Refactory Occipital Neuralgia: Preoperative Assessment with CT-Guided Nerve Block Prior to Dorsal Cervical Rhizotomy

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Refractory Occipital Neuralgia: Preoperative Assessment with CT-Guided Nerve Block Prior to Dorsal Cervical Rhizotomy

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BACKGROUND AND PURPOSE: Occipital neuralgia syndrome can cause severe refractory headaches. In a small percentage of people, these headaches can be devastating and debilitating, with the potential for complete relief following surgical rhizotomy. We describe CT fluoroscopy–guided percutaneous C2–C3 nerve block for the confirmation of diagnosis of occipital neuralgia and for demonstrating to patients the sensory effects of intradural cervical dorsal rhizotomy before the definitive surgical procedure.

METHODS: Seventeen patients with occipital neuralgia underwent 32 CT fluoroscopy–guided C2 or C2 and C3 nerve root blocks. Of the 17 patients, nine had occipital neuralgia following prior neck or skull base surgeries. On the basis of the positive results of the nerve blocks in terms of temporary pain relief, all 17 patients underwent unilateral (n = 16) or bilateral (n = 1) intradural C1 (n = 9), C2 (n = 17), C3 (n = 17), or C4 (n = 7) dorsal rhizotomies. All patients were followed up for a mean of 20 months (range, 5–37 months) for assessment of pain relief. Sixteen patients were assessed for degree of satisfaction with and functional state after surgery.

RESULTS: All patients had temporary relief of symptoms after percutaneous CT-guided block (positive result) and felt that occipital numbness was an acceptable alternative to pain. Immediately after surgery, all patients had complete relief from pain. At follow-up, 11 patients (64.7%) had complete relief of symptoms, two (11.8%) had partial relief, and four (23.5%) had no relief. Seven of eight (87.5%) patients without prior surgery had complete relief of symptoms and one (12.5%) patient had partial relief, as opposed to complete relief in four of nine (44.4%), partial relief in one of nine (11.2%), and no relief in four of nine (44.4%) patients with a history of prior surgery. Because of the small number of patients, this difference was not statistically significant (P = .110). Eleven of 16 (68.8%) patients stated that the surgery was worthwhile. Eight of 16 (50%) patients felt they were more active and functional after surgery, whereas 25% felt they were either unchanged or less functional than before surgery. None of the patients without a history of prior surgery reported a decreased sense of functional activity following rhizotomy.

CONCLUSION: CT fluoroscopy–guided percutaneous cervical nerve block is useful for the confirmation of occipital neuralgia, for demonstrating to patients the sensory effects of nerve sectioning, and possibly as a guide for selection of patients for intradural cervical dorsal rhizotomy. Although not statistically significant, there was a trend toward better response to rhizotomy in patients without prior head or neck surgery.

Headache is one of the most common symptoms affecting the general population. Occipital neuralgia is an uncommon cause of headache described in 1821 by Beruto and Ramos (1). It is a specific syndrome of paroxysmal severe lightening-like sharp headache in the distribution of the occipital nerve. Although most cases of occipital neuralgia are idiopathic, they may be related to specific causes such as trauma, prior skull base surgery, rheumatoid arthritis, nerve entrapment by hypertrophied atlantoepistrophic (C1–C2) ligament, compression by an anomalous ectatic vertebral artery, or degenerative C1–C2 arthrosis (2–6). A wide variety of treatments have been tried, including cervical collars, transcutaneous nerve stimulation, analgesics and antimigraine drugs, occipital nerve block with or without glucocorticoid injection, chem-
eral or radio-frequency occipital nerve ablation, atlantoaxial arthrodesis, and dorsal cervical rhizotomy (2, 3, 6–11), each with variable degrees of success. We describe a group of patients with severe occipital neuralgia refractory to medical treatment. These patients were screened for potential surgery by using CT fluoroscopy-guided percutaneous C2- and C3-selective nerve blocks. If these blocks abated the symptoms, the patients then underwent intradural surgical sectioning of the upper cervical nerve roots (rhizotomy). Patients who did not respond to CT-guided nerve block were not offered surgical sectioning. We present our technique of selective nerve root block and the long-term follow-up of patients undergoing rhizotomy.

Methods

Patients

The medical records of 17 consecutive patients who had undergone CT fluoroscopy–guided cervical nerve block and surgical dorsal rhizotomy for occipital neuralgia, between December 1999 and September 2002, were retrospectively reviewed. Patient ages ranged from 17 to 76 years (mean age, 43 years). Six patients were male, and eleven were female. All patients had refractory occipital neuralgia. Nine patients developed occipital neuralgia following neck or skull base surgery that included surgery for trigeminal neuralgia (n = 4); retromastoid vestibular neurectomy (n = 2); resection of neck neuroma (n = 1); cervical diskectomy (n = 1); and occipital osteoma resection (n = 1). Seven patients did not have an identifiable cause of occipital neuralgia, and in one patient it commenced after an automobile accident.

CT Fluoroscopy–Guided Nerve Block

No anesthesia or sedation was used for any patient, and a total of 32 (C2 = 18 and C3 = 14) nerve root blocks were performed. One patient underwent bilateral C2 and C3 nerve root block. An axial scout CT from C1 to C3 without intravenous contrast material was performed in all patients. Thereafter, the anticipated site of needle entry between C1–C2 and C2–C3 was marked. Needle placement for C2 block was between posterior arches of C1 and C2, just behind the inferior aspect of the lateral mass of C2 (Figs 1 and 2). For C3 block, needle placement was at the lateral aspect of the C2–C3 foramen, just anterior to the base of C3 superior facet (Figs 3 and 4). Using sterile technique, a 25-gauge 8.89-cm straight spinal needle (Becton Dickinson, Franklin Lakes, NJ) was advanced medially under intermittent CT fluoroscopy toward the C2 (or C3) nerve root. After confirming the placement of needle tip adjacent to the expected location of the exiting C2 (or C3) nerve root (Fig 5), a short connector tubing was attached to the spinal needle. Approximately 0.5–2 mL of 0.25% bupivacaine was injected after making sure that no blood was aspirated before injection. Injection of 1 mL of nonionic iodinated contrast material (Optiray 350, Mallinckrodt, St. Louis, MO) was performed in two patients to document accurate placement of needle tip (Fig 6). The patient’s response to bupivacaine injection was documented, and at the completion of the procedure trigger points were palpated in an attempt to elicit the pain and assess the nerve block’s effectiveness. A positive response was considered complete relief of pain with numbness in the distribution of the occipital nerves and no pain on stimulation of trigger points. A negative response was considered pain persistence following the nerve block or after pain during trigger point stimulation after the nerve block. The total duration of anesthesia was not determined.

Surgery

Seventeen patients with a positive response to C2 or C2 and C3 nerve blocks underwent unilateral (n = 16) or bilateral (n = 1) intradural C1 (n = 9), C2 (n = 17), C3 (n = 17), or C4 (n = 7) dorsal rhizotomies. C2 and C3 rhizotomies were performed in isolation or in combination with C1 or partial C4 rhizotomies. The number of levels was dependent on presence of C1 dorsal rootlets and access to upper C4 rootlets after C1, C2, and partial C3 laminectomies. All rhizotomies were performed by using general anesthesia with the patient prone. A midline cervical incision was used to bilaterally expose the ring of C1 and lamina of C2, C3 and C4. Following resection of ring of C1 and lamina of C2 and upper C3, the dura and arachnoid were opened and the cord with its exiting nerves exposed. The C1–C4 dorsal nerve roots were identified. All dorsal nerve rootlets on the side of the pain for C1, C2, C3, and upper C4 were sectioned. A careful search for small interconnecting branches between C1–C4 dorsal nerves was made, and they too were sectioned. Following completion, the cervical dorsal rhizotomies the dura and wound were closed in a watertight fashion. The patients were discharged home within 2–3 days. All patients were followed up for a mean of 20 months (range, 5–37 months) for relief of pain. Sixteen patients were additionally assessed for satisfaction with surgery and subjec-
tive functional state following surgery. One patient died 8 months after rhizotomy of complications related to preexisting liver disease.

Results

All 17 patients had occipital numbness for at least 1–4 hours after the nerve blocks with complete relief of their usual pain; during this period no pain could be elicited with trigger-point stimulation. One patient experienced a vasovagal response to the injection but recovered uneventfully. There were no other complications related to CT fluoroscopy–guided occipital nerve block. Following surgery, 11 of 17 (64.7%) patients had complete relief of symptoms at follow-up, two (11.8%) patients reported partial relief, and four (23.5%) patients experienced no relief despite permanent numbness. Of the eight patients without history of prior surgery, seven (87.5%) had complete relief of symptoms and one (12.5%) patient had partial relief. Complete relief was found in four of nine (44.4%), partial relief in one of nine (11.2%), and no relief in four of nine (44.4%) patients with a history of prior surgery. This difference was not statistically significant (P = .110). Six patients without complete relief had diagnostic C2 or C3 nerve blocks before surgery. Of these six patients two each had C2, C3 and C2, C3, of C4 rhizotomies, respectively, and the remaining two patients each had C1, C2, C3 and C1, C2, C3, or C4 rhizotomies. There was no correlation between levels of surgery and pain relief. Eleven of 16 (68.8%) patients stated that the surgery was worthwhile, whereas five of 16 (31.2%) patients did not feel it was beneficial. Subjective functional state was improved in eight of 16 (50%) patients and unchanged or worse in four (25%) patients each. No patients without a history of prior surgery had decrease in functional status following rhizotomy.

Discussion

The earliest reference to occipital neuralgia was in 1821 by Beruto and Ramos (1). Numerous sporadic reports of this condition and its treatment have been described since (2, 3, 7–13). The syndrome’s clinical features, described by Hammond and Danta in 1978, (3) included severe paroxysmal or continuous pain in occipital nerve distribution with localized tenderness overlying the nerve trunk as it crosses the superior nuchal line, altered sensation in the form of hypo-, para-, or dysesthesia in the distribution of the nerve during or following the acute event, and relief of
symptoms by local treatment such as nerve block with local anesthesia or occipital neurectomy. More recently, the International Headache Society defined occipital neuralgia (14) as a paroxysmal, sharp pain in the distribution of the lesser or greater occipital nerve with associated paraesthesia or dysesthesia in the same region. There is usually tenderness over the affected nerve with persistent aching between the paroxysms and temporary relief of the condition by local anesthetic block.

Anatomy of the greater and lesser occipital nerves provides explanation of etiology and treatment options available for occipital neuralgia. The greater occipital nerve is formed by the medial branch of the dorsal ramus of C2 that runs between the posterior arch of the atlas and lamina of the axis. The greater occipital nerve ascends between the inferior oblique and the semispinalis capitis muscles. It pierces the semispinalis capitis and the trapezius (adjacent to their insertion into the occipital bone between the superior and inferior nuchal lines) to run along the occipital artery (15). It receives a filament from the medial branch of the third dorsal cervical (C3) ramus after it pierces the trapezius. A cutaneous branch of the suboccipital nerve [first cervical (C1) dorsal ramus] will occasionally join the greater occipital nerve as it accompanies the occipital artery. The greater occipital nerve frequently connects with the lesser occipital nerve, which arises from the cervical plexus (formed by the upper four ventral cervical rami), and uncommonly with the superficial auriculotemporal nerve (16). The greater occipital nerve divides into several branches and supplies the skin of the back of the scalp as far forward as the vertex of the skull. Radiation of pain to the retro-orbital and other facial regions is believed to be due to sensory connections between the principal sensory nucleus of trigeminal nerve and substantia gelatinosa of the upper cervical spinal cord via the nucleus of spinal tract of the trigeminal nerve (3, 15, 17, 18) which explains the frequent occurrence of occipital neuralgia with trigeminal neuralgia and for the occurrence of retro-orbital pain. Seven of 17 patients in our series had coexistent trigeminal and occipital neuralgia. Seven patients also described numbness of retro-orbital pain. Seven of 17 patients in 17, 18) which explains the frequent occurrence of occipital neuralgia (14) as a paroxysmal, sharp pain in the distribution of the lesser or greater occipital nerve with associated paraesthesia or dysesthesia in the same region. There is usually tenderness over the affected nerve with persistent aching between the paroxysms and temporary relief of the condition by local anesthetic block.

Unlike other cervical nerve roots, pedicles and articular facets do not protect the dorsal rami of C1 and C2 nerves as they pass above the arches of the atlas and axis, respectively (Figs 2 and 5). Because there is little motion between atlas and occipital bone, it is unlikely that C1 nerve root plays a major role in the syndrome of occipital neuralgia (13). The marked degree of movement (rotary and extension) between the posterior arches and articular facets of atlas and axis, however, has the potential of traumatizing C2 dorsal ramus (13). With rotary motion, the inferior atlantoaxial joint disease involves the arch of atlas on the side of rotation of the chin, whereas on the opposite side the arches of atlas and axis are in contact. During neck extension, the posterior arches of atlas and axis (Fig 7) come close to each other and may actually be in contact. Hence, there is potential for compression and injury to the posterior C2 ramus on either side with normal or excessive head rotation and extension (13). Although the greater occipital nerve receives contributions from dorsal rami of C3 and C4 (via lesser occipital nerve), they are less likely to be traumatized because their nerve roots are protected by pedicles or articular facets. Numerous other conditions—such as developmental or congenital anomalies of the craniovertebral junction (2), rheumatoid arthritis (3), osteoarthritis (3–5), gout, infections, and, rarely, ectatic vertebral artery (6)—can compress C1–C4 dorsal nerve roots and cause occipital neuralgia.

The other site where the greater occipital nerve is vulnerable to injury (Fig 7) is as it pierces the poste-
Occipital neuralgia is a complex pain syndrome. CT fluoroscopy–guided cervical nerve block is a safe procedure that is useful in diagnosis, confirmation, and surgical result simulation (numbness). Although the results of this small series were not statistically significant, there was a trend toward patients with occipital neuralgia secondary to nonsurgical causes having a better outcome compared with patients who had postsurgical occipital neuralgia.

**Conclusion**

Occipital neuralgia is a complex pain syndrome. CT fluoroscopy–guided cervical nerve block is a safe procedure that is useful in diagnosis, confirmation, and surgical result simulation (numbness). Although the results of this small series were not statistically significant, there was a trend toward patients with occipital neuralgia secondary to nonsurgical causes having a better outcome compared with patients who had postsurgical occipital neuralgia.

**Acknowledgments**

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