Paparella: Volume I: Basic Sciences and Related Principles

Section 9: Otolaryngologic Manifestations of Systemic Diseases and Pain

Chapter 41: Evaluation and Management of Patients with Chronic Head and Neck Pain

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Chronic facial pain lends itself to a pattern that involves the inception and evolution of physiologic and behavioral changes, clearly separating this entity from its acute counterpart. The chronic pain patient, defined as a patient with 3 or more months of continuous pain, has usually proceeded through a pain pattern involving anatomic and physiologic manipulations. These additionally injure the involved tissues and intensify pain in regional or distant regions, and can serve to reinforce the patient's belief that a serious problem is present. Pain behavior develops during this period of reinforcement, further aided by such complicating factors as drug dependence and financial gain.

Few situations are more frustrating to the primary care physician than the management of the patient with chronic facial pain. Inadequate understanding of the problem and the frustration of the patient can lead to the initiation of a hodgepodge of therapies, resulting in a deterioration of the physician-patient relationship. After initial evaluation, these patients are generally better managed at a pain control center, which can be found in most major medical centers. In these centers an interdisciplinary program of chronic pain management offers a more structured treatment plan than the typical approach, in which the patient goes from one health care professional to another in search of relief.

The therapies available for patients with chronic facial pain include medications, nerve blocks, neuroablative procedures, stimulation-produced analgesic techniques, physical therapy, psychological techniques, and rehabilitation. There is no one method of treating these patients. Treatment varies with the diagnosis, past history of treatments, and characteristics of the individual patient, and with the experience and expertise of those responsible for prescribing the treatment. The multidisciplinary approach serves to avoid patient dependence on individual professionals, because they each offer a type of treatment only from within their own area of interest. The anesthesiologist may suggest nerve blocks; the otolaryngologist, tumor debulking or rhizotomy; the neurosurgeon, a cordotomy or nerve thermocoagulation; and the psychiatrist, psychotherapy and biofeedback. A clear understanding of how a pain control center operates provides an insight into the management of the chronic pain patient.

It has been found that most chronic pain patients share a number of characteristics, including the following:

Loss of self-esteem.
Hostile or manipulative behavior, or both.
Apathy toward vocation and avocations.
Addiction to drugs.
High stress levels, with accompanying anxiety or depression.
Dependence on others, especially family and health care providers.
Marital, family, and personal conflicts.
Poor risk for obtaining pain relief from further procedures.
Affected by active litigation.
Poor personal hygiene, trophic changes.

Acute Versus Chronic Pain

Acute pain usually indicates the presence of a pathology, such as trauma, infection, or neoplasm, and serves to protect the region against further pathology. Once resolved, acute pain leaves no permanent disability. In contrast, chronic pain serves no useful purpose; there is little or no underlying pathology, or there is a minor pathosis inconsistent with the degree of discomfort experienced. The chronic condition may result in limited function caused by residual fibrous or osseous deposits and muscle contraction. More important is the psychological disability, in which the patient shows depression because of loss of agility and body image. The patient may present with a long-standing history of one catastrophe after another in which there has been well-intentioned but inappropriate surgical and medical intervention, resulting in a patient who resembled an iatrogenic museum. Such patients are highly skilled at manipulating health care providers.

Stress is often an accompanying symptom in chronic pain patients, not so much because of the pain that they experience, but because of the chronic pain syndrome to which they are exposed. Initially this stress can create a state of anxiety as patients search for some source of relief from the pain but, as they continue to fail in obtaining relief, the accompanying stress is manifested as depression. Acute and chronic pain are contrasted in Table 1.

Table 1. Features of Acute and Chronic Pain

Acute Pain	Chronic Pain
Useful	Not useful
Brief duration	Over 6 months duration
Triage and therapy	Multifactorial: triage and therapy
Defined and successful	Success limited
Limited drug therapy	Prolonged drug therapy with complications
No permanent disability	Permanent disability or complete disability.

Assessment

A progression of one pain syndrome to another is common with chronic pain patients. A thorough assessment is therefore necessary. Therapeutic options depend on the correct diagnosis of such syndromes.

A full history must be obtained, and should include these essential points: (1) the events at onset of the problem, and its initial presentation; (2) evaluation of the pain characteristics; and (3) the various interventions that have been made, and their effect(s) on the patient.

A complete physical examination should be carried out, with special emphasis on the head, neck, and upper extremity anatomy. It should include likely tissues of pain origin and any physiologic changes resulting from chronicity. In an attempt to define which structures hurt, and why they hurt, the physical examination begins with the patient's description of the site, patterns, and varying intensities of pain. The patient's perception of pain might have little to do with the structures that have actually produced or modified it.

The physical examination should include evaluation of the patient's systemic status (eg respiratory, cardiac, or endocrine problems) and of symptoms of diffuse disease involving the joints or muscles.

Evaluation of the central nervous system is important and should include examination of the somatic, sympathetic, and parasympathetic systems in the involved region. Generally, somatic pain pathways for intracranial structures above the tentorium are in the trigeminal nerve (V), with the pain usually referred to the frontotemporal, parietal, or orbital regions of the skull. Pain pathways below the tentorium are contained in the glossopharyngeal nerve (IX), the vagus nerve (X), and the upper cervical sensory roots. Pain referred from these structures is usually felt in the occipital region of the skull. Postganglionic sympathetic fibers come through the stellate or superior cervical ganglion, whereas post-ganglionic parasympathetic fibers come through the oculomotor, facial, glossopharyngeal, and vagus nerves.

The workup indicated for patients with chronic head and neck pain includes radiography of the affected area, especially of the sinuses and teeth. Basal skull views are used to check for integrity of the foramina. Radiographs of the temporomandibular joints and carotid angiograms might be indicated, particularly if the pain is strongly unilateral. Computerized tomography (CT) and brain scans might be indicated if a focal neurologic disorder is suspected. Magnetic resonance imaging (MRI) can be useful in evaluating soft tissue pathology.

A thorough psychological evaluation is also useful, because many chronic pain patients develop into hypochondriacs and suffer from depression and hysteria. The Minnesota Multiphasic Personality Inventory (MMPI) is a most valid and reliable personality profile measure that aids in differentiating those in various psychiatric groups from normal individuals. In addition to the MMPI, other psychometric tests are available to help evaluate the chronic pain relief.

Differential Diagnosis

Some of the more common pain conditions are discussed in this chapter. Headache has been discussed elsewhere in this text. The health care professional is reminded that the primary objective in dealing with a pain patient is first to determine the correct diagnosis before attempting to manage the pain condition.

The differential diagnosis of chronic head and neck pain includes pain of dental origin (eg from odontalgia, abscess, periodontitis), temporomandibular joint disorder, stylohyoid (Eagle's) syndrome, trigeminal neuralgia (primary or secondary), and acute herpes zoster-postherpetic neuralgia, and sympathetic fiber-mediated, atypical facial, musculoskeletal, and cancer pain.

Pain of Dental Origin

Toothache is the most common cause of trigeminal or "jaw" pain. Pain caused by exposure of the dentin is provoked by cold or sweet food. The pain of pulpal irritation is provoked by hot food or drink. In addition, the pain of dental abscess often results from pressure by inflamed tissues that surround the affected tooth. Odontalgia usually results from pulp irritation related to dental caries. Other causes of odontalgia include abrasion and erosion of the teeth, apical periodontitis, occlusal trauma, and unerupted teeth that cause pressure on branches of the trigeminal nerve by the periodontal membranes. Also, localized jaw pain can be traced to infected cysts or carcinoma in the mandible or maxilla.

Careful inspection and palpation of the teeth can elicit the patient's pain. A dental evaluation is essential in dealing with anyone suffering from facial pain.

Temporomandibular Joint Disorder

The temporomandibular joint is a synovial joint composed of a superior and inferior compartment that are separated by an interarticular disc. The problems associated with temporomandibular joint pain are classified as extracapsular or intracapsular.

Extracapsular Temporomandibular Joint Problems. These can be related to occlusion problems, psychological stress, trauma to the joint, and habit patterns. All can cause muscle dysfunction that leads to muscle spasm, hypermobility, loss of function, or limitation of motion of the joint, referred to as a myofascial pain dysfunction syndrome. Such a syndrome is characterized by pain, muscle tenderness, clicking of the temporomandibular joint, and deviation or limited motion of the jaw. Radiographs of the temporomandibular joint are normal. Psychological stress, with clenching and/or bruxism, is an important cause of this syndrome.

Alteration in the bite is another important cause of this syndrome. A bite-repositioning appliance, usually made of plastic, can be placed over the teeth; this will allow the muscles of mastication to relax and results in a decrease or complete recovery of the muscle dysfunction.

As a diagnostic tool, this appliance will reveal if the occlusion is the cause of the pain problem.

Other less obvious causes of extracapsular temporomandibular joint problems include certain oral habits, such as a patient's biting the fingernails. This causes pain at the insertion of the masseter muscle on the right or left side.

Intracapsular Temporomandibular Joint Problems. Displacement of the articular disc can be observed by arthrography of the temporomandibular joint. If not corrected, the displacement can lead to dislocation of the articular disc, intractable pain, and osteoarthritis. Fibrous and bony ankylosis can develop from trauma to the temporomandibular joint.

Osteoarthritis of the temporomandibular joint can result from malocclusion (eg severe overbite or underbite). Similarly, rheumatoid arthritis can affect the temporomandibular joint, as with other joints of the body. The facial pain patient suffering from a disorder of the masticatory apparatus must be evaluated by a dentist or physician who specializes in the diagnosis and treatment of such problems.

Stylohyoid (Eagle's) Syndrome

Elongation of the stylohyoid process occurs in approximately 4 per cent of the population, but seldom produces symptoms. Rarely, however, a glossopharyngeal neuralgia may result from elongation of the styloid process. This might develop initially after tonsillectomy. The pain in the pharynx is sharp and persistent and is aggravated by swallowing. It can be referred to the ipsilateral ear. If the styloid process impinges on the internal or external carotid artery, headache and pain related to the distribution of the artery can occur (carotidynia). This is confirmed by radiographic evidence of the presence of the elongated process.

Generally, the patient with this syndrome should be managed conservatively. Nerve blocks using long-acting local anesthetics, steroids, or both can be tried. With persistent and severe pain, however, surgical removal of the styloid process might be indicated. This can be performed by an intra-oral or external approach.

Trigeminal Neuralgia

The syndrome of trigeminal neuralgia, or tic douloureux, produces unilateral, recurrent, excruciating, lancinating pain that radiates medially in the distribution of the trigeminal nerve. This form of neuralgia typically occurs in elderly patients, with a 2:1 predominance in women. Generally, only the second and third divisions of the trigeminal nerve are involved. The patient usually has "trigger zones" on the face where touch can initiate severe pain; the most common sites are over the infraorbital and mental foramina. There is usually no sensory loss, but, if present, one should be concerned that this is a secondary neuralgia and an underlying cause should be sought (eg intracranial tumors or vascular anomalies).

Conservative management involves the use of carbamazepine (200 to 1500 mg/day) or diphenylhydantoin (100 to 400 mg/day). The addition of baclofen (10 to 80 mg/day) may also be beneficial in refractory cases. nerve blocks using local anesthetics and/or steroids may be effective. Neurolytic blocks, rhizotomy, or posterior fossa craniotomy might be necessary in severe refractory cases.

Sympathetic Fiber-Mediated Pain

The syndrome of sympathetic fiber-mediated pain describes a condition of severe burning pain associated with major peripheral nerve injury, such as after a sinus or neurosurgical procedure or even after facial trauma. The sympathetic fiber-mediated pain is described as continuous, with variable intensity. It is aggravated by any stimulus to the region that increases sympathetic outflow. Trophic changes similar to those seen in reflex sympathetic dystrophy are a striking feature of the condition. The skin is often warm, dry, and erythematous, but periods of vasoconstriction and hyperhydrosis occur frequently.

The condition is thought to involve a combination of peripheral and central mechanisms. It is thought that an abnormal interaction in peripheral tissues between sensory and sympathetic nerve endings or the release of pain-producing substances might be involved. Injured nerve segments can produce spontaneous neural activity, which may spread to sensory fibers across demyelinated axons. Selective damage to large afferent fibers could lead to self-sustaining or spontaneous activity within pain systems of the central nervous system. This pain also responds to sympathetic neural blockade.

Atypical Facial Pain

"Atypical facial pain" is a term used to describe a heterogeneous group of disorders characterized by pain that do not lend themselves to a precise diagnosis. Thus, atypical facial pain represents a diagnosis by exclusion. Extreme caution should be exercised in the use of the term, because it is not a true diagnosis. It usually refers to patients who have a large psychological component to their pain. In such patients there is no obvious precipitating factor, but the pain can be aggravated by fatigue, worry, or tension. The pain might last for a few hours or persist throughout the day. During acute exacerbations, major arteries in the neck and temple are tender and full, and often there are ipsilateral nasal stuffiness and excessive lacrimation.

This pain responds best to conservation care. If medication is administered, it should have no addictive potential. Techniques of behavioral modification are helpful in the evaluation and management of patients for whom this "diagnosis" is being considered.

Herpes Zoster and Postherpetic Neuralgia

The varicella-zoster virus can lie dormant in the sensory ganglia of the nervous system. With increasing age and reduction of effectiveness of immune mechanisms the virus can become active, resulting in an acute vesicular eruption along a peripheral nerve in the face (usually the

first division of the trigeminal nerve). These is often severe pain in the distribution of the affected nerve, before or accompanying the eruption of vesicles, which is exacerbated by touching or stimulating the skin. Postherpetic neuralgia can occur after several weeks in the region of scarring from healed herpetic lesions, where the skin is hyperpathic. The pain is of a burning type and often severe. The duration of pain without treatment varies, but can be several years.

The primary goals in the treatment of acute herpes zoster include early resolution of the acute disease and prevention of the development of postherpetic neuralgia. Postherpetic neuralgia, which occurs almost exclusively in older patients, is well known in pain centers for being one of the most crippling and difficult-to-treat pain syndromes - therefore, its prevention is critical. Once postherpetic neuralgia has developed, the major treatment goals are relief of pain, control of depression and anxiety, and management of insomnia. The need for treatment of acute herpes zoster beyond symptomatic therapy is debatable in younger, healthy patients. In the elderly or immunocompromised population, early aggressive therapy is clearly indicated (Mayne et al, 1986).

Additional concerns in the management of acute herpes zoster include pain control in the initial phase, prevention of systemic dissemination in immunocompromised patients, prevention of secondary infection, and prevention of spread of the virus to other individuals. Additionally, in the case of trigeminal V1 or V2 acute zoster, an immediate ophthalmologic consultation should be obtained, because blindness can result. Although scarring of the skin is often seen following acute herpes zoster, few reports concerning its prevention have been published.

Unfortunately, most treatment studies reported in the literature are uncontrolled. Also, most reports do not take into account the ages of the patients and the duration of herpes zoster or neuralgia prior to treatment. Younger patients rarely develop postherpetic neuralgia, and therefore might appear to respond well to any form of treatment. The longer acute herpes zoster is left untreated, the less effective any therapy seems to be. Once postherpetic neuralgia is established for more than 3 to 6 months, it becomes particularly refractory to all treatment (Portenoy et al, 1986). The treatment of acute herpes zoster and postherpetic neuralgia involves modalities beyond those in the standard pain management regimen (see below, Treatment of Acute Herpes Zoster and Postherpetic Neuralgia).

Musculoskeletal (Myofascial) Pain

Musculoskeletal pain can be primary or secondary to many chronic pain syndromes. It can be a result of reflex muscle spasm, ischemia of the myofascial structures, impaired nutrition, muscle fatigue caused by overuse, or direct muscle injury. Once the painful state is produced it is perpetuated by feedback cycles from myofascial trigger points, with further pain caused by muscle spasm. The pain is constant and diffuse. When the muscle is activated by motion, sharp stabbing pain may be felt. Trigger points (fascial areas of muscle of exquisite tenderness to palpation) can be identified on the involved muscles.

The skeletal muscle system is the largest single organ in the human body, accounting for approximately 40 per cent of body weight. Because the skeletal muscles are subjected to the wear and tear of daily activities, it is easy to understand how they can develop myofascial trigger points that can lead to pain and muscle spasm.

Tender muscle trigger points are extremely common, and latent trigger points occur more often than active trigger points. Sola and colleagues (1950) found latent trigger points in 54 per cent of the women and 45 per cent of the men in a normal young adult population. In patients hospitalized for myofascial pain, the incidence of active trigger points has been found to be highest in those between ages of 31 and 50 years (Kraft et al, 1968). With advancing age and reduced physical activity, latent trigger points become more prominent (Gutman, 1938).

A major difficulty in understanding myofascial pain has been the many names given to this syndrome. Good (1951) first used the term "muscular rheumatism" in 1938. Later, the same author used "nonarticular rheumatism", "myalgic spots", "idiopathic myalgia", and "muscular sciatica" for the syndrome of myofascial pain (Good, 1951). Kelly used the term "fibrositis" (Gutstein, 1938). Travell initially used "idiopathic myalgia", changing it to "myofascial trigger points" in later reports. (Travell et al, 1942, 1983; Travell, 1976). Other names given to this syndrome include rheumatic myositis, nodular fibromyositis, and fibropathic syndrome (Neufeld, 1952; Sola and Kuitert, 1954; Telling, 1911; Yawger, 1909).

Myofascial pain is not always readily identified. Myofascial masseter pain can present as unrelenting dental pain that persists beyond tooth extraction. Temporomandibular joint pain is frequently the result of temporalis muscle myofascial pain. The diagnosis is supported by history, elimination of other possibilities, and identification of trigger points, which when pressed reproduce or worsen the pain complaint.

Many techniques have been proposed for the management of myofascial pain. In addition to transcutaneous electrical nerve stimulation (TENS) and myoneural injection therapy (see below), other therapeutic options may be tried, including pharmacotherapy, physical therapy, and behavioral medicine. Pharmacotherapy is often the initial treatment used in myofascial pain conditions, but its primary purpose is to control the patient's pain on a short-term basis; it should never be the major treatment choice. Physical therapy includes soft tissue mobilization, body mechanics, postural exercises, muscle balancing and strengthening exercises, development and management of a home exercise program, and other specific techniques (eg heat and cold therapy, spray and stretch, ultrasonography, electrogalvanic stimulation, phonophoresis). Behavioral medicine techniques such as relaxation therapy, biofeedback, behavior modification, and operant conditioning can also be helpful in relieving myofascial pain. It should be realized that no one type of treatment is likely to "cure" the patient, and that the patient with chronic myofascial pain is best managed in a multidisciplinary fashion, with an emphasis on conservative treatment using noninvasive or at least reversible techniques.

Management

When a patient's pain originates in myofascial tissues, direct myoneural injection of local anesthetic (with or without steroid) to the involved myofascial tissues is used for pain relief. A mixture of 0.75 per cent bupivacaine (for prolonged block of afferent pain fibers), 1 per cent etidocaine (for prolonged block of efferent fibers), and dexamethasone 4 mg/10 mL (as an anti-inflammatory) affords excellent results.

Once the effect of the injection has worn off the relaxed muscle should be prevented from going back into spasm, because the spasm could be re-initiated by stretching or contraction of the muscle. Daily myoneural injections are not practical - the local anesthetic mixture can become irritating focus and lead to muscle spasm. Other means must therefore be used to prolong the effects of the injection, including oral medication.

The use of narcotic analgesics should be avoided; instead, nonsteroidal anti-inflammatory agents, acetaminophen, and/or mild skeletal muscle relaxants, which do not have as great an addiction potential, should be used. The eventual goal is to eliminate all oral pain medications as soon as possible. Application of transcutaneous electrical nerve stimulation can raise the patient's pain threshold. Once the patient has achieved a degree of relief, an exercise program can be started to improve strength and mobility. During this time, if the physical therapy exacerbates the pain, myoneural injection can be used to maintain the muscle relaxation. The main objective is to stretch and strengthen the painful agonistic and antagonistic muscle groups so that they do not go into spasm with normal muscle activity.

Myoneural (Trigger Point) Injection

Myoneural (trigger point) injections represent one of the most effective methods of relieving myofascial pain acutely, with the pain relief often outlasting the pharmacologic action of the local anesthetic. It can be used diagnostically - to determine the specific pain pathway involved to help differentiate the source of pain - and therapeutically - to provide motor blockade that breaks up tender muscle trigger points and relieves the pain.

Myoneural block therapy should rarely be the initial treatment of choice or the sole treatment for the relief of chronic myofascial pain. It should be used adjunctively with pharmacotherapy, active-passive physiotherapy, TENS therapy, and behavioral medicine techniques, such as relaxation therapy, biofeedback, behavior modification, and operant conditioning. The goal of myoneural injection therapy is not elimination or cure of the pain, but breakdown of tender muscle trigger points to provide the patient with adequate relief so that conservative noninvasive therapies may be used most beneficially. Myoneural injections are typically given to an individual muscle group or groups in a series of three to five treatments, usually at weekly intervals. After this initial period, depending on their degree of effectiveness, injections are discontinued or continued with a longer interval between blocks (eg every 2, 3, or 4 weeks), with additional injections given only for severe pain exacerbation. Myoneural block injections can also be useful as a "tuneup" following physiotherapy, when a few severe trigger

points remain and continued muscle guarding is noted.

It is generally inappropriate to administer more than five myoneural injections per patient visit, with the number of injections often being limited by the total dose of local anesthetic that has been injected. When faced with a large number of apparent trigger points, the one or two most prominent, tender muscle trigger points that have been resistant to conservative management should be isolated, and these should be injected.

Patient Examination and Technique for Myoneural Junction Injection

Examination of the patient to locate painful, tender muscle trigger points is as much an art as a science. The clinician must first establish for the patient the sensation of firm finger pressure by pressing over a nonpainful area, such as the occipital bone, because the examination procedure itself can be somewhat uncomfortable, even in the absence of tender muscle trigger points. Once this sensation has been established, the patient is instructed to inform the clinician when finger pressure elicits marked tenderness or pain. Trigger points, which are discrete points of focal tenderness within tight bands of muscle, can be found by applying pressure so that the pain is reproduced in a particular distribution (eg masseter palpation causing dental pain). The trigger point is the most sensitive point in the palpable muscle band. The muscle is placed under sufficient stretch so that the tight band can be palpated with flat palpation or by rolling the muscle band back and forth between the fingers. Careful examination usually demonstrates multiple muscle groups with tender muscle trigger points in the same patient. Although the muscle groups involved are often firm and taut (like a stretched rope), this will not be as obvious in the temporalis and masseter muscles as in the strap muscles in the neck and shoulders. A positive "jump" sign (the patient jumping in response to palpation of a tender point) is usually noted with palpation of a tender muscle. The patient is requested to respond when the discomfort to palpation is the strongest, because this is the site that will be marked for injection.

An aseptic technique is required for injection of the trigger points. Sterility of the solutions, needles, and syringes must be maintained prior to use. To perform a trigger point injection, the needle is inserted perpendicular to the skin and slowly advanced to the depth of the tender muscle trigger point. On reaching the trigger point, elicitation of the jump sign indicates the location for injection. Once the local anesthetic has been injected into the area of focal tenderness, the needle can be repositioned in the muscle without withdrawal from the skin and local anesthetic fanned out through additional adjacent muscle groups. Usually 0.5 to 5 mL of local anesthetic is injected into a particular trigger point, depending on the bulk of the muscle.

As with all techniques involving entry of a needle into the tissue, postinjection pain might be noted. As a general rule, the more tender the trigger point and the tenser the patient, the more tenderness the patient will note following the procedure. When the first in a series of injections is administered, it is not uncommon for the patient to complain of some slight tenderness as long as a week later, at the time of the next scheduled procedure. The patient should always be informed that, any time an injection such as that given, increased pain might be experienced in the area, as well as bleeding or infection. Also, it is uncommon for the patient to experience

some dizziness or euphoria (the so-called highball effect). When injecting a local anesthetic solution in the area of the seventh cranial nerve, a facial palsy might be noted. Depending on the type of local anesthetic used, this can last up to 12 hours, or even longer.

Dry needling of trigger points without injecting any solution can be effective, but clinically does not appear to equal the therapeutic effectiveness of injecting local anesthetic into the site. As with all techniques involving entry of a needle into the tissue, postinjection pain can follow dry needling. Sola and Kuitert (1955) treated a series of 100 patients with isotonic saline injected into trigger points, and found saline to be effective in relieving the pain. Because both dry needling and injection of saline can be used to treat myofascial pain, caution should be observed when making a diagnosis of psychogenic pain based on a patient's positive response to a placebo injection.

A more detailed discussion of equipment and agents used for myoneural injections are given below (Pain Management Techniques: Myoneural Injection).

Cancer Pain

Cancer pain can result from tumor infiltration, inflammation in the subcutaneous tissue, or metastasis to bony structures. Frequently, in those with head and neck cancer, a correlation is found between regression of the tumor mass and reduction of the pain. Thus, surgical debulking, chemotherapy, and radiation therapy can greatly reduce cancer pain initially. When pain recurs following such therapy, the risk of increasing pain with further anatomic distortion by surgery or radiation must be weighed against the efficacy and risks of other therapies, because radiation, chemotherapy, or surgery usually become less effective in controlling pain with each subsequent treatment.

In terminally ill cancer patients, quality of life is the main consideration in a pain management program. Ideally, good-quality pain control should be coupled with maximum functioning; frequently, however, oversedation with high doses of parenteral narcotics occurs when doses are gradually increased to relieve pain. A decrease in the total narcotic dose required, with a resulting decrease in sedation and side effects, can be achieved by adding appropriate synergistic pain medications to the patient's regimen: nonsteroidal anti-inflammatory drugs (eg ibuprofen), antipsychotics, antidepressants, steroids, and even amphetamines. Formulation of the proper combination and dosages varies among patients, and, more notably, in the same patient over time as the disease progresses.

Other therapies that can be tried in an effort to decrease narcotic use and increase functioning include physical therapy, TENS, biofeedback, and self-hypnosis. Epidural narcotics given by indwelling implanted catheters can drastically reduce the total narcotic requirement, with subsequent improved pain control and less sedation. Destruction of the offending peripheral nerves with alcohol or phenol block is also an effective way to decrease narcotic requirements, as long as nerves critical to patient functioning (eg the motor nerves involved in chewing, if the patient is still eating) are not destroyed.

Determining appropriate narcotic management for the cancer patient can be difficult. Short-acting narcotics taken on an as-needed basis frequently result in large doses being used and periods of time still occurring when the narcotic wears off and pain emerges. Two long-acting narcotics frequently employed in cancer pain management are sustained-release morphine (MS Contin) and methadone (pill or elixir), each of which can be started on a 12-hourly dosing regimen to achieve reasonably steady blood narcotic levels. When the cancer pain is so severe that rapid control is needed, continuous intravenous infusion of morphine or methadone can quickly achieve steady blood narcotic concentrations while an oral regimen is then begun. For patients unable to tolerate oral regimens, continuous subcutaneous narcotic infusions can be used at home, as can narcotic suppositories. Current research is evaluating the efficacy of transdermal narcotic patches.

Pain Management Techniques

No single method of treatment can relieve chronic pain. This can be frustrating for the patient and physician. In spite of more information being obtained in regard to pain problems, the diagnosis is frequently difficult or vague, and pain management techniques are often a matter of trial and error. Therefore, the multidisciplinary approach has been adopted by those in most pain control centers. As a general rule, noninvasive techniques, such as biofeedback and TENS, should be employed before resorting to surgical technique or narcotic analgesia.

The following represent the various methods currently in use for managing those with chronic pain:

Medications: analgesics, antidepressants, sedatives, topical agents.
Myoneural injections.
Nerve blocks: differential-diagnostic, therapeutic, neurolytic.
Stimulation-produced analgesia: transcutaneous electrical nerve stimulation (TENS), acupuncture.
Physical therapy.
Psychological techniques: behavior modification, biofeedback, relaxation therapy.
Treatment of acute herpes zoster and postherpetic neuralgia.

Medications

When drugs are included in a program for managing those with chronic pain, the minimum dose that produces the desired response, while avoiding side effects, must be used. This can be determined only by observation of its effect, including the patient's pain relief, function, and emotions. The results of administration of the first dose of any drug should be monitored, because not all patients react in the same way (Pflug and Bonica, 1977). The existence of the placebo response should remind the health care professional of the need for correct psychological management of the patient and for understanding the wide patient variation that exists.

Generally, drugs should not be the major emphasis of a management program for chronic pain patients. Anxiety and fear of acute pain are replaced by depression and despair in these patients. Psychosedatives such as diazepam (Valium) and narcotics that relieve acute pain are not appropriate in the management of chronic pain, because use of these drugs can prolong the symptoms and complicate therapy.

Abuse of analgesic medications is a prime factor in the maintenance of illness behavior in over 50 per cent of patients presenting with chronic pain syndromes to pain control centers (Black, 1975). A major improvement in the patient's condition can often be made by discontinuing the drugs already being taken. It is best to avoid the situation in which patients with chronic benign pain depend on drugs for pain control, because this creates a sense of helplessness as a result of reliance on external forces beyond their direct control. This often leads to patients engaging in manipulative behavior. Such patients frequent medical offices and demand prescriptions or visit hospital emergency rooms complaining of intractable pain that requires parenteral narcotics. In an effort to provide a sound foundation for the rational use of drugs in the management of chronic pain, a brief description of the more commonly used medications for the management of chronic facial pain is presented here.

Analgesics

In the management of chronic pain, a beneficial effect can be obtained by the clock-regulated use of analgesic drugs. Rather than letting the patient wait until the pain is severe before taking medication, medications should be taken punctually at fixed times so that preceding doses do not have time to wear off. Many practitioners believe that, once pain has been reduced, it is important to prevent its exacerbation. If the pain is allowed to return in full force, it can take more than one or two doses of medication to restore the benefits that have been lost. Additionally, when medication is prescribed on an as-needed basis (prn), the patient is often tempted to increase the medication consumption above the prescribed amount.

Nonsteroidal Anti-Inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are a heterogenous group of compounds that are often chemically unrelated, but that share certain therapeutic actions and side effects. The prototype for this group of drugs is aspirin.

The therapeutic activity of NSAIDs appears to depend on the inhibition of a defined biochemical pathway responsible for the biosynthesis of prostaglandins. Although the analgesic action of narcotic agonists occurs centrally, aspirin and NSAIDs mainly act peripherally (Lim et al, 1964). By preventing the synthesis and release of prostaglandins in inflammation, NSAIDs can desensitize pain receptors to mechanical stimulation or other mediators - therefore, NSAIDs tend to be ineffective as analgesics in noninflamed tissues, as shown by the Randall-Selitto test (Randall and Selitto, 1957). Results of a number of studies agree with the theory that NSAIDs drugs are effective only as analgesics in pathologic conditions or experimental models in which prostaglandins are synthesized locally. This also explains why NSAIDs are usually ineffective

against sharp pain (which is caused by direct stimulation of sensory nerves), but are effective in the relief of the dull pain of inflammation (when prostaglandins have apparently sensitized the peripheral nerve endings).

NSAIDs share several undesirable side effects. The most common problem is gastric or intestinal ulceration, which can be accompanied by a secondary anemia from the resultant blood loss. Gastrointestinal discomfort can be limited to dyspepsia (heartburn), or it can increase in severity to include the problems mentioned above. Use of buffering agents with NSAIDs cannot be relied on to reduce gastrointestinal upset, perhaps because of the systemic action of these drugs (De Kornfeld et al, 1962). Apparently this is not just the result of direct irritation of the gastric mucosa, because adverse gastrointestinal effects have been observed with the intravenous administration of NSAIDs. Prostaglandin inhibition in the gastric mucosa, leading to a functional hyperemia, appears to be the most likely mechanism. Of the members in this group, acetaminophen is probably least likely to cause gastric erosion and bleeding, but it has only weak anti-inflammatory properties.

Hypersensitivity to aspirin is a contraindication to therapy with most NSAIDs. Patients who are sensitive to aspirin react to all inhibitors of prostaglandin biosynthesis. Administration of any one of these drugs could provoke a life-threatening allergic reaction; hypersensitivity reactions are frequently serious, and deaths have occurred. It is the responsibility of the clinician to attempt identification of patients with hypersensitivity to NSAIDs by checking the prior drug history before recommending their use.

When the toxic level for NSAIDs is exceeded, either by cummulation or overdose, various signs and symptoms are seen. A mild toxic reaction - salicylism - is characterized by tinnitus, headache, nausea, vomiting, dizziness, and diminished vision. With higher blood levels of the drug a serious toxic crisis can result, leading to death by respiratory arrest.

NSAIDs are the drugs of choice for the relief of painful chronic musculoskeletal conditions in which inflammation is involved. Often, patients with an inflammatory component to their chronic pain are referred to a pain control center with intractable pain that is unresponsive to acetaminophen, propoxyphene, or pentazocine (or a combination), all of which are classified as analgesics. When such patients are switched from these drugs to agents noted for their anti-inflammatory ability, the intractable pain becomes manageable.

The most common NSAIDs drugs used for the treatment of pain are aspirin, acetaminophen, and ibuprofen.

Aspirin. Unfortunately, clinicians are accustomed to recommending aspirin in analgesic doses of 300 to 600 mg every 4 hours, as needed. This dose is ineffective for most adults in the management of pain caused by inflammation. In this category of pain, the anti-inflammatory properties of aspirin are highest at doses that are close to toxicity. This requires a blood level of 20 to 30 mg/dL, which usually means administration of three to five 325-mg tablets every 6 hours. In these doses side effects such as tinnitus and gastric irritation are more frequent. The

clinician must use good judgment in choosing low- or high-dose aspirin therapy. Often, the patient dose is a compromise in the range of three to six 325-mg tablets taken in four divided doses. Patients with gastric irritation problems can sometimes be helped with buffered aspirin; however, when using high-dose aspirin therapy, enteric-coated aspirin is not recommended because its absorption is erratic and stable blood levels are difficult to achieve.

Acetaminophen. Acetaminophen (Tylenol; Tempra; Datril; Anacin-3) is popularly regarded as an aspirin substitute for patients who cannot tolerate aspirin. Studies have demonstrated, however, that acetaminophen and aspirin are both equipotent and equianalgesic (Cooper et al, 1973). Acetaminophen has much less anti-inflammatory activity than aspirin and does not inhibit platelet aggregation, as does aspirin. The incidence of side effects is low, and patients tolerate acetaminophen well when compared with aspirin (Skjelbred and Album, 1977). Acetaminophen overdose represents a serious problem; it can cause hepatic necrosis and acute hepatic failure as a result of long-term use by chronic pain patients (Groarke et al, 1977). Additionally, patients with renal disease should avoid using this drug. The adult dose of acetaminophen ranges from 650 to 1000 mg every 6 to 8 hours.

Poisoning and death can occur from chronic abuse of acetaminophen. Chronic toxicity is usually associated with a high incidence of anemia, renal damage, and gastrointestinal disturbances, including peptic ulcer. Chronic acetaminophen use can lead to methemoglobinemia as a result of an accumulation of p-aminophenol, a metabolite of acetaminophen. Hepatic necrosis leading to hepatic coma can occur, particularly in individuals in whom the plasma half-life of acetaminophen exceeds 4 hours.

Ibuprofen. Ibuprofen (Motrin; Rufen; Advil; Nuprin) is a member of the phenylalkanoic acid derivative class. This new class of drugs appears to have analgesic and anti-inflammatory properties that are superior to those of aspirin and acetaminophen. Fortunately, the enhanced activity of this group is not associated with an increase in side effects. Platelet aggregation is impaired by ibuprofen, but bleeding times remain within normal limits (McIntyre et al, 1978).

Ibuprofen has been found to be effective in the management of acute pain. It was demonstrated to be approximately 3.5 times as potent as aspirin for the relief of pain following surgery for dental impactions (Cooper, 1981). A double-blind study compared the effectiveness of 400 and 800 mg of ibuprofen to 650 mg of aspirin, 65 mg of propoxyphene, and placebo for the management of postoperative oral surgical pain (Winter et al, 1959, 1978). The results revealed that both doses of ibuprofen were more effective in regard to the degree and duration of relief from pain. Long-term studies evaluating the effectiveness of ibuprofen in managing those suffering from chronic pain with an inflammatory component have not been completed, however, it seems to be effective for long-term pain management, and is presently used in many pain centers. The adult dose range for ibuprofen is 400 to 800 mg every 6 to 8 hours. The total daily dosage should not exceed 24,000 mg.

Other NSAIDs. In addition to ibuprofen, many new NSAIDs are now available. These include the indole derivatives - indomethacin (Indocin), sulindac (Clinoril), tolmetin (Tolectin),

naproxen (Naprosyn), fenoprofen (Nalfon), diflunisal (Dolobid), piroxicam (Feldene), and ketoprofen (Orudis). These drugs can be used as alternatives to aspirin, acetaminophen, ibuprofen, or some narcotic analgesics when these latter agents prove inadequate or are contraindicated. Unfortunately, the superiority of one NSAID over another has not yet been firmly established. Selection is usually based on the prescriber's experience with a particular agent's efficacy, dosage, and side effects in the treatment of a particular condition. Therefore, with each new NSAID that is used in a patient's pain program, the dose must be carefully and objectively titrated for maximum benefit. An additional consideration is that the cost of these newer agents can be from three to five times more than that of the same effective dose of aspirin, acetaminophen, or ibuprofen.

Narcotic Analgesics

Narcotics range from those with pure agonist actions (heroin) to these with pure antagonistic actions (naloxone). Between these extremes are many drugs with varying degrees of both agonist and antagonist actions. Agonist actions include analgesia, euphoria, stimulation of the chemoreceptor trigger zone (nausea, vomiting), and respiratory depression. Drugs with only partial agonist activity can also cause dysphoria and hallucinations.

The mode of action of narcotic agonists appear to be twofold. These drugs inhibit the release of acetylcholine from nerve endings, which is thought to account for the constipation seen with their use. This same mechanism appears to be responsible for many of the drug's central effects. Although the exact mechanism is unknown, analgesia appears to result from a depression of cholinergic transmission in certain critical areas of the central nervous system.

High-dose narcotic analgesics can produce coma or stupor. Respiratory depression becomes a liability with the use of the more potent narcotic agonists until patient tolerance has been established. Narcotics depress the sensitivity of the respiratory center to carbon dioxide, but not to hypoxia. Thus, in some circumstances, the administration of oxygen to a patient can result in apnea (Weil et al, 1975). Postural hypotension is one of the cardiocirculatory effects of the strong analgesics. This has been well documented for morphine and, to a lesser extent, for meperidine. In addition, the upper-dose range of these agents is also limited because of increasing sedation, dysphoria, nausea, and vomiting with increased dosage (Vandam, 1972, 1977).

When narcotics are indicated as part of a chronic pain management program, the clinician should try to use the longest acting agent orally on a regular schedule at a dose that provides sufficient relief. Narcotic therapy is often unsatisfactory because of improper choice of drug or improper administration. It is not unusual for a terminal cancer patient to be allowed to suffer pain because the physician is so afraid of the complications of dependence that a less than adequate dose is prescribed. Also, a patient might be given a narcotic (eg morphine) by one physician and a narcotic antagonist (eg butorphanol) by another. Another error involves prescribing short-acting agents to be taken at long time intervals. The patient keeps increasing the dose and thus suffers from side effects of this large dose shortly after administration while losing the analgesic effect before the next dose is due to be taken. The clinician should be

familiar with analgesic equipotencies and use long-acting drugs, such as morphine, methadone (Dolophine), and hydromorphine (Dilaudid), at appropriate doses and intervals (Table 2).

Table 2. Analgesic Equivalents for Control of Pain

Drug	Oral (mg)	Intramuscular (mg)
Codeine	100	60
Hydromorphone (Dilaudid)	4	2
Levorphanol (Levo-Dromoran)	2	1
Meperidine (Demerol)	150	50
Methadone (Dolophine)	10	5
Morphine	15	5
Oxycodone (Percodan; Tylox)	10	7.5
Oxymorphone (Numorphan)	5	1
Pentazocine (Talwin)	90	30.

The following is a brief review of only those narcotics that are frequently used in the management of the terminal patient with chronic pain. Short-acting narcotics are not discussed, because they are inappropriate for such patients.

Opium Alkaloids

Morphine. Morphine is the standard by which most analgesics are measured, and most narcotics behave in a similar fashion. The most powerful effects of morphine are on the central nervous system, and these result from a mixture of stimulant and depressant actions. Although central nervous system depression usually predominates, morphine is not an anticonvulsant; it often acts synergistically with convulsant drugs. Its depressant action on the cerebrum reduces the patient's ability to concentrate, impairing mental and physical performance. Normal fears and apprehension are diminished, and this gives rise to the condition known as euphoria. Various medullary centers are affected. The respiratory center is depressed and becomes less sensitive to the stimulant effects of carbon dioxide, leading to respiratory arrest in cases of overdosage. The cough center is also depressed. In contrast, the chemoreceptor emetic trigger zone and the parasympathetic portion of the oculomotor nucleus are stimulated. This leads to nausea in up to 50 per cent of ambulatory patients, with vomiting observed in approximately 15 per cent. Nausea and vomiting are less common in patients who are at rest and who receive morphine when pain is already present.

The pupils are constricted by the effect on the oculomotor nucleus. In cases of morphine overdose, the pupils can be pinpoints in size.

Analgesic doses of morphine cause constipation by reducing gastrointestinal secretions and motility. Morphine can produce urine retention by increasing the smooth muscle tone of the

urinary tract, and it also has an antidiuretic effect by stimulating the release of antidiuretic hormone of the pituitary.

Morphine causes cerebral vasodilation, which appears to be secondary to respiratory depression. This results in an increase in intracranial and spinal fluid pressures. Consequently, morphine should not be used in patients with head injuries or in whom increased intracranial pressure might be present. High doses of morphine can lead to central nervous system convulsions and stimulation of the vagus (hypotension and bradycardia), in addition to respiratory arrest (see above).

Morphine should not be administered to patients with severe liver or kidney disease unless the dosage has been decreased and titrated. The liver is primarily responsible for the conjugation of morphine. Severe liver damage decreases the proportion of conjugated to free morphine detectable in the urine. Because about 90 per cent of morphine is eliminated by the kidneys in its conjugated form, severe renal disease would limit the patient's rate of drug elimination, allowing for inadvertent toxicity or overdose.

When addiction has been established, denial or morphine produces a withdrawal syndrome within 15 to 20 hours, with a peak in 2 to 3 days and remission in 10 to 14 days. This syndrome can be brought on almost immediately by the administration of narcotic antagonists. Symptoms of withdrawal range from depression to delirium, and can include yawning, lacrimation, perspiration, dilated pupils, anorexia, irritability, tremor, nausea, abdominal cramps, tachycardia, and increased blood pressure.

The principal use of morphine continues to be control of moderate to severe pain. Although morphine is absorbed orally, only about two-thirds of the oral dose reaches the systemic circulation. The oral route is primarily used for the control of chronic oncologic pain. Oral MS Contin, a slow-release tablet form of morphine, is available in 30-mg pills and generally provides analgesia for 8 to 12 hours. Starting doses would be about 30 mg every 12 hours. Morphine tablets or elixir at starting doses of 10 to 30 mg provide more rapid pain relief, but of shorter duration (2 to 6 hours). If the patient cannot take morphine orally, the starting parenteral dose is 0.1 to 0.25 mg/kg body weight. Although the probable optimal parenteral adult dose of morphine for a 70-kg patient is 10 mg for acute pain, there is no optimal dose for chronic pain. The drug is titrated until results are obtained. The duration of morphine's action with an optimal dose has been estimated at 5.4 hours against "moderate" pain and 4.6 hours against "severe" pain (Gravestein and Beecher, 1957). For those with severe chronic pain, oral doses of 100 to 150 mg morphine every 4 hours are frequently given.

Codeine Phosphate. Codeine is one of the primary alkaloids found in natural opium. The actions of codeine are weaker than those of morphine. Thus, codeine is less likely to produce constipation, nausea, or vomiting. Codeine has a minimal sedative action and, with increased doses, can even cause excitement. Codeine is an intermediate narcotic analgesic that generally does not produce respiratory paralysis, even in high doses. The demethylation of codeine yields either morphine or norcodeine. It has been suggested that the analgesic action of codeine is

primarily a result of this production of morphine during degradation (Way and Adler, 1960). Codeine is generally not recommended for the management of those with chronic pain.

Semisynthetic Narcotic Derivatives

Dihydromorphinone. Dihydromorphinone (Dilaudid) is a more potent analgesic than morphine; it is of shorter duration and does not induce nausea as readily. It has a rapid onset, either orally or parenterally. Initially, the usual adult dose is 20 to 40 mg/kg body weight, which can be given every 4 to 6 hours. As a result of excellent uptake of the drug by the oral route, the oral and parenteral doses are considered to be equally effective.

Oxycodone. Oxycodone (Percocet-S; Percodan; Tylox) is a semisynthetic narcotic with actions similar to those of codeine. It provides analgesia and sedation for moderate pain relief. Oxycodone is similar to codeine and methadone in that it retains at least 50 per cent of its analgesic activity when administered orally. Oxycodone is more potent and more addicting than codeine, however, but produces similar side effects.

Oxycodone is given orally at a dose of 5 mg every 6 hours for pain relief. In the US, Oxycodone is usually found compounded with other drugs to enhance its analgesic action. Popular commercial combinations for compounding include acetaminophen and aspirin. Although there is little doubt that these combination products do alleviate most mild to moderate pain, any advantage over the use of single-entity preparations has not been established. Oxycodone is generally not recommended for the management of chronic pain.

Synthetic Narcotics. Methadone (Dolophine) is chemically distinct from the natural opiates and the meperidine type of synthetics. It is closely related chemically to the nonnarcotic analgesic propoxyphene, but these drugs share few pharmacologic properties of importance. Methadone is similar to morphine in potency, but has only about 25 per cent of morphine's sedative action, producing minimal euphoria. In equianalgesic doses methadone produces less depression of respiration, has less of a spasmogenic effect on smooth muscle, and causes less stimulation of nausea. Marked tolerance to methadone, plus sedative and respiratory depressant actions, have been observed in humans. Methadone is therefore used to prevent and alleviate the opiate withdrawal syndrome in narcotic addicts. Withdrawal from methadone appears to be accomplished more easily than withdrawal from morphine.

Methadone can be used for the treatment of those with severe chronic pain. The initial daily analgesic dose for methadone is 0.7 mg/kg body weight, given in divided doses every 4 to 6 hours. Methadone is effective when given orally, subcutaneously, or intramuscularly. The drug is not recommended for intravenous administration because of its effect of severe respiratory depression.

Benzomorphans: Agonist-Antagonist Agents. The narcotic antagonist nalorphine, a benzomorphan, has been demonstrated to have analgesic properties (Lasagna and Beecher, 1954). Shortly after the analgesic properties of nalorphine were discovered, a series of totally synthetic

antinarcotic agents with the same benzomorphan nucleus were produced. The motivation behind this research was the creation of a strong analgesic that would be free of addicting properties and of the effects of respiratory depression, constipation, and urinary retention. Several members of this group have currently gained clinical acceptance, mainly pentazocine, butorphanol, and nalbuphine.

Pentazocine. Pentazocine (Talwin) was introduced to the US in 1967 as a potent synthetic analgesic that is chemically related to the opiates. Although pentazocine is regarded as a nonnarcotic drug, it is addicting and can be abused. It should be prescribed with the same care and concern as narcotics.

Pentazocine (20 to 30 mg) has effects equivalent to those of morphine (10 mg) or meperidine (50 to 100 mg); however, it has less respiratory depressant effect on a dose-equivalent basis (Engineer and Jennett, 1972). Side effects include sedation, dizziness, nausea, sweating, and dysphoria. Pentazocine is not considered to be as effective parenterally as morphine or meperidine (Kolliker, 1972; Miller, 1975).

Butorphanol. Like pentazocine, butorphanol (Stadol) is a synthetic narcotic agonist-antagonist. Butorphanol in 2-mg doses has an analgesic potency equivalent to that of 10 mg of morphine and depresses respiration the same as 10 mg of morphine. Butorphanol has many of the same clinical agonist-antagonist properties as pentazocine. Because of its antagonist properties, however, it is not recommended for patients who are physically addicted to narcotics.

Research on those with severe chronic pain has shown that parenteral butorphanol in doses of 2 to 4 mg at an average interval of 6 hours provides satisfactory relief for most patients (Kliman et al, 1977).

Nalbuphine. Like pentazocine, nalbuphine (Nubain) is a synthetic narcotic agonist-antagonist. Nalbuphine has an analgesic potency equivalent to that of morphine on a milligram-to-milligram basis. The narcotic antagonist activity of nalbuphine is as potent as that of nalorphine. Nalbuphine has many of the same clinical agonist-antagonist properties as pentazocine. Nalbuphine is available only in parenteral form in a concentration of 10 mg/mL. The recommended maximum single dose is 10 mg.

Nonnarcotic Agent with Narcotic Structure. Propoxyphene (Darvon; Darvocet-N) is structurally related to methadone. It produces analgesia by actions on the central nervous system that are qualitatively similar to the actions of codeine. It has no anti-inflammatory or antipyretic effects and is compounded with aspirin or acetaminophen for the relief of mild to moderate pain.

A dose of 65 mg of the hydrochloride or 100 mg of the napsylate is regarded as equianalgesic with 325 to 500 mg of aspirin. Propoxyphene is often abused by the chronic pain patient. Chronic consumption of over 800 mg daily has been associated with psychosis and convulsions. An acute overdose produces respiratory depression, which can be treated with naloxone.

Antidepressants

Chronic pain can be a major cause of depression. Once a chronic pain-depression cycle has started, the patient's depression can lower the pain threshold and slow the response to chronic pain management. Depression is evidenced by various symptoms: insomnia, anorexia, decreased libido, inability to concentrate, delusions of guilt, and thoughts of suicide or death. The patient often exhibits a desire to be alone, a lack of interest in activities, neglect of personal hygiene, and a decrease in job performance. Folic acid or pyridoxine deficiency and low thyroid function can also contribute to depression.

Antidepressants are commonly used in pain control centers. Unfortunately, few objective studies have documented the efficacy of these drugs in chronic pain management. Most tricyclics require about 2 to 3 weeks to achieve their maximum clinical effect. The most popular tricyclics, amitriptyline and doxepin, have sedative effects and usually the complete or largest dose is given at bedtime. This sedative effect, leading to a good sleep pattern, is a major benefit of these two agents.

The most common side effects of the tricyclics are dry mouth and urinary hesitancy. The most serious side effects are tachyarrhythmias and the reversal of the effects of certain antihypertensive drugs. Tricyclics should not be administered with monoamine oxidase inhibitors because of their combined adverse effect on adrenergic transmitters.

Although the precise mechanism of action of the tricyclic antidepressants is unknown, it appears that these agents restore normal levels of neurotransmitters by blocking the reuptake of these substances from the synapse in the central nervous system. Evidence has shown that the secondary amine tricyclic antidepressants (imipramine and desipramine) might have a more potent effect on blocking the reuptake of norepinephrine, and that tertiary amine tricyclic antidepressants (amitriptyline and doxepin) might have a greater effect on serotonin reuptake.

Lascelles was one of the first researchers to note that chronic headache and facial pain might be relieved with the use of antidepressants (Lascelles, 1966). Others have noted that amitriptyline could have an analgesic effect that is independent of its antidepressant action (Lance and Curran, 1964). It has been suggested that the tricyclic antidepressants interfere in some way with the synaptic mechanisms responsible for processing information relating to nociception; thus, they could be considered to be analgesic agents in a restricted sense - "nonanalgesic analgesics".

The major tricyclic agents in current use are compared in Table 3.

Various antidepressants are most commonly prescribed when pain is prolonged, constant, of low intensity, and combined with depression. These include amitriptyline (Elavil; Endep), doxepin (Sinequan; Adapin), imipramine (Tofranil), and desipramine (Norpramine). The clinician should exercise caution with these agents; if any questions or problems arise concerning their use, a psychiatrist should be consulted. In most pain control centers patients are screened by a psychiatry-psychology group of specialists during the initial evaluation so that, when tricyclic

agents are used, there is no loss in continuity of patient care or safety.

Table 3. Comparison of Tricyclic Agents

Agent	Noradr Reuptake	Serotonin Reuptake	Sedative Effects	Anti-Ach Effects	Half-life (hour)
Amitriptyline	No	Yes	Strong	Strong	10-50
Amoxapine	Yes	No	Moderate	Mild	8-30
Clomipramine	No	Yes	Moderate	Moderate	12-36
Desipramine	Yes	No	Mild	Mild	25-50
Doxepin	No	Yes	Strong	Strong	8-25
Imipramine	Yes	Yes	Moderate	Moderate	6-20
Nortriptyline	Yes	Yes	Mild	Moderate	18-93
Protriptyline	Yes	No	Mild	Strong	54-198
Trimipramine	Yes	No	Strong	Strong	9-11.

Muscle Relaxants

Muscle relaxants can be important in the pharmacotherapy of chronic pain management. These drugs cause skeletal muscle relaxation without loss of consciousness as a result of a selective action in the central nervous system and do not have a direct effect on the muscles. There are many types of muscle relaxants. When prescribing muscle relaxants the physician should be as conservative as possible and choose those that have minimal side effects. The following drugs represent muscle relaxants that are currently available.

Carisoprodol (Soma) has a rapid onset of action, and its effects last for 4 to 6 hours. The commercial combination of carisoprodol with phenacetin, caffeine, and codeine is not recommended for long-term use in the chronic pain patient.

Methocarbamol (Robaxin) is commercially available combined with aspirin for the management of muscle spasm and inflammation associated with some forms of myofascial pain.

Despite its tricyclic nucleus, cyclobenzaprine (Flexeril) does not possess antidepressant actions. It can be used in the short-term management of severe musculoskeletal pain to break the cycle.

The use of diazepam in the management of a multitude of acute and chronic problems has been well documented. This benzodiazepine agent should be used cautiously and it is not recommended that it be used for more than 2 or 3 weeks.

Orphenadrine (Norflex) has an antihistamine structure similar to that of diphenhydramine (Benadryl).

Chlorzoxazone is combined with acetaminophen (Parafon Forte) to manage pain associated with musculoskeletal disorders. The low incidence of drowsiness reported with the use of this drug indicates that it can safely be given to patients who must remain alert (Asoury, 1979).

Sedatives and Antipsychotics

Research has indicated that sedatives and antipsychotics can assist in the control of pain. These drugs can be useful in the treatment of pain from neoplasms by helping the patient to deal with anxiety and fear. With chronic pain from nonprogressive lesions, however, such as in the thalamic syndrome, the phenothiazines have been shown to be beneficial without the patient having notable evidence of anxiety.

Phenothiazines. The clinician should exercise care in prescribing phenothiazines, because this class of drugs can cause depression and parkinsonism simultaneously. Liver function should be monitored when these drugs are prescribed.

Fluphenazine (Prolixin), chlorpromazine (Thorazine), and promethazine (Phenergan) have all been used successfully in the management of chronic pain.

Butyrophenones. Haloperidol (Haldol), a member of the butyrophenone class of major psychosedatives, has been used with success to manage certain intractable facial pain conditions (in addition to the management of psychotic disorders). Care should be taken to warn patients of the multiple side effects associated with the use of haloperidol, including extrapyramidal reactions, tardive dyskinesia, tachycardia, and hypotension.

Benzodiazepines. Members of the benzodiazepine class of drugs are generally not indicated for long-term use in patients with chronic pain because of problems with alteration in sleep pattern and development of tolerance and dependence.

Hypnotics

The patient's history should reveal the nature and seriousness of any sleep disturbance. Depressed patients tend to fall asleep easily, but awaken later in the morning feeling exhausted. These patients complain of being awakened by pain or noise.

An important aspect in dealing with the symptomatic relief of sleep disturbances is that insomnia is not simply difficulty with sleep or insufficient sleep. Most insomniac patients feel that the quality of their life, as reflected in their ability to work and interact effectively, is seriously compromised by their sleep difficulties. Thus, in treating chronic pain patients with insomnia, the clinician must deal with the patient's daytime functioning and nocturnal sleep habits. Many patients with chronic pain are found to have a basic disturbance in their circadian rhythms. Structured daytime activities should be encouraged and documented by a daily pain management diary, which includes the amount of pain relief, amount of medication taken, functional activities, and the emotional sphere. Patients should be kept out of bed during the day

and even sedentary habits, such as television watching, should be discouraged.

When indicated, sleep-inducing agents should be used that allow a "natural" sleep. Preferably, the rapid eye movement phase of sleep should not be affected, and the patient should not awaken in the morning obtunded or with a hangover feeling. Chloral hydrate and diphenhydramine are two popular drugs that provide gentle sleep induction.

Anticonvulsants for Central Pain Management

Chronic pain is not only the result of peripheral tissue injury. Lesions within the central nervous system can lead to pain that is as severe as that caused by peripheral noxious input. Central pain often persists after complete deafferentation of the region in which the pain is perceived. Tic douloureux is unique among central pain states because of its responsiveness to neurolytic procedures. Central pain is often associated with diseases or injuries that directly affect the neurons and their processes, and synapses. Postherpetic neuralgia is caused by a viral infection of the skin and dorsal root ganglia. The thalamic syndrome follows a vascular lesion in the ventrolateral thalamus. Unfortunately, the etiology of tic douloureux and atypical facial pain is unexplained.

Certain central pain states respond to anticonvulsant medications, such as diphenylhydantoin (Dilantin) and carbamazepine (Tegretol). Types of pain that have been found to have a favorable response to these medications include explosive onset, abrupt termination, and electric shock-type pain. Patients who describe their pain as constant and burning, however, are not as likely to obtain relief with diphenylhydantoin and carbamazepine. For such patients, the combination of the psychoactive drugs amitriptyline (Elavil) and fluphenazine (Prolixin) can be beneficial. One mechanism proposed for constant, burning pain appears to be the equivalent of a focal cortical epilepsy occurring in the cutaneous sensory nervous system.

The constant form of central pain seems to represent a sequela of injury to afferent somatic or visceral nerves that results in the reduction or elimination of sensory input. This syndrome can develop immediately or weeks after the initial insult or infection. Once the pain begins, it persists for a long period, and does not fluctuate greatly in severity. Commonly, the patient describes the pain as burning, crawling, itching, or aching. The pain is usually perceived over wide areas of the body. Causalgia, reflex sympathetic dystrophy, and postherpetic pain are unique in this group, because they also respond to sympathetic nerve blocks.

Migraine Prevention - Abortive Therapy

Vascular headaches of the migraine type include the classic, common, and cluster varieties. These are presumed to be related to changes in the caliber of vessels supplying the meninges and brain (Dalession, 1974). The prodromal period is accompanied by vasoconstriction. This changes to vasodilation with the onset of headache. With the release of histamine from the wall of the vessel, the vessel wall develops edema and results in prolonged vasodilatation.

The prodrome of classic migraine includes sharply defined transitory sensory or motor disturbances, such as scotoma or visual defects. In common migraine these prodromal effects are absent. With common migraine headaches the pain that develops is pulsating, hemicranial, and of several days' duration. Severe autonomic disturbances are often observed, including nausea, vomiting and diarrhea. Cluster headaches occur more frequently than classic or common migraine headaches. The cluster duration is also longer, 5 to 14 days. Cluster headache is usually accompanied by rhinorrhea, lacrimation, and visual disturbances. Therapy for this group of headaches is directed toward producing vasoconstriction in the affected vessels (Diamond and Dalession, 1978).

A number of medications have been found to be useful in the prophylaxis and treatment of migraine headaches.

Ergot Derivatives. Ergot is produced by certain parasitic fungi that grow on rye and other grains. In 1918 Stole succeeded in isolating the active alkaloid constituent of ergot, ergotamine. Ergot derivatives can be used in the management of acute migraine attacks. The typical adult dose is 1 mg of ergot (one tablet) immediately at the onset of the headache and one tablet every 30 minutes, up to a maximum of 6 mg ergot per attack.

Ergot is often found compounded with other headache relievers. The most common combination is ergot with caffeine. Caffeine is presumed to have a cerebral vasoconstrictor effect that reduces cerebral blood flow, and it has a synergistic effect when combined with ergot. Belladonna alkaloids are also combined with ergot to provide relief for those suffering from migraine-induced nausea and vomiting. When severe nausea and vomiting prevent the oral ingestion of medication, ergot preparations are available as rectal suppositories and nasal sprays.

Propranolol. Chance appears to have led to the discovery of propranolol (Inderal) as a drug useful for the prophylaxis of migraine. Rabkin and associates (1966) observed the disappearance of coexistent migraine headaches in a patient with heart disease treated with propranolol. It is thought that the beta-adrenergic receptor blockade in cranial arteries does not allow vasodilatation, which is considered to be the main pain-inducing event in migraine. Care should be taken when using propranolol, because it can have serious side effects. The initial daily starting dosage is 80 mg, given in divided doses. The usual effective daily dosage range is 160 to 240 mg. The dosage should be gradually increased to achieve optimal migraine prophylaxis. Propranolol therapy should be discontinued in 6 weeks if satisfactory results have not been obtained. It is suggested decreasing or stopping this drug should be done gradually over a 2-week period.

Nadolol. Nadolol (Corgard) is the only other beta blocker suggested to be useful in the treatment of migraine. The side effects of this drug are similar to those of propranolol. In addition, patients with chronic pain receiving nadolol should be observed for increasing signs of depression. The initial daily adult dosage of nadolol is 40 mg for the prevention of migraine. This can be gradually increased. It is usually not necessary to exceed 160 mg per day. If, after 6 weeks, the response is not satisfactory, the drug should be gradually stopped.

Methysergide. Methysergide (Sansert) inhibits the effects of serotonin, a substance that has been suggested as mediating vascular headaches. Methysergide is used for the prevention or reduction of intensity and frequency of vascular headaches. The usual daily adult dosage is 4 to 8 mg. If, after a 3-week trial, its efficacy has not been demonstrated, the drug should be discontinued. Continuous administration should not exceed 6 months. There must be a drug-free interval of 3 to 4 weeks after each 6-month course of treatment, because retroperitoneal fibrosis, pleuropulmonary fibrosis, and fibrotic thickening of cardiac valves can occur with long-term therapy. The dosage should be gradually reduced during the last 2 to 3 weeks of each treatment course to avoid rebound of headache.

Lithium Carbonate. Lithium can be used for the management of manic episodes of manic-depressive illness, and also in the prevention of attacks of cluster headache (Ekbom, 1981). Treatment with lithium is an alternative in therapy-resistant chronic cases of cluster headache. The initial adult dose of lithium carbonate is 300 mg bid. Serum blood levels of lithium must be checked; regularly an optimal serum concentration is from 0.4 to 1.2 mEq/L. Unfortunately, lithium toxicity is closely related to serum lithium levels, and can occur at doses close to therapeutic levels. Adverse reactions are seldom encountered at serum levels below 1.5 mEq/L. Patients should be warned to discontinue lithium if signs of toxicity appear, such as diarrhea, vomiting, tremor, mild ataxia, drowsiness, or muscular weakness. Duration of treatment is typically 16 to 24 weeks.

Tricyclic Antidepressants. The headache-prone patient tends to be depressed, anxious, or both. Tricyclic antidepressants have been well documented to be effective in controlling many types of headache in depressed patients.

Placebo Effect

The placebo effect is a response that results from a patient's understanding of and emotional response to the administration of any treatment. Because all conscious patients think and feel when they are undergoing treatment, the placebo effect can occur in normal and abnormal patients, and with pharmacologically active or inert substances.

A most important factor in the patient's understanding of an emotional reaction to a medication is usually what the clinician conveys, explicitly or implicitly. The placebo effect can be used positively to influence patients who are trying to gain some control over their chronic pain condition. A negative placebo effect has been demonstrated, however, such as when patients in double-blind trials were given pharmacologically active agents that the clinician thought would be of minimal benefit. In these instances, patients generally reported less than expected pain management.

On the average, about 35 per cent of patients are significantly influenced by the placebo effect. Failure to use and appreciate this phenomenon diminishes a physician's clinical effectiveness, no matter what agents are used. This favorable response generally fades with time, however. Only if the medication stands the test of time should it be considered effective.

Topical Agents

If intraoral pain is localized and the mucosa is responsive to topical management, oral topical pain relief can be provided. Toxic concentrations of local anesthetics can be reached, however, with the use of topical agents. Patients with ester local anesthetic sensitivity should not receive topical formulations containing ester local anesthetics. Some common formulations for oral pain relief are the following:

1. Lidocaine 2 per cent, viscous, 10 to 20 mL.

2. Diphenhydramine (Benadryl) elixir 10 mL, viscous 2 per cent lidocaine 5 mL, and antacid suspension of choice 5 to 10 mL (note that each 5 mL of diphenhydramine elixir contains 12.5 mg of diphenhydramine with 14 per cent alcohol).

3. Diphenhydramine elixir, 10 mL, with Kaopectate, 10 mL.

4. Dyclonine (Dyclone), 0.5 per cent, spray or gargle.

5. Benzocaine 14 per cent, butyl aminobenzoate 2 per cent, tetracaine 2 per cent, benzalkonium chloride 0.5 per cent, and cetyl dimethylethyl ammonium bromide 0.005 per cent (Cetacaine) - spray, ointment, or gel.

6. Acetaminophen with codeine elixir ("swish and swallow"); each 5 mL of elixir contains codeine phosphate 12 mg and acetaminophen 120 mg.

These formulations are generally used every 4 to 6 hours and before meals. Topical sprays should be limited to a 2-second application. Cetacaine should not be used on large, denuded tissue areas.

Myoneural Injection

The use of myoneural junction (trigger point) injection in the management of chronic myofascial pain has been discussed (see above). This therapy is discussed at length because of the controversy that now surrounds its use.

Equipment

The syringe chosen should hold the expected volume to be injected and should allow for easy aspiration. Aspiration in the head and neck region can result in the injection of cerebrospinal fluid, blood, or air if the needle is misplaced.

Many find the ring-aspirating syringe to be the safest and most reliable syringe for myoneural injection. The dental aspirating ring syringe is acceptable for myoneural injection if a plain solution of local anesthetic not exceeding an injected volume of 1.8 mL is anticipated.

Diagnostic injections can be performed with the standard local anesthetic solutions found in the 1.8-mL dental cartridge. However, these full-strength solutions are not recommended for repeat injection to the same region because of the potential for tissue irritation associated with the standard local anesthetic-strength solution. More popular is the 10-mL three-ring disposable plastic aspirating syringe, which allows for adequate volume and mixing of the agents. Many compound their agents in the syringe to lower the local anesthetic concentration and to decrease the potential for tissue irritation.

Although not in common use, jet injector devices have been used for myoneural injections (Lewitt, 1979). These are thought to be less traumatic to the tissue because the use of needles is avoided, but it is difficult to penetrate the muscle to the precise myoneural junction depth with use of the jet injector.

For strength, ease of insertion, ability to aspirate, and lack of deflection the disposable 25-gauge needle is popular for myoneural injections. The 5/8- and 1-inch needles are useful for superficial injections. The 1.5- and 2-inch needles are long enough to reach the deeper myoneural junctions. The practitioner should limit the use of each needle to one injection.

Agents

Agents from multidose vials containing alcohol or paraben compounds should not be used for myoneural injections because of their potential for tissue irritation and because, when used with steroid compounds, they can produce flocculation of the steroid. Additionally, 1.8-mL dental cartridges containing methylparaben should not be used. Myotoxicity of the antiseptic and preservative additives varies, depending on the volume and concentration of the agent injected into the muscle.

Local Anesthetics. The choice of local anesthetic solution for use in myoneural block injections is mainly on an individual basis, with no single agent or combination having been shown to be ideal. The use of the ester-linked local anesthetic procaine has long been advocated by Travell and Simons (1983) for myoneural injections. Because the use of the ester forms has shown an increased incidence of sensitivity reactions over the amide forms, many prefer to use the amides. Amide-linked local anesthetics commonly used for myoneural injections include lidocaine, mepivacaine, bupivacaine, and etidocaine.

There is much controversy over the concept of damage to tissue at the injection site using clinically effective concentrations of local anesthetics and vasoconstrictors. In some studies no damage to muscle was reported (Jurgens, 1955; Mannheimer et al, 1954; Margolis, 1953). Other studies reported various effects on muscle, ranging from edema to necrosis (Brun, 1959; Libelius et al, 1970; Maykur and Ryan, 1953; Long, 1973; Pizzolato and Mannheimer, 1961; Sokoll et al, 1968). Other studies have indicated that there is rapid muscle necrosis after injection of local anesthetic, followed by complete regeneration within 4 weeks after drug exposure (Benoit and Belt, 1970; Bloede and McCreery, 1975; Hall-Craggs, 1974). When using both a local anesthetic and epinephrine, there appears to be a more than additive effect in regard to muscle damage. The

muscle damage increases further as the concentration of epinephrine increases (Benoit, 1978; Yagiela, 1982).

Although reports agree on the resolution of necrotic lesions and the regeneration of new muscle fiber after local anesthetic exposure, severe muscle destruction can be induced by single or repeated intramuscular injections of myotoxic concentrations of local anesthetics, leading to permanent microscarring of the affected tissue (Benoit, 1978; Foster and Carlson, 1980).

To decrease Myotoxicity when administering myoneural injections, one to two approaches can be taken. The concentration of the local anesthetic can be diluted with preservative-free 0.9 per cent normal saline solution, or two local anesthetic agents can be compounded to decrease the local anesthetic concentration of each and to permit their therapeutic effects to be maximized. Travell and Simons (1987) recommended diluting the concentration of procaine from the 2 per cent concentration, which is available from the manufacturer, to 0.5 per cent with normal saline. Similarly, many use normal saline to dilute amide-linked local anesthetics to the following concentrations: lidocaine, 0.5 per cent; mepivacaine, 0.5 per cent; bupivacaine, 0.25 to 0.375 per cent; and etidocaine, 0.25 to 0.5 per cent.

Lidocaine or mepivacaine can be combined with bupivacaine in a 50:50 mixture. This allows for a rapid block onset because of the lidocaine or mepivacaine and for a prolonged duration because of the bupivacaine. The combination is especially useful in somatic peripheral nerve blocks. A more commonly used mixture for myoneural injections is 0.75 per cent bupivacaine and 1.0 per cent etidocaine in a 50:50 combination. The etidocaine allows for rapid block onset in addition to prolonged motor fiber blockade (efferent fiber block). The bupivacaine provides for prolonged sensory fiber block (afferent fiber block).

Steroids. Various steroids can be used in combination with local anesthetic agents, including 4 mg dexamethasone, 25 mg hydrocortisone, or 6 mg betamethasone sodium phosphate-betamethasone acetate suspension/10 mL local anesthetic solution. In addition to the usual medical precautions involving the use of steroids, patients can experience euphoria, insomnia, and mood swings with the repeated use of parenteral steroids.

The injection of long-acting steroids is controversial, because some evidence has shown that parenteral steroids can be destructive to muscle fibers and irritating to nerves (Gottlieb and Riskin, 1980). However, Raj (1986) has reported the use of dexamethasone 4 mg/10 mL of a 0.375 per cent bupivacaine and 0.5 per cent etidocaine solution in more than 10,000 patients receiving myoneural injection therapy. No sequelae from the use of this combination of local anesthetic and steroid were noted.

Patients might experience a burning sensation in the area of injection for 24 to 48 hours after injection of steroid solution. This subsides, however, and improved pain relief begins 5 to 10 days after injection.

Sarapin. Sarapin has been used parenterally for the management of myofascial pain since the 1930s. It came on the market prior to 1938, allowing it to be "grand-fathered" by the Food and Drug Administration (FDA). It is one of the few agents that the FDA allows to be listed as nontoxic, and as having no side effects. The drug is an aqueous distillate of *Sarracenia purpurea,* the pitcher plant. The active ingredient of the extract is thought to be ammonium sulfate. The manufacturer indicates that Sarapin is used in local injection therapy for the relief of pain of neuromuscular or neuralgic origin.

Typically, sarapin is compounded with a local anesthetic prior to myoneural injection. Studies documenting the clinical efficacy of Sarapin are limited, and some are several decades old (Bates, 1939, 1943; Bates and Judovich, 1942; Roppel and Mitchel, 1975). Much of the original work was done by Bates and Judovich (1942). Their studies indicated that the pitcher plant extract relieved somatic but not visceral or sympathetic pain. Their experiments demonstrated no analgesic or anesthetic properties. Sarapin produces no motor weakness, loss of touch, or reflex changes. Those who use Sarapin for therapeutic myoneural injections should exercise caution to avoid central neural blockade, because it contains 0.75 per cent benzyl alcohol.

Alcohol. The injection of alcohol to interrupt pain pathways for a prolonged period of time has been practiced for many years. The goal of such injections is to destroy specific nerve fibers, producing long-term results. Injections of 95 per cent and absolute alcohol destroy sympathetic, sensory, and motor components of a mixed somatic nerve, 75 per cent alcohol primarily affect sensory and sympathetic nerve fibers, and 50 per cent alcohol primarily affects sympathetic fibers (Judovich, 1935).

When alcohol is indicated for myoneural injection therapy to achieve a prolonged response, absolute ethyl alcohol is most commonly combined with 0.75 per cent bupivacaine in a 50:50 mixture, because the injection of alcohol without the local anesthetic can be painful.

In addition to the usual myoneural injection precautions, precautions should be taken to clear the needle with a small amount of nonalcohol-containing solution prior to removing the needle. This helps to prevent the formation of a fistulous tract by the alcohol.

The use of alcohol to obtain a prolonged block can have a potentially serious side effect, alcoholic neuritis. During the period of nerve regeneration after the block, hyperesthesia and intense burning and/or sharp shooting pains can occur. These pains can be so severe that they can be worse than the original pain. Fortunately, such symptoms usually subside within 2 to 8 weeks. Because of these side effects, however, the use of alcohol for injections is generally limited to the terminally ill or elderly patients suffering from severe intractable pain.

Side Effects and Cautions

Myoneural injection therapy is a relatively benign treatment, as long as precautions are taken to ensure that an overdose of local anesthetic agent is not administered and that

intravascular or spinal injection is avoided. As with any injection of local anesthetic, rigid standards of preinjection, intrainjection, and postinjection patient care must be maintained. Failure to assess the patient's medical history adequately, use appropriate medication selection and dosage, follow accepted standards of aspiration and injection, and monitor the patient can result in patient compromise.

Nerve Blocks

Nerve blocks are effective for the relief of those with acute pain problems. For those with chronic pain problems, they can be used in the following situations:

Sympathetic nerve blocks: reflex sympathetic dystrophies can be diagnosed and treated.

Somatic nerve blocks: these are diagnostically useful to ascertain the existence of a nociceptive stimulus and its pathway.

If neurolytic blockade or destruction is being considered, the benefits of relief from pain must be weighed against the possibilities of motor paresis, postinjection neuritis, and anesthesia dolorosa. Alcohol, phenol, surgical, and radio-frequency destruction are the usual methods of afferent neural interruption. Also, cryoanalgesia - freezing of the nerve - has been introduced as a neurolytic procedure.

Surgical sectioning of peripheral nerves, including the sensory branches of the trigeminal nerve, is used only as a last resort, because the patient will experience anesthesia in addition to analgesia along the distribution of the nerve. Surgical nerve sectioning should be preceded by a local anesthetic nerve block so that the patient can assess the sensation of complete anesthesia before consenting to the operation.

When chronic head and neck pain is diagnosed as being transmitted by the sympathetic nervous system, the stellate ganglion is normally the sympathetic ganglion involved. Neuroablative procedures can be performed on the stellate ganglion in such patients for the relief of terminal or crippling chronic autonomic pain.

The techniques for nerve blockade are discussed elsewhere in this text.

Stimulation-Produced Analgesia

Stimulation-produced analgesia is currently in wide use for the modulation of pain. It presumably acts through the release of analgesic peptides (endorphins and enkephalins) that are produced in the brain and associated structures. Subsequent binding occurs between these opiate-like endogenous peptides and the substantia gelatinosa of the dorsolateral funiculus, resulting in a degree of analgesia. Studies on these endogenous analgesics have shown their clinical relation to the opiates, because endorphin and enkephalin analgesia can also be reversed with the administration of naloxone.

Transcutaneous electrical nerve stimulators and acupuncture both produce a sensation that is believed to be responsible for suppressing the appreciation of pain by the central nervous system. This form of therapy is effective in approximately 30 to 40 per cent of chronic pain patients, the degree of pain relief varies among patients.

Transcutaneous electrical nerve stimulation (TENS) is excellent for the management of many types of chronic head and neck pain. It should be used whenever possible, because it is not invasive and can be used by the patient at any time and any place. Unfortunately, many patients have not had adequate teaching and a proper trial with TENS prior to purchase, resulting in dissatisfied patients and practitioners. This section gives the practitioner the fundamentals needed for understanding the effectiveness of TENS in a multidisciplinary pain management program.

Nerve stimulators work best in those painful sites where sensation is present. They do not appear to be effective in numb areas. At present, however, there is no well-defined indication as to which patients will benefit from transcutaneous stimulation and which will not. Therefore, those with chronic pain should be given a trial of the TENS unit for a 2- to 4-week period to determine if it helps with their pain problem. Electrodes from the unit should initially be applied over the painful area, and then moved as indicated for more relief. Success has been achieved by placing the electrodes over the nerve supplying the painful area.

The present use of TENS began after the 1965 publication of Melzack and Wall's classic paper "Pain Mechanisms: A New Theory". Two years later it was found that external application of electrical stimulation was effective in relieving pain. The technique was used to determine if a patient was a suitable candidate for the surgical implantation of dorsal column electrodes (Shealy, 1972). The early researchers laid the foundation for the current use of TENS in the management of acute and chronic pain.

TENS has been used in various health care settings, including pain control centers, emergency rooms, operating rooms, postanesthesia care units, and labor rooms. There is a need for health professionals to develop knowledge and expertise in this noninvasive method of providing patient analgesia. Of key importance is the area of patient education in the use of TENS. With proper training and equipment, the patient can learn to use a TENS unit at home with satisfactory results, often giving them a significant degree of self-control over their chronic pain.

Theories on Mechanism of Action

Although a number of theories have been proposed to explain the mechanism of action of TENS two hypotheses are currently in vogue, the gate control theory and the endogenous opiate theory.

According to the gate control theory, stimulation of large, myelinated, A-alpha fibers inhibits the transmission of pain impulses carried by the smaller, nonmyelinated C fibers and by the myelinated A-delta fibers. This inhibition takes place at the level of the spinal cord in the

substantia gelatinosa of the dorsal horn and in the higher levels of the central nervous system. These large, myelinated A fibers have a low threshold for electrical stimulation and are easily stimulated with a TENS unit (Bloede and McCreery, 1975).

According to the endogenous opiate theory, the body produces endogenous opiates in response to certain types of electrical stimulation (Sjolund and Eriksson, 1979). Endorphins have been known to produce analgesia by occupying the opiate receptor sites.

In addition, a third theory, the frequency-dependent conduction block theory, proposes that a pain-transmitting neuron can be rendered inactive or blocked by adjusting the frequency of impulse so that it is delivered before all the ionic channels in that neuron respond. Because no action potential is generated by the neuron, pain sensation is not felt (3m, 1983).

Other theories include modification of pain perception by the stimulation of afferent nerve fibers (Long and Carolan, 1974). Physiologically, with the relief of pain, most TENS units probably also increase vascularity to the area of stimulation by producing localized vasodilatation (Guilula and Markovich, 1977; McCaffery, 1979).

The placebo effect noted with the use of TENS has been a subject of study by many researchers. The placebo effect is felt to be minimal (Long, 1974). If it occurs during a trial of TENS, it will not be sustained.

Indications for TENS

TENS has been demonstrated to be effective in relieving both acute and chronic pain. TENS therapy alone can be sufficient to modulate pain, but it is most often used in conjunction with other types of therapy to maintain relaxation and pain relief.

Chronic musculoskeletal pain, peripheral nerve injuries, phantom pain, arthritis, carcinoma, postherpetic neuralgia, and neuroma have all responded favorably to TENS treatment (Long, 1977; McDonnel, 1980; Shealy, 1974). Pain of central origin and severe neuralgias rarely respond to TENS (Long, 1977). Pain of psychogenic origin is usually not helped and is often aggravated by the use of TENS. Patients who have previously undergone electroconvulsive therapy might react adversely to TENS, because the TENS electrodes and the electrical current used can lead to unpleasant associations. Even in such patients, though, a trial of TENS can be undertaken, with positive responses often being observed.

Many factors are involved that influence a patient's acceptance or rejection of TENS. To ensure patient compliance, an individualized, positive, and realistic approach to the patient's pain problem is necessary. Family education should be included in the teaching program when possible.

Objectives of TENS Therapy

The goals of TENS therapy alone or in conjunction with other types of therapy, are as follows: a 50 per cent decrease in pain, a 50 per cent increase in function and mobility, and a 50 per cent decrease in medication, with the elimination of agents with addictive potential. These results have been obtained using TENS on patients experiencing acute pain and chronic pain (Shealy, 1972, 1974; Long, 1977; Hymes et al, 1974).

TENS Use and the Chronic Pain Patient

After a thorough assessment of the pain problem, proper electrode placement can be determined. Conventional TENS is the mode most frequently chosen for the initial TENS trial. With the early TENS units, patients were usually instructed to use this setting for 2 hours on and 1 hour off. Generally, with the newer TENS units, the patients can use the TENS machine continuously, if needed. At bedtime the unit should be turned off and the electrodes removed so that the patient's skin can be cleansed and allowed to rest overnight. The TENS unit should be used on a regular, clock-regulated basis, not on a prn basis, to achieve the best results. The prescribed treatment schedule and settings can be modified over the course of treatment to accommodate the varying analgesia needs of the individual patient. For example, during a severe exacerbation of a patient's pain, it might be appropriate for the patient to use a high-intensity mode, such as the burst mode, for 15 to 40 minutes.

The length of time a chronic pain patient uses TENS varies, but often, after approximately 1 to 6 months, the patient can gradually decrease daily use, eventually using it only on a prn basis.

Physical Therapy

Because a high percentage of chronic facial pain patients suffer from musculoskeletal pain, either as their primary complaint or secondarily as a result of other conditions causing guarding for fear of eliciting additional pain, a competent physical therapist is needed on the multidisciplinary chronic pain management team. The goal of physical therapy is for patients to achieve the maximum possible function within the limitations of their environment. Outpatient physical therapy should be directed toward development of a home exercise program, so that strength and mobility can be maintained.

Psychological Pain Management

The experience of chronic pain has a psychosomatic component, as well as a pure neuroanatomic response, so various psychological techniques should be considered along with somatic approaches. Psychosomatic pain components of acute pain or anxiety include hyperactivity of the sympathetic nervous system, such as tachycardia, muscle tension, increased blood pressure, and palmar diaphoresis. In the chronic pain patient, anxiety and depression can coexist.

Several psychological techniques that produce an altered state of pain awareness can be used to combat anxiety and depression in patients with both acute and chronic pain. Various approaches include conventional hypnosis, meditation, and guided imagery. All these techniques deal with stress reduction and self-control of the patient's chronic pain condition.

Behavioral therapy is useful in exposing the basic neuroses and anxieties of the patient with chronic pain, because these originally directed the patient to attain and maintain the chronic pain state. The therapist assists the patient in remodelling destructive pain behavior patterns in conjunction with somatic pain management techniques.

Guided imagery involves a state of relaxation that allows patients to communicate with their nondominant cerebral hemisphere through the evocation of images. Through this technique, patients communicate with themselves to develop an image of their pain that they can control. This enables patients to resist the thought that the pain is controlling them.

Progressive relaxation techniques and meditation can be effective in controlling many physiologic functions previously thought to be purely sympathetic in nature. These require retraining of the sympathetic nervous system and are useful in patients with benign pain syndromes of the craniofacial region, such as causalgia and migraine headaches.

Biofeedback can be regarded as another form of conditioned learning. Audio or visual feedback is used to inform patients what their body is doing at a particular time and to demonstrate their control of that function.

Treatment of Acute Herpes Zoster and Postherpetic Neuralgia

There are two commonly reported approaches for the management of acute herpes zoster. Many recommend a noninvasive approach, including the use of antiviral medications, oral steroids, analgesics, antidepressants, and topical agents. An invasive approach, either alone or in combination with any of these medications, is suggested by others, and includes the use of sympathetic nerve blocks, somatic nerve blocks, subcutaneous infiltration of local anesthetic (with or without steroid), and epidural nerve blocks. The presence of multiple therapeutic regimens shows that further controlled studies are needed to establish which approaches are most effective.

Treatment of postherpetic neuralgia is one of the most difficult challenges of pain control centers. A wide variety of approaches have been proposed, with none proving fully effective (Loeser, 1986; Layman et al, 1986). As for acute zoster, the literature is filled with case reports but few controlled studies.

Noninvasive Therapies

Antiviral Agents. Initially limited to parenteral administration in patients with acute herpes zoster, antiviral agents are now more frequently used since the introduction of oral forms. Oral acyclovir, 400 mg, five times daily has been shown to be as effective as parenteral therapy

in controlling pain, accelerating skin healing, and decreasing the period of viral shedding (Peterslund et al, 1984). Another double-blind study on patients with facial zoster showed that oral acyclovir, 6000 mg, five times daily for 10 days reduced pain during the acute phase and reduced the risk of ocular complications, but did not alter the incidence of postherpetic neuralgia (Cobo et al, 1986). High-dose oral acyclovir (800 mg, five times daily for 1 week) given to patients over 60 years of age demonstrated better results (McKendrick et al, 1986), with faster and more complete resolution of the pain by the end of the treatment period. The optimal dosage regimen and the role of oral acyclovir in young patients has yet to be determined.

Because postherpetic neuralgia reflects a condition unrelated to acute infection, antiviral agents play no role in the management of postherpetic neuralgia.

Steroids. For many practitioners, oral steroid therapy has become a standard in the treatment of acute herpes zoster (Goldberg, 1987; Portenoy et al, 1986). Concerns about immunosuppression, with resulting dissemination of the disease, have not been supported in the literature, despite the frequent use of steroid therapy.

Studies to compare different dosages and different steroids in the treatment of acute herpes zoster have not been performed. Suggested regimens include prednisone, 40 to 60 mg/day for 3 weeks (Goldberg, 1987), or 60 mg/day for the first week, 30 mg/day for the second week, and 15 mg/day for the third week (Mayne et al, 1986). It should be stressed that therapy, to be effective, must begin as soon as the diagnosis is made, preferably within 10 days.

Oral steroids, although recommended in early reviews and studies, are not frequently preferred as a treatment for postherpetic neuralgia.

Analgesics. Analgesics are important in the management of acute herpes zoster. Aspirin, ibuprofen, and acetaminophen are useful for controlling mild pain but, for pain of moderate degree, codeine, propoxyphene (Darvon), oxycodone (Percodan), or other moderately addictive narcotics might be required on a short-term basis. When used in the acute stage of acute herpes zoster, narcotics should be tapered quickly, as the level of pain decreases (Mayne et al, 1986).

In postherpetic neuralgia, it is generally believed that narcotics are of little help in the long-term management of pain (Mayne et al, 1986; Loeser, 1986), especially given their addictive potential. Narcotics can be useful in controlling pain in the early course of treatment, however, while other therapies are being instituted. If nonnarcotic therapy is ineffective and narcotics provide good relief, with minimal side effects, their long-term use might be indicated, but this remains a very controversial issue (Portenoy et al, 1986).

Antidepressants and Tranquilizers. Clinical evidence suggests that a trial of tricyclic antidepressant therapy is warranted in any patient with acute herpes zoster whose pain is not relieved by other means, whether evidence of clinical depression is present or not (Mayne et al, 1986). These agents are also noted for sedative properties and can be taken at night as an aid for sleep. Possible starting dosages are 10 to 25 mg for amitriptyline (Elavil), or 10 to 25 mg for

doxepin (Sinequan), taken at bedtime. Tricyclics need up to 3 weeks of regular use for their efficacy to be evaluated, and their use might need to be continued for an extended period. Phenothiazines have been used in combination with the tricyclic antidepressants for the management of postherpetic neuralgia. Fluphenazine (Prolixin), 1 mg orally, bid or tid, is among the most frequently recommended of the phenothiazines (Mayne et al, 1986; Portenoy et al, 1986; Loeser, 1986; Watson et al, 1982).

Anticonvulsants with central activity can be useful in the management of postherpetic neuralgia if severe shooting pain is experienced by the patient. Carbamazepine (Tegretol), starting at 100 mg bid and increasing to 1,600 mg daily dosage, can be considered (Gerson et al, 1977).

Anxiolytics might also be indicated for short-term use during the initial phases of acute herpes zoster and postherpetic neuralgia. Lorazepam (Ativan), 1 to 2 mg, bid or tid, alprazolam (Xanax), 0.25 to 0.5 mg tid, or diazepam (Valium), 2 to 5 mg tid, might be considered for periods not to exceed 2 months.

Topical Agents. The aim of topical treatment in acute herpes zoster is to provide comfort, promote crusting of the lesions, and prevent secondary infection. Wet to dry cool compresses soaked with Burow's solution, tid or qid, or calamine lotion are reasonable choices. Patients should be instructed regarding the infectivity of the vesicles. Eroded or ulcerated lesions should be treated with antibiotic ointments. Topical therapy with steroids or antibiotics is critical in the case of ocular involvement, in which untreated zoster can progress to blindness (Shellow et al, 1981).

Not yet fully studied, iontophoresis of local anesthetic with epinephrine followed by steroid iontophoresis has provided good relief in 7 of 13 patients with postherpetic neuralgia, however, the age of the patients, their prior therapy, and follow-up beyond 2 months were not reported in this study (Gangarosa et al, 1985).

Topical capsaicin (Zostrix), a substance found in hot peppers and other fruits of the nightshade family, has showed promise in preliminary studies for relieving the pain of zoster neuralgia (Bernstein et al, 1987). Tolerance to the analgesia produced by capsaicin can occur with frequent application, and the cost is high despite it being an over the counter medication.

Invasive Therapies

Local Infiltration

Larger groups of patients with acute zoster have been treated with subcutaneous infiltration in areas of vesicular eruption, using steroid with an without local anesthetic (Epstein, 1971, 1981). It is debatable whether the actual infiltration or the systemic absorption of the steroid is responsible for any observed benefit.

In postherpetic neuralgia, local infiltration of the scarred and painful region with 0.2 per cent triamcinolone, with or without 0.25 per cent bupivacaine, has been reported to be effective (Epstein, 1981; Tio et al, 1978).

Somatic Nerve Block

Trigeminal, brachial plexus, paravertebral, intercostal, sciatic, and other nerve blocks have been performed in an effort to treat acute herpes zoster, but have been found to be of limited value (Mayine et al, 1986). In postherpetic neuralgia, somatic nerve blocks generally provide relief only for the duration of action of the anesthetic. If relief is obtained with a diagnostic somatic block, one might consider a neurolytic block (Mayine et al, 1986; Barnard et al, 1981).

Sympathetic Nerve Block

Of the various invasive approaches for the treatment of acute herpes zoster, the most studied involves sympathetic nerve blockade. Sympathetic blockade has been used to relieve the vasospasm thought to contribute to the pain and the nerve damage associated with herpes zoster (Mayne et al, 1986; Lofstrom et al, 1980). Many believe that sympathetic blocks are efficacious in controlling the pain of the acute phase and in preventing the development of postherpetic neuralgia (Rosenak, 1956; Colding, 1969; Olson and Ivy, 1980; Tenicela et al, 1985). As with all other proposed treatments of acute herpes zoster, the earlier the sympathetic block is performed after the development of the rash, the greater the chance of therapeutic success. Winnie (1983) has stated that almost 100 per cent success can be achieved if sympathetic block is performed within the first 2 to 3 weeks, with only 20 per cent success after 4 to 6 weeks.

Sympathetic blocks in postherpetic neuralgia appear to be far less effective than in acute zoster, typically providing only temporary relief (Colding, 1969). If the postherpetic neuralgia is of recent onset, sympathetic block can provide prolonged relief (Bonica, 1953).

Epidural Block

Epidural blockade using low concentrations of local anesthetic has been reported to be effective therapeutically in acute zoster, although this might be the result of the sympathetic block produced (Perkins and Hanlon, 1978). Epidural steroids have also been reported to be an effective treatment for postherpetic neuralgia (Forrest, 1980).

Other Therapies

Treatments that are not recommended for acute herpes zoster include neurolytic blocks and surgical procedures, because the acute stage is usually self-limiting and does not warrant these extreme measures. TENS, acupuncture, and hypnosis are also usually not required in acute herpes zoster, because the conventional therapy discussed above is adequate. Additionally, psychological evaluation and treatment are usually reserved for patients with chronic postherpetic neuralgia (Mayine et al, 1986).

Postherpetic neuralgia has had many more attempted treatments, including intravenous local anesthetics and various neurosurgical procedures, such as dorsal rhizotomies, dorsal root entry zone lesions, and thalamic stimulation (Loeser, 1986). Unlike acute zoster, less invasive techniques, such as psychotherapy, physical therapy, acupuncture, biofeedback, and TENS, can be of significant help in these patients.

In developing a clinical approach to patients with acute herpes zoster, the practitioner must determine with what regimens they are most comfortable, and what has been shown to be successful. Only symptomatic treatment in the young, healthy patient appears needed, although one could justify treatment, given the seriousness of postherpetic neuralgia. In the healthy patient over the age of 50, treatment for the prevention of postherpetic neuralgia is essential in addition to symptomatic relief. Some have recommended a series of sympathetic blocks or subcutaneous infiltrations as the appropriate initial therapy (Mayne et al, 1986), whereas others have started with only oral medications, such as steroids and acyclovir (Goldberg, 1987). In addition to either of these, the immunocompromised patient warrants aggressive treatment of acute herpes zoster with an antiviral agent to prevent dissemination, but the use of steroids in the immunocompromised patient is debatable.

For postherpetic neuralgia, treatment can begin with medications alone, such as tricyclics, phenothiazines, and NSAIDs, or can be combined initially with a series of epidural steroid-local anesthetic injections. For trigeminal herpetic neuralgia, a series of stellate ganglion blocks combined with a series of somatic steroid - local anesthetic injections of the involved branch might be beneficial. Physical therapy and psychological counselling should be instituted early, where appropriate. Aggressive therapy for patients in whom the duration of neuralgic pain is 6 months or less is appropriate, but beyond that time a cure becomes less likely. All conservative measures should be considered to control the pain prior to resorting to irreversible or surgical procedures.

Further Considerations

As chronic pain patients improve, they must be continually reassured that they can lead a normal life, both socially and vocationally. Partial relief from pain or pathologic conditions that induced the pain can leave them with a permanent, partial disability. Rehabilitation centers can evaluate patients and guide them into skills that will enable them to return to a position of usefulness.

Although it is both natural and appropriate to offer sympathy to someone in acute pain, such sympathy might act as a reward system for the patient with chronic pain. Friends and relatives must understand that sympathy can be inappropriate, and should treat the patient with "rational sympathy".

Signs of drug addiction and dependence are often complicated by the number of drugs taken. This use of polypharmacy is instigated by the patient in an attempt to find some agent that might offer relief from the pain. Addiction and tolerance are not confined solely to the drug

regimen, but can also extend to surgical procedures. The patient usually does not have to be persuaded to receive surgery, but willingly accepts any treatment that might offer relief.

Trauma involving the head and neck that has occurred at work is closely linked to a complex secondary gain situation. This often results in serious ramifications with peers, family members, the medical community, and government agencies. The idea that "someone is to blame for my predicament" leads to prolonged battles over compensation for injury, suffering, and loss of income. Failure to identify the secondary gain factor and psychosomatic components of this type of problem leads to futile attempts at alleviating the patient's suffering. Management of chronic pain is compounded when active litigation is in progress. For many patients, this can be the main reason why all treatment apparently fails. If patients stand to gain financially from the fact that they experience pain, it might be difficult for them to accept the success of treatment, consciously or unconsciously. The degree to which this attitude exists depends on the patient's character and psychological makeup, in addition to the financial amount that is likely to be obtained as a result of the severity of the injury.

Complex chronic pain is best assessed and managed using a multidisciplinary approach. The approach for the relief of chronic benign pain generally includes oral medications with no addictive potential, initial diagnostic-therapeutic injections-nerve blocks, physical therapy, relaxation and/or psychotherapy, TENS, and rehabilitation therapy.

Musculoskeletal pain is the most common component of intolerable pain in patients with chronic facial pain.

Treatment of the chronic pain patient is directed toward reducing the pain and improving the patient's function rather than trying to eliminate the pain totally. Realistic initial pain management goals are 50 per cent improvement in subjective pain relief, 50 per cent increase in function, and significant decrease in drug usage, with elimination of agents with addictive potential in patients who are not terminally ill.