Thalamic Pain Syndrome

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ABSTRACT: Though it occurs infrequently, thalamic pain syndrome (TPS) can be devastating. Producing a sensation described as burning, TPS is activated by cutaneous stimulation and temperature changes. The syndrome can occur immediately, or even many months after stroke. The pain is unaffected by analgesics or narcotics and surgical intervention has demonstrated minimal success. Studies testing the efficacy of tricyclic antidepressants have shown a positive response. It is the goal of the nurse to maintain a tolerable pain level for the patient and promote the highest level of function and well-being.

Introduction

Thalamic pain is a devastating syndrome that can occur after a stroke. The syndrome occurs infrequently but causes major setbacks in patient rehabilitation. This article will describe thalamic pain syndrome (TPS), its cause, effects and treatment regimes.

Case Study

Mrs. C., a 62 year-old female, experienced a lacunar stroke in the left cerebral hemisphere. Right upper extremity flaccidity and expressive aphasia were residual effects of the stroke. The initial course of rehabilitation was uneventful. By the third week she was functional, with minimal assistance, in performing activities of daily living such as dressing with set up and occasional cues. She was able to transfer with supervision for safety.

It was during the third week Mrs. C. began complaining of pain on the right side. When anyone attempted to put her shoulder through range of motion she grimaced and cried. Radiographic films and physical examination demonstrated no subluxation or other abnormality of the shoulder. A regime of analgesics and narcotics was used in an unsuccessful attempt to relieve the pain. Rehabilitation continued but the right upper extremity pain remained.

Edema of the right hand necessitated use of an isotonic exerciser (isotoner glove) and maintenance of the extremity in an elevated position when lying or sitting. Each procedure was increasingly more agonizing until Mrs. C. refused to allow anyone to touch her arm and hand. She cradled the extremity and was unable to participate in therapy during periods of highest pain. At times when the pain had subsided somewhat, she would elevate her hand to decrease the edema.

Eventually she was unable to make any further gains in therapy and was discharged. During a follow-up visit a few weeks after discharge, she appeared much thinner, paler and exhausted. She was also developing contractures of the elbow, wrist and fingers due to positioning in an attempt to protect them from pain. At the time, there was no other known treatment to relieve Mrs.

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Copyright © American Association of Neuroscience Nurses 0047-2603/89/2106-0362\$1.25 C.'s pain except possible stereotaxic mesencephalotomy which she and her family refused. Mrs. C. remained with her daughter and continued to have intermittent episodes of pain until her death approximately two years after discharge.

This case is important in that it describes the phenomenon of TPS. It is an extremely frustrating occurence which limits the rehabilitation process and results in endurance of excruciating pain.

Pathophysiology

The thalamus is the major sensory relay between the periphery and the cerebral cortex. Major pathways of sensation to the thalamus are:¹²

- the lateral spinothalamic tracts which transmit sensations of pain and temperature;
- the spinoreticular tracts which transmit burning pain; and
- the anterior spinothalamic tracts which transmit sensations of touch and pressure.

The thalamus is also the relay for cerebellar, limbic and basal ganglionic pathways.

Divisions within the thalamus are called thalamic nuclei. These nuclei can be identified by their patterns of connection within the cerebrum and topographical locations within the thalamus." Nuclei important in sensory relay are the ventral posterolateral nuclei (VPL) which relay information from the periphery and the ventral posteromedial nuclei (VPM) which relay information from the head. Subcortical thalamic nuclei, also known as reticular nuclei, set up a feedback system between the thalamus and the cerebral cortex." This feedback system influences the excitation or inhibition of pain production.14 Reticular nuclei receive fibers from the spinothalamic and trigeminothalamic tracts. The stimulus received is then regulated by either focusing or downgrading it at the brainstem and thalamic levels.14 The cortex similarly regulates the reticular and thalamic nuclei with corticothalamic fibers giving rise to the ability to tolerate pain at different thresholds.¹⁴

Generalized sensations can be felt at the level of the thalamus but cortical involvement is necessary for "refinement of sensation, awareness of discriminative touch and proprioception" (p. 41). For example, if a person fell and twisted an ankle, the initial pain sensation and the position of the ankle would be interpreted in particular areas of the cortex. The deep throbbing pain following injury would be interpreted by the thalamus.

The presence of TPS is most often related to an infarct within the thalamus or surrounding structures. Occasionally, it can occur from an abscess or tumor. Due to the deep nature of the structures involved, other forms of brain injury, ie, superficial or cortical head trauma would not necessarily produce the syndrome.

A larger branch of the thalamogeniculate artery which supplies the lateral thalamus, the posterior limb of the internal capsule and the putamen is thought to be involved in TPS. Infarcts can be of lacunar, embolic or hemorrhagic origin causing ischemia of "fibers passing from the medial and lateral portions of the thalamus to the cortical sensory" (p. 963) area. Three reasons for the development of TPS after a stroke seem to exist: (1) remaining sensory fibers may be reorganized pathologically; (2) the feedback system of control, as previously described, may be lost; (3) collateral fibers may develop causing poor localization of sensation.

Clinical Picture

"La Syndrome Thalaminique," first described between 1903 and 1907 by Dejerine and Roussy, was characterized by the following:¹³

- · resolving mild hemiplegia;
- hemianesthesia with changes in deep pressure sensation;
- mild ataxia and complete astereognosis on the affected side;
- severe paroxysmal pain that is very often intolerable on the affected side; and
- choreoathetoid movement of limbs on the affected side.

One part of the Dejerine-Roussy syndrome is TPS.

Thalamic pain syndrome does not usually present itself until a few weeks to months after the initial stroke. It often occurs as the patient is experiencing functional improvement. If the patient makes a complete recovery or has an extension of the stroke, the syndrome could be eliminated. Sensory transmission is restored with complete recovery, and an extension of the stroke would obliterate the three possible causes previously discussed. However, the syndrome can recur if a patient who makes a complete recovery suffers a stroke in the same area or if a stroke should occur in the same area on the opposite side.

The primary symptom of TPS is pain. The pain is different from nociceptive pain because it is not caused by the stimulation of receptors but rather by the disruption of fibers transmitting the pain. Thalamic syndrome pain is described by patients as burning, tight, knife-like, crushing, stinging, a storm, a shock and indescribable. Often patients also complain of hypersensitivity to temperature and touch, ie, warm air from a heater or pulling a sleeve up an extremity may produce an intolerable sensation.

Treatment

There are two forms of treatment used in TPS. Various surgical procedures are still used and have met with varying levels of success, while recent studies have identified drugs effective in treating TPS.

Surgical Treatment

Surgical interventions used to relieve the pain of TPS include: (1) extirpation of the postcentral gyrus (complete removal of the postcentral gyrus) to remove the ability to interpret pain as well as transmit pain to associated areas, thus eliminating the sensation of pain; (2) cervical cordotomy (division of a nerve tract in the spinal cord) to remove the tract's ability to transmit a stimulus to the brain, thus removing the possibility of triggering TPS; (3) posteromedial hypothalamotomy to interrupt ability to interpret pain on an emotional level thus eliminating the ability to perceive pain; (4) stereotaxic mesencephalotomy to interrupt pain tracts which can trigger TPS. Although these surgical procedures can eliminate pain, they can also cause additional neurological damage, reducing functional ability or damaging other pathways unrelated to pain.

Another surgical intervention, deep brain stimulation, involves implantation of electrodes in the thalamic region or the periaqueductal gray matter of the midbrain. Deep brain stimulation which occurs when the electrodes are connected to an electrical source, causes the release of endorphins which in turn produce analgesia.¹⁶

Pharmacologic Therapy

The usual analgesics and narcotics are ineffective in the treatment of TPS due to the nature of their target receptors. Nonsteroidal anti-inflammatory analgesics prevent nociceptor activation of prostaglandin synthesis in the peripheral nervous system. Most narcotics imitate neurotransmitters that activate receptors in the posterior horns of the spinal cord. Neither of these mechanisms influences thalamic pain.

Studies have shown that tricyclic antidepressants (TCA) have been effective in treating pain not only from peripheral nerve injury but also thalamic pain. The apparent effect of TCA is potentiation of descending analysesic pathways by inhibiting re-uptake of serotonin and norepinephrine. They also appear to

Table 1.

Nursing Care Plan for the Patient with TP:

Problem	Intervention	Patient and Family Education
I. Pain		
A. Assessment 1. Character a. burning, stinging or knife-like 2. Location a. remains in one place, extends to other body areas 3. Duration 4. Intensity 5. Precipitating factors change in body position, touching the extremity or temperature change	A. Medication 1. Type a. analgesic b. narcotic c. tricyclic antidepressant d. combination of above 2. Lowest effective dose a. monitor effectiveness b. monitor adverse effects B. Behavior modification 1. Positive reinforcement for non-pain behavior to increase pain threshold ¹⁴ 2. Relaxation training to reduce stress, a protagonist to pain	A. Education about medication and pair control 1. Names of medications used, how they are effective, adverse effects 2. The impact of pain ¹⁴ a. changes in lifestyle b. possible role changes
II. Functional ability A. Assessment of physical 1. Strength 2. Endurance 3. Capabilities	A. Therapies 1. Physical, occupational or vocational a. provide overall strengthening b. improve endurance c. maintain or increase ability to perform ADL and maintain bowel and bladder function d. provide gait training e. provide adaptive devices to help com- pensate for paresis or paralysis f. increase verbal and nonverbal commu- nication skills g. provide training for re-entry into the work force h. adapt the work environment	A. Compliance 1. Have family members attend therapy sessions 2. Review information and techniques learned each day with patient and family 3. Give patients time needed to complete tasks learned
B. Assessment of psychological response	B. Provide psychological support 1. Improve self-esteem 2. Decrease depression 3. Increase motivation	B. Importance of maintaining a positive attitude 1. Encourage compliance with therapies 2. Allow patient to voice concerns and anger 3. Acknowledge patient's improvements

have an effect on the ascending monoaminergic system which is important in the perception of pain.1

Tricyclic antidepressants which have been studied are clomipramine, imipramine and amitriptyline. Amitriptyline appears to be the most effective due to its analgesic effect, the low dose required and the least incidence of adverse effects. A recommended dose for TPS is 75 mg daily in divided doses. Effectiveness is usually noted during the second week of administration.

Nursing Implications

Nursing is challenged in caring for TPS patients in neuroscience, rehabilitation and general medical-surgical settings. The patient not only suffers pain, but is also at high risk for developing depression, contractures of affected limbs and loss of function, all of which affect performance of activities of daily living (ADL). It is the goal of nursing to assist the patient in achieving the optimum level of function with the least amount of pain. The nurse, as an integral part of the multidisciplinary team, acts as moderator, mediator, controller and instructor to attain these goals.

The nurse as *moderator* must assess the TPS patient on a continual basis. Areas to be assessed are functional ability and pain perception. Function is measured by the progress, plateauing or regression made in ADL, transfers and ambulation. Pain perception is evaluated by observing overt motor behavior and by observing frequency of facial grimacing, rubbing of the painful area, guarding and sighing. Subjective pain may be measured by using a visual analogue scale, rating the pain on a scale of 0 to 10 with 10 being the most severe. The McGill pain questionnaire which measures intensity, perception and the affective component of pain can also be helpful.

As a *mediator*, the nurse assesses the patient's ability to follow through and carryout instructions or skills. For example, in relation to safety, observe whether the patient locks the wheelchair before transferring. Note whether the patient uses relaxation techniques taught by members of the health care team.

The nurse as *controller* evaluates the effectiveness of plans implemented and, along with other team members, changes those plans when necessary. For example, if the patient continues to be incontinent, the bowel and bladder program may need to be changed.

In the role of *instructor*, the nurse teaches the patient and family the importance of medication in or-

der to promote compliance, good body alignment while sitting or lying, performing ADL and preventing further complications. Table 1 is a more complete plan of care.

Summary

Though the exact cause and nature of thalamic pain syndrome is only postulated at this time, patients with TPS need not go untreated. Research has shown medications may reduce or eliminate the devastating pain so patients can live more productive and comfortable lives.

Nursing intervention for the patient with TPS focuses on evaluating the pain and effects on functional ability, as well as administering medications, monitoring their effectiveness and educating the patient and family.

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