Pterygoid venous plexus anastomosis in trigeminal percutaneous glycerol rhizotomy: illustrative case

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BACKGROUND Percutaneous glycerol rhizotomy (PGR) is a common, effective, and relatively safe treatment for trigeminal neuralgia that is refractory to medical management. Anastomotic skull base venous anatomy should be considered when delivering percutaneous agents.

OBSERVATIONS The authors report an anastomotic connection, not previously described in the literature, between the bilateral pterygoid venous plexuses upon air injection during PGR with computed tomography (CT) guidance for trigeminal neuralgia. Pertinent microsurgical and skull base venous anatomy is reviewed.

LESSONS Anastomoses between the pterygoid venous plexuses present a potential passage for materials used during PGR to reach unintended contralateral neurovascular structures. The use of CT guidance may identify this anastomotic connection and decrease the likelihood of an aberrant flow of materials used during the PGR.

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KEYWORDS pterygoid venous plexus; percutaneous glycerol rhizotomy; trigeminal neuralgia

Percutaneous glycerol rhizotomy (PGR) is a safe and effective treatment for medication-refractory trigeminal neuralgia,1,2 although it may lead to trigeminal distribution sensory loss.3,4 Computed tomography (CT)-guided PGR has been shown to improve procedural efficiency, reduce operator radiation exposure, and allow definitive needle placement within the foramen ovale.5 In addition to the foramen ovale, CT guidance allows the visualization of key skull base anatomy, such as the infratemporal fossa.6

The infratemporal fossa houses the pterygoid venous plexus, which is closely associated with the foramen ovale and thus presents an avenue for errantly injected materials. The pterygoid venous plexus is located between the temporalis and lateral pterygoid muscles, with known connections to the maxillary and facial veins via the deep facial veins, as well as the cavernous sinus through emissary veins.6–9 Intracranial cavernous sinus anastomoses via the anterior and posterior circular sinuses are well known and present a possible indirect connection between pterygoid plexuses.10 Extracranial anastomoses from one pterygoid venous plexus to the other have not been described in the literature and may be an important consideration during CT-guided PGR planning injections to decrease the risk of unilateral or bilateral venous embolic adverse events.

In this report, a middle-aged man with left ophthalmic (V1) and maxillary (V2) distribution trigeminal neuralgia that did not respond to medical management and microvascular decompression (MVD) was found to have an anastomotic connection between his pterygoid plexuses.

Illustrative Case

History

A 56-year-old man with left trigeminal neuralgia in the ophthalmic (V1) and maxillary (V2) distributions more than the mandibular (V3), which had developed after an extensive left neck dissection and radiation for papillary thyroid cancer 9 years prior, did not respond to medical management and underwent MVD at an outside institution 9 months before his presentation to us with persistent left facial pain. The patient initially had several months of relief following
the MVD with residual facial numbness, but the pain returned. The pain was once again sharp, lancinating, and triggered by a variety of stimuli (e.g., touching the face, the cold, chewing) and predominantly in the V1 and V2 distributions. Carbamazepine, gabapentin, baclofen, and opioids were trialed without relief. His neurological examination finding was significant for decreased sensation to pinprick in the left V2 and V3 distributions. Magnetic resonance imaging (MRI) of the head did not demonstrate compressive vascular pathology on the left trigeminal nerve (Fig. 1). The patient was offered a left-sided PGR.

Operation
The patient underwent a left-sided PGR, as previously described.5 After advancing the spinal needle into the foramen ovale under CT guidance (Fig. 2), injected air (because of a contrast allergy) demonstrated egress across to the contralateral pterygoid venous plexus (Fig. 3). Given this venous anastomosis, we repositioned the needle under CT guidance in the foramen ovale and then ensured no further venous egress was present with additional small-volume air injections. Glycerol was then injected.

Postoperative Course
The patient tolerated the procedure without complication, and his postoperative course was uneventful. Unfortunately, he obtained no symptomatic relief from the procedure. He was seen in our clinic, where we offered one additional trial of PGR, then stereotactic radiosurgery (SRS) if his condition failed to respond. Following the second PGR, he experienced several months of symptomatic relief, but his left facial pain recurred. He then underwent repeat MRI with thin cuts through the trigeminal nerve, which demonstrated a non-enhancing mass lesion consistent with an operative implant from his MVD (Fig. 4). We then recommended, and the patient underwent, SRS with 85 Gy to the left trigeminal dorsal root entry zone. This procedure resulted in partial symptomatic relief.

Patient Informed Consent
The necessary patient informed consent was obtained in this study.

Discussion
Observations
We observed an anastomosis between bilateral pterygoid venous plexuses during CT-guided PGR on scout injections of air for needle positioning. In our review of the literature, we found no reports of contralateral anastomosis of the pterygoid venous plexus during PGR or complications affecting the contralateral side.

Lessons
Proximity of the pterygoid venous plexus to the foramen ovale and anastomoses between the bilateral pterygoid venous plexuses present potential passages for materials used during PGR to reach unintended neurovascular structures and cause bilateral side effects. Although possible indirect intracranial anastomoses via the cavernous sinuses are known, there are no reports of extracranial pterygoid venous plexus anastomosis.

The pterygoid plexus is located in the infratemporal fossa with close relationships to many skull base neurovascular structures.6–8 It communicates with the cavernous sinus, inferior ophthalmic vein, and facial veins.6 The anterior facial vein provides additional anastomoses between the pterygoid plexus and cavernous sinus via the
deep facial, ophthalmic, and angular veins. Furthermore, in the foramen ovale, spinosum, and lacerum, there are sphenobasal emissary channels that connect the cavernous sinus and the pterygoid venous plexus. Although there is no direct communication between the contralateral sides via the vessels of the infratemporal fossa, the intercavernous sinuses connect the left and right cavernous sinuses and thus provide a theoretical indirect connection.

The presence of contralateral air may be due to direct and/or indirect intracranial and/or extracranial anastomoses between the bilateral pterygoid venous plexuses. This distinction cannot be made without diagnostic cerebral angiography, but the presence of a passage that allows contralateral air egress on our imaging is nevertheless important for clinicians to know.

Contralateral pterygoid venous plexus anastomosis in this case highlights the possibility of bilateral adverse events. Specifically, cavernous sinus pathologies can lead to periorbital edema, cranial nerve palsy, diplopia, ophthalmoplegia, paresthesias, or stroke. The use of CT guidance for trigeminal PGR may identify contralateral egress of injected agents via known intracranial and/or anomalous extracranial anastomotic connections and thus may help to avoid the theoretical risks of contralateral adverse events.

References

Disclosures
Dr. Resnick reported stock options from NIDUS.

Author Contributions
Conception and design: Buckley, Cordeiro, Kraemer, Pun, Resnick. Acquisition of data: Buckley, Kim, Pun, Resnick. Analysis and interpretation of data: Buckley, Kim, Kraemer, Resnick. Drafting the article: Buckley, Cordeiro, Kim. Critically revising the article: Buckley, Cordeiro, Kim, Kraemer, Resnick. Reviewed submitted version of manuscript: Buckley, Cordeiro, Kim, Kraemer. Approved the final version of the manuscript on behalf of all authors: Buckley. Administrative/technical/material support: Cordeiro.

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FIG. 4. Axial T2-weighted MRI with thin cuts through the trigeminal nerve showing a nonenhancing mass-occupying lesion at the dorsal nerve root entry zone consistent with an operative implant.