Status Epilepticus efter hjärtstopp -kan det behandlas?

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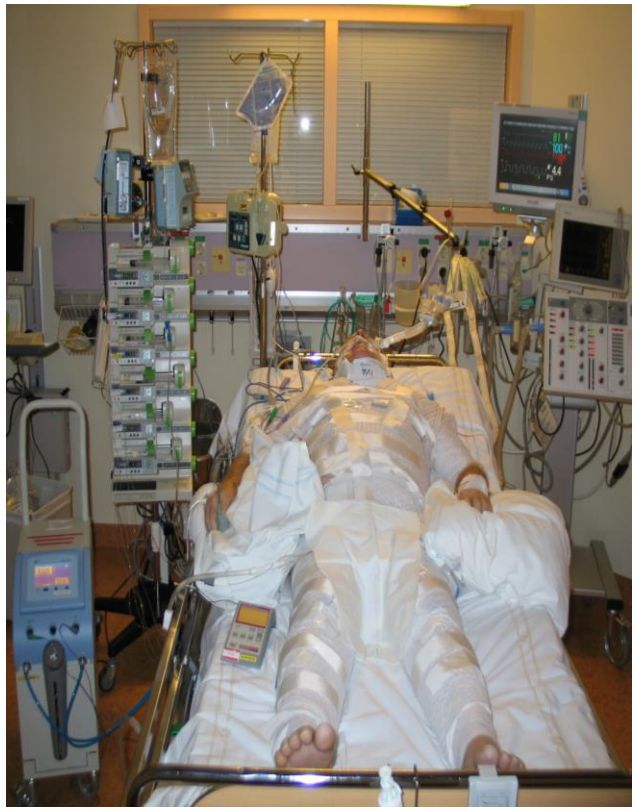
Skånes Universitessjukhus
Lunds Universitet

En patient har kramper efter hjärtstopp

2 viktiga frågor

- Vad innebär det för prognosen?
- (Hur) skall vi behandla?



Terminologin för kramper efter hjärtstopp är förvirrande

Myoclonus*	Epileptiformt EEG	Terminologi
Ja	Ja	Myoklont status epilepticus (MSE)

* Generaliserat > 30 min

AAN-guidelines, Wijdicks et al, *Neurology*, 2006

Kramper kan manifestera sig kliniskt och/eller elektrografiskt

Myoclonus*	Epileptiform EEG	Terminology
Ja	Ja	Myoklont status epilepticus (MSE)
Ja	Nej/oklart	Status Myoclonus

* Generaliserat > 30 min

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Myoclonus*	Epileptiform EEG	Terminology
Ja	Ja	Myoklont status epilepticus (MSE)
Ja	Nej/oklart	Status Myoclonus
Nej	Ja	Non-Konvulsivt Status Epilepticus (NCSE)

* Generaliserat > 30 min

Hur vanligt är kliniska kramper?

TTM studien 2010-13

Table 2
Frequency of clinical seizures.

Seizure type	TTM33 (n = 473)	TTM36 (n = 466)	All (n = 939)
Any seizure	147 (31%)	121 (26%)	268 (29%)
Myoclonic	132 (28%)	108 (23%)	240 (26%)
Status myoclonus	37 (8%)	36 (8%)	73 (8%)
Focal myoclonus	48 (10%)	33 (7%)	81(8%)
Tonic-clonic	37 (8%)	34 (7%)	71 (8%)
Tonic-clonic status	12 (3%)	8 (2%)	20 (2%)
Focal tonic-clonic seizures	6 (1%)	5 (1%)	11 (1%)
Combination[a]	22 (5%)	21 (5%)	43(5%)

Lybeck, *Resuscitation*, 2017

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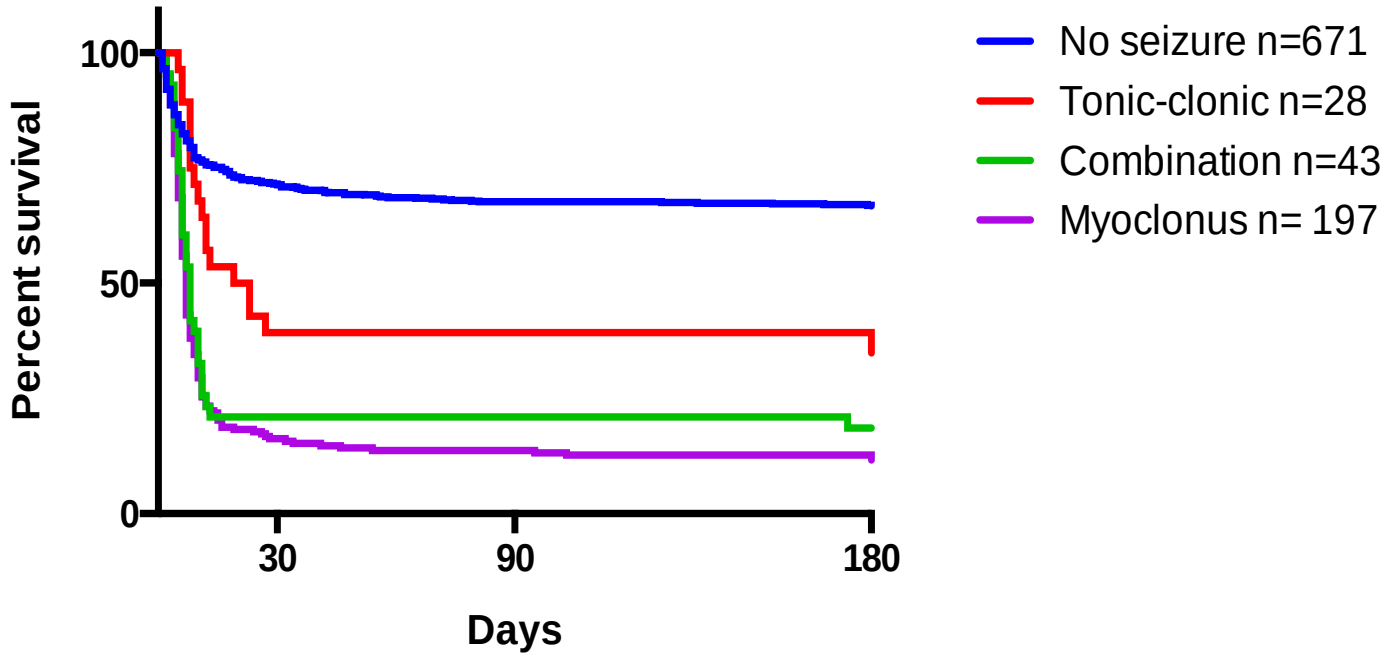
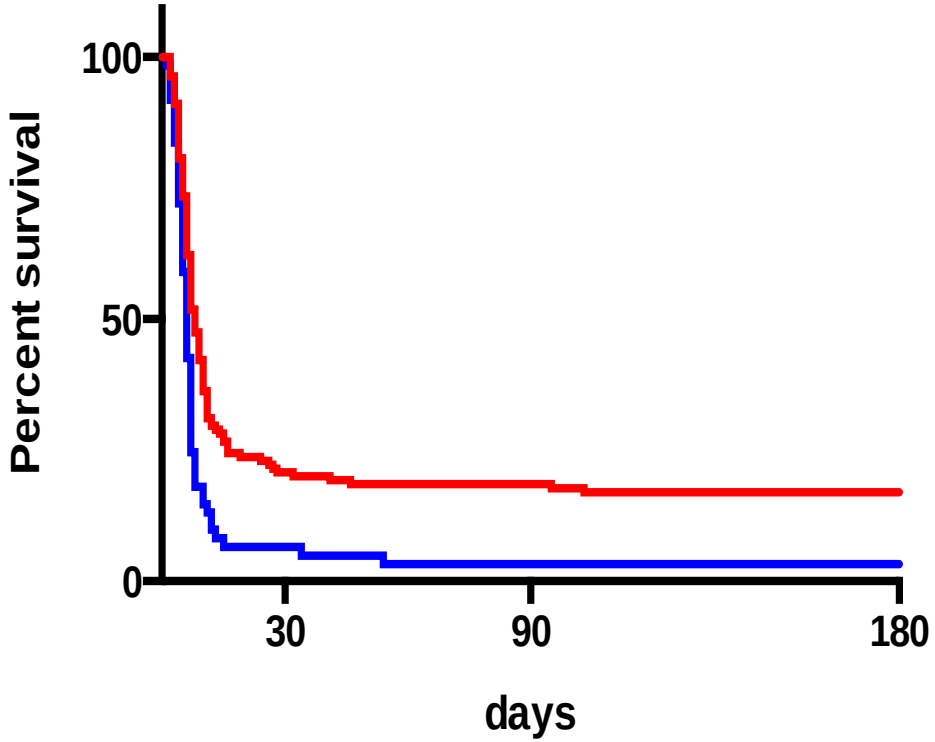
Lybeck, *Resuscitation*, 2017

Kramper är ett dåligt tecken



Lybeck, *Resuscitation*, 2017

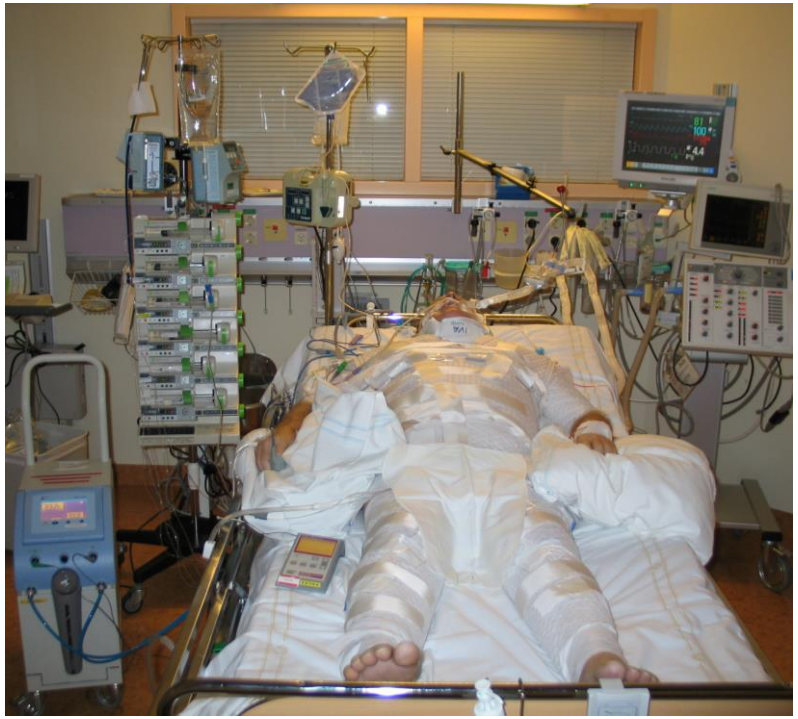
Status myoklonus är ett **mycket** dåligt tecken



60/61 med status myoklonus fick ett dåligt utfall

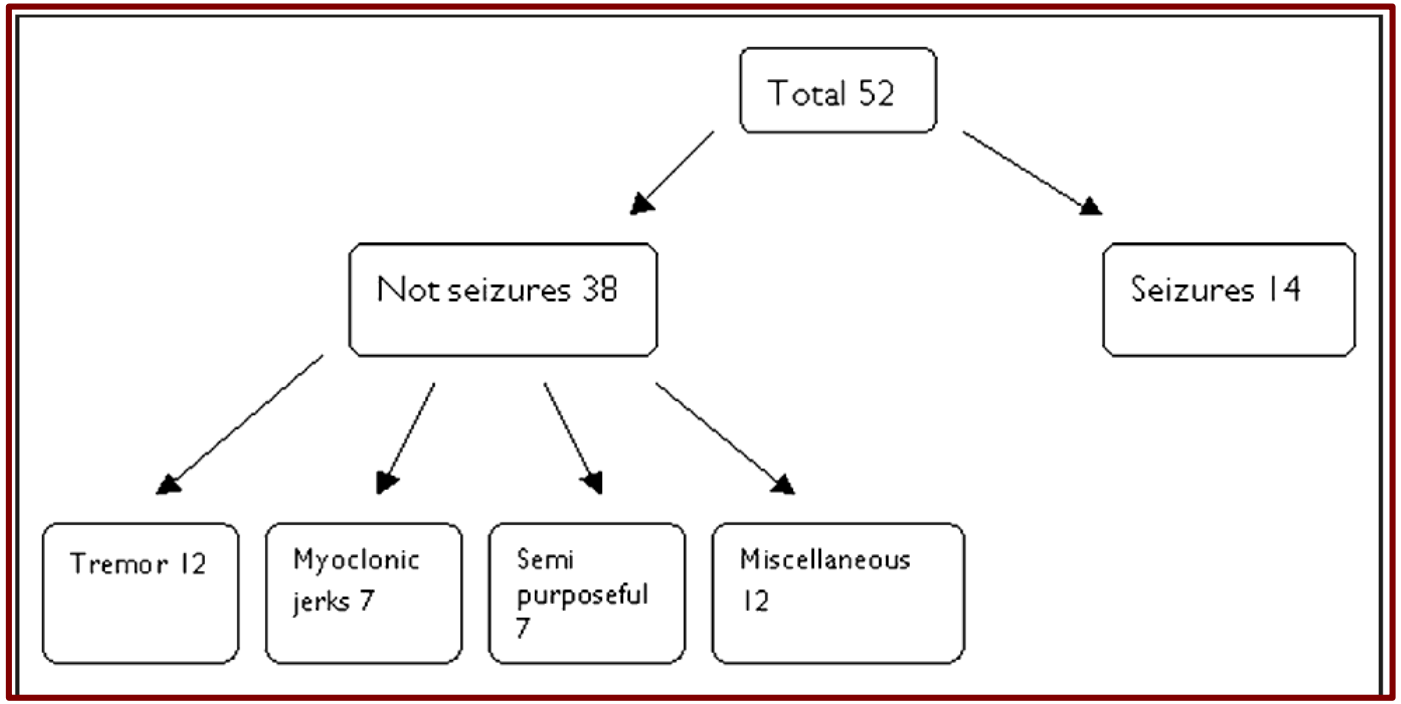
Lybeck, *Resuscitation*, 2017

Modern intensivvård försvårar vår neurologiska bedömning



- Temperaturreglering till 33 eller 36°C
- Sedation, analgesi och muskelrelaxation
- Förlångsammad metabolism av läkemedel
- Kliniska kramper maskeras

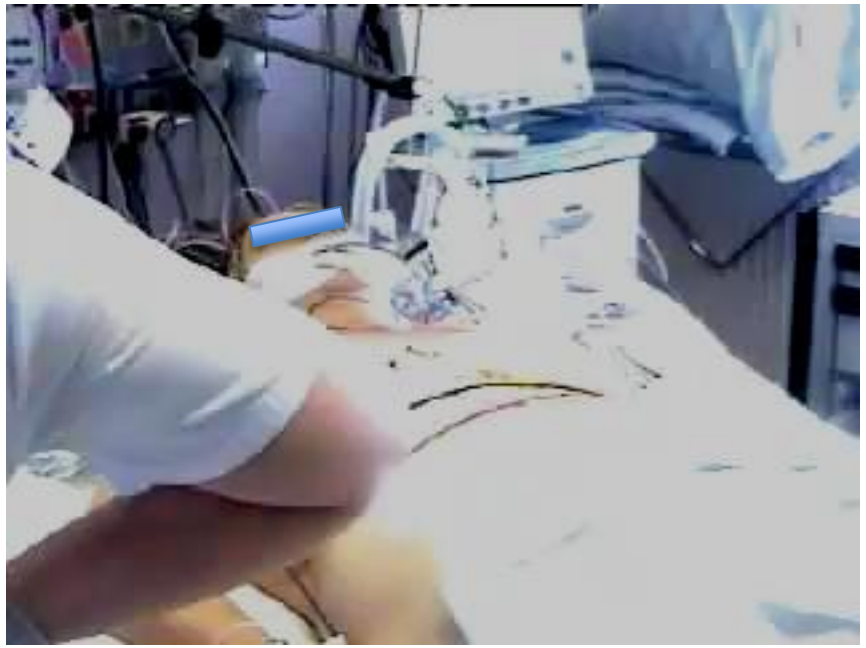
What's shaking in the ICU?

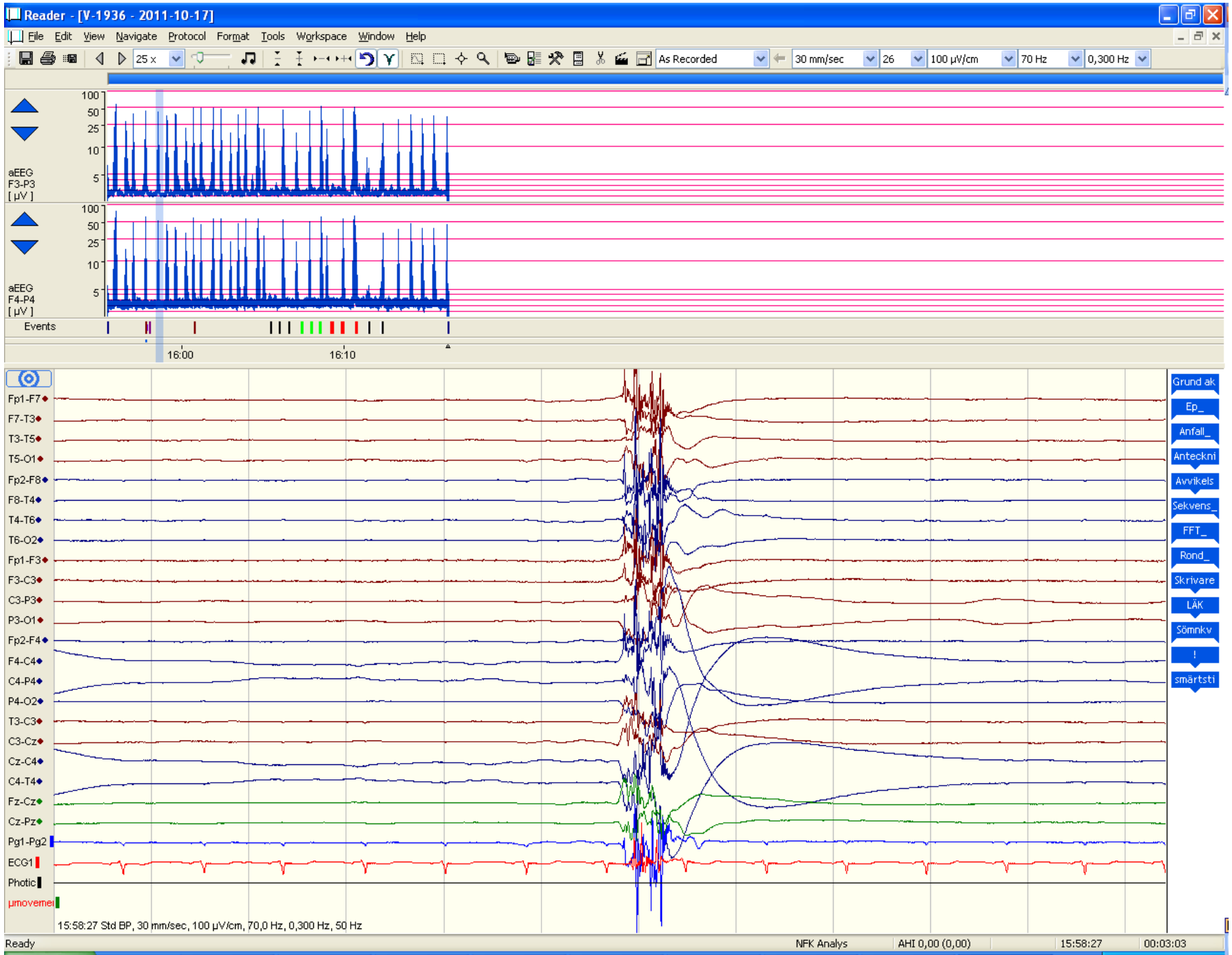


- Vuxna patienter på IVA
- Video-EEG på indikationen "misstänkt kramp"
- 73% var inte epileptiskt

Benbadis et al, *Epilepsia,* 2010

What's shaking in the ICU?




Reader - [V-1936 - 2011-10-17]
File Edit View Navigate Protocol Format Tools Workspace Window Help
As Recorded
30 mm/sec
100 µV/cm
70 Hz
0,300 Hz
aEEG F3-P3 [µV]
aEEG F4-P4 [µV]
Events
16:00
16:10
Fp1-F7
F7-T3
T3-T5
T5-O1
Fp2-F8
F8-T4
T4-T6
T6-O2
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4
P4-O2
T3-C3
C3-Cz
Cz-C4
C4-T4
Fz-Cz
Cz-Pz
Pg1-Pg2
ECG1
Photic
15:58:27 Std BP, 30 mm/sec, 100 µV/cm, 70,0 Hz, 0,300 Hz, 50 Hz
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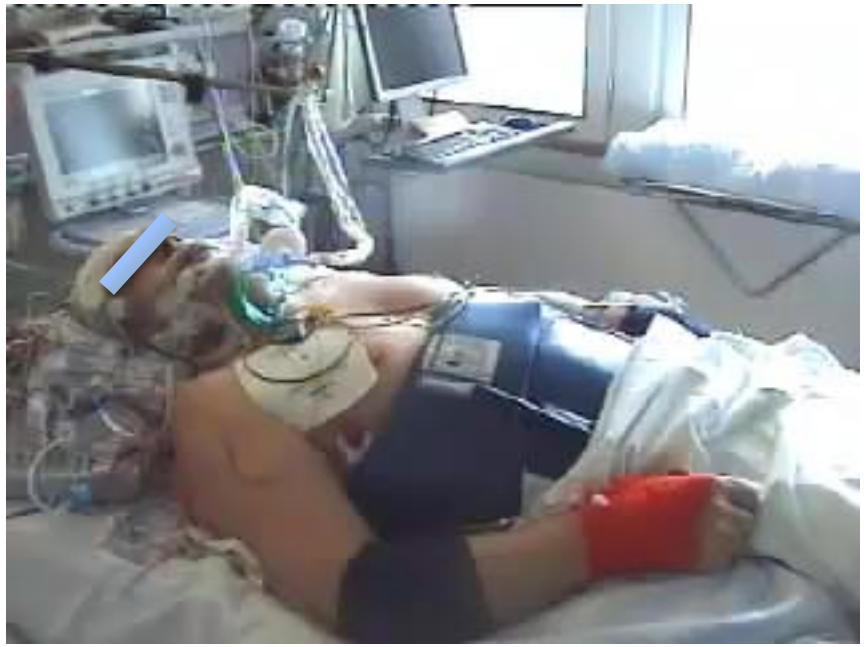
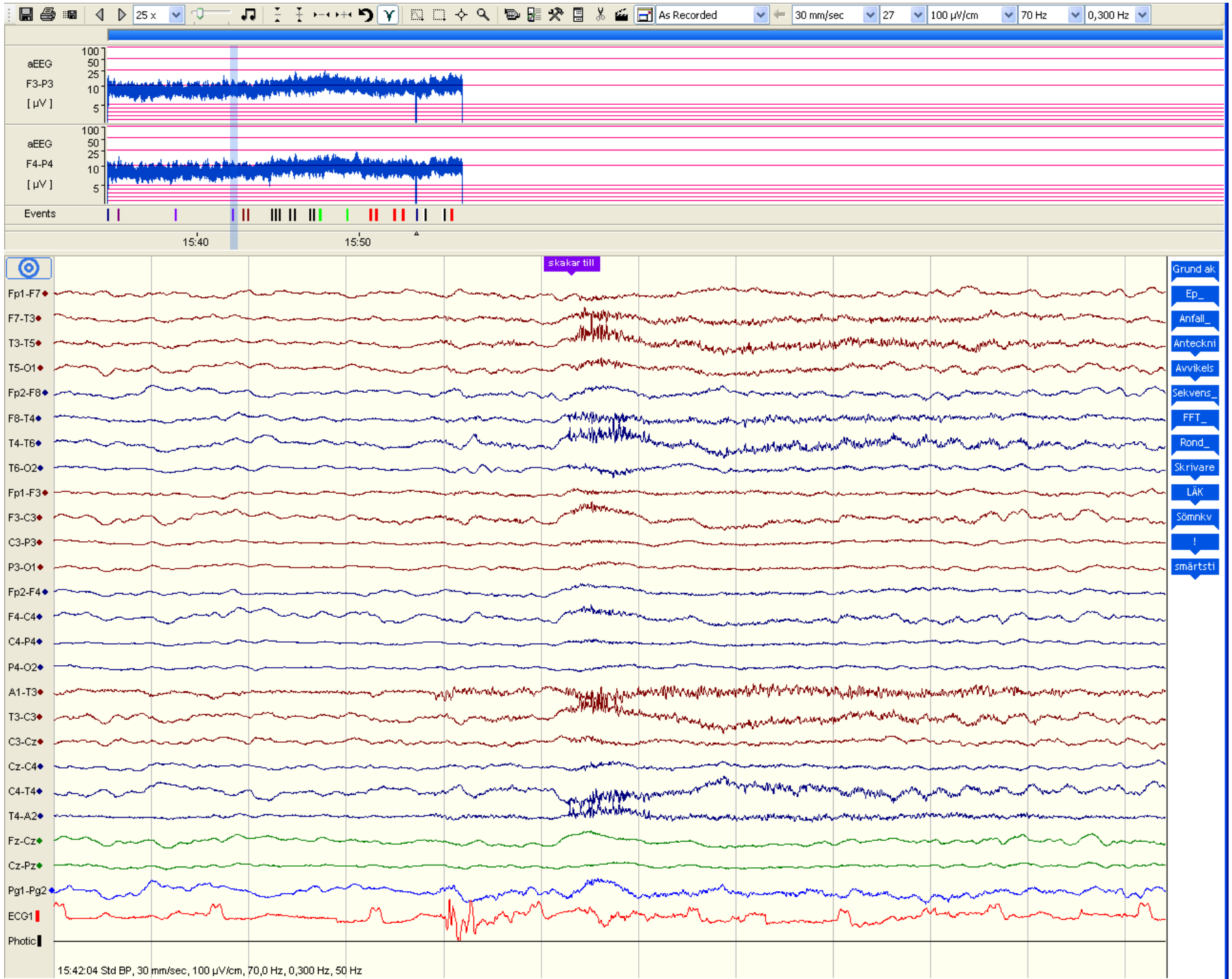
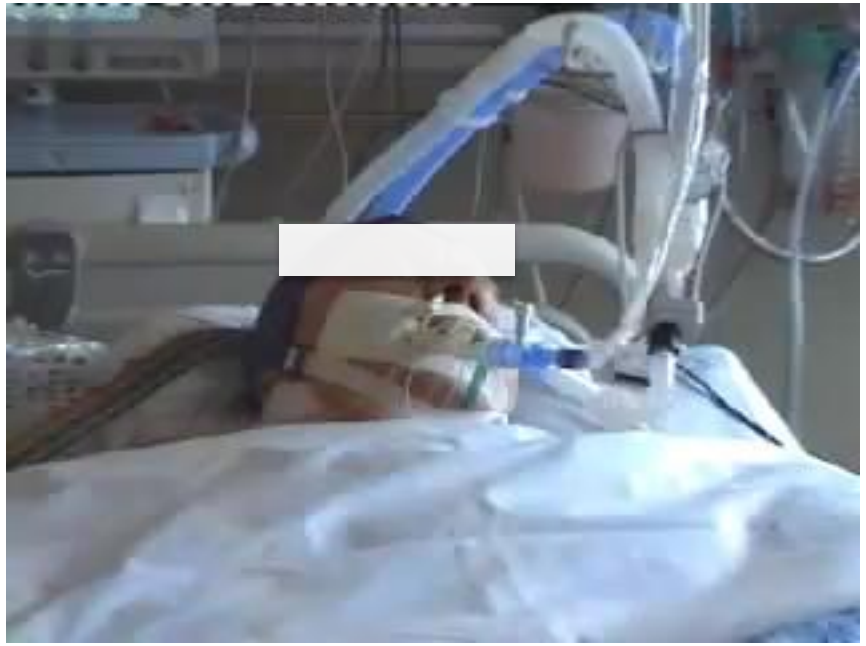
Anteckni
Avvikels
Sekvens_
FFT_
Rond_
Skrivare
LÄK
Sömnkv
!
smärtsti
Ready
NFK Analys
AHI 0,00 (0,00)
15:58:27
00:03:03

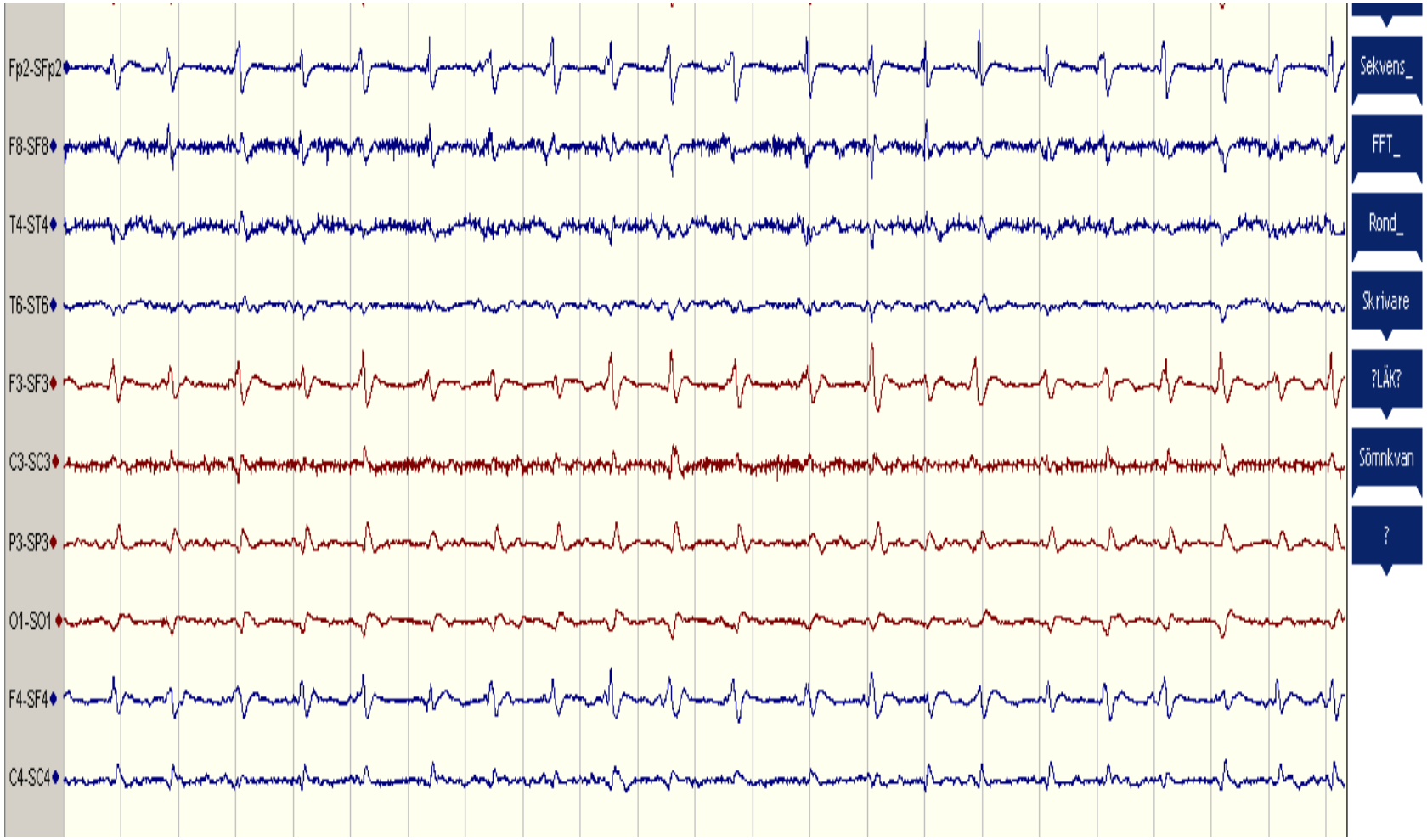
What’s shaking in the ICU?




25 x
As Recorded
30 mm/sec
27
100 µV/cm
70 Hz
0,300 Hz
aEEG
F3-P3
[µV]
100
50
25
10
5
aEEG
F4-P4
[µV]
Events
15:40
15:50
skakar till
Fp1-F7
F7-T3
T3-T5
T5-O1
Fp2-F8
F8-T4
T4-T6
T6-O2
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4
P4-O2
A1-T3
T3-C3
C3-Cz
Cz-C4
C4-T4
T4-A2
Fz-Cz
Cz-Pz
Pg1-Pg2
ECG1
Photic
15:42:04 Std BP, 30 mm/sec, 100 µV/cm, 70,0 Hz, 0,300 Hz, 50 Hz
Grund ak
Ep_
Anfall_
Anteckni
Avvikels
Sekvens_
FFT_
Rond_
Skrivare
LÄK
Sömnkv
!
smärtsti

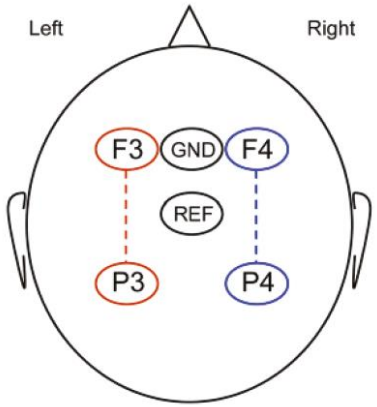
What’s shaking in the ICU?




Fp2-SFp2
F8-SF8
T4-ST4
T6-ST6
F3-SF3
C3-SC3
P3-SP3
O1-SO1
F4-SF4
C4-SC4
Sekvens_
FFT_
Rond_
Skrivare
?LÄK?
Sömnkvan
?

Kontinuerligt EEG kan användas för att följa hjärnans återhämtning

- Förenklat montage appliceras av IVA-sköterskor
- Distanstolkning av neurofysiolog



Friberg, *Critical Care*, 2013

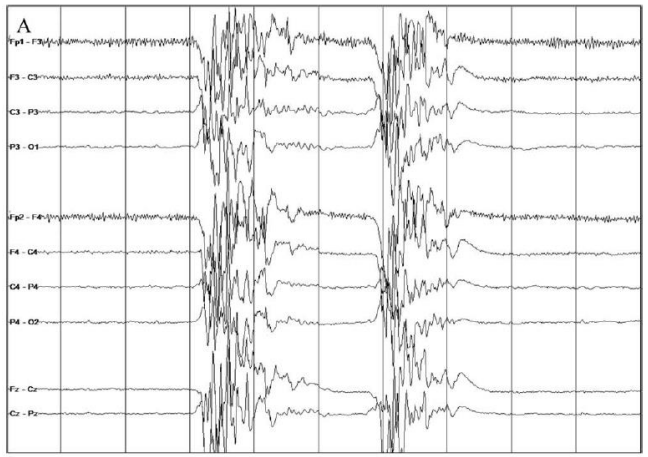
Clinically Distinct Electroencephalographic Phenotypes of Early Myoclonus after Cardiac Arrest

Jonathan Elmer, MD, MS,[1,2] Jon C. Rittenberger, MD, MS,[1] John Faro,[3]
Bradley J. Molyneaux, MD, PhD,[2,4] Alexandra Popescu, MD,[4]
Clifton W. Callaway, MD, PhD,[1] and Maria Baldwin, MD,[5]
for the Pittsburgh Post-Cardiac Arrest Service

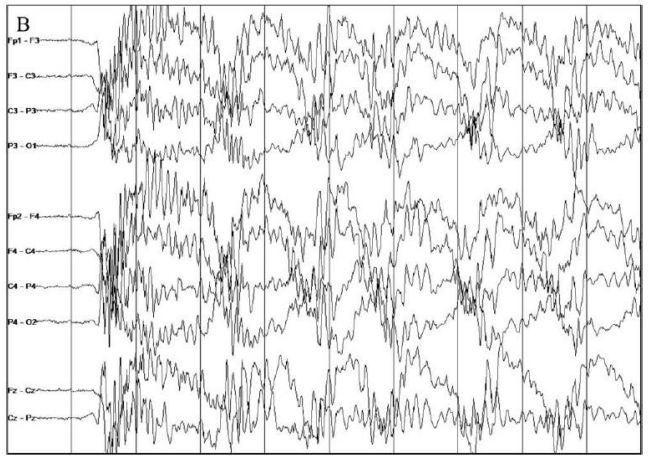
Objective: We tested the hypothesis that there are readily classifiable electroencephalographic (EEG) phenotypes of early postanoxic multifocal myoclonus (PAMM) that develop after cardiac arrest.
Methods: We studied a cohort of consecutive comatose patients treated after cardiac arrest from January 2012 to February 2015. For patients with clinically evident myoclonus before awakening, 2 expert physicians reviewed and classified all EEG recordings. Major categories included: Pattern 1, suppression-burst background with high-amplitude polyspikes in lockstep with myoclonic jerks; and Pattern 2, continuous background with narrow, vertex spike-wave discharges in lockstep with myoclonic jerks. Other patterns were subcortical myoclonus and unclassifiable. We compared population characteristics and outcomes across these EEG subtypes.
Results: Overall, 401 patients were included, of whom 69 (16%) had early myoclonus. Among these patients, Pattern 1 was the most common, occurring in 48 patients (74%), whereas Pattern 2 occurred in 8 patients (12%). The remaining patients had subcortical myoclonus (n = 2, 3%) or other patterns (n = 7, 11%). No patients with Pattern 1, subcortical myoclonus, or other patterns survived with favorable outcome. By contrast, 4 of 8 patients (50%) with Pattern 2 on EEG survived, and 4 of 4 (100%) survivors had favorable outcomes despite remaining comatose for 1 to 2 weeks postarrest.
Interpretation: Early PAMM is common after cardiac arrest. We describe 2 distinct patterns with distinct prognostic significances. For patients with Pattern 1 EEGs, it may be appropriate to abandon our current clinical standard of aggressive therapy with conventional antiepileptic therapy in favor of early limitation of care or novel neuroprotective strategies.

ANN NEUROL 2016;80:175–184

Type 1: Burst suppression with time-locked myoclonus

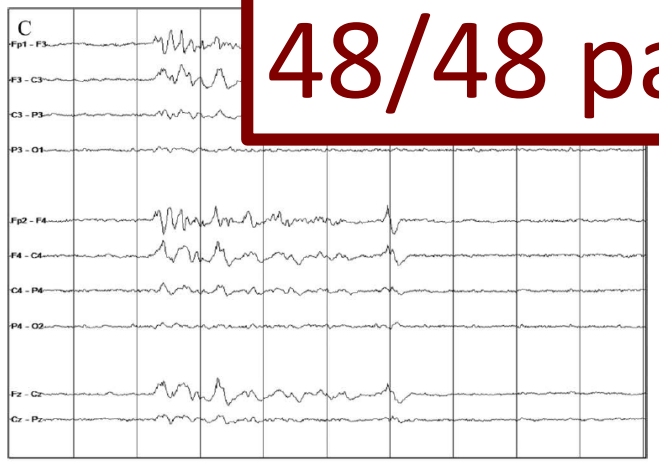


D0

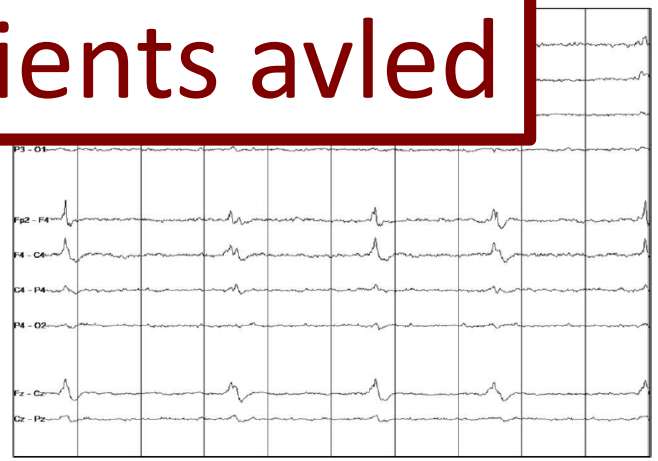


D1

48/48 patients avled

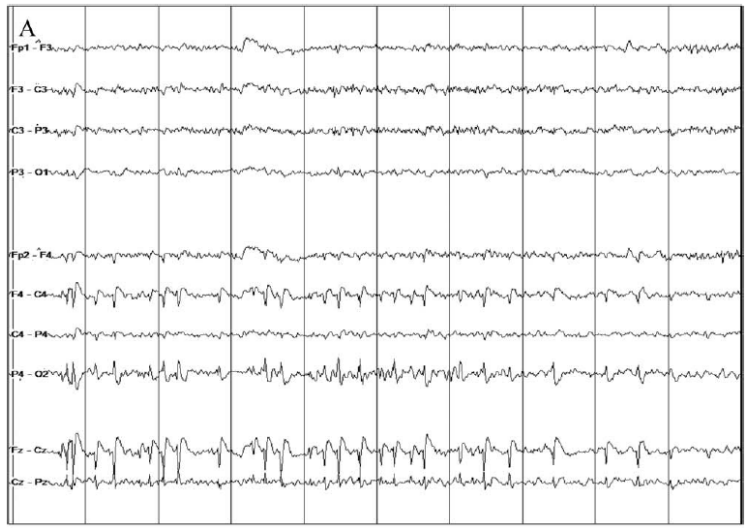


D2

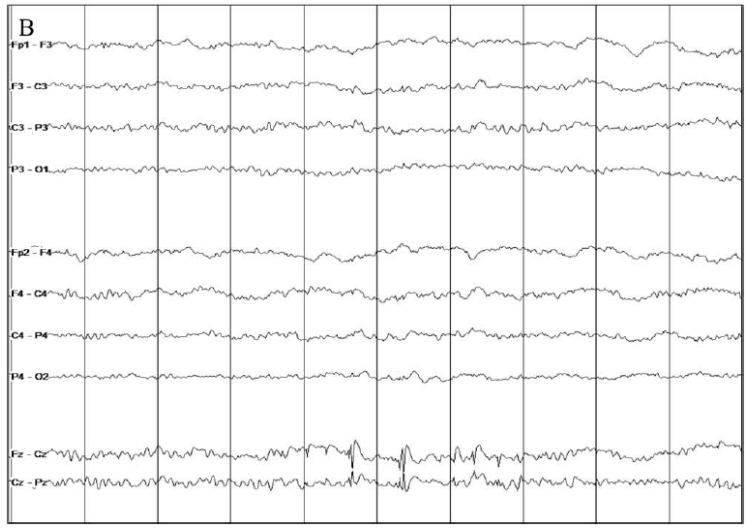


D3

Type 2: Spike-wave with time-locked myoclonus



D0



D40

4/8 patienter överlevde

Alla hade Lance Adams action-myoclonus

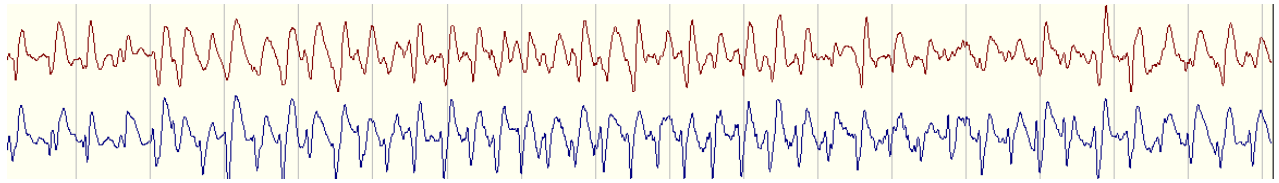
Postanoxiskt status epilepticus (PSE)

- Ingen konsensus rörande EEG-kriterier för PSE.
- Incidensen beror på klassifikationen.
- Kan diagnostiseras med EEG hos 18-38% under de första dagarna efter hjärtstopp

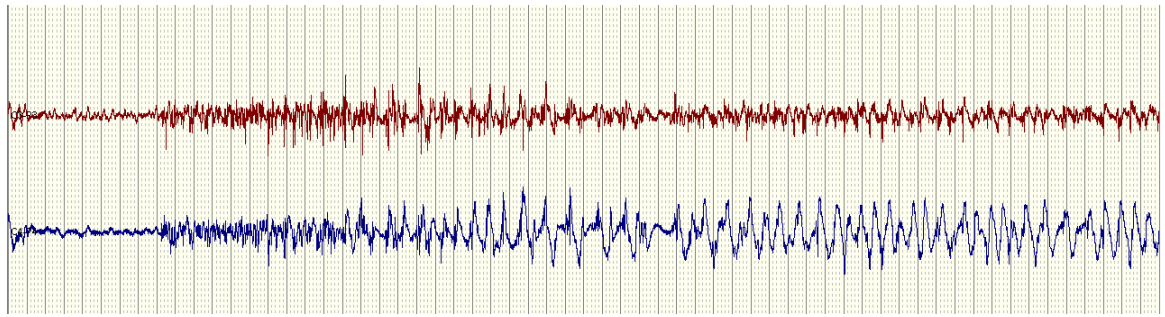
Rossetti et al, *Neurology*, 2009
Legriel et al, *Epilepsia,* 2010
Mani, *Resuscitation*, 2012
Rittenberger, *Neurocrit care*, 2012
Dragancea, Epilepsy and behaviour, 2015

American Clinical Neurophysiology Society's Critical Care EEG Terminology: 2012 version

- Unequivocal electrographic seizure
  - Generalized spike-wave discharges at 3/s or faster



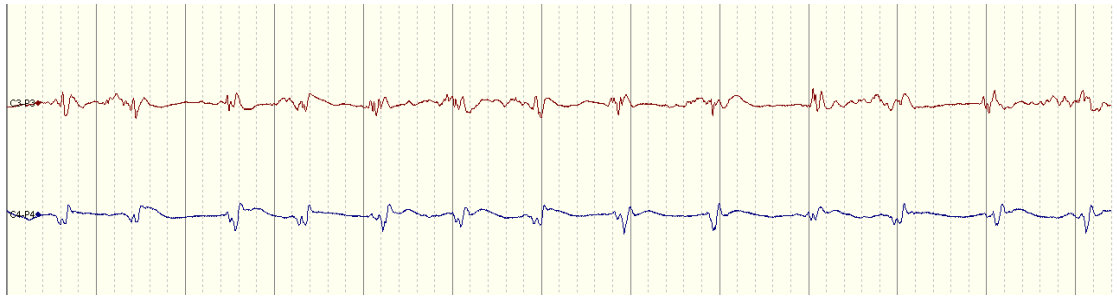
  - clearly evolving discharges of any type that reach a frequency >4/s



Hirsch et al, *J Clin Neurophys,* 2013

American Clinical Neurophysiology Society's Critical Care EEG Terminology: 2012 version

- Possible ictal/interictal patterns
  - Generalized spike and wave patterns slower than 3/s; and evolving discharges that remain slower than or equal to 4/s.



Typical PSE
1-2 /s

"This does not imply that these patterns are not ictal, but simply that they may or may not be."

Hirsch et al, *J Clin Neurophys,* 2013

SPECIAL REPORT

A definition and classification of status epilepticus – Report of the ILAE Task Force on Classification of Status Epilepticus

*†‡Eugen Trinka, §Hannah Cock, ¶Dale Hesdorffer, #Andrea O. Rossetti, **Ingrid E. Scheffer, ††Shlomo Shinnar, ‡‡Simon Shorvon, and §§Daniel H. Lowenstein

Epilepsia, 56(10):1515–1523, 2015
doi: 10.1111/epi.13121

Table 3. Currently indeterminate conditions (or "boundary syndromes")

Epileptic encephalopathies
Coma with non evolving epileptiform EEG pattern[a]
Behavioral disturbance (e.g., psychosis) in patients with epilepsy
Acute confusional states, (e.g., delirium) with epileptiform EEG patterns

[a]Lateralized and generalized periodic discharges with monotonous appearance are not considered as evolving EEG patterns.[26,27]

“Otvetydigt” eller “möjligt” PSE

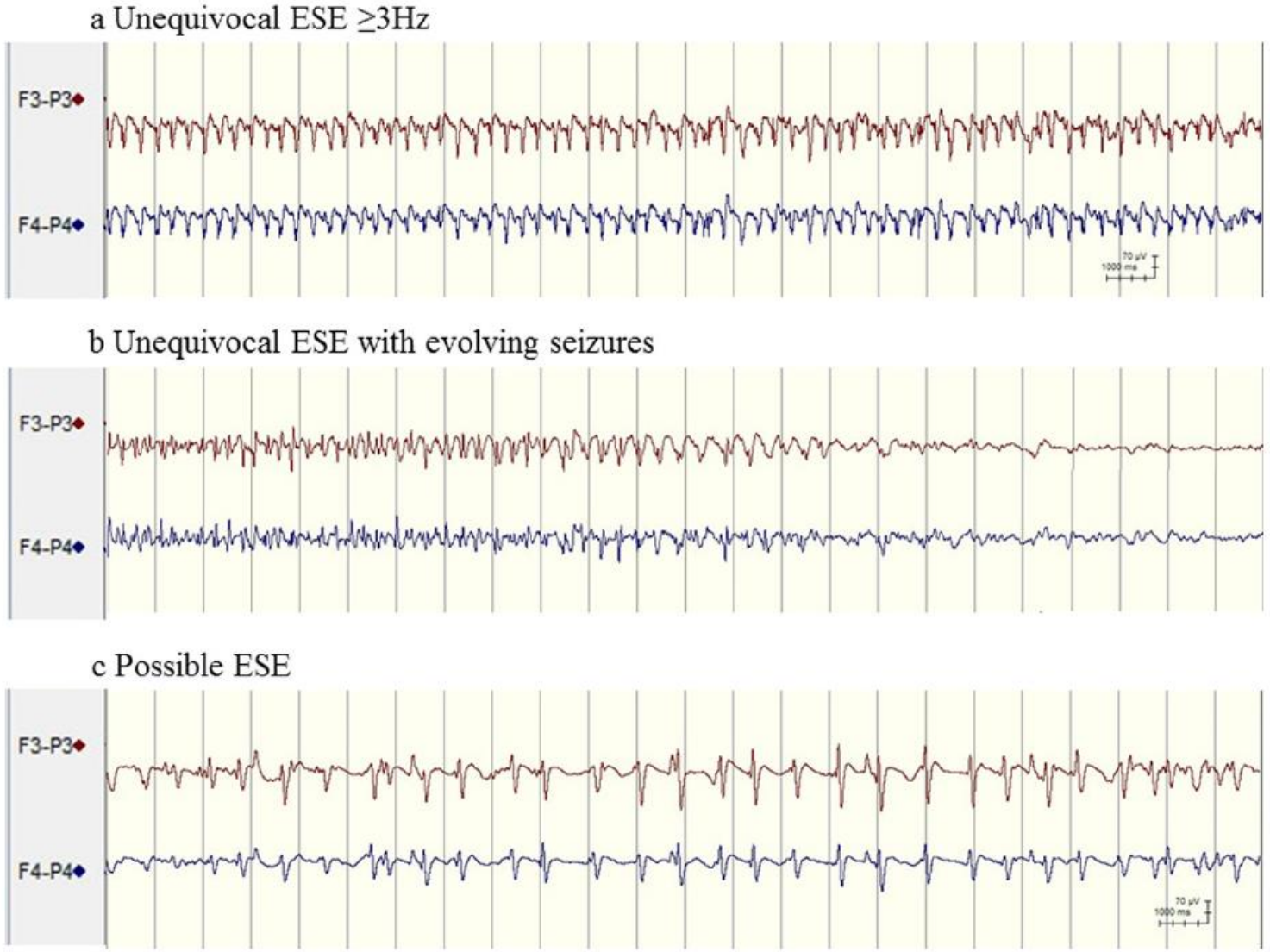
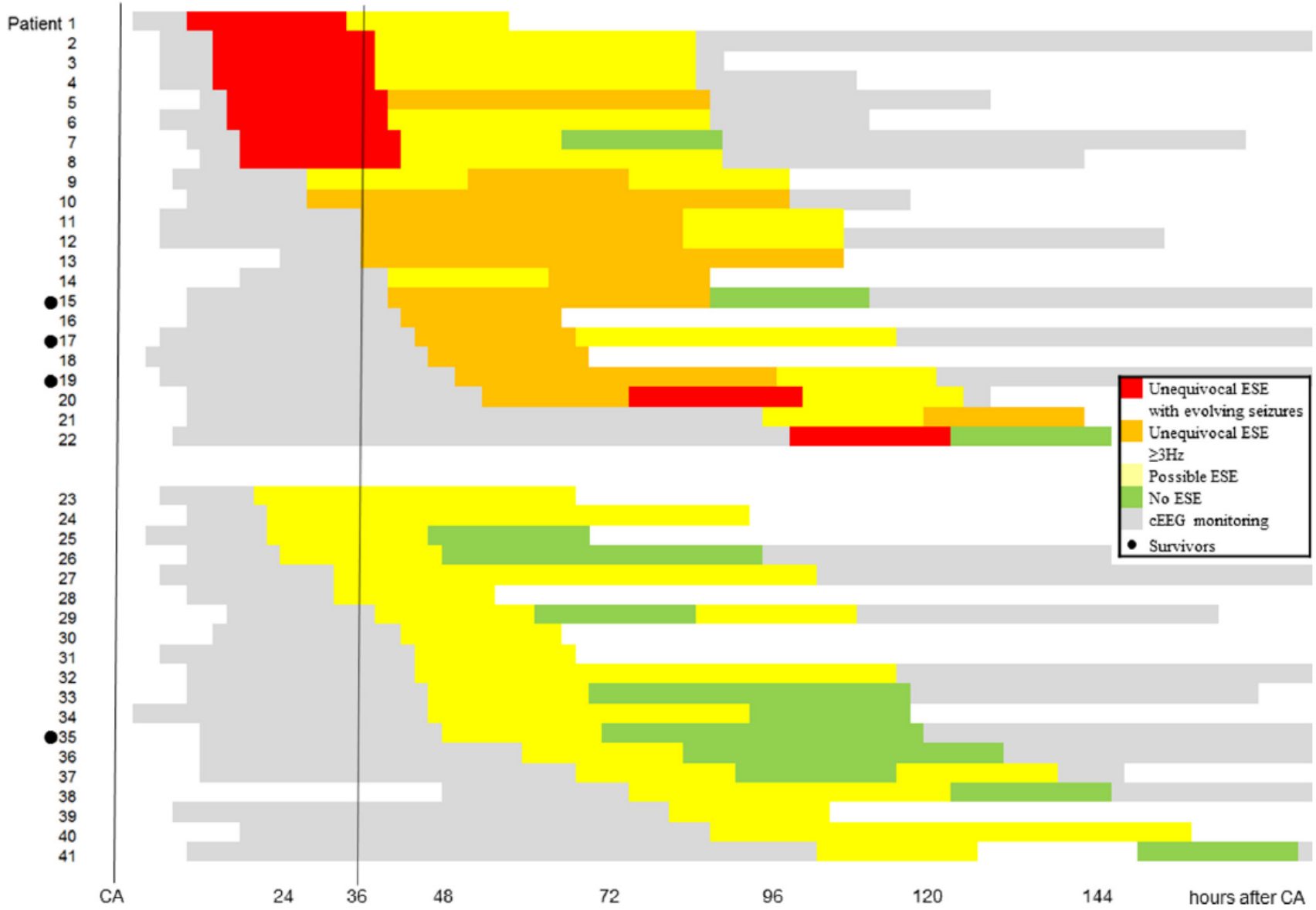


Fig. 1. Electrographic status epilepticus patterns on simplified 2-channel cEEG.

Backman, *J Clin Neurophys,* 2017

Otvetydiga mönster ses tidigt



Backman, *J Clin Neurophys,* 2017

PSE-patienter har dålig prognos

- 0-10% vaknar
- De flesta överlevare har en funktionsnedsättning (CPC 2-3)
- Bra utfall (CPC 1-2) hos 0-8%

Rossetti et al, *Neurology*, 2009
Legriel et al, *Epilepsia,* 2010
Rittenberger, *Neurocrit care*, 2012
Mani, *Resuscitation*, 2012
Dragancea, Epilepsy and behaviour, 2015

Vad utmärker överlevarna?

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Data collection	Retrospective	Retrospective	Retrospective	Prospective	Prospective	Prospective
Age, y	60	61	55	53	68	58
Female	Yes	Yes	No	No	No	No
CA due to VF	Yes	Yes	No	Yes	Yes	Yes
Time to ROSC, min	32	45	17	20	20	21
Cardiac etiology	Yes	Yes	Yes	Yes	Yes	Yes
Preserved BR	Yes	Yes	NA	Yes	Yes	Yes
Absent MR	Yes	No	NA	No	No	Yes
SE diagnosis delay from CA, d	2	4	2	2	3	9
SE clinically (myoclonus)	Yes	No	Yes	Yes	No	No
EEG description	Repetitive diffuse sharp waves (1.5 Hz), bilateral	Repetitive diffuse sharp waves (2–3 Hz), bilateral	Repetitive diffuse sharp waves (2 Hz), bilateral	Sharp waves, spike-waves (2 Hz), L>R; SIRPID	Frontal evolving rhythmic sharp waves (3 Hz), bilateral	Frontal poly-spike-waves (2–3 Hz), R>L
EEG reactivity	Yes	Yes	Yes	Yes	Yes	Yes
PSE duration (d, on EEG)	3	2	2	2	5	3
Preserved N20 on SSEP	Yes	NA	Yes	Yes	Yes	Yes
AEDs	PRO, VPA, CLZ	VPA, CLZ, LEV	PRO, PHT, LEV, CLZ	VPA, PHT, LEV, CLZ	PRO, VPA, LEV, CLZ	VPA, LEV, CLZ
CPC outcome at 6 mo	3	2	2	1	3; death on day 18 (sepsis)	2
LA syndrome	Yes	No	No	Yes	No	No

Rossetti et al, *Neurology*, 2009

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EEG reactivity	Yes	Yes	Yes	Yes	Yes	Yes
PSE duration (d, on EEG)	3	2	2	2	5	3
Preserved N20 on SSEP	Yes	NA	Yes	Yes	Yes	Yes
AEDs	PRO, VPA, CLZ	VPA, CLZ, LEV	PRO, PHT, LEV, CLZ	VPA, PHT, LEV, CLZ	PRO, VPA, LEV, CLZ	VPA, LEV, CLZ
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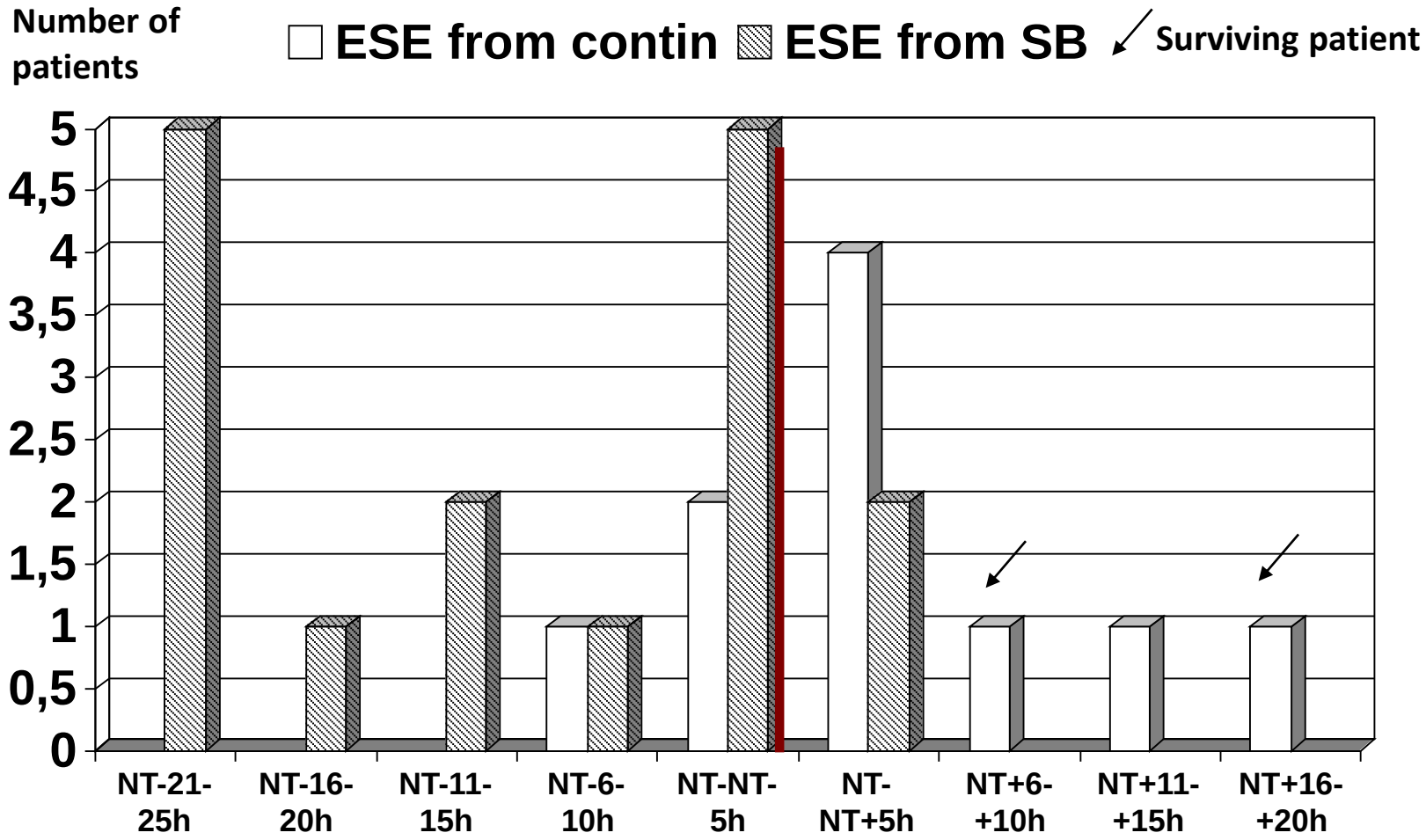
EEG reactivity	Yes	Yes	Yes	Yes	Yes	Yes
PSE duration (d, on EEG)	3	2	2	2	5	3
Preserved N20 on SSEP	Yes	NA	Yes	Yes	Yes	Yes
AEDs	PRO, VPA, CLZ	VPA, CLZ, LEV	PRO, PHT, LEV, CLZ	VPA, PHT, LEV, CLZ	PRO, VPA, LEV, CLZ	VPA, LEV, CLZ
CPC outcome at 6 mo	3	2	2	1	3; death on day 18 (sepsis)	2
LA syndrome	Yes	No	No	Yes	No	No

Rossetti et al, *Neurology*, 2009

Lund 2004-2008, 26/95 patienter (27%) hade PSE, 2 överlevde



Rundgren, *Crit Care Med,* 2010

Lund 2008-13, 41/127 patienter (32%) med PSE
4 överlevare

	Survivors N = 4	Nonsurvivors N = 37	
Time to ROSC	28 (20–76)	27 (21–40)	0.930
TTM			1.000
33 °C	4 (100%)	34 (92%)	
36 °C	0 (0%)	3 (8%)	
Time from CA to cEEG initiation (h)	8 (6–51)	8 (6–11)	0.707
Initial cEEG patterns			0.419
Flat	1 (25%)	16 (43%)	
Burst suppression	2 (50%)	18 (49%)	
Discontinuous	0 (0%)	2 (5%)	
Continuous	1 (25%)	1 (3%)	
Time from CA to debut of ESE (h)	46 (41–62)	36 (21–50)	0.210
Background prior to ESE			0.038
Burst suppression	0 (0%)	15 (40%)	
Discontinuous	0 (0%)	10 (27%)	
Nearly continuous	0 (0%)	2 (5%)	
Continuous	4 (100%)	10 (27%)	
ESE duration (h)	203 (137–269)	58 (16–113)	0.004
NSE at 48 h	22 (18–34)	47 (26–82)	0.060
SSEP			0.435
Absent N20 bilaterally	0 (0%)	7 (19%)	
Present N20 bilaterally	4 (100%)	22 (60%)	
Not performed	0 (0%)	8 (22%)	
ICU stay (h)	420 (390–540)	150 (86–212)	0.002
Hospital stay (days)	51 (26–74)	8 (4–12)	0.003
WLST	0 (%)	34 (92%)	≤0.001

- Enligt ACNS klassifikation
- 4/4 utvecklade kontinuerlig bakgrund före ESE
- Alla hade låga eller måttliga nivåer av NSE
- Alla hade SSEP-N20 svar

Dragancea, *Epilepsy & Behaviour,* 2015

Alla överlevare fick 3-4 AED

	Patient 1	Patient 2	Patient 3	Patient 4
Age	61	69	52	54
Cause of CA	Cardiac	Cardiac	Cardiac	Cardiac
Time(min) from CA to ROSC	20	36	20	85
Time(hours) from CA to ESE diagnosis	46	42	40	58
Clinical seizures/myoclonus	Yes, after normothermia	Yes, after normothermia	No	No
EEG characteristics	Continuous background → ESE	Continuous background → ESE	Continuous background → ESE	Continuous background → ESE
Anticonvulsant drugs	Fosphenytoin Clonazepam, Levetiracetam, Phenobarbital	Valproic acid , Levetiracetam Phenobarbital	Valproic acid Levetiracetam Phenobarbital Phenytoin	Valproic acid Levetiracetam Phenobarbital
Time from ESE (days) to ability to follow commands	20	24	Unknown	15
Length of sedation (day)	11	3,5	8	14
CPC at 6 months	2	3	1	2

Dragancea, *Epilepsy & Behaviour,* 2015

..och 3-20 dagar sedation

	Patient 1	Patient 2	Patient 3	Patient 4
Age	61	69	52	54
Cause of CA	Cardiac	Cardiac	Cardiac	Cardiac
Time(min) from CA to ROSC	20	36	20	85
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Time from ESE (days) to ability to follow commands	20	24	Unknown	15
Length of sedation (day)	11	3,5	8	14
CPC at 6 months	2	3	1	2

Dragancea, *Epilepsy & Behaviour,* 2015

De vaknade efter 2-4 veckor

	Patient 1	Patient 2	Patient 3	Patient 4
Age	61	69	52	54
Cause of CA	Cardiac	Cardiac	Cardiac	Cardiac
Time(min) from CA to ROSC	20	36	20	85
Time(hours) from CA to ESE diagnosis	46	42	40	58
Clinical seizures/myoclonus	Yes, after normothermia	Yes, after normothermia	No	No
EEG characteristics	Continuous background →ESE	Continuous background →ESE	Continuous background → ESE	Continuous background → ESE
Anticonvulsant drugs	Fosphenytoin Clonazepam, Levetiracetam, Phenobarbital	Valproic acid , Levetiracetam Phenobarbital	Valproic acid Levetiracetam Phenobarbital Phenytoin	Valproic acid Levetiracetam Phenobarbital
Time from ESE (days) to ability to follow commands	20	24	Unknown	15
Length of sedation (day)	11	3,5	8	14
CPC at 6 months	2	3	1	2

Dragancea, *Epilepsy & Behaviour,* 2015

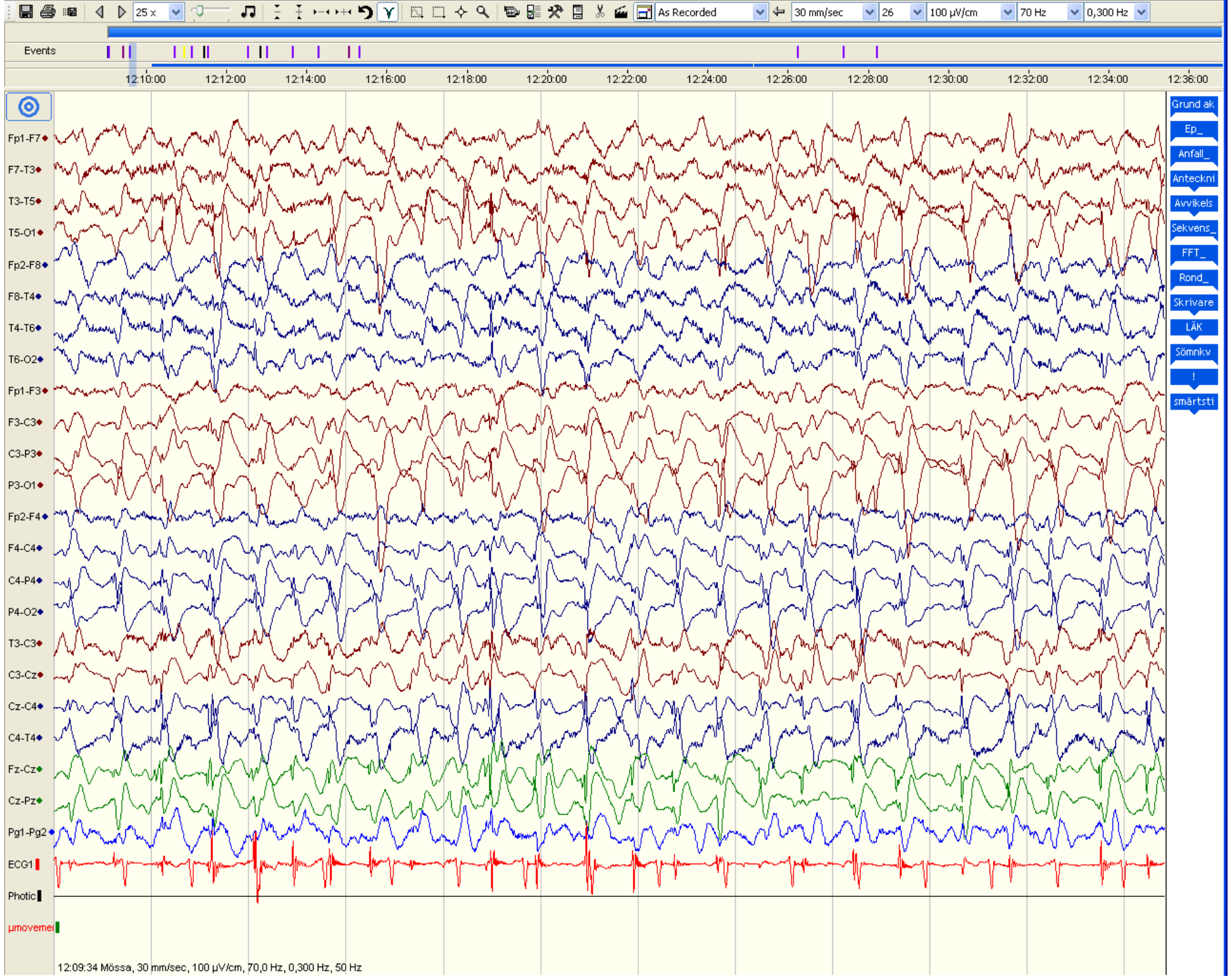
Lätt-måttlig funktionsnedsättning hos 3/4

	Patient 1	Patient 2	Patient 3	Patient 4
Age	61	69	52	54
Cause of CA	Cardiac	Cardiac	Cardiac	Cardiac
Time(min) from CA to ROSC	20	36	20	85
Time(hours) from CA to ESE diagnosis	46	42	40	58
Clinical seizures/myoclonus	Yes, after normothermia	Yes, after normothermia	No	No
EEG characteristics	Continuous background → ESE	Continuous background → ESE	Continuous background → ESE	Continuous background → ESE
Anticonvulsant drugs	Fosphenytoin Clonazepam, Levetiracetam, Phenobarbital	Valproic acid , Levetiracetam Phenobarbital	Valproic acid Levetiracetam Phenobarbital Phenytoin	Valproic acid Levetiracetam Phenobarbital
Time from ESE (days) to ability to follow commands	20	24	Unknown	15
Length of sedation (day)	11	3,5	8	14
CPC at 6 months	2	3	1	2

Dragancea, *Epilepsy & Behaviour,* 2015

59-årig man på thoraxintensiven

- Bilateral lungtransplantation på grund av fibros
- D2 Massiv lungembolism
- D10 Hjärtstopp. Kylbehandling 33℃
- D12 “kramper” när sederingen fasas ut
  - EEG


25 x
As Recorded
30 mm/sec
26
100 µV/cm
70 Hz
0,300 Hz
Events
12:10:00
12:12:00
12:14:00
12:16:00
12:18:00
12:20:00
12:22:00
12:24:00
12:26:00
12:28:00
12:30:00
12:32:00
12:34:00
12:36:00
Fp1-F7
F7-T3
T3-T5
T5-O1
Fp2-F8
F8-T4
T4-T6
T6-O2
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4
P4-O2
T3-C3
C3-Cz
Cz-C4
C4-T4
Fz-Cz
Cz-Pz
Pg1-Pg2
ECG1
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Sekvens_
FFT_
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Skrivare
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Sömnkv
!
smärtsti
12:09:34 Mössa, 30 mm/sec, 100 µV/cm, 70,0 Hz, 0,300 Hz, 50 Hz

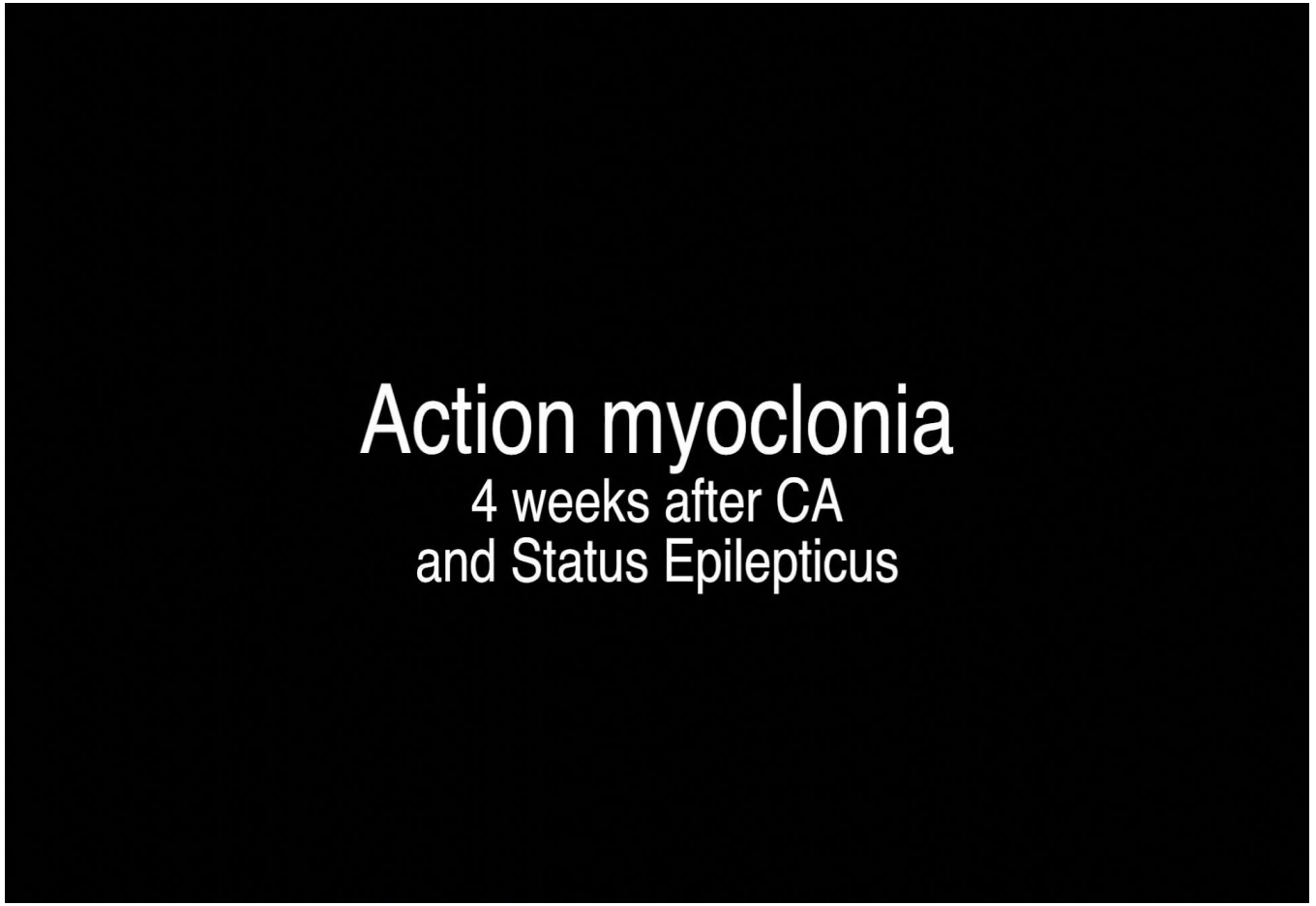
4 veckors behandling…

- SSEP med bevarade N20-svar bilat. MR-hjärna normal.
- Ökande epileptiform aktivitet när man försöker fasa ut propofol
- valproat, klonazepam, levetirazetam, fenobarbital, propofol, midazolam
- Långsamt minskande epileptiform aktivitet, reaktiv EEG-bakgrund
- Minskande doser AED…..

Långsam återhämtning…

- D 32 grimaserar
- D 36-38 Börjar röra händer, huvud och ben, grimaserar och nickar som svar
- D 43 Vaken, kommuniserar, generaliserad muskelatrofi och svaghet
  - GTK
  - Ökande myoklonus
  - valproat, levetiracetam och klonazepam

Lance-Adams syndrome



Lance &Adams, *Brain*, 1963

Evidens för behandling av PSE saknas

- Rapporterade överlevare har behandlats aggressivt
- PSE är självbegränsande (hos överlevare)
- Behandling kan vara skadlig
  - Pneumoni
  - Critical illness polyneuropathy/myopathy
  - Pessimism pga iatrogent koma
- Vi behöver randomiserade studier!

Ruijter *et al. Trials* 2014, **15**:433
http://www.trialsjournal.com/content/15/1/433

TRIALS

STUDY PROTOCOL Open Access

Treatment of electroencephalographic status epilepticus after cardiopulmonary resuscitation (TELSTAR): study protocol for a randomized controlled trial

Barry J Ruijter[1*], Michel JAM van Putten[1,2], Janneke Horn[3], Michiel J Blans[4], Albertus Beishuizen[5], Anne-Fleur van Rootselaar[6], Jeannette Hofmeijer[1,7], on behalf of the TELSTAR study group

Ruijter et al, *Trials*, 2014

Vår behandlingsmodell

- cEEG med förenklat montage
- Vanligen kombination av valproat och levetirazetam med dagliga koncentrationsbestämningar
- Vi eftersträvar anfallssuppression (< 1 Hz)
- Fenobarbital kan övervägas

Konklusioner

- Kliniska kramper och epileptiformt EEG efter hjärtstopp innebär en sämre prognos
- En del patienter återhämtar sig väl
- Det finns ingen evidensbaserad behandlingsstrategi
- Bedöm prognosen med andra metoder (SSEP, MRI, NSE)
- Ge **alltid** patienten en chans att vakna upp ur sedationen

4TH INTERNATIONAL SYMPOSIUM ON

Post Cardiac Arrest Care

FOCUSING ON neuroprognostication, follow-up, quality-of-life, rehabilitation

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4TH INTERNATIONAL SYMPOSIUM ON

Post Cardiac Arrest Care

FOCUSING ON neuroprognostication, follow-up, quality-of-life, rehabilitation

PROGRAM - Thursday May 23rd, 2019

08.15-09.00	*Registration*
09.00-10.10	**Welcome** *Hans Friberg, Tobias Cronberg, Gisela Lilja*
	Chairs: Marcus Skrifvars & Hans Friberg
09.10-09.30	**Surviving cardiac arrest - what are the critical desicions?** Jerry Nolan, UK
09.30-09.50	**In the field - early stopping rules** *Laurie Morrison, Canada*
09.50-10.00	*Discussion*
10.00-10.30	Coffe break & exhibition
	Chairs: Jeannette Hofmeyer & Mauro Oddo
10.30-10.45	**Are we making critical desicions too early - the NORCAST study** *Kjetil Sunde, Norway*
10.45-11.00	**In the emergency room - early prediction models** *Florence Dumas, France*
11.00-11.15	**In the ICU - Multimodal neurological prognostication** *Tobias Cronberg, Sweden*
11.15-11.30	**Machine learning for prediction of outcome** *Niklas Nielsen, Sweden*
11.30-12.00	*Discussion*
12.00-13.00	Lunch break with posters & exhibition
	Chairs: David Seder & Tobias Cronberg
13.00-14.30	**Best abstracts; prognostication** **Simplified monitoring and interpretation of continuous EEG after cardiac arrest - a useful bedside tool for the ICU physician** *Anna Lybeck, Sweden* **Factors associated with abnormal EEG after out-of-hospital cardiac arrest: a post hoc analysis of a randomised clinical trial** *Pekka Jakkula, Finland* **Are providers overconfident in predicting outcome after cardiac arrest?** *Alexis Steinberg, USA* **Neurocardiac risk stratification 6 hours after resuscitation from cardiac arrest** *David Seder, USA* **Routine EEG versus continuous monitoring-pro/con debate** Routine EEG is superior - *Andrea Rossetti, Switzerland* Continuous EEG monitoring is superior - *Jeannette Hofmeijer, The Netherlands*
14.30-15.00	Coffe break & exhibition
	Chairs: Irina Dragancea & Jerry Nolan
15.00-15.45	**Novel methods of prognostication** Pupillometry - *Mauro Oddo, Switzerland* Novel blood biomarkers - *Niklas Mattsson, Sweden* MRI- diffusion tensor imaging - *Lionel Velly, France*
15.45-16.00	Short break
16.00-17.00	**Interactive training session**

Routine neurological prognostication	Clinical and electrographic seizures	My worst case
Clifton Callaway, Mauro Oddo, Irina Dragancea	*Andrea Rossetti, Jeannette Hofmeijer, Tobias Cronberg*	*Jerry Nolan, Laurie Morrison, Kjetil Sunde*

18.30	Conference Get together

PROGRAM - Friday May 24th, 2019

08.10-08.30	*Registration*
08.30-08.40	**Welcome** *Hans Friberg, Tobias Cronberg, Gisela Lilja*
	Chairs: Giesla Lilja & Jerry Nolan
08.40-09.10	**The chain of recovery. From cardiac arrest to social integration** *Clifton Callaway, USA*
09.10-09.30	**What's wrong with the good outcome; to measure outcome after cardiac arrest** *Kirstie Haywood, UK*
09.30-10.00	**Patient reported outcomes (PRO) in cardiac arrest registers. Yes it works.** *Karen Smith, Australia*
10.00-10.30	Coffe break & exhibition
	Chairs: Thomas Keeble & Erik Blennow Nordström
10.30-11.00	**Rehabilitation of the patient with a prolonged Disorder of Consciousness** *Alison Goodbolt, Sweden*
11.00-11.30	**Memory rehabilitation** *Barbra Wilson, UK*
11.30-12.00	**Fatigue after cardiac arrest** *Gisela Lilja, Sweden*
12.00-13.00	Lunch break with posters & exhibition
	Chairs: Karen Smith & Clifton Callaway
13.00-14.00	**Best abstracts; outcome, follow up and rehabilitation** **LOCAS I - Understanding Long-term Outcomes after Cardiac Arrest from the Survivor and Family Member Perspective** *Katie Dainty, Canada* **Cardiac arrest and hospitalization induced-hyperarousal symptoms are associated with 1-year risk of major adverse cardiovascular events and all-cause mortality** *Sachin Agarwal, USA* **Quality of Life in a long term follow up in out-of-hospital cardiac arrest survivors** *Henning Wimmer, Norway* **Patient and public involvement in the development of rehabilitation interventions for survivors of cardiac arrest in Denmark** *Vicky Joshi, Denmark*
14.00-14.30	**Patient and partner support groups** *Thomas Keeble & Paul Swindell, UK*
14.30-14.50	Coffe break & exhibition
	Chairs: Laurie Morrison & Kjetil Sunde
14.50-15.10	**To form a clinical center of excellence for rehabilitation after cardiac arrest** *Paulien Goossens, The Netherlands*
15.10-15.30	**What we learned from the ALASCA trial; focusing on follow-up after cardiac arrest** *Caroline van Heughten, The Netherlands*
15.30-15.45	Short break
15.45-16.30	**Minisymposiums**

To build a follow up system after CA	To assess long-term outcome in clinical trials and register studies	Cognitive rehabiliation in practice, clincial examples
Paulien Goossens, Thomas Keeble	*Kirstie Haywood, Karen Smith*	*Caroline van Heughten, Barbra Wilson*

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