Surgical treatment of pharmacoresistant post-stroke epilepsy

รศ. นพ.บรรพต สิทธินามสุวรรณ
สาขาวิชาประสาทศัลยศาสตร์ ภาควิชาศัลยศาสตร์
คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล

Overview

- Post-stroke epilepsy
- Pharmacoresistant post-stroke epilepsy
- Presurgical consideration
- Resective surgery
- Disconnection surgery
- Neurostimulation

Reading recommendation

Poststroke seizure and poststroke epilepsy

Krittika Siritanan, MD*

**Division of Neurology, Department of Internal Medicine, Faculty of medicine Vajira hospital Navamindradhiraj University, Bangkok 10300 Thailand*

ภาวะชักและโรคลมชักจากโรคหลอดเลือดสมอง

พญ.กฤติกา ศิริธานันท์*

**สาขาประสาทวิทยา ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์วชิรพยาบาล มหาวิทยาลัยนวมินทราธิราช กรุงเทพฯ 10300 ประเทศไทย*

J Thai Stroke Soc. Volume 19 (1), 2020

Post-stroke epilepsy

- Hemorrhagic stroke
- Anterior circulation infarction
- Stroke severity
- Cortical or corticosubcortical involvement

Table 1 Seven items of the Post-Stroke Epilepsy Risk Scale

Item	Weight
Supratentorial stroke	2
ICH involving cortical areas	2
Ischaemia involving cortical or cortical-subcortical areas	1
Ischaemia + ongoing neurological deficit	1
Stroke caused neurological deficit with mRS > 3	
Seizure occurred up to 14 days after stroke	1
Seizure occurred 15 days or later after stroke	2

ICH, intracerebral haemorrhage; mRS, modified Rankin scale.

Strzelczyk A, Haag A, Raupach H, *et al*. Prospective evaluation of a post-stroke epilepsy risk scale. *J Neurol* 2010;257:1322–6.

Post-stroke epilepsy

- Medical treatment

  Prophylaxis vs. treatment

- Assessment for risk of recurrent epilepsy
- Non-pharmacologic treatment

  Surgical treatment for pharmacoresistant epilepsy

Pharmacoresistant post-stroke epilepsy

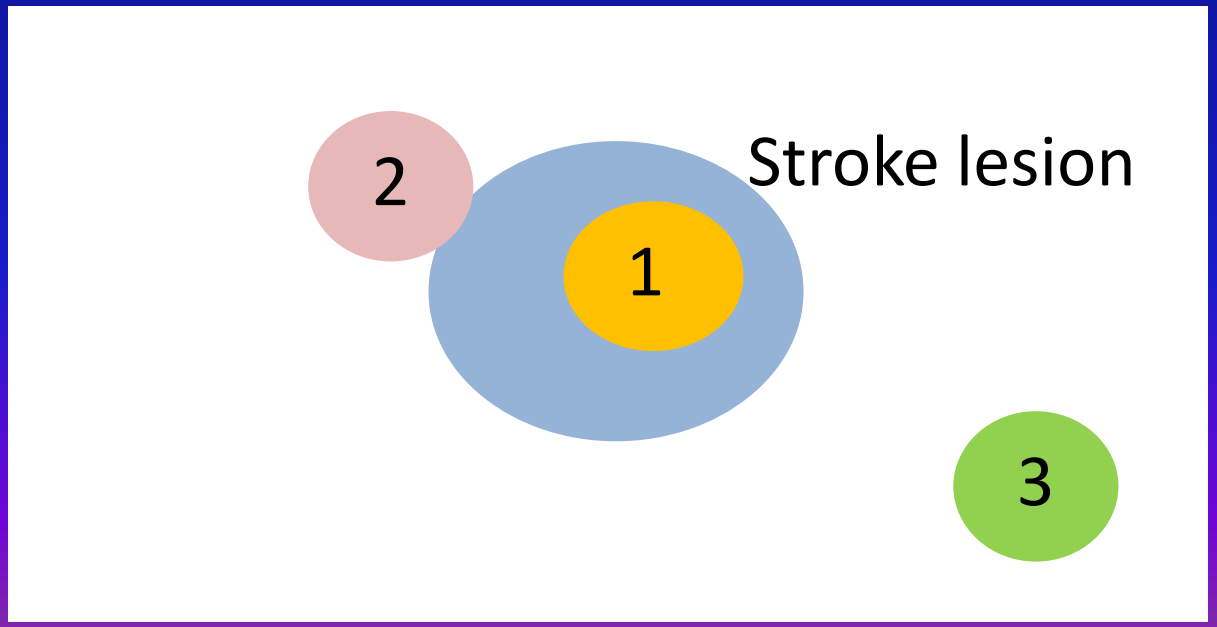
- Uncommon (< 25% of post-stroke epilepsy)
- No factor associated with occurrence of pharmocoresistant post-stroke epilepsy

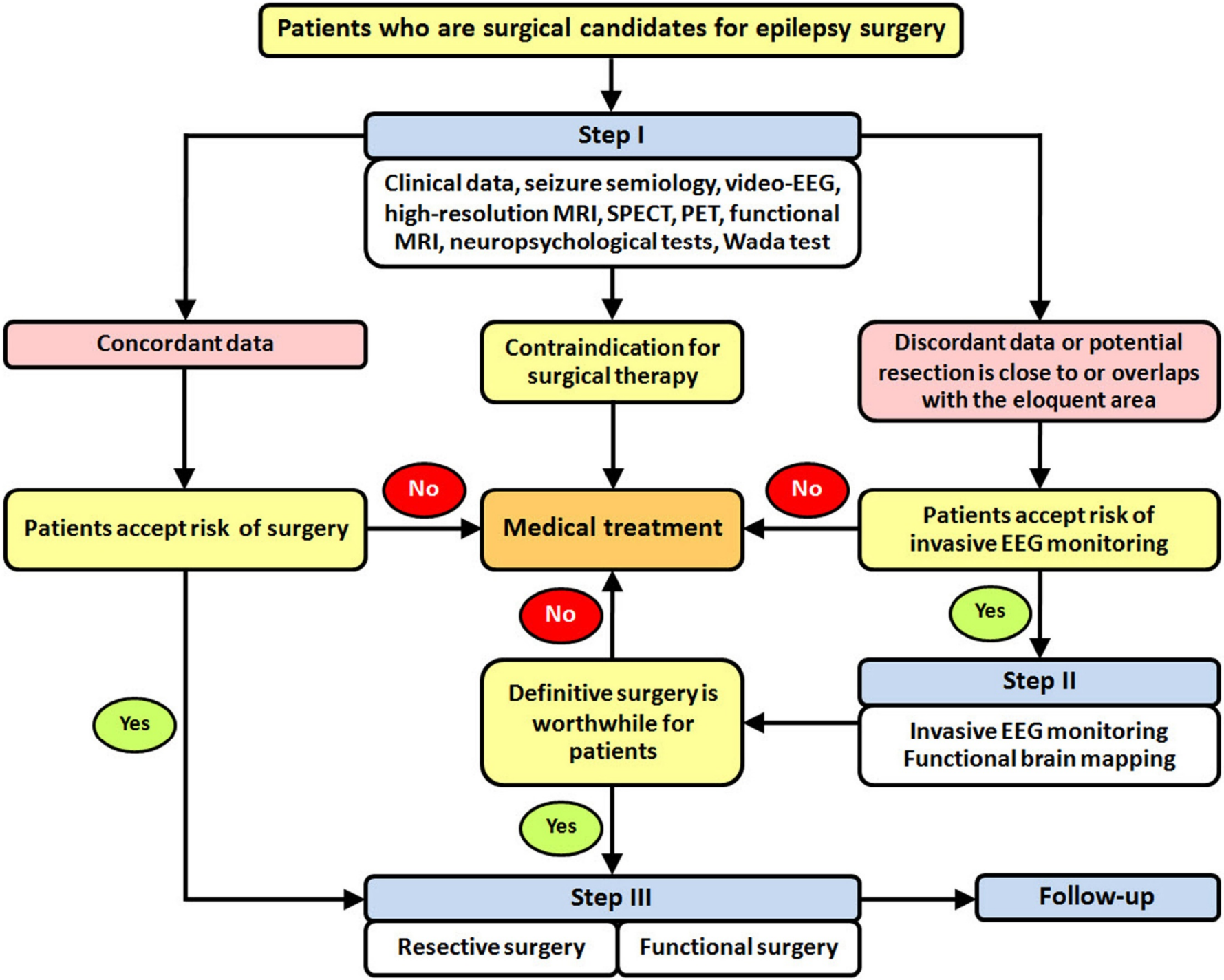
Epilepsy surgery for post-stroke epilepsy

- Goal to improve quality of life and cognitive development, and also neurological function
- Presurgical evaluation
- Resective surgery
- Neurostimulation

Possible locations of epileptogenic zone in post-stroke epilepsy

1. Intralesional
2. Perilesional (adjacent)
3. Distant




Patients who are surgical candidates for epilepsy surgery
Step I
Clinical data, seizure semiology, video-EEG, high-resolution MRI, SPECT, PET, functional MRI, neuropsychological tests, Wada test
Concordant data
Contraindication for surgical therapy
Discordant data or potential resection is close to or overlaps with the eloquent area
Patients accept risk of surgery
No
Medical treatment
No
Patients accept risk of invasive EEG monitoring
Yes
No
Step II
Invasive EEG monitoring
Functional brain mapping
Definitive surgery is worthwhile for patients
Yes
Yes
Step III
Resective surgery
Functional surgery
Follow-up

Resective surgery

- Lesionectomy
- Extended lesionectomy (lesionectomy with removal of perilesional brain tissue or hemosiderin)
- Focal resection
- Standard anterior temporal lobectomy
- Extra-temporal Lobectomy
- Multilobar resection
- Hemispherectomy

Disconnection surgery

- Corpus callosotomy
- Lobar disconnection
- Multilobar disconnection
- Hemispherotomy

Seizure: European Journal of Epilepsy 88 (2021) 116–124

Contents lists available at ScienceDirect

Seizure: European Journal of Epilepsy

journal homepage: www.elsevier.com/locate/seizure

Epilepsy surgery in stroke-related epilepsy

Miguel A. Arévalo-Astrada [a], Richard S. McLachlan [a], Ana Suller-Marti [a], Andrew G. Parrent [a], Keith W. MacDougall [a], Seyed M. Mirsattari [a], David Diosy [a], Brent Hayman-Abello [a,d], Susan Hayman-Abello [a,d], Ashley Miles [a,d], David A. Steven [a,b], Jorge G. Burneo [a,b,c,*]

[a] *Epilepsy Program, Department of Clinical Neurological Sciences, Schulich School of Medicine and Dentistry, Western University, 339 Windermere Rd. London, Ontario, Canada, N6A 5A5*

[b] *Department of Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, Western University, 339 Windermere Rd. London, Ontario, Canada, N6A 5A5*

[c] *Neuro-Epidemiology Unit, Schulich School of Medicine and Dentistry, Western University, 339 Windermere Rd. London, Ontario, Canada, N6A 5A5*

[d] *Department of Psychology, Schulich School of Medicine and Dentistry, Western University, 339 Windermere Rd. London, Ontario, Canada, N6A 5A5*

Arévalo-Astrada et al 2021

Jan 2012 - Jan 2020

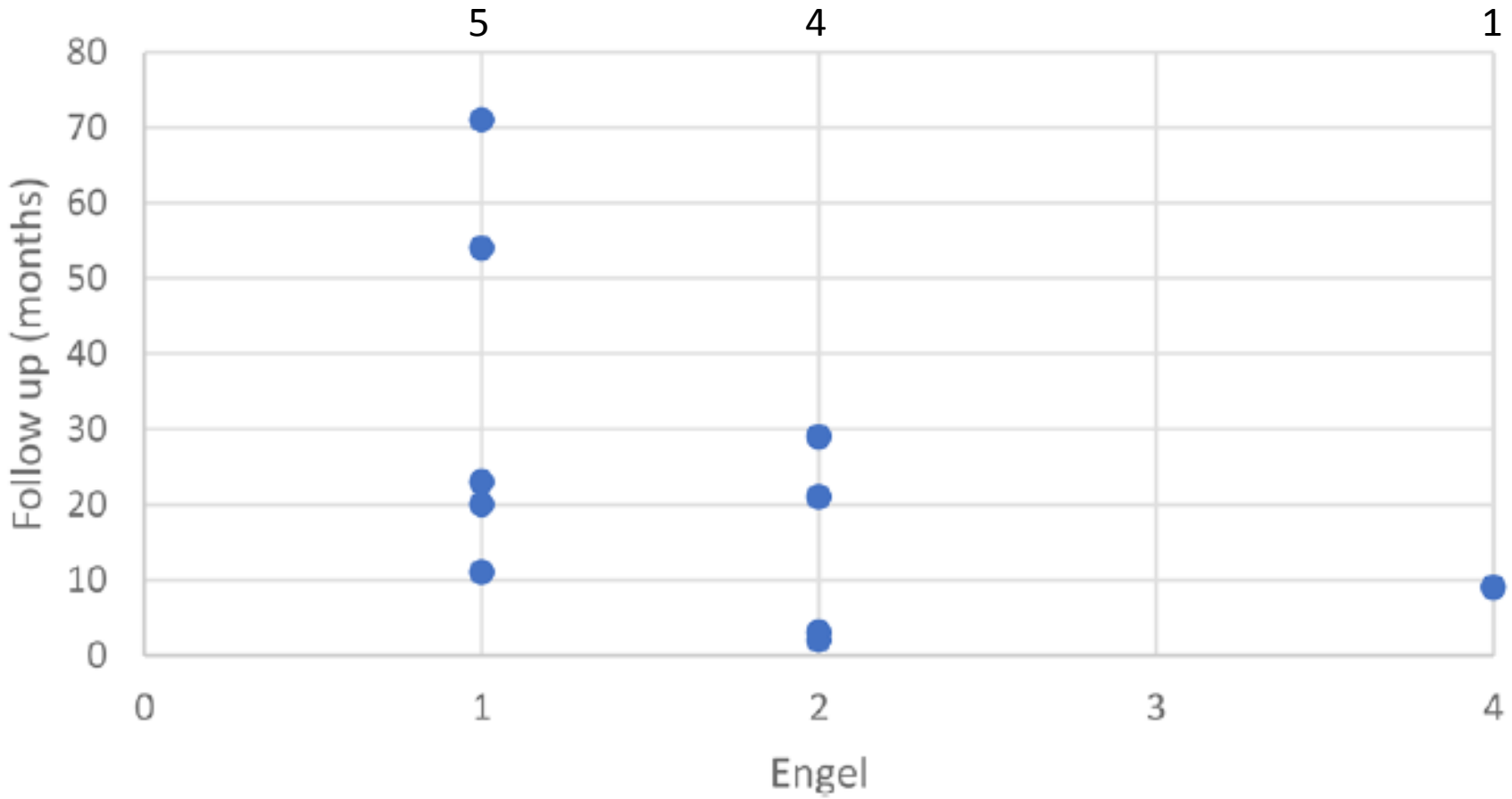
Seizure onset zone in patients who underwent intracranial EEG

- Intralesional 1 case
- Extralesional 5 cases
- Intra and extralesional 7 cases

10 underwent resective surgery
4 underwent VNS
2 underwent corpus callosotomy + VNS

Arévalo-Astrada et al 2021

10 cases who underwent resective surgery



Epilepsy Research 155 (2019) 106155

Contents lists available at ScienceDirect

Epilepsy Research

journal homepage: www.elsevier.com/locate/epilepsyres

Epileptogenicity and surgical outcome in post stroke drug resistant epilepsy in children and adults

Angela Marchi[a,b,c], Daniela Pennaroli[a], Stanislas Lagarde[a,b], Aileen McGonigal[a,b], Francesca Bonini[a,b], Romain Carron[b,d], Anne Lépine[g], Nathalie Villeneuve[e], Agnes Trebuchon[a,b], Francesca Pizzo[a,b], Didier Scavarda[f,b], Fabrice Bartolomei[a,b,*]

[a] APHM, Timone Hospital, Epileptology Department, Marseille, France
[b] Aix Marseille Univ, INSERM, INS, Inst Neurosci Syst, Marseille, France
[c] Hôpital Saint Anne, Clinical Neurophysiology Department, Paris, 75014, France
[d] APHM, Timone Hospital, Functional and Sterotactical Neurosurgery Department, Marseille, France
[e] Hôpital Henri Gastaut, Marseille, France
[f] APHM, Timone Hospital, Paediatric Neurosurgery Department, Marseille, 13005, France
[g] APHM, Timone Hospital, Paediatric Department, Marseille, 13005, France

Marchi et al 2019

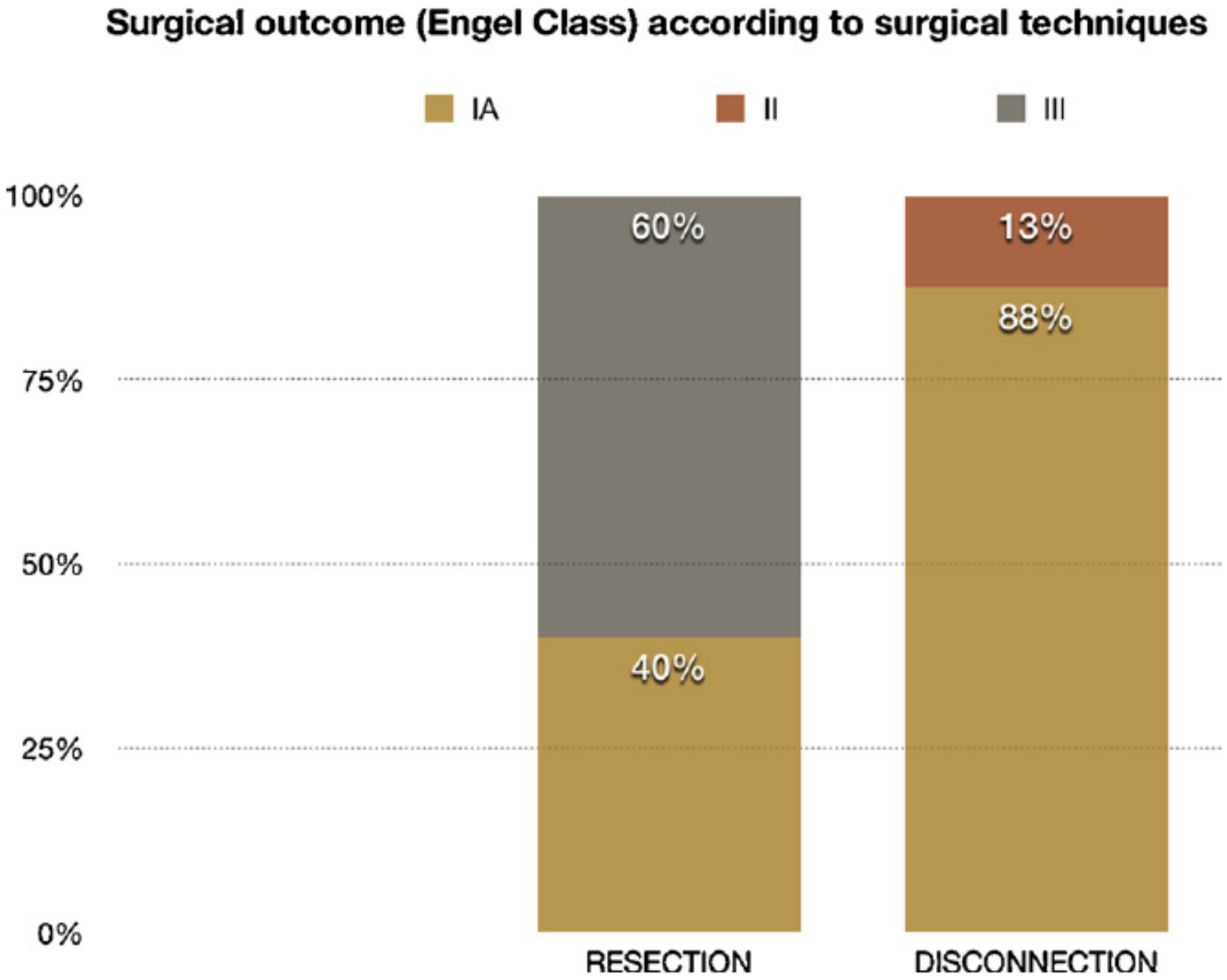
2000 - 2016

21 patients with focal drug-resistant epilepsy secondary to vascular destructive lesion

Perinatal stroke 14
Postnatal stroke 7

Ischemic 17
Hemorrhagic 3
Post-infectious vascular event 1

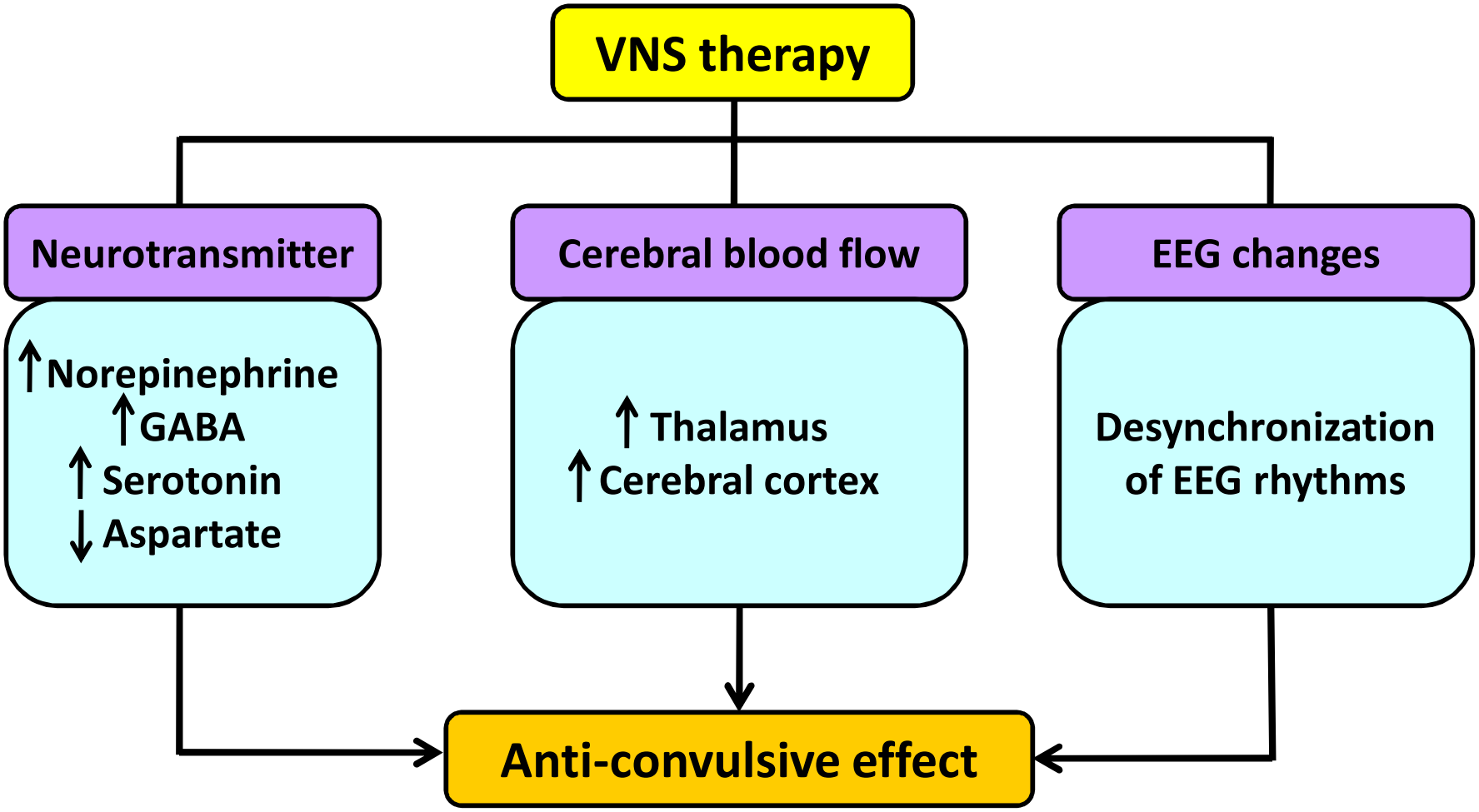
Marchi et al 2019



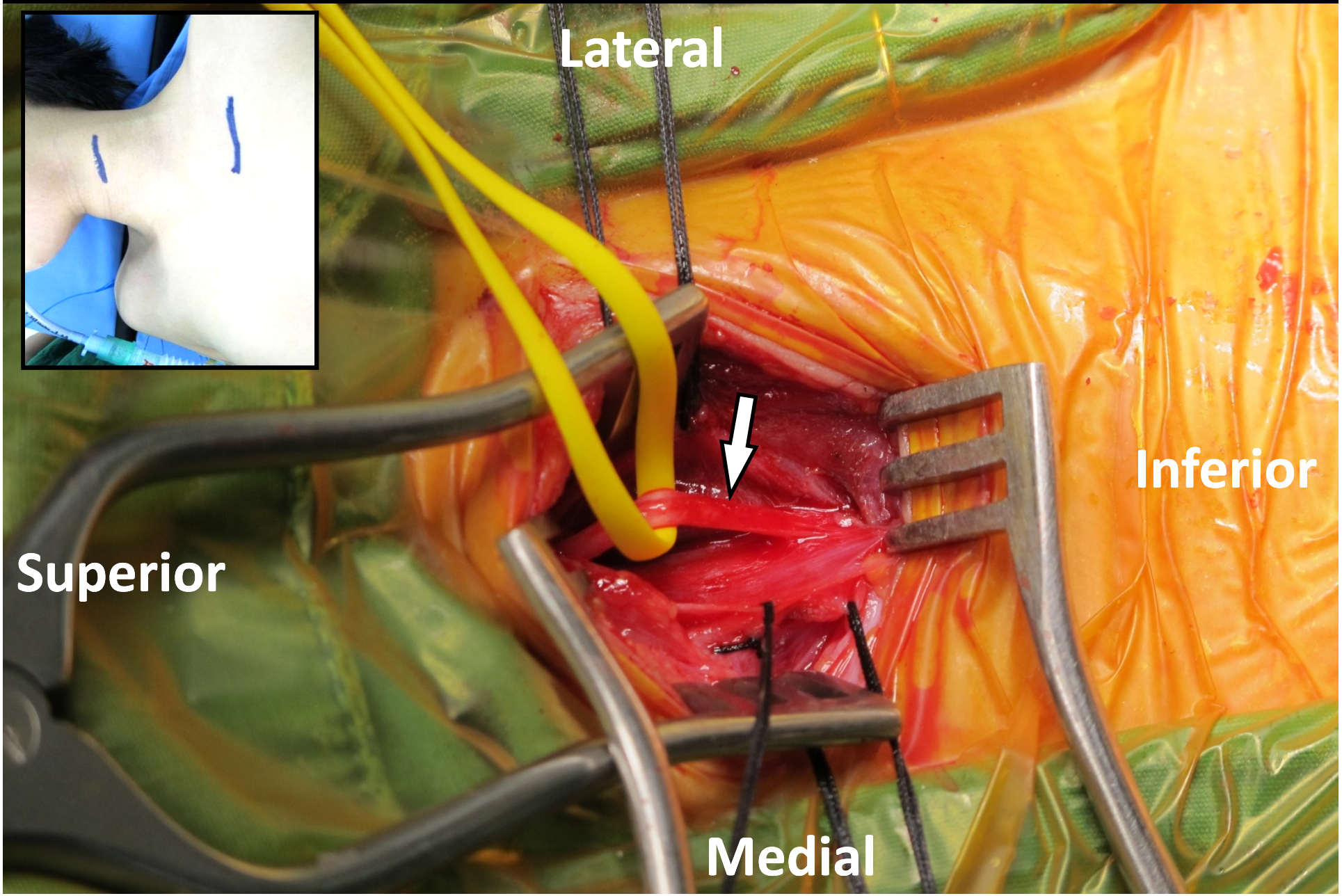
Neurostimulation

- Vagus nerve stimulation

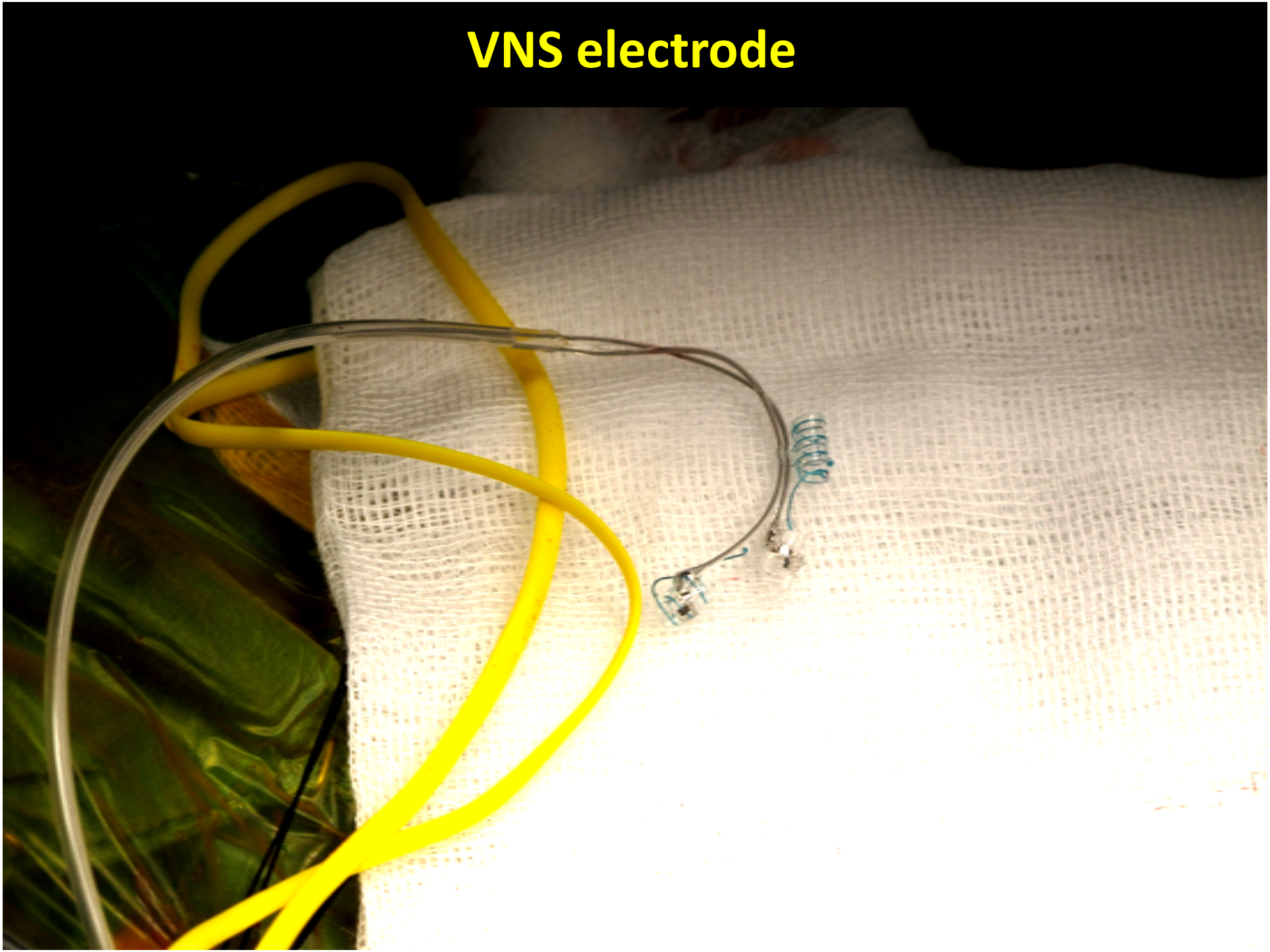
Vagus nerve stimulation

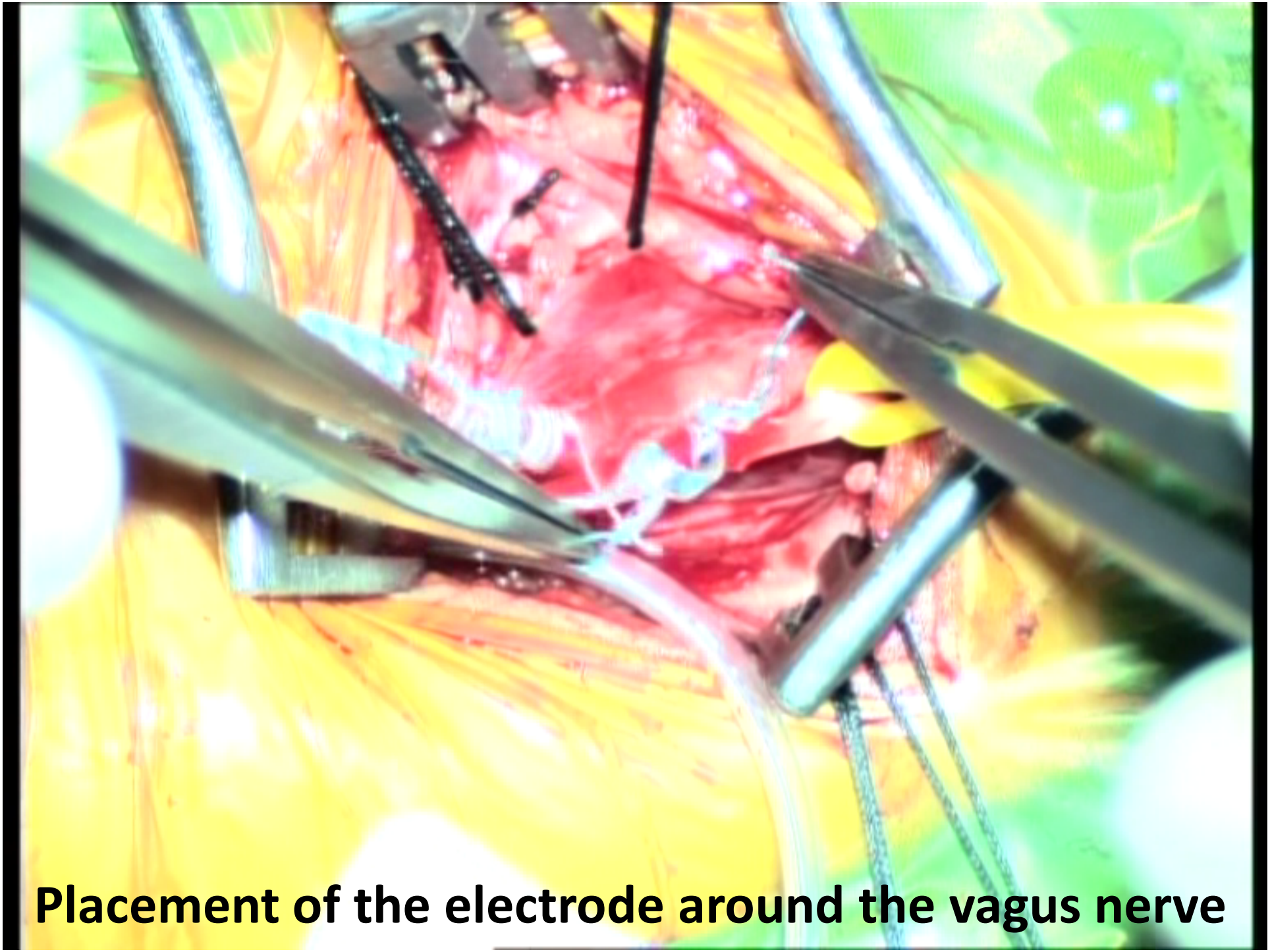


Exposure of the left vagus nerve

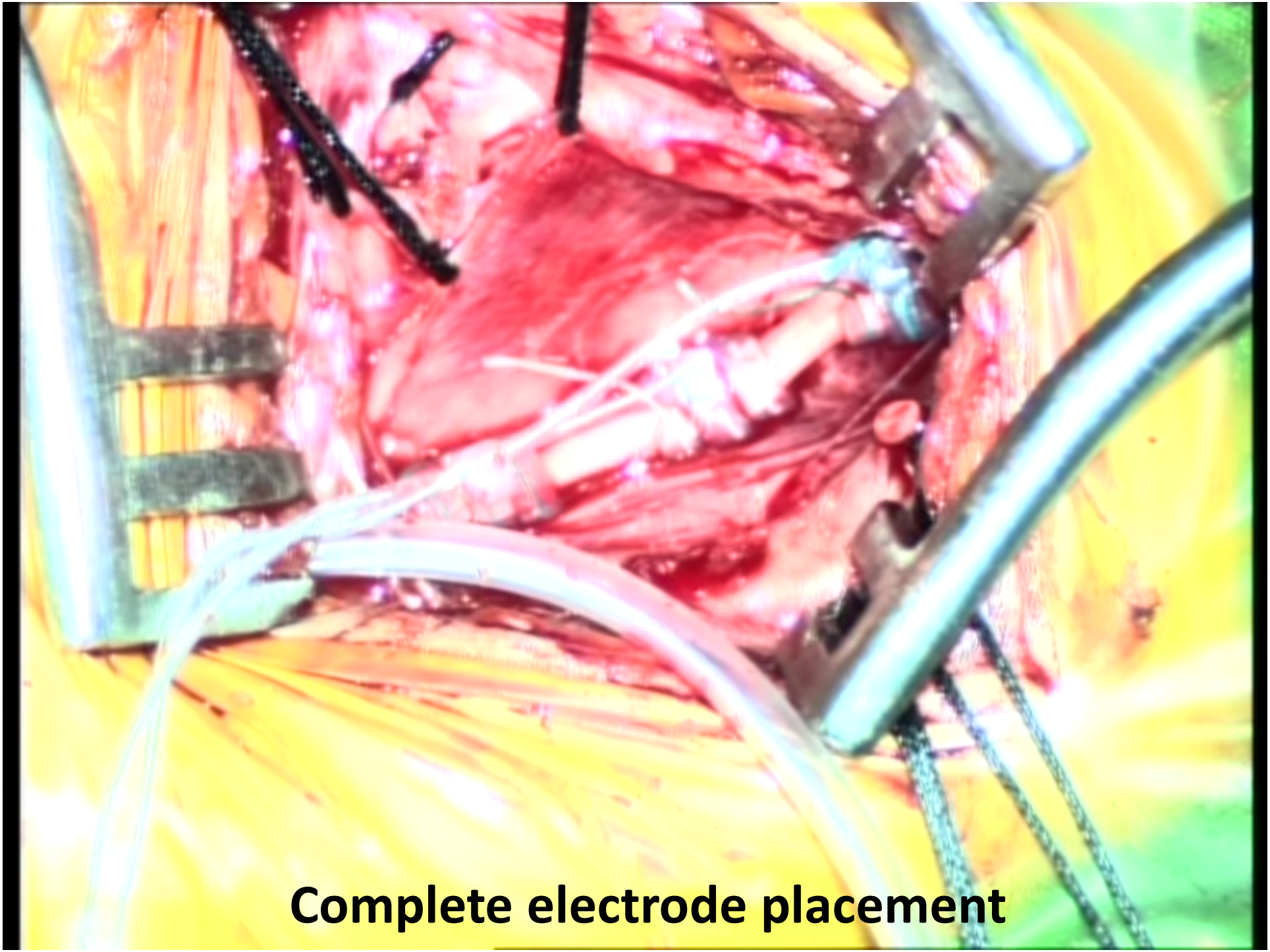


VNS electrode



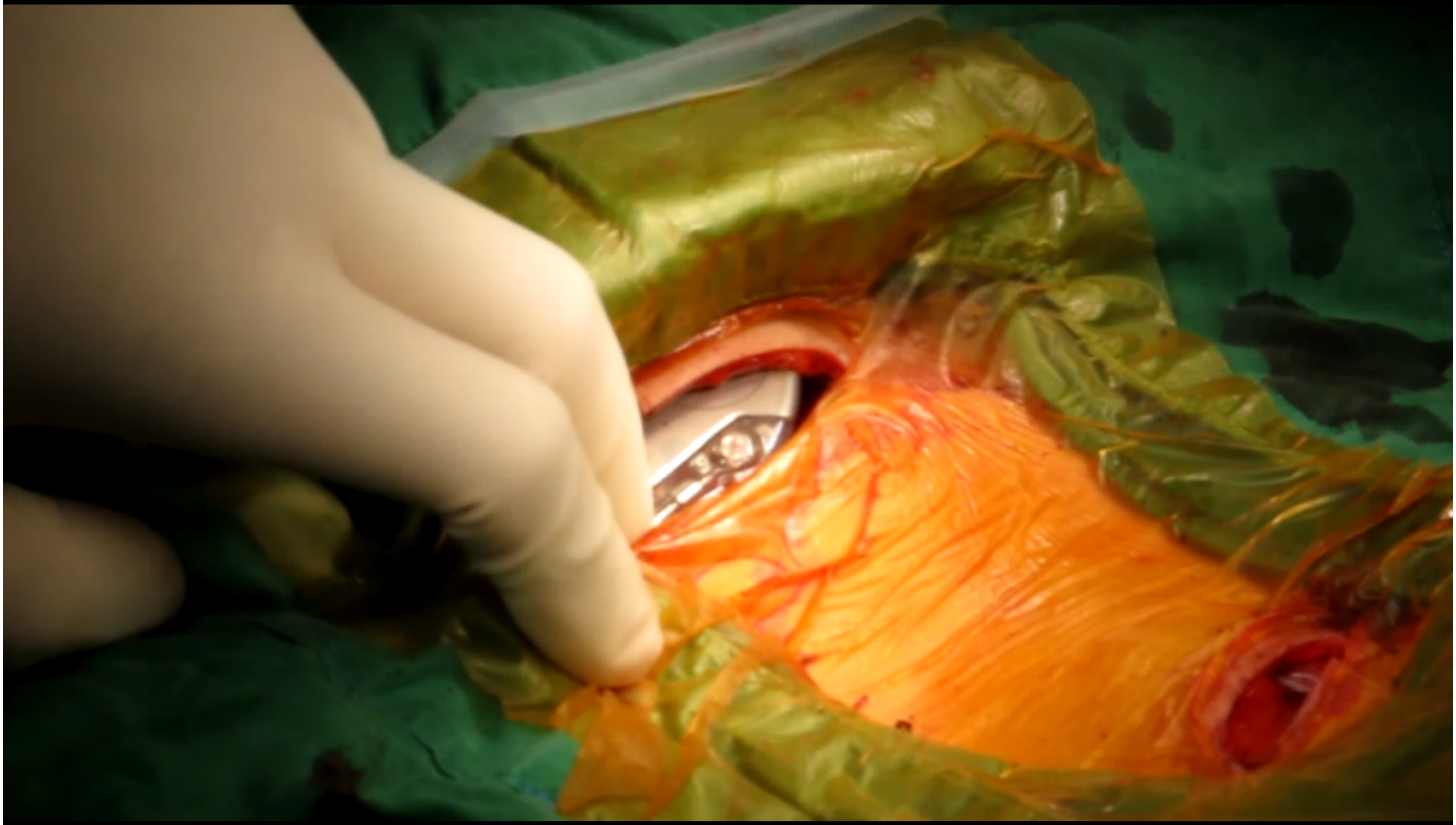


Placement of the electrode around the vagus nerve

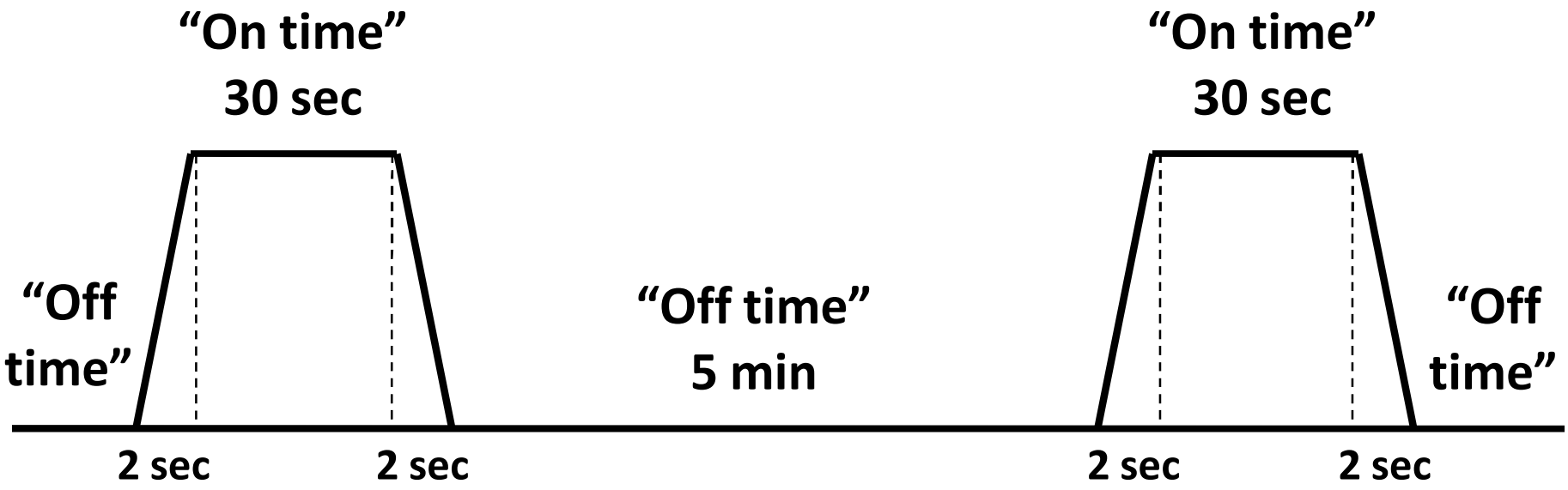

Complete electrode placement

Connection between caudal end of the electrode and pulse generator

Insertion of the pulse generator into the infraclavicular subcutaneous pocket



VNS standard setting



Output current: 0.25, 0.5, 0.75, 1.0, 1.25, 1.5 mA
Frequency 20, 30 Hz
Pulse width 250, 500 usec

World Neurosurg. (2020) 133:e448-e451.

ORIGINAL ARTICLE

Efficacy of Vagal Nerve Stimulation for Pharmacoresistant Poststroke Epilepsy

Yuichi Kubota[1,2], Hidetoshi Nakamoto[1,2], Satoru Miyao[1,2], Takakazu Kawamata[2]

From the [1]Department of Neurosurgery, Stroke and Epilepsy Center, TMG Asaka Medical Center, Saitama; and [2]Department of Neurosurgery, Tokyo Women's Medical University, Tokyo, Japan

10 patients who were not candidate for resective surgery
Mean age 64.5 years
Follow up 2 years or more following VNS
Mean VNS intensity 1.75 mA (1.25 – 2.0 mA)

Kubota et al 2020

Table 1. The Characteristics of Patents with Pharmacoresistant Poststroke Epilepsy

Case Number	Sex	Age at VNS Implantation (Years)	Stroke Type	Involved Region	Duration from Stroke Onset to Seizure Onset (Months)	Duration from Seizure Onset to Implantation (Months)	Current AEDs (mg)	Preoperative Seizure Frequency	VNS Intensity (mA)	Postoperative Follow-Up Period (Years)	Postoperative Seizure Frequency	Engel Classification	Mchugh Classification	Magnet Use
1	F	70	SAH	Left temporal	7	109	LEV 3000, LTG 400, CBZ 300	Monthly	2.00	7	Yearly	IIB	II	Yes
2	F	68	ICH	Right frontal	5	30	VPA 400, ZNS 200, PB 60	Monthly	2.00	6	Yearly	IB	I	Yes
3	F	70	CI	Left frontal	6	15	VPA 400, LEV 1000	Monthly	1.50	6	None	IA	I	No
4	M	64	ICH	Left frontal	1	29	LEV 1000, CBZ 400	Monthly	1.50	5	None	IA	I	Yes
5	F	71	SAH	Left temporal	10	51	LEV 3000, CBZ 200, LTG 200	Monthly	2.00	4	Yearly	IIB	II	Yes
6	F	62	SAH	Left frontal	8	30	LEV 3000, ZNS 200, PHT 200	Monthly	1.75	4	Monthly	IIIA	II	Yes
7	M	65	ICH	Right parietal	77	92	LEV 3000, CBZ 400	Monthly	2.00	2	Monthly	IIIA	II	Yes
8	M	23	ICH	Left parietal	0	61	LEV 3000, CBZ 700	Monthly	1.25	2	None	IB	I	Yes
9	M	80	ICH	Left temporal	36	268	LCM 100, LEV 3000	Monthly	1.50	2	None	IA	I	No
10	M	72	SAH	Right temporal	7	14	LCM 400, GBP 1200	Monthly	2.00	2	Yearly	IIA	II	No

VNS, vagal nerve stimulation; AED, antiepileptic drug; F, female; SAH, subarachnoid hemorrhage; LEV, levetiracetam; LTG, lamotrigine; CBZ, carbamazepine; Monthly, 2—12 seizures per year; Yearly, 0—1 seizure per year; ICH, intracerebral hemorrhage; VPA, valproate; ZNS, zonisamide; PB, phenobarbital; CI, cerebral infarction; M, male; PHT, phenytoin; LCM, lacosamide; GBP, gabapentin.

Kubota et al 2020

VNS is potentially safe and effective option for patients with pharmacoresistant post-stroke epilepsy

If seizures are not controlled with AEDs, VNS should be considered in early stage from a physical and economic point of view

Conclusions

- Epilepsy surgery is still effective in the treatment of pharmacoresistant post-stroke epilepsy
- Special consideration of epileptogenic location “intralesional” “perilesional” “distant”
- Presurgical consideration as pharmacoresistant epilepsy due to other causes

Conclusions

- Resective and disconnection surgeries render favorable seizure outcome in well-selected patients
- Vagus nerve stimulation is an interesting treatment option in patients with pharmacoresistant post-stroke epilepsy