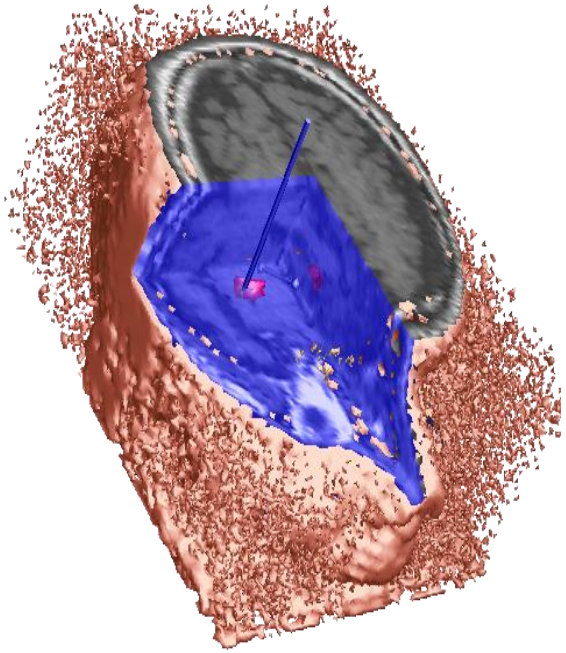
HAREKET BOZUKLUĞU CERRAHİSİNDE HEDEFLEME YÖNTEMLERİ VE SONUÇLAR

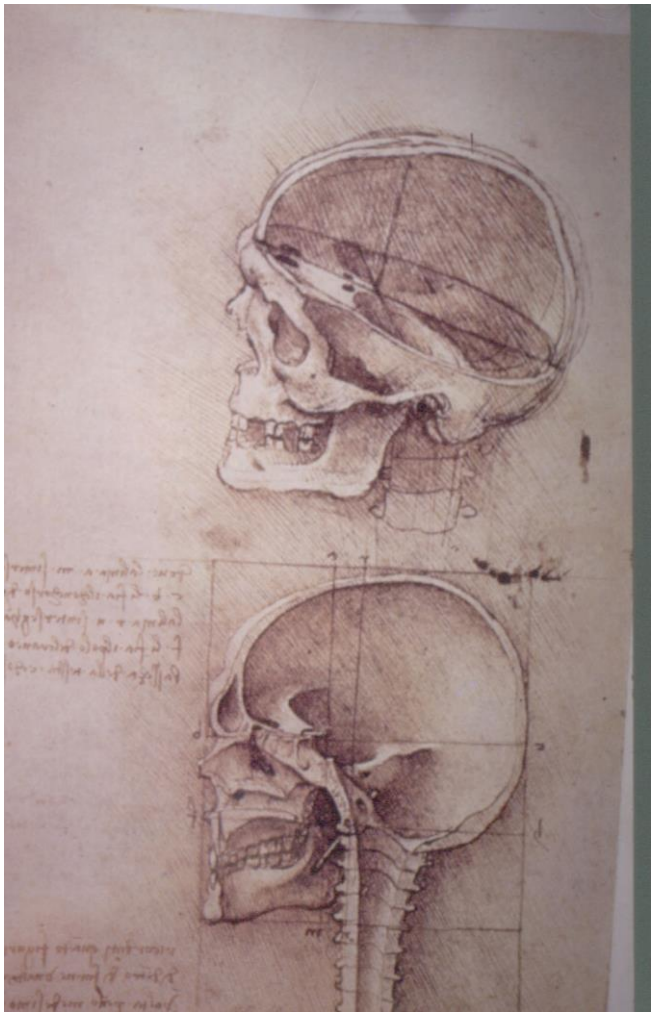
Prof. Dr. Ali Savaş

Ankara Üniversitesi Tıp Fakültesi
Nöroşirürji Anabilim Dalı



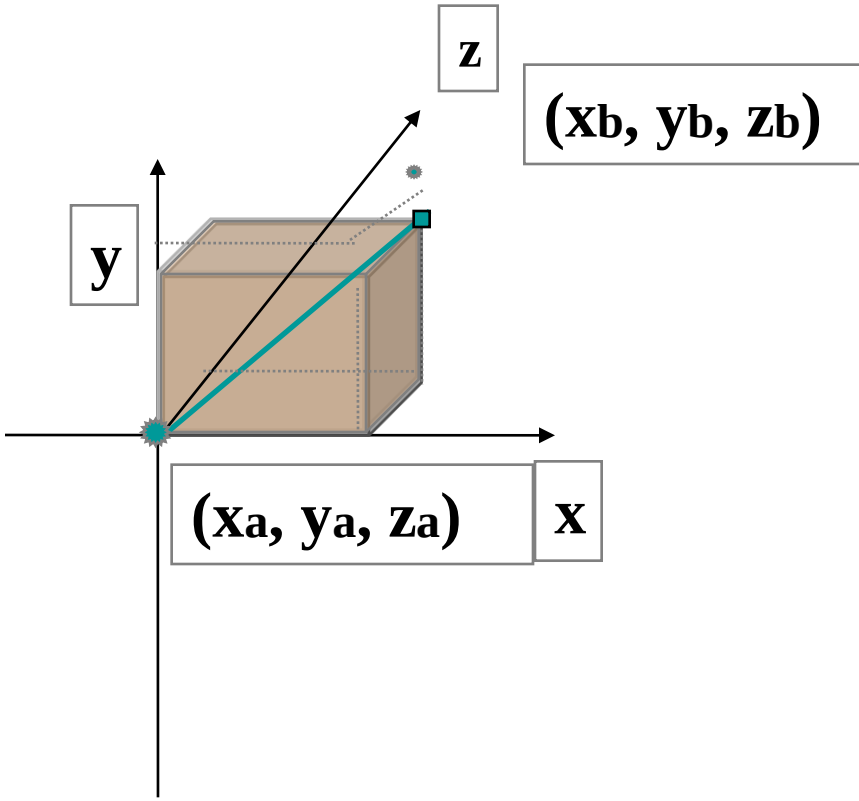
KRANİAL GEOMETRİK TASARIM

LEONARDO DA VİNCİ



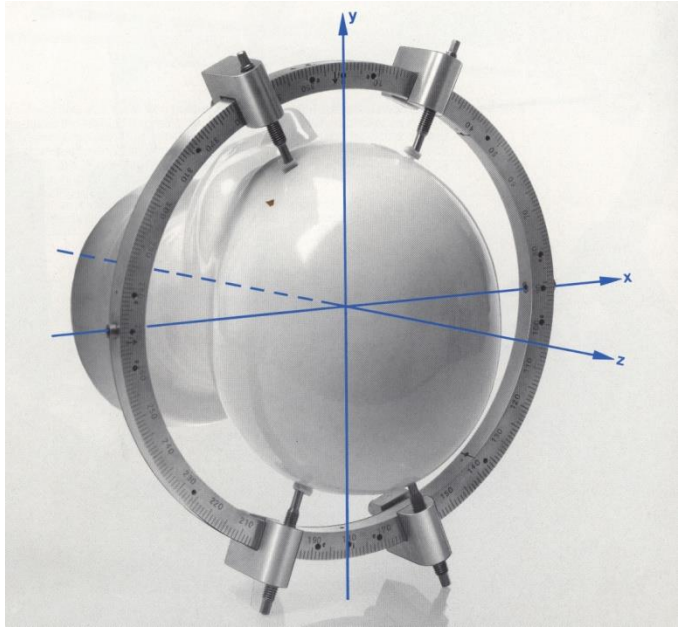
KARTEZYEN KOORDİNATLAR

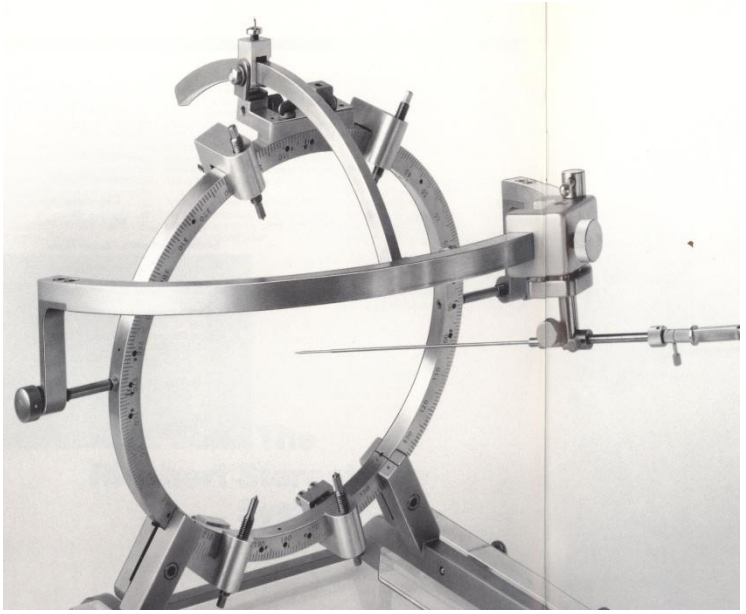
RENE DESCARTES

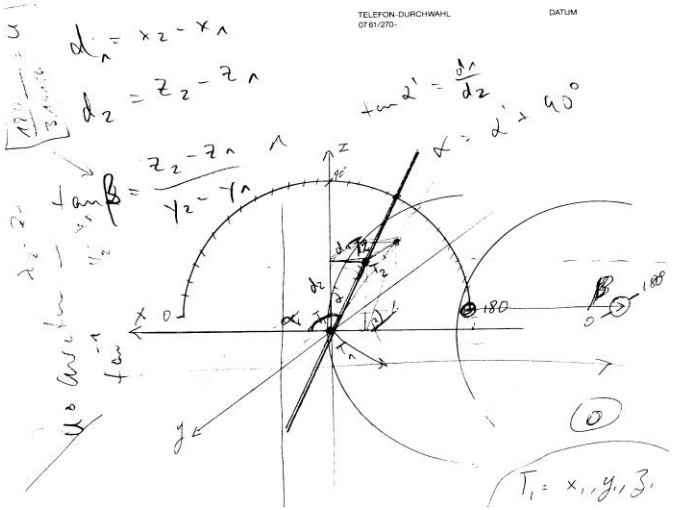


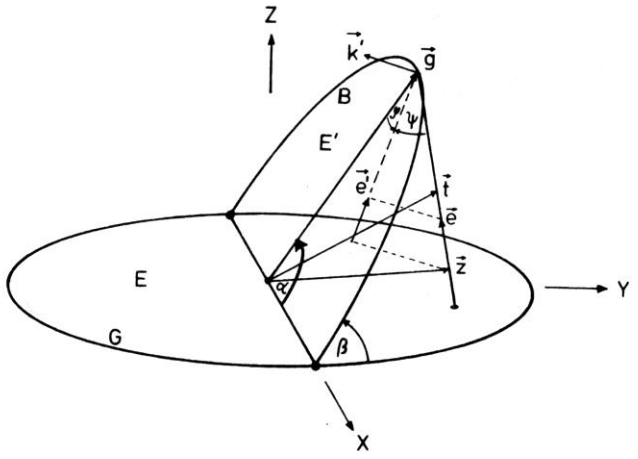
STEREOTAKTİK HEDEFLEME TEKNİKLERİ

STEREOTAKTİK BAŞLIKLAR









STEREOTAKTİK HEDEFLEME TEKNİKLERİ

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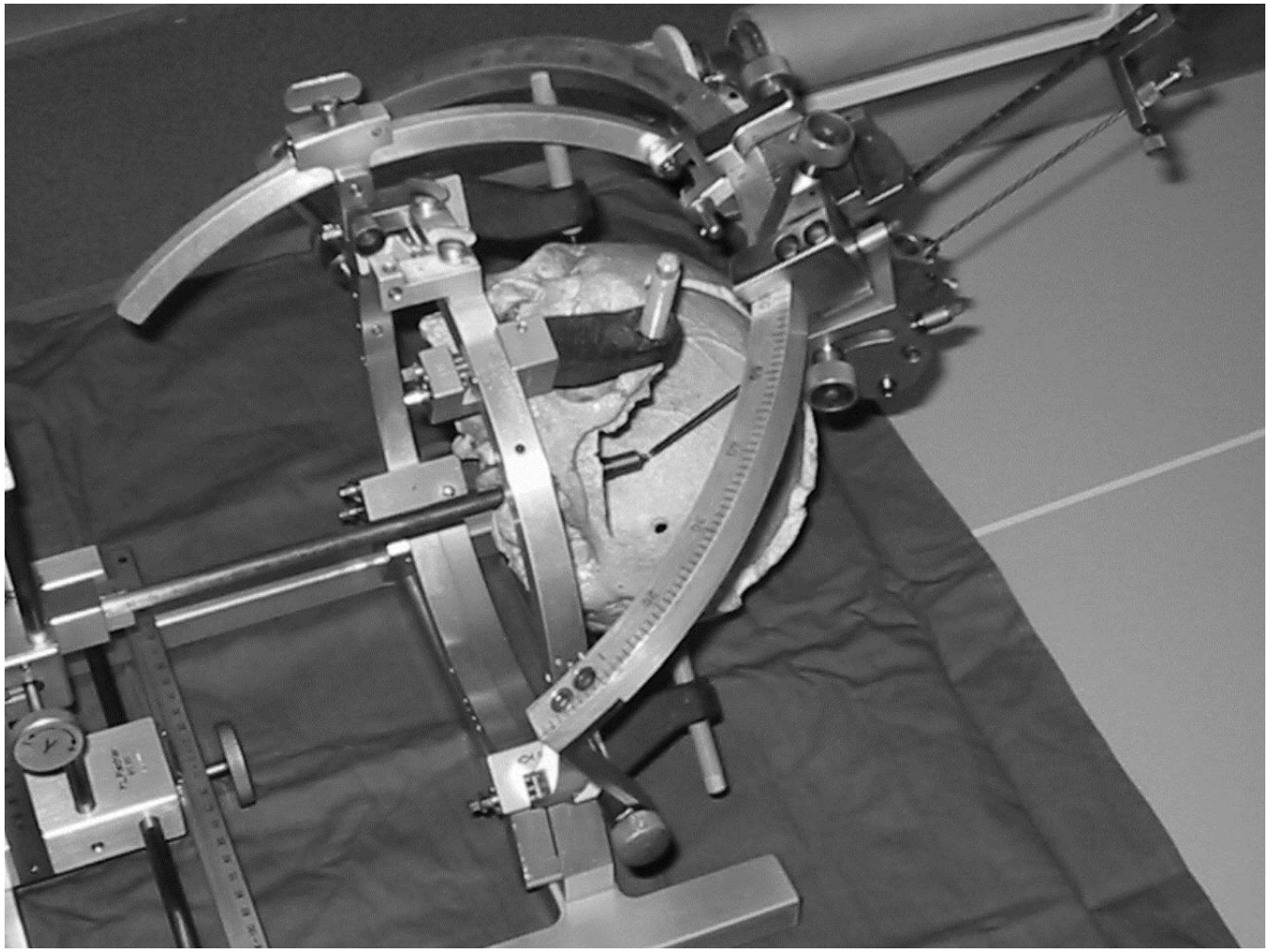


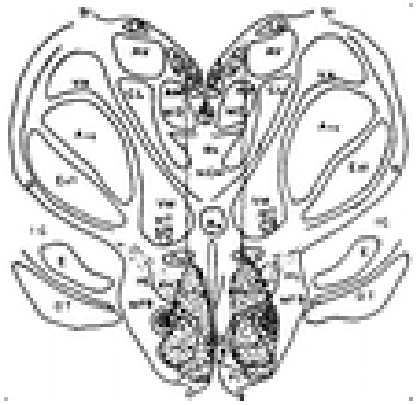
STEREOTAKTİK HEDEFLEME TEKNİKLERİ

BAŞLIĞIN HEDEF DOĞRULAMASI

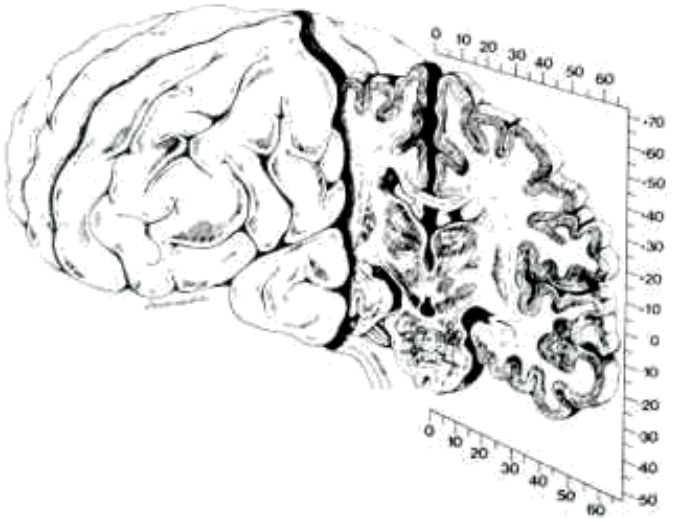
SİMULASYON

STEREOTAKTİK BEYİN ATLASLARI

1908- Horsley & Clark – Maymun beyin atlası (kranial referans)

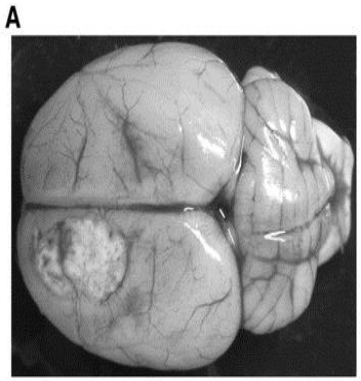


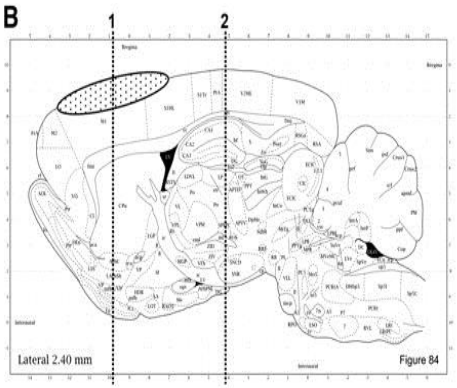
1952 Spiegel & Wycis (Komissural referans)

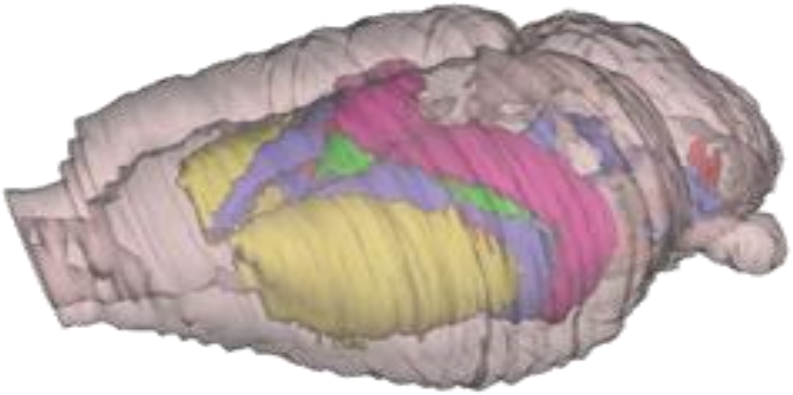


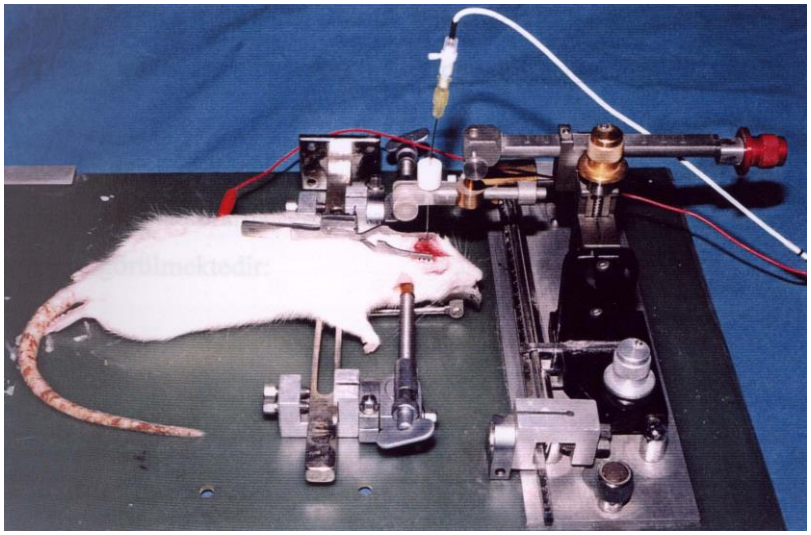
STEREOTAKTİK HAYVAN BEYİN ATLASLARI

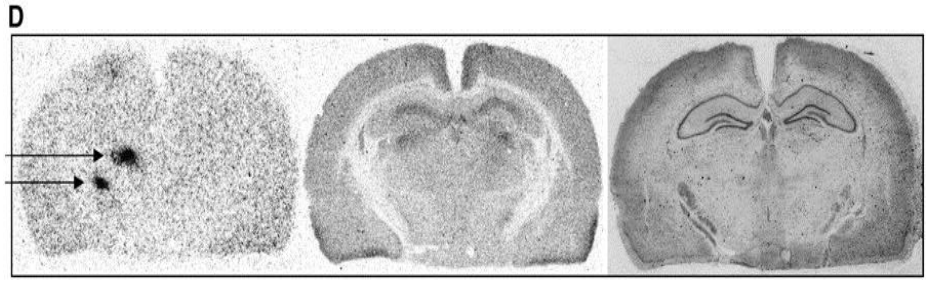
(Bregma - referans)





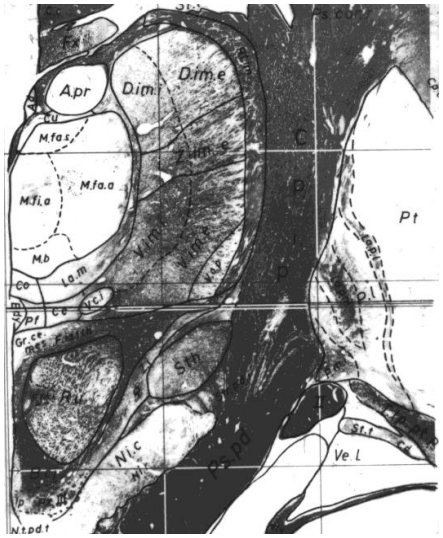




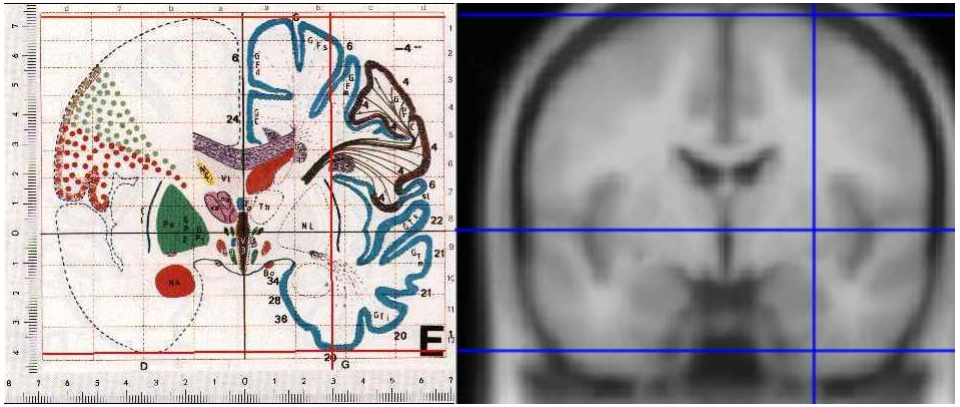


STEREOTAKTİK İNSAN BEYİN ATLASLARI

Schaltenbrand

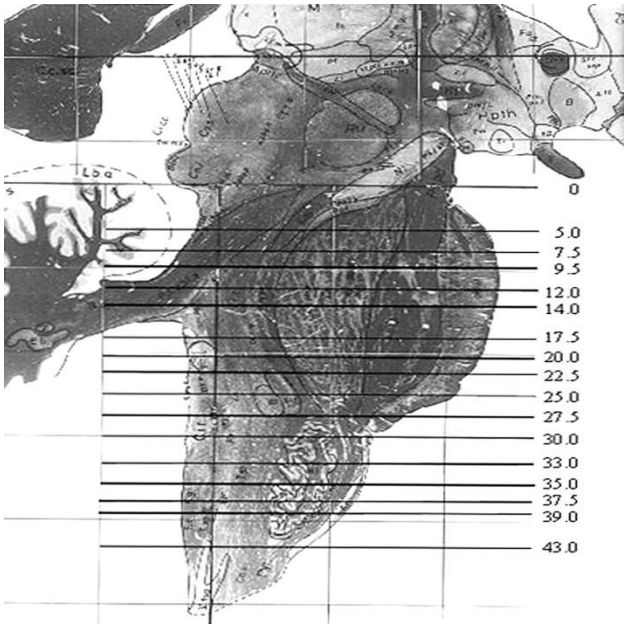


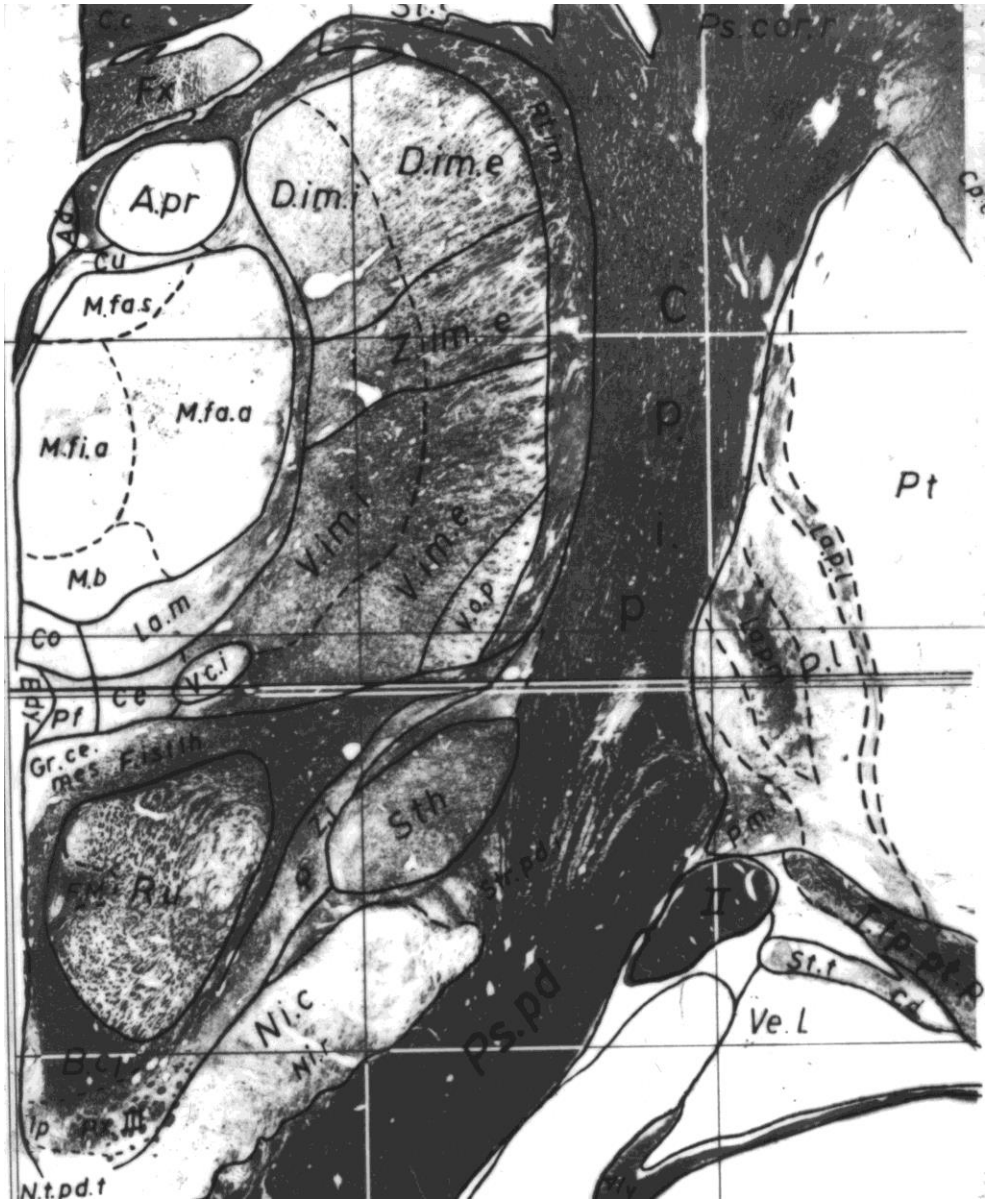
Talairach



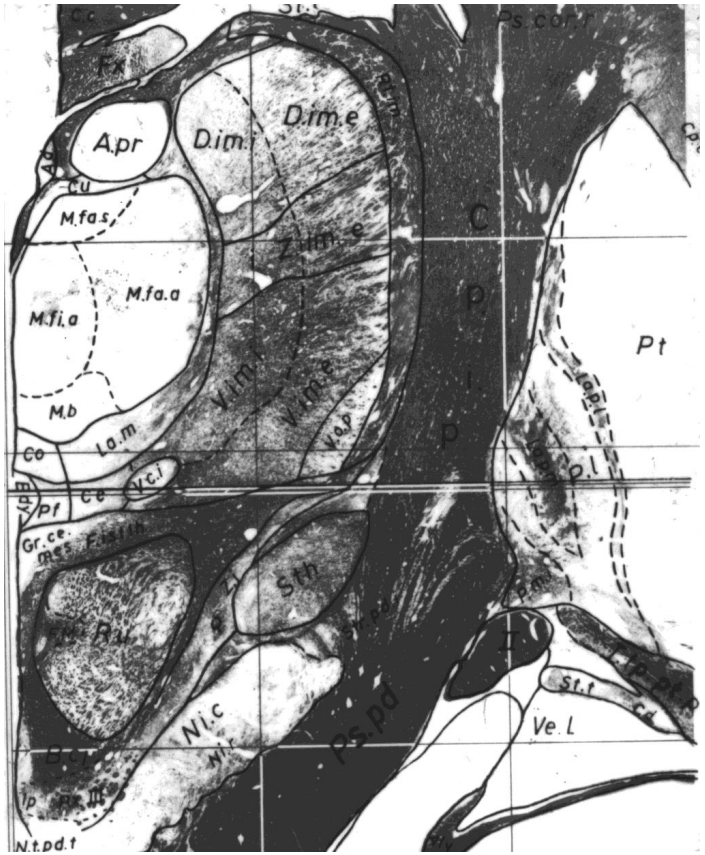
Diğer Atlaslar:
Andrew and Watkins and Van Buren and Borke

STEREOTAKTİK İNSAN BEYİN ATLASLARI





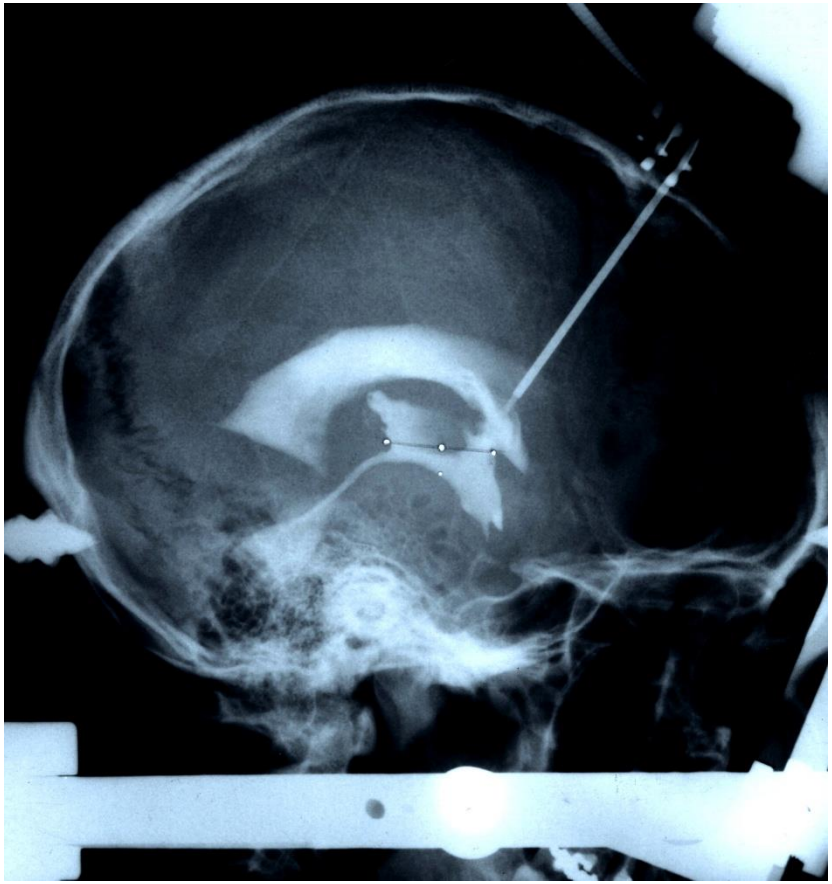
STEREOTAKTİK İNSAN BEYİN ATLASLARI

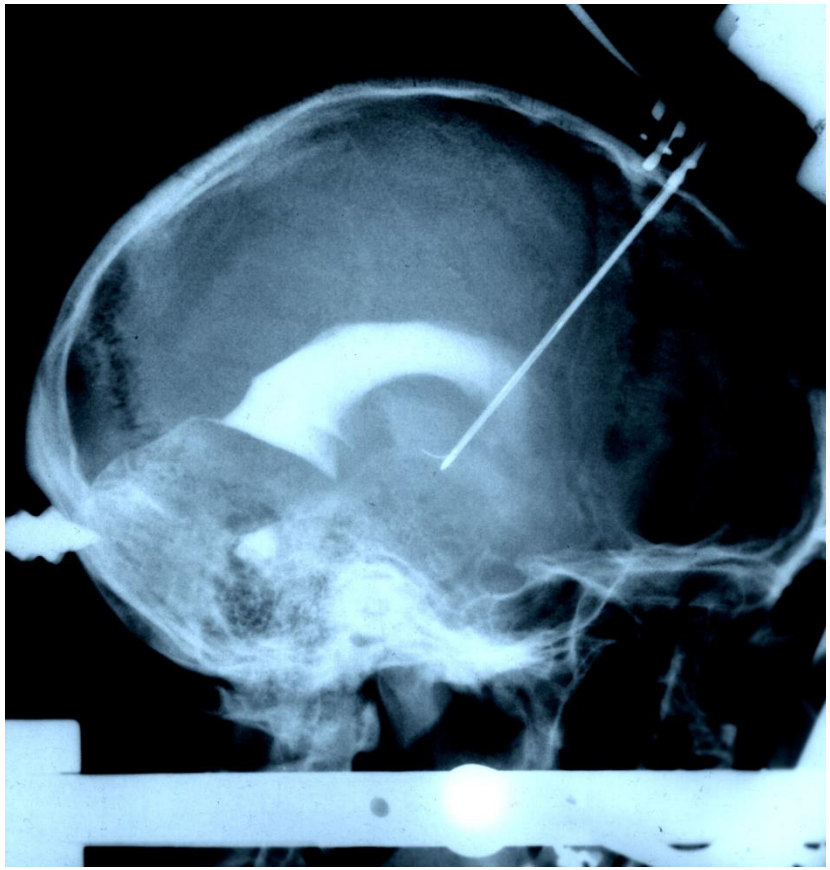


	X	Y	Z
Vim	± 14	-5	+1
Gpi	± 18	+3	-2
STN	± 12	-3	-3

STEREOTAKTİK HEDEFLEME TEKNİKLERİ

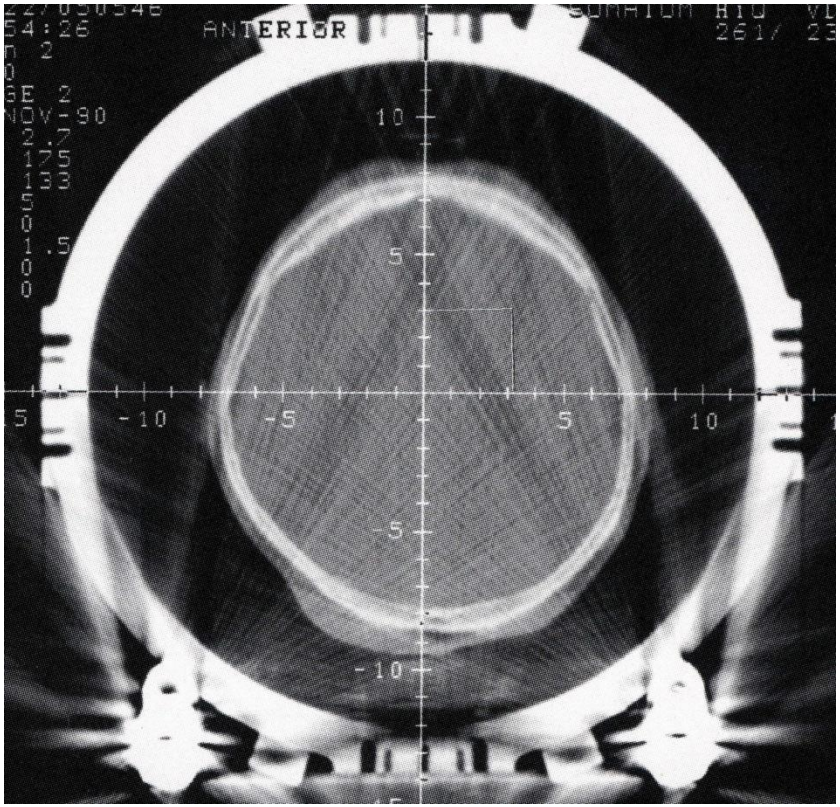
“STEREOTAKTİK VENTRİKULOGRAFİ”

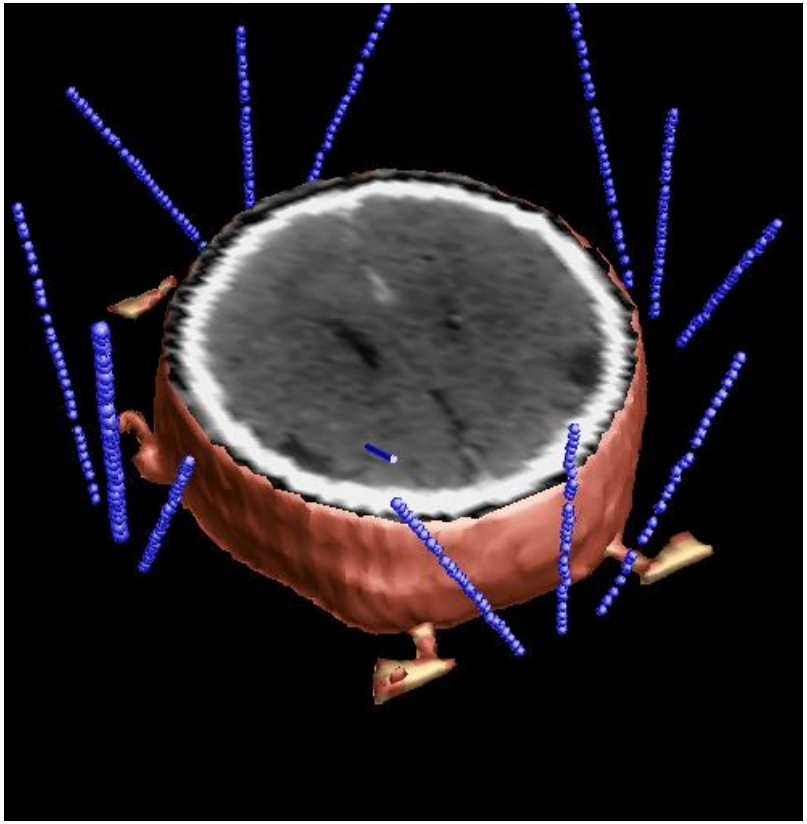




STEREOTAKTİK HEDEFLEME TEKNİKLERİ

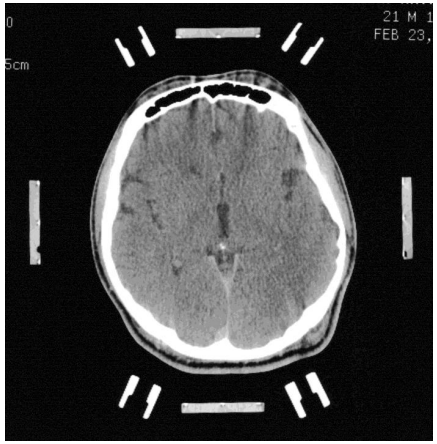
“STEREOTAKTİK BT/MRI”

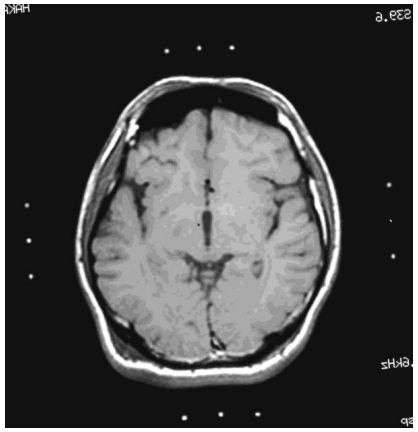




STEREOTAKTİK HEDEFLEME TEKNİKLERİ

“STEREOTAKTİK BT/MRI”

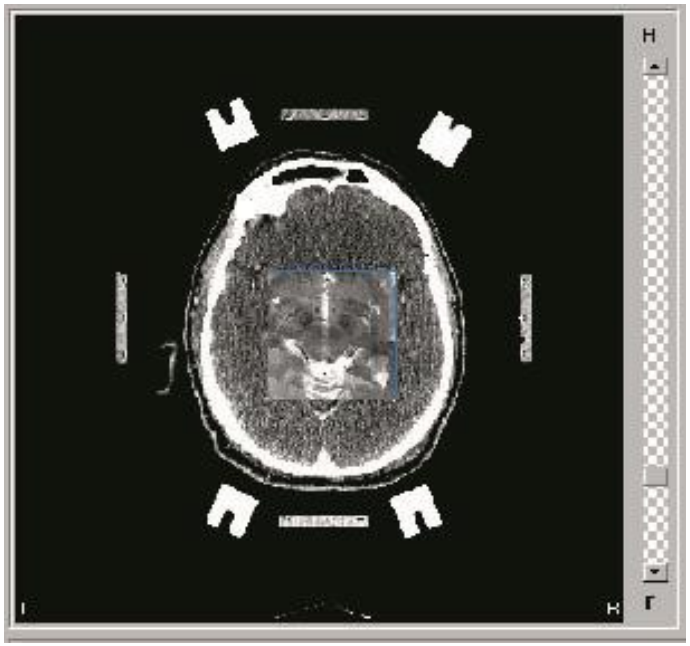


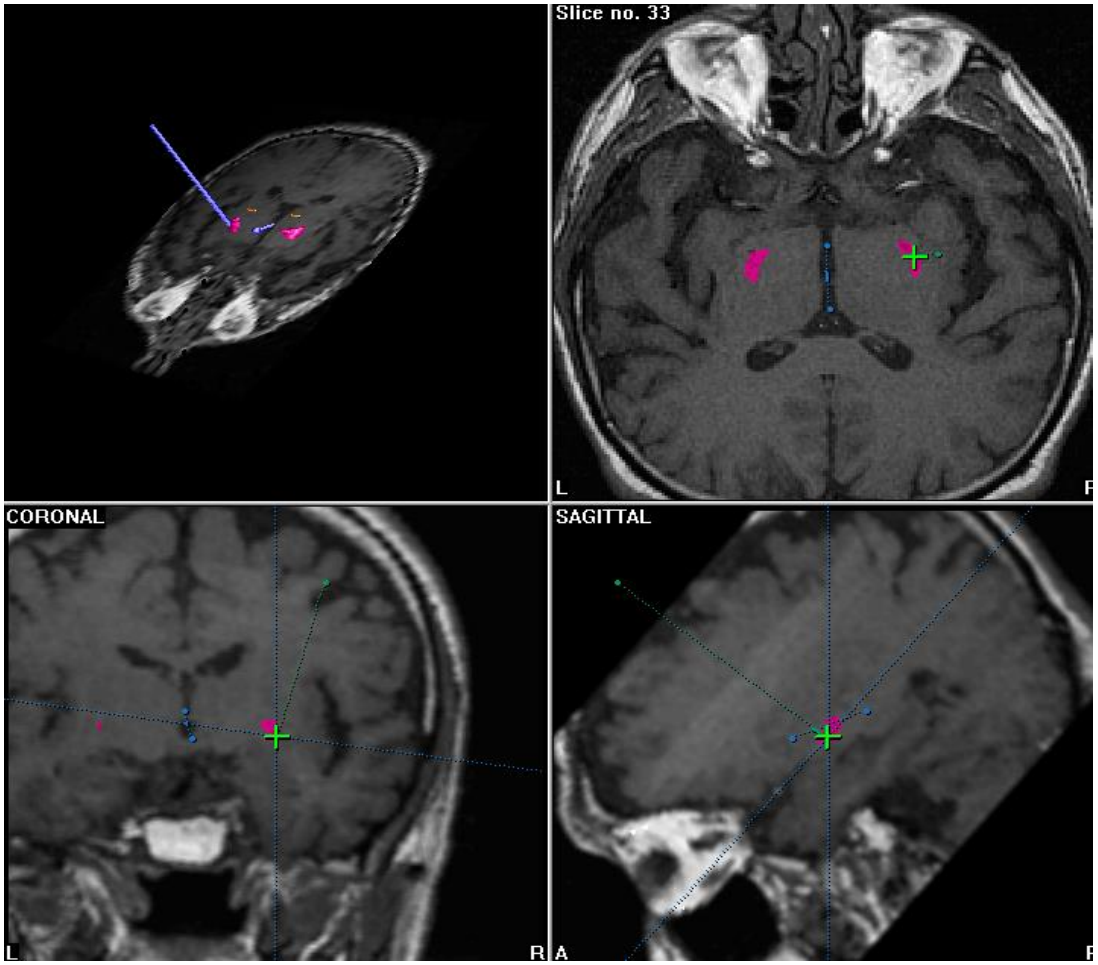


STEREOTAKTİK HEDEFLEME TEKNİKLERİ

“STEREOTAKTİK BT/MRI”

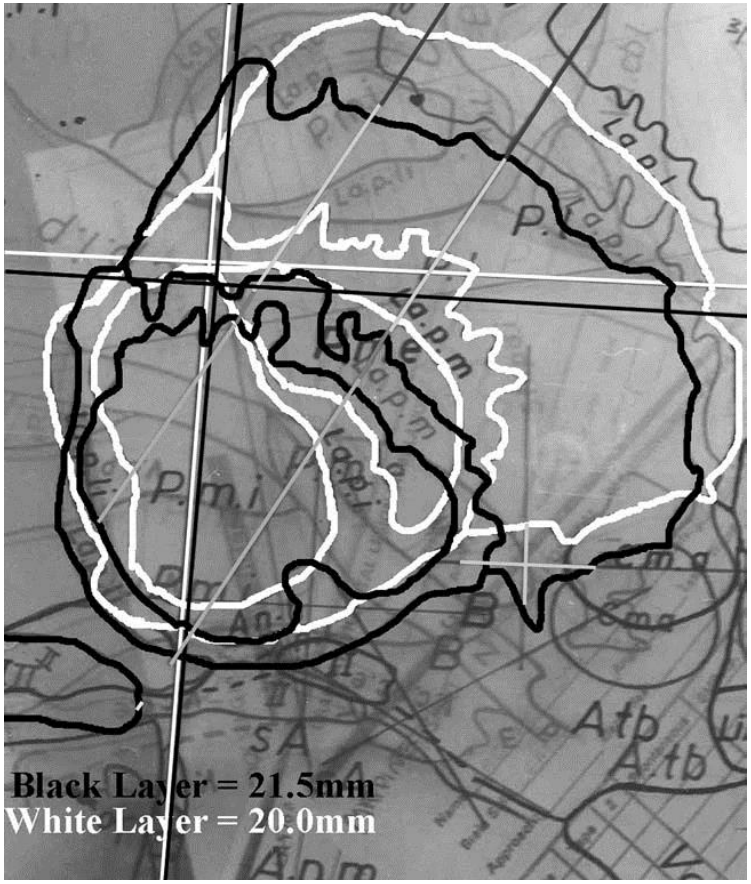
“, MULTİ-PLAN GÖRÜNTÜ İŞLEMİ & IMAGE FUSION”

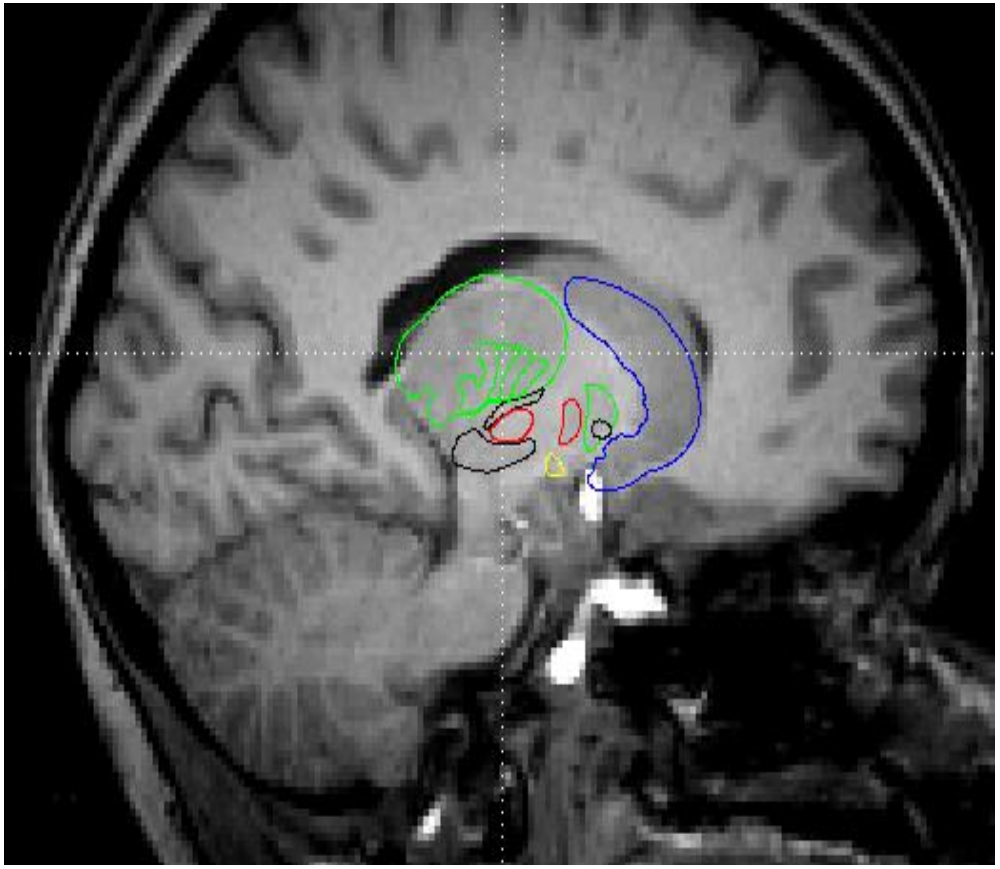




STEREOTAKTİK İNSAN BEYİN ATLASLARI

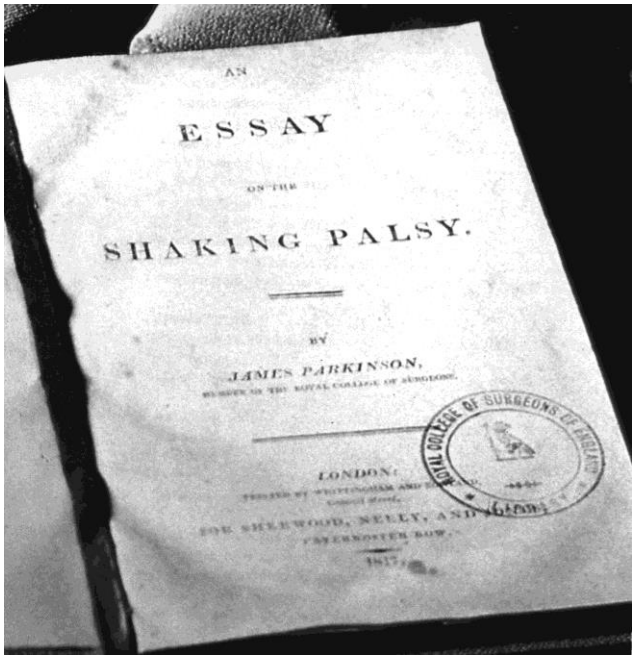
Computer based stereotactic atlases:





HAREKET BOZUKLUKLARINDA CERRAHİ TEDAVİ

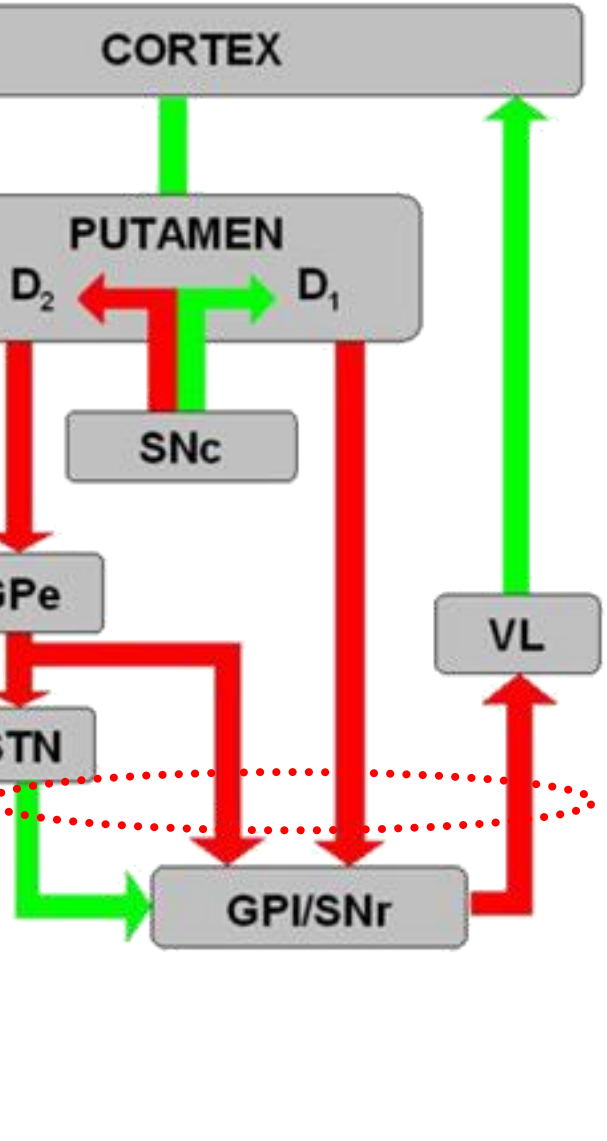
- **Parkinson Hastalığı**
- **Esansiyel Tremor**
- **Distoni**

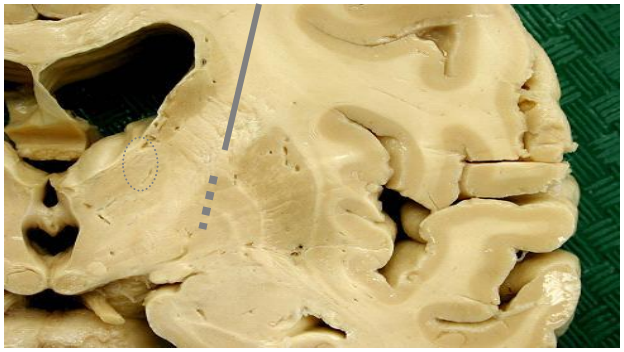


<u>Çeşitli Oranlarda Tedaviye Cevap Verebilen Hareket Bozuklukları:</u>

- **Kore-atetoz, “Cerebral Palsy”**
- **Hemiballismus ...vb**

HAREKET BOZUKLUĞU CERRAHİSİ
HEDEF ALANLAR





Thalamus-Vim

Zona incerta

Pallidum - Gpi

HAREKET BOZUKLUKLARINDA CERRAHİ TEDAVİ

- **Parkinson hastalığı- STN-Nörostimulasyonu**

  (Pallidal-DBS, Pallidotomi, Talamotomi, STN lezyonu?)

- **Esansiyel Tremor- Talamotomi, Talamik nörostimulasyon**

- **Primer genel distoni - Pallidal nörostimulasyon**

- **Sekonder distoni (CP..) – Talamotomi-kampotomi,**

  Baklofen pompası (?), DBS

- **Tardiv diskinezi- Pallidal nörostimulasyon, pallidotomi**

- **Hemidistoni- Talamotomi-kampotomi, pallidal nörostimulasyon**

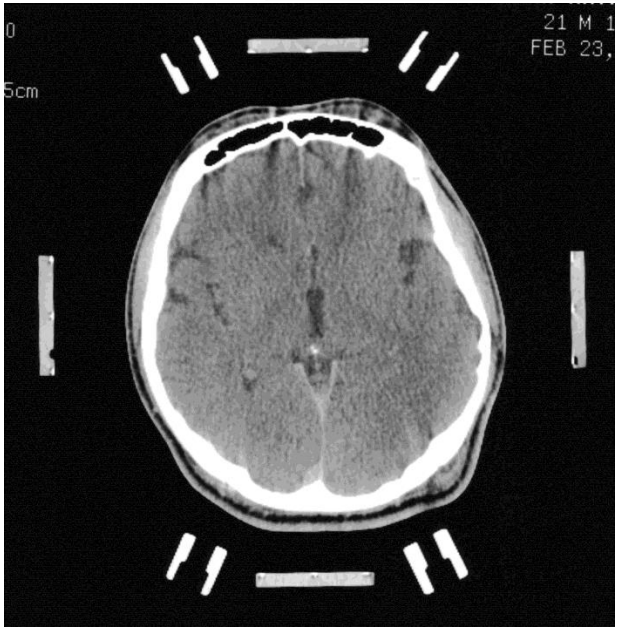
CERRAHİ TEKNİK

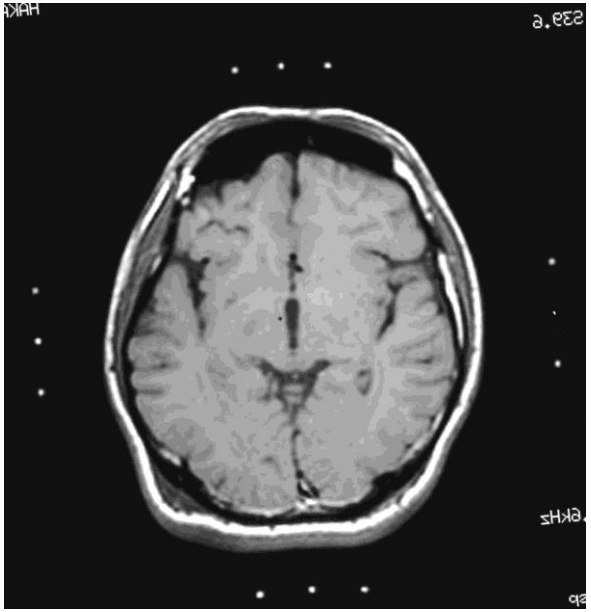
Morfolojik Lokalizasyon:

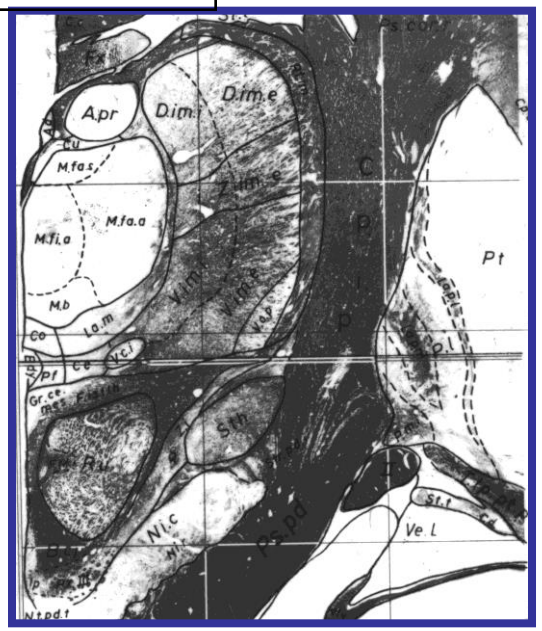
CT / MRI ile AC-PC üzerinde koordinat hesabı

MCP / Vim, Zona incerta, GPi, STN / (x, y, z)

	X	Y	Z
Vim	± 14	-5	+1
Gpi	± 18	+3	-2
STN	± 12	-3	-3





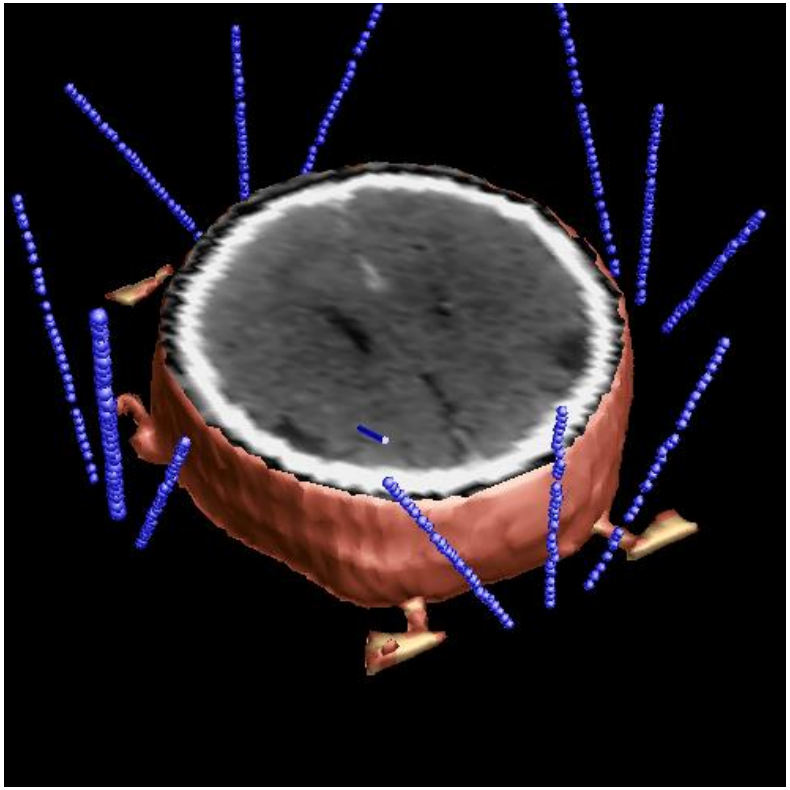


CERRAHİ TEKNİK

Morfolojik Lokalizasyon:

CT/ MRI görüntü füzyonu

Atlas programlarıyla morfolojik haritalama

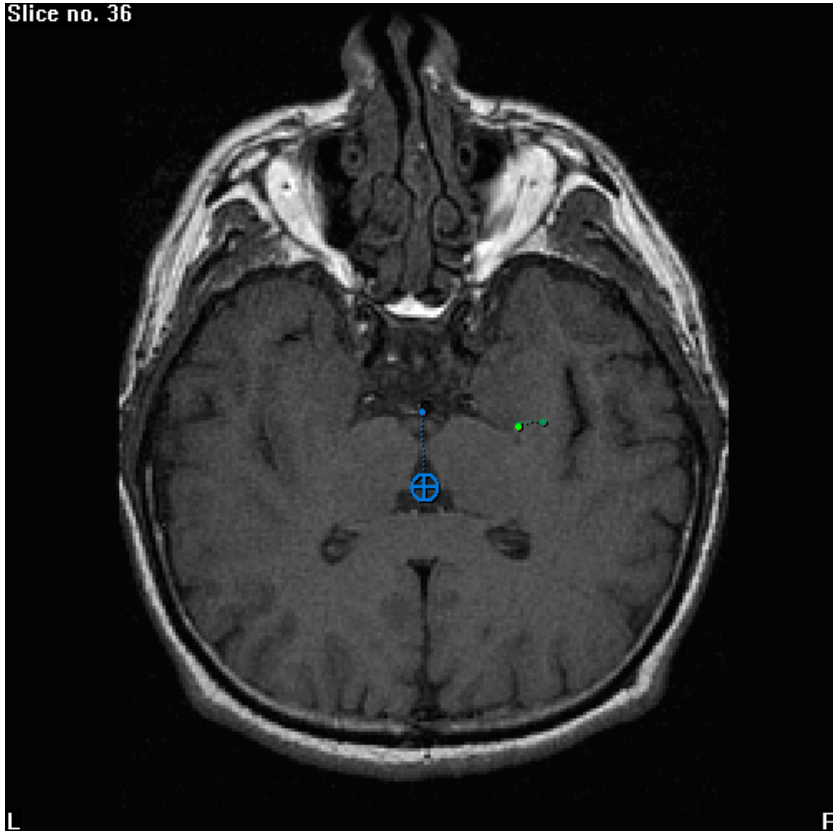


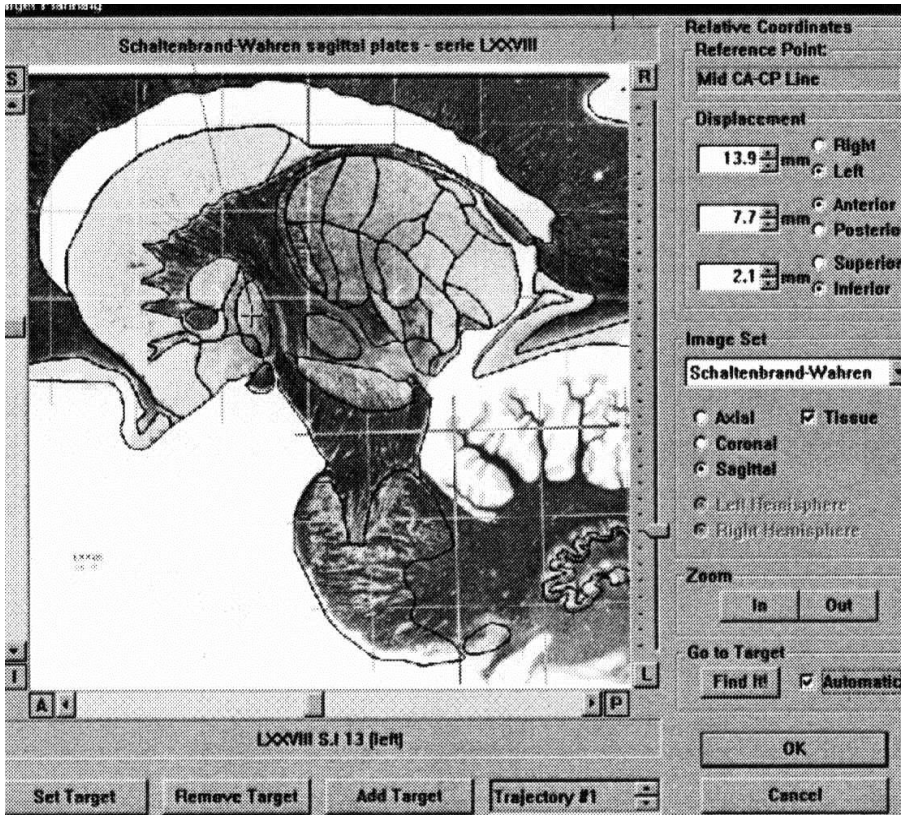
CERRAHİ TEKNİK

Morfolojik Lokalizasyon:

CT/ MRI görüntü füzyonu

Atlas programlarıyla morfolojik haritalama





CERRAHİ TEKNİK

Morfolojik Lokalizasyon:

CT/ MRI görüntü füzyonu

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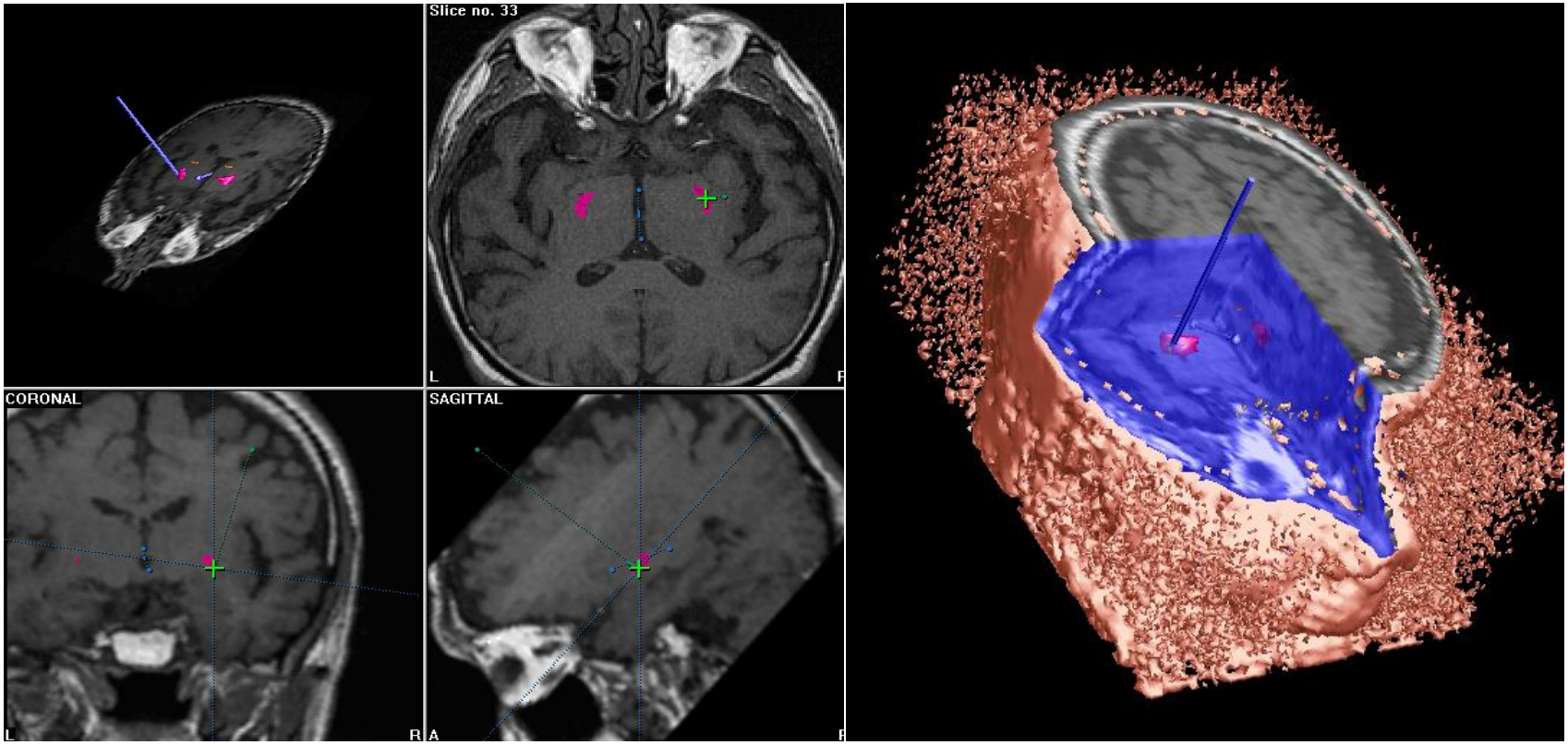


SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

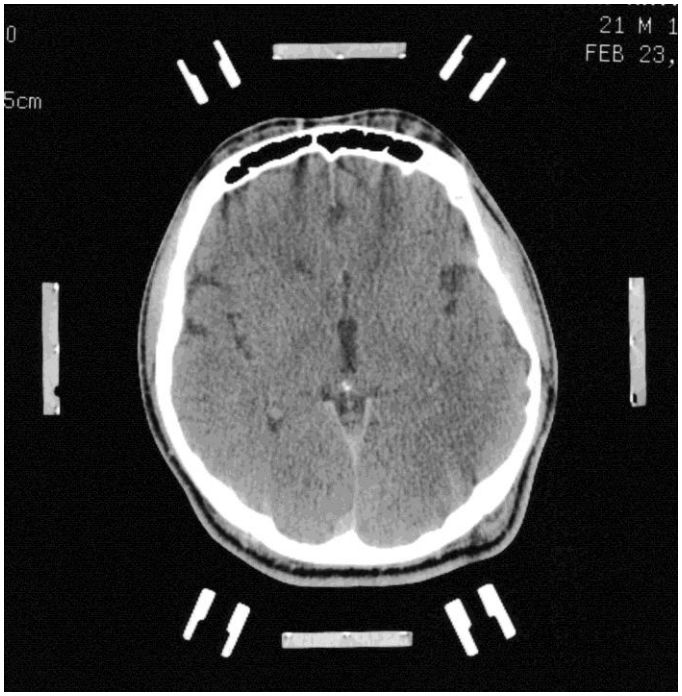
"METOD"

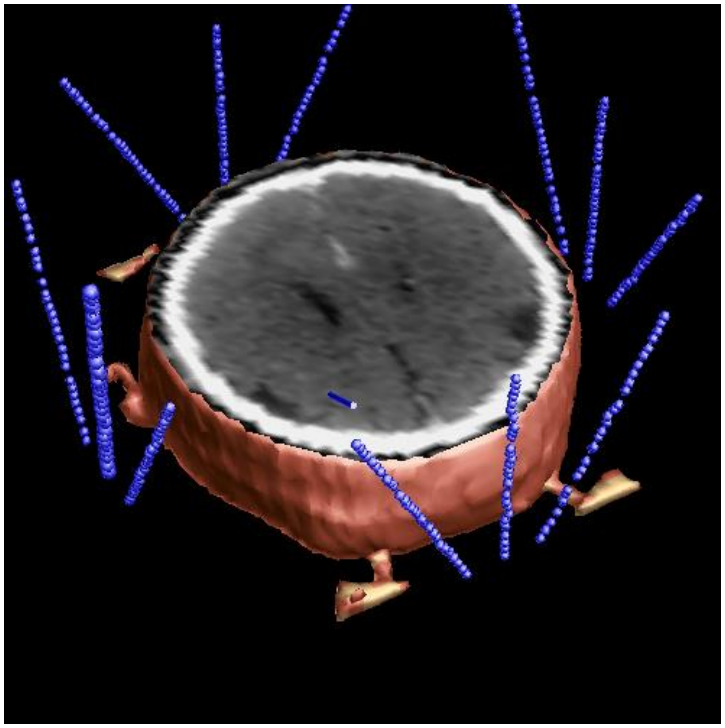
- **Başlıklı BT-stereotaktik görüntüleme**

Cerrahi günü

Verinin stereotaktik bir software kullanılarak transferi

(@target, BrainLab, München)





SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

"METOD"

- **Başlıksız olarak T2-ağırlıklı MRI**
- **STN'in Görüntülenmesi cerrahiden birkaç gün önce**

Verinin stereotaktik bir software kullanılarak transferi

(@target, BrainLab, München)

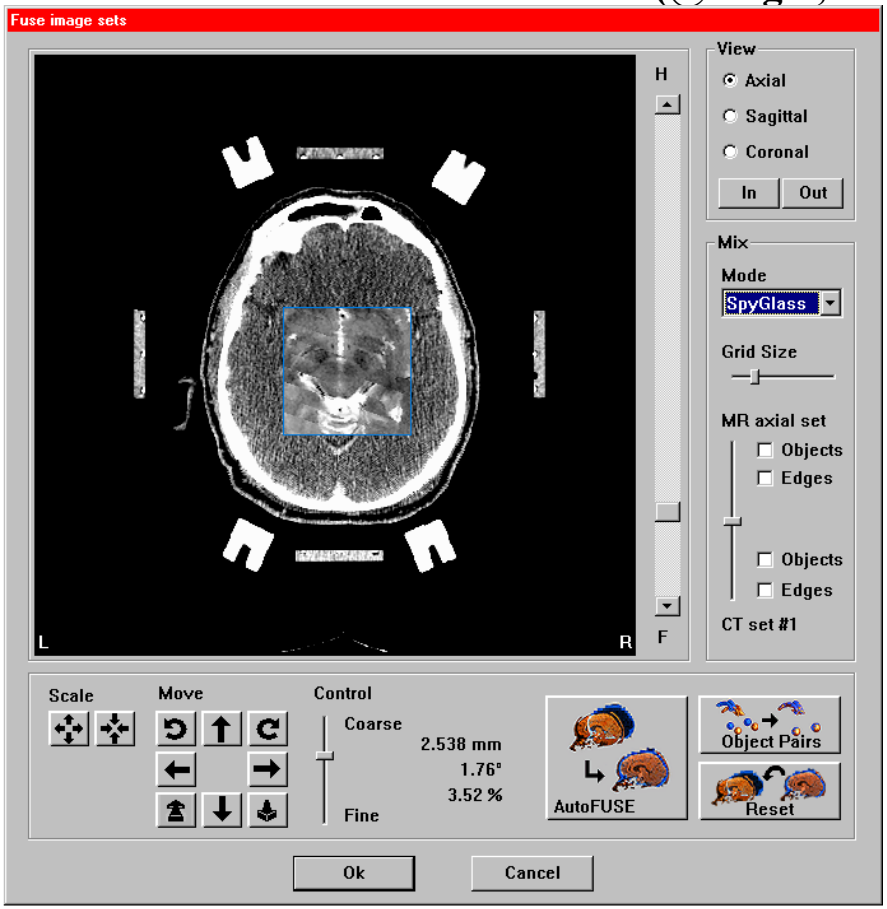
SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

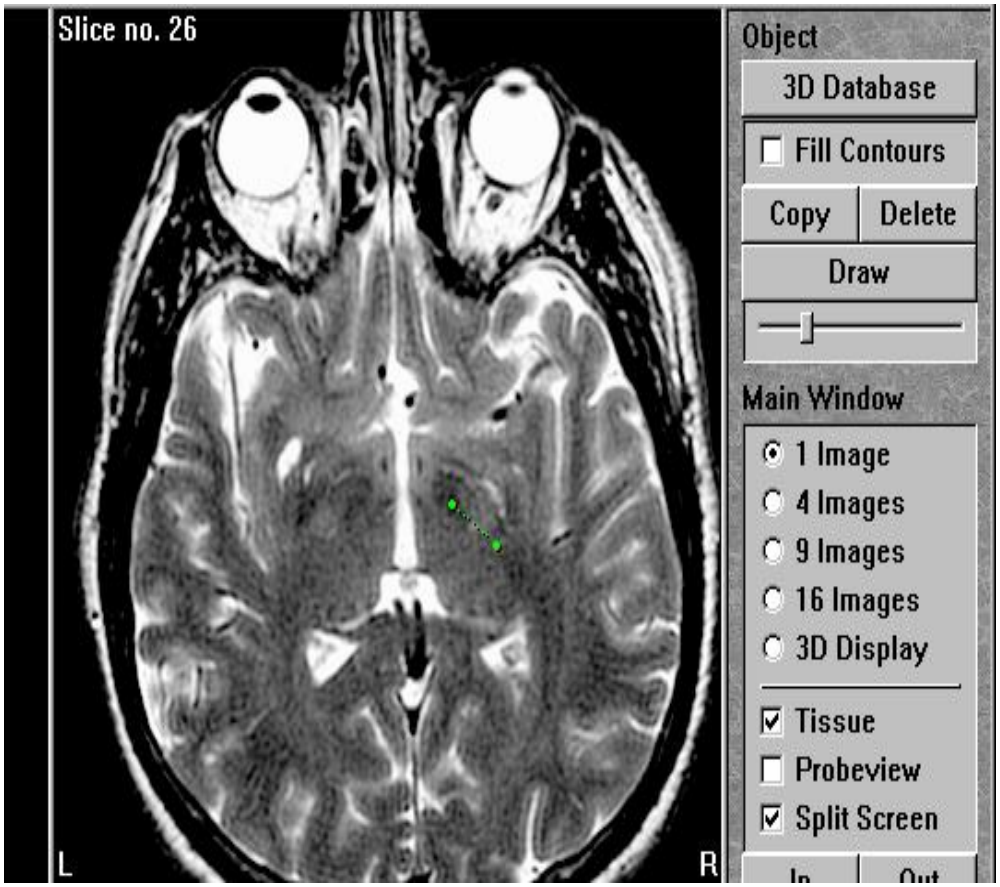
"METOD"

- **CT / MRI image fusion & direkt hedefleme**

Stereotaktik bir programla CT/MRI auto-fusion

(@target, BrainLab, München)

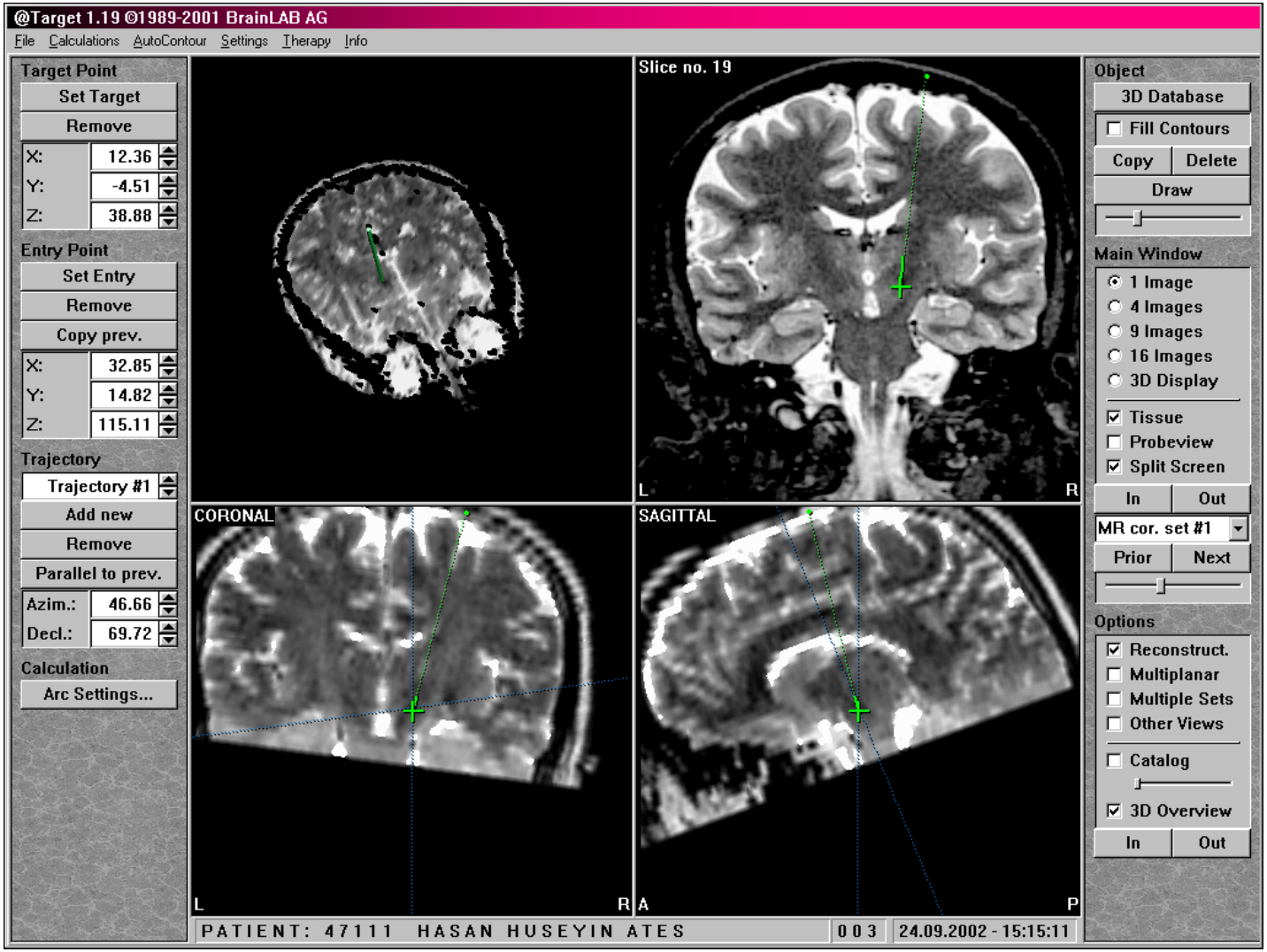




SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

"METOD"

- **CT / MRI image fusion & Direkt hedefleme**



SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

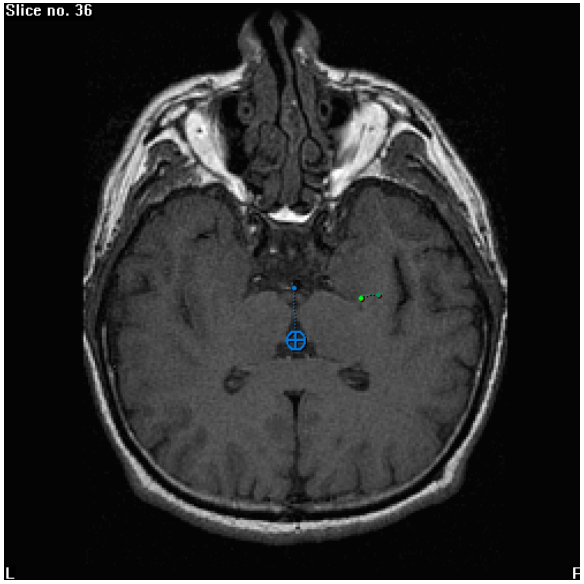
"Diğer hedefleme yöntemleri"

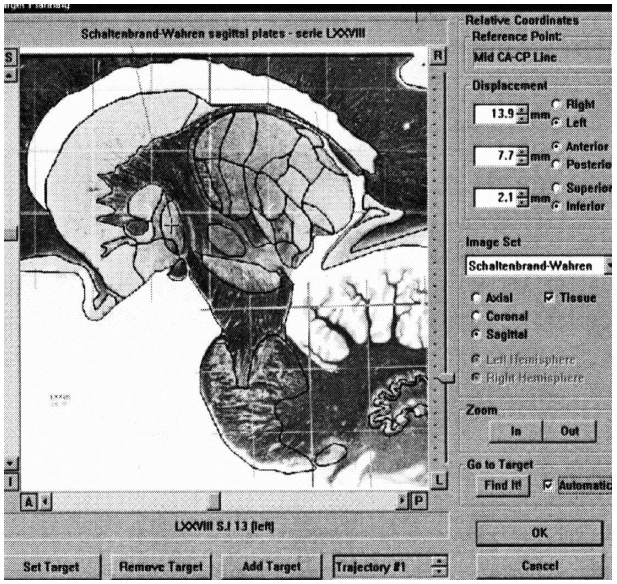
- **Konvansiyonel indirekt hedefleme yöntemi**

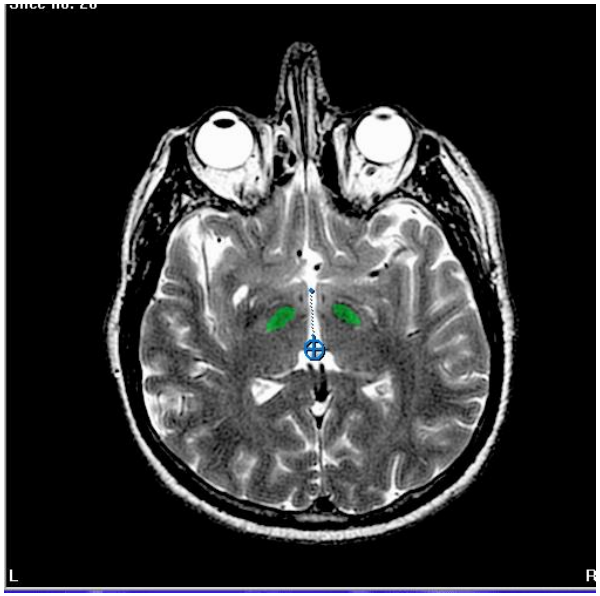
  AC/PC: MCP koordinatları: x: ± 13 ; y: -4; z: -5 mm (Sapma!!!)

- **Komputerize beyin atlası and fonksiyonel planlama: AC/PC**

  stereotactic software (@target, BrainLab, München)





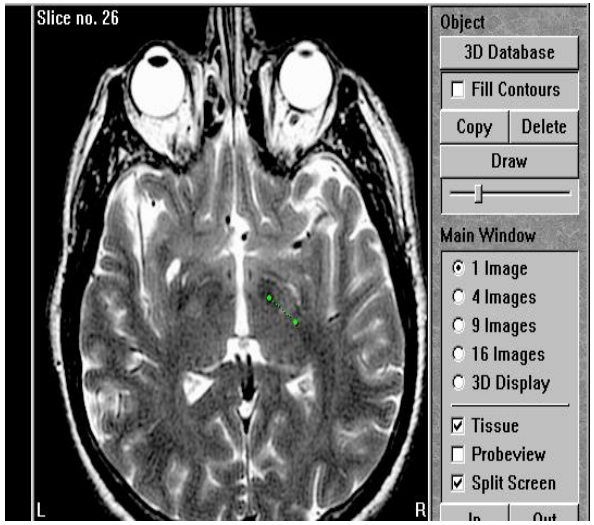


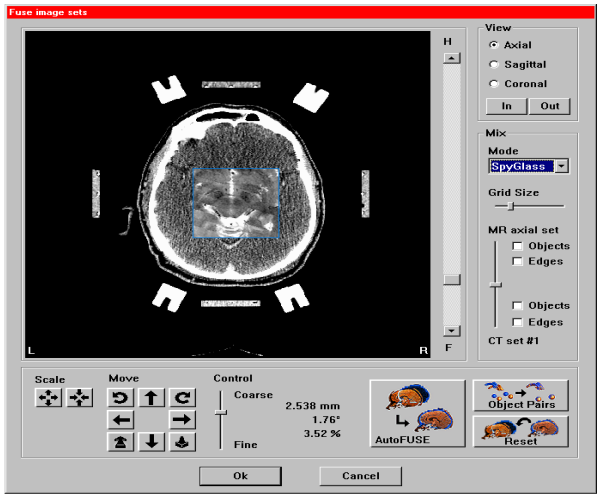
SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

"METOD" – **2000**-2014

- **CT / MRI image fusion & direkt hedefleme**

CT/MRI auto-fusion





A Comparison Between Stereotactic Targeting Methods of the Subthalamic Nucleus in Cases with Parkinson's Disease

Ali Savas, Melih Bozkurt, and Cenk Akbostancı

Abstract *Background*: Several methods are used for targeting of the subthalamic nucleus (STN) for the surgical treatment of Parkinson's disease (PD). The goal of this study is to determine the most suitable morphological method for localizing the STN in order to perform deep brain stimulation (DBS) in the treatment of PD.

Methods: Twelve cases with PD underwent bilateral STN-DBS and followed up for 5 years. Indirect calculation of the STN using AC-PC coordinates, and direct targeting of the STN using stereotactic CT/MRI fusion, were used for targeting. A microelectrode recording method was used to localize the STN.

Results: Direct targeting of the STN using CT/MRI fusion was very precise in every case, based upon evaluation of the intraoperative microelectrode recordings, postoperative MRI scans, and clinical follow-up of the cases. The coordinate differences obtained from these two methods were statistically significant.

Conclusion: Direct targeting method of the STN using CT/MRI fusion provided higher precision than the indirect calculation method. This method may be used as a standard targeting technique, and may obviate the need for using complicated technologies such as microelectrode recording, which may sometimes be risky and counterproductive.

Keywords Deep brain stimulation • Subthalamic nucleus • Image fusion • Targeting • Parkinson's disease

Introduction

Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an effective surgical treatment for patients with advanced Parkinson's disease (PD). The technique of bilateral DBS of the STN has been accepted as one of the most commonly used surgical procedures since 1994, largely replacing the chronic stimulation of the ventral intermediate nucleus of the thalamus that was first reported in 1991 [4, 5, 18].

The success of STN-DBS for achieving clinical improvement is directly proportional to the accuracy of targeting the STN and lead placement [6, 22]. Different types of methods have been used to localize the STN stereotactically. The indirect coordinate calculation method using the anterior (AC) and posterior commissures (PC) has been a conventional technique for localizing the functional deep brain structures, such as the STN, thalamus, and pallidum [9, 22]. Some other methods, such as stereotactic ventriculography and direct visualization of the STN by magnetic resonance imaging (MRI), are useful for accurate localization [5, 22, 25]. Electrophysiological recording of the STN during the procedures can be applied, and provides real-time functional confirmation of the target [3, 30].

The goal of this study was to determine the most suitable morphological method to localize the STN in order to perform DBS in the treatment of cases with advanced PD.

Material and Methods

During the period 2001–2006, 12 cases (with 24 targets) with PD who underwent bilateral subthalamic DBS operations for PD were selected randomly for this study. There were seven male and five female patients. The mean age was 59.08 (44–64) years. The mean diagnosis duration was 11.1 (4–26) years, and all patients were under medical therapy on admission. Two of the patients had undergone unilateral

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G. Nikkhah and M. Plasker (eds.), *Stereotactic and Functional Neurosurgery*, Acta Neurochirurgica Supplement, Vol. 117,
DOI 10.1007/978-3-7091-1482-7_6, © Springer-Verlag Wien 2013

CERRAHİ TEKNİK

Nörofizyolojik Lokalizasyon:

- Uyanık hastanın nörolojik bulgularının takibi

- Makro-stimulasyon:
  - 5-100 Hz-0.2 msec-1-3 V

    Kontraksiyon, parezi, görme bulguları vb.

CERRAHİ TEKNİK

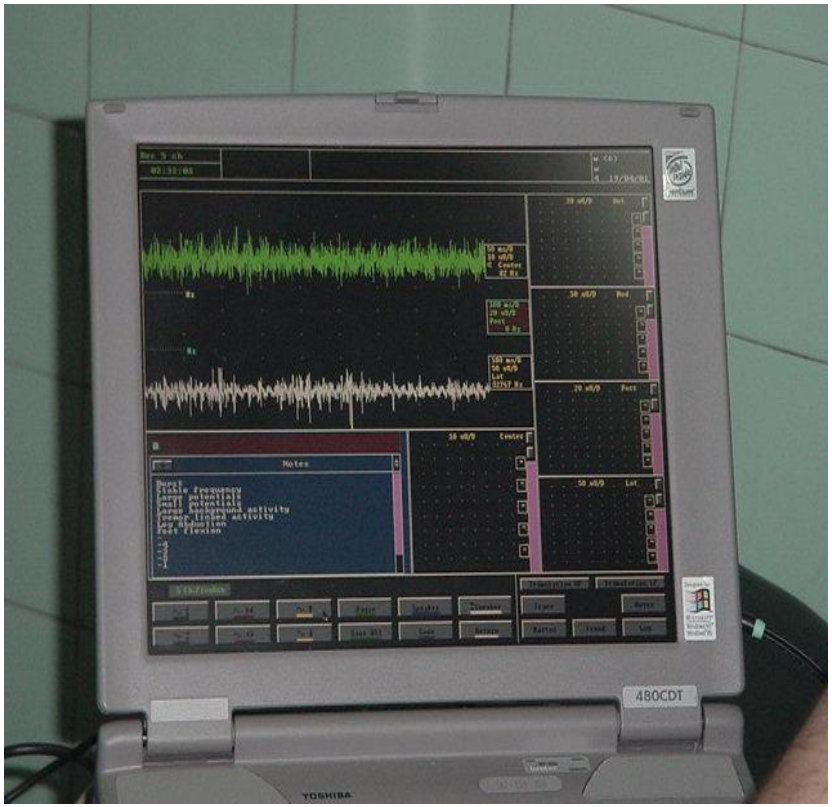
Nörofizyolojik Lokalizasyon:

- **μ--rekord-**

Single-unit neuronal activite- uç-10 μ mm

- **μ-stimulasyon-**

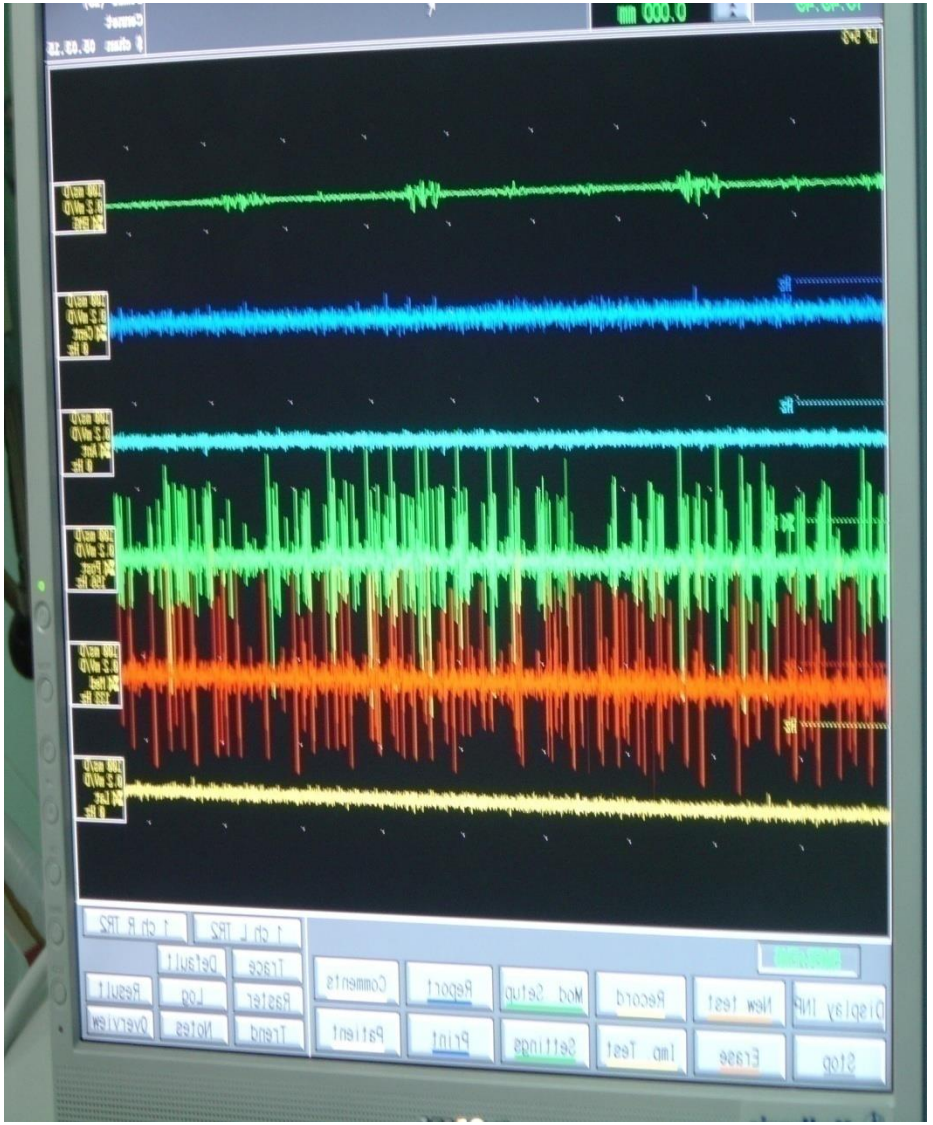
- **Tremor-EMG**



(Medtronic, Leadpoint™ 2/4)

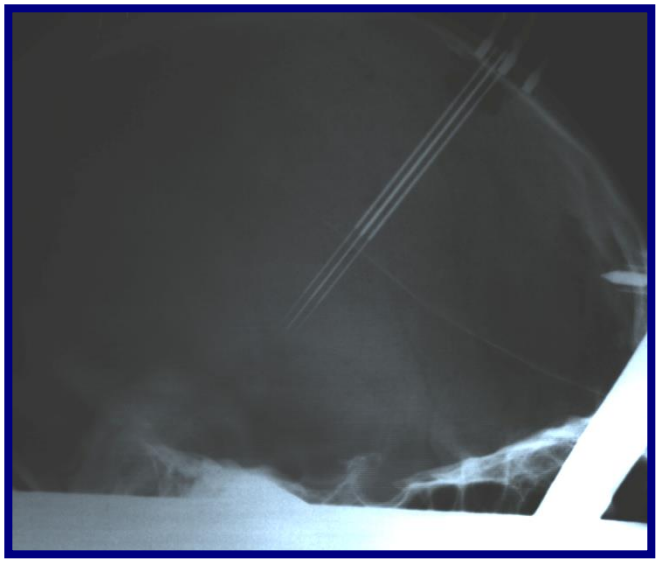
5 Kanal (+3) Mikro-elektrod Kayıt
Single-unit neuronal activite- uç-10 μ mm

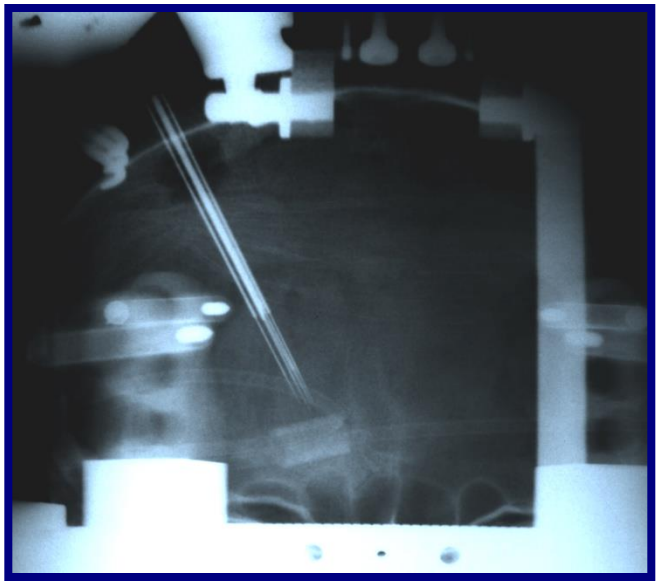
5 Kanal (+3) Mikro-elektrod Kayıt
Medtronic-TM 5.04

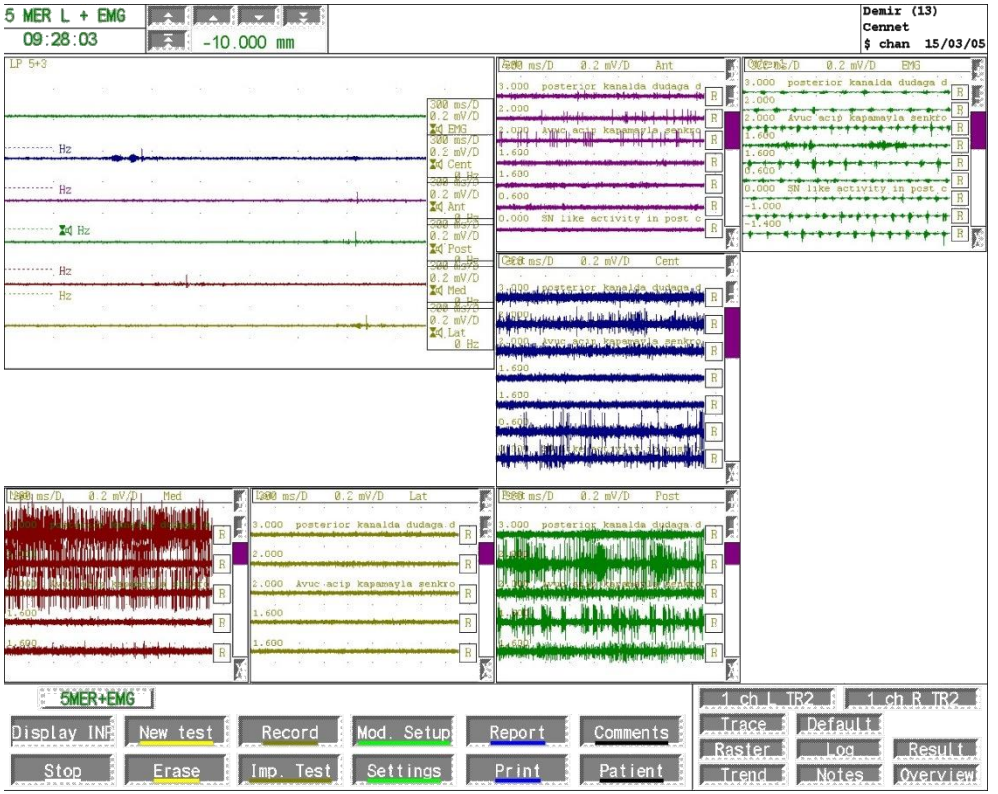


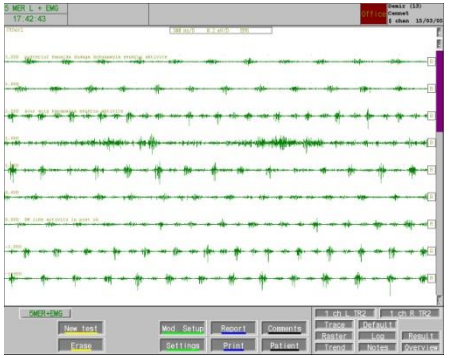
5 Kanal (+3) Mikro-elektrod Kayıt

Single-unit neuronal activite- uç-10 μ mm



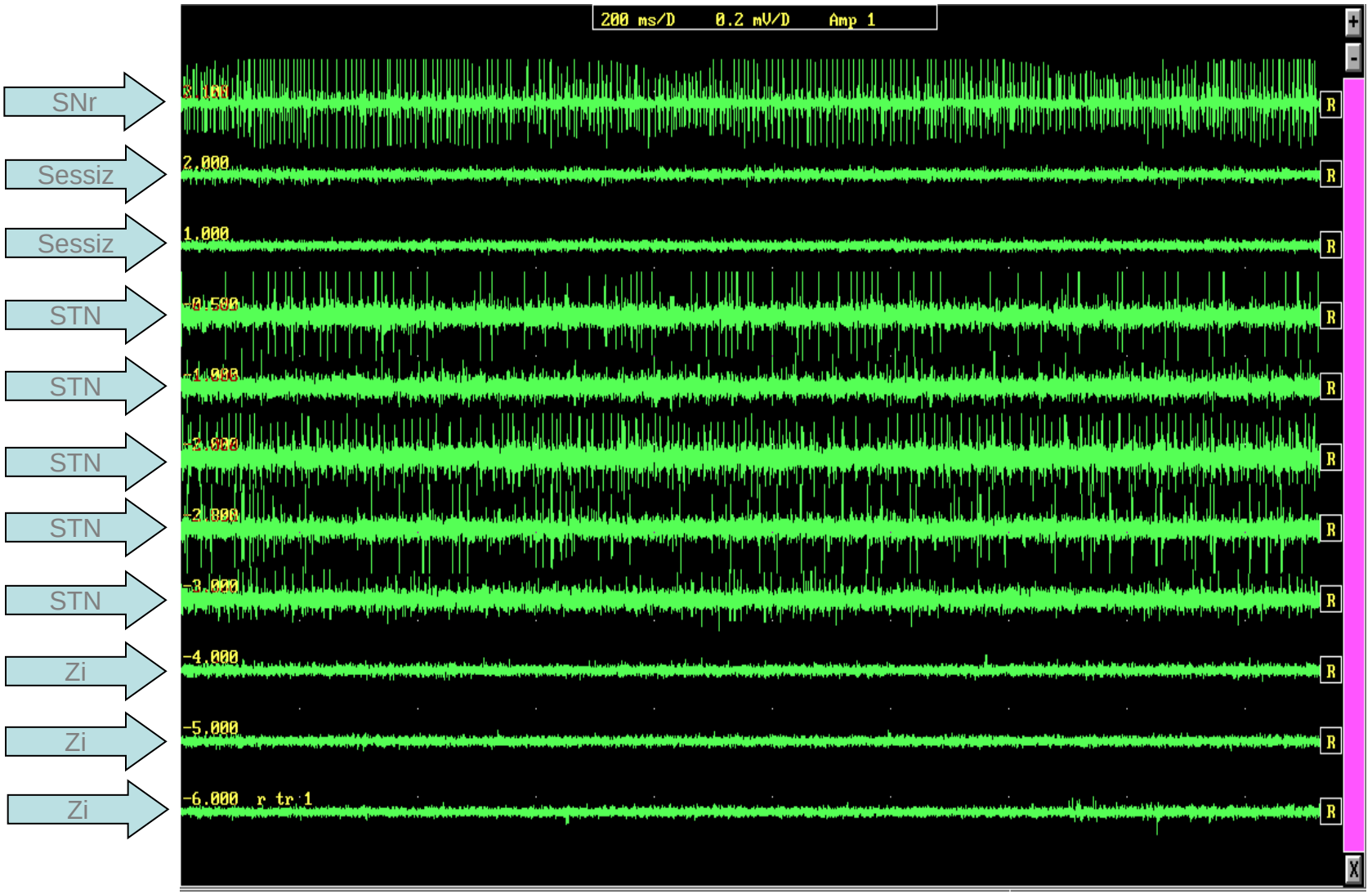




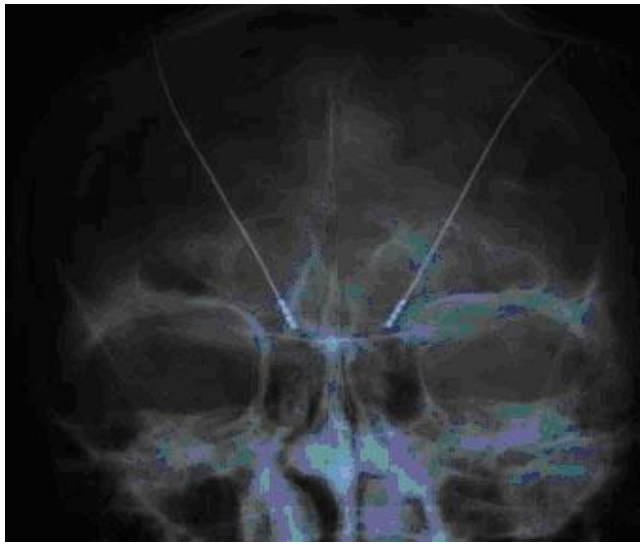


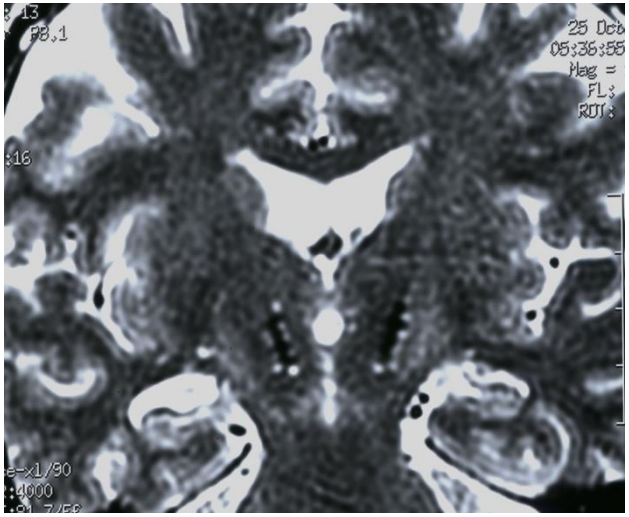
SUBTALAMİK NUKLEUS'UN HEDEFLENMESİ

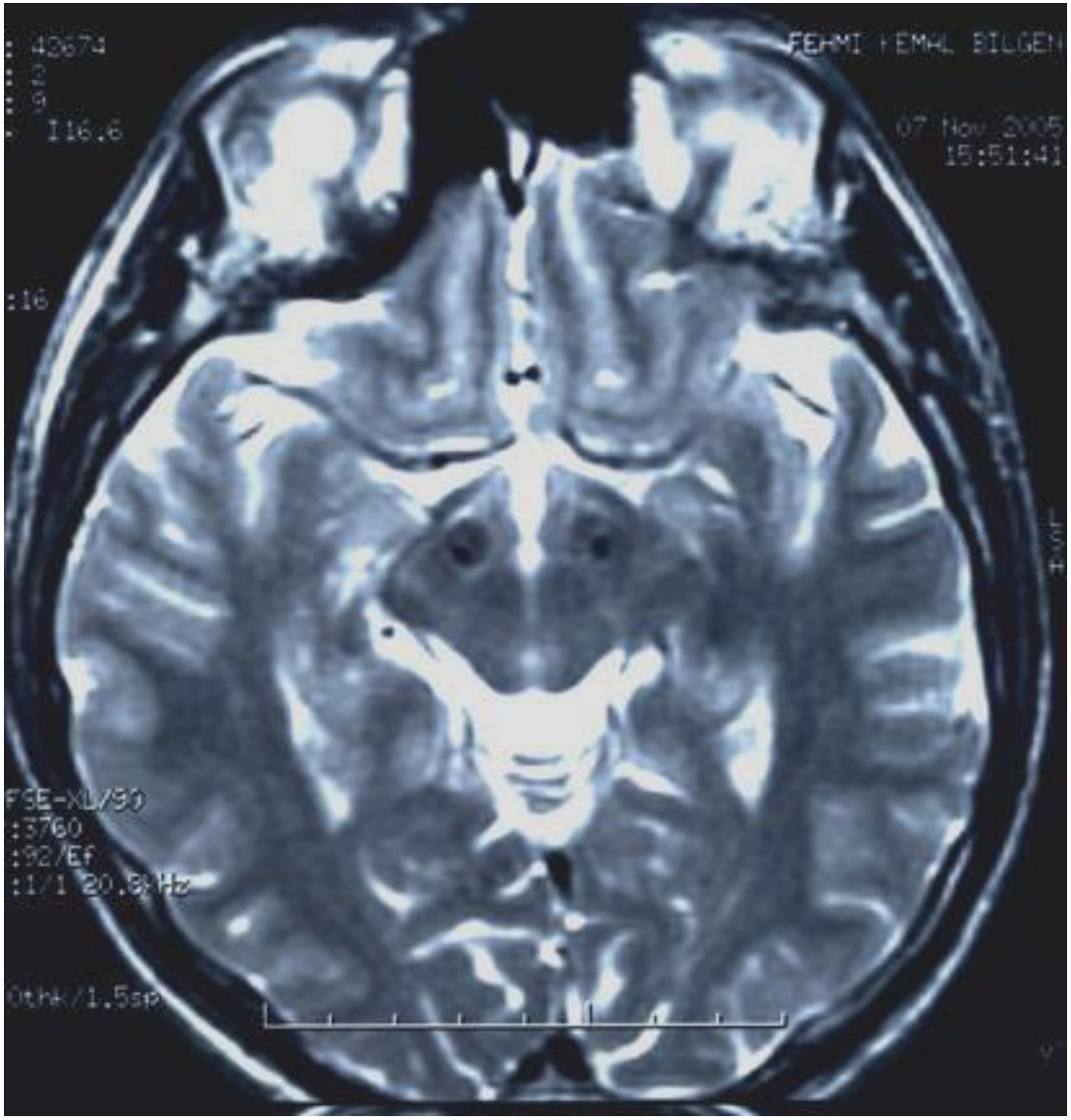
Mikroelektrod Kayıt



** KONTROL MRI **



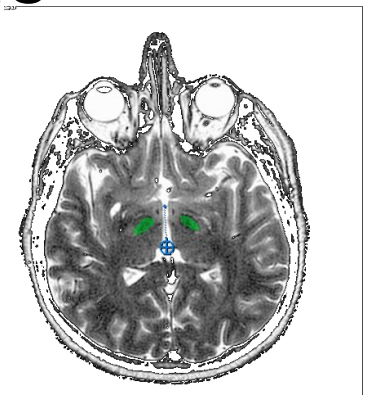

25 Oct
05:36:55
Mag =
FL:
ROI:


FEHMI KEMAL BILGEN
07 Nov 2005
15:51:41
FSE-XL/90
:3760
:92/Ef
:1/1 20.8 Hz
0thk/1.5sp

Sonuçlar

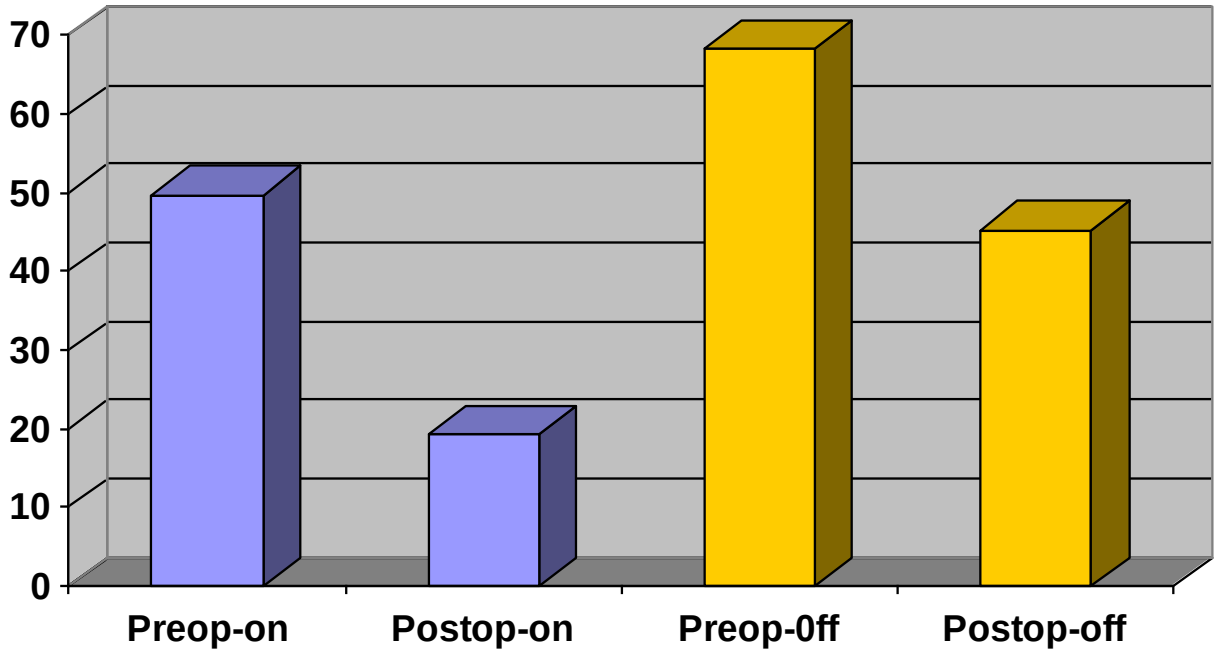
BİLATERAL STN NÖROSTİMULASYONU PARKİNSON

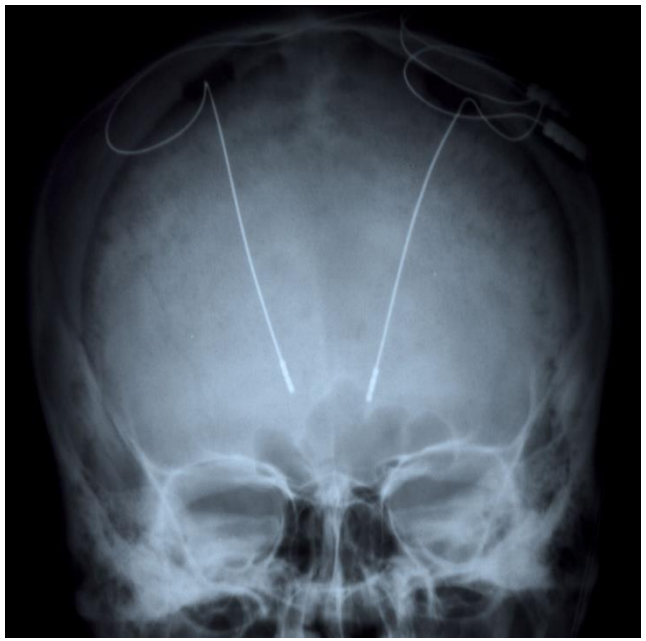
UPDRS	Preop-on	Preop-off	Postop-on	Postop-off
Ortalama	49,7	68,3	19,3	45,3



UPDRS %51 Düzelme

İlaç dozunda azalma- %57





SEÇİLMİŞ OLGULAR

SUBTALAMİK NUKLEUS NÖROSTİMULASYONU

Akinezi dominant

Parkinson

	Preop-on	Preop-off
UPDRS	22	47

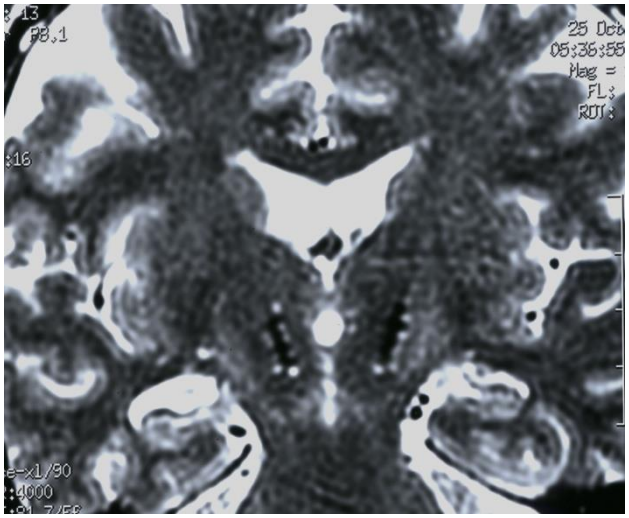
Preop.

SEÇİLMİŞ OLGULAR

SUBTALAMİK NUKLEUS NÖROSTİMULASYONU

Akinezi dominant

Parkinson



	Preop-on	Preop-off	Postop-on	Postop-off
UPDRS	22	47	18	34

Postop.

ANKARA UNIVERSITY

ALGORHITM FOR SURGICAL TREATMENT OF DYSTONIA

DYSTONIA

(RESISTANT TO MEDICAL TREATMENT AND BOTULINUM TOXIN)

FOCAL DYSTONIA

GENERALIZED DYSTONIA

HEMI-DYSTONIA

FOCAL OR SEGMENTAL EXTREMITY DYSTONIA

SERVICAL DYSTONIA

OROMANDIBULAR DISTONIA

OTHERS

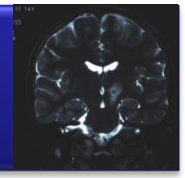
SECONDARY

GENETIC OR IDIOPATHIC

OR TARDIVE

UNILATERAL

THALAMOTOMY & KAMPOTOMY



THALAMOTOMY & KAMPOTOMY

DTY6 (-) & GENETIC EVIDENCE (-)

PRIMARY OR TARDIVE

DYT6 MUTATION (+)

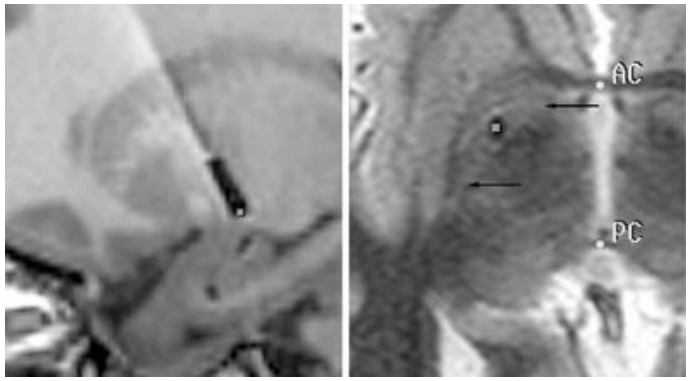
?

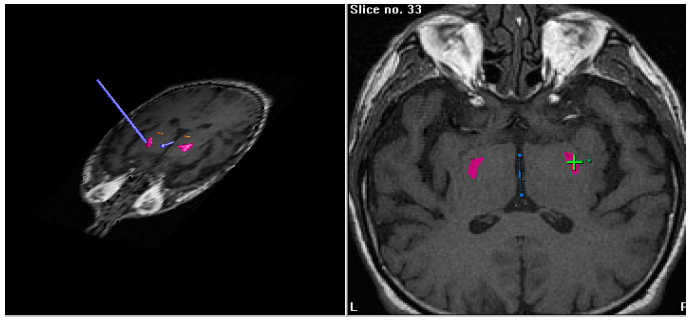
GPI-DBS

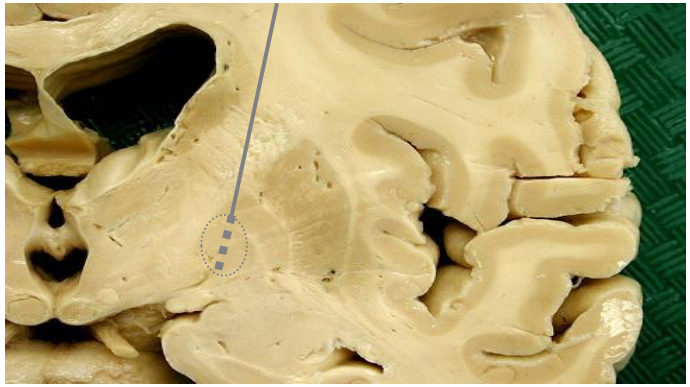
PRİMER DİSTONİ

BILATERAL GL. PALLIDUS (GPI) NEUROSTIMULASYON

OLGU-1 (preop)



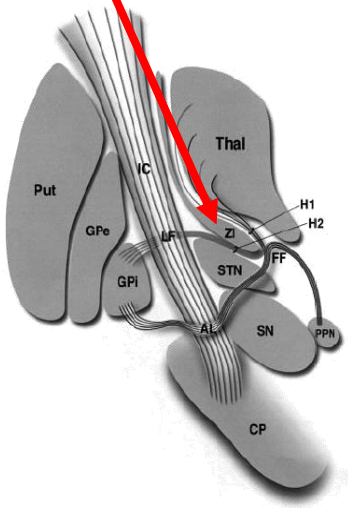


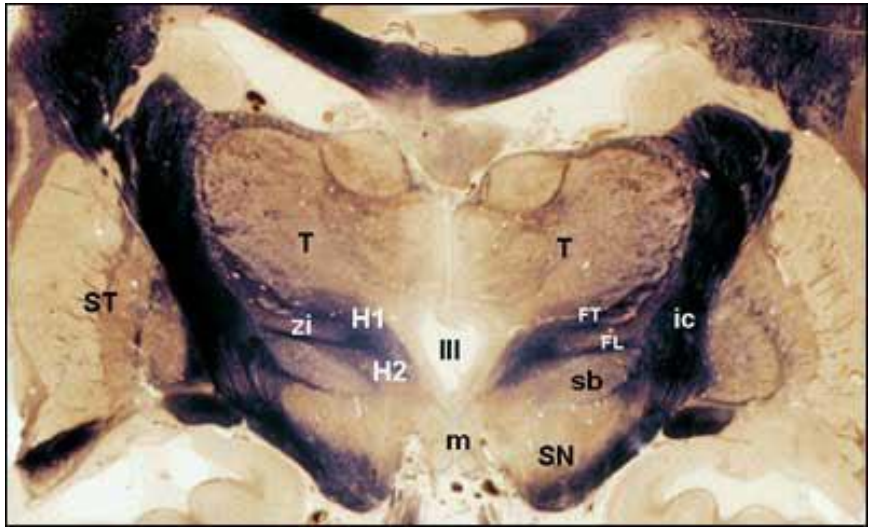


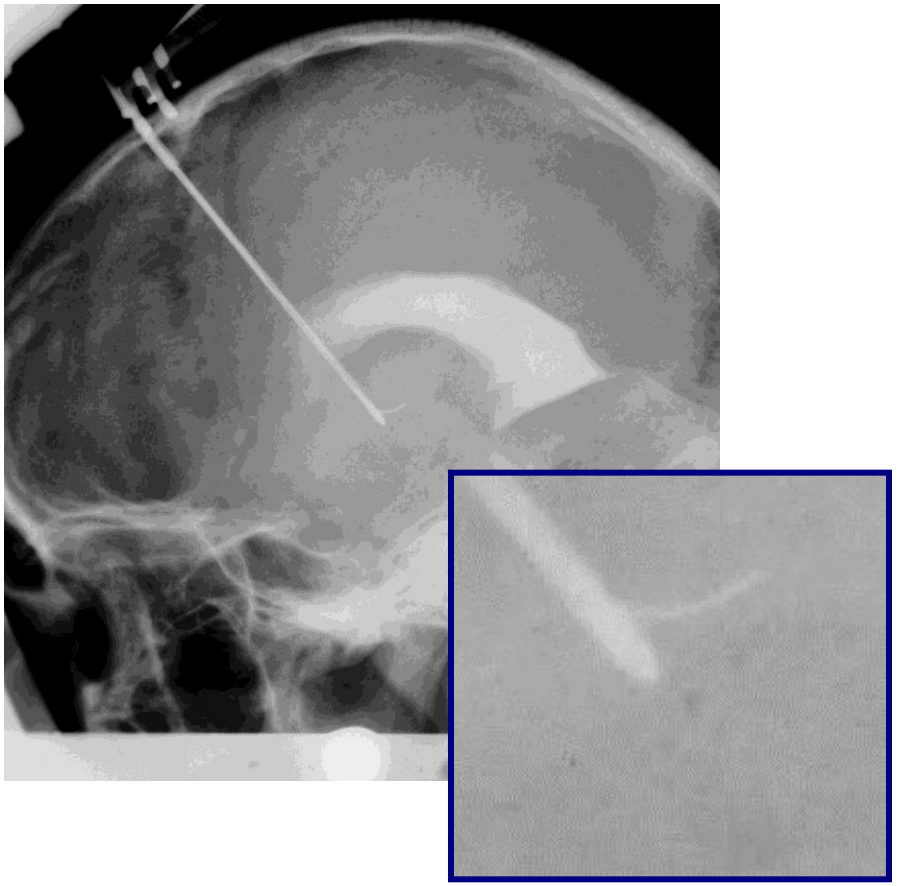
NÖROŞİRÜRJİNİN KAYIP AMELİYATI

“KAMPOTOMİ”

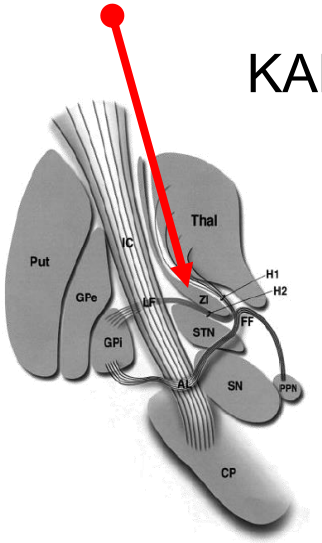
Zona incerta lesions- Forel Alanları
Strio-Pallidofugal Sistem
“Multi-potent ETKİ-diskinesia”

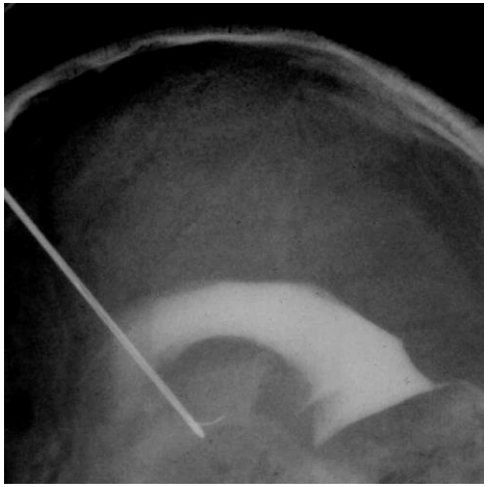


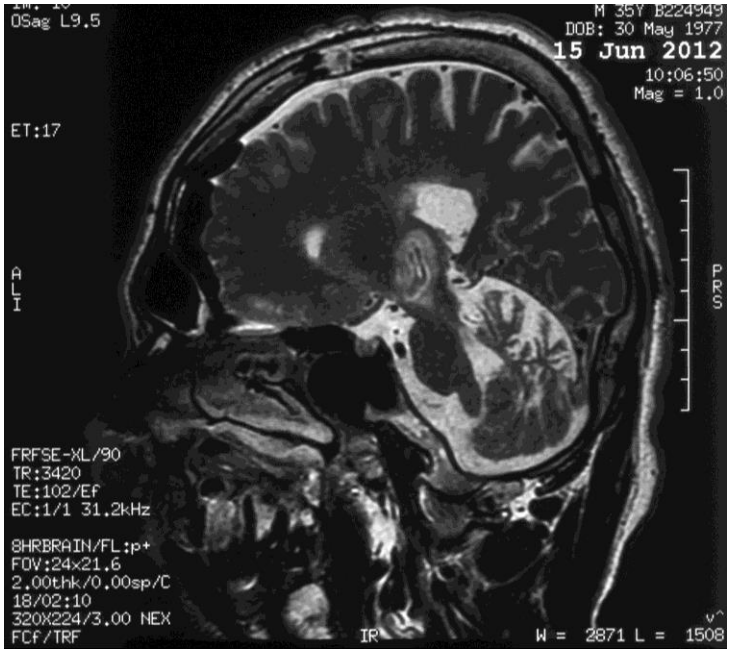


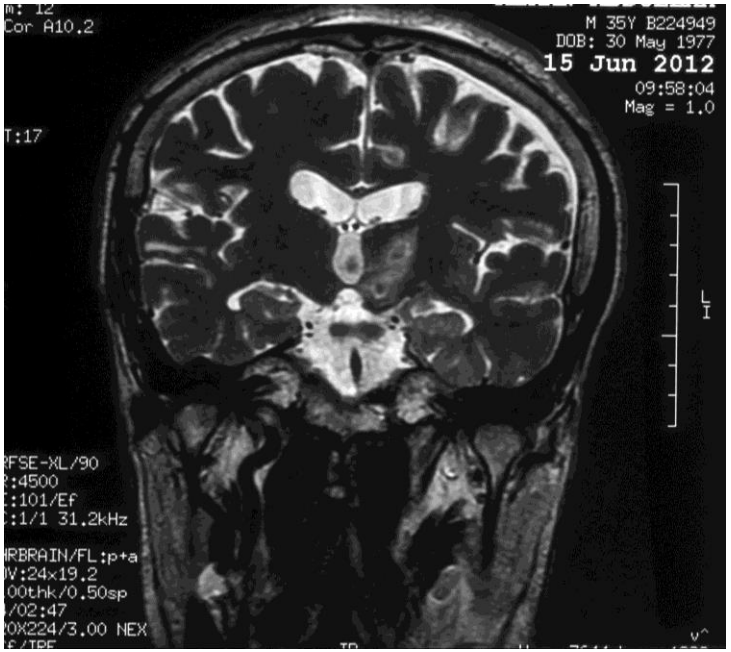


KAMPOTOMİ-ZONA INCERTA LEZYONLARI









TREMOR TALAMOTOMİ

TREMOR

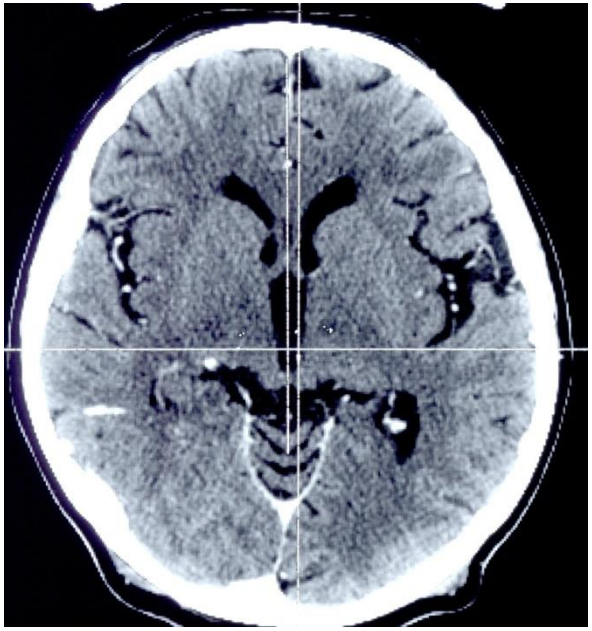
OLGU -2

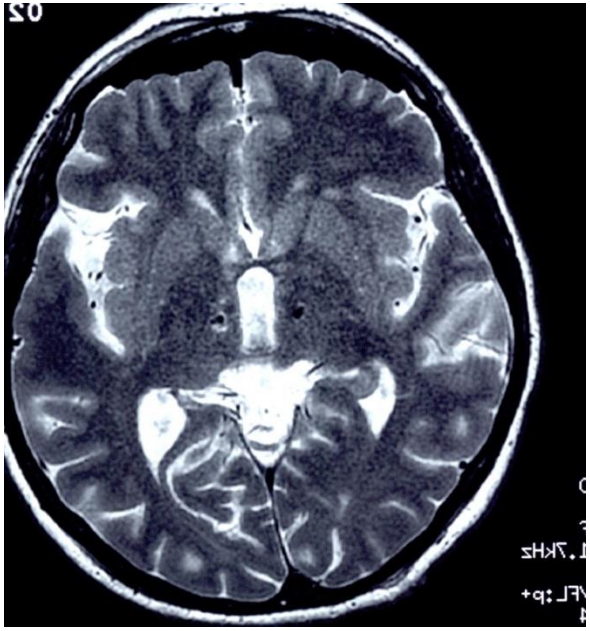
48 Yaşında Kadın Hasta
Bilateral Esansiyel Tremor

Sol Talamotomi- perop- mikro-kayıt ve stimulasyonla tam lokalizasyon

erken rekürrens!

Talamotomi bölgesine bilat. DBS ⟶ **Tremor kontrolü**





Hareket Bozukluklarında Cerrahi tedavinin etkinliğindeki en önemli faktör Preoperatif Radyolojik Stereotaktik Planlamadır