

Prognostic criteria in the selection for resective surgery



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Epilepsy surgery

The goal of epilepsy surgery is the elimination of disabling seizures, without causing new neurological deficits unacceptable to the patient¹

The goal is a better life for the patient

Increase in QOL after epilepsy surgery is correlated to seizure freedom²

¹Engel, NEJM 1996;334(10):647-52. ²Spencer et al. Ann Neurol. 2007 62(4):327-34

Prognostic criteria

The chance of seizure freedom after resective surgery according:

- location of the epileptogenic zone
- TLE
- FLE
- pathology
- dual pathology
- IQ

Engel classification



Class 1 Free of disabling seizures

- b. completely seizure-free since surgery
- c. only non-disabling simple partial seizures since surgery
- d. some disabling seizures after surgery but free of disabling seizures for at least two years
- e. generalized convulsions only when medications are withdrawn

Class 2 Almost seizure-free

Class 3 Worthwhile improvement

Class 4 No worthwhile improvement

Engel. 1987

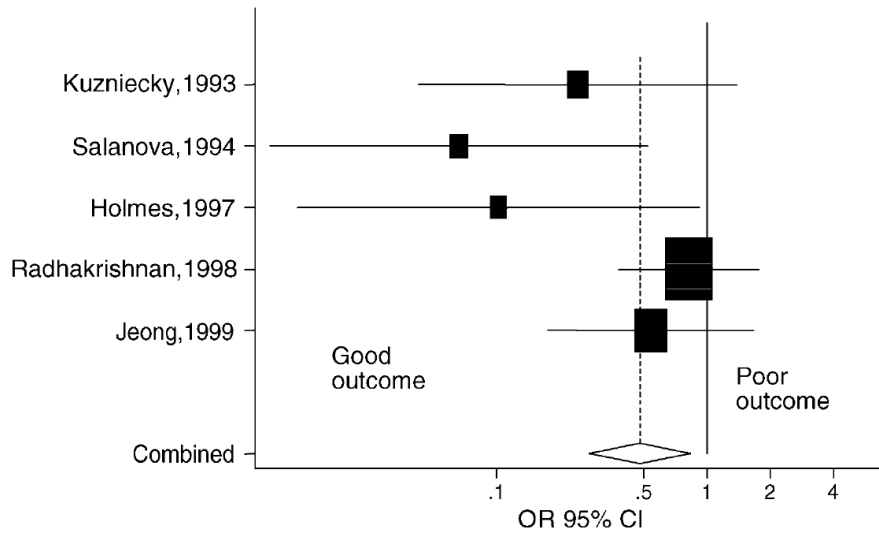
Predictors of epilepsy surgery outcome

- a systematic review of articles published 1984-2001
- 1051 studies, 47 met all the eligibility criteria
- 3511 patients, 67% seizure-free (median, follow-up?)

Positive predictors

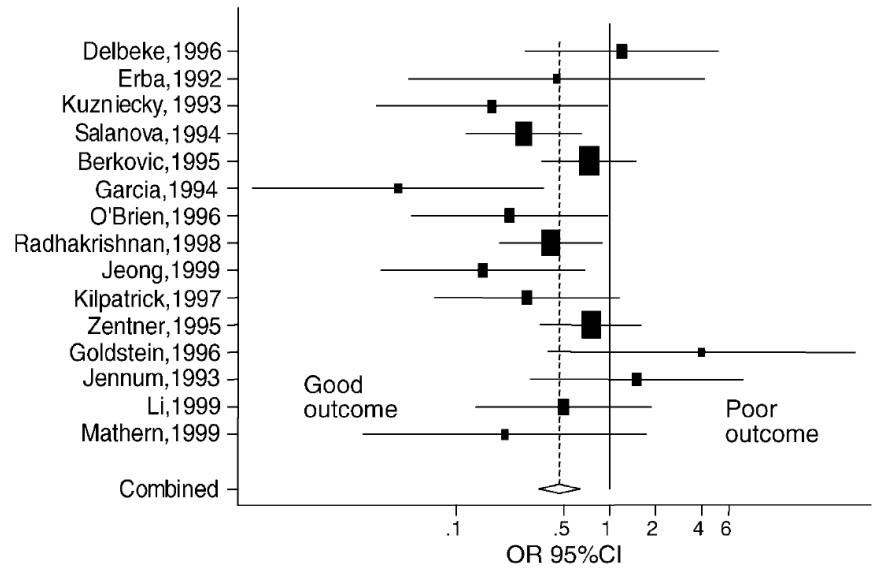
FERBILE SEIZURES

AVERAGE ESTIMATE(FIXED EFFECTS)=0.480(C.I.:0.277;0.833)
 TEST FOR HETEROGENEITY:Q=7.957 ON 4 DEGREES OF FREEDOM (P=0.093)



MESIAL TEMPORAL SCLEROSIS

AVERAGE ESTIMATE(FIXED EFFECTS)=0.471(C.I.:0.348;0.638)
 TEST FOR HETEROGENEITY:Q=21.861 ON 14 DEGREES OF FREEDOM (P=0.082)



Positive predictors

TUMO

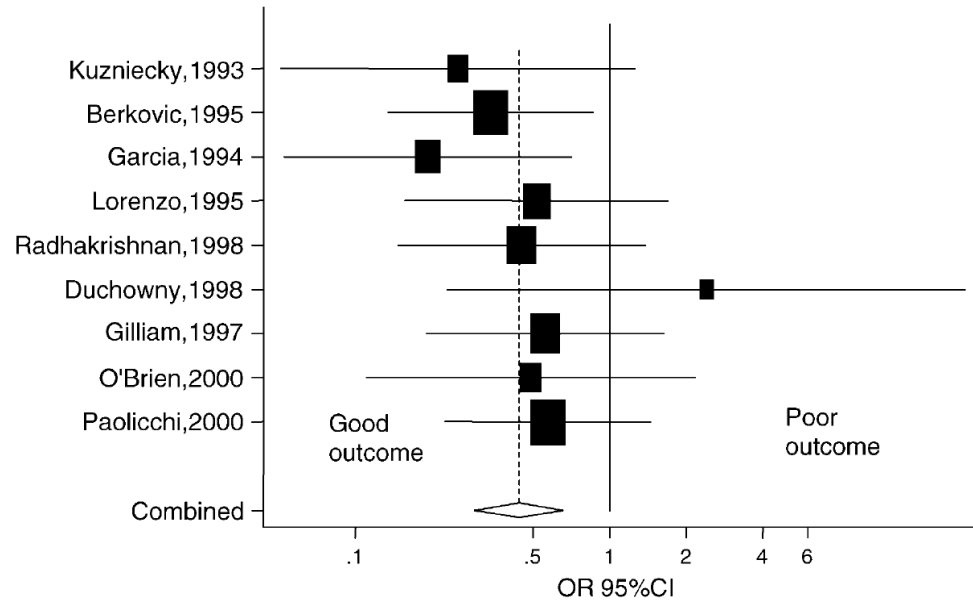
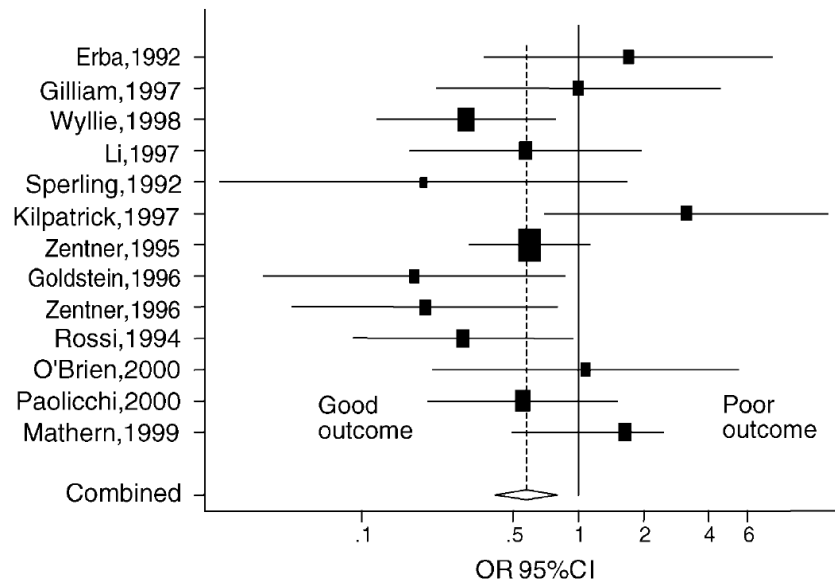
AVERAGE ESTIMATE(FIXED EFFECTS)=0.576(C.I.:0.416;0.797)

TEST FOR HETEROGENEITY:Q=19.301 ON 12 DEGREES OF FREEDOM (P=0.08)

ABNORMAL MRI

AVERAGE ESTIMATE(FIXED EFFECTS)=0.439(C.I.:0.295;0.654)

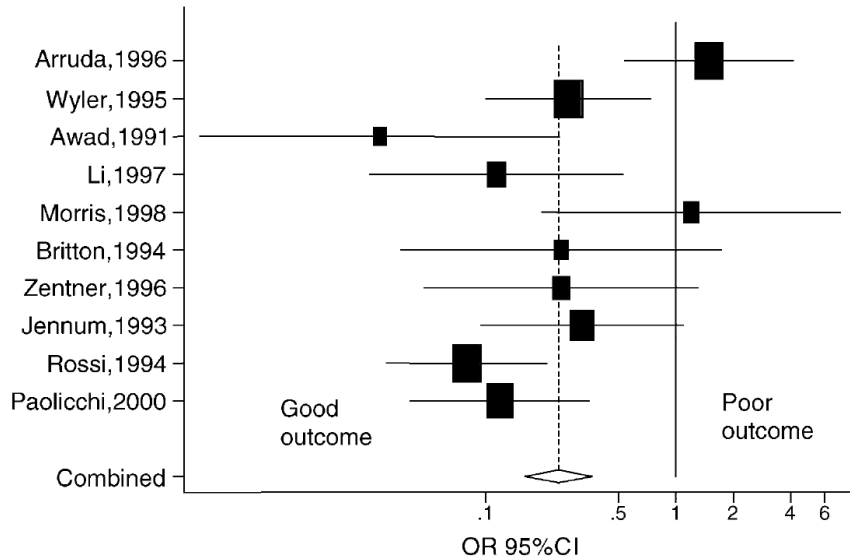
TEST FOR HETEROGENEITY:Q=4.901 ON 8 DEGREES OF FREEDOM (P=0.768)



Positive predictors

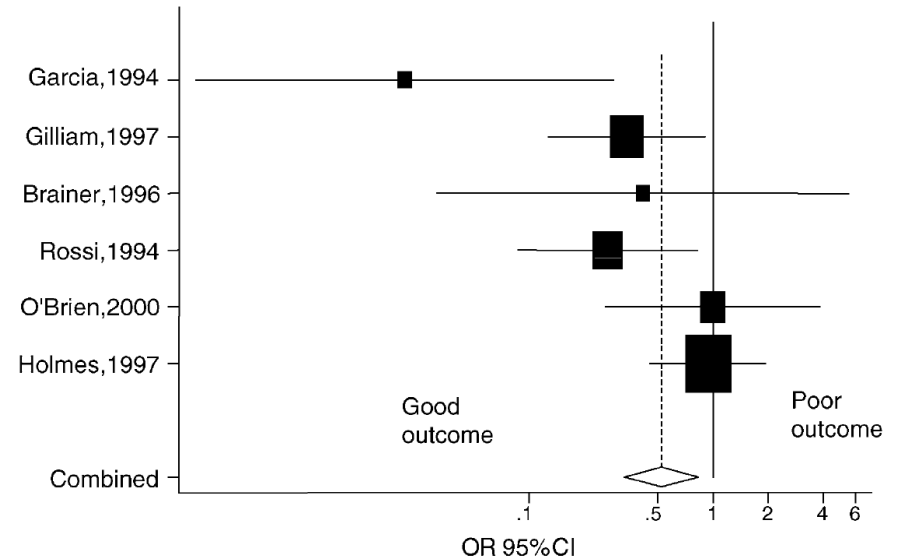
EXTENT OF RESECTION

AVERAGE ESTIMATE(FIXED EFFECTS)=0.243(C.I.:0.162;0.363)
 (RANDOM EFFECTS)=0.234(C.I.:0.113;0.486)
 TEST FOR HETEROGENEITY:Q=26.942 ON 9 DEGREES OF FREEDOM (P=0.001)

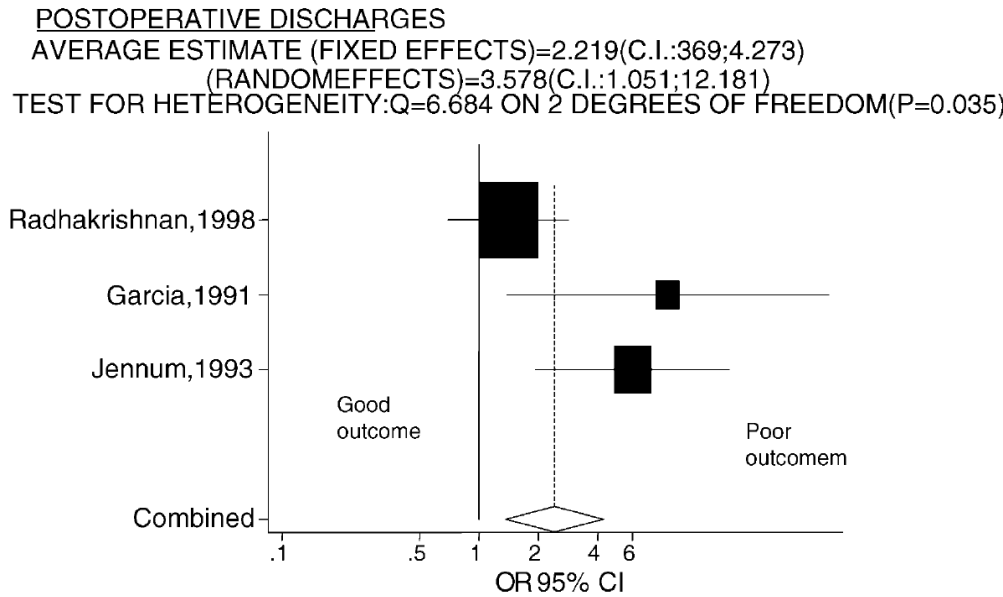
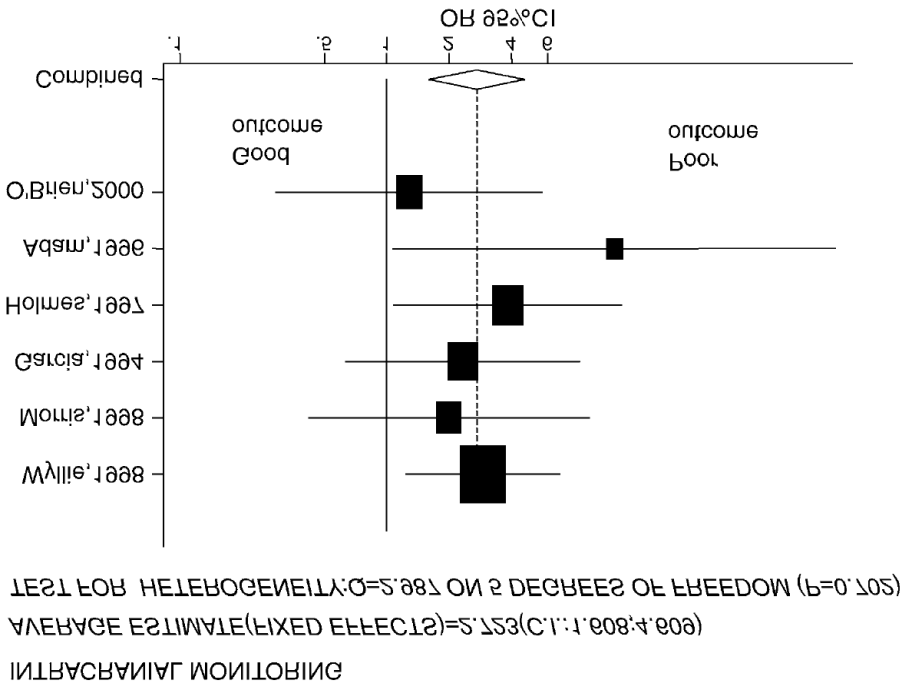


EEG/MRI/CONCORDANCE

AVERAGE ESTIMATE(FIXED EFFECTS)=0.525(C.I.:0.329;0.837)
 (RANDOM EFFECTS)=0.423(C.I.:0.190;0.938)
 TEST FOR HETEROGENEITY:Q=11.387 ON 5 DEGREES OF FREEDOM (P=0.044)



Negative predictors

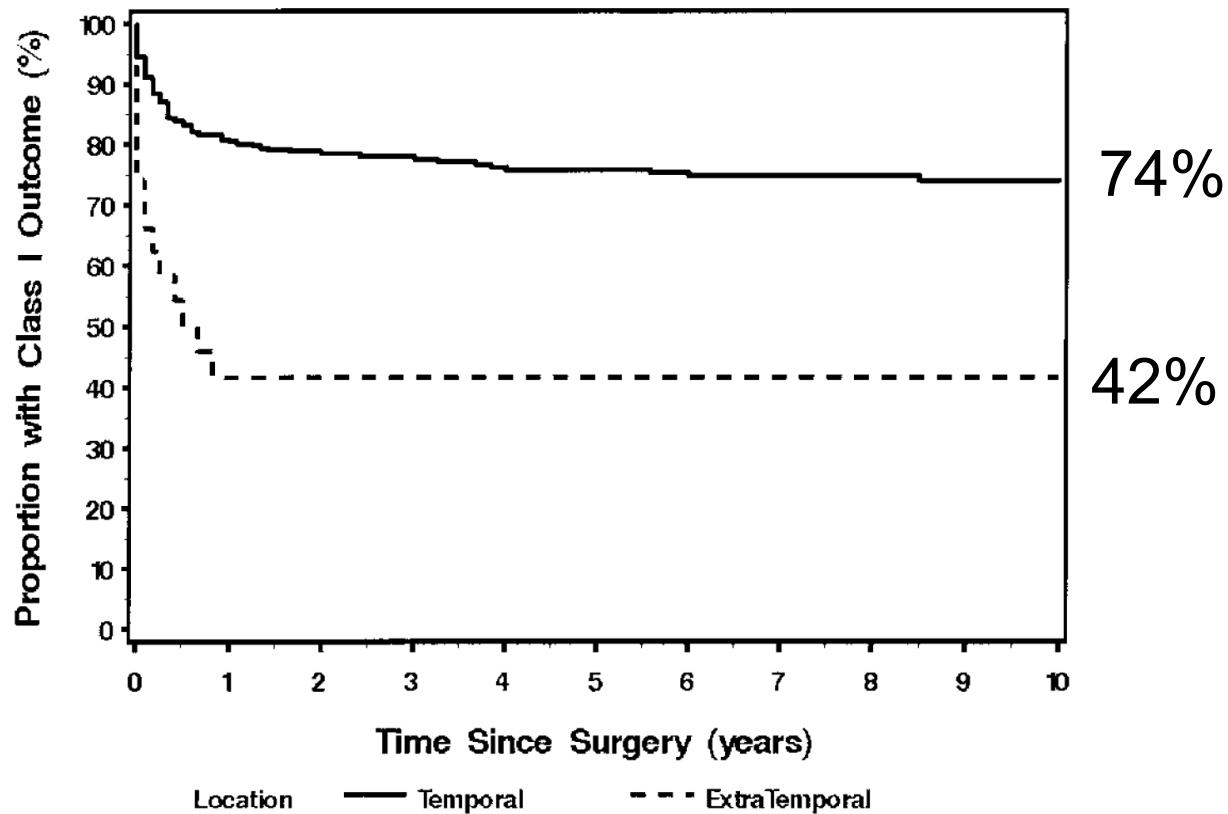


Prognostic criteria

The chance of seizure freedom after resective surgery according to:

- location of the epileptogenic zone
- TLE
- FLE
- pathology
- dual pathology
- IQ

Location of epileptogenic zone



399 consecutive epilepsy surgery patients from Mayo Clinic
372 (93%) temporal and 27 (7%) ektratemporal resection

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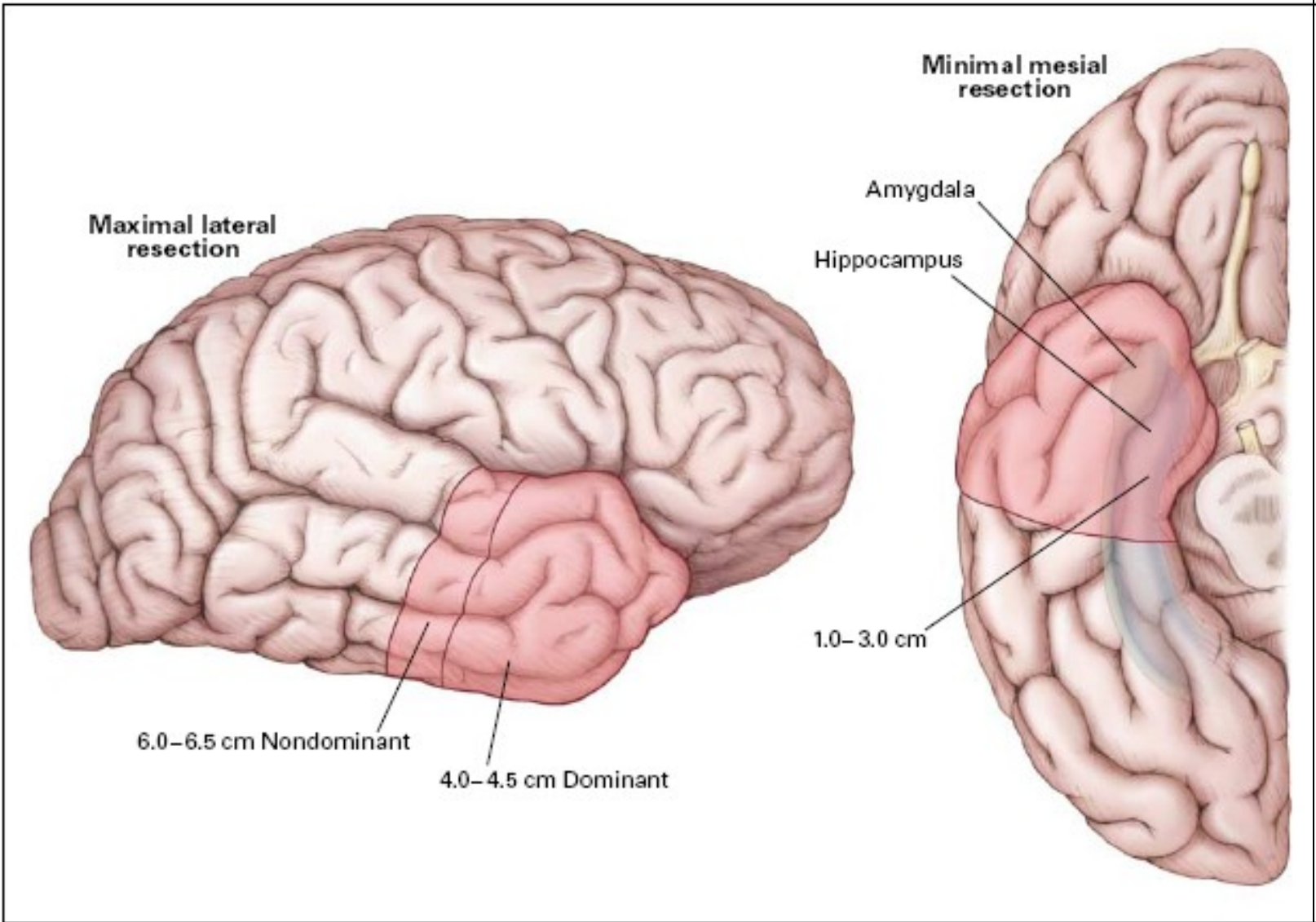
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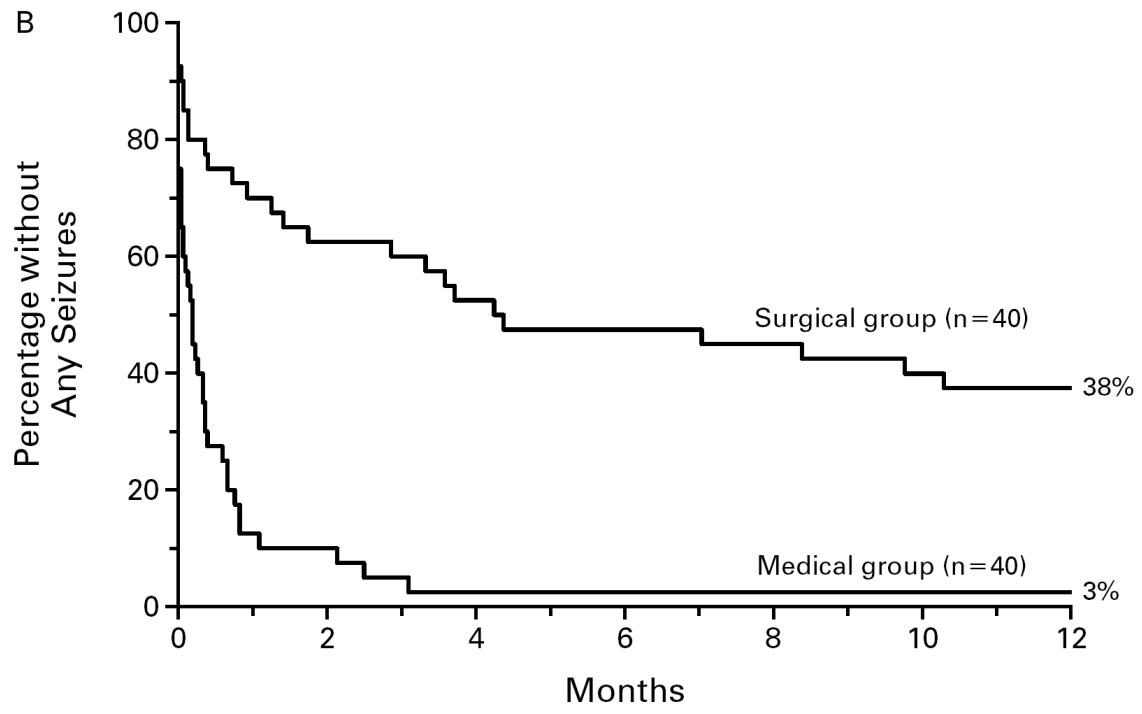
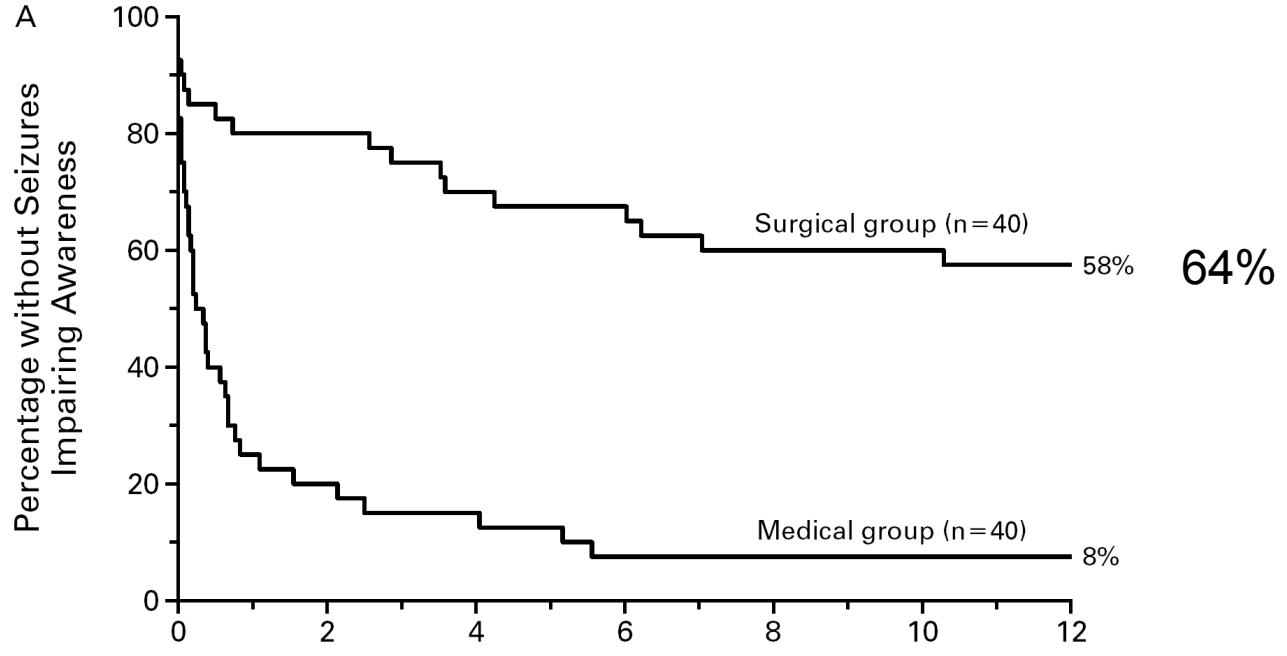


A RANDOMIZED, CONTROLLED TRIAL OF SURGERY FOR TEMPORAL-LOBE EPILEPSY

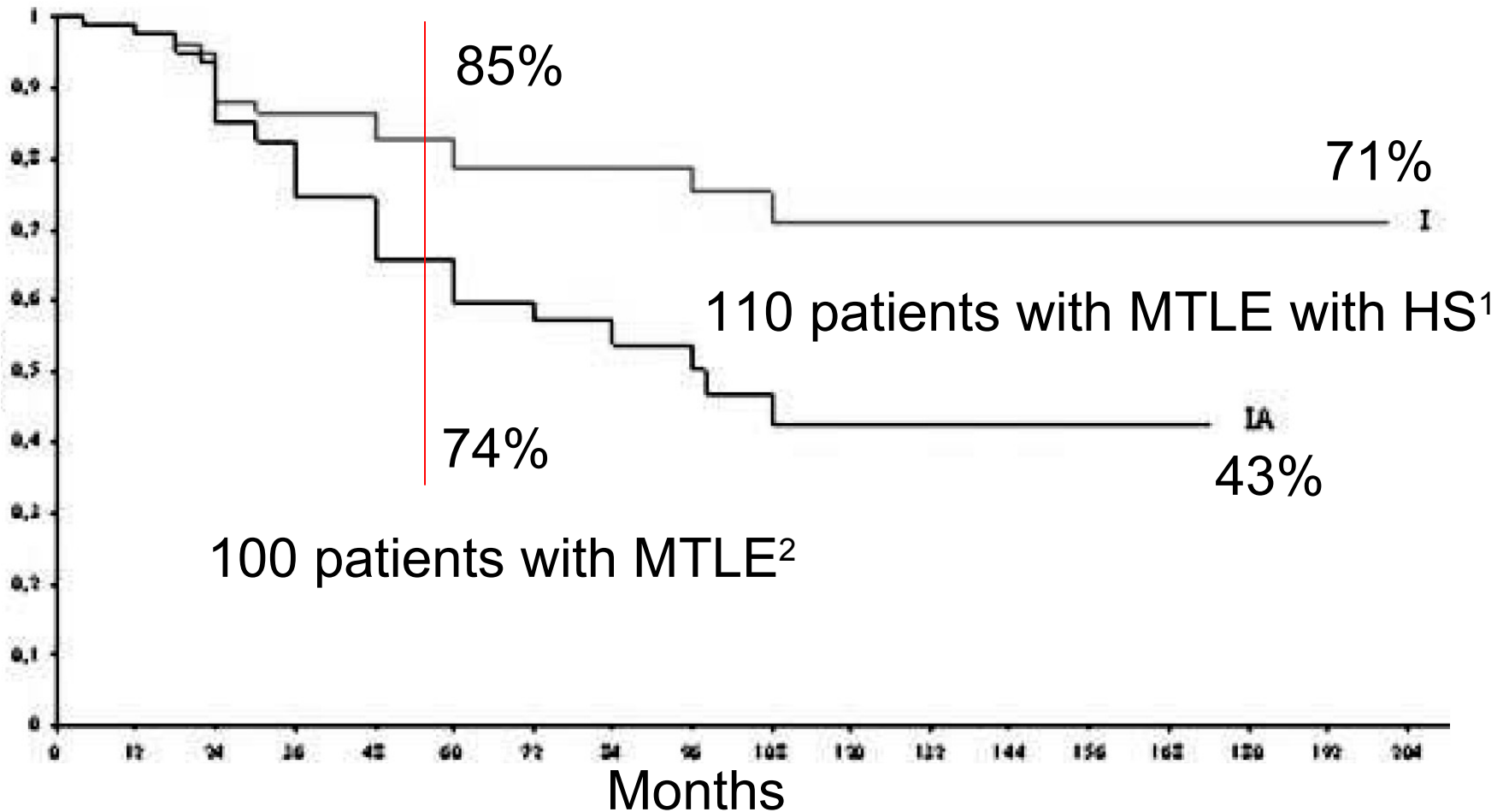
SAMUEL WIEBE, M.D., WARREN T. BLUME, M.D., JOHN P. GIRVIN, M.D., PH.D., AND MICHAEL ELIASZIW, PH.D.,
FOR THE EFFECTIVENESS AND EFFICIENCY OF SURGERY FOR TEMPORAL LOBE EPILEPSY STUDY GROUP*

Temporal lobe



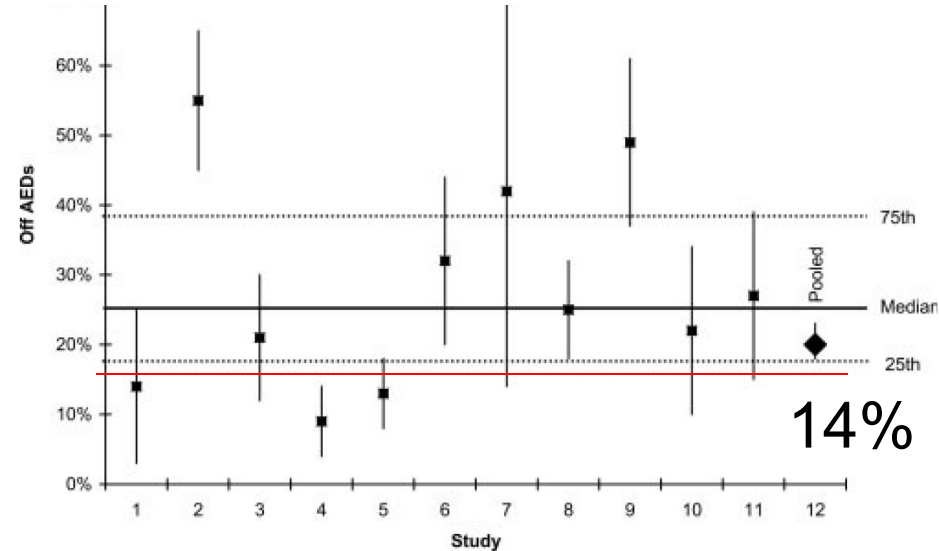
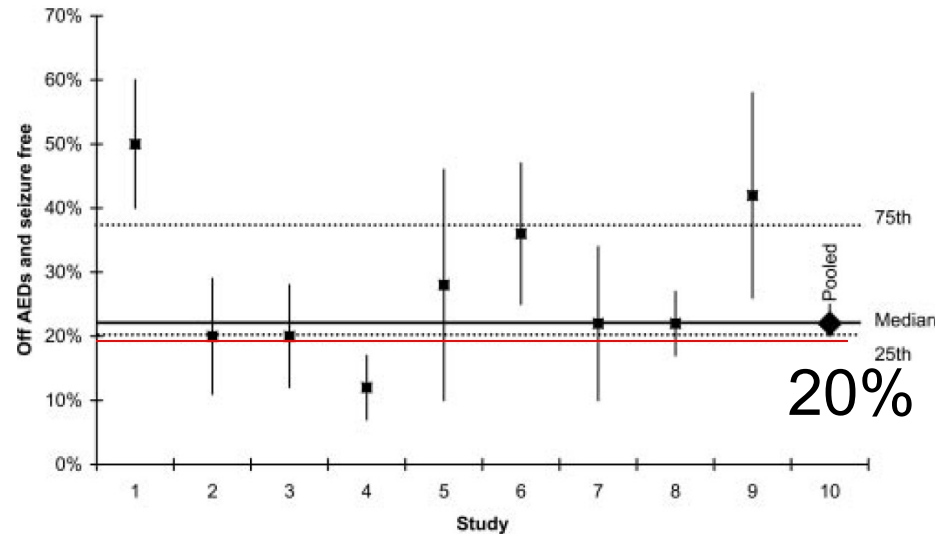


Mesial temporal lobe epilepsy



¹Dupont et al. Epilepsia 2006;47;12:2115–2124. ²Sindou. Acta neurochir 2006;148:39-45

AED after epilepsy surgery



Meta-analysis of 35 studies with mean follow-up ~6 years¹

148 patients operated for TLE: 9% off AED (4.8 years)²

¹Télez-Zenteno et al. Brain 2007;130:334-45. ²Bien et al. Epilepsia 2001;42;11:1416-21

Neocortical temporal lobe

Table 4 Studies selectively investigated the surgical prognosis of neocortical TLE

	Jung et al. (1999) ²⁴	Schramm et al. (2001) ¹⁵	Present study
Number of operated patients	31	62	29
Minimal follow-up	18 months	1 month	2 years
Ratio of postoperatively seizure-free patients	67%	79%	69%
Positive predictors	<ol style="list-style-type: none"> 1. Localized seizure onset on the invasive EEG 2. Anteriotemporal seizure onset 3. Slow ictal propagation time 	Tumorous tissue on histological examination	<ol style="list-style-type: none"> 1. Lateralized, localized seizure pattern 2. Tumor on MRI
Negative predictors			<ol style="list-style-type: none"> 1. Cortical dysplasia 2. Left-sided lesionectomy^a

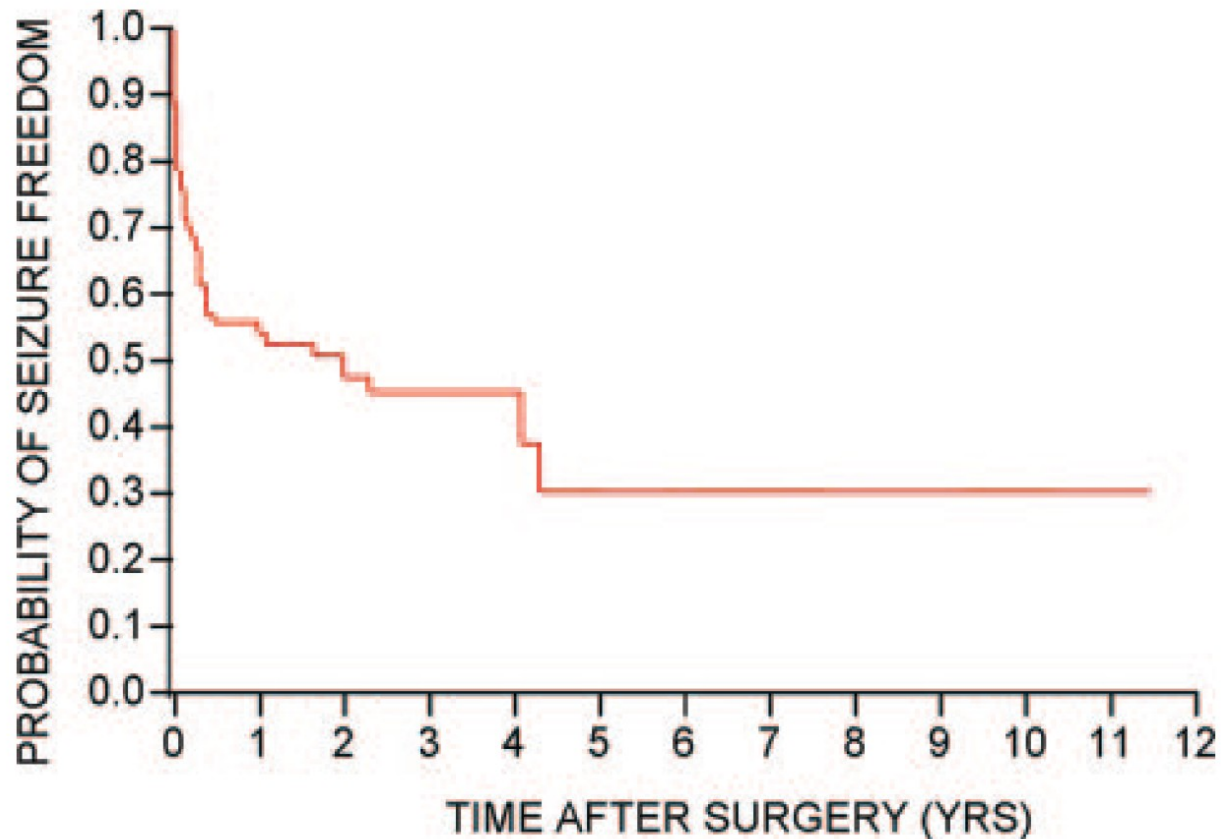
^a This variable was not found to be significant by multivariate analysis.

Prognostic criteria

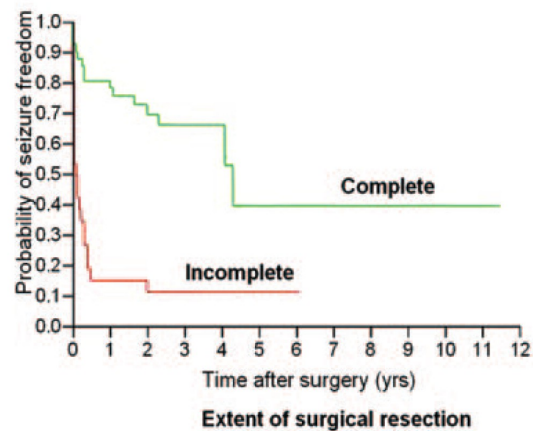
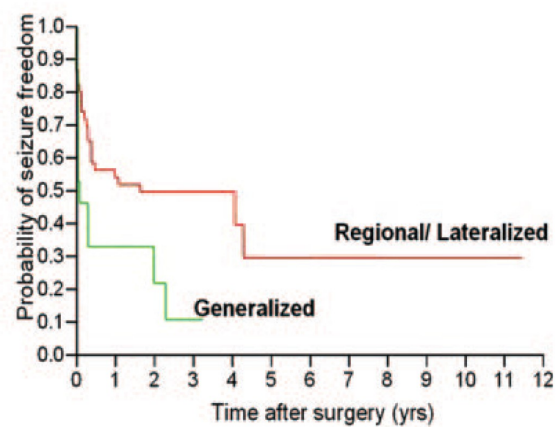
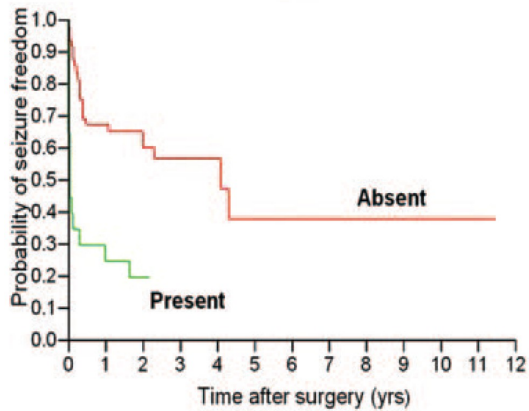
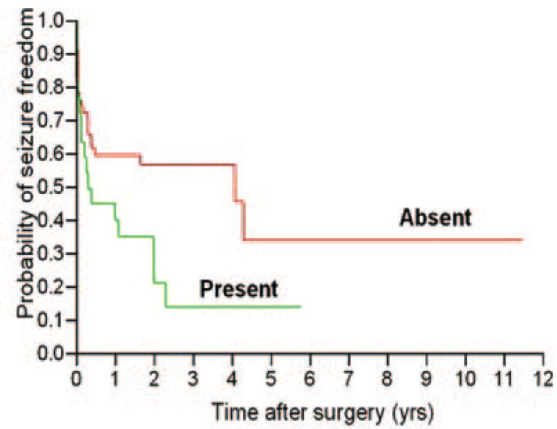
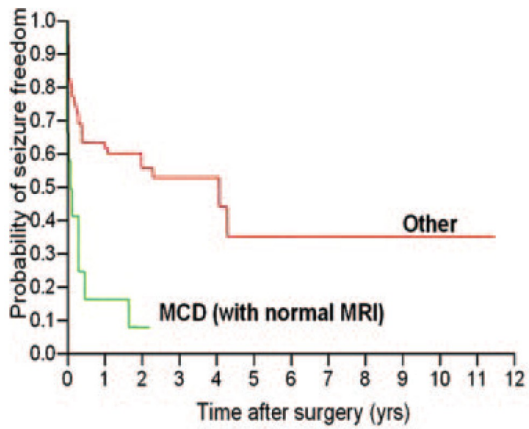
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Frontal lobe epilepsy



70 patients who underwent a frontal resection
at Cleveland Clinic 1995-2003



Frontal lobe epilepsy

Rate of seizure-freedom following FLE surgery: 13-80%

Patients with NFLE: 16/21(76%) Engel Ia (>1 y postop)¹
MRI neg. patients: 5/10 (50%) Engel Ia

¹Nobili et al. Brain 2007;130:561-73.

Prognostic criteria

The chance of seizure freedom after resective surgery according to:

- location of the epileptogenic zone
- TLE
- FLE
- **pathology**
- dual pathology
- IQ

Pathology: TS

Tuberous sclerosis

- a systematic review (1960-2006)
- 47 studies, 25 studies included
- mean follow-up: 3.7 years
- 101/177 (57%) seizure-free
- IQ<70 and tonic seizures related to recurrent seizures

Pathology: cavernoma

Cerebral cavernous malformations¹

- 168 consecutive patients with a single cavernoma
- Engel I: 70% (1y), 68% (2y), 65% (3y)

A subgroup analysis of 31 patients²

- hemosiderin completely removed:
Engel I: 77% (1y), 65% (2y), 59% (3y)
- hemosiderin partly/not removed
Engel I: 65% (1y), 41% (2y), 24% (3y)

Pathology: gangliogliomas

Gangliogliomas

- 21 patients, mean follow-up: 5.4 years
- 14/21 (67%) Engel I

Pathology: DNET

Authors & Year	No. of Patients w/ DNET	Follow Up (yrs)		Patients w/ Engel Class I
		Mean	Range	
present study	18	10.8	7.8–14.8	66.7
Daumas-Duport, et al., 1988	39	9.0	1–18	76.9
Luyken, et al., 2003	25	8.0 [†]	2–14	86.0
Fernandez, et al., 2003	14	7.3	2.1–13.9	85.7
Kirkpatrick, et al., 1993	27	5.8	1–14	81.0
Aronica, et al., 2001	13	5.0	5	58.0
Nolan, et al., 2004	26	4.3	1–11	62.0
Lee, et al., 2000	20	3.2	1.1–10	90.0
Kameyama, et al., 2001	5	2.9	0.3–6.2	80.0
Davis, et al., 1997	18	2.7	0.5–7	77.8
Raymond, et al., 1995	21	1.8	0.2–14	52.4
Raymond, et al., 1994	14	1.4	0.7–2.5	75.0
Nolan, et al., 2004	26	1.0	1	85.0
Aronica, et al., 2001	13	1.0	1	58.0
Honavar, et al., 1999	74	NR	?–18	77.8
Degen, et al., 2002	21	NR	NR	84.2
Wolf, et al., 1995	43	NR	NR	58.5
Ostertun, et al., 1996	16	NR	<0.5–7	56.3
Koeller & Dillon, 1992	6	NR	NR	82.0
Zentner, et al., 1995	19	NR	NR	71.0
Reis, et al., 2000	6	NR	0.2–1.5	66.7

* NR = not reported; ? = unknown.

[†] Number represents median value.

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Dual pathology

41 operations in 38 patients with dual pathology:
an extrahippocampal lesion plus hippocampal atrophy

- lesionectomy: 2/16 (13%) seizure-free
- mesial temporal resection: 2/10 (20%) seizure-free
- lesionectomy plus mesial temp. resec.: 11/15 (73%) s-f

Prognostic criteria

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IQ

- Epilepsy is common in the mentally retarded (20-45%)
- Epilepsy is often intractable in the mentally retarded
- Mentally retarded patients are rarely operated on (3-15%)

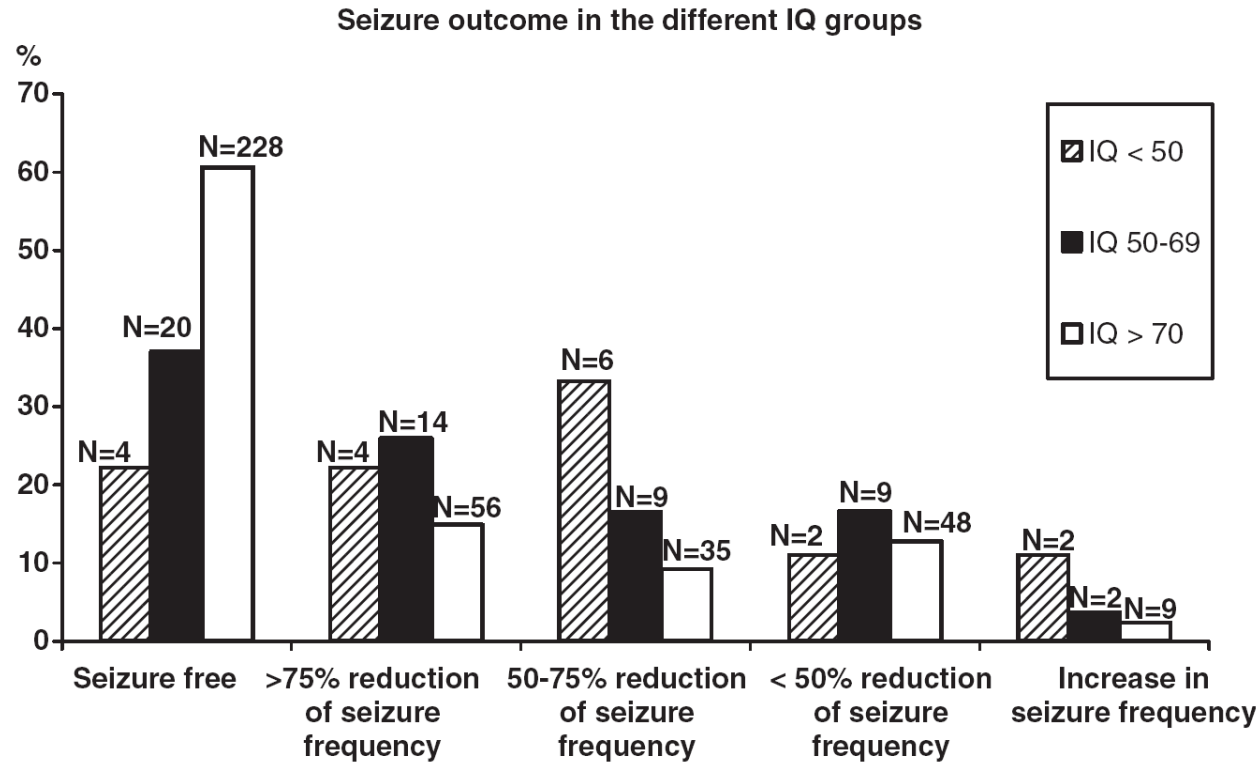
Studies have indicated that patients with low IQ have lower rates of seizure freedom after surgery

IQ

Table I Baseline seizure frequency in the different IQ groups

	IQ <50 N = 18		IQ 50-69 N = 54		IQ ≥70 N = 376	
	Median	(Q1 : Q3) ^a	Median	(Q1 : Q3)	Median	(Q1 : Q3)
Monthly total seizure frequency						
Temporal lobe epilepsy	105	(58:229)	35	(11:103)	10	(5:25)
Extratemporal epilepsy	165	(66:275)	100	(50:300)	30	(7:75)

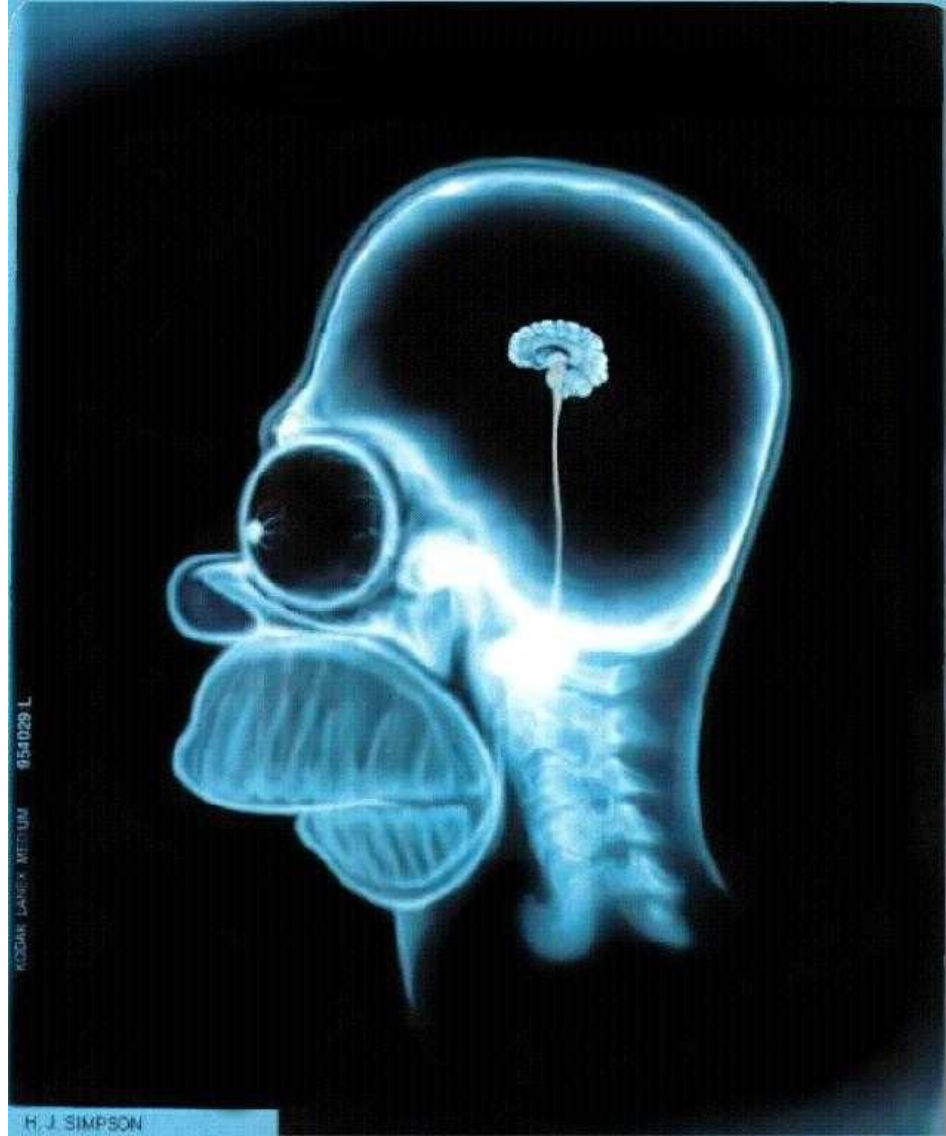
^aInterquartile range; 25th centile; 75th centile.



Conclusion

Predictors for seizure freedom after epilepsy surgery:

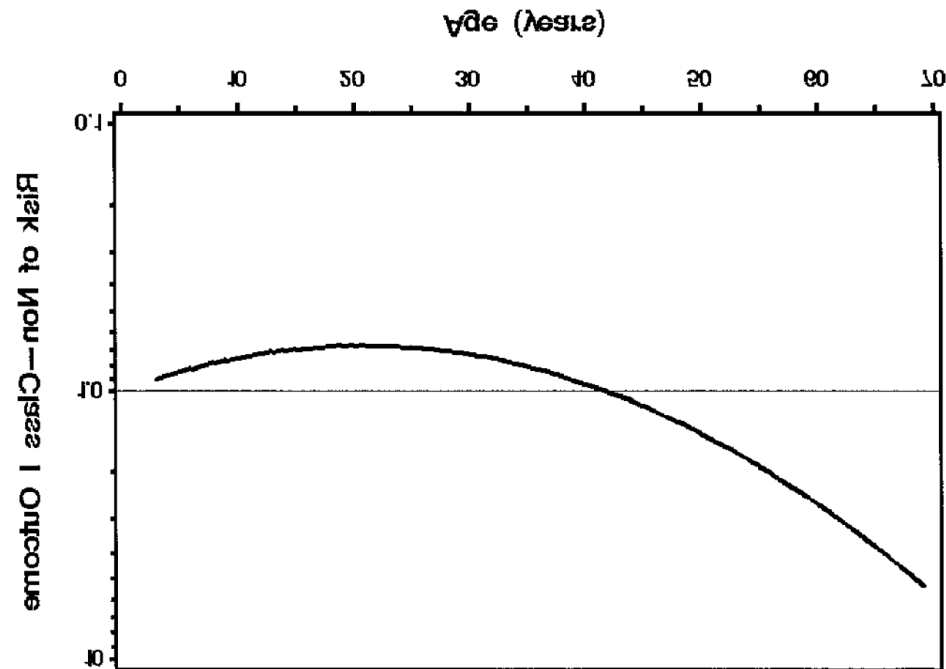
- Location of the epileptogenic zone
extraTLE < TLE < MTLE
- Pathology (MRI)
widespread/no < dual < mono < tumor/HS
- Ictal-EEG
non-localized/intracranial < localized
- Surgery
incomplete (EEG/MRI) < complete
- Age and IQ
not so young and not so clever < young and clever



Age

Temporal lobe surgery: ratio of seizure free patients

- >50 yo vs <50 yo: 0.6 (0.4-0.8)¹
- 10 years older: 0.6 (0.4-0.8)²
- age had no effect on outcome³



¹ Téllez-Zenteno. Brain 2005;128:1188-98. ² Jeong. Epilepsia 2005;46(8): 1273-9

³ McIntosh. Brain 2004;127:2018-30 ⁴ Cohen-Gadol. J Neurosurg 2006;104:513-24.