# Case Report

# Successful Treatment of Intractable Aggressive Behavior, Psychotic Features and Substance Dependence Using Bilateral Stereotactic Anterior Cingulotomy in a Patient with Paranoid Schizophrenia

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***Background:*** *Psychosurgery is the mainstay treatment for refractory psychiatric illness. Anterior cingulotomy can be used for treating various mental and chronic pain disorders.*
***Objective:*** *To report success of this procedure in the treatment of severe aggressive behavior in a patient with paranoid schizophrenia.*
***Case Report:*** *A 44-year-old male developed psychotic features, substance dependence and aggressive behavior since he was at the age of 25. The patient was admitted several times in a forensic psychiatric hospital. His psychiatric symptoms were refractory to medical therapy and electroconvulsive therapy. Bilateral anterior cingulotomy was performed by using modern technique of stereotactic brain surgery to suppress his violence.*
***Results:*** *There was no aggressive behavior after the operation. Auditory hallucination, paranoid delusion and substance abuse behavior also disappeared. The patient could return to live in his community and started working as a seller in a primary school. There was no cognitive disturbance and recurrent symptom at one year postoperatively. However, antipsychotics were continuously prescribed as a maintenance therapy.*
***Conclusion:*** *Psychosurgery is an appropriate option in refractory cases of psychiatric illness. Anterior cingulotomy renders favorable result in the treatment of aggression behavior, psychotic manifestation and substance dependence. To date, this article is the first case report of schizophrenia treated by modern techniques of psychosurgery in the 21st century of Thailand.*

***Keywords:*** *Psychosurgery, Anterior cingulotomy, Aggressive behavior, Schizophrenia, Psychosis, Substance dependence*

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In the past several decades, psychosurgery was abandoned because of innovative development of psychotropic drugs, significant neurological sequelae and unpredictable surgical outcomes[1]. In the 21st century, a scant number of case reports and case series regarding neurosurgery for psychiatric disorders have been published in the medical literature[2-14]. Even though appropriate medical treatment and electroconvulsive therapy (ECT) are given, there is still a reasonable amount of patients suffering from psychiatric diseases which can be defined as refractory psychiatric disorders. In such patients, psychosurgery still had a major role for controlling intractable symptoms.

Among stereotactic surgery for mental disorders, anterior cingulotomy is one of the most common operations. This procedure can be utilized to treat obsessive compulsive disorder (OCD), major depressive disorder (MDD), anxiety disorder, drug addiction, aggressive behavioral disorder and intractable chronic pain[7,8,15-18]. The author used anterior cingulotomy for the treatment of intractable aggressive

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behavior in a male patient with paranoid schizophrenia. The success of the operation in this particular case and details of surgical technique are described.

**Case Report**

A 44-year-old male patient was a boxer when he was teenage. In 1996, the patient had burglary behavior when he was 25 years old. He was arrested by police and sent as a criminal mental patient to a forensic psychiatric hospital. The patient had 12 cases of misdemeanor, including burglary, robbery, unlawful possession of a weapon and physical assaults. His psychiatric symptoms consisted of auditory hallucination, paranoid delusion, and multiple psychoactive substances dependence, including alcohol, amphetamine, cigarette and cannabis. He also made several troubles to family and neighbor community, such as destroying objects, intimidating other people, stabbing his older brother with knife and hurting his older sister. He was sent and admitted in a psychiatric hospital 19 times since 1996 by police. The diagnosis was paranoid schizophrenia and multiple psychoactive substances dependence syndrome. The treatment included multiple antipsychotics (risperidone, clozapine, chlorpromazine, trihexyphenidyl, haloperidol decanoate injection) and eighteen sessions of ECT.

In 2015, his psychotic and aggressive symptoms were still active and could not be controlled by aforementioned therapies. Because of his mental incapacity, his elder sister, the major caregiver, was provided an explanation of the operative procedure, its risks and possible outcomes so as to understood the implications; she gave her informed consent for the psychosurgery.

The patient underwent bilateral stereotactic anterior cingulotomy as psychosurgery for suppressing aggressive behavior at the age of 44 years. A titanium stereotactic frame (Leksell Stereotactic System) was applied under general anesthesia. The target was determined on each side by using Brainlab Neuronavigation System on images of head computerized tomography. The target for ablation was 20 to 25 mm posterior to the anterior margin of the frontal horn of the lateral ventricle and 7 mm lateral to the midline (Fig. 1). The ablation was performed by using Radionic RF Lesion Generator System. The tip of radiofrequency (RF) electrode was inserted into the target (0 mm); the target was coagulated with a temperature of 90°C for 90 seconds. Then the electrode tip was withdrawn 3, 6 and 9 mm (-3, -6 and -9 mm), respectively. On the individual location of the electrode tip, ablation was repeated with the same temperature and duration. The electrode was moved anteriorly and posteriorly 5 mm paralleled to the first track. In each track, the electrode tip was inserted and the ablation was performed at 0, -3, -6 and -9 mm, respectively. Therefore, we made 12 tandem lesions to create a large lesion on one side of the anterior cingulate gyrus. The identical procedure was repeated on the contralateral side. Postoperative cranial CT scan revealed large lesions at the bilateral anterior cingulum (Fig. 2).

Postoperatively, aggressive symptoms absolutely disappeared. The Modified Overt Aggression Scale (MOAS) score was reduced from 22 pre-operatively (2 points of verbal aggression, 4 points of aggression against property, 0 point of auto-aggression and 16 points of physical aggression) to 0

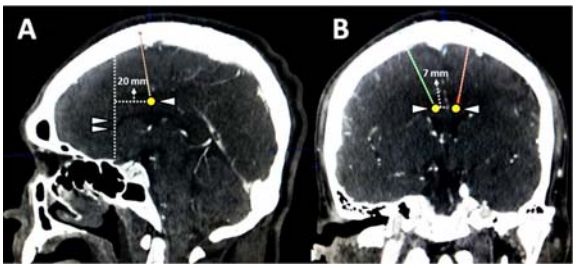


**Fig. 1** Localization of targets for anterior cingulotomy in navigation CT scan of the brain. (A) In sagittal CT, the targets at the anterior cingulated cortex (arrowhead) located 20 mm posterior to the anterior border of the lateral ventricle (double arrowheads); (B) In coronal CT, the targets situated at the anterior cingulated gyrus 7 mm lateral to the midline.

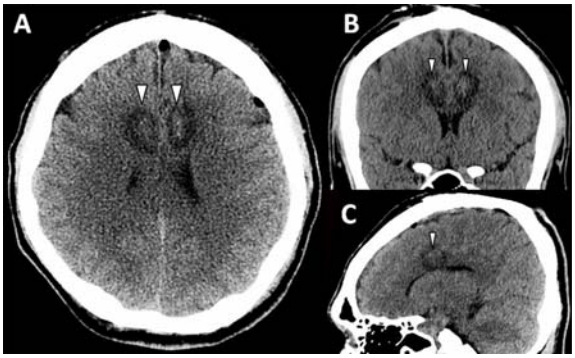


**Fig. 2** Postoperative CT scan of the brain showing stereotactic lesions (arrowhead) at bilateral anterior cingulate gyrus in axial (A), coronal (B) and sagittal (C) views.

postoperatively (0 point of all domains). He had mild transient urinary incontinence which spontaneously resolved within a few days. There was no other neurological deficit. One week after the surgery, the patient was transferred to the psychiatric hospital and could be discharged without complication. Psychiatric medication was still continued. On the follow-up, there was no recurrent aggressive behavior. Surprisingly, psychotic features and substance abuse behavior also vanished. He could return to live in the community. Under his elder sister and the community assistances, he started to work as an orange juice seller in a primary school in his community. He could do his daily activities and calculate money as normal. At one year after the anterior cingulotomy, no recurrent aggressive and psychotic symptom was found. Psychoactive substances use behavior was also not found.

**Discussion**

When mental disorders are refractory to conventional treatment, psychosurgery is the last resort for controlling disabling psychiatric symptoms. Selection of surgical candidates is still a controversial key point in neurosurgery for psychiatric disorders. Regarding the presented case, indication for psychosurgery was fulfilled because the patient had prolonged and uncontrollable psychiatric manifestation, especially aggressive behavior which caused much trouble for the family and community. Therefore, the main purpose of psychosurgery in this case was to control intractable aggressiveness while extinctions of psychotic features and substance dependence were additional benefits. To the best of our knowledge, this is the first report of patient with schizophrenia undergoing novel technique of stereotactic psychosurgery in the 21st century of Thailand.

Regarding psychosurgical procedures in the treatment of aggression, amygdalotomy is an effective and the most commonly used procedure[19-22]. However, in our experience with psychosurgery in several patients, stereotactic bilateral amygdalotomy alone could not achieve long-term control of aggressive behavior and additional stereotactic ablative procedure, such as anterior cingulotomy or anterior capsulotomy was required. That was why the authors used anterior cingulotomy as the primary psychosurgical procedure in this case.

There was a few case series which reported the use of anterior cingulotomy in a combination with anterior capsulotomy for the treatment of aggressive behavior[7,8], whereas we used anterior cingulotomy alone for eliminating intractable aggressive behavior in our case and the operation could render excellent control of violent symptoms in the long term. Our result indicates that bilateral anterior cingulotomy alone is also effective in the treatment of severe aggressiveness. The adverse effect is minimal and self-limited with time. Thus, in our more recent cases, we used anterior cingulotomy alone or in a combination with subcaudate tractotomy as limbic leucotomy for treating severe refractory aggressive behavior which also rendered excellent outcome.

Schizophrenia is a common psychotic disorder harboring complex pathophysiology. The number of studies focusing on psychosurgery for schizophrenia were limited. A surgical case series of 16 patients with schizophrenia was reported by da Costa. Twelve patients were treated by cingulotomy plus posterior hypothalamotomy and the remaining four were treated by cingulotomy combined with lesions of the fundus striae terminalis. Improvement was found in 14, and 2 had partial improvement[23]. A large series of 116 patients undergoing MRI-guided anterior capsulotomy was conducted by Liu et al. Of 116 patients, 100 (86.2%) completed the 2-year follow-up. Full recovery was noted in 11 cases, obvious improvement in 25, improvement in 38 and 26 showed no change of symptoms. Overall effectiveness of the procedure was 74%[11]. Ballantine et al reported the outcomes of stereotactic cingulotomy in 198 psychiatric patients. Of 198 patients, 11 were schizophrenic. Improvement was found in 4, partial improvement in 4 and no improvement in 3[24]. In our case, anterior cingulotomy could abolish psychotic features, including paranoid delusion, auditory hallucination, and also ceased substance abuse behavior. Our result encourages us to perform this ablative procedure in psychiatric individuals with refractory psychosis or severe drug addiction although deep brain stimulation is increasingly utilized as a novel treatment for refractory schizophrenia[25-28] and target trends for surgical intervention in schizophrenia have been changed[28,29].

In our early cases of anterior cingulotomy, the authors performed only three coagulations on each side of the anterior cingulum and found that most patients developed recurrent aggressive symptoms within few months after surgery. Subsequently, we performed 12 tandem ablations of the anterior cingulate gyrus to create a large lesion with a volume of 1.5 to 2 ml on the individual side and the recurrence rate obviously decreased after the change of surgical

technique. The adverse effects found in 12 tandem coagulations were not different from that found in 3 tandem lesions. By using image-guided frame-based stereotactic ablation with careful targeting method, the accuracy of target localization is dramatically improved and less invasive when compared with old day methods, such as ventriculography-assisted stereotactic surgery. We have never encountered an incorrect target or wrong-site ablation in our experience.

**Conclusion**

Psychiatric surgery is a good alternative in cases with psychiatric illness refractory to conventional treatment. Bilateral stereotactic anterior cingulotomy is effective for controlling severe aggressivess, psychotic manifestation and substance dependence. To date, this is the first case with schizophrenia treated by modern techniques of psychosurgery in the 21st century of Thailand.

**What is already known on this topic?**

Neurosurgical intervention still has an important role in the treatment of drug-resistant mental disorders. Stereotactic ablation of various targets in the brain has been performed worldwide for several decades and across the century.

**What this study adds?**

This report is the first patient with treatment-resistant schizophrenia treated by modern stereotactic psychosurgery in Thailand. Our result confirms efficacy of bilateral anterior cingulotomy in control of severe aggressiveness, psychotic features and substance dependence with minimal and transient adverse effects.

**Potential conflicts of interest**

None.

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## ความสำเร็จของการรักษาพฤติกรรมก้าวร้าว อาการโรคจิต และการติดสารเสพติดที่ดื้อต่อการรักษาโดยการผ่าตัดเพื่อทำให้เกิดรอยโรคในสมองบริเวณ cingulate gyrus ส่วนหน้า

โชติวัฒน์ ตันศิริสิทธิกุล, บรรพต สิทธินามสุวรรณ, ดวงตา ไกรภัสสร์พงษ์, จุฬาลักษณ์ ตรีสุวรรณวัฒน์, ศรุตพันธุ์ จักรพันธุ์ ณ อยุธยา, ศรัณย์ นันทอารี

**ภูมิหลัง:** การผ่าตัดรักษาโรคจิตเวชยังคงเป็นการรักษาหลักสำหรับโรคจิตเวชที่ดื้อต่อการรักษา การผ่าตัดเพื่อทำให้เกิดรอยโรคในสมองบริเวณ anterior cingulate gyrus ส่วนหน้าสามารถรักษาความผิดปกติทางจิตเวชได้หลากหลายรวมทั้งอาการปวดเรื้อรัง

**วัตถุประสงค์:** เพื่อรายงานความสำเร็จของการผ่าตัดวิธีนี้ในการรักษาพฤติกรรมก้าวร้าวรุนแรงในผู้ป่วยที่เป็นโรคจิตเภทชนิดหวาดระแวง

**รายงานผู้ป่วย:** ผู้ป่วยชายอายุ 44 ปี เริ่มมีอาการโรคจิต ติดสารเสพติด และมีพฤติกรรมก้าวร้าวตั้งแต่อายุ 25 ปี ผู้ป่วยได้รับการรักษาเป็นผู้ป่วยในของโรงพยาบาลเฉพาะทางด้านนิติจิตเวชหลายครั้ง อาการทางจิตเวช ของผู้ป่วยรายนี้ไม่ตอบสนองต่อการรักษาด้วยยาและการรักษาทางจิตเวชด้วยไฟฟ้า จึงได้รับการผ่าตัด เพื่อควบคุมพฤติกรรมก้าวร้าวโดยกำหนดตำแหน่งพิกัดในสมองและจี้บริเวณ anterior cingulate gyrus ทั้งสองข้างด้วยความร้อน

**ผลการศึกษา:** หลังได้รับการผ่าตัดผู้ป่วยไม่มีพฤติกรรมก้าวร้าว ไม่มีอาการหูแว่ว หวาดระแวง หลงผิด และพฤติกรรมติดสารเสพติด สามารถกลับไปอาศัยในชุมชนเดิมและประกอบอาชีพขายของในโรงเรียนประถมได้ ไม่พบระดับสติปัญญาที่ลดลง และไม่มีอาการกลับเป็นซ้ำที่เวลา 1 ปีหลังการผ่าตัด โดยผู้ป่วยยังคงได้รับยาต้านโรคจิตร่วมด้วย

**สรุป:** การผ่าตัดรักษาโรคจิตเวชเป็นทางเลือกที่เหมาะสมในผู้ป่วยจิตเวชที่ดื้อต่อการรักษา การผ่าตัดเพื่อทำให้เกิดรอยโรคในสมองบริเวณ anterior cingulate gyrus ส่วนหน้าให้ผลเป็นที่น่าพอใจในการรักษาพฤติกรรมก้าวร้าว อาการโรคจิต และการติดสารเสพติด บทความนี้เป็นรายงานผู้ป่วยโรคจิตเภทรายแรกในศตวรรษที่ 21 ของประเทศไทยซึ่งได้รับการรักษาด้วยเทคนิคการผ่าตัดรักษาโรคจิตเวชในปัจจุบัน