

Surgical results of anterior callosotomy on medically intractable epilepsy

H. BABA Department of Neurosurgery, National Nagasaki Chuo Hospital, Nagasaki, Japan

K. ONO Department of Physiology, Nagasaki University School of Medicine, Nagasaki, Japan

M. YONEKURA Department of Neurosurgery, National Nagasaki Chuo Hospital, Nagasaki, Japan

S. TERAMOTO Department of Neurosurgery, National Nagasaki Chuo Hospital, Nagasaki, Japan

SUMMARY

We analyzed surgical results of anterior callosotomy (AC) in 27 patients with intractable symptomatic generalized epilepsy or frontal lobe epilepsy. Excellent outcome (decrease in seizure frequency of greater than 80% or no seizure) was obtained in 59.3%, and 14.8% showed good outcome (decrease in seizure frequency of greater than 50%). There was no significant difference of the results between children and adults. AC was more effective on atypical absence, drop attack, head drop attack and generalized tonic-clonic seizure, but decrease in seizure frequency and severity were also observed in other type of seizures. The extent of AC (anterior 1/2 to 4/5) did not influence seizure reduction. However, patients whose seizures onset before 4 years old had a poor outcome. In postoperative EEG, marked lateralization of diffuse bilaterally synchronous spike and wave (SSW) to unilateral hemisphere implied a better prognosis than that of bilateral independent SW.

INTRODUCTION

Corpus callosotomy has been widely used for a surgical treatment on medically intractable epilepsies in whom resectable epileptic foci can hardly be identified. However, surgical indication and results are still controversial. In this study, we analyzed results of anterior callosotomy (AC) on patients of medically intractable symptomatic generalized epilepsy or frontal lobe epilepsy.

MATERIAL AND METHODS

Twenty seven patients with intractable symptomatic generalized epilepsy including 8 patients of Lennox-Gastaut syndrome, and 7 patients with frontal lobe epilepsy were selected for AC. Age at the time of surgery ranged from 5 to 41 years old (mean 18). Hereafter, 14 patients under 16 years old were assigned to children group and the rest were referred as adult group. Duration from seizure onset to surgery ranged from 4 to 34 years (mean 13.7). Preoperative evaluation included long-term EEG-video monitoring, CT, MRI, cerebral angiography, and psychological examinations. Intracarotid amytal test was only performed on adaptable patients over 10 years old. The extent of division of the corpus callosum was post-operatively confirmed by MRI. Outcome with respect to seizures was classified according to criteria proposed by Wilson et al; Excellent: greater than 80% reduction in seizure frequency and /or severity, Good: greater than 50% reduction of seizure, Poor: no significant change, Worse: worsening of seizures and/or unacceptable neurological deficits.

RESULTS

1) Overall results of anterior callosotomy

The mean follow-up periods after surgery was 44.7 months (14-92 months). Seizure outcome was excellent in 16 (59.3%), which included complete elimination(4, 14.8%), good in 4 (14.8%) and poor in 7 patients (25.9%). There were no patients who showed increased seizures or unacceptable neurological deficits. In 27 patients, 20(74.2%) benefited by surgery after all. Of the children group, 64.2% got excellent outcome and the ratio was slightly superior in comparison with 53.8% of the adult group.

Table 1. Effect of Anterior Callosotomy on Seizure Type

	Total	Free	Improved	Unchanged
tonic seizure	13	4(30.8%)	5(38.4%)	4(30.8%)
atypical absence	10	6(60.0%)	2(20.0%)	2(20.0%)
drop attack	10	6(60.0%)	2(20.0%)	2(20.0%)
nodding spasm	5	4(80.0%)	1(20.0%)	0
GTC	3	3(100%)	0	0
myoclonic seizure	6	1(16.7%)	4(66.7%)	1(16.7%)
CPS	8	2(25.0%)	4(50.0%)	2(25.0%)

GTC: generalized tonic-clonic seizure, CPS: complex partial seizure

2) Effects of anterior callosotomy on seizure type

In patients of frontal lobe epilepsy, complex partial seizures with or without secondary generalized seizure were recorded during EEG-video monitoring except for one patient who had drop attack, tonic seizure and myoclonic seizure after traumatic injuries of bilateral frontal lobes. In patients of symptomatic generalized seizure, multiple seizures were usually confirmed including tonic seizure, atypical absence, drop attack, nodding spasm, myoclonic seizure, generalized tonic-clonic seizure and complex partial seizure. Table 1 shows effects of AC on each seizure type. While complete seizure elimination was obtained in the majority of generalized tonic-clonic(100%) and atypical absence(60%) seizures, drop attacks and nodding spasms, complete suppression was hardly obtained against tonic seizures, complex partial seizures or myoclonic seizures(16.7-33.3%). However, though in the latter types of seizures, significant improvements (i.e., reduction of frequency and severity of seizure and shortening of seizure duration) were observed more than 75% of patients.

3)Extent of callosotomy and surgical results

On postoperative MRI, anterior 1/2 division was performed in 3, anterior 2/3 division in 14, anterior 3/4 in 8, and anterior 4/5 in 2 patients, respectively. There is no clear relationship between surgical results and the extent of division of the corpus callosum .

4)Age at seizure onset and surgical results

The mean age of seizure onset was 5.2 years (3 months-17 years). There was a significant difference in the rate of poor outcome whether seizure began before or after 4 years old, i.e., 41.6% for the former group vs 13.3% for the latter.

5)Postoperative EEG change and surgical results

EEG was recorded before and 1 month after callosotomy. Interictal epileptic discharges were assessed visually. Prior to surgery, diffuse bilaterally synchronous spike and wave(SSW) was observed in 20, frontal spike with bilateral synchrony in 3, bilateral sharp wave in 3 and bifrontal independent spike in 1 patient. Postoperatively, the tendency of disappearance of bilateral synchrony was characteristic in all patients. In 20 patients who had SSW before surgery, SSW was not captured in one patient even in a long-term EEG monitoring. In the rest, SSW amplitude predominantly lateralized to one hemisphere in 12 (lateralized discharge group) or had changed into bilateral independent spike and waves in 7 patients (independent discharge group). In lateralized discharge group, 75%(9 patients) obtained excellent outcome in contrast to 57% of independent discharge group.

Table 2. Changes of EEGs and Surgical Results

Pre-op / Post-op	Total	Excellent	Good	Poor
SSW / no seizure discharge	1	1(100%)	0	0
SSW / independent SW	7	4(57.1%)	1(14.3%)	2(28.6%)
SSW / lateralized SW	12	9(75.0%)	1(8.3%)	2(16.7%)
SBS / lateralized spike	2	2(100%)	0	0

SSW: diffuse synchronous spike and wave, SBS: secondary bilateral spike

DISCUSSION

Significant improvement was obtained in 74.1% which is comparable to that of international outcome survey. Surgical outcome of children group was comparable or even slightly superior than that of adult group, suggesting that early operation during childhood may be preferable since psychosocial improvement after surgery could be more expected in children. Patients whose seizure began before 4 years old showed poor outcome in contrast to patients whose seizure began after 4 years old. This result suggests that earlier onset of seizures might reflect more severe and diffuse brain damage. The extent of callosotomy did not significantly influence seizure reduction in accordance with recent reports. Although AC has been reported to be less effective as compared with total callosotomy, surgical mplications including permanent disconnection syndrome were much more frequent after total callosotomy. Relationships between sizure outcome and postoperative EEG changes are still controversial, although disruption of synchrony and decrease in amount of SSW have been recongnized. Our result that seizure outcome was superior in lateralized discharge group as compared to independent discharge group, implies that epileptic abnormalities may exist primarily in the unilateral hemisphere and callosotomy may inhibit secondary bilateral synchrony in lateralized discharge group. Theses results are compatible to the results in previous reports of allosotomy in which the presence of unilateral epileptic abnormalities was good prognostic factor. On the other hand, in independent discharge group, bilateral diffuse abnormality might be present in both hemispheres and callosotomy only disrupt bisynchrony between spike and wave discharge generated independently in each hemisphere. Preoperative EEG analysis may be worth to predict surgical outcome, as analysis of the preoperative EEG through a multi-dimensional autoregressive model can predict such postoperative EEG chnages.

