Case Series

Trigeminal Neuralgia Treated with Percutaneous Balloon Compression: A Case Series

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ABSTRACT

Background: Trigeminal neuralgia (TN) produces sudden, repeated, electric-shock-like face pain with significant functional impairment. Percutaneous balloon compression (PBC) of the trigeminal (Gasserian) ganglion is a less invasive alternative to medication-refractory TN or patients not suitable for extensive surgery.

Case Summary: Three adults with refractory TN received fluoroscopy-guided PBC. Case 1: A 54-year-old female with left V1–V3 pain, refractory to carbamazepine/gabapentin, experienced ≈75% immediate relief and complete analgesia at 1 and 6 months. Case 2: A 28-year-old female with left V1–V3 TN following unsuccessful radiofrequency ablations and microvascular decompression experienced a mild post-procedure headache with minor magnetic resonance imaging-detectable bleed treated conservatively; pain-free at day 7 and 6 months. Case 3: A 64-year-old male with right V1–V2 TN had total relief within 1 h; temporary facial numbness/dry eye settled by 2 months, pain-free at 7 months.

Conclusions: PBC provided prompt, long-lasting analgesia with acceptable, predominantly reversible sensory effects. Selective, "pear-shaped" balloon confirmation, and uniform compression durations favor PBC as an efficacious interventional treatment for TN.

Keywords: Gasserian ganglion, interventional analgesia, neuropathic facial pain, percutaneous balloon compression, trigeminal neuralgia

INTRODUCTION

Trigeminal neuralgia (TN) is a chronic pain condition with paroxysms of one-sided, shock-like pain along one or more divisions of the trigeminal nerve.[1-3] Attacks are frequently initiated by low thresholds of stimuli such as eating, speaking, toothbrushing, or light facial touch, and can completely devastate quality of life.[2,3] Initial treatment consists of carbamazepine or oxcarbazepine; however, some patients have suboptimal control or unacceptable side effects.[2,3] For such patients, interventional treatments – radiofrequency thermocoagulation, glycerol rhizolysis, stereotactic radiosurgery, microvascular decompression (MVD), and percutaneous balloon compression (PBC) – are used.[1-3]

PBC creates controlled, transient compression of trigeminal rootlets in Meckel's cave, preferentially damaging large myelinated fibers transmitting the lancinating pain of TN while preserving small unmyelinated fibers.[1-3] With proper foramen ovale cannulation and typical "pear-shaped" balloon shape under lateral fluoroscopy, PBC provides high rates of immediate pain relief with an excellent safety profile.[1-3] This case series reports technique, peri-procedural management, and outcomes in three consecutive patients with refractory TN.

METHODS

This series of cases followed the Declaration of Helsinki and the ICMR National Ethical Guidelines. Informed consent in writing for the procedure and for publication of de-identified clinical details/images was taken from all patients; identifiers were not used to maintain confidentiality. Since this is a descriptive series of routine care, trial registration wasn't necessary.

CASE 1

A 54-year-old woman had a 1-month history of severe, electric shock-like pain in the left V1–V3 distribution,

triggered by mastication and mouth opening and disrupting sleep, with no relief from carbamazepine or gabapentin. After counselling, she consented to PBC. Following fasting and pre-anesthetic evaluation, she received oxygen (3 L/min) and midazolam 1 mg IV; with the head neutral and the ipsilateral cheek prepped, the foramen ovale was identified under C-arm guidance in approximately 25° oblique and 15° caudal direction [Figure 1]. After local infiltration with 2% lignocaine, a 10-cm 20-gauge needle was advanced to the foramen ovale, the stylet removed, and a guidewire placed to railroad a dedicated PBC cannula; lateral fluoroscopy confirmed appropriate depth without crossing the clivus–petrous junction [Figure 2]. A 4F Fogarty balloon was introduced and inflated with 0.8 mL iohexol; a propofol bolus facilitated tolerability during inflation. The balloon assumed the characteristic pear shape and was maintained for 90 s under continuous fluoroscopy before deflation and removal. Hemostasis was achieved by brief external pressure. She awoke within minutes, reporting 75% immediate pain relief without headache. Mild ipsilateral cheek numbness and paresthesia were anticipated and resolved spontaneously. After overnight observation and a brief course of IV antibiotics, she was discharged the next day. At 1 and 6 months, she remained pain-free off medication.

Figure 1: Patient position

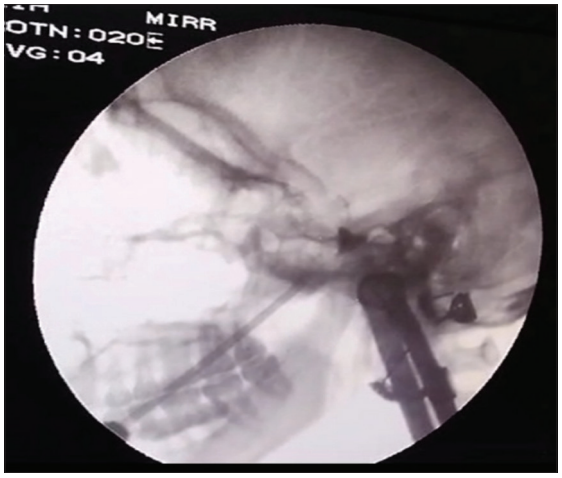

Figure 2: Lateral fluoroscopy image

CASE 2

A 28-year-old woman with hypothyroidism had left-sided TN involving all three divisions, refractory to two radiofrequency procedures and to MVD (Dacron patch) with persistent pain. PBC was pursued after shared decision-making. The procedural steps mirrored Case 1. A pear-shaped balloon configuration was documented. She experienced immediate analgesia and was discharged at 48 h. She developed a post-procedure headache, and magnetic resonance imaging (MRI) showed a small focal hemorrhage without mass effect. Conservative management with mannitol and dexamethasone, alongside prophylactic antibiotics, resulted in resolution within 7 days. She remained pain-free at 6 months.

CASE 3

A 64-year-old man had right-sided TN involving V1–V2 dermatomes with 3 years of partial response to carbamazepine and gabapentin. After counseling on radiofrequency versus PBC, he opted for PBC.

After pre-medication with midazolam and glycopyrrolate, the foramen ovale was accessed as above. A 4F balloon was inflated with 0.6 mL iohexol for 90 s under lateral fluoroscopy, followed by uneventful removal. Complete pain relief occurred within 1 h of recovery. Transient facial numbness and ipsilateral dry eye were managed with lubricating drops and resolved within 2 months. He remained pain-free at 7 months without medication.

Procedural considerations

Patient selection: The typical candidates are classic TN refractory to medical treatment, intolerance to medication, or not suitable for craniotomy/MVD.[2,3] Delineation of the involved trigeminal division and trigger zones, medication history, and previous interventions influence planning, which should be clarified.[2]

Anesthesia and monitoring: Most PBC procedures can be carried out under monitored anesthesia care with mild to moderate sedation (e.g., midazolam ± propofol), supplemented with local infiltration. Airway equipment and resuscitation facilities must be readily accessible. Hemodynamic and respiratory monitoring are routine.

Imaging and access: Oblique and caudal C-arm angles are used to best visualize the foramen ovale. The needle trajectory is planned to prevent intracranial vascular or dural penetration. Lateral imaging verifies depth;

proceeding beyond the clivus–petrous line poses a risk of inappropriate placement.

Balloon inflation: Lateral fluoroscopy ensures the typical "pear shape" to confirm intradural position within Meckel's cave and successful compression of ganglia.[1,3] Optimized volumes are usually ~0.5–1.0 mL of non-ionic contrast; compression durations frequently are 60–120 s, titrated by division-specific symptoms and patient tolerance.[1,3]

Post-procedure care: The patient is monitored for headache, cranial neuropathies (specifically corneal anesthesia if V1 is affected), and sensory disturbances. Transient dry eye is treated with lubricating eye drops. Analgesics and short-term antibiotics may be given according to institutional protocol.

Outcomes and adverse effects

In the three cases, PBC was associated with instant pain relief with long-lasting remission at 6–7 months. Transient facial paresthesia, numbness, and dry eye – the most frequent effects in keeping with selective damage of large myelinated fibers – cleared within weeks to months.[1,3] A post-procedure headache occurred in one patient with a minor MRI-detected bleed that cleared with conservative management.

In published reports, PBC produces prompt relief of pain in a high percentage of patients, with cumulative rates of recurrence, but potentially treatable with recrudescence by compression.[1,3] Sensory alterations (hypoesthesia, dysesthesia) are common but usually minor; severe complications (anesthesia dolorosa, cranial nerve palsy, vascular damage) are rare with careful technique.[1-3] Long-term comparative results indicate that PBC's effectiveness converges with other percutaneous rhizotomy procedures, with reduced procedure time and positive recovery profiles, and MVD as a lasting option when neurovascular compression is present and surgical risk is acceptable.[2,3]

DISCUSSION

This series highlights pragmatic aspects of PBC for anesthesiologists in interventional pain practice: notably, PBC can succeed even after failed radiofrequency ablation and MVD, as in Case 2, offering a salvage option without re-craniotomy.[2,3] Outcomes hinge on technique fidelity – an unwavering fluoroscopic workflow with precise foramen ovale cannulation, lateral depth confirmation, and achievement of the characteristic "pear-shaped" balloon – to optimize efficacy and safety.[1,3] Compression parameters in our cases – balloon volumes ~0.6–0.8 mL and dwell times near 90 s – yielded reliable relief and fall within commonly reported practice ranges.[1] Anticipatory counselling on expected sensory sequelae, including transient numbness/paraesthesia and corneal hypoesthesia (especially with V1 involvement), promotes adherence to eye-protection measures and reduces anxiety.[1,3] Although complications are uncommon, vigilance is essential: post-procedure headache and small imaging-visible bleeds may occur yet are typically managed conservatively, as demonstrated in Case 2, underscoring the need for prompt recognition and supportive care. Against a backdrop where TN has a low but age-rising incidence and causes stereotyped, brief, debilitating attacks,[4] pharmacotherapy remains first-line; however, PBC occupies a valuable niche for refractory disease, frail patients, or those preferring a percutaneous day-care approach.[2,3] Our experience – swift analgesia, short hospitalization, and minimal morbidity – mirrors broader literature and supports PBC as a valuable, repeatable technique in appropriately selected patients.[3-6]

As an uncontrolled, small case series, generalizability is limited. Follow-up extended to 6–7 months; longer surveillance is needed to characterize recurrence and late adverse events. Pain intensity was not quantified with standardized scales (e.g., Numeric Rating Scale), and quality-of-life measures were not recorded. Future prospective work should incorporate validated outcomes and standardized compression parameters to refine best practices.

CONCLUSIONS

Fluoroscopy-guided PBC offered prompt, significant, and long-lasting pain alleviation in three patients with medication-resistant TN, one of whom had previous unsuccessful ablative and microvascular surgery. With judicious patient selection, informed consent, and precise technique, PBC is a useful, minimally invasive procedure with largely temporary sensory side effects and short hospital stays.

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