing to 3.5:1 at 39 years, and decreasing to 2.5:1 at 70 years.⁶ Early epidemiologic studies of *headaches* have found that 57% of males and 76% of females describe having 1 or more attacks per month, whereas *migraine* prevalence for the preceding month was determined to be 3% for males and 7.4% for females.⁷ Other more recent studies, have estimated the 1-year prevalence of migraines to be 3% among men and 13% among women.⁶ Variations from these data exist, and the incidence of migraines may be higher. For example, medical attention might be sought well after the first migraine, which would cast doubt on accuracy of age of onset. Many patients do not seek medical care for headaches, and reliable histories from early onset cases (5-6 years) can be questioned.⁵ Extrapolating from the most recent data suggests that approximately 4 million men and 19 million women in the US population have migraine attacks.

Clinical diagnoses of headaches

There are 3 defined types of headache disorders: (1) migraine, (2) tension-type headache, and (3) cluster headache. Differentiating these specific types is difficult because the clinician must base diagnosis on analysis of the patients' descriptions of prior attacks. Because the recall of headache characteristics may be incomplete or distorted, headache diaries are encour-

Table 1. Diagnostic criteria for migraine

Migraine without aura

- A. Minimum of 5 attacks with criteria of B, C, and D and evaluation E
- B. Headache lasts 4-72 h (untreated or unsuccessfully treated)
- C. Headache has at least 2 of the following 4 characteristics:
 - 1. Unilateral localization
 - 2. Pulsating quality
 - 3. Moderate or severe intensity
 - 4. Aggravation by walking stairs or physical activity
- D. Headache has at least 1 of the following:
 - 1. Nausea and/or vomiting
 - 2. Photophobia and phonophobia
- E. History, physical, and neurological examinations do not suggest association with trauma, vascular disorders, withdrawal from drugs, infections, metabolic disorders, or disorder of cranial or facial structures (eg, temporomandibular joint syndrome)

Migraine with aura

- A. At least 2 attacks fulfilling criteria B, C, and D
- B. Aura consisting of at least 1 of the following, but no motor weakness:
 - 1. Fully reversible visual symptoms including positive features (flickering lights, spots, or lines) and/or negative features (loss of vision)
 - 2. Fully reversible sensory symptoms including positive features (pins and needles) and/or negative features (numbness)
 - 3. Fully reversible dysphasic speech disturbance
- C. At least 2 of the following:
 - 1. Visual symptoms of the same field of each eye (homonymous) and/or unilateral sensory symptoms
 - 2. Minimum of 1 aura symptom develops gradually over ≥ 5 min and/or different aura symptoms occur in succession over ≥ 5 min
 - 3. Symptoms lasts ≥ 5 and ≤ 60 minutes
- D. Headache fulfilling criteria B-D for *migraine without aura* begins during the aura or follows aura within 1 h
- E. Not attributed to another disorder (see E above)

(Adapted from the 2003 International Headache Society standards.¹)

aged.⁵ The first headache classification system was published in 1962 by the National Institutes of Health; however, progress in understanding headache disorders made this system obsolete. A refinement was published in 1988 by the International Headache Society, and again in 2004¹ and has been providing a basis for uniform terminology and operational diagnostic criteria.⁸ The criteria for migraines include symptoms such as with or without aura, frequency and duration of attacks, the severity of pain, photophobia, nausea and vomiting, and an assessment of the pulsating quality of the headache (Table 1).

A careful patient history is the key for proper diagnosis and treatment of headaches. The results from

Table 2. Migraine contributing factors

Migraine contributing factors	Research findings
A. Genetics	<ol style="list-style-type: none"> 1. Four single missense mutations for brain-specific Ca²⁺ channel subunits⁹ 2. Two single missense mutations found for Na⁺ K⁺ pump subunit in migraineurs¹⁰ 3. Evidence, therefore, indicates that common types of migraines are neuronal ion channel disorders.
B. Endocrine/electrolyte	<ol style="list-style-type: none"> 1. Hormone changes from menstruation, pregnancy, use of contraceptive medications, and menopause 2. Lower Mg²⁺ electrolyte levels were found in erythrocytes of migraineurs. Treatment with Mg²⁺ showed a significant reduction in attacks.¹¹
C. Neuronal hyperexcitability	<ol style="list-style-type: none"> 1. Excitability of cell membranes of neurons in occipital area seems to be fundamental to the brain's susceptibility to migraines.¹² 2. Factors considered are mitochondrial dysfunction, metabolic imbalances, and ischemic changes.
D. Cortical spreading depression	<ol style="list-style-type: none"> 1. Described as a cerebral neuronal depolarization wave followed by depression of normal neuronal function; associated with temporary increase in cerebral blood flow that precedes spreading hypoperfusion.¹³ 2. Hypothesized to be responsible for the visual aura of migraine attack¹⁴
E. Trigeminal nerve activation	<ol style="list-style-type: none"> 1. Key inducer of migraine pain arises from trigeminal nerve activation (not vasodilation). 2. Calcitonin gene-related peptide and substance P, which are released from trigeminal neurons, <i>increase</i> pain transmission via vasodilation.¹⁵ Causes of vasodilation include electrolyte, hormonal, and metabolic imbalances and activation of brainstem sensory nuclei or from cortical spreading depression.

many population-based studies have demonstrated that migraine is a heterogeneous disorder with variations in levels of migraine-related disabilities, pain intensity, and frequency and duration of attacks. Knowledge of the diagnostic criteria, development, and treatment of migraines will continue to ensure that anesthesia providers are an invaluable asset on the patient care team.

Major factors in migraine development

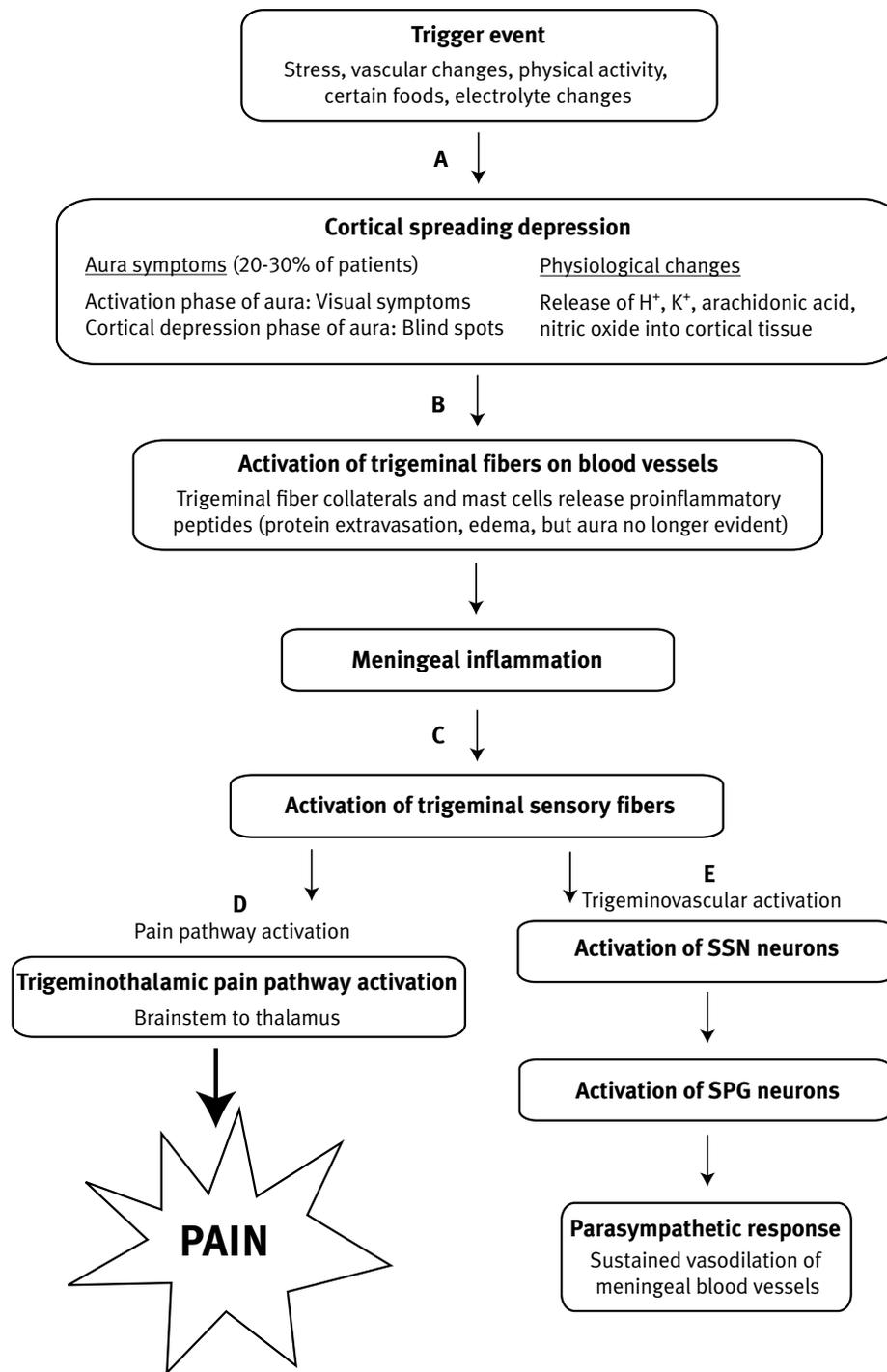
The pathogenesis of migraines remains incompletely understood, but 5 contributing factors have been identified: (1) *genetic abnormalities*; (2) *endocrine changes* and *electrolyte imbalance*, (3) *neuronal hyperexcitability* of neurons in the cerebral cortex, transiently or chronically, especially in the occipital region; (4) *cortical spreading depression* (CSD), especially as the basis of auras, and (5) *trigeminal nerve activation*, peripherally or centrally, as a neural trigger for induced migraine attacks. These factors (Table 2) alone or in combination are believed to be the key indices of migraine formation.⁹⁻¹⁵

- *An integrated conceptualization of migraine development.* Bolay et al¹⁶ proposed a link among CSD, auras, cerebral blood flow changes, trigeminal nerve activation, inflammation, and migraine pain. Previously, these factors were assumed to be isolated or independent components in migraine development.

This integrated model will provide anesthesia providers with a framework to discuss migraine development with migraineurs.

The model is as follows: the brain is largely insensitive to pain, but the meningeal dura, innervated by the trigeminal nerve, is very sensitive. The trigeminal nerve not only conveys sensory signals for the cephalic pain experience to higher centers in the central nervous system, but also participates in *trigeminovascular reflexes* that give rise to migraines (Figure). This *neurogenic* hypothesis suggests that alterations in blood flow develop as a consequence of neuronal events. Their work suggests a link between (non-painful) CSD as a trigger for the noxious activation of trigeminal afferents.¹⁶ Bolay and colleagues¹⁶ demonstrated that CSD gives rise to increased blood flow in the pial vessels and middle meningeal artery, resulting in protein leakage and meningeal inflammation. This could be caused by trigeminal fibers (see Figure) that are primed to release vasoactive neuropeptides such as substance P, calcitonin gene-related peptide (CGRP), and neurokinin A, which are neuropeptides that promote plasma protein leakage and vasodilation within the dura mater.¹⁶ In summary, this model suggests that CSD activates trigeminal responses that, in turn, activate trigeminovascular reflexes that sustain vasodilation and stimulate central pain pathways. This work

Figure. Current view of the physiological progression to migraine symptoms



A. Triggering events lead to cortical spreading depression (CSD), in some patients, leads to an aura. B. Physiological changes in the cerebrum lead to activation of trigeminal fibers on blood vessels, causing the release of proinflammatory peptides. C. Meningeal inflammation (but not vasodilation) leads to activation of trigeminal sensory fibers. D. Activation of the *trigeminothalamic* pathway from the trigeminal nucleus caudalis in the brainstem activates thalamic and cortical pathways leading to pain. E. *Trigeminovascular* reflexes involving activation of the superior salivatory nucleus (SSN) and the sphenopalatine ganglion (SPG) induce parasympathetic vascular responses, leading to sustained vasodilatation of cerebral blood vessels. Vasodilation can, in turn, cause added activation of trigeminal sensory fibers, further promoting head pain and trigeminovascular changes.

(Adapted from Bolay et al¹⁶ and Parsons and Strijbos.¹⁷)

Table 3. Common pharmacological agents for acute therapy of migraine

Drugs	Mechanism of action	Side effects and comments
1. Nonsteroidal anti-inflammatory drugs	A. Inhibition of prostaglandin synthesis via inhibition of enzymes cyclooxygenase 1 and 2	a. Gastrointestinal bleeding b. Diarrhea, dyspepsia c. Higher incidence of heart attack ¹⁹ (eg, rofecoxib [Vioxx]) d. Rhinitis
2. Serotonin agonists (triptans)	A. Intracranial vasoconstriction ²² B. Inhibition of neuropeptide release (calcitonin gene-related peptide, substance P) ²³ C. Direct inhibition of impulse transmission in the brainstem and upper cervical column ²⁴	a. Stroke b. Chest discomfort c. Heart attack
3. Ergot alkaloids	A. High affinity for norepinephrine, serotonin, and dopamine receptors B. Constriction of large capacitance arteries C. Inhibits neurogenic inflammation	a. High incidence of nausea and vomiting b. Coronary artery constriction effects
4. Opioids	A. mu, kappa, and delta receptors B. Decreases Ca ²⁺ influx in pain afferent neurons and decreases excitatory neurotransmission release ²⁵	a. Ventilatory depression b. Addiction c. Constipation d. Pruritis
5. Lidocaine (nasal spray)	A. Blockade of parasympathetic intracranial vasodilation via the sphenopalatine ganglion ²⁶	a. Not effective in bilateral migraines
6. Oxygen	A. Breathing 100% oxygen for 15 min has a cerebral vasoconstrictive effect	a. Minimal side effects with short-term use

suggests that CSD is the trigger for the onset of migraine, with vasodilatation as a consequence.

Alternatively, the vascular hypothesis summarized by Parsons and Strijbos,¹⁷ suggests that vascular changes (endothelial factors) can trigger CSD. As evidence, direct stimulation of cerebral and meningeal blood vessels or balloon distention of cerebral vessels produces severe ipsilateral headaches. Occlusion of the ipsilateral carotid artery relieves the migraine. It is likely that neuronal and vascular changes are relevant in the precipitation of CSD and contribute to the onset of pain.

Pharmacological intervention

Behavioral avoidance of individual triggering events is pivotal to preventing migraines. However, if pharmacological intervention is needed, migraine therapy should rapidly and consistently alleviate episodic symptoms, prevent recurrence, minimize the use of rescue medications for migraine pain, restore the patient's ability to function, minimize side effects, and be cost effective. Although part of migraine patho-

physiology may involve nerve-directed vascular changes, the initial asynchronous central nervous system activity suggests the disorder is best managed as a neurological ailment.¹⁸

• *Preventive measures.* Pharmacological intervention consists of 2 distinct treatment modalities: preventive and acute. Patients with more than 3 migraines per month should be considered for preventive therapy, which includes using β -adrenergic receptor antagonists (propranolol, timolol), calcium channel blockers (verapamil), muscle relaxants (baclofen), tricyclic antidepressants, or selective serotonin reuptake inhibitors.¹⁹ Antiepileptic drugs (valproic acid, gabapentin, divalproex, topiramate) have proven effective in preventing migraines. The mechanisms of actions include the following: (1) inhibition of voltage-gated Na⁺ and Ca²⁺ channels; (2) inhibition of glutamate mediated α -amino-3 hydroxy-5-methylisoxazole-4-propionic acid and kainate receptors; and (3) enhancement of chloride ion flow through γ -aminobutyric acid-A receptors. It is unknown which mechanism is most important in preventing migraine occurrence.

Antidepressants, used as a preventive therapy, are classified into 2 major groups: tricyclic antidepressants (TCAs) and serotonin reuptake inhibitors (SSRIs). The TCAs increase the concentration of serotonin in the central nervous system and increase the levels of norepinephrine and dopamine. Side effects of TCAs are related to their histaminergic, cholinergic and α_1 -adrenergic antagonist actions, which lead to drowsiness, weight gain, dry mouth, dizziness, and constipation.²⁰ The SSRIs are the most frequently prescribed therapeutic agents in all of medicine and function by increasing the synaptic serotonin concentration by preventing reuptake. The SSRIs have a better therapeutic profile with less cholinergic and antiadrenergic activities than TCAs, but side effects are common, including insomnia, sexual dysfunction, nausea, diarrhea, lassitude, and nervousness.²¹ Anesthesia implications of preventive drugs will be addressed later.

- *Acute therapy.* Acute management of migraine should begin with the simplest treatment. If needed, practitioners can modify drug administration, becoming more aggressive, until a successful treatment is found. Antiemetics for the nausea and vomiting component of migraine, calcium channel blockers, oral contraceptive, barbiturates, angiotensin converting enzyme inhibitors, and botulinum toxin A injections near the trigeminal axon¹⁹ have been used for migraine treatment. Table 3 summarizes the common pharmacological agents used for the treatment of migraine.^{19,22-26}

Anesthesia management

Many long-term migraineurs have discovered that a key to successful management of migraine is prevention. Anesthesia providers must communicate with patients to determine the causative factors for each individual and coordinate conditions that *help the patient avoid stimuli that may trigger a migraine attack* (Table 4). Analgesics and TCAs should be maintained to avoid exacerbation, and consideration should be given to avoiding the sudden cessation of analgesics used on a long-term basis for headache.²⁷ Preoperative counseling of patients to avoid tyramine (in cheese, red wine) and monosodium glutamate 72 hours before surgery may have merit. Avoiding marked elevations in blood pressure with vasodilation, which often occurs with surgery or the Valsalva maneuver with labor, could be important.

Effective assessment and patient history are critical to avoid mishaps, as misdiagnosis could lead to subsequent mismanagement of migraine.²⁷ A common scenario is a migraine being treated as possible postdural puncture headache, complete with epidural blood patch. (Readers are referred to appropriate texts

Table 4. Anesthesia management of patients with migraine

1. Discuss with patient individual symptoms that correspond to migraine onset.
2. Document triggering events of migraine.
3. Be aware of effective pharmacological treatment for the individual patient.
4. Preventive medications for migraines should be continued unless contraindicated. (Anesthesia providers often discontinue monoamine oxidase inhibitors before surgery.)
5. Strive for normotensive anesthesia management, avoiding wide variations in blood pressure, temperature, and carbon dioxide levels.
6. Rapidly and aggressively treat migraine using agents to which the patient has previously had a response. (Other suggestions include ketorolac, meperidine, chlorpromazine, and sumatriptan. Reserve parenteral route for patients with severe nausea and vomiting or intolerance of oral medications.)

for diagnosis of postdural puncture headaches.)

A critical component of safe anesthesia management is awareness of the patient's current medications. History and physical records and the initial anesthesia interview will determine relevant medications for migraine treatment with a possible anesthesia impact. Table 5 summarizes the major preventive pharmacological agents that are prescribed for migraine treatment and indicates potential anesthesia management concerns.

Migraineurs have a low concentration of Mg^{2+} on the surface of their erythrocytes. Oral magnesium supplementation has been prescribed widely in Canada as a preventive measure owing to its low cost, effectiveness, and safety profile.^{11,28}

Recent pharmacological research

Current pharmacological interventions for migraine relief are not effective for all individuals, and the side-effect profile of many drugs discourages self-administration. Moreover, concurrent physical ailments (such as cardiovascular disease) can prohibit the use of certain classes of therapeutically effective drugs, such as the triptans. Research continues for the explication of additional pharmacological avenues for effective and improved treatment. An additional prospect for medical treatment is the synthesis of *neuropeptide antagonists*. By acting on specific neuropeptide receptors, these agents hold promise as an additional, potentially specific treatment for certain maladies. As explained in Table 6, current research with peptide antagonists has made significant progress in migraine treatment.²⁹⁻³¹

- *Benefits of peptide antagonists.* Peptides may be

Table 5. Preventive medications for migraine

Drugs	Anesthesia precautions
A. Beta blockers (atenolol, metoprolol)	1. Additive myocardial depression with inhaled or injected anesthetics 2. Excess sympathetic activity from abrupt discontinuation (continue administration)
B. Ca ²⁺ channel blockers (verapamil, nifedipine)	1. Classes of drugs are vasodilators and myocardial depressants 2. May potentiate neuromuscular blocking drugs
C. Muscle relaxants (cyclobenzaprine [Flexeril], methocarbamol [Robaxin])	1. Enhance effects of barbiturates and central nervous system depressants 2. Could have life-threatening interactions with monoamine oxidase inhibitor
D. Tricyclic antidepressants (amitriptyline, imipramine)	1. Pressor response evoked by indirect-acting sympathomimetics (ephedrine) may be increased 2- to 10-fold. 2. Possible increase in cardiac dysrhythmias 3. Augments analgesic and ventilatory depressant effects of opioids
E. Selective serotonin reuptake inhibitors (fluoxetine [Prozac], paroxetine [Paxil])	1. Half-life of benzodiazepines may be prolonged (p450 liver enzyme inhibition) 2. More careful coagulation monitoring suggested with anti-coagulation drugs (synergistic)
F. Antiepileptic drugs (valproic acid, topiramate)	1. Can potentiate other central nervous system depressant drugs 2. Increased liver enzyme levels lead to increased metabolism of anesthesia drugs
G. Mg ²⁺ oral supplementation	1. Physiological oral doses of Mg ²⁺ are devoid of the pharmacological effects of parenteral Mg ²⁺ 11,28

released preferentially, at least in some systems, when neurons are strongly activated or under pathological conditions. It is thus *only* under these circumstances that an antagonist can exert an effect. Taken together, these characteristics should lead to less pronounced side effects.²⁹ The discovery that peptides often have more than 1 receptor provides added opportunities to design nonpeptide antagonists for receptor subtypes involved in specific functions. This principle has been important in the monoamine field in which already many subtype-specific agonists and antagonists have been developed.²⁹

- *Calcitonin gene-related peptide.* CGRP is the most abundant peptide in the nervous system, suggesting its involvement in a variety of different processes mediated by the central and peripheral nervous systems. Recently, a very specific, highly potent, nonpeptide CGRP receptor antagonist called BIBN 4096 BS has been shown to have selective affinity to human CGRP receptors in the picomolar range.³² It was tested in human clinical trials with a response rate of 60% to 66% of subjects tested, which is the percentage threshold for effective migraine treatment.³⁰ BIBN

4096 BS is the first migraine-specific medication that is not a vasoconstrictor³⁰ and may be the drug of choice for patients with coronary artery disease and patients at risk for hypertension. Unfortunately, this drug is still 1 to 2 years from the market because the only formulation is intravenous, and an oral form needs to be developed and tested for patient use.

- *Anesthetic uses for CGRP antagonists.* Although preliminary studies have been very encouraging for BIBN 4096 BS in treatment of migraine, other uses for this unique drug may be warranted. A preliminary study showed that coadministration of morphine (15 µg) with BIBN 4096 BS (0.1 µg) prevented the decline of the antinociceptive effect of morphine and partially restored the antinociceptive effect of morphine in opioid-tolerant rats.³³ As anesthesia providers are aware, treatment of neuropathic or chronic pain often results in tolerance to opioids, and increased doses of opioids result in more side effects without improving analgesia. Therefore, a significant advance for decreasing tolerance in the treatment of pain would be to combine CGRP antagonists with opioids. CGRP antagonists may function indirectly by preventing glutamate

Table 6. Current pharmacological research

Drug type	Mechanism of action	Consequences
A. Peptide antagonists	<ol style="list-style-type: none"> 1. Act on specific neuropeptide receptor subtypes 2. Nonpeptide antagonists can be involved with specific functions 3. Only exert effect under pathological conditions or when neurons are strongly activated²⁹ 	<ol style="list-style-type: none"> a. Overall less pronounced effects than classic transmitters (glutamate, γ-aminobutyric acid) b. Higher safety profile with fewer side effects²⁹
B. Example: the calcitonin gene-related peptide antagonist, BIBN 4096 BS	<ol style="list-style-type: none"> 1. Inhibits neurogenic inflammation 2. Decreases blood flow to brain 3. Inhibits pain transmission at second order neurons 4. Clinical role in decreasing inflammation to hyperexcitability of neurons in arthritic conditions 	<ol style="list-style-type: none"> a. Temporary paresthesia that subsides within 15-20 min b. Not a vasoconstrictor (increased safety profile with cardiac patients)³¹ c. Demonstrates effective migraine treatment with minimal side effect profile³⁰

release and decreasing N-methyl-D-aspartate activation, which in turn blocks morphine tolerance.

Conclusion

The high incidence and prevalence of migraine and its debilitating effects on human performance emphasizes the need for continued research into means to alleviate its symptoms. Limited pharmacological progress was made in migraine treatment during the last century. Fortunately, there have been recent advancements in understanding the pathophysiology of migraine and in the development of antimigraine drugs. Research into migraine pathogenesis and treatments ultimately may result in the development of novel pharmacological interventions. Because one of the primary missions of anesthesia providers is to effectively alleviate pain, further advances in treatment of migraine may profoundly change and improve our current pain relief measures.

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AUTHORS

LTC Joseph O'Sullivan, CRNA, MS, AN, USA, is a neuroscience graduate fellow at the Uniformed Services University of the Health Sciences, Bethesda, Md. Email: josullivan@usuhs.mil

Joseph T. McCabe, PhD, is a professor and vice chair of the Anatomy, Physiology, and Genetics Department at the Uniformed Services University of the Health Sciences, Bethesda, Md.

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