Stereotactic lesioning for mental illness

M.-C. Kim, T.-K. Lee

Department of Neurosurgery, College of Medicine, Kangnam St. Mary’s Hospital, The Catholic University of Korea, Seoul, Korea

Summary

Objective. The authors report stereotactically created lesioning by radiofrequency or Cyberknife radiosurgery for patients with mental illness.

Materials and methods. Since 1993, thirty-eight patients have undergone stereotactic psychosurgery for medically intractable mental illnesses. Two patients had aggressive behavior. Twenty-five patients suffered from Obsessive-Compulsive Disorder (OCD) and ten patients had depression. Another patient suffered from atypical psychosis. Bilateral amygdalotomy and subcaudate tractotomy were done for aggressive behavior. Limbic leucotomy or anterior cingulotomy was done for OCD and subcaudate tractotomy with or without cingulotomy was done for depression. In twenty-three patients, the lesions were made by a radiofrequency (RF) lesion generator. In fifteen cases, the lesions were made with CyberKnife Radiosurgery (CKRS).

Results. The Overt Aggression Scale (OAS) declined from 8 to 2 with clinical improvement during follow up period. With long-term follow up (meaning 57 months) in 25 OCDs, the mean Yale Brown Obsessive Compulsive Score (YBOCS) declined from 34 to 13 (n = 25). The Hamilton Depression scale (HAMD) for ten patients with depression declined from 38.5 to 10.5 (n = 10). There was no operative mortality and no significant morbidity except one case with transient urinary incontinence.

Conclusion. Authors suggest that stereotactic psychosurgery by RF and CKRS could be a safe and effective means of treating some medically intractable mental illnesses.

Keywords: Stereotactic psychosurgery; obsessive-compulsive disorder; depression; cyberknife radiosurgery.

Introduction

Psychosurgery was defined as “the selective surgical removal or destruction of nerve pathways for the purposes of influencing behavior” in 1976 by the World Health Organization. As “functional” or “limbic system” surgery, neurosurgery has the potential to become a more acceptable treatment for psychiatric diseases [2–4, 24]. With the development of radiation sensitizers and improved delivery vehicles, radiosurgery to treat carefully selected intractable mental illness may become an alternative to prolonged psychiatric therapy.

Materials and methods

Demographics

From 1993 to 2006, Thirty-eight patients underwent stereotactic psychosurgery for medically intractable mental illnesses. All the patients were referred by psychiatrists. Two patients had aggressive behavior. Twenty-five patients suffered from OCD and ten patients had depression with anxiety disorders. One patient suffered from atypical psychosis. Bilateral amygdalotomy and subcaudate tractotomy were done for aggressive behavior. Limbic leucotomy or anterior cingulotomy was done for OCD and subcaudate tractotomy with or without cingulotomy was done for depression with anxiety.

Target localization

Ventriculography was used in the first seven patients and Magnetic Resonance Image (MRI)-guided stereotaxy was used in recent cases for the localization of target. The lesions were made with a Radionics radiofrequency lesion generator (Burlington, MA, USA) The lesions were always made bilaterally. Our targets for amygdalotomy were 5 mm anterior and 5 mm medial to the anterior tip of the temporal horns or 23–30 mm lateral from the midline. In subcaudate tractotomy target was 12 mm ant from tuberculum sellae, 10 to 15 mm above the floor of the ant fossa, laterally 6 to 14 mm from the midline. We could make a triangular-shaped lesion bilaterally. For Cingulotomy, target was 25 to 35 mm posterior from the anterior part of frontal horn, 5 to 10 mm above the ventricle roof and 10 mm lateral from the midline. Bilateral amygdalotomy and subcaudate tractotomy were done for aggressive behavior. Limbic leucotomy which is combined bilateral cingulotomy with subcaudate tractotomy was done for OCD and subcaudate tractotomy with or without cingulotomy was done for depression with anxiety. In twenty-three cases, the lesions were made with radiofrequency lesion generator (Fig. 1) and in fifteen cases (eleven patients with OCD and four patients with depression), the lesions were made with Cyberknife (Sunnyvale, CA, USA) radiosurgery. Computed Tomography (CT) was used in patients for localization of target. A thin-section CT scan (240 slices,
thickness 1.0 mm) was made through the entire head, showing the anatomy of ventricle and corpus callosum. The 80% isodose line was prescribed in a conformal fashion to an 7-mm diameter of the target (Fig. 2). We started 75 Gy with 10 mm collimator at 80% isodose line but the necrotic lesion volume was larger than our expectations and now our dose parameter is reduced to 50 Gy with 7 mm collimator at 80% margin dose line.

**Treatment protocol**

The structured clinical interview for DSM-III-R-Patient Version (SCID-P) was administered to assess current and previous psychiatric diagnoses. A detailed history of the pre- and postoperative course of illness and the current level of psychosocial functioning were recorded. The results of OCD were evaluated with YBOCS, VAS (Visual Analogue Scale) and CGI (Clinical Global Impairment). The OAS, MMS (Mini Mental State) and WAIS (Wechsler adult intelligence scale) were checked for the evaluation of aggressive behavior. Hamilton Depression scale (HAMD) was used for the evaluation of depression.

**Results**

In OAS scores of aggressive behavior during follow up, scores declined from 8 to 2 with clinical improvement (Table 1). With a long-term follow up (mean 57 months) in 25 OCDs, mean YBOCS decline from 34 to 13 ($n = 25$). Eighteen returned to previous social life. In ten patients with depression with anxiety HAMD declined from 38.5 to 10.5 ($n = 10$). There was no operative mortality and no significant morbidity except one case of mild transient urinary incontinence. In four patients with depression who underwent CKRS, the median score in HAMD declined from 34 to 12 and three patients returned to previous social life. The signal changes in target area were seen in T2-weighted images in MRI performed at 3 months after the treatment. The significant lesions were made with the volume of 0.94 cm$^3$ and the surrounding margin of low attenuation at 6 months (Fig. 3). With follow up in eleven patients with OCDs after CKRS, the median score in YBOCS of six patients declined from 37 to 23 after 10 months and clinical improvement was observed. T2-weighted images in MRI showed the signal changes in target areas at 6 months after the treatment. There was no operative mortality after CKRS and no significant morbidity except one patient with fatigue and malaise. The RF limbic leucotomy for the 14 patients with OCD improved symptoms in 12 patients (84%) and CKRS induced relief of symptoms in 6 of the 11 patients (54%) with OCD. In ten patients with depression, Six patients had complete relief after RF subcaudate tractotomy and three out of four patients had symptom relief after CKRS.