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The Outcome of Corpus Callosotomy for Intractable Epilepsy : 10 Years Experience of Corpus Callosotomy

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Objective : The purpose of this study is to evaluate the effect of the corpus callosotomy and to elucidate possible prognostic factors.

Methods : The cases of 39 patients who underwent corpus callosotomy were reviewed retrospectively. Clinical outcomes were analyzed using Engel's classification, with consideration of various presurgical conditions and the extent of the callosal resection during follow-up more than one year.

Results : Satisfactory outcome (Engel' s class I, II) was obtained in 20 patients (51%) of 39 patients. In 36 cases with drop attack seizures, the class I, II outcomes were 22 patients (61%). When the patients were grouped according to the extent of callosal resection, the class I, II outcomes were 50% of the patients with anterior 1/2 or 2/3, 50% of those with anterior 4/5 callosotomy, and 57% of those with total callosotomy, respectively. The mean follow-up period was 34 months (24 to 58 months).

Conclusion : Although it is not statistically significant, the patients who had underwent total callosotomy show better outcomes than those with partial callosotomy. Corpus callosotomy is efficacious in controlling medically intractable epilepsy in appropriately selected patients.

KEY WORDS : Intractable Epilepsy · Drop attack · Callosotomy.

Introduction

Van Wagenen and Herren introduced 10 cases of corpus callosotomy as a palliative surgical treatment for medically intractable epilepsy in 1940[15]. Followed by many reports from different centers, corpus callosotomy is now widely accepted as an alternative and effective treatment for intractable epilepsy[2]. There are a few reports, which has analysed the effect of extent of callosal resection in different seizure types. The seizure control has been improved by medical management in generalized epilepsies. However about 20~25% of cases are still intractable. Especially in cases of drop attack seizures, corpus callosotomy should be considered as the most helpful procedure.

The object of this study is to verify the effect of callosotomy on intractable seizure according to surgical extent and search possible prognostic factors. We reviewed forty patients who had underwent corpus callosotomy in our hospital, between 1993 and 2003. In some literatures, limited or staged resections are thought to result in less pronounced surgical, neuropsychological, and psychomotor sequelae than complete callosotomy performed as a single procedure[6,7,9,13,17]. But, there was an opinion that total callosal resection is more effective method[8]. Nevertheless, there were remaining questions regarding as patient selection, morbidity, and factors that predicting the outcome.

Materials and Methods

Preoperative evaluation

All 39 patients performed prolonged Video-EEG monitoring and brain MRI, preoperatively.

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Selection of patients

We reviewed the medical records of 39 patients who underwent corpus callosotomy for medically intractable epilepsy between 1993 to 2003. The mean follow up period was 34 months (range 24 months to 58 months). The most recent follow up was done by telephone interview. Their ages ranged from 2 to 28 years (mean age 10.9 years) at operation. There were 26 males and 13 females. The mean age of seizure onset was 4.5 years (range 2 months to 12 years).

Surgical indications contain intractable epilepsy with interictal generalized and/or multifocal epileptogenic foci which could not be resected focally, at least 2 years of duration for refractory seizure despite of adequate antiepileptic drug therapy or seizure complicated by several episodes of convulsive status epilepticus or body injury because of fall down.

In the precedent event, encephalitis was the most common (13%), followed by trauma (8%), febrile convulsion (5%), band heterotopia (5%), and unknown etiology (59%).

Types of seizure and surgical outcome

The types of seizure were drop attack, generalized tonic-clonic seizure, complex partial seizure, simple partial seizure, myoclonic and absence seizure. The drop attacks included atonic, akinetic, tonic and tonic atonic seizure. Each patient could be diagnosed as multiple classifications. The surgical outcome was evaluated with Engel's classification.

Surgical methods

Authors performed corpus callosotomy with resection of anterior 1/2 or 2/3 (15% of patients), anterior 4/5 (50%), and total corpus callosotomy (35%) using frameless stereotactic instruments (Viewing wand and Brainlab). Three patients were received additional operative procedures (2 corticectomy and 1 vagus nerve stimulation), after corpus callosotomy. There was no operative mortality.

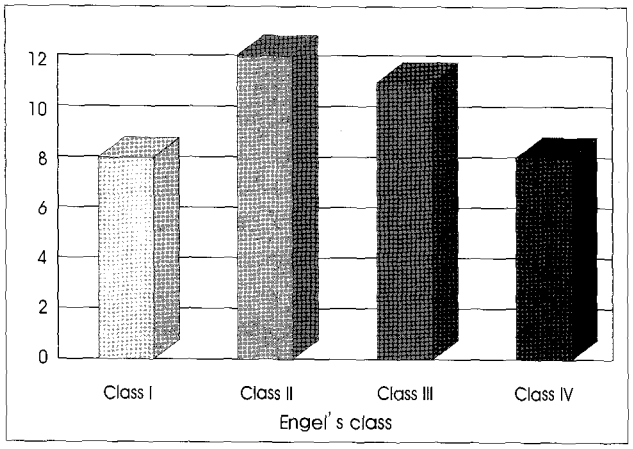

Fig. 1. Outcome for most disabling seizure.

Results

Preoperative EEGs were not of value in localization or lateralization of the epileptogenic zone in all patients. Among 39 patients, Lennox-Gastaut syndrome and West syndrome were 29 patients and one patient in each. A specific diagnosis of epileptic syndromes was not made in the other patients. Thirty-six patients (93%) had suffered from frequent drop attack seizures, which was the most common type of seizures among the patients in this study.

Overall seizure outcome in 39 patients categorized by means of Engel's classification were; satisfactory in 20 patients (51%; 8 patients with class I, and 12 patients with class II), improved in 11 patients (28%; class III), and class IV in 8 patients (21%) (Fig. 1).

Especially for 36 patients who had intractable drop attacks, the outcomes were better than those who had not. The outcomes in this group of patients were satisfactory in 22 patients (61%; Engel's class I in 17, class II in 5), improved in 8 patients (22.2%; Engel's class III), and unchanged in 6 patients (17%) (Fig. 2).

In the cases with myoclonic seizures, 10 patients (62%) were

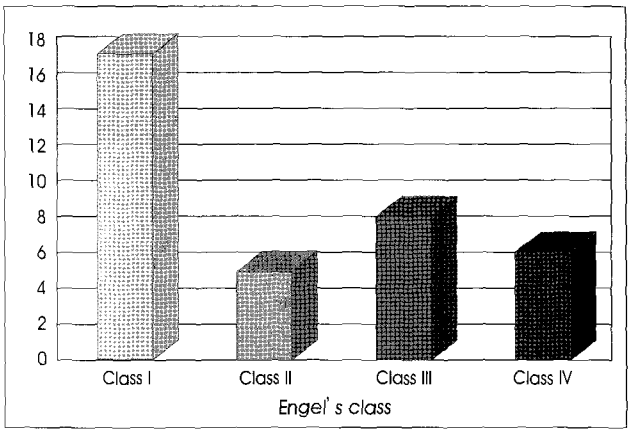

Fig. 2. Outcome of the drop attack seizure.

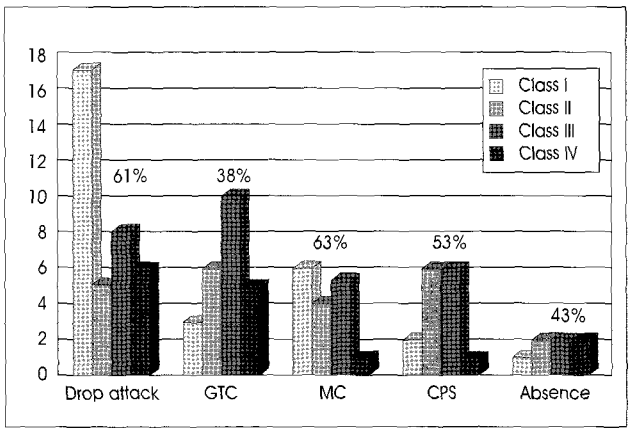

Fig. 3. Outcome by seizure type (Satisfactory outcome).

satisfactory in total 16 patients. Fig. 3 summarized the results according to the various types of seizures.

In the aspect of the extent of callosal resection, satisfactory outcomes were achieved in 50% (3 out of 6 patients) in patients who had underwent anterior 1/2 or 2/3 callosotomy, 50% (10 out of 20 patients) in those with 4/5 callosotomy, and 57% (8 out of 14 patients) in patients with total callosotomy (Fig. 4). The patients with total callosotomy showed more of satisfactory results although the differences were not statistically significant.

Fig. 5 showed the relationship in the extent of callosotomy and postoperative reduction of drop attack seizures. The outcome was satisfactory in 77% (10 out of 13 patients) for the patients with total callosotomy, while those with 1/2 or 2/3, and those with 4/5 callosotomy showed satisfactory results in 33% (2 out of 6 patients) and 59% (10 out of 17 patients), respectively. Those differences, however, did not have statistical significance either.

Postoperative disconnection syndrome was evident in 5 patients (13%) postoperatively, three after total callosotomy, one after anterior 4/5 callosotomy, and one patient after anterior 1/2 or 2/3 callosotomy. The symptoms related with disconnection syndrome were left side apraxia, apathy, mutism and urinary incontinence. Those symptoms disappeared within a few months after surgery in all.

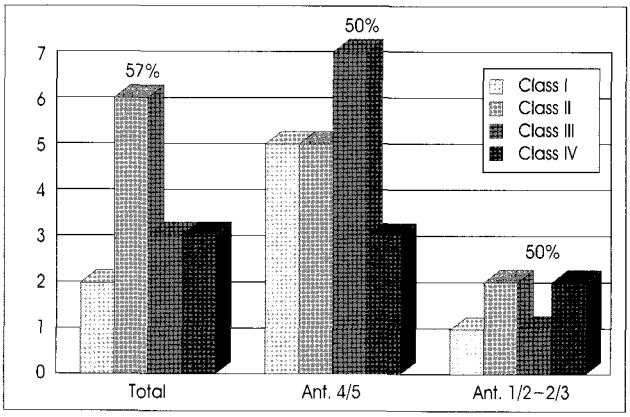

Fig. 4. Outcome for callosal sectioning extent (Satisfactory outcome).

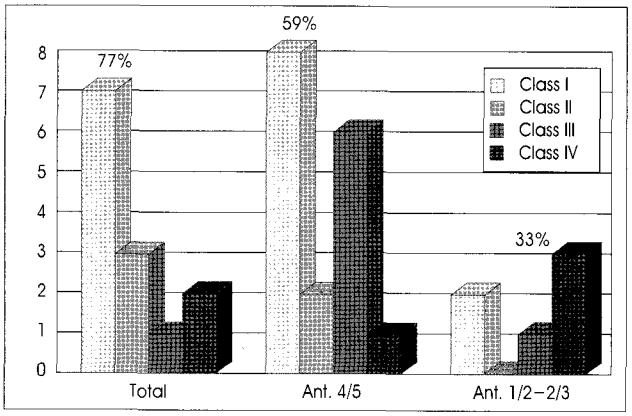

Fig. 5. Drop attack outcome for callosal sectioning extent (Satisfactory outcome).

Two patients underwent additional surgical procedures for epilepsy because of unsatisfactory results from initial callosal resection. A patient underwent additional corticectomy after 5 years of anterior 2/3 callosotomy. He improved his seizure frequency during 3 years, but dissimilar seizure was recurred. Video-EEG monitoring was done, and then corticectomy was done after 5 years of callosotomy. But the other side, a patient underwent simultaneous vagus nerve stimulation with total callosotomy, and she became seizure free after 31 months follow up.

Discussion

The rationale for corpus callosotomy was based on the hypothesis that corpus callosum is the most important pathway for the interhemispheric spread of seizure activity, especially in secondarily generalized seizures[2]. So, the goal of this surgical procedure is not to remove epileptogenic focus, but rather to limit the spread of epileptogenic discharge. In the literatures, corpus callosotomy is a safe procedure that effectively attains its goal of palliation in a majority of cases, same as our cases[5]. But also, there were frequent operative complications of callosotomy. They include hydrocephalus, meningitis, sagittal sinus tearing, venous infarction, and postoperative hemorrhage. But in our cases, any surgical complication was not noticed.

There was no statistical relationship of callosal sectioning extent and disconnection syndrome in our study. In disconnection syndrome which is one of the major postoperative complications, we had 5 cases of postoperative disconnection syndrome. Those, however, were improved spontaneously. In our cases, the extent of the callosotomy was not related to postoperative disconnection syndrome, statistically. Prudent suggestion for extensive(including total) callosotomy is made for good outcome. Undoubtedly, there are variable debates for callosal section extent. As mentioned above, many surgeons proposed anterior 1/2 callosotomy, 2/3 callosotomy. 4/5 callosotomy rather than complete commissurotomy[3,4,9,11-13]. SY Kwan et al. commented the rationale for anterior partial callosotomy[13]. Those included that (1) the anterior 2/3 of the corpus callosum connects bilateral prefrontal and frontal regions which are essential for generalization of tonic and tonic-clonic convulsions and atonic drops, (2) anterior partial callosotomy can preserve sufficient interhemispheric fibers for coordinated brain function and markedly reduce the risk of complications such as are seen following complete callosotomy, (3) there was no marked difference in the prognosis for postoperative seizure outcome between partial and complete callosotomy.

But, our 39 cases showed neither meaningful relationship of extent and disconnection syndrome, nor also marked difference of partial and complete callosotomy.

Although the extent of callosal sectioning (1/2, 2/3, 4/5, or total callosotomy) was not associated with seizure outcomes, one-stage total callosotomy showed the best result, in case of drop attack seizure. Spencer et al found that 77% of patients benefited after total callosotomy but only 35% of patients benefited after partial callosotomy[14]. Pinard et al demonstrated that partial callosotomy for drop attacks was effective only in 27%, whereas total callosal section was effective in 89%[10]. So, we have the opinion that in cases of children and significant mental retarded adults, total callosotomy would be a choice for preventing drop attack.

Drop attack is one of the most frequent seizure pattern and most likely symptom to benefit from corpus callosotomy. Our result supports this principle. Exact preoperative diagnosis is needed for good outcome.

Vagus nerve stimulation might be considered as a second step operation after callosotomy[1]. In our case, a girl who performed simultaneous vagus nerve stimulation with total callosotomy showed seizure free status.

This study may have some limitation of retrospective study. Our results are mainly based on subjective assessment and opinions of the patients' families. In the literatures, some authors mentioned age for presurgical prognostic factor. Younger patients had significantly better outcome in overall daily function (<18 years old)[8]. But we could not obtain functional result by telephone interview. It may perhaps be a limitation of the functional outcome scaling method. Functional outcome scale as well as seizure cessation itself are needed for proper measurement.

Conclusion

In summary, corpus callosotomy is a safe and effective procedure for patients with intractable epilepsy, particularly for those susceptible to epileptic fall. Although there was no obvious relationship of special seizure type and outcome, complete preoperative study with exact diagnosis may lead to good result in intractable epilepsy. The extent of the callosal section has some debate in the aspect of functional reserve versus seizure control, but total callosotomy would be a better one in our cases. Vagus nerve stimulation may be an alternative method for patients with no change in seizure control after callosotomy.

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Commentary

This is a paper analyzing the follow-up results of corpus callosotomy of 39 patients of 10 year experiences in the same institute. Pricncipally I agree with the authors' conclusion that total callosotomy gives better results than partial one. Now in my institute we perform total callosotomy for every patient, because almost all patients coming from pediatric group and they want to do total callosotomy. Drop attacks are very nice candidate if medical treatment fails to control these agonizing drop attacks. If long-term follow-up data more than five years of these callosotomized patients should be given, this paper might be more important.

Further follow-up data should be given in the future, but I appreciate the author's honest analysis of their data in this article.

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