Transkütanöz Ablasyon

Prof.Dr. Ahmet Akyol
Acıbadem Üniversitesi Kardiyoloji A.B.D.
Acıbadem Maslak Hastanesi

Enerji Türleri

- Radyofrekans
- Kriyoenerji
- Mikrodalga
- Ultrason
- Lazer

CyberHeart Sistemi

.

FIGURE 1: The CyberKnife Radiosurgery System

These initial animal studies confirm the feasibility of radiosurgical treatment of atrial fibrillation. Clinical studies are needed to prove safety and efficacy in humans.

CyberKnife Sistemi

- Lineer hızlandırıcı
- Hareketli bir masa
- Robotik kol
- Biplan X-ray kameraları ve algılayıcıları
- Temel referans işaretleri
- Synchrony algılayıcıları

CyberKnife Sistemi

- Kayıt ve doğru hedefleme

Daha önceden çekilmiş BT görüntüleri ile tedavi sırasındaki X-ray görüntülerini ya sabit kemik yapılara göre yada cerrahi veya kateter yolla yerleştirilmiş referans noktalarına olan ilişkileri ile değerlendirerek yapıyor.

CyberKnife Sistemi

- Hedefi izlemeyi ise 2 yolla yapıyor:

1-Cerrahi veya kateter yol ile kalbe veya hedefe yakın noktalara yerleştirilmiş radioopak referans işaretleri ile

2-Anatomik bölgeyi belirleyecek BT görüntüleri ile

CyberKnife Sistemi

- Tedavi sırasında hedef bölgenin takibi ise

1-X-Sight spine software

2-Synchrony software

- Klinik doğruluk, eğer 1.25 mm incelikte BT kesitleri alınır ise 1.1 +/-0.3 mm.

CyberKnife Sistemi

- Konturlama
- Klinik hedef volümün saptanması


MultiPlan® System
Load
Fuse
Contour
Align
Plan
Visualize
Plan QA
Settings
Help
Setup
Isocentric
Conformal
Show Isocenters
Show Beam on 3D
Show VOI
PTV
AV Node
Esophagus
Trachea
Left Bronchus
Right Bronchus
Shell 5
Shell 10
Layouts
3D
DVH
A
Dose
S
C
Target Volume
All Target Regions
Critical Volume
All Critical Regions
Soft Tissue
Dose
Nodes
Beams
Max Dose (cGy)
Total MU
Min MU
Max MU
Dose Statistics Table
VOI
CI
Coverage
Patient
Plan
Rx

Noninvasive stereotactic radiosurgery (CyberHeart) for creation of ablation lesions in the atrium

Arjun Sharma, MD,* Douglas Wong, MD, PhD,† Georg Weidlich, PhD,† Thomas Fogarty, MD,‡ Alice Jack,‡ Thilaka Sumanaweera, PhD,‡ Patrick Maguire, MD, PhD‡

*From *Sutter Medical Research Institute, Sacramento, California, †The Community Hospital of Fresno, California, and ‡CyberHeart Incorporated, Menlo Park, California.*

BACKGROUND A variety of catheter-based energy modalities are used for cardiac ablation to treat arrhythmias. Robotic radiosurgery is increasingly being utilized to successfully accomplish precise tissue ablation in anatomically remote areas.

OBJECTIVE The purpose of this study was to examine the experimental feasibility of a noninvasive method using stereotactic robotic radiosurgery (SRS) to create cardiac lesions.

METHODS Sixteen (16) Hanford-Sinclair mini swine (weight 40–70 kg) under general anesthesia were studied. Baseline computed tomographic scans were performed, followed by electroanatomic mapping using the CARTO system. Stereotactic robotic radiosurgery was performed using the CyberHeart system, with predetermined targets at the cavotricuspid isthmus, AV node, pulmonary vein–left atrial junction, or left atrial appendage. From 25 to 196 days after treatment, the animals were investigated with repeat electroanatomic voltage mapping and transesophageal echocardiography, when possible. The animals then were sacrificed and pathology specimens taken.

RESULTS Dose ranging suggested that 25 Gy was needed to produce an electrophysiologic effect. The time course showed an electrophysiologic effect consistently by 90 days. The method was feasible for producing bidirectional cavotricuspid isthmus block and AV nodal conduction block. The pulmonary vein-left atrial junction and left atrial appendage showed marked voltage reduction to less than 0.05 mV. No spontaneous arrhythmias were observed. Pathology specimens showed no evidence of radiation damage outside the target. Histology samples from target sites showed effects consistent with X-beam radiation.

CONCLUSION Stereotactic robotic radiosurgery can produce cavotricuspid isthmus block, AV nodal block, and significant decreased voltage at the pulmonary vein–left atrial junction. No other organ damage was seen. The study findings demonstrate the feasibility of this noninvasive treatment method for creating cardiac lesions. This approach merits further investigation in the treatment of arrhythmias.

KEYWORDS Arrhythmia; CyberHeart; Noninvasive ablation; Radiosurgery; Stereotactic radiosurgery

ABBREVIATIONS CT = computed tomography; **CTI** = cavotricuspid isthmus; **Gy** = Gray (unit of absorbed radiation dose); **SRS** = stereotactic robotic radiosurgery

(Heart Rhythm 2010;7:802–810)

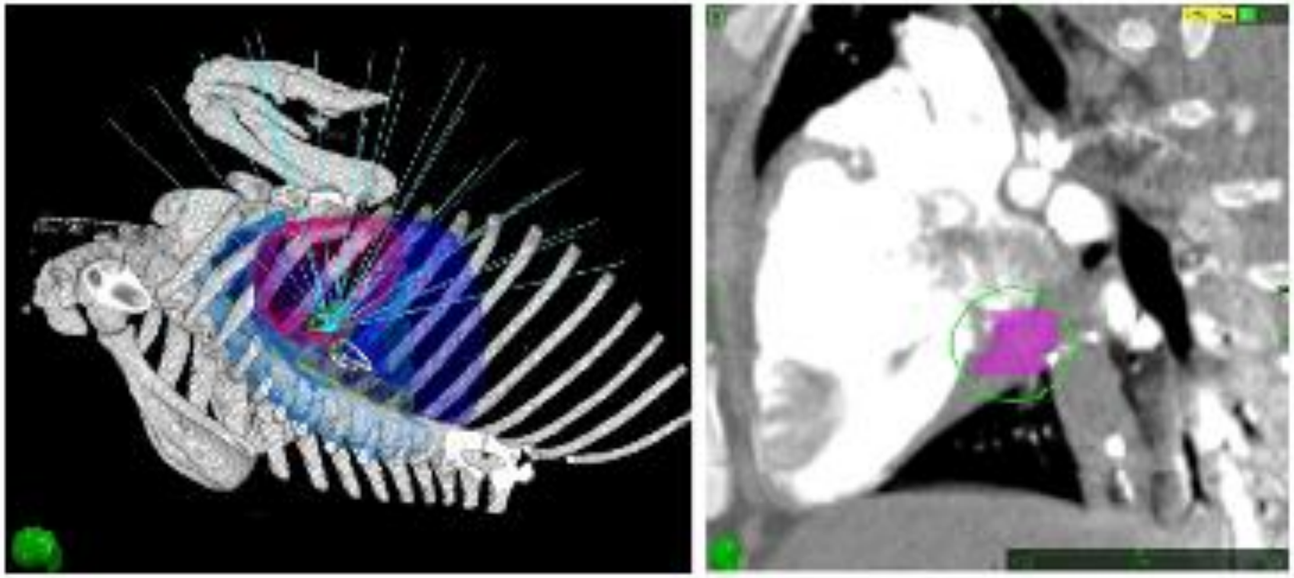


Figure 3 Advance conformal treatment plan for right atrium. **Left:** Beam set that will focus energy at the target. **Right:** Treatment plan that "conforms" to the three-dimensional volume of the myocardium of the cavotricuspid isthmus to minimize exposure to surrounding tissue.

Table 1 Baseline mapping, cardiac-gated computed tomography, CyberKnife treatment, follow-up electrophysiologic mapping, and histology

Target	Dose range (Gy)	Time from treatment to assessment (days)	Effect
Cavotricuspid isthmus (n = 9)	32–80	25–108	Decreased voltage at all doses Bidirectional block seen at 40 Gy and 33 days
Left atrial appendage (n = 2)	32–80	16–33	Decreased voltage at 38 Gy and 33 days
Left pulmonary vein (n = 3)	38–40	89–196	Decreased voltage at pulmonary vein–left atrium junction in all
AV node (n = 2)	40–70	25–108	Third-degree block at 49 days One animal euthanized early (15 days) secondary to pacemaker pocket infection

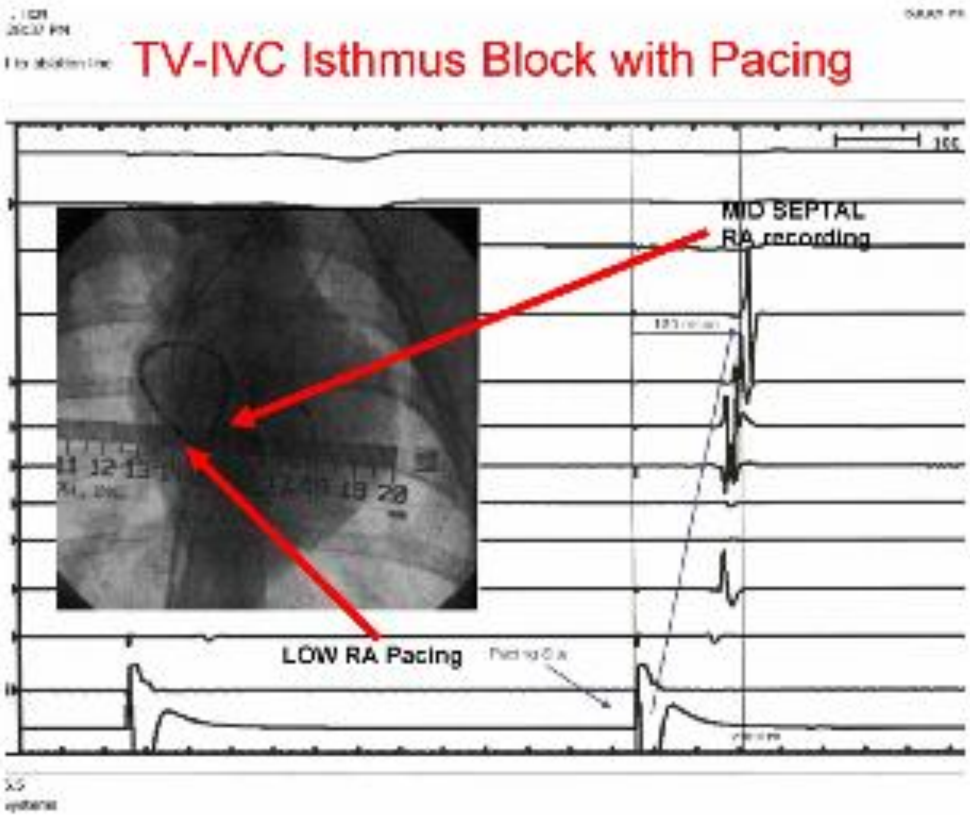


Figure 4 Tricuspid valve-Inferior Vena Cava (TV-IVC) isthmus block with pacing. Fluoroscopic image (**left**) showing catheter locations in right atrium and coronary sinus. Atrial electrograms show septal activation medial to the ablation site from high to low, with pacing in the low right atrium (RA) just lateral to the ablation site.

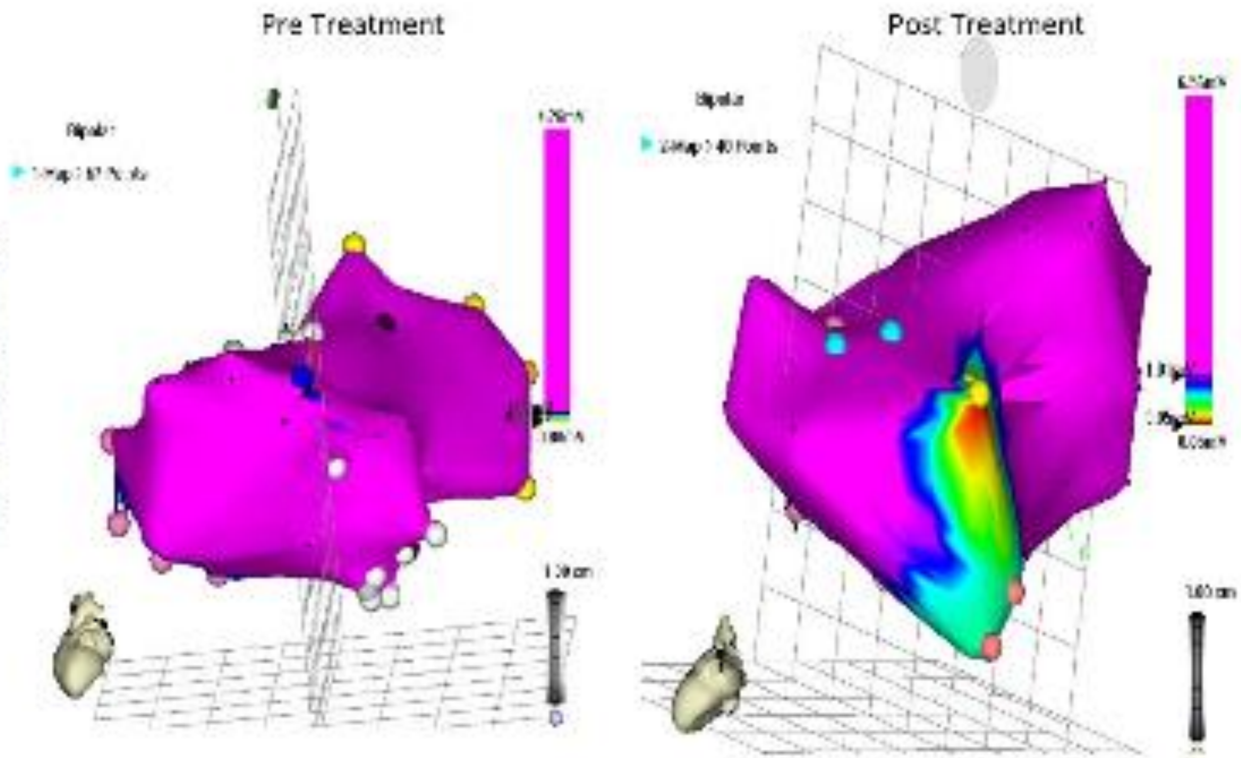


Figure 6 Electroanatomic voltage maps of left atrium in left posterior oblique views. **Left:** Pretreatment. No areas of decreased voltage are seen. Pulmonary veins are not shown. **Right:** Posttreatment. Pulmonary veins are marked. In contrast to pretreatment, an area of low-amplitude signals is seen extending from the left superior pulmonary vein to the left inferior pulmonary vein, consistent with the target.

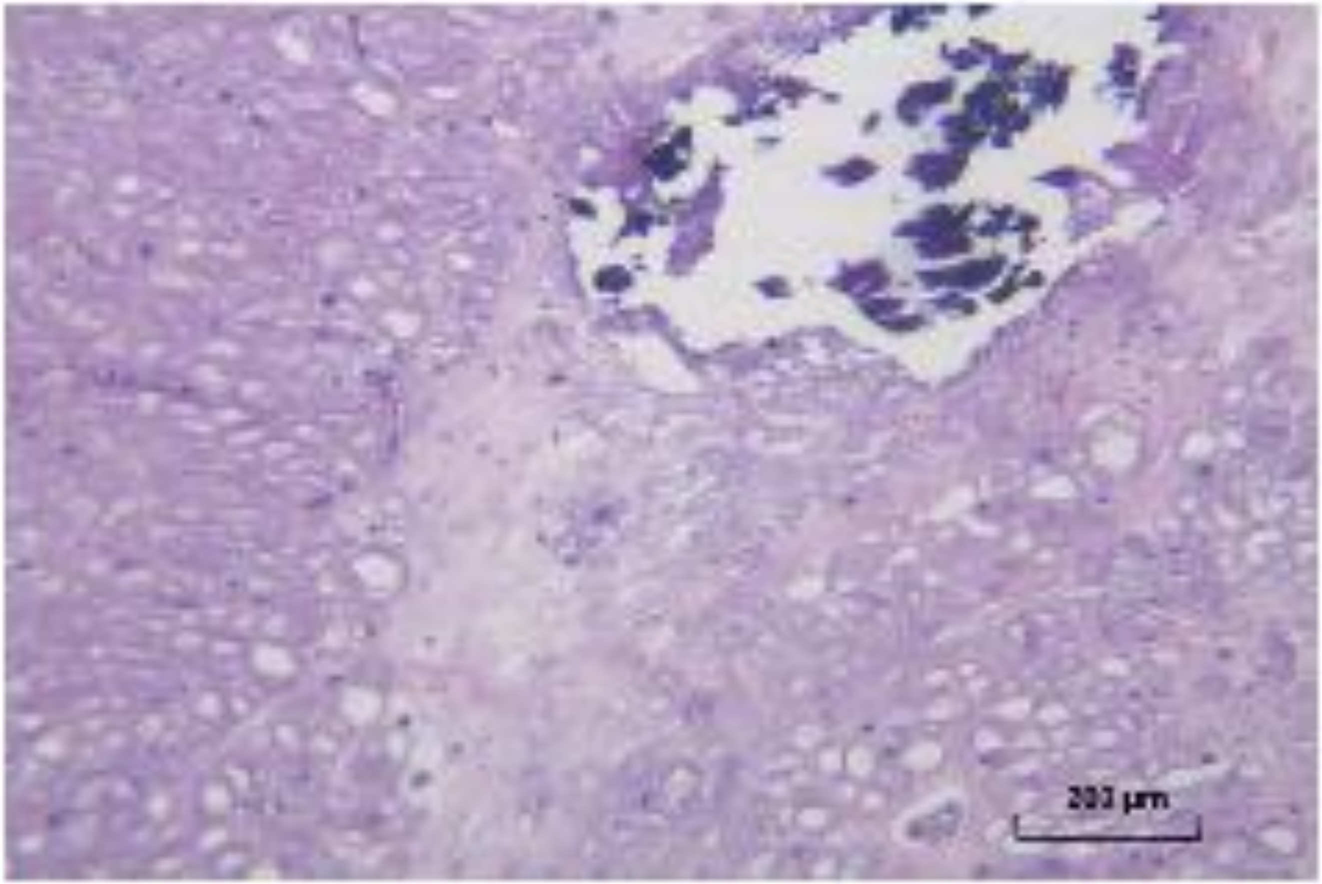


Figure 8 Histologic appearance of the ablation area. Normal architecture is absent. Vacuoles, fibrosis, and calcification are seen.

Sorular

- Sinüs ritmi dışındaki ritimlerde ve spontan solunum sırasında
- BT kayıtları ile tedavi sırasındaki ritim farklılıkları
- SRS'un uzun dönem sonuçları (çevre dokular)
- Miyokardın radyasyona olan yanıtı, tür spesifik.
- Sağlıklı dokular ile anormal miyokardial dokuların radyosensitivitesi ?
- Uzun dönem elektrofizyolojik yanıt ?

First-In-Man Treatment of Arrhythmia (Ventricular Tachycardia) using Stereotactic Radiosurgery

Access this presentation

HRS Meeting Name
Heart Rhythm On Demand 2013

Presenter(s)
Paul C. Zei, MD, PHD, FHRS

Track
Special Session

Syposium/Session Title
Poster Session V

Session Date and Time
Friday, May 10, 2013, 2:00 PM

Lecture ID
8777

Abstract

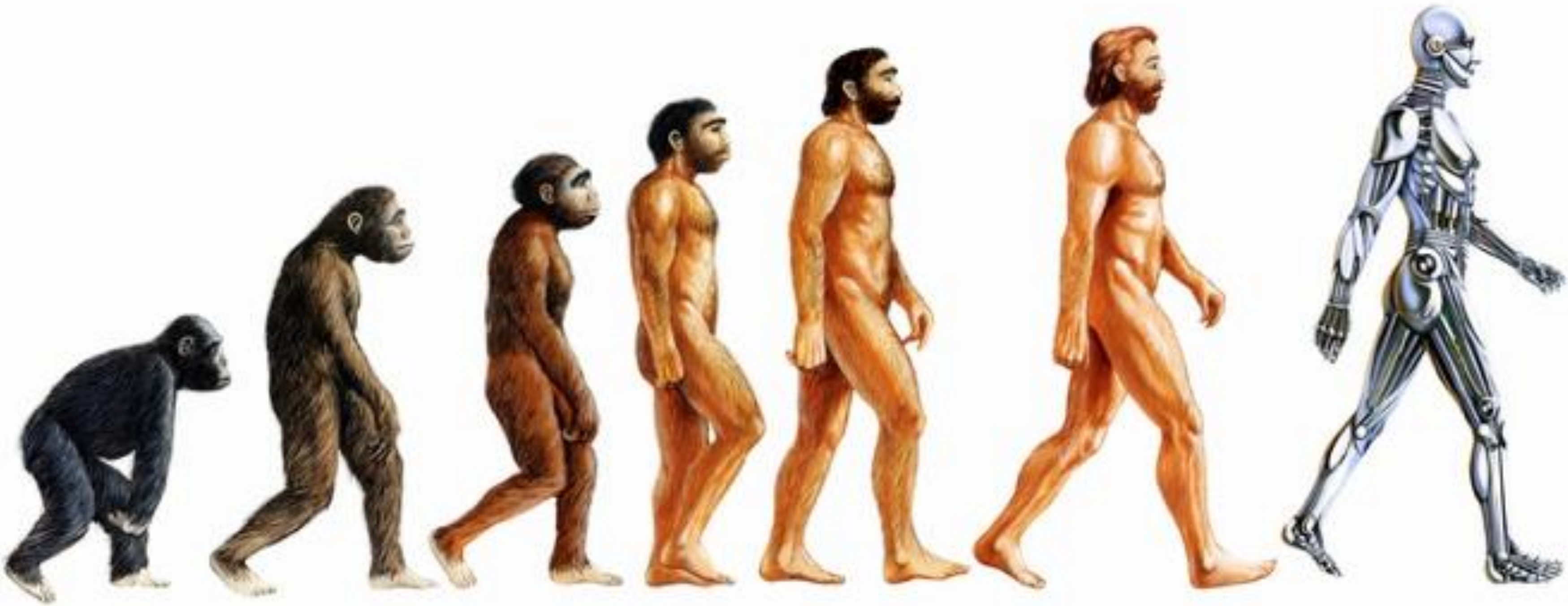
Introduction: Malignant ventricular tachycardia (VT) can be treated effectively with catheter ablation (CA). However, many patients fail or cannot undergo CA due to inaccessible substrate or comorbidities. Stereotactic radiosurgery (SRS) is used clinically to ablate solid tumors. We report the first use of SRS to treat arrhythmia, specifically VT, in a human subject.

Methods: The protocol was approved by the FDA and IRB for Compassionate Use therapy. SRS was planned with Cardioplan (CyberHeart, Portola Valley, CA) software and delivered via CyberKnife (Accuray, Sunnyvale, CA).

Results: The subject is a 71 yo man with CAD, atrial fibrillation (AF), and severe COPD (O2 dependent, FEV1 0.77L), s/p ICD. Nearly incessant VT, pace- and shock-terminated, occurred for over 2 years despite sotalol and mexilitine. VT is monomorphic, cycle length 380-411ms per ICD. 12-lead ECG during VT is RBBB pattern, superior axis, precordial transition V3-V4, 150bpm. Baseline ECG shows AF, IVCD and inferior infarct. Echocardiography: EF 24%, basal inferior aneurysm, apical/infero-posterior akinesis. PET scan: non-viable distal inferior wall, hypoperfused basal-mid inferior wall. The subject was referred for CA but deemed too high risk. A SRS treatment plan of 25Gy was designed to encompass the inferior wall scar, with margin for cardiac motion (FIGURE: SRS plan overlaid on PET images). Respiratory motion was compensated by dynamic target tracking using a temporary pacing lead as a fiducial marker. SRS was delivered over 2 hrs. The patient required no sedation, tolerated the procedure well, had no immediate complications.

Conclusions: We report first-in-man treatment of arrhythmia (VT) using Stereotactic Radiosurgery.

..dünümüz , bugünümüz…



SABRINIZ İÇİN TEŞEKKÜRLER