Trigeminal Neuralgia

Percutaneous Interventions

Michelangelo, "Il cavadenti", 1608-1610, cm 139,5 x 194, 5; Firenze, Galleria Palatina.
IASSP definition

Sudden, usually unilateral, severe brief stabbing recurrent
pains in the distribution of one or more branches of the
Vth cranial nerve

IHS definition

Painful unilateral affliction of the face, characterized by brief electric shock like pain
limited to the distribution of one or more divisions of the trigeminal nerve.
Pain is commonly evoked by trivial stimuli including washing, shaving, smoking, talking,
and brushing the teeth, but may also occur spontaneously. The pain is abrupt in onset and
termination and may remit for varying periods

Nurmikko TJ et al, BJA 2001
Trigeminal Neuralgia

- Usually starts in the second or third divisions
- First division is affected in <5% of patients
- The pain never crosses to the opposite side but it may rarely (0.5%) occur bilaterally (multiple sclerosis?)
- After the 4th-5th decade, female/male: 3/2
Epidemiology

PREVALENCE: 107.5/1.000.000 MALE
200.2/1.000.000 FEMALE

INCIDENCE: 4.3/100.000 per year
5.9/100.000 per year

Correlation of incidence with age:
17.5/100.000 between 60-69 years
25.6/100.000 over 70 years of age

FAMILY': 4-6% of cases

COMPRESSION OF THE TRIGEMINAL NERVE ROOT AT OR NEAR DORSAL ROOT ENTRY ZONE BY A BLOOD VESSEL

• NOVEL IMAGING METHODS (MRI-MRTA)
• PAIN RELIEF AFTER DECOMPRESSION (JANNETTA PJ et al, NEJM 1996)
• EVIDENCE FROM ROUTINAR Y AUTOPSY (?)

ESSENTIAL TN

Nurmikko TJ et al, BJA 2001
ESSENTIAL TN

CENTRAL THEORY

- HYPERACTIVITY OF TRIGEMINAL NUCLEUS

Alteration of function of nucleus trigeminale in the trunk for loss of inhibitory control

Loss of inhibitory control
Ectopic potentials

Nurmikko TJ et al, BJA 2001
Etiology

CENTRAL MECHANISMS

VASCULAR COMPRESSION

Nurmikko TJ et al, BJA 2001
Etiology

SECONDARY TN

MULTIPLE SCLEROSIS (2-4%)

- ENTRY ZONE LESION AT PONS LEVEL
- DEMIELINIZATION

POSTERIOR FOSSA TUMORS (2%)

- MENINGIOM
- NEURINOM
- others

Nurmikko TJ et al, BJA 2001
Etiology

SECONDARY TN

HERPES ZOSTER
• REACTIVATION OF HSV

ISCHEMIC LESION
• PONTINE INFARCTION (rare)

UNINTENTIONAL or INTENTIONAL INJURY
• TRAUMA, SURGERY
• SURGICAL PROCEDURE FOR TN

Nurmikko TJ et al, BJA 2001
Investigations

- HISTORY
- CLINICAL EXAMINATION
  - ELETTROPHYSIOLOGICAL TECHNIQUES?
  - CNS IMAGING
    - MRI
    - MRTA
CNS IMAGING

MRI
Evaluation and treatment

FACIAL PAIN
Clinical and instrumental evaluation

DIAGNOSIS OF TN

FIRST LINE MEDICAL THERAPY
Resolution of pain

YES

Pain controlled for 6-8 week

NO

SECOND LINE MEDICAL THERAPY
Resolution of pain

YES

SECOND LINE MEDICAL THERAPY
Resolution of pain

NO

SURGICAL OPTIONS

YES

OPEN PROCEDURES

NO

PERCUTANEOUS PROCEDURES

Recurrence of pain

Stop medications

RADIOSURGERY
Treatment Options

- **Pharmacologic**
  - Anticonvulsants (phenytoin, carbamazepine, gabapentine)
  - Tricyclic antidepressants

- **Surgical**
  - Decompression operations, rhizotomies, tractotomies

- **Percutaneous invasive**
  - Trigeminal ganglion approaches (RF, balloon compression, glycerol)
  - Glossopharyngeal nerve (RF, local anaesthetic, glycerol)
  - Sphenopalatine ganglion (RF, local anaesthetic, phenol)
  - Occipital nerve (RF, local anaesthetic, steroid)
“In base of all studies related with the clinical efficacy of drugs used in trigeminal neuralgia carbamazepine is the first choice, lamotrigine and baclofene may be utilized as an alternative, on other drugs such as phenytoine, oxcarbazepine, clonazepam, valproic acid and gabapentin there are non controlled studies

Percutaneous techniques
Percutaneous transovale approach alcohol  Hartel, 1912
Radiofrequency thermocoagulation
Sweet, 1965
Retrogasserian glycerol injection
Hakanson, 1981
Ballon Compression
Mullan Lichtor, 1983
Indications for Percutaneous Intervention

- Failure of adequate medical management
- Intolerable side effects of drugs
- Age, health considerations, generally over 50 years
- Fear from operation
The Procedure

- Penetration through the foramen ovale
- Trial stimulation
- RF lesioning, glycerol injection, balloon compression
Positioning of the needle

Landmarks

- 2-3 cm lateral to commisura labialis
- 3 cm anterior to external auditory meatus
- Beneath the medial aspect of the pupil of the lower lid
Positioning of the needle

Rotation to get a submental view
A line drawn (A) through the intersection of the clivus and petrous part of the temporal bone meets perpendicularly at the base of the skull through the foramen ovale.
Retrogasserian glycerol injection
Balloon compression
Trigeminal Ganglion Balloon Compression
Improper positioning of the needle

- Superiorly to infraorbital fissure; retroorbital haematoma
- Posteriorly medially foramen; lacerum carotid artery
- Posteriorly inferiorly in the juguler foramen or carotid canal
Peripheric branches

- Supraorbital
- Infraorbital
- Mental
  - Glycerol, Phenol ??
  - Pulsed RF ???
Complications

- Facial numbness
- Annoying dysesthesia and anesthesia dolorosa
- Loss of corneal reflex
- Neurolytic keratitis
- Visual loss

- Retrobulbar haematoma
- Haematoma in the cheek
- Motor deficit
- Carotid artery puncture
- Meningitis
Helpful hints

- With edentulous patients, point of entry needs to be more posterior, the needle will strike the foramen at too acute an angle.
- If the patient has artificial teeth, do not take it out.
- The depth of the needle should be confirmed by lateral view. Deep needle placement will cause brain stem damage and may cause hemorrhage.
- In case of aspiration of CSF, do not give any agent, especially glycerol or phenol, they may spread to the brain stem or other structures.
- Glycerol may cause nausea and vomiting.
- Phenol may cause inadvertent neurolysis of the adjacent cranial nerves.
Helpful hints

- Irritation of dura may cause persistent headache, nausea and vomiting for several days.
- If blood is aspirated, change the place of the needle; if continues stop the procedure.
- Before repeating RFTC, aspirate again, monitor the impedance, nearly 300-450 Ω.
- To prevent hematoma in the cheek, apply ice compression to the cheek in every instance.
- If the opthalmic branch is affected and RFTC is applied, corneal loss of sensation occur and the cornea should be protected by eye glasses and artificial eye drops every day.
- After repeated thermocoagulation, fibrosis inside the cavern may develop and RFTC becomes less efficient.
Minor versus major procedures
Minor Versus Major Procedures

- Minor do not address the pathology or remove the cause of pain
- Effective with less morbidity
- No mortality
- Older patients often biased towards minor because of considerations such as life expectancy, longer hospital stay, increased recovery time
RFTC

Advantages
- Very effective, good or excellent relief
- Safe
- High immediate pain relief
- Ease of repeating the lesion
- Avoidance of craniotomy
- Minimal morbidity
- No mortality
- Cost effective

Disadvantages
- Anesthesia dolorosa
- Paresthesia
- Diminished corneal reflex
- Haematoma in the cheek
- Keratitis
Glycerol

**Advantages**
- Effective pain relief in 48 hrs 72-96%
- Technical failure 15%
- Recurrence rate over a follow up from 3-72 months 18-72%
- Median time of recurrence 16-32 months

**Disadvantages**
- Paraesthesia
- Dysesthesia
- Diminished corneal reflex
- Muscle weakness
- Herpes labialis
- Haematoma at the entry site
- Keratitis rarely
Balloon Compression

**Advantages**
- Useful in elderly or young patients rejecting a major procedure
- Slight permanent sensory deficit
- Technical ease
- Moderate relapse rate in skilled hands
- Quickness
- Patient cooperation is not needed

**Disadvantages**
- Mortality is uncommon
- Complication rate 3-5%
- Transient otalgia
- Aseptic meningitis
- Significant masseter weakness
- Dysesthesia
## Radiofrequency Thermocoagulation - summary of selected large retrospective series

<table>
<thead>
<tr>
<th>Author</th>
<th>Number patients</th>
<th>Initial pain relief (%)</th>
<th>Recurrence rate (%)</th>
<th>Sensory change (%)</th>
<th>Anesthesia dolorosa (%)</th>
<th>Corneal anesthesia (%)</th>
<th>Motor weakness (%)</th>
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<tr>
<td>Kanpolat et al.</td>
<td>1600</td>
<td>97.6</td>
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<td>1</td>
<td>0.8</td>
<td>6 0.6% keratitis</td>
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<td>Taha and Tew</td>
<td>500</td>
<td>98</td>
<td>20</td>
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<td>2</td>
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<td>Broggi et al.</td>
<td>1000</td>
<td>95</td>
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<td>1.5</td>
<td>20 0.6% keratitis</td>
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<td>Fraioli et al.</td>
<td>533</td>
<td>97</td>
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<td>—</td>
<td>15.2</td>
<td>1.5</td>
<td>20.3 1.9% keratitis</td>
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<td>700</td>
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<td>122</td>
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<td>72</td>
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## Balloon compression - summary of selected large retrospective series

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<td>Skirving and Dan</td>
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<td>Abdennebi et al.</td>
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<td>Lobato et al.</td>
<td>144</td>
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<td>Fraioli et al.</td>
<td>159</td>
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<td>Lichtor and Mullan</td>
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<td>100</td>
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</table>
SYSTEMATIC REVIEW OF ABLATIVE NEUROSURGICAL TECHNIQUES FOR THE TREATMENT OF TRIGEMINAL NEURALGIA

Lopez BC et al, Neurosurgery 2004
Efficacy of percutaneous techniques: Follow up

FIGURE 1. Graph showing actuarial rates of complete pain relief, indicated in a Kaplan-Meier plot of the median values for the selected studies at each follow-up time (raw data in Table 3). The curves are presented up to the median follow-up time for the relevant studies. Rates for percutaneous RFT represent complete pain relief without all medications. Rates for percutaneous GR and SRS represent complete pain relief with or without medication. RFT seems to be the most effective technique at all stages of follow-up monitoring in mixed series.

Lopez BC et al, Neurosurgery 2004
Percutaneous vs MVD

Jannetta PJ et al, NEJM 1996
Pulsed RF
Comparison of pulsed radiofrequency with conventional radiofrequency in the treatment of idiopathic trigeminal neuralgia

Serdar Erdine a,*, Nuri Suleyman Ozyalcin a, Ali Cimen a, Mehmet Celik b, Gul Koknel Talu a, Rian Disci c

a Istanbul University, Istanbul Faculty of Medicine, Department of Algology, Capa Klinikleri, Capa, Istanbul 34390, Turkey
b Istanbul Pain Institute, Turkey
c Istanbul University, Istanbul Faculty of Medicine, Department of Biostatistics, Turkey

Received 21 November 2005; received in revised form 12 April 2006; accepted 16 April 2006
Trigeminal neuralgia: PRF vs. CRF

a: p < 0.001; the difference between PreVAS and PostVAS-0, PostVAS-3, PostVAS-6.
b: p < 0.001; the difference between PostVAS-3 and PostVAS-6.
*: CRF application has been done in Group 2 (PRF), after the evaluation at the 3rd month.

Erdine et al. 2006
Trigeminal neuralgia: PRF vs. CRF

- In conclusion, the results of our study demonstrate that unlike CRF, PRF is not an effective method of treatment for idiopathic trigeminal neuralgia.
Serdar Erdine, N. Suleyman Ozyalcin, Gul Koknel Talu, Ali Cimen


Trigeminal neuralgia: RF lesioning

- Immediate pain relief: %96.3
- Pain recurrence in the first year: %14
- Pain recurrence in 5 years: %29.7

Erdine et al. 2006
Trigeminal neuralgia: RF lesioning

- No mortality
- Diminished corneal reflex: %7.3
- Masseter weakness: %4.9
- Peri-oral herpetic eruption: %3.4
- Annoying dysesthesia: %2
- Anesthesia dolorosa %1.3
- Transient paralysis of VIth cranial nerve: %0.3

Erdine et al. 2006
CONCLUSIONS

PAIN TREATMENT IN REFRACTORY TRIGEMINAL NEURALGIA

ESSENTIAL TN

Vascular compression at MRI/MRTA

YES

• ASA physical status

YES

MVD

NO

A

Percutaneous techniques

B

Radiosurgery

C

Surgical exploration ?
CONCLUSIONS

PAIN TREATMENT IN REFRACTORY TRIGEMINAL NEURALGIA

MS ASSOCIATED TN

MRI/MRTA

VASCULAR COMPRESSSION

• ASA phisycal status

YES

NO

MVD

NO VASCULAR COMPRESSISON

A

Percutaneous techniques

B

Radiosurgery
State of The Art

- Definition of a good result
- Variation of the follow-up
- Learning curve-experience
- No method is curable
- Preference of minor versus major proc.
- Differences among procedures
Conclusions

- Cure is unpredictable, recurrence rate is predictable
- Both technique has advantages and disadvantages
- RF is still the preferred technique
- Less morbid more cost effective then open techniques
- Glycerol causes mild complications, less effective
- Balloon causes mild sensorial loss
- Recurrence rate for open techniques may be similar
CONCLUSIONS

PAIN TREATMENT IN REFRACTORY TRIGEMINAL NEURALGIA

ATYPICAL TN

Rodin - Il Pensatore (Parigi, Musée Rodin, 1880-1904)
Voltaire’s Cynicism

“Doctors pour drugs of which they know little, for diseases of which they know less, into patient of which they know nothing!!”
Thank you