Clinical Case Report

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Bilateral anterior capsulotomy and amygdalotomy for mental retardation with psychiatric symptoms and aggression

A case report

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Abstract

Rationale: Mental retardation (MR) is a chronic condition that often has no readily identifiable cause or treatment. Aggression and psychiatric symptoms are prevalent in children with MR. Surgical treatment of aggression and psychiatric symptoms of MR is seldom investigated and studies are limited.

Patient concerns: We encountered a 19-year-old female who had MR with aggression and psychiatric symptoms.

Diagnoses: She was diagnosed with mild MR with aggressiveness and psychiatric symptoms.

Interventions: Because the patient was refractory to conservative treatment, bilateral anterior capsulotomy and amygdaloid neurosurgery were performed for her psychiatric symptoms and aggression. The benefits and side effects of the surgery were analyzed.

Outcomes: After surgery, the patient showed significant alleviation of her psychiatric symptoms and aggression with no observed side effects.

Lessons: Bilateral anterior capsulotomy in combination with amygdaloid neurosurgery may resolve both psychiatric and aggressive symptoms. Future investigations of control studies with large patient cohorts are needed.

Abbreviations: CSTC = cortico-striato-thalamo-cortical, DBS = deep brain stimulation, LM = logical memory, MR = mental retardation, MRI = magnetic resonance imaging, OAS = overt aggression scale, PFC = prefrontal cortex, VR = visual reproduction, WCST-S = Wisconsin card sorting test-simplified, YMRS = young manic rating scale.

Keywords: aggression, amygdalotomy, capsulotomy, mental disorder, mental retardation

1. Introduction

Mental retardation (MR) comprises a series of conditions with a common feature of an intellectual limitation that develops before the age of 18 years, which afflicts 2% to 3% of the global population.[1] MR is characterized by subaverage general intellectual functioning accompanied with significant limitations in adaptive functioning.[2] MR is a chronic condition that often has no readily identifiable cause or treatment. Coexisting symptoms may include aggressiveness, psychiatric symptoms, and self-harming behaviors.[1,2] Although desirable surgical outcome of patients with mental diseases or aggressiveness has been reported, surgical management of MR with aggressiveness and psychiatric symptoms is limited.[3–8]

2. Case report

The parents reported that the patient was dull and slow to respond at the age of 2 years, and began to talk and walk later than her peers. She significantly presented inattention and learning difficulties in school. Moreover, she was often ridiculed by her classmates and finally dropped out of middle school. She scored 68 points on the Wechsler intelligence text for children, indicating a mild intelligence deficit. She was diagnosed with mild MR by a psychiatrist at the age of 13 years. Five years ago, she presented soliloquy, irritable, staying up, hallucinations, and aggressiveness. These symptoms included crying for no reason, shouting, throwing objects, delusion of persecution, self-biting, pulling her hair, slapping her face, and hitting her parents with aggression that mainly presented as self-harming behaviors. These symptoms were gradually aggravated and finally occurred about once every hour. (See video before surgery, http://links.lww.com/MD/B495.) The patient was confined to bed and supervised by her parents, which greatly affected the normal daily and social life of the whole family. The effect of management with antipsychotics and cognitive behavioral treatments for 2 years was limited in alleviating her psychiatric symptoms and aggression. She was then diagnosed with mild MR with

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Table 1

Neuropsychological evaluations at 3-year follow-up.

	Before the first surgery	1 year after the first surgery	Before the second surgery	1 year after the second surgery
OAS	9	0	4	0
YMRS	43	14	23	13
LMI	5	16	14	15
VRI	3	8	6	8
LMD	Cannot perform	9	9	8
VRD	Cannot perform	5	6	6
Similarities	12	14	13	14
Block	Cannot perform	18	16	22
WCST-S				
Correct	Cannot perform	26	24	29
Error	Cannot perform	22	24	19
PE	Cannot perform	21	22	15
NPE	Cannot perform	1	2	4
Categories	Cannot perform	5	4	5

LMD = logical memory carried out after a 30-minute delay, LMI = logical memory of the Wechsler memory scale carried out immediately, NPE = nonperseverative errors, OAS = overt aggression scale, PE = perseverative errors, VRD = visual reproduction carried out after a 30-minute delay, VRI = visual reproduction of the Wechsler memory scale carried out immediately, WCST-S = Wisconsin card sorting test-simplified, YMRS = young manic rating scale.

aggressiveness and psychiatric symptoms at the age of 16 years. Based on our experience of surgery in patients with obsessive–-compulsive disorder, depression, Tourette syndrome and other neuropsychiatric diseases,[9] we carefully specified her treatment options, which included further medical treatment, deep brain stimulation (DBS), or capsulotomy and amygdalotomy. Her parents opted for capsulotomy and amygdalotomy for financial reasons. The surgery was approved by the ethics committee of West China Hospital. Informed consent was acquired from her parents.

Preoperative magnetic resonance imaging (MRI) of the patient was normal. To assess the benefits of surgery and detect postoperative neurocognitive impairments, neuropsychological evaluations were conducted using the overt aggression scale (OAS),[10] the young manic rating scale (YMRS),[11] the logical memory (LM) and visual reproduction (VR) subtests of the Wechsler memory scale,[12] the similarities and block subtests of the Wechsler adult intelligence scale,[13] and the Wisconsin card sorting test-simplified (WCST-S).[14] Both the LM and VR were conducted immediately and after a 30-minute delay. Parts of neuropsychological evaluations were usually applied in the patients with mental disorders before surgery; we described carefully in our reported study.[9] Only parts of the preoperative neuropsychological evaluations were conducted before surgery because of her psychiatric symptoms and bursts of aggressiveness during the evaluation process. Neuropsychological assessments were completed before surgery and every year after surgery during a 3-year follow-up by the same psychiatrist, who knew the patient underwent surgery (Table 1).

Before the surgery, the patient had MRI without head frame. In addition, a repeat MRI was performed with head frame using the same parameters as those used in the first scan. We then used SurgiPlan workstation (Elekta Instrument AB, Stockholm, Sweden) and Leksell stereotactic operation system (Elekta Instruments AB) to calculate the targets (Fig. 1) and inserted the lesion electrodes into the targets. Next, multiple lesions were performed utilizing the Elekta neurostimulator at 75°C for 60 seconds each. The length of the lesions was 12 to 15 mm in the anterior limb of the internal capsule and 4 to 8 mm in the amygdala (Fig. 2). The above-mentioned surgical procedures were described carefully in our reported study.[9]

The patient's aggression disappeared on postoperative day 2. Slow reaction, lack of concentration, mild somnolence, and indifferent were observed during hospitalization after surgery, but most of these symptoms disappeared within 2 weeks. As a 12-month follow-up, her parents reported that the patient's hallucinations, delusion of persecution, and aggressiveness had disappeared. Furthermore, significant improvements in staying up, soliloquy, irritability, and loss of concentration were observed. The patient was gentler and could focus attention more easily. She developed a normal sleep time and pattern. In addition, she could handle activities of daily living and play with

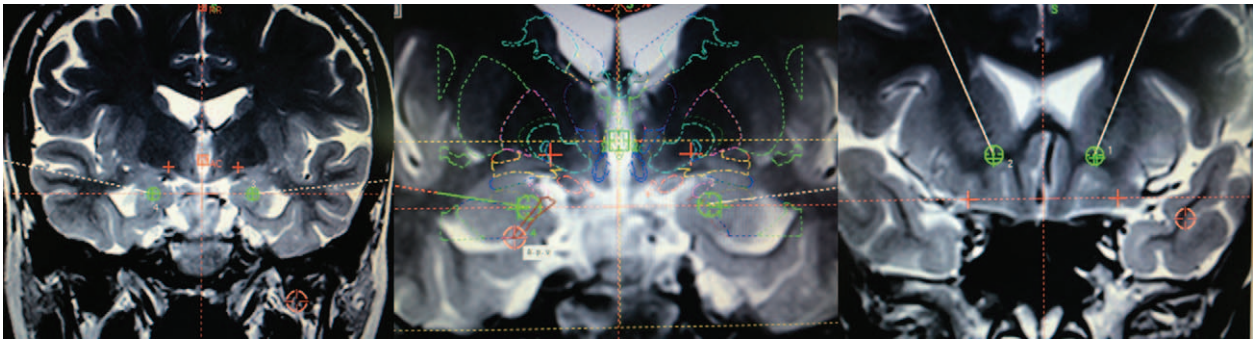

Figure 1. Planning to set up the lesion coordinates of the target and the angles of electrode penetration in the anterior limb of the capsule and amygdala.

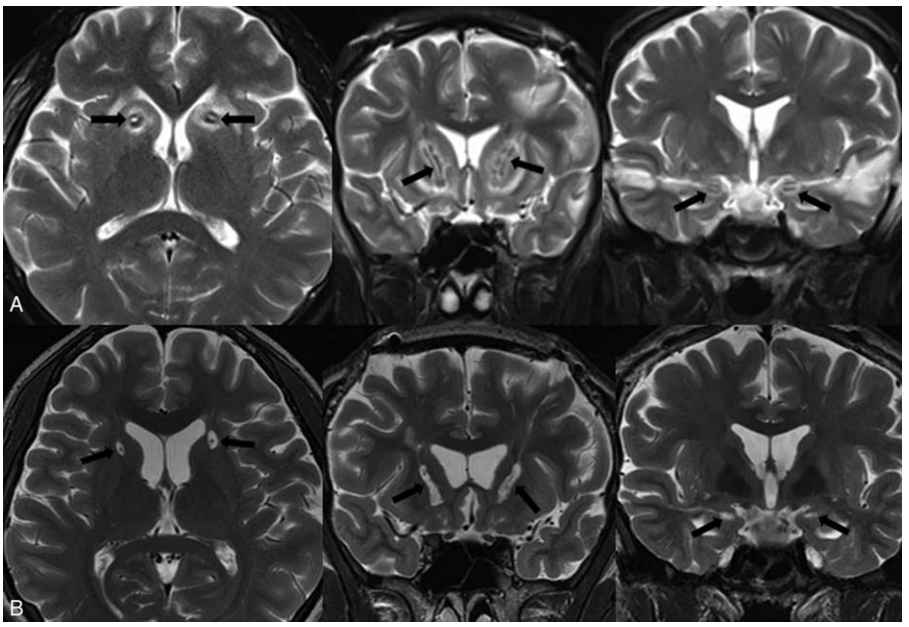

Figure 2. (A) T2-weighted MRI 10 days after the first surgery. (B) T2-weighted MRI 12 months after the first surgery. Black arrows indicate lesions produced by the first surgery.

neighboring children. Her parents reported that she was more tractable and could follow their instructions, which greatly improved their normal daily life and social activities. (See video after the first surgery, http://links.lww.com/MD/B496.) The OAS and YMRS showed significant decreases in both aggression and psychiatric symptoms. The neuropsychological evaluations were easier to carry out and the results were better than preoperatively. At 16 months after surgery, her parents reported mild and infrequent recurrence of aggression, which presented as self-biting and shouting for no reason. However, these symptoms were milder than before surgery. Further medical and behavioral treatments for 7 months were of little help. Finally, her parents decided on a second surgery. (See video before the second surgery, http://links.lww.com/MD/B497.) In order to prevent severe neurocognitive impairment, small and mild lesions were produced in the amygdala in the first surgery. We then considered another bilateral amygdalotomy to produce larger lesions in the amygdala than during the first surgery (Fig. 3). At a 15-month follow-up after the second surgery, her parents reported that antipsychotics were discontinued and there were no further episodes of aggression. The patient was as gentle and tractable as after the first surgery. (See video after the second surgery, http://links.lww.com/MD/B498.) After the second surgery, the daily life and social activities of all family members further improved. The results of the neuropsychological evaluations at 1 year after the second surgery showed further decreases in OAS and YMRS and no observed neurocognitive impairment.

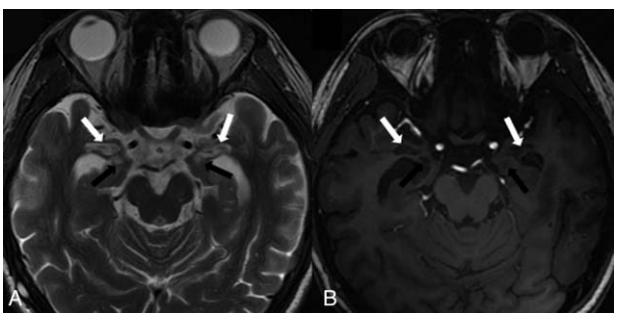

Figure 3. (A) T2-weighted MRI 6 months after the second surgery. (B) T1-weighted MRI 6 months after the second surgery. Black arrows indicate lesions produced by the first surgery. White arrows indicate lesions produced by the second surgery.

3. Discussion

Current knowledge of the mechanisms underlying mental disorders and aggression remain incomplete. Dysfunction and disorder of the cortico-striato-thalamo-cortical (CSTC) pathways is a popular conception of mental diseases, which project from the frontal cortex toward corresponding targets and back to the original frontal territory where the loop started.[15] The prefrontal cortex (PFC) which projects through the internal capsule is relevant to mental disorders.[16] Thus, anterior capsulotomy may affect projections in the internal capsule of CSTC and projectional fibers from the PFC, which would result in significant improvement in psychiatric symptoms.[9] The amygdala is part of the limbic system and relevant to fear, anxiety, impulsivity and aggression.[15,17] Prefrontal cortex–-amygdala circuits are responsible for several mental diseases, including aggression.[18] Therefore, amygdalotomy may alleviate aggression and psychiatric symptoms through projections and chemistry of the prefrontal cortex-amygdala circuits and amygdala.

Studies of surgical treatment for aggression are limited.[4–8] Jiménez et al[5] reported that bilateral capsulotomy and cingulotomy may reduce aggressive behavior and improve clinical evaluations in the long term. Harat et al[6] described the use of DBS of the nucleus accumbens for a patient with severe aggressiveness refractory to conservative treatment, which resulted in cessation of aggressive behavior and no side effects. Franzini et al[7] reported a series of patients affected by MR with aggressiveness who consistently benefited from high-frequency

DBS of the hypothalamic region in long-term follow-up. Torres et al[8] described that posteromedial hypothalamus DBS resulted in reduced outbursts of violence in a series of patients with aggression, with no significant adverse effects.

The amygdala is directly relevant to impulsivity and aggression while amygdaloid neurosurgery is effective for treatment of aggressive behavior.[4,17] Therefore, we chose amygdalotomy for treatment of aggression of our patient instead of other encephalic regions, as reported elsewhere. Besides aggression, the patient had other psychiatric symptoms, which were treated with capsulotomy because this procedure can achieve more satisfactory outcomes and fewer side effects, as compared to other encephalic regions.[3,9,19] The patient had both aggression and psychiatric symptoms while the Wechsler intelligence test indicated a mild intellectual deficit. Because conservative treatments had limited effects, we considered capsulotomy and amygdalotomy, which significantly alleviated her psychiatric symptoms and aggression with no observed side effects. The amygdala is part of the limbic system and relevant to emotion.[15,17] Therefore, in order to prevent severe cognitive impairment and side effects, the lesions produced in the amygdala during the first surgery were small. A second surgery was performed for the mild return of aggression, which further alleviated her aggressiveness. We consider that repeated amygdalotomy for this patient would be safer and could avoid severe side effects and neurocognitive impairment, as compared to the initial amygdalotomy, which produced sufficient lesions. After the second surgery, the neuropsychological evaluations of the patient showed obvious improvements in psychiatric symptoms and aggression with no observed neurocognitive impairment. As confirmed by both surgeries, capsulotomy and amygdalotomy can alleviate aggression and psychiatric symptoms.

We performed surgery to correct psychiatric symptoms and aggression for a MR patient, which has been rarely reported in the literature. Future investigations of control studies with large patient cohorts are needed.

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