



Gamma Knife for Obsessive Compulsive Disorder: Can It be Detrimental?

Obsesif Kompulsif Bozukluk İçin Gamma Bıçağı: Zararlı Olabilir mi?

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ABSTRACT

Functional neurological disorders (FND) have been a challenge to treat both for neurologists and neurosurgeons. Various ablative as well as non-ablative techniques have been used to treat these disorders. Gamma knife radiosurgery (GKRS) is also being practised to treat refractory obsessive-compulsive disorder (OCD). The subsequent complications of GKRS reported have been variable, with headache being the most common. We discuss here a rare complication of 'late onset radiation necrosis in bilateral caudate nuclei' in a patient after receiving GKRS three years back. This case highlights the need to be more cautious before administering ablative procedures in patients suffering with functional disorders.

KEYWORDS: Gamma knife radiosurgery, Caudate nucleus, Radiation necrosis, Obsessive compulsive disorder

ÖZ

İşlevsel nörolojik bozukluklar hem nörolog hem de nöroşirürjiyenler için zor bir konudur. Bu bozuklukları tedavi etmek için çeşitli ablatif ve non ablatif teknikler kullanılmıştır. Gamma bıçağı radyocerrahisi tekniği de refrakter obsesif kompulsif bozukluk (OKB) tedavisi için kullanılmaktadır. Gamma bıçağı radyocerrahisinin uygulanmasından sonraki komplikasyonları en sık baş ağrısı olmak üzere çeşitli şekillerde görülmüştür. Burada üç yıl önce gamma bıçağı radyocerrahisi yapılmış bir hastada 'bilateral kaudat nükleusta geç başlangıçlı radyasyon nekrozu' şeklinde nadir bir komplikasyon sunuyoruz. Bu vaka işlevsel bozuklukları olan hastalarda ablatif işlemler uygularken daha dikkatli olunması gereğini vurgulamaktadır.

ANAHTAR SÖZCÜKLER: Gamma bıçağı radyocerrahisi, Kaudat nükleus, Radyasyon nekrozu, Obsesif kompulsif bozukluk

INTRODUCTION

Radiosurgery for OCD and anxiety neurosis has been being performed for over 45 years. OCD is a debilitating disease consisting of intrusive anxiety provoking thoughts and ritualized behaviors. In its severest form, OCD can lead to deep incapacitation, inability to work and function in society and need for hospitalization. Pharmacological and psychological therapies form the mainstay of treatment, however in 30-40% cases of refractory OCD, neurosurgery is the last resort for treatment (3, 4). For refractory OCD patients, neurosurgery offers options of thermo-capsulotomy, gamma capsulotomy and deep brain stimulation (DBS). Regarding radiosurgery, the most common noted complication is edema with clinical manifestation in the form of headache (5). Rare complications are asymptomatic caudate nucleus infarct, frontal lobe dysfunction and weight gain (5). We report a case of resistant OCD treated with GKRS developing large radiation necrosis with cystic changes in bilateral caudate nucleus region with significant mass effect warranting surgical intervention.

CASE REPORT

A 24-year-old unmarried female was receiving drug treatment along with cognitive behavioral therapy (CBT) for obsessive-

compulsive disorder (OCD) for the last 9 years. The patient had a childhood onset behavioral disturbance of frequent washer. Over the course of disease, she became depressed as she had insight of her absurd behavior. Her sister was a frequent tooth brusher and two of her second-degree cousins were checker and washer.

For her complaints, she was receiving regular psychiatric treatment. Despite being on selective serotonin reuptake inhibitors (SSRIs) and CBT, she was worsening symptomatically. Her neurological examinations and MRI were within normal limits. Her Yale Brown OCD score (YB-OCDs) was 39/40 putting her in 'resistant category'. She was treated by Leksell C machine for Gamma knife radio-surgery (GKRS) at a different center with bilateral ventral capsulotomy in 2009. Bilateral capsulotomies were done with a prescription dose of 160 gray at 100% isodose curve with 4 mm collimator (Figure 1A). 6 months post-procedure, she improved symptomatically and her YB-OCD score decreased to 30/40. After this, the patient was lost to follow up for three years.

Three years post procedure, patient presented to us with complaints of recent onset headache with vomiting episodes. She had bilateral papilledema. In her magnetic resonance imaging (MRI) of brain, there were asymmetrical cystic

changes in bilateral caudate nucleus and anterior limb of internal capsule (R>L) with mass effect towards left side. The cyst in the vicinity of left caudate nucleus was isointense to cerebrospinal fluid (CSF) on both T1 and T2 weighted images and was not taking any contrast. But, the cyst near right caudate nucleus was hypointense to CSF on T1W1 images and isointense on T2W1 with a fluid level. The cyst had one mural nodule at the posterior part of the caudate nucleus with wall taking contrast uptake. The cyst wall was taking peripheral ring like contrast uptake with central hypo intensity suggestive of necrotic changes (Figure 1B-D, 2A-C). Her positron emissive tomography (PET) scans showed increased metabolic activity in orbitofrontal cortex and cingulate gyrus. The right cystic lesion was tapped through right frontal burr hole (Figure 3B). Fluid was negative for any pus or malignant cytology. The patient again developed recollection of the cyst warranting right frontal craniotomy with excision of right cyst wall was done (Figure 3C, D). The biopsy revealed cystic changes in bilateral caudate nucleus with fibrinoid necrosis and neovascularization in the cyst wall (Figure 4A-D). Patient is asymptomatic at four months follow up.

DISCUSSION

NMD (Neurosurgery for mental disorders) is in practice since the times of Egaz Moniz. The first radiosurgical capsulotomy was performed by Leksell in 1953 using 300 kV X rays. Psychosurgery was initially welcomed with great enthusiasm to be later regretted due to the morbidities and severe complications. For OCD, gamma capsulotomy, thermo capsulotomy or DBS are performed in which lesions are placed bilaterally in the anterior limb of internal capsule involving fibers connecting the medio-dorsal thalamus and the prefrontal cortex. Other possible sites for lesioning are anterior cingulotomy, subcaudate tractotomy, limbic leucotomy and central lateral thalamotomy/ anterior medial pallidotomy (3).

With the current available literature, recommendation of one surgical procedure over the other is not possible. Recently the Food & Drug Administration, United States approved bilateral anterior internal capsule DBS for the management of OCD (2). Both procedures (gamma capsulotomy and DBS) are associated with a spectrum of complications. Complications common to both procedures are weight gain, urinary

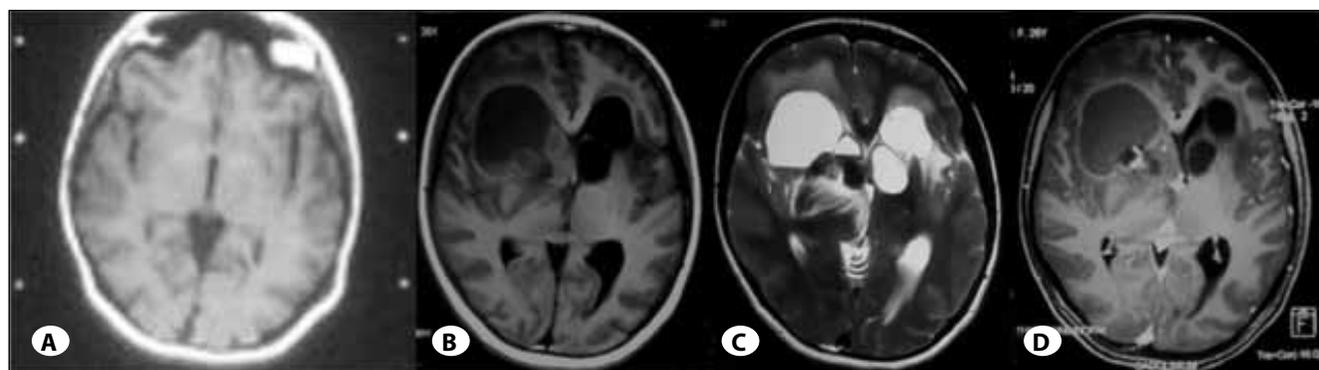


Figure 1: A) Pre GKRS CT, axial view showing normal brain parenchyma; B) Post GKRS MRI, T1W1 axial image showing bilateral cystic changes in caudate nucleus region; C) MRI, T2W1 axial image and D) Contrast enhanced MR axial image showing cyst with mural nodule in right sided cyst.



Figure 2: A) MRI, T2W1 coronal image showing bilateral caudate nucleus cyst; B) T2 sagittal image and C) Contrast MRI image showing cyst with mural nodule.

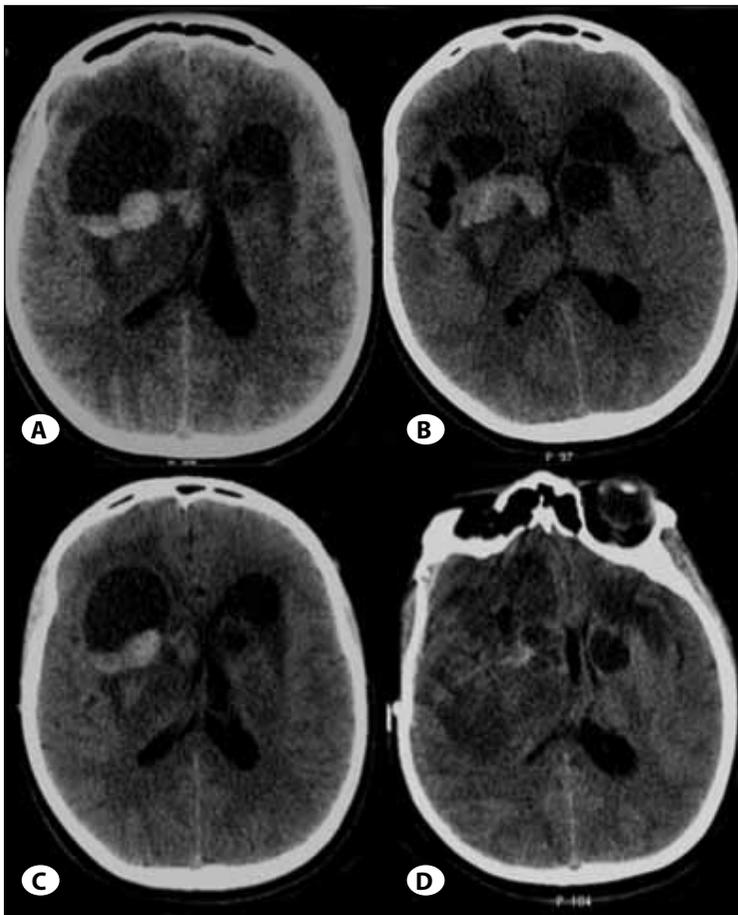


Figure 3: **A)** Preoperative CT scan, axial image showing bilateral caudate nucleus cystic changes with blood in right cyst; **B)** CT scan, axial film showing cyst decompression through right frontal burr hole; **C)** CT scan, axial film showing cyst recollection 2 weeks following decompression; **D)** CT scan, axial film, showing post operative changes following cyst excision through right frontal craniotomy.

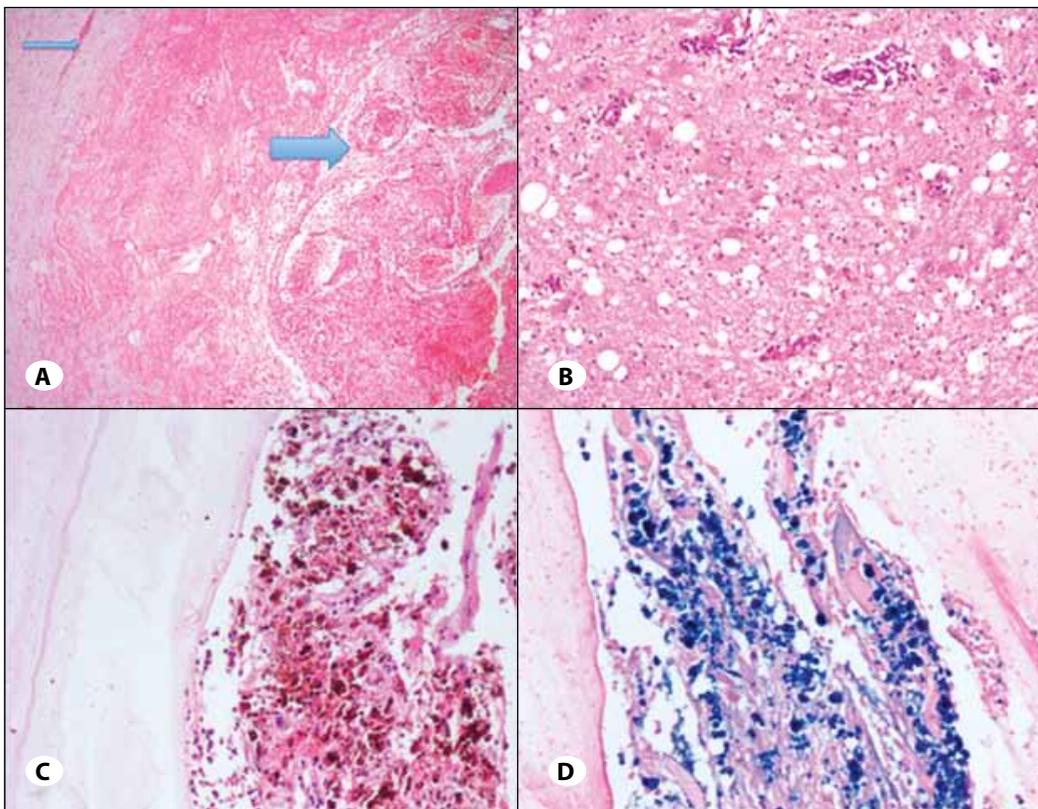


Figure 4: HPR image- **A)** Low magnification view of the nodule shows peripheral fibrosis (thin arrow), with organising haematoma. The centre shows many inter communicating ectatic new vessels containing fibrin thrombi (thick arrow). HE x original magnification 4. **B)** Reactive astrocytosis at the peripheral portions. HE x20. **C)** Numerous haemosiderin laden macrophages at the peripheral portion of haemorrhage HE X10. **D)** Perl's stain to demonstrate haemosiderin. Perl's stain HE x20.

incontinence, apathy, executive dysfunctions and sexual disinhibition (5). The most common complication with GKRS is edema. The unique and rare complications with GKRS are caudate nucleus infarcts and late onset radiation necrosis and malignancy (1,2).

Radiation necrosis is a long-term complication that occurs six months to even decades after radiation treatment. Radiation necrosis is coagulative due to small arterial injury and thrombotic occlusion. In an extensive review, Lopes et al. assessed complications following gamma knife capsulotomy over a period of 36 months (4). No study mentions the complication of cystic changes due to radiation necrosis in caudate nucleus region. This case highlights late onset radiation necrosis in bilateral capsular regions (right>left). The critical determinants of this complication are total radiation dose, number of settings and size of collimator used. The usual prescribed dose is 140-150 gray to an average target volume of 48 mm³ with a 4 mm collimator (2). The maximum reported dose used was 200 gray with three isocenters (5).

CONCLUSION

The natural quest of human being for a treatment modality with no complications leads to novel modalities of management. Like any new treatment modality, GKRS has also suffered initial reluctance. After some hesitation over the last six decades, it is a treatment modality for a spectrum of benign and malignant neurological disorders at present. It is a rare but cruel some complication of delayed cystic radiation necrosis in bilateral caudate nucleus warranting surgical intervention following GKRS. This dreadful complication

occurred in a young female with functional disorder of brain leading to progressive deterioration. Though we are unable to explain bilateral caudate nucleus radiation necrosis yet this case highlights the need to be more cautious before selecting an ablative procedure in patients with functional disorders.

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