Indian Journal of Clinical Anatomy and Physiology 2022;9(3):174–178

Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical Anatomy and Physiology

Journal homepage: https://www.ijcap.org/

Review Article

A study on trigeminal nerve: Does superior cerebellar artery causes trigeminal neuralgia

Prasanna Shravan Gaydhanker[1], Anuradha Prasanna Gaydhanker[2,*]

[1]*Dept. of Anatomy, College of Medicine and Health Sciences, Abu Dhabi, United Arab Emirates*
[2]*Dept. of Medical Education, College of Medicine and Health Sciences, Abu Dhabi, United Arab Emirates*

ARTICLE INFO

Article history:
Received 17-08-2022
Accepted 26-08-2022
Available online 10-10-2022

Keywords:
Trigeminal nerve
Trigeminal neuralgia
Cranial nerve

ABSTRACT

Background: Our brain is the most complex organ in our body which conducts various complex functions and this level of complexity is operated by different structures of the brain. The complexity of relaying information between brain and different parts of the body is conducted by 12 pairs of cranial nerves. Out of 12 pairs of cranial nerves, the most complex and largest nerve is know as trigeminal nerve which is responsible for sensation of face and motor functions such as biting and chewing. Sometimes due to offendation of this nerve typically by Superior Cerebellar Artery leads to most excruciating painful disorder humanity have ever witnessed.
Materials and Methods: A systemic self-study was planned to determine and review with proper enlightenment on the existing facts to find the root sources of trigeminal neuralgia.
Discussion: This article discussed and focused on the exact cause of trigeminal neuralgia it's association with Superior Cerebellar Artery along with descriptive analysis on the available treatments for this disorder.
Conclusions: We concluded with the fact that based on our thorough review and analysis Superior Cerebellar Artery is the main artery which typically causes world's most excruciating painful Suicide Disease.

1. Introduction

1.1. What is trigeminal nerve ?

Brain is the most complex organ in body of vertebrates. This level of complexity is operated by different structures of brain. The complexity of relaying information between brain and different parts of the body primarily to and from regions of head and neck is conducted by 12 pairs of nerves known as cranial nerves. Out of 12 pairs of cranial nerves, the fifth nerve is the largest nerve which is primarily responsible for sensation and motor functions such as biting and chewing is the nerve known as trigeminal Nerve.[1]

Among 12 pairs of cranial nerves, trigeminal nerve is the most complex cranial nerve known. The trigeminal nerve arises by roots from pons at it's junction with middle cerebellar peduncle. The two roots include very large sensory and small medial motor root which run forward and laterally over the apex of petrous temporal bone to enter the middle cranial fossa. Hence, by the name trigeminal nerve which suggests that tri-three, geminus-twin :- so "three-born/triplet", deriving from each of two nerves, one on each side of pons.[2] The Trigeminal nerve is divided into three main branches:-

1. Ophthalmic division of trigeminal nerve (V1)
2. Maxillary division of trigeminal nerve (V2)
3. Mandibular division of trigeminal nerve (V3)

* *Corresponding author*.
E-mail address: psgaydhanker@gmail.com (A. P. Gaydhanker).

https://doi.org/10.18231/j.ijcap.2022.037

The first two branches of trigeminal nerve are purely sensory whereas the mandibular branch supplies both motor and sensory function.[3]

1.2. What is trigeminal neuralgia?

A condition of intense, electric shock like pain which is the most excruciating pain produced to humanity is trigeminal neuralgia. Trigeminal neuralgia affects typically V2 and V3 branches of trigeminal nerve, so this stabbing pain is felt in lower faces and jaw commonly and also sometimes in region around nose and cheeks, very rarely around frontal and orbit region. This disease also known as Fothergill disease, Tic Douloureux. It is also know by the name suicide disease, because according to one report which states the fact that 50 percent of patients suffering from this chronic disorder for long time tends to developed suicide ideation because of long term chronic sufferings of pain, and many commits suicide due to suffering from psychological disorder caused by chronic sufferings. There are several controversies on its causes of this humanities most excruciating painful disorder through our systemic self studied review, we will enlighten on the possibility of its cause of trigeminal neuralgia.

2. Materials and Methods

A systemic self-study review was planned at Department of Anatomy to focus, review and enlighten on the facts of cause of trigeminal neuralgia.

2.1. Statistical methods

This systemic self-study reviewed the facts derived from history of trigeminal neuralgia documented since from the past 2.5 millennia to our current advancement of health care, discovering and investigating the possibilities of sources of this excruciating disorder. Vast analysis is made on this study to determine the cause of trigeminal neuralgia and it's association with vascular structures.

3. Observation

Based on our systemic self-study, we observed the facts that historical reviews of this facial pain was attempted for the past 2.5 millennia. Earlier renowned Greek Physician of that era Hippocrates, Aretaeus and Galen have described and demonstrated, but they weren't clear with our modern day description.[4] Aretaeus was known for giving one of the earliest descriptions of migraine which has been credited with first indication of trigeminal neuralgia by describing a headache in which "spasm & distortion of countenance takes place".[5] In the year 1756, Nicholas Andree first coined the term "tic douloureux" by conceptualizing trigeminal neuralgia in terms of convulsive behavior.

This name persisted for years even though not all patients demonstrated facial tics in conjunction with their pain.[6]

In the later year 1773, John Fothergill gave the first full accurate description of trigeminal neuralgia.[7] He presented his observation and impression of trigeminal neuralgia to Medical Society of London by describing a condition "as a painful affliction of face" in which excruciating episodes come on suddenly but last a short time, returning at irregular intervals. He also mentioned how certain actions, such as eating, talking or tactile contact, might elicit these painful episodes.

In the year 1891 first open surgical procedure was proposed for trigeminal neuralgia. In 1925, Dandy had unintentionally performed the Microvascular decompression surgery for the trigeminal nerve root. He gave his first observational fact by enlightening the cause of trigeminal neuralgia as the nerve was being compressed by vascular loops. Dandy in 1932 theorized and finalized the fact that trigeminal neuralgia was always caused by blood vessels compressing the nerve and causing this electric shock like pain. By the end of 1960s, W. James Gardner demonstrated the fact that removal of offending lesions or decompression could alleviate pressure on trigeminal nerve and the pain associated with trigeminal neuralgia.[8]

By the end of 1990s, very recognized neurosurgeon Dr Peter Janetta proved Dandy's original hypothesis. Janetta visualized the compression of trigeminal nerve at the root entry zone in patients of trigeminal neuralgia using an intraoperative microscope. Upon his observation in the trigeminal nerve root, he was very surprised to see a pulsating superior cerebellar artery compressing the largest cranial nerve i.e: trigeminal nerve. He exclaimed by saying "That's the cause of tic".[9]

According to Peter Janetta's which he accounted in New England Journal of Medicine that Superior Cerebellar Artery is one of the most frequent vessels responsible for trigeminal neuralgia.[10] With the recent advances of technology in healthcare, Magnetic Resonance Imaging (MRI) have indicated this fact very precisely that trigeminal neuralgia is caused by offendation of vascular structures. Based on our review from history of trigeminal neuralgia to our modern day advancements we derived the fact that trigeminal neuralgia is caused by offendation of vascular structures, in majority of the cases it is being observed that Superior Cerebellar Artery is the main offending vascular structures which causes the compression on trigeminal nerve and causes the world's most excruciating pain humanity have ever witnessed.[11]

4. Discussion

According to International Headache Society which defines suicide disease as painful unilateral affliction of face characterized by brief electric shock limited to divisions of one or more branches of trigeminal nerve. In simple terms, suicide disease or trigeminal neuralgia could be defined as

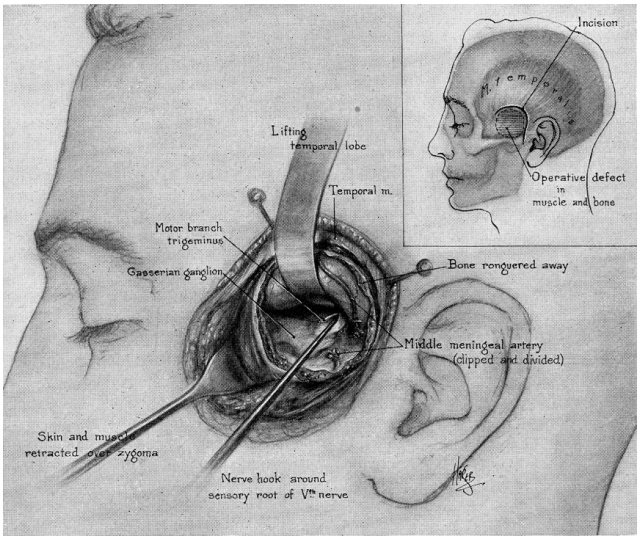

Fig. 1: History of trigeminal neuralgia (Sources :- neurosurgery.the clicnics.com)

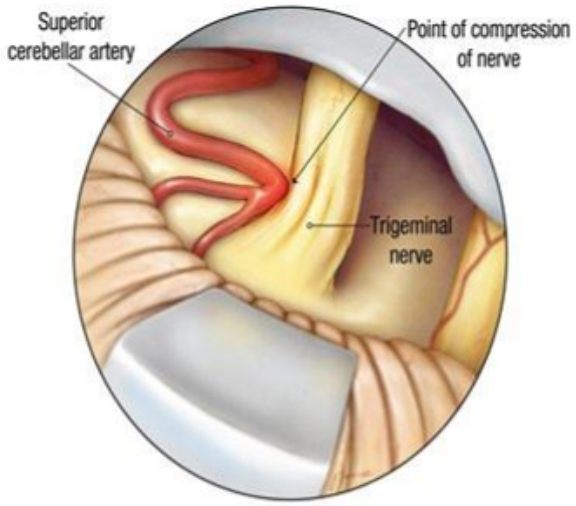

Fig. 2: Superior cerebellar artery compressing the trigeminal nerve

a chronic conditions characterized by sudden attack of pain lasting from few hours to several days which is confined to distribution of one or more divisions of trigeminal nerve. Trigeminal neuralgia is a condition which mainly arises from blood vessels typically Superior Cerebellar artery which compresses the trigeminal nerve when it exits the Brain stem. These compression cause damage to protective covering present around the myelin sheath. These injury to myelin sheath are known to cause such chronic conditions of suffering. The excruciating pain which becomes intolerable to patients. After suffering such chronic conditions patient starts developing psychiatric disorders which often results in long term depression, anxiety followed by sleep disorders.

Fig. 3: Potratit of nicolusandre (Sources: seminatic scholar.org)

Fig. 4: Potratit of Dandy

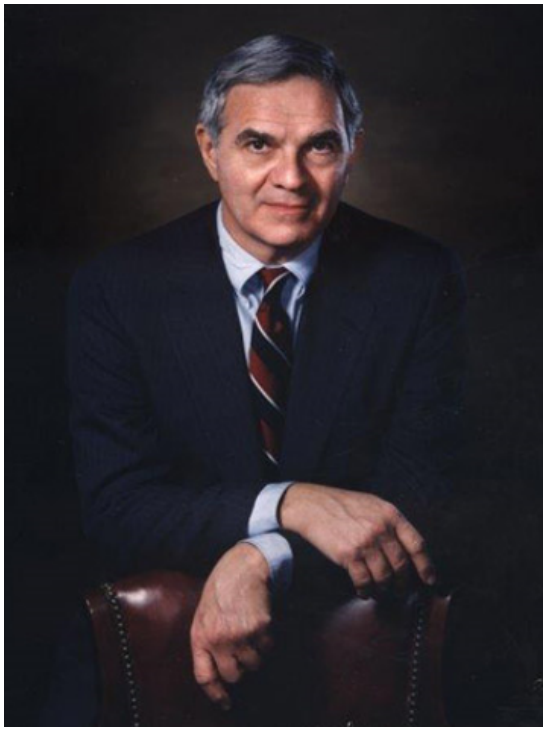

Fig. 5: Potrait of Peter J Janetta (Sources:- horatioalger.com)

At further stages suicide ideation is developed in patients.[12]

There are several forms of neurovascular compression syndromes known out of which the most common ones are trigeminal neuralgia and Hemifacial spasm whereas geniculate neuralgia, nervous intermedius neuralgia and Vestibular Paroxysmia are the less common ones. All this forms of Neurovascular compression Syndromes are characterized by functional disturbances of cranial nerves. The treatment of neurovascular compression syndromes starts with therapeutic medications at initial stage of this disorder and once it advances requires surgical procedures for permanent cure.

Medications which are used to treat almost all forms of Neurovascular compression syndromes and are found to be very effective in controlling the pain and providing relief initially includes:[13]

1. Carbamazepine
2. Baclofen
3. Phenytoin
4. Gabapentin
5. Clonazepam

Carbamazepine is considered as the drug of choice because it provides very good relief of symptoms initially. But adverse effects such as hyponatremia are usually observed which may necessitate the discontinuation of medication. Also, this medication provided relief of symptoms for very short period of time. So, the affected patient would require operative procedures for long term pain relief.

There are various major and minor surgical procedure known which are employed to cure Neurovascular compression syndromes for long term basis of pain relief. Among all the surgical procedure known, Microvascular decompression surgery [MVD] have shown the highest pain relief period of 12-15 years or more. In 1967, Dr Peter Janetta have introduced this surgical procedure and reported his study in 'The New England Journal of Medicine'. It showed that initial success rate was 82% for complete pain relief. The main objective of MVD was to separate the offending nerve from vascular structure by placement of Teflon sponge. Teflon sponge isolates the nerve from pulsating effect and pressure of blood vessels.[5] According to an research conducted by Dr. Aqueel Pabaney reported in Neurosurgical Atlas which showed that MVD could cure TN for a period of 10-20 years, then recurrence of symptoms were observed. There were often some general complications which were reported widely related to MVD was neural damage which further included dysphagia, CSF leakage, facial paralysis, double vision and very often hearing loss. There were sometimes very serious complications observed across worldwide which were intracerebellar hematoma, acute hydrocephalus, cerebellar subdural hematoma, status epilepticus, infection of brainstem, subarachnoid hemorrhage due to traumatic aneurysm and infaraction in territory of posterior cerebellar artery. The conventional implant Teflon which was used in MVD to separate the offendation showed various major complications out of which the most prominent clinical condition is known by the name as Teflon Granuloma. Teflon granuloma is an inflammatory giant cell foreign body reaction to polytetrafluoroethylene fibers. Teflon Granuloma clinically, pathologically and radiographically could emulate malignancy. So for proper cure of Neurovascular compression syndromes one must aim at repositioning of affected cranial nerve with better alternative which will not produce any adverse effects and would cure permanently.[14]

5. Conclusions

We state this fact that out of 12 pairs of Cranial Nerves, the most complex and largest cranial nerve is trigeminal nerve. Trigeminal nerve could produce the humanities most excruciating pain which is suffered by person tends to develop suicide ideation. Hence, this disease is also termed as suicide disease.

We are concluding this study by stating our perspective based on our review that vascular structures mostly Superior Cerebellar Artery compresses the trigeminal nerve and hence causes suicide disease.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Pandit M. Introduction of MOLUMA'S Implant-An Innovation to permanent cure of Trigeminal neuralgia and several Neurovascular compression syndrome. *Indian J Neurosci*. 2020;6(2):101–3.
2. Morris W. The American Heritage dictionary. New York: American Heritage Pub. Co,; 1969.
3. Pazhaniappan N. The Trigeminal Nerve. Teach me Anatomy; 2020. Available from: https://teachmeanatomy.info/head/cranial-nerves/trigeminal-nerve/.
4. Eboli P, Stone JL, Aydin S, Slavin KV. Historical characterization of trigeminal neuralgia. *Neurosurgery*. 2009;64(6):1183–6.
5. Clifford F. Trigeminal Neuralgia. *Arch Neurol*. 1995;59(9):1163–4.
6. UT Health San Antonio Physician. History of Trigeminal Neuralgia. Available from: https://www.uthscsa.edu/patient-care/physicians/services/trigeminal-neuralgia/history-trigeminal-neuralgia.
7. Stookey B, Ranshoff J. Trigeminal Neuralgia: Its History and Treatment. 1959;170(18):2261–10.
8. Patel SK, Markosian C, Choudhry OJ, Keller JT, Liu JK. The historical evolution of microvascular decompression for trigeminal neuralgia: from Dandy's discovery to Jannetta's legacy. *Acta Neurochirurgica*. 2020;162(22):2773–82.
9. Kaufmann A, Price AV. A history of the Jannetta procedure. *J Neurosurg*. 2019;132(2):639–46.
10. Barker G, Jannetta PJ, Bissonette DJ, Larkins MV, Jho HD. The long-term outcome of microvascular decompression for trigeminal neuralgia. *N Engl J Med*. 1996;334(7):1077–83.
11. Pandit M. Neurovascular Compression Syndromes: An Innovative Cure for Pain-Free Future. *Suntext Rev Neurosci Psychol*. 2020;1. doi:10.51737/2766-4503.2020.016.
12. Malik NA. Textbook of Oral and Maxillofacial Surgery With Dvd-Roms. New Delhi: Jaypee Brothers Medical Publishers; 2016.
13. Pabaney A. Microvascular Decompression for Trigeminal Neuralgia. Neurosurgical Atlas; 2020. Available from: https://www.neurosurgicalatlas.com/volumes/cranial-nerve-compression-syndromes/trigeminal-neuralgia/microvascular-decompression-for-trigeminal-neuralgia.
14. Cruccu G, Stefano GD, Truini A. Trigeminal Neuralgia. *N Engl J Med*. 2020;383(8):754–62.

Author biography

Prasanna Shravan Gaydhanker, Instructor

Anuradha Prasanna Gaydhanker, Research Assistant

Cite this article: Gaydhanker PS, Gaydhanker AP. A study on trigeminal nerve: Does superior cerebellar artery causes trigeminal neuralgia. *Indian J Clin Anat Physiol* 2022;9(3):174-178.