PERCUTANEOUS BALLOON COMPRESSION OF GASSERIAN GANGLION FOR THE TREATMENT OF TRIGEMINAL NEURALGIA: AN EXPERIENCE FROM INDIA

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Abstract

Trigeminal neuralgia (TN) is characterized by unilateral, lancinating, paroxysmal pain in the dermatomal distribution area of trigeminal nerve. Percutaneous balloon compression (PBC) of Gasserian ganglion is an effective, comparatively cheaper and simple therapeutic modality for treatment of TN. Compression secondary to PBC selectively injures the large myelinated A-alfa (afferent) fibers that mediate light touch and does not affect A-delta and C-fibres, which carry pain sensation. Balloon compression reduces the sensory neuronal input, thus turning off the trigger to the neuropathic trigeminal pain. In this current case series, we are sharing our experience with PBC of Gasserian Ganglion for the treatment of idiopathic TN in our patients at an academic university-based medical institution in India. During the period of August 2012 to October 2013, a total of twelve PBCs of Gasserian Ganglion were performed in eleven patients suffering from idiopathic TN. There were nine female patients and two male patients with the age range of 35-70 years (median age: 54 years). In all patients cannulation of foramen ovale was done successfully in the first attempt. In eight out of eleven (72.7%) patients ideal ‘Pear-shaped’ balloon visualization could be achieved. In the remaining three patients (27.3%), inflated balloon was ‘Bullet-shaped’. In one patient final placement of Fogarty balloon was not satisfactory and it ruptured during inflation. This case was deferred for one week when it was completed successfully with ‘Pear-shaped’ balloon inflation. During the follow up period of 1-13 months, there have been no recurrences of TN. Eight out of eleven patients (72.7%) are completely off medicines (carbamazepine and baclofen) and other two patients are stable on very low doses of carbamazepine. All patients have reported marked improvement in quality of life. This case series shows that percutaneous balloon compression is a useful minimally invasive intervention for the treatment of trigeminal neuralgia.

Introduction

Trigeminal neuralgia (TN) is characterized by unilateral, lancinating, paroxysmal pain in the dermatomal distribution area of trigeminal nerve¹. According to International Headache Society (IHS) and International Association for Study of Pain (IASP) trigeminal neuralgia is

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painful, unilateral affliction of face, characterized by brief, electric shock like pain limited to one or more divisions of trigeminal nerve, commonly evoked by trivial stimuli like shaving, talking, washing of face but may also occur spontaneously with abrupt onset and termination. Exact cause of TN is not known, and multiple treatment options are available but there is no ideal treatment available for all patients. Severity of pain can result in poor health and deterioration of day-to-day functional status.

According to IHS, TN can be classified as classical or idiopathic and symptomatic or secondary. In 2003, Burchiel classified TN on the basis of clinical features: Type 1 TN which is predominantly episodic and sharp; and Type 2 TN which is constant, dull, and burning in nature.

The American Academy of Neurology (AAN) and the European Federation of Neurological Societies (EFNS) Guidelines on TN treatment (2008) recommend medical treatment with carbamazepine and oxcarbazepine or lamotrigine and baclofen as first option for TN. In patients refractory to medical treatment or in whom side effects of medications are intolerable, other surgical treatments are recommended. Various modalities of surgical treatment are possible, from major intracranial operation to minimally invasive percutaneous techniques. Because of the achievable longest duration of pain relief, microvascular decompression (MVD) is recommended as the first option, but it is a major intracranial operation, which may not be suitable for older, debilitated patients. MVD is also complicated with the risk of major neurological morbidity and mortality. Due to their minimally invasive nature and possibility to repeat, percutaneous procedures are widely used for the surgical treatment of TN, mostly in the patients who are not eligible for MVD, are not willing to have MVD or are refractory to previous surgical treatments. One of these procedures is percutaneous balloon compression (PBC) of Gasserian ganglion which was first introduced by Mullan and Lichtor in 1983.

PBC is an effective, comparatively cheaper and simple therapeutic modality for treatment of TN. Compression secondary to PBC selectively injures the large myelinated A-alfa (afferent) fibers that mediate light touch and does not affect A-delta and C-fibres, which carry pain sensation. Balloon compression reduces the sensory neuronal input, thus turning off the trigger to the neuropathic trigeminal pain. PBC is not as selective for pain originating from a particular trigeminal division as radiofrequency thrombocoagulation (RFTC) is.

In this current case series, we are sharing our experience with PBC of Gasserian ganglion for the treatment of idiopathic TN in our patients at an academic university-based medical institution in India.

**Case Series**

During the period of August 2012 to October 2013, a total of twelve PBCs of Gasserian Ganglion were performed in the Department of Anesthesiology and Pain Medicine at Lala Lajpat Rai Memorial Medical College, Meerut, India in eleven patients suffering from idiopathic TN. There were nine female patients and two male patients with the age range of 35-70 years (median age: 54 years). All the patients were suffering from Burchiel Type 1 TN with the classical features of idiopathic TN i.e., electric shock-like lancinating pain in the territory of trigeminal nerve (CN V). Two patients had involvement of both maxillary (V2) and mandibular (V3) divisions of Cranial Nerve V; three patients had involvement of V2 division only and remaining six patients had TN along V3 division only. The duration of the disease ranged from 2.5-12 years. Only three patients could undergo a magnetic resonance imaging because of financial constraints; all other patients were screened for any intracranial pathology by computerized tomography scanning. None of our patients had bilateral TN; five patients had involvement of right side CN V and six patients had left-sided involvement. All patients had been treated with carbamazepine and baclofen as part of failed medical management prior to PBC. One patient had already undergone retrogasserian glycerol rhizotomy, which provided pain relief for only five months. One patient underwent PBC on two occasions secondary to non-satisfactory placement of balloon inside the Meckel’s cave followed by rupture of balloon and venous bleeding. The case was deferred and performed again after one week with satisfactory results.
Procedural Details of PBC: All the procedures were performed under conscious sedation using two dimensional C-arm fluoroscopic guidance. Patients were placed in supine position with slight extension of neck. C-arm fluoroscope was aligned to take a ‘Modified sub-mental view’, in which foramen ovale was visualized between mandible on the lateral side and maxilla on the medial side (Figure 1). In this view, a 14-gauge cannula with blunt trocar was used to enter the foramen ovale to reach the Meckel’s cave where the Gasserian ganglion is situated (Figure 2). Once entry was confirmed in the Meckel’s cave, lateral view was obtained wherein 4-Fr Fogarty catheter was gently threaded in to the Meckel’s cave up to the clivus. After confirmation of correct position of the balloon in anterio-posterior and lateral views, Fogarty balloon was inflated with 0.8-1 ml of water soluble contrast dye (Omnipaque-240, GE Healthcare) for 1.5-3minutes. After completion of the intervention, Fogarty balloon was deflated and removed along with the cannula; and manual digital pressure was applied for five minutes against the maxilla to stop any bleeding and cerebrospinal fluid drainage. A small dressing was applied on the skin puncture site and patients were transferred to post-anesthesia care unit for observation. After regaining full consciousness, patients were examined for relief in pain, facial sensation and corneal reflex; and, after two to four hours, patients were discharged home on oral antibiotics and non-steroidal anti-inflammatory drugs (NSAIDs).

Procedural Results of PBC: In all patients cannulation of foramen ovale was done successfully in the first attempt. In eight out of eleven (72.7%) patients ideal ‘Pear-shaped’ balloon visualization could be achieved (Figures 3-4). In the remaining three patients (27.3%), inflated balloon was ‘Bullet-shaped’. In one patient final placement of Fogarty balloon was not satisfactory and it ruptured during inflation. This case was deferred for one week when it was completed successfully with ‘Pear-shaped’ balloon inflation. In one patient, venous bleeding was detected on removal of trocar from cannula that ceased after placement of Fogarty catheter and successful PBC. In another patient, who had not been pre-medicated with atropine, there was sudden asystole on entering in to the foramen ovale, which responded to Inj. atropine 1.2mg intravenous bolus with no post-operative sequelae. In all other patients, no episode of major bradycardia occurred due to pre-medication with atropine 0.4mg intravenously. All patients had complete relief of neuralgic pain in the immediate post-operative period. In nine out of eleven patients (81.81 %), there was mild to moderate facial hypoesthesia, which was more prominent with longer compression-duration (3 minutes vs. 1.5 minutes). This hypoesthesia improved within 6-8 weeks and did not cause appreciable discomfort to these patients. Five out of eleven patients (45.4%) complained about mild facial dysesthesias (continuous burning sensation in CN V distribution), which improved in 6-8 weeks with the use of neuro-modulatory drugs such as pregabalin. One patient complained of malocclusion of mandible and difficulty in chewing on the operated side, which
also improved in four weeks without any treatment. Four out of eleven (36.36%) patients revealed mild to moderate asymptomatic masseteric weakness on post-operative physical examination that also improved in 4-6 weeks. None of the patients had loss of corneal reflex and/or anesthesia dolorosa. In two out of eleven (18.2%) patients, there was eruption of herpes labialis on the ipsilateral side, which was treated with anti-viral drugs with resolution of the lesions within two weeks. All patients complained of temporal headache in the immediate post-operative period, which improved in 24-48 hrs with the use of NSAIDs and ice fomentation. None of the patients had any major complication such as corneal ulcer, 4th or 6th cranial nerve palsy, meningitis or death. During the follow up period of 1-13 months, there have been no recurrences of TN. Eight out of eleven patients (72.7%) are completely off medicines (carbamazepine and baclofen) and other two patients are stable on very low doses of carbamazepine. All patients have reported marked improvement in quality of life.

Minimally invasive pain interventions have found a niche among the available treatments for many intractable, chronic painful conditions such as TN. PBc has been found to be an effective intervention in many studies. PBc has an advantage of sparing the corneal reflex over other percutaneous methods. It has a unique mechanism of action of selective injury to large myelinated A-alfa and A-beta fibers and relative sparing of small, unmyelinated C-fibers and poorly myelinated A-delta fibers. So it may be the best technique for addressing ophthalmic division (V1) pain of TN and this observation has been confirmed by Brown et al.

Initially PBc was advocated for older age group and for those who were unfit for major surgical procedure. Now it has been found useful even in many young patients, especially those who do not have any evidence of vascular malformation and/or are unwilling to undergo major surgery. Strojnik and Smigoc and Natrajam have used this technique in patients with aberrant basilar artery as well as in young patients. In our study, there was a female patients preponderance, most patients were of advanced age and there was almost equal distribution of right side vs. left side involvement, although some authors have found preponderance of right sided involvement.

In all our patients, modified Mullan’s technique was used for PBc. Though ‘Pear-shaped’ balloon is considered to be the best in some studies, this shape was achieved in only eight out of eleven patients in our series but we did not find any differences in the outcome, possibly due to shorter follow-up in our study (1-13 months). Same can be true in regards to the compression-duration wherein practitioners have used compression time ranging from 1-20 minutes; some authors have reported correlation between the duration of compression and duration of pain relief but with longer duration of compression, more complications like facial dysesthesias have been reported.
Because there is no consensus on the optimal duration of compression during PBC, in our practice we have used the compression times of 1.5 minutes and 3 minutes; and we have found that although the pain relief was complete with both compression-duration, incidence and magnitude of facial hypoesthesia and dysesthesia was more in patients who had received compression for longer duration.

Prolonged masticatory weakness due to masseter-ptyerygoid weakness has been reported after PBC. We also encountered malocclusion on ipsilateral jaw in one patient and mild masseteric weakness in four patients, which was not bothersome to the patients because pre-procedure, they were not chewing from that side any way due to the precipitation of their neuralgic pain. In all patients, this weakness completely recovered in 4-6 weeks without any intervention. In all patients in our series, complete relief from neuralgic pain was observed, which is similar to other studies. Autonomic changes such as bradycardia and hypotension have been reported on entering the foramen ovale in more than 50% of cases which was not observed in our series because of pre-medication with atropine. Though no mortality has been reported during PBC in the literature, Natraj had reported an incidence of intra-operative myocardial infarction which was managed successfully. We also encountered a case of sudden asystole on foramen ovale penetration in a patient who was not given atropine pre-operatively in spite of our policy. It was recognized immediately due to continuous electrocardiography and was managed successfully with rescue dose of atropine with no post-operative sequelae. Therefore, it is our suggestion to ensure premedication with atropine prior to penetration of foramen ovale before all percutaneous procedures including PBC. Though review of medical literature elicits rare incidences of anesthesia dolorosa, intracranial fistula formation and cranial nerve injury, corneal ulceration and death during PBC, we did not encounter any such adverse effect.

Recurrence of pain after successful PBC and initial pain relief has been reported very widely in the literature, Baabor and Perez-Limonte had reported 15% recurrence after 3 years, and Skirving and Dan had reported 31.9% recurrence in 20-years duration. In our moderate follow-up period of 1-13 months, we have not found any recurrence so far.

The major limitations in the present study were retrospective nature of the case series, small number of patients (n=11) and short duration of follow-up (1-13months).

**Conclusion**

This case series shows that percutaneous balloon compression of Gasserian ganglion is a useful minimally invasive intervention for the treatment of trigeminal neuralgia. If performed appropriately with the help of anatomical landmarks and radiological guidance, it is a low risk procedure with high success rate. Due to very low incidence of corneal anesthesia and anesthesia dolorosa, we recommend PBC as first choice among percutaneous interventions for TN especially involving V1 division as well as in multidivisional pain.
References

4. Pollock BE, Stein KJ: Surgical management of trigeminal neuralgia patients with recurrent or persistent pain despite three or more prior operations. World Neurosurgery; 2010, 73:523-528.
The key to

Lock-up

Postoperative Pain

Initial bolus
Inject 1 ampoule Tramal® 100 mg i.v. or i.m. slowly over 2-3 minutes

Ways of administration after initial bolus

Infusion
Inject 2 ampoules Tramal®, each 100 mg, in 50mL of infusion solution. infusion rate 12-24 mg Tramal® (160-200 ul/min or 30-60 mL/h).

PCA
Subsequent increments of 20 mg with a lock-out time of 5 minutes.

Injection
Usual dose 50 mg or 100 mg iv/4 hourly up to a total daily dose of 400 mg except in special clinical situations which might necessitate daily dose up to 600 mg. Further treatment with Tramal® balus on demand.

If needed further doses of Tramal® 50 mg up to a total of 200 mg (excluding the initial bolus) within the first 60 min.

Follow-up

STEP I

Intra-Operative

Loading Dose
2.5 - 3 mg/kg at wound closure

Post-Anaesthesia Care Unit

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100 mg over 2-3 mins

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- 98% of BRIDION patients recovered to a TOF\(^*\) ratio of 0.9 from reappearance of T\(_{2}\) within 5 minutes\(^2\)
- 97% of BRIDION patients recovered to a TOF\(^*\) ratio of 0.9 from 1 to 2 PTCs \(^1\) within 5 minutes\(^3\)

**Rapid reversal**

- BRIDION rapidly reversed patients from reappearance of T\(_{2}\) \(^\uparrow\) in 1.4 minutes\(^2\)
- BRIDION rapidly reversed patients from 1 to 2 PTCs \(^\uparrow\) in 2.7 minutes\(^3\)

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade \(^1\)

**Important safety information**

BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the Intensive Care Unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nonneostigmine neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysesthesia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or snuffling on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation to BRIDION was uncertain. In a few individuals, allergic-like reactions (ie, flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchospasm was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (13%-22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or concomitant condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation.

Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

\(^1\) Train-of-four

\(^2\) Post tetanic counts

\(^3\) Second twitch

**REFERENCES**

1. BRIDION Summary of Product Characteristics (SPC)

Please see summary of product characteristics for full prescribing information.
Pioneering Medical Technology

TAP Block And InfiltraLong
For Effective Treatment
Of Long And Deep Incisions

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