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# Transfacial Transpterygomaxillary Access to Foramen Rotundum, Sphenopalatine Ganglion, and the Maxillary Nerve in the Management of Atypical Facial Pain

*Abstract*—Post-traumatic atypical facial pain syndromes are refractory to medical therapy and thus challenging to treat. Some of these patients have a facial causalgia syndrome that may include autonomic as well as trigeminal fibers as the anatomic mediators. A procedure that may be of both diagnostic and therapeutic benefit is a nerve block in the region of the foramen rotundum. This allows access to both the maxillary nerve and the sphenopalatine ganglion. A simple technique developed to perform this procedure is described, and the results in a series of six patients are presented. (*Skull Base Surgery, 4(1):15–20, 1994*)

Patients who have atypical facial pain syndromes are more difficult to treat than those with typical trigeminal neuralgia. Patients may have such syndromes after trauma, after surgery, or on an idiopathic basis. These patients, after having visited a variety of specialists and experiencing little relief of their suffering, are often exceedingly frustrated. These syndromes are often refractory to all medical therapy, including the standard neuralgic preparations. After trauma, this condition seems to exist frequently in the midface in the area supplied by the maxillary division of the trigeminal nerve; however, it is sometimes difficult to distinguish the pain from other craniofacial pain or headache syndromes. The exact anatomic mediators may be unclear, with possible autonomic contribution as well as the trigeminal nerve fibers.

Attempts to treat these patients with peripheral neurolytic procedures such as nerve avulsions and injections in the infraorbital nerve are often unsuccessful owing to the contribution of other components of the maxillary nerve, such as the orbital branch to the floor of the orbit, the palatine nerves, or the superior alveolar nerve. Such treatment would neglect the common accompaniment of the superficial facial pain with dental, intraoral, or orbital pain. Similarly, intraoral injection would allow access to the superior dental nerves and the palatine nerves, but would spare blockade of the superficial facial, the orbital branch, and the adjacent autonomic fibers passing through the sphenopalatine ganglion.

A challenging locus to reach, the extracranial maxillary nerve and the sphenopalatine ganglion may be injected by passing a needle through the pterygopalatine fossa. No standard neurosurgical procedure for this purpose is taught. A lateral infrazygomatic approach to this area has been described that may provide access to these structures.[1] There are no reports detailing the technique for an anterior approach, although such a concept has been mentioned.[2] The present work describes a technique developed initially in cadaveric specimens and skulls and

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subsequently adapted to a series of patients with intractable atypical post-traumatic facial pain.

## METHODS

### Laboratory

In the cadaver head and on skulls, measurements were made to define a needle trajectory passing from the face and through the pterygomaxillary fissure to allow the needle tip access to the anterior aspect of the foramen rotundum. The technique that was developed used a point of needle entry through the face at the site of intersection of a vertical line extending along the lateral orbital wall and a horizontal line tangential to the lateral aspect of the inferior surface of the zygomatic process of the maxilla. From this point of entry, a 3.5 inch 22 gauge spinal needle was passed with the tip angled 30° medial to the vertical line (Fig. 1B, angle A) 40° above the horizontal line (Fig. 1C, angle B). This trajectory allowed the needle to rest at the anterior portion of foramen rotundum (Fig. 2). The needle could not be made sufficiently coaxial with the foramen actually to pass through it. The procedure is executed most safely by erring on the side of underestimating these two angles to avoid passage of the needle through the inferior orbital fissure, or into the orbital apex and possibly into the superior orbital fissure, or optic foramen.

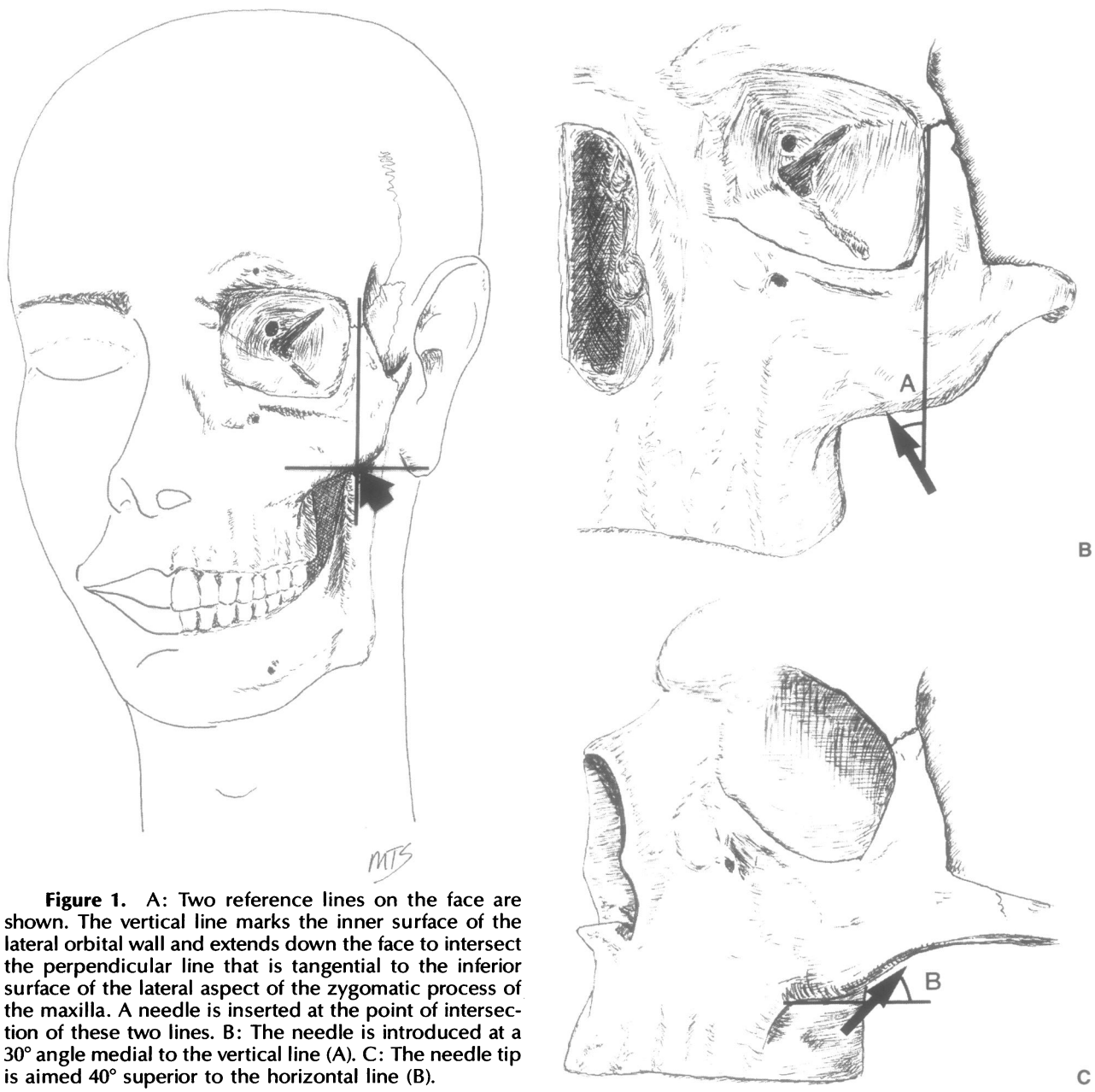



**Figure 1.** A: Two reference lines on the face are shown. The vertical line marks the inner surface of the lateral orbital wall and extends down the face to intersect the perpendicular line that is tangential to the inferior surface of the lateral aspect of the zygomatic process of the maxilla. A needle is inserted at the point of intersection of these two lines. B: The needle is introduced at a 30° angle medial to the vertical line (A). C: The needle tip is aimed 40° superior to the horizontal line (B).

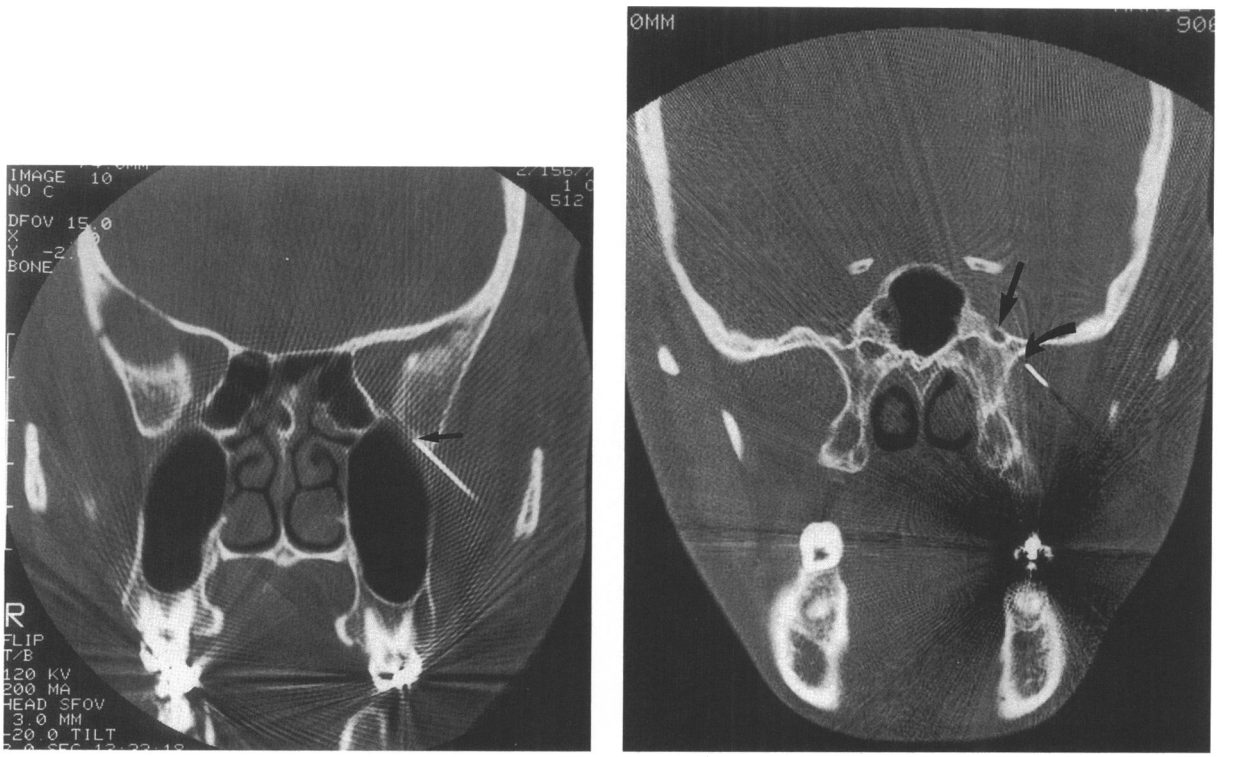



**Figure 2.** A: Coronal CT images through the orbital apex. The tip of the needle (arrow) is seen coursing along the curved lateral wall of the maxillary antrum. B: Coronal CT through the foramen rotundum. This image is obtained posterior to A. The tip of the needle (curved arrow) lies in the pterygopalatine fossa 5 mm from the foramen rotundum (straight arrow).

## Patient Series

The indication for use of this technique was atypical facial pain in the distribution of the maxillary nerve. In one case, there was a history of a baseball injury to the maxilla; in one, a motor vehicle accident in which the face struck the dashboard; and in two, a maxillary dental procedure with persistent pain afterward. All patients had an incomplete sensory deficit in the distribution of the maxillary nerve. All had intraoral and dental pain, and not just superficial facial pain. The pain was described as a constant dull aching or burning, with either minimal or no complaints of lancinating pain as seen in typical trigeminal neuralgia. In all patients, a local anesthetic block was performed (0.5% bupivacaine without epinephrine) as the first stage of treatment. In two of the patients in whom local anesthetic completely relieved their pain, secondary procedures using the described approach but incorporating alcohol neurotomy were carried out within 7 days.

This technique was used seven times in four patients using computed tomography (CT) scan to confirm the ultimate needle position or to guide fine adjustments in position. The CT images were obtained using a GE9800 scanner (General Electric, Milwaukee, WI) and a high resolution thin section (3 mm) bone algorithm. With the patient supine and the neck fully extended, the head was immobilized in a standard CT head holder. The gantry was angled to achieve images approximating the 120° coronal plane. Before beginning the procedure, contiguous images were obtained from the dorsum sellae to the orbital apex to localize the foramen rotundum and the pterygomaxillary fissure. The first two times this procedure was performed, intravenous midazolam or diazepam was used for sedation; but subsequently this was found to be unnecessary, and the procedure was performed with local anesthetic only.

After suitable images that allowed identification of the foramen rotundum were obtained, each patient was withdrawn from the gantry. With a surgical marker, a vertical line was drawn on the face extending down along the lateral orbital wall, and a horizontal line was drawn tangentially to the lateral aspect of the inferior aspect of the zygomatic process of the maxilla (see Figure 1). The skin was prepared with iodine solution. The skin and subcutaneous tissue were anesthetized with 1% lidocaine. The spinal needle was then introduced at the point of intersection of the two drawn lines and aimed using angles A and B described before. In all but one patient, the final position required several adjustments of needle trajectory to position the tip. Subsequent images to follow needle placement were obtained as needed during the procedure. In all patients, CT scan confirmed the needle tip to be within 1 to 3 mm of the anterior end of the foramen rotundum and within 5 mm of the foramen in the mediolateral plane (see Figure 2A, B). The patient was with-

drawn from the gantry after imaging confirmed ideal needle placement, and the injection was made.

For the first stage, local anesthetic blockage, 1.5 to 2 cc of 0.5% bupivacaine, was used. These patients were instructed to keep notes on their pain and numbness for the ensuing 6 to 8 hours after the procedure. Three reported satisfactory relief with no intolerance to the numbness. One patient had no relief of pain. Those patients who responded were brought back, and the second stage of treatment, alcohol neurotomy, was performed.

For the second stage, alcohol neurotomy, a solution of dehydrated alcohol (98% ethyl alcohol by volume) and 0.5% bupivacaine in a 2:1 ratio by volume was injected. The total volume introduced was 1 to 1.5 cc. Consistently occurring pain at the initiation of the injection was minimized by incremental injection of the total volume. The needle was then withdrawn, and the patient was allowed to get up.

Although coronal images were used as the main imaging guide for this technique, during two of the studies, axial images were also obtained to permit the measurement of the needle angles in vivo using reference planes and anteroposterior and lateral CT scout films taken while the needle was in the face (Figure 3A, B).

## RESULTS

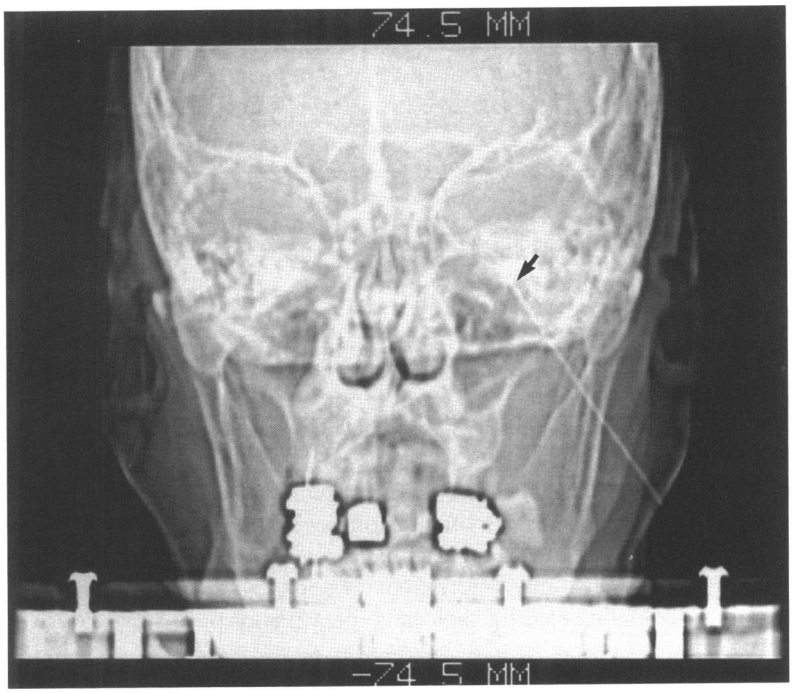
Three patients experienced complete pain relief after the anesthetic blockade and went on to have alcohol neurotomy performed. Two of these patients remained free of pain: one for 12 months, and the other for 5 months. The first patient's pain recurred with its initial severity after 12 months. Repetition of the alcohol and bupivacaine injection resulted in complete resolution of her pain. She is now 8 months into her second period of follow-up. One patient had a partial response to diagnostic blockade; and one patient, who also had a history of extensive ipsilateral maxillary antral surgery, had no response. Neither of these two patients went on to have the second stage of alcohol injection. In all cases, adequacy of the block was confirmed by anesthesia or profound hypalgesia and hypesthesia in the distribution of the maxillary nerve. There were no complications resulting from either the local anesthetic or alcohol injection. One patient had mild ipsilateral xerophthalmia that did not require treatment.

## DISCUSSION

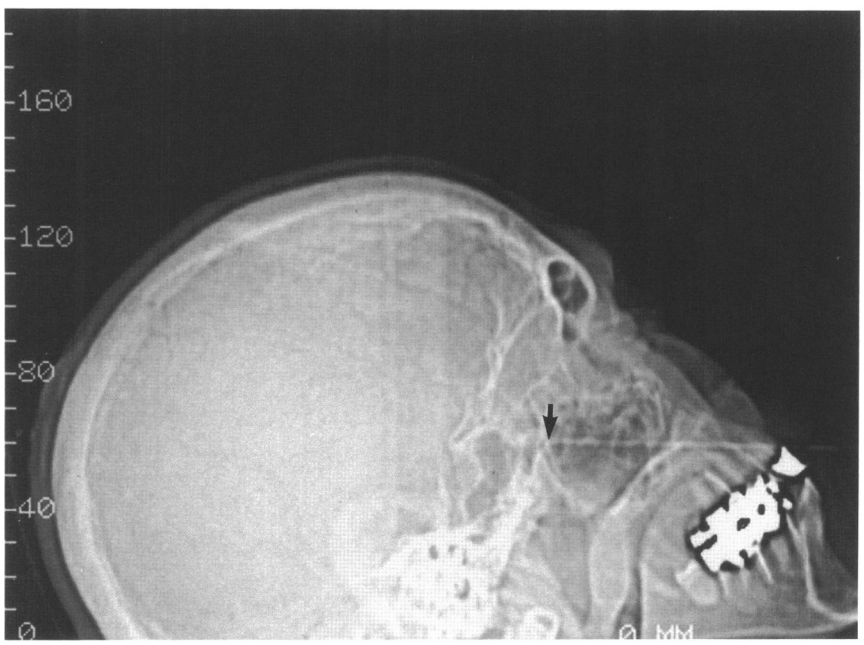
Although standard techniques are available to successfully manage typical trigeminal neuralgia, the eradication or control of some atypical facial pain syndromes may be very difficult. Patients with atypical facial pain, particularly of the post-traumatic variety, involving the superficial and deep structures of the midface may benefit from peripheral nerve blockade and subsequent neurolytic procedures directed at the maxillary nerve. The region of the foramen rotundum is not regularly accessed percutaneously, and consequently no standard technique has been popularized for this purpose. The present work offers a simple technique to reach this difficult anatomic locus through the face in a manner analogous to the percutaneous transovale technique described by Hartel[3] for allowing access to the foramen ovale. The lower face approach of Hartel is not suitable for reaching the foramen rotundum because the posterior border of the maxillary antrum obstructs the path of the needle to the pterygopalatine fossa. An anterior transfacial technique has been mentioned in the literature, but without any technical or anatomic details.[2] White and Sweet[1] described a lateral infrazygomatic approach to the pterygopalatine region. This technique has also been used and described by Murali.[4] The advantage of the currently described technique over the lateral infrazygomatic approach is that it allows the needle to be oriented more closely to the axis of the foramen rotundum and the maxillary nerve.

Alternative treatments that may be used include intraoral injections of the palatine nerves and the superior dental nerves, and injection of the infraorbital nerve. However, these may not be successful if the injury is more proximal; and the injection may miss other maxillary trigeminal branches, such as the sphenopalatine nerves, the pharyngeal nerve, and the orbital branches of the maxillary nerve, which may be contributing to the pain syndrome. Similarly an infraorbital nerve injection may be adequate for superficial facial pain, but will not adequately address the structures contributing to the genesis of deeper facial and intraoral pain. Creating a lesion in the trigeminal ganglion may address the trigeminal fibers reaching this area, but in practice it is very difficult to make a suspended maxillary fiber lesion without the risk of creating additional sensory deficits in the distribution of one or both of the other trigeminal divisions. We prefer not to perform a destructive lesion in the ganglion in this group of patients to avoid the possibility of the development of worsening pain with a peripheral procedure. Leaving the ganglion intact preserves the patient as a candidate for chronic trigeminal ganglion stimulation.[5]

An additional benefit of treatment directed at the pterygopalatine fossa in this particular group of patients is that it allows the potential eradication of the contribution of the autonomic fibers to the pain syndrome, since some of these patients have been referred to as having facial causalgia. The nerve of the pterygoid canal, or vidian nerve, is made up of the parasympathetic fibers of the greater superficial petrosal nerve joining the sympathetic fibers of the deep petrosal nerve coming from the pericarotid plexus. The vidian nerve has been implicated as a mediator in some craniofacial pain syndromes such as cluster headache.[6] An autonomic contribution to post-traumatic facial pain has also been described.[7] This theoretical concern makes a case for the extracranial creation of a neurolytic lesion at the foramen rotundum, rather than




A




B

**Figure 3.** A: Coronal CT scout view. The needle is seen coursing obliquely through the left face, lateral to the maxillary antrum. The needle tip (arrow) projects over the inferior orbit just below to the inferior orbital fissure. B: Lateral CT scout view. The needle courses horizontally through the face and is seen through the maxillary antra. The needle tip (arrow) projects over the posterior sinus in the pterygopalatine fossa.

making a transovale retrogasserian lesion in some of these patients, because it permits destruction of autonomic as well as trigeminal nerve fibers.

There were no complications in this series. No patient had disabling xerophthalmia. A theoretical complication is the inadvertent passage of the needle through the inferior orbital fissure into the intraorbital contents, or even the globe. For this reason, the CT scan was used to confirm needle position. Owing to the complexity of the structures in this area, fluoroscopy was not considered to be an alternative to the CT images.

The described technique provides a simple method for reaching pterygopalatine fossa. Reaching this area allows the performance of ablative procedures that may be very helpful in the treatment of some therapeutically intractable post-traumatic atypical facial pain syndromes. Although alcohol neurotomy has been used in this series, this technique for reaching this area may be used in conjunction with other neurolytic techniques such as radiofrequency. It could also be used in neuroaugmentative treatment as a route for implantation of an indwelling maxillary nerve stimulating electrode.

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## REVIEWER'S COMMENTS

Stechison and Brogan are to be complimented for an interesting anatomic description of a method for local anesthetic and possible chemical neurotomy of facial sensory components in the sinopalatine region. Typical trigeminal neuralgia often can be treated by direct access to the foramen ovale or rotundum for specific branches. However, there are a number of cases of atypical facial pain that respond only incompletely to these more traditional approaches. I am not aware of other anatomic descriptions of approaches to this particular space, and the authors are to be complimented for their lucid presentation.

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