Pain Management and End-of-Life Care CME Program

Module 11

Registration: The registration page and test questions are at the end of this article. The 10 questions must be answered and submitted to the CSA in order to receive the CME credit. The full text of each module of this CME program, along with references, will be accessible through the CSA Web Site, **www.csahq.org**, in the *Bulletin*/Online CME section and as part of the online *CSA Bulletin*.

Fees: This is a free service for CSA members. Non-members will be charged $25 per CME credit hour. Your CME certificate will be mailed from the CSA office.

Availability: This module is available from September 30, 2006, until September 30, 2009.

Target Audience: California law now requires that every licensed physician complete 12 credit hours in pain management and end-of-life care by the end of 2006. This module fulfills one credit hour of CME toward that requirement. This program is intended for all licensed physicians, including anesthesiologists, residents, and physicians with an interest in pain management.

Faculty and Disclosures for Module 11:

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All faculty participating in continuing medical education activities sponsored by the California Society of Anesthesiologists are required to disclose any real or apparent conflict(s) of interest related to the content of their presentation(s) or any of the industry sponsors of the meeting. In addition, speakers must disclose when a product is not labeled for the use under discussion or when a product is still investigational.

For this program, Dr. DeSalles has disclosed that he has received an honorarium for his role as a speaker for BrainLab and fellowship support for his role as a fellow advisor from BrainLab and Medtronic.

CME Sponsor/Accreditation: The California Society of Anesthesiologists is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.

The California Society of Anesthesiologists Educational Programs Division designates this educational activity for a maximum of 1 AMA PRA Category 1 Credit™.

Evaluation: An evaluation of Module 11 of this series is offered after the test questions. Please fill in your responses and return them to the CSA office.

Objectives: At the conclusion of this course, participants should be able to:

- Recognize when to ask help of the neurosurgeon to treat chronic and cancer pain
- Apply surgical techniques for treatment of chronic and cancer pain
- Explain to patients the consequences and risks of neurosurgical procedures for pain.

Resources: These materials, including questions, are offered online at the CSA Web Site at **www.csahq.org.** Instructions for the *Bulletin* version are on the registration page.

Neurosurgical Options for Refractory Pain Management

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Dr. DeSalles is an academic neurosurgeon practicing Functional and Stereotactic Surgery at the University of California in Los Angeles since 1990. He received his medical degree and basic neurosurgical training at the Federal University of Goias in Brazil. He received his Doctorate in Philosophy degree from the Virginia Commonwealth University, Medical College of Virginia, where he also completed a neurosurgical fellowship specializing in intensive care for severe head injury patients. He continued his neurosurgical training with a specialization in Stereotactic Surgery from Harvard University working at the Massachusetts General Hospital. Dr. DeSalles became familiar with neurosurgical procedures for pain at the Massachusetts General Hospital and at the University of Umea in Sweden where he participated in implants of dorsal column stimulators, deep brain stimulators, trigeminal neuralgia treatment, cordotomy, and dorsal route entry zone. Dr. DeSalles was trained in radio frequency and fluoroscopy techniques, including lesions of the peripheral nervous system, in Holland. He has practiced these techniques in Southern California since 1990. He is currently Head of the Stereotactic and Functional Neurosurgery Section at the Division of Neurosurgery, University

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Introduction

Management of medically refractory pain is one of the most controversial issues in modern medicine. There are remarkable disagreements among specialists on how to manage persistent pain. The discussion becomes even more intense when opioids and destructive procedures in the nervous system become necessary. Opioids are more acceptable when cancer pain is at play.[1] Opioid treatment of persistent pain of benign origin requires careful consideration. Primary care physicians and rheumatologists who prescribe opioids for chronic pain may not consider their chronic use to be a major problem. However, pain specialists, including neurologists, anesthesiologists, neurosurgeons and psychiatrists, are particularly opposed to chronic use of opioids by patients who do not have a limited life span. Complications of chronic use of opioids include intolerance (64 percent), physical tolerance (34 percent), withdrawal (17 percent), and abuse (13 percent). Psychiatrists are less likely to endorse or use the long-term use of opioids.[2] Frequently neurosurgical procedures for pain are not even considered by a large percentage of practitioners.[3]

Abbreviations Key	
CNS	Central nervous system
DBS	Deep brain stimulation
DREZ	Dorsal route entry zone
fMRI	Functional magnetic resonance imaging
IC	Internal capsule
MSPP	Medically and surgically persistent pain
PAG	Periaqueductal gray matter
PET	Positron emission tomography
PVG	Periventricular gray matter
VPL	Ventroposterior lateral
VPM	Ventroposterior medial

Understanding and diagnosing persistent pain are the first steps to its proper management. "Medically and surgically persistent pain" is defined as persistent pain when all medical and curative surgical measures have been exhausted. Invasive palliative procedures in the nervous system become necessary to control pain. In this article, "chronic pain" stands for MSPP non-cancer pain while "cancer pain" is pain from cancer not responding to opioid therapy, or in cases where the side effects of opioid therapy are unbearable to the patient (Table 1). Neurosurgical procedures for these two categories of persistent pain will be discussed (Table 2). Drug delivery systems as well as chronic spinal

stimulation implants, initially in the realm of neurosurgery, now are widely managed by anesthesiologists.

Table 1: Pain Categories When Considering Neurosurgical Procedures

Acute Pain: Usually nociceptive, considered tractable by common analgesics, short course of opioids, or a curative surgical procedure.

Persistent Non-cancer Pain (Chronic Pain): Usually neuropathic or mixed.

Persistent Cancer Pain: Usually nociceptive, lack of opioid response because of neuropathic component or opioid tolerance.

Chronic Pain

Pain is considered chronic when it has had at least six months duration, and it often is associated with disability, secondary gain, psychosocial dysfunction, and litigation. The most common and typical example is the "failed back syndrome." This complex syndrome has nociceptive and neuropathic components that are aggravated by the factors above. These factors are important and must be considered when evaluating patients for neurosurgical procedures for pain.

Collaboration of pain specialists is indispensable for the proper use of palliative invasive procedures in chronic pain patients. Frequently these patients have unrealistic expectations of neurosurgical pain procedures. A succession of failed procedures increases frustration and complicates their management. The most difficult aspect of evaluating pain procedures for chronic pain is the inconsistency of successful evaluating methods.[2] Results that are considered excellent by some surgeons are not accepted by others. The variables leading to such disagreement include length of follow-up, differences in techniques, patient selection and the difficulty in evaluating results with such a subjective symptom, mostly when drug dependence and secondary gains are at play.

Deep Brain Stimulation

DBS usually is considered only after patients have failed the appropriate trial of peripheral and spinal stimulation and intrathecal drug delivery systems. Although controversial, DBS avoids permanent interruption of CNS pathways and the destruction of CNS nuclei. DBS for chronic pain is regaining popularity

in recent years because of the improvement of stereotactic techniques and DBS instrumentation.[4] The PAG, PVG, VPL and VPM nucleus of the thalamus, and sensory IC are all potential targets for DBS lead placement. In general, PAG and PVG stimulation is applied for diffuse pain responsive to opioids, while VPM, VPL and sensory IC stimulation are used for localized neurogenic pain.[5] Development of double channel generators has allowed the implant of two or more targets in cases of complex refractory pain. (See Figure 1 on the CSA Web Site, <www.csahq.org>.)

Table 2: Neurosurgical procedures applied to Chronic Pain Syndromes*

Peripheral Nerve Injury
Chronic nerve stimulation
Rhizotomy
Ganglionectomy
Dorsal route entry zone lesion
Spinal dorsal rhizotomy

Trigeminal Neuralgia
Microvascular decompression
Radiosurgery
Radiofrequency rhizotomy
Glycerol retrogasserial rhizolysis
Percutaneus balloon compression

Atypical Facial Pain
Rhizotomy
Trigeminal nerve stimulation
Radiofrequency sphenopalatine ganglionectomy

Brachial Plexus Avulsion
Dorsal root entry zone lesion

Phantom Limb Pain
Dorsal column stimulation
Deep brain stimulation
Dorsal root entry zone lesion

Failed Back Syndrome and Whiplash Syndrome
Dorsal column stimulation
Facet denervation
Deep brain stimulation

Sympathetic Dystrophy
Radiofrequency sympathectomy
Endoscopic sympathectomy
Open sympathectomy

Central Pain
Motor cortex stimulation
Deep brain stimulation
Mesencephalotomy
Thalamotomy
Cingulotomy

* These are the most common neurosurgical procedures for chronic pain.

Success of DBS has been reported to vary from 2.2 percent to 94 percent. A review of 1,539 described DBS cases demonstrated benefit in 57 percent of the patients undergoing implant.[7] Initially described in 1993, this technique has gained popularity in cases of anesthesia dolorosa, post failure of treatment of trigeminal neuralgia and post-stroke pain. Modern methods of brain mapping, including fMRI and PET, coupled with frameless stereotactic surgery and

image fusion, promise to improve results of this approach.[6] A recent target described for treatment of refractory cluster headache is the posterior medial hypothalamus.[8] (See Figure 2 on the CSA Web Site, <www.csahq.org>.)

Peripheral Nervous System Surgery

Rhizotomy and Ganglionectomy

Spinal dorsal rhizotomy and dorsal root ganglionectomy are techniques of interrupting afferent stimuli to the spinal cord. Dorsal root ganglionectomy offers a theoretical advantage over dorsal rhizotomy in that ganglionectomy ablates the cell bodies of the dorsal root afferents as well as the cell bodies of the afferent fibers traveling in the ventral root of the spinal cord. The presence of afferent nerve fibers in the ventral root of the spinal cord is thought to be one factor leading to recurrence if dorsal rhizotomy is performed without an associated ganglionectomy. These procedures have been mostly used for cancer pain; however, they have been tried with modest success—and high recurrence rate—for occipital neuralgia, cervical neuralgia, thoracic neuralgia, post herpetic neuralgia, and coccydinia.[9,10,11]

Facet Denervation

Facet denervation differs from dorsal rhizotomy in that only the median branch of the posterior primary ramus is interrupted, resulting in a selective denervation of the facet joint capsule. Facet denervation is performed percutaneously under fluoroscopy guidance using radiofrequency ablation. Indications for facet denervation include intractable back and neck pain. Successful anesthetic facet block is a prerequisite for this procedure. Success rates are 60 percent to 69 percent.[12]

Trigeminal Neuralgia

The classic pain of "Tic douloureux" is an extremely painful shock-like sensation in the territory of the trigeminal nerve induced by touch in a specific site known as a "trigger point." It comes in paroxysms and improves with anti-convulsant treatment. When medical therapy fails, the only curative procedure is microvascular decompression of the root of the trigeminal nerve as it enters the brainstem. This surgery is indicated when a vascular compression is identified. Modern MRI techniques can almost always identify compression. Secondary causes of trigeminal neuralgia such as multiple sclerosis or tumor compression of the trigeminal complex must also be ruled out. Because not all trigeminal neuralgia is caused by a vascular compression, and the microvascular decompression may pose unacceptable risks for many patients, several alternative ablative procedures have been employed. All of them achieve good to excellent

results, but the recurrence rate in all procedures, including microvascular decompression, is approximately 25 percent. Except in the case of microvascular decompression, which carries the complication risks of a major neurosurgical procedure in the posterior fossa, the main complication of the ablative procedures is variable degrees of facial numbness.[13]

Numbness is usually the goal of the ablative procedure; however, if the numbness is intense, dysesthesias may ensue in variable degrees. If anesthesia of the face follows one of the ablative procedures, the patient develops a deafferentation pain which is worse than trigeminal neuralgia and of an intractable nature. At this point, only central procedures, such as DBS or motor cortex stimulation, may give the patient some relief.

The most intense numbness can be achieved with radiofrequency ablation, while glycerol injection, balloon compression and radiosurgery offer a less intense numbness. Glycerol rhizolysis is known to have the highest recurrence rate. Balloon compression appears equivalent to radiofrequency ablation, but with less specificity for a branch of the trigeminal nerve. Radiosurgery also has less specificity for a branch of the trigeminal nerve; however, it is considered the least invasive of all procedures.[14] It has the advantage of causing only mild numbness, although approximately 30 percent of the patients will still require a minor amount of anticonvulsant therapy to remain pain free. Generally we offer microvascular decompression for young patients having proven vascular compression with modern imaging techniques. Radiosurgery is offered to the elderly with pain in any of the divisions. (See Figure 3 on the CSA Web Site.) When the patient is in a crisis of "tic douloureux," unable to eat and unresponsive to medication, radiofrequency ablation is offered if the pain is in the second and third division of the trigeminal nerve, while balloon compression is offered for patients with pain in the first division. Because glycerol is the technique with less specificity for trigeminal division and has the highest recurrence rate, we reserve this technique for cases refractory to the other techniques.[15]

Sympathectomy

Sympathectomy is the surgery of choice for treatment of causalgia and severe cases of complex regional pain—also known as sympathetic dystrophy.[16] Surgical techniques in order of invasiveness include percutaneous radio frequency thermocoagulation, thoracoscopic sympathectomy, and open surgical sympathectomy. Sympathetic blockade is important as a diagnostic measure prior to surgical intervention, and in many cases it is curative. When repeated blockades fail to completely abate the pain, surgery is indicated. Thoracic endoscopic sympathectomy is the technique of choice for upper

extremity pain, with the lower third of the stellate ganglion (T1, T2, T3 and T4 ganglia) being severed. The most common complication of sympathectomy is post sympathectomy neuralgia, which occurs approximately two weeks after the procedure and usually resolves in the ensuing months. Lumbar sympathectomy is best achieved with open surgery; however, we try radiofrequency sympathectomy in this region before offering the patient open surgery.

Central Nervous System Ablative Surgery

Cordotomy

Cordotomy provides pain relief by interrupting the spinothalamic tract in the spinal cord. Because of its high morbidity and relatively short duration of pain relief—less than 18 months—cordotomy is generally reserved for treatment of patients with unilateral cancer pain. Complications include paresis, ataxia, urinary incontinence and dysesthesia. Bilateral cordotomy can present with formidable side effects, and especially at the high spinal cord levels, it can lead to respiratory arrest during sleep.[17] In spite of the improvement of image guidance for cordotomy using computer tomography, this operation is rarely performed because of the availability of intrathecal drug delivery pumps and dorsal column stimulation.

Dorsal Root Entry Zone Lesion

A lesion made in the Rexed's laminae I through V has been popularized and is called the DREZ lesion. Its main application has been for the treatment of regional pain secondary to brachial plexus avulsion; however, its merits have been discussed for other applications, including treatment of refractory pain in the trigeminal distribution, through an approach to the trigeminal tract via an occipital craniectomy and C1-C3 laminectomy. The most popular way of causing a lesion in the DREZ is with radiofrequency,[18] but some authors suggest the use of laser[19] and others microsurgical section of the region with a sharp instrument.[20]

Complications of DREZ include dysfunction of the dorsal column tracts and spinocerebellar tract, as well as dysesthesia and bladder incontinence. Initially at the level of 50 percent, side effects of the operation have fallen as low as 5 percent with improvement of the technique. Currently, the operation is largely reserved for patients with intractable regional pain due to brachial plexus avulsion. The operation, when performed in the thoracic region, is more prone to complications than when performed in the cervical or lumbar regions where the cord has a larger diameter.

Intracranial Stereotactic Destructive Procedures

The creation of stereotactic lesions in the CNS for treatment of chronic pain almost has been abandoned. Lack of understanding of mechanisms of centrally mediated pain leads to frequent failure of these procedures.[21] Thalamotomy and cingulotomy have appeared in the literature, either with radiofrequency or radiosurgery, and in both situations pain relief is inadequate and short-lived.

Cancer Pain

The incidence of pain in cancer patients increases with the progression of the disease (Table 3). It is present in 5 percent to 10 percent of the patients in the initial stages, to 75 percent in the intermediate phase, to the majority of the patients in the terminal stage. Approximately one-third of the patients receive little benefit from medical therapy.[22] Drug intolerance, severe sedation, and poor pain control greatly impair the quality of life for these patients. Unfortunately patients with MSPP are seldom referred to neurosurgeons, and when referred, usually it is too late in the evolution of their disease. They already are very poor candidates, and moreover, the likelihood that they will enjoy a good quality of life after the neurosurgical procedure is limited because they are already bedridden and addicted to some form of opioid.

Table 3: Neurosurgical procedures to control cancer pain*

Decompression of the neural elements from tumor	
Cranial nerves	Spinal nerves
Brachial plexus	Lumbar plexus
Sacral plexus	Spinal cord
Delivery of drugs directly in the central nervous system	
Epidural (spinal canal)	Spinal subarachnoid
Intrathecal	Intraventricular
Augmentation of pain-controlling pathways	
Deep brain stimulation	Dorsal column stimulation
Cortical stimulation	Peripheral nerve stimulation
Interruption of pain pathways in the peripheral or central nervous system	
Rhizotomy	Ganglionectomy
Cordotomy	DREZ
Commissural myelotomy	Mesencephalotomy
Thalamotomy	Cingulotomy
Chemical hypophysectomy	

* Only the most common neurosurgical procedures performed for cancer pain are listed.

Decompression of Neural Elements from Tumor

Tumor compression to neural structures, particularly peripheral nerves and the spinal canal, can cause severe pain that responds poorly to medical management. The surgical treatment is decompression of these structures.[23] Detailed imaging studies, including PET, MRI and CT, must be performed to identify the extent of tumor spread, compression, and the realistic surgical approach to decompress the neural elements. Skull base invasion can lead to severe pain in the trigeminal territory. Similarly, invasion of high cervical elements can lead to severe occipital and cervical pain; invasion of other levels of the spine will lead to severe pain related to the dermatomes involved. Resection of the compressive mass and stabilization of spinal levels must be undertaken in many instances. Recently, stereotactic radiosurgery of the skull base and spinal lesions has emerged as an effective noninvasive way of resolving pain involving diverse levels of the skull base and spine (See Figure 4 on the CSA Web Site).[24] When these approaches fail, one should remember the drug delivery systems and electrical stimulation of the spinal cord. [25]

Deep Brain Stimulation

The remarkable improvement of the deep brain stimulation instrumentation, development of safe procedures and exquisite quality of current stereotactic surgery brings the possibility of exploring this technique to control refractory cancer pain. Reports[26] suggest that this reversible and minimally invasive technique has potential to help debilitated cancer patients with pain.

Interruption of Pain Pathways

As the survival and longevity of patients with cancer increases, destructive techniques of the nervous system become less common. The pain relief afforded by destruction of pain pathways is usually limited to less than one year, while modulation of the CNS by means of drug delivery systems and electrical stimulation are longer lasting and mutilates the patient less, providing a better quality of life.

Rhizotomy and Ganglionectomy

These procedures are important for patients who are not expected to live long, have failed nondestructive measures, and have well-segmented pain. The surgeon, as well as the anesthesiologist, can perform percutaneous techniques of rhizotomy or ganglionectomy with alcohol, phenol, and glycerol injections or radiofrequency. These procedures are performed under local anesthesia with fluoroscopy guidance and, as a rule, with minimal invasion. The patient cooperates with the surgeon to identify the roots that should be severed to

provide pain relief. When the percutaneous techniques fail, neurosurgeons can perform open section of the roots or ganglia under general anesthesia. The main drawback of these sections is the short duration of pain relief and the possibility of development of severe deafferentation pain in the area denervated. In addition, if several dermatomes are denervated, resultant lack of proprioception can severely compromise function.

Cordotomy and Myelotomy

Cordotomy was the most common destructive procedure performed for cancer pain. Its relief of unilateral and lower extremity pain is reliable in up to 95 percent of the cases and lasts up to 18 months.[27] The risks of unilateral cordotomy are reasonable, and the neurological deficit imposed to the patient does not impair substantially the quality of life. The patient usually loses unilateral pain and temperature perception. It does not impair touch or proprioception, and therefore, the patient functions normally except for the loss of the protection that pain and temperature sensation affords.

Percutaneous cervical cordotomy is performed under CT or fluoroscopy guidance in an awake patient cooperating during electrical stimulation of the spinothalamic tract with a radiofrequency electrode introduced in the anterolateral aspect of the spinal cord.[28] Open cordotomy through a laminectomy also is practiced, but it is a large operation in a patient already made clinically labile by the cancer. Complications of cordotomy include urinary incontinence, hemiparesis, and death from respiratory arrest in cases of bilateral cordotomy above the C4 level; also know as Ondine's syndrome, the patient stops breathing during sleep.

The unique crossing of the pain fibers in the commissure of the spinal cord allows another operation to control pain. Myelotomy consists of a longitudinal midline section of the spinal cord at the dermatome level of pain. It affords bilateral control of pain at the dermatomal level operated. The complication rate of this operation is higher than that of cordotomy, and therefore currently it seldom is performed.

Intracranial Ablative Procedures

Disconnection of the limbic system usually offers control of cancer pain without somatic sensory loss. Surgery in both cingulate gyri is followed by remarkable decrease in opioid intake. The suffering component of the pain is abolished after limbic disconnection. Pain, although present, does not bother the patient.[29] MRI provides excellent visualization of the cingulate gyrus for stereotactic lesion placement. Ablation of the cingulum can be performed by radiofrequency or radiosurgery.[30]

Several intracranial targets to control cancer pain have been described. Stereotactic guidance and electrical stimulation for target confirmation ensure safety and effectiveness. However, pain relief afforded by these central procedures is short-lived. Mesencephalotomy has been advocated to control intractable facial, arm and entire-body contralateral pain. Side effects of mesencephalotomy are formidable and include ocular motor palsies, dysesthesia and anesthesia dolorosa; therefore, this procedure has progressively been abandoned. Thalamotomy directed to the spinothalamic tract relay, VPL and VPM, provides control of pain on the opposite side of the body and is accompanied by contralateral hypoesthesia.

Conclusion

The most common neurosurgical techniques for treatment of pain of benign or malignant origin follow a progressive order culminating with destruction in the nervous system. Currently less invasive and reversible techniques are preferred. A thorough evaluation of the patient with MSPP by a team of pain specialists including oncologists, neurologists, anesthesiologists and psychiatrists, all versed in analgesics and antidepressant therapies, must be consulted before any surgical pain palliative procedure is offered to the patient.

References and figures are available on the CSA Web Site (www.csahq.org). If you do not have access to the Internet, please contact the CSA executive office, (800) 345-3691, and we will be glad to fax or mail the references to you.

Pain Management and End-of-Life Care

CSA Educational Program

California law now requires that every licensed physician complete 12 credit hours in pain management and end-of-life care by the end of 2006. The CSA Educational Programs Division is providing a 12-module program to satisfy this requirement. Each article is written by a current or former director of a university-based pain management program in California. The full text of each article, along with references, will be accessible through the CSA Web Site. Joshua P. Prager, M.D., M.S., of the David Geffen School of Medicine at UCLA is the Coordinator of this series.

One module worth one CME credit hour is presented in each quarterly issue of the *CSA Bulletin* for Volumes 53-55 and it is also offered online through the end of 2006 at **www.csahq.org**.

In this issue of the *Bulletin*, Module 11 is available. Modules 1 through 11 are available on the CSA Web Site now. You may also contact the CSA office at (800) 345-3691, and we will send you the materials by fax or mail.

Module 12 will be available online by November 2006 to finish the series. It will also appear in the Winter 2007 issue for those who are still interested.

Watch for Module 12 in the Winter 2007 issue.

Registration

To register for the CSA CME Course in Pain Management and End-of-Life Care, Module 11, fill out this form. Then complete the test and the evaluation, and **mail or fax** all three to the CSA office at:

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Questions

1. Patients with Medically and Surgically Persistent Pain (MSPP) are candidates for neurosurgical pain palliative procedures.
    a. True
    b. False

2. Neurosurgical procedures for Trigeminal Neuralgia include:
    a. Microvascular Decompression
    b. Radiosurgery
    c. Radiofrequency Rhizotomy
    d. Balloon Compression
    e. All of the above

3. The most accepted neurosurgical procedure for the treatment secondary to brachial plexus avulsion is Dorsal Root Entry Zone (DREZ) lesion.
    a. True
    b. False

4. One of the procedures below is *not* used for treatment of "failed back syndrome":
    a. DREZ
    b. Dorsal Column Stimulation
    c. Facet Denervation
    d. Deep Brain Stimulation
    e. All of them are used in "failed back syndrome"

5. Central Pain can be treated by
    a. Motor Cortex Stimulation
    b. Deep Brain Stimulation
    c. Dorsal Column Stimulation
    d. Ganglionectomy
    e. a and b

6. Cordotomy is an excellent procedure for treatment of persistent pain of benign origin.
    a. True
    b. False

7. Interruption of pain pathways should be offered in the initial phases of cancer pain to avoid the use of opioids.
    a. True
    b. False

8. Augmentation techniques for pain control include:
    a. Dorsal Column Stimulation
    b. Motor Cortex Stimulation
    c. Deep Brain Stimulation
    d. Peripheral Nerve Stimulation
    e. All of the above

9. Radiosurgery of spine lesions is an option for treatment of pain secondary to metastatic disease to the spine.
    a. True
    b. False

10. Central Nervous System procedure used to control cancer pain include:
    a. Cordotomy
    b. Cingulotomy
    c. Thalamotomy
    d. Hypophysectomy
    e. All of the above

Evaluation of Module 11

As part of the CSA Educational Programs Division's ongoing efforts to offer continuing medical education, the following evaluation of this program is requested. This is a useful tool for the EPD in preparing future CME programs.

1. How well were the learning objectives of this program met?

Very Well	5	Above Average	4
Average	3	Below Average	2
Not Well at All	1		

2. How relevant was the information in this program to your clinical practice?

Very Relevant	5	Above Average	4
Average	3	Below Average	2
Not Relevant	1		

3. How would you rate this program overall?

Excellent	5	Above Average	4
Average	3	Below Average	2
Poor	1		

4. Did you detect any commercial bias in this module?

Yes	No