
Psychiatric Assessment of Candidates for Epilepsy Surgery

G. Savard and R. Manchanda

ABSTRACT: Patients with medically intractable epilepsy often present with comorbid psychiatric diseases. When referred to a program for the surgical treatment of the epilepsies, these patients benefit from a pre-admission psychiatric assessment with a view to lessen the chances of a psychiatric crisis during the pre- and postoperative investigations. This article proposes a practical approach to the psychiatric assessment and monitoring of adult candidates to the surgery of epilepsy. It emphasizes, in agreement with a world literature review, that definitive psychiatric contraindications to this elective surgery are few, and that adverse long-term psychiatric outcomes are less frequent when good seizure outcome is achieved.

RÉSUMÉ: Évaluation psychiatrique des candidats à la chirurgie de l'épilepsie. Les patients qui ont une épilepsie résistante au traitement médical présentent souvent une comorbidité psychiatrique. La disponibilité d'une expertise psychiatrique est précieuse quand un patient est référé à une équipe de chirurgie de l'épilepsie, afin de diminuer les chances d'une crise psychiatrique pendant le séjour hospitalier et pour faciliter les investigations pré et postopératoires. Cet article traite de la spécificité de l'évaluation psychiatrique des candidats adultes à la chirurgie de l'épilepsie et indique, selon une revue de la littérature mondiale, que les contre-indications précises à cette chirurgie électorale sont peu nombreuses et rares.

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Psychiatric illnesses are genuine medical disorders that are not always recognized as such by physicians who are unfamiliar with them. The prevalence of these illnesses as comorbid entities to medically intractable epilepsy is high.^{1,2} In one study, up to 70% or 42 of 60 consecutive candidates for epilepsy surgery were found to have one or more principal psychiatric diagnosis(es) using a structured interview and a classification of mental disorders recognized by the American Psychiatric Association.³

In an active surgery program, the treating neurologists or neurosurgeons should be aware of the presence of comorbid mental disorders and arrange for early psychiatric consultation. Ensuring proper psychiatric risk management facilitates pre- and postoperative investigations.⁴

This article proposes a practical approach to the psychiatric assessment and monitoring of adult candidates for epilepsy surgery with a view to lessen the chances of a psychiatric crisis during the pre- and postoperative investigations. It emphasizes, in agreement with the published studies describing psychiatric findings before and after surgery, that the psychiatric contraindications to this elective surgery are few, and that adverse long-term psychiatric outcomes are less likely when good seizure control is achieved.⁵

PSYCHIATRIC ASSESSMENT

In 1995, the American Psychiatric Association published a practice guideline for the psychiatric evaluation of adults.⁶ It focused on the purpose, settings, domains, and process of clinical psychiatric evaluations. According to purpose, three types of evaluation were described: general evaluation, emergency evaluation and clinical consultation. The scope, pace and depth of the evaluation were discussed in three settings: outpatient, inpatient, general medical-surgical unit. The various domains of the evaluation were addressed including: reason for evaluation, history of present illness, past psychiatric history, medical history, history of substance abuse, psychosocial/developmental history, social and vocational history, family history, review of systems, physical examination, mental status examination,

From the Department of Neurology, and Department of Psychiatry, McGill University and Montreal Neurological Hospital and Institute, QC., H3A2B4
Reprint requests to: G. Savard, Department of Neurology, and Department of Psychiatry, McGill University and Montreal Neurological Hospital and Institute, 3801 University, Montreal, QC, Canada H3A2B4

functional assessment, information derived from the interview process. Methods of obtaining information were reviewed: patient interview, use of collateral sources, use of structured interviews, questionnaires and rating scales, use of psychological and neuropsychological tests, examination under restraint, physical examination. Lastly, recommendations were made regarding diagnosis formulation, initial treatment planning, legal, administrative and system issues.

While adherence to such a practice guideline is not meant to replace good clinical judgment and local experience, it is one helpful way to standardize the basic assessment of a population with dual diagnoses i.e. epileptic and psychiatric illnesses, across a finite but growing number of centers around the world where the surgical treatment of the epilepsies is carried out.

Textbooks in neuropsychiatry and in epilepsy include chapters on the psychiatric evaluation of patients with central nervous system disorders and with epilepsy: in-depth discussions are provided about the problems encountered in the psychiatric assessment of these patients, including problems specific to this population of patients and problems arising from the special neurological investigations or treatments underway.^{7,8,9} As the examiner becomes more experienced with these problems, he or she can not only thoroughly assess candidates for surgery before admission, but can delineate those particular clinical issues that should be monitored during the admission and after discharge. This ensures optimal psychiatric risk management.

In practice, there is a lack of acceptance of a common psychiatric assessment protocol among the centers that specialize in the surgical treatment of the epilepsies. This situation has likely endured because there are too few full-time neuropsychiatrists appointed to the epilepsy surgery teams although appreciation of their role is growing.⁹

At the Montreal Neurological Hospital, where approximately 100 patients a year are surgically treated for medically intractable epilepsy, growing recourse to neuropsychiatric expertise has resulted in implementation of clinical measures found by patients, families and surgical team members to reduce the psychiatric and neurologic morbidity in this group of patients (Fred Andermann, personal communication). These measures are presented next.

CLINICAL PSYCHIATRIC MEASURES

Timing, setting, type and purpose of initial psychiatric assessment

The timing of psychiatric assessment is important in the setting of surgical programs.¹⁰ In our center, where a psychiatrist is available full time, all patients with a known, or suspected psychiatric vulnerability are referred for a pre-admission, outpatient general psychiatric assessment. This measure serves to identify early the psychiatric syndrome present and the effective means to treat or manage it. Review of psychiatric records is performed at that time. Attention is paid to the usual precipitants of psychiatric relapse and to known preventive measures. Past use of chemical or mechanical restraints is noted. The interview can be interrupted by seizure occurrence: subtle and obvious psychic seizure phenomena are appreciated. Enquiry is made about peri- or ictal psychiatric symptoms and recall of them.¹¹ Antecedents of postictal psychosis are

documented if any, as well as degree of compliance with antiepileptic drugs (AED). A review of current and past AED is mandatory, with a list of their positive and negative psychiatric side effects.¹² Up-to-date assessments of the capacity to give informed consent to medical care and of the legal responsibility for one's behaviour are done. The patient's burden of illness both epileptic and psychiatric, motivation for seizure freedom, and ability to tolerate the frustrations during the pre- and postoperative investigations, including telemetry with or without depth electrodes, are ascertained. Consent to contact significant others is secured and corroboration of pertinent findings with them takes place. Such a lengthy assessment aims not only to gather crucial information including diagnosis and the therapeutic steps to follow, but also aims to begin a therapeutic alliance.

Availability of family and of specialized personnel

Pre-admission interventions include identification of a legal representative in the case of patients incapable of consenting. The recruitment of family members, sitters or psychiatric nursing is arranged with a view to offer more support to the patient than is readily available on a busy, acute care neurosurgical ward. In the case of patients with a low intellectual quotient and impulsivity, the continuous bedside presence of a caring and familiar person is requested in order to avoid the excessive use of mechanical and chemical restraints and the ensuing risks.

Collaboration with the neuropsychologist

When assessing candidates for epilepsy surgery, the psychiatrist takes into consideration the limitations imposed by neurological handicap and by neuropsychological deficits. For example, meaningful communication can be impaired by low IQ, short attention span, aphasia, anosognosia, or amnesia. Assessment of the behavioural manifestations of frontal and of parietal lobe dysfunctions, especially involving the nondominant hemisphere, is receiving more attention but remains arduous.¹³ For historic reasons, the epilepsy surgeon has collaborated primarily with the neuropsychologist who has provided invaluable data in regard to cognitive function prior and subsequent to surgery. Neuropsychological testing protocols are standardized.¹⁴ Given the difficulties in measuring objectively the behavioural impact of these resections, the psychiatrist is well-advised to share findings with the neuropsychologist, especially when frontal or parietal resections are contemplated for the control of seizures.

Medical communication

Diagnostic formulation should adhere to the inclusion and exclusion criteria of an official classification such as that provided by the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders IV (DSM IV), although reference to historical texts at times remains invaluable for effective communication, especially in a surgical milieu.¹⁵ For example, a patient with an impulse disorder not otherwise specified (DSM IV) may best be described to have the classic Kluver-Bucy syndrome if neuropathological findings are concordant.¹⁶

Prevention of postictal psychosis

Most helpful are the interventions targeted to prevent, during

telemetry, the emergence of psychiatric symptoms that have a direct temporal relationship with seizures. In our experience, postictal psychosis can often be prevented by reducing the likelihood of unnecessarily intense or frequent seizure activity during videotelemetry. Slower tapering of AEDs and a routine order, written on admission to the videotelemetry unit, of a benzodiazepine such as lorazepam (1 to 2 mg) after one or more generalized convulsive seizures or after three or more complex partial seizures within a 24-hour period is, generally, all that is needed.¹⁷

Psychopharmacological interventions

All psychopharmacological interventions are selected so as to interfere the least with the seizure threshold and with electroencephalographic (EEG) recording and avoid adverse drug interactions with the AEDs.¹⁸ Compatibility with the anesthetic drugs obviously precludes the use of monoamine oxidase inhibitors because of the risk of hypertensive crisis. In our center, the use of valproic acid, a first-line mood stabilizer, as well as an AED is avoided in the two weeks prior to surgery because of a tendency to lower platelets, although this is not accepted by all.^{19,20}

Liaison with community psychiatric resources

Following discharge, liaison with community mental health resources are crucial to identify psychiatric complications and treat them promptly in the patient's milieu. Availability of the surgical team's psychiatrist for consultation is essential to assist in the early treatment of any emergent psychiatric complications in the early postoperative period and thereafter.

Prevention of neurologic and psychiatric morbidity

In our experience, carrying out outpatient, pre-admission general psychiatric assessments and providing, during admission, basic psychiatric therapeutic avenues are feasible within the confines of a surgical program. Psychiatric crises are prevented and length of stay is minimal. In particular, the incidence of postictal psychosis during telemetry is lessened. Psychiatric complications are addressed promptly, impacting positively on their prognosis. This approach lessens morbidity and compares favorably to the earlier practice of requesting a psychiatric consultation on an emergency basis during crisis.

PSYCHIATRIC CONTRAINDICATIONS TO SURGERY

Sound clinical psychiatric practice teaches that there are few definitive psychiatric contraindications to elective epilepsy surgery. One such contraindication, which in the author's experience is not encountered frequently, is the presence of a severe psychiatric illness that is refractory to psychopharmacological treatment, that cannot be managed safely on a non-psychiatric ward and that precludes satisfactory participation to preoperative and postoperative investigations.

In the case of psychosis, it is generally accepted that the presence of delusions in themselves does not preclude the ability to consent to surgery, despite the circumscribed lack of insight that these delusions entail.²¹ Exceptionally, the delusional theme impacts on the patient's understanding of the etiology of epilepsy and nature of surgical treatment and threatens informed consent.

This can occur with delusions of bodily control, of possession and of exorcism that are sometimes encountered in schizophrenia.

Significant danger from active suicidality or aggressivity cannot be managed safely on a nonpsychiatric ward given the risk of self-injury, injury to other patients and personnel and even death. Proper risk management warrants delay of the surgery until these risks have abated.

Preoperative depression is not a reason to withhold surgical treatment. Affective illness typically runs a course with relapse and remission. Depression developing in the context of abrupt postoperative seizure remission, whether relapsing or occurring *de novo*, is expected to respond to psychiatric management.

In the author's experience, substance abuse represents a relative contraindication to epilepsy surgery. If it contributes to poor seizure control preoperatively and the patient is unmotivated to achieve abstinence, it may well contribute to poor seizure control postoperatively.

Unrealistic expectations that surgery will correct all the losses associated with chronic epilepsy that are unyielding, despite repeated attempts to correctly inform the patient of the risk-to-expected-benefit-ratio of surgery, also represent a relative contraindication. Such expectations warrant careful consideration of the particular circumstances of those patients whose divergent views are not always the result of psychiatric illness, but are shaped by misinformation, culture and psychosocial context.

Nowadays, nontemporal resections are performed in increasing numbers and the psychiatric aspects relevant to them remain poorly understood and understudied. The debate on whether to offer a frontal lobe resection, indicated for the control of devastating seizures, to a patient who is severely impaired by frontal lobe executive dysfunction with behavioural disinhibition or apathy, is difficult to resolve. Psychiatric assessment can help through the identification of the behavioural problems linked to the frontal lobe dysfunction and of the means to cope or compensate for them.¹³ In our center, the rare cases in whom the difficulty in social reintegration worsened postoperatively, typically occurred after right frontal lobe resections but the reasons for this are unclear (L. Taylor, personal communication). In many individuals, the expected benefit in seizure control outweighs deficits such as loss of initiative or drive.

When a relative psychiatric contraindication is present, each patient's situation is best assessed individually.

TEMPORAL LOBE EPILEPSY, SURGICAL TREATMENT AND PSYCHIATRIC LONG-TERM OUTCOME

The literature on long-term psychiatric outcome following epilepsy surgery has concerned itself mainly with nonaffective psychosis, with suicide and less with depression, mania and anxiety.

The Maudsley series, from where many influential neuropsychiatric studies originated, was based on an epileptic patient population, drawn from psychiatric institutions and operated on in London by Mr Murray Falconer, from the early 1950s to the mid-1970s.^{22a,b} Falconer demonstrated that, contrary to sexual and aggressive disorders and to postictal psychoses, which could improve with achievement of good postoperative seizure control, well-established psychoses did not. With this

experience, Falconer abandoned the surgical treatment of epilepsy in patients with seizures and chronic psychoses. His influence was far reaching and, for many years thereafter, patients with psychosis were rejected from most epilepsy surgical programs including our own. Reutens and colleagues from our center where opinion was mixed in that regard, reported five patients with florid schizophrenia-like psychosis who underwent temporal lobe resection and became seizure-free. These patients, despite their severe psychosis, showed preserved ability to give informed consent to the surgery and to collaborate sufficiently with pre- and postoperative investigations. Their psychiatric management on the surgical ward was uneventful. Seizure remission was obtained in all. As expected, the psychoses continued postoperatively. This combined outcome proved beneficial to the patients: in one, it led to vocational reintegration; in the others, integration to psychiatric rehabilitative programs was made possible.⁴

Falconer also realized that schizophrenia-like psychosis could arise *de novo* postoperatively and run a chronic course despite enduring seizure control. Another finding was the development of postoperative depression occasionally leading to suicide, an outcome especially unsettling in the context of hard won seizure freedom.^{22a,b}

Taylor's review of the Maudsley data suggested that 23% of operated patients who had an alien tissue lesion were psychotic, compared to 5% of patients who had mesial temporal sclerosis. He found that left-handed females with an alien tissue lesion were more likely to develop schizophrenia-like psychosis. Also, he suspected a laterality effect, as left hemisphere lesions were more often associated with such psychosis.²³ Interestingly, right temporal resections have recently been associated with postoperative *de novo* psychoses and postictal psychosis.^{24,25}

Bruton reviewed all 249 cases of "en bloc" temporal lobe resection performed by Falconer, essentially the same series reviewed by Taylor.²⁶ Patients with Ammon's horn sclerosis (49.3%) were found to benefit the most from surgery with good postoperative seizure control and improved psychosocial outcome. Among patients with alien tissue lesions (20%) with predictably good seizure outcome, patients with ganglioglioma (nine patients) had disastrous psychiatric outcomes. Four of the nine (4/9) patients developed *de novo* schizophrenia after lobectomy including one who died from suicide and two who became aggressive and unmanageable. Patients with traumatic (4%), indefinite (10%) and no apparent (16.5%) lesions had unaltered seizure frequency, but deteriorated postoperatively from a psychiatric standpoint. Bruton concluded that operating on patients with Ammon's horn sclerosis was justified, operating on patients with ganglioglioma was potentially harmful, and removing a temporal lobe without a well-defined lesion caused more harm than good.

The nature of the association between neuropathology and psychiatric outcome remains unclear. The presence of a temporal ganglioglioma appears to predispose patients to postoperative *de novo* psychosis even when seizures are abolished. Such cases are relatively rare and merit further study but they do not imply a definitive contraindication for the surgical treatment of patients who harbour such lesions.²⁷

The early literature is remarkably silent about the incidence of

affective psychoses or of mood congruent psychotic features and of bipolar affective disorders. An incidence of preoperative depression of 0.4% (one patient) and of postoperative depression of 10% was reported in Falconer's series: six patients died from suicide.²⁶

Naylor and colleagues reported depression in five of 37 patients whose epilepsy was treated by selective amygdalohippocampectomy. Three of these patients were psychiatrically healthy before surgery. Three had surgery on the right. Only one patient had *de novo* hallucinosis, and none had *de novo* paranoid psychosis. In sum, affective illness was the most common psychiatric complication after operation.²⁸

Postoperative anxiety disorders are not often reported on. In a series of 110 patients, over half or 54% developed postoperative anxiety, especially after left temporal resection. Discontinuation of clonazepam after surgery was considered a possible etiologic factor.²⁹

In preparation for a recent international meeting on forced EEG normalization, we reviewed the world literature on the psychiatric outcome of epilepsy surgery and concluded that postoperatively, both worsening of, and *de novo* emergence of severe psychopathology preferentially occur in the presence of continuing seizures.⁵ In our experience as well as that of others, postoperative continuing seizures entail both the risks of recurrent acute postictal psychosis²⁵ and chronic interictal psychosis.^{30,31} In cases of uncontrolled seizures, the role of incompletely resected epileptogenic lesions and scarring from surgical complications, must be considered. The occurrence of postoperative psychosis *de novo* in patients whose seizures had remitted following temporal resection is quite exceptional.⁵ There are, however, rare isolated instances in which this did occur.^{24,29,30,31} In the series of Stevens, one out of 14 patients developed *de novo* paranoid schizophrenia after left temporal resection in the context of residual auras only.³⁰ Mace et al reported on six patients who developed *de novo* psychosis after right temporal resections: two achieved seizure remission, including one who developed psychotic depression and another who had a schizophreniform psychosis.²⁴ This may relate to the long previous history of uncontrolled temporal lobe epilepsy, which may remain a predisposing factor just as long duration (a mean of 15 years) of uncontrolled temporal epilepsy is the rule before chronic schizophreniform psychosis emerges.^{32,33}

In the case of depression, the relationship to continuing seizures is less clear, as depression can develop at the time of unprecedented seizure control, whether postsurgery or following the use of a powerful AED. Landolt's concept of forced EEG normalization is interesting in this regard.³⁴ No study has definitively addressed the question of a possible association with preoperative peri-ictal, postictal and interictal depression. The etiology of depression in epilepsy is admittedly complex, and whether occurring pre- or postoperatively, it is likely related to a mixture of factors including genetic vulnerability to affective disorders, gender, adverse life events, a personal past history of depression, site of seizure of focus and lesion, and site of drug action.³⁵

CONCLUSIONS

Clinicians, patients and families are understandably

concerned with the nonremission, occasional worsening or new development of psychopathology in the postoperative period, especially when good postoperative seizure control is achieved and social and vocational integration is entertained. The challenge is to better identify those patients in whom surgical intervention will resolve or improve seizures, without leading to psychiatric functional disability.³⁶ For this challenge to be met, early recognition and optimal assessment of psychiatric disorders need to take place routinely. Optimal psychiatric risk management within epilepsy surgical programs is feasible with proper recourse to neuropsychiatric services.

The surgical procedures in themselves remain a safe and beneficial treatment for uncontrolled seizures in the majority of patients: this suggests that those poor psychiatric outcomes are mainly induced in patients of a certain neuropsychiatric vulnerability. In the early surgical series, the standard temporal lobe resection was an "en bloc" removal of cerebral tissue. Contemporary series include alternative approaches like awake tailored resection, amygdalohippocampectomy, radical hippocampectomy, lesionectomy. It is not known whether removal of less tissue leads to fewer neuropsychological and psychiatric complications.²⁸

Clearly established psychiatric contraindications to elective epilepsy surgery are few. The main variable related to long-term adverse psychiatric outcome and in particular, to psychosis, is continuing postoperative seizures.⁵ It is hoped that research efforts will continue to clarify the complexity of interplay between the many neurobiological variables and external factors.³⁷

REFERENCES

- Manchanda R, Schaefer B, McLachlan RS, et al. Psychiatric disorders in candidates for surgery for epilepsy. *J Neurol Neurosurg Psychiatry* 1996; 61(1):82-89.
- Blumer D, Montouris G, Hermann B. Psychiatric morbidity in seizure patients on a neurodiagnostic monitoring unit. *J Neuropsychiatry Clin Neurosci* 1995;7(4):445-456.
- Victoroff J. DSM-III-R psychiatric diagnoses in candidates for epilepsy surgery: lifetime prevalences. *Neuropsychiatry, Neuropsychol Behav Neurol* 1994; 7:87-97.
- Reutens DC, Savard G, Andermann F, et al. Results of surgical treatment in temporal lobe epilepsy with chronic schizophrenia-like psychosis. *Brain* 1997; 120:1929-1936.
- Savard G, Andermann LF, Reutens DC, et al. Epilepsy, surgical treatment, and postoperative psychiatric complications: a re-evaluation of the evidence. In: Trimble MR and Schmitz B, eds. *Forced EEG normalization: a tribute to Hans Landolt*. Bristol:Wrightson Biomedical Publishing, 1998;179-192.
- American Psychiatric Association. Practice guideline for psychiatric evaluation of adults. *Am J Psychiatry* 1995; 152(Suppl):11:67-80.
- Ovsiew F. Bedside neuropsychiatry: eliciting the clinical phenomenon of neuropsychiatric illness. In: Yudofsky SC and Hales RE, eds. *American Psychiatric Press Textbook of Neuropsychiatry*. Washington, American Psychiatric Press, 1992; 89-125.
- Mueller J, Fogel BS. Neuropsychiatric examination. In: Fogel BS, Schiffer RB, Rao SM, eds. *Neuropsychiatry*. Baltimore, Williams&Wilkins, 1996;11-28.
- Fenwick PBC, Blumer D, Caplan R, et al. Presurgical psychiatric assessment. In: J Engel Jr, ed. *Surgical Treatment of the Epilepsies*, 2nd Ed. New York: Raven Press, 273-290.
- Krahn LE, Rummans TA, Peterson GC. Psychiatric implications of surgical treatment of epilepsy. *Mayo Clinic Proc* 1996; 71(12):1201-1204.
- Lancman M. Psychosis and peri-ictal confusional states. *Neurology* 1999;53(Suppl 2):S33-38.
- Ketter TA, Post RM, Theodore WH. Positive and negative psychiatric effects of antiepileptic drugs in patients with seizure disorders. *Neurology* 1999; 53(Suppl 2):S53-S67.
- Mah L, Savard G, Andermann F, et al. Assessment of neuropsychiatric aspects of frontal lobe epilepsy. *J Neuropsychiatry Clin Neurosci* 1999; 11:1, 132-133 (Abstract).
- Rausch R, Le M-T, Langfitt JT. Neuropsychological evaluation - adults. In: Engel J Jr, Pedley TA, eds. *Epilepsy-a Comprehensive Textbook*. Philadelphia, Lippincott-Raven, 1997;977-987.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, 4th Ed. Washington: American Psychiatric Association Press, 1994.
- Klüver H, Bucy PC. Psychic blindness and other symptoms following bilateral temporal lobectomy in rhesus monkeys. *Am J Physiol* 1937;119:352-353.
- Trop D, Olivier A, Dubeau F, et al. Seizure surgery-anesthetic, neurologic, neurosurgical, and neurobehavioral considerations. In: Albin MS, ed. *Textbook of Neuroanesthesia with Neurosurgical and Neuroscience Perspectives*. New York: McGraw-Hill Companies, 1997, 643-696.
- Allredge BK. Seizure risk associated with psychotropic drugs: clinical and pharmacokinetic considerations. *Neurology* 1999; 53(Suppl 2):S68-75.
- Ward MM, Barbaro NM, Laxer KD, et al. Preoperative valproate administration does not increase blood loss during temporal lobectomy. *Epilepsia* 1996; 37(1):98-101.
- Anderson GD, Lin Y-X, Berge C, et al. Absence of bleeding complications in patients undergoing cortical surgery while receiving valproate treatment. *J Neurosurgery* 1997; 87(2):252-256.
- Stagno SJ, Smith ML. The presurgical workup: evaluation of psychiatric issues and informed consent. Luders HO ed. New York: Raven Press, 1992, 453-460.
- Falconer MA. Pathological substrates in temporal lobe epilepsy with psychoses. In: Laitinen LV and Livingston KE, eds. *Surgical Approaches in Psychiatry*. Baltimore: University Park Press, 1973, 121-124.
- Falconer MA. Reversibility by temporal lobe resection of the behavioral abnormalities of temporal lobe epilepsy. *N Engl J Med* 1973; 289: 451-455.
- Taylor DC. Factors influencing the occurrence of schizophrenia-like psychosis in patients with temporal lobe epilepsy. *Psychol Med* 1975; 5:249-254.
- Mace CJ, Trimble MR. Psychosis following temporal lobe surgery: a report of six cases. *J Neurol Neurosurg Psychiatry* 1991; 54:639-644.
- Manchanda R, Miller H, McLachlan RS. Post-ictal psychosis after right temporal lobectomy. *J Neurol Neurosurg Psychiatry* 1993; 56: 277-279.
- Bruton CJ. *The Neuropathology of Temporal Lobe Epilepsy*. Oxford: Oxford University Press, 1988; 158.
- Andermann F, Savard G, Mencke JH, et al. Psychosis after resection of ganglioglioma or DNET: evidence for an association. *Epilepsia* 1999;40(1):83-87.
- Naylor AS, Rogvi-Hansen BA, Kessing L, et al. Psychiatric morbidity after surgery for epilepsy: short-term follow-up of patients undergoing amygdalohippocampectomy. *J Neurol Neurosurg Psychiatry* 1994;57(11): 1375- 1381.
- Bladin PF. Psychosocial difficulties and outcome after temporal lobectomy. *Epilepsia* 1992; 33(5):898-907.
- Stevens JR. Psychiatric consequences of temporal lobectomy for intractable seizures: a 20-30 year follow-up of 14 cases. *Psychol Med* 1990; 20: 529-545.
- Leinonen E, Tuunainen A, Lepola U. Postoperative psychoses in epileptic patients after temporal lobectomy. *Acta Neurol Scand* 1994; 90(6): 394-399.
- Slater E, Beard AW, Glithero E. The schizophrenia-like psychoses of epilepsy. *Br J Psychiatry* 1963;109:95-150.
- Toone B. Psychoses of epilepsy. In: Reynolds EH, Trimble MR, eds. *Edinburgh: Churchill Livingstone*, 1981;113-137.
- Landolt H. Serial electroencephalographic investigations during

- psychotic episodes in epileptic patients and during schizophrenic attacks. In: De Haas L, ed. *Lectures on Epilepsy*. New York: Elsevier, 1958, 91-133.
35. Robertson MM. Forced normalization and the aetiology of depression in epilepsy. In: Trimble MR and Schmitz B, eds. *Forced Normalization and Alternative Psychosis of Epilepsy*. Bristol:Wrightson Biomedical Publishing, 1998, 143-167.
36. Pilcher WH, Roberts DW, Flanigin HF, et al. Complications of epilepsy surgery. In: *Surgical Treatment of the Epilepsies*. 2nd ed. Engel J Jr ed. New York: Raven Press, 1993, 565-581.
37. Engel J Jr, Taylor DC. Neurobiology of behavioral disorders. In: Engel J Jr and Pedley TA, eds. *Epilepsy: A Comprehensive Textbook*. Philadelphia: Lippincott-Raven Publishers, 1997, 2045-2052.