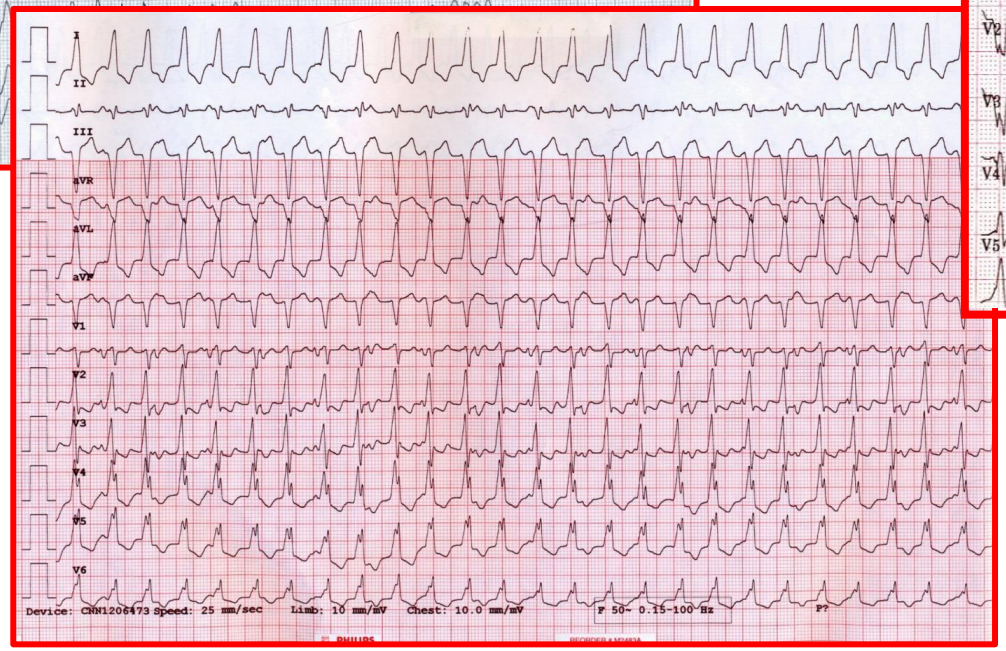
VŠEOBECNÁ FAKULTNÍ NEMOCNICE V PRAZE

1. LÉKAŘSKÁ FAKULTA Univerzita Karlova

Zprvu defibrilovatelný, teď už si nejsem jist…

Štěpán Havránek

Šokovatelné rytmy



Zdroj: Archiv II. interní kliniky 1.LF UK a VFN v Praze.

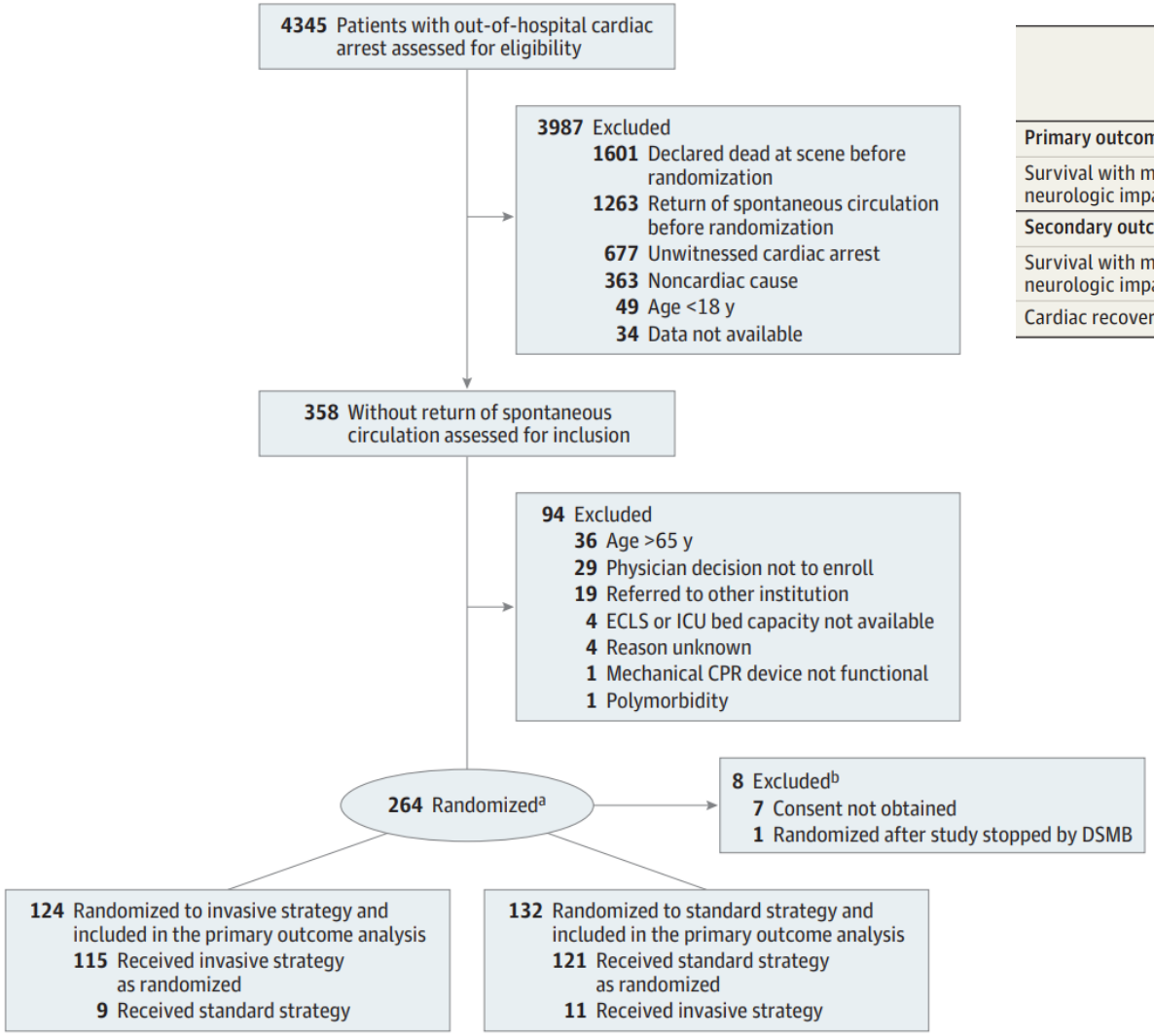
Prognóza dle vstupního rytmu

Data z Prague OHCA

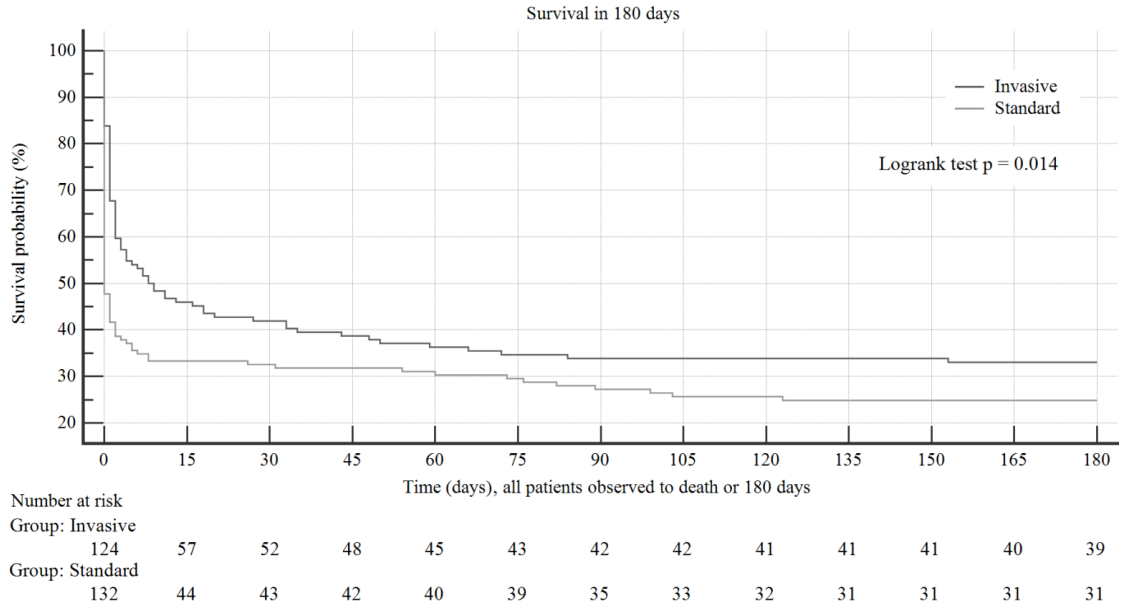
Prague OHCA trial

Nemocní se spatřenou refrakterní mimonemocniční oběhovou zástavou

- Standardní vs. invazivní přístup



	No. (%)			
	Invasive strategy (n = 124)	Standard strategy (n = 132)	Absolute difference, % (95% CI)	*P* value
Primary outcome				
Survival with minimal or no neurologic impairment at 180 d[a]	39 (31.5)	29 (22.0)	9.5 (−1.3 to 20.1)	.09
Secondary outcomes				
Survival with minimal or no neurologic impairment at 30 d[a]	38 (30.6)	24 (18.2)	12.4 (1.9 to 22.7)	.02
Cardiac recovery at 30 d[b]	54 (43.5)	45 (34.1)	9.4 (−2.5 to 21)	.12



Belohlavek J., et al. JAMA 2022;327:737-47.

Základní klinická a demografická data

Parameter	Shockable rhythm (*N* = 156)	Non-shockable rhythm (*N* = 100)	*P*
Age (years)	56 (45–64)	60 (51–66)	0.03
Sex			
Female	15 (10%)	29 (29%)	<0.001
Male	141 (90%)	71 (71%)	
Medical history			
Hypertension	57/126 (45%)	32/65 (49%)	0.65
Coronary artery disease	26/125 (21%)	8/62 (13%)	0.23
Chronic heart failure	10/123 (8%)	6/62 (10%)	0.78
Diabetes mellitus	18/120 (15%)	18/62 (29%)	0.03
Chronic kidney disease	2/122 (2%)	3/61 (5%)	0.34
Chronic obstructive pulmonary disease	7/122 (6%)	3/62 (5%)	1.00
ICD implanted	1/134 (1%)	2/76 (3%)	0.30
Bystander CPR	154 (99%)	98 (98%)	1.00
Time from collapse to EMS arrival (min)	9 (6–11)	9 (7–12)	0.54
Time from collapse to ACLS (physician arrival) (min)	10 (8–13)	11 (6–14)	0.87
Dispatcher assisted CPR	133 (85%)	70 (70%)	0.006
Time until or of dispatcher assisted CPR began (min)	3 (2–4)	3 (1–5)	0.97
Time from collapse to randomization (min)	25 (20–30)	24 (20–32)	0.98
Number of adrenaline doses prehospitally (mg)	4 (2–6)	5 (4–7)	<0.001
Intermittent ROSC	56 (36%)	30 (30%)	0.40
Randomised to			
Standard	84 (54%)	48 (48%)	0.44
Invasive	72 (46%)	52 (52%)	

Havranek S., et al. Resuscitation 2022;181:289-96.

Hospitalizační fáze

Parameter	Shockable rhythm (*N* = 156)	Non-shockable rhythm (*N* = 100)	*P*
Admitted to hospital	136 (87%)	74 (74%)	0.01
Time to hospital admission (min)	55 (46–64)	51 (41–63)	0.12
Time from randomization to admission (min)	30 (23–37)	28 (20–35)	0.20
Declared dead	33 (21%)	42 (42%)	<0.001
Time of CPR (time to death/ROSC or ECLS) (min)	54 (33–69)	51 (39–68)	0.33
Sustained ROSC on admission	67 (43%)	25 (25%)	0.005
TTM used	122/136 (90%)	66/74 (76%)	0.01
ECLS			
ECLS implanted	57 (37%)	35 (35%)	0.91
Time to ECLS (min)	62 (57–73)	60 (50–66)	0.09
Invasive assessment			
Coronary angiography	126/127 (99%)	55/62 (89%)	0.002
Pulmonary angiography	8/127 (6%)	19/62 (31%)	<0.001
Aortography	22/127 (17%)	19/62 (31%)	0.06
Left ventricle angiography	29/127 (23%)	18/62 (29%)	0.37
Laboratory values on admission			
pH	7.00 (6.87–7.17)	6.85 (6.75–6.97)	<0.001
Lactate (mmol/L)	10.7 (7.8–13.8)	13.8 (10.5–17.0)	<0.001
Cause of cardiac arrest (including autopsy findings)			
Acute coronary syndrome	89 (57%)	38 (38%)	<0.001
Coronary artery disease – chronic	29 (19%)	3 (3%)	
Pulmonary embolism	1 (1%)	23 (23%)	

Havranek S., et al. Resuscitation 2022;181:289-96.

Primární a sekundární endpointy

Parameter	Shockable rhythm (N = 156)	Non-shockable rhythm (N = 100)	P value
Primary outcome			
Survival with CPC at 180 days			
1 or 2	63 (40.4 %)	5 (5 %)	<0.001
≥3	93 (59.6 %)	95 (95 %)	
Secondary outcomes			
Cardiac recovery at 30 days			
Yes	84 (53.8 %)	15 (15 %)	<0.001
No	72 (46.2 %)	85 (85 %)	
Neuro recovery at 30 days			
Yes	58 (37.2 %)	4 (4 %)	<0.001
No	98 (62.8 %)	96 (96 %)	

Havranek S., et al. Resuscitation 2022;181:289-96.

Primární a sekundární endpointy

	INVASIVE			Konvenční		
Initial rhythm	Shockable (N = 72)	Non-shockable (N = 52)	P	Shockable (N = 84)	Non-shockable (N = 48)	P
Primary outcome						
Survival with CPC at 180 days						
1 or 2	35 (49 %)	4 (8 %)	<0.001	28 (33 %)	1 (2 %)	<0.001
≥3	37 (51 %)	48 (92 %)		56 (67 %)	47 (98 %)	
Secondary outcomes						
Cardiac recovery at 30 days						
Yes	43 (60 %)	11 (21 %)	<0.001	41 (49 %)	4 (8 %)	<0.001
No	29 (40 %)	41 (79 %)		43 (51 %)	44 (92 %)	
Neuro recovery at 30d days						
Yes	34 (47 %)	4 (8 %)	<0.001	24 (29 %)	0 (0 %)	<0.001
No	38 (53 %)	48 (92 %)		60 (17 %)	48 (100 %)	

Havranek S., et al. Resuscitation 2022;181:289-96.

Cox regression analysis

Predikce nepříznivého neurologického outocome

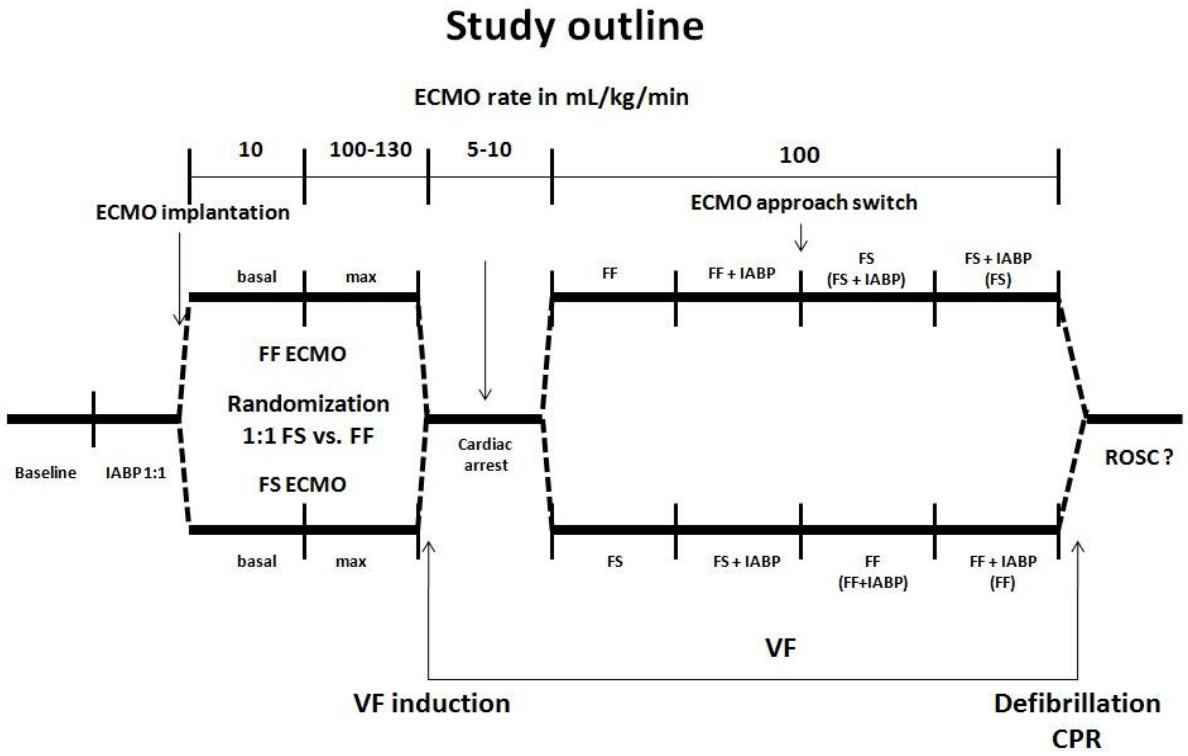
	Model A (Admitted to hospital) (n = 210)			Model B (After the initial in-hospital evaluation) (n = 181)		
Covariate	HR	95% CI	*P*	HR	95% CI	*P*
Age ≥ 65 years	0.92	0.63–1.34	0.67	0.87	0.57–1.34	0.53
Sex = women	0.96	0.62–1.49	0.86	1.17	0.73–1.85	0.52
Sustained ROSC on admission = yes	0.35	0.24–0.51	<0.001	0.69	0.41–1.15	0.15
Length CPR > 45 min = yes	–	–	–	1.97	1.16–3.32	0.01
Telephone assisted bystander CPR = yes	1.19	0.8–1.77	0.39	1.31	0.82–2.1	0.26
Acute coronary syndrome = yes	–	–	–	1.29	0.86–1.94	0.22
Shockable rhythm = yes	0.32	0.22–0.46	<0.001	0.27	0.18–0.41	<0.001

Havranek S., et al. Resuscitation 2022;181:289-96.

Rytmus se může změnit

Čím delší KPCR, tím větší šance na změnu rytmu

Změna charakteru fibrilace komor

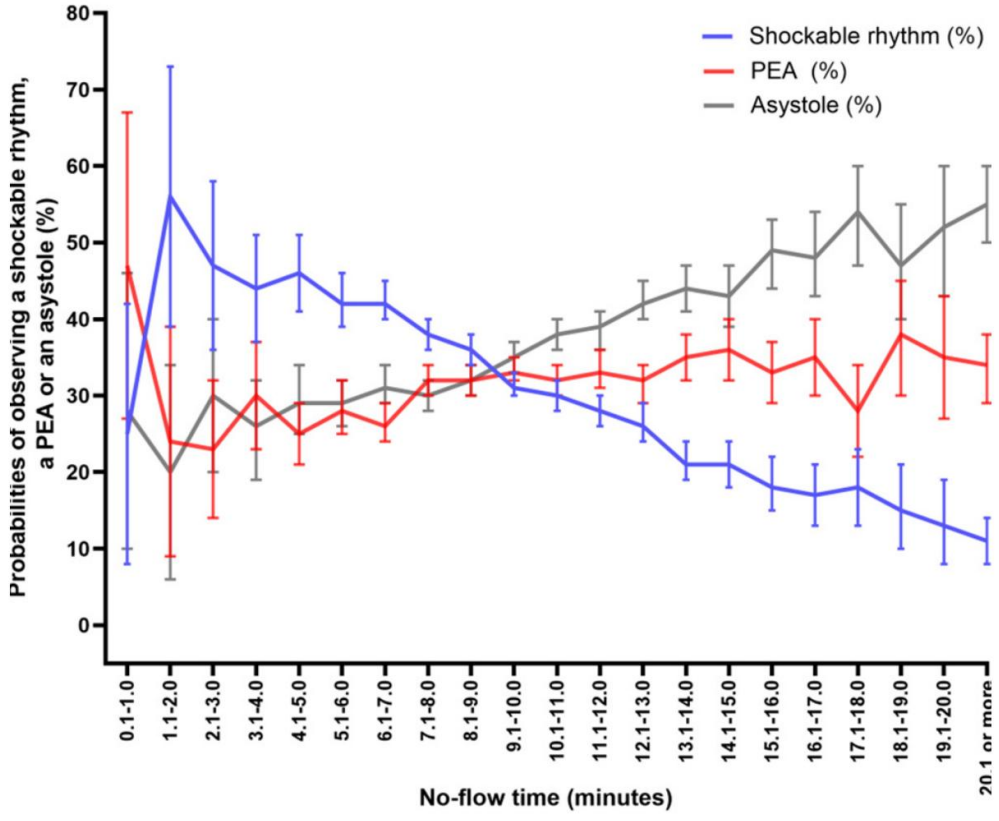


Platí i pro amplitudu fibrilačních vln

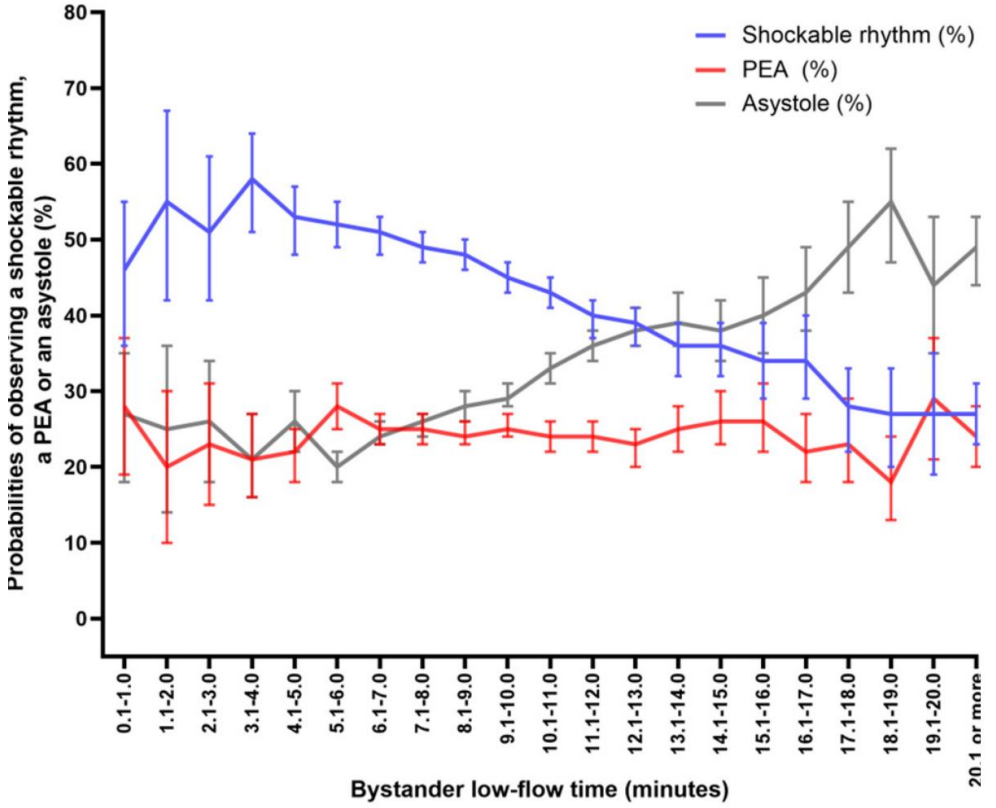
Havranek S., et al. Int J Artif Organs 2014;37:48-57.

Pravděpodobnost pozorování fibrilace komor

Závislost na době NO-FLOW



Závislost na době BYSTANDER LOW-FLOW



Cournoyer A., et al. Resuscitation 2001;167:355-61.

Jak častá je změna rytmu v přednemocniční fázi?

Retrospektivní analýza
- 625 OHCA pacientů
- 49 (~ 8%) změna rytmu
- 20 (41%) defibrilovatelný rytmus
→ ~ 4-5 % defibrilovatelných rytmů se změní

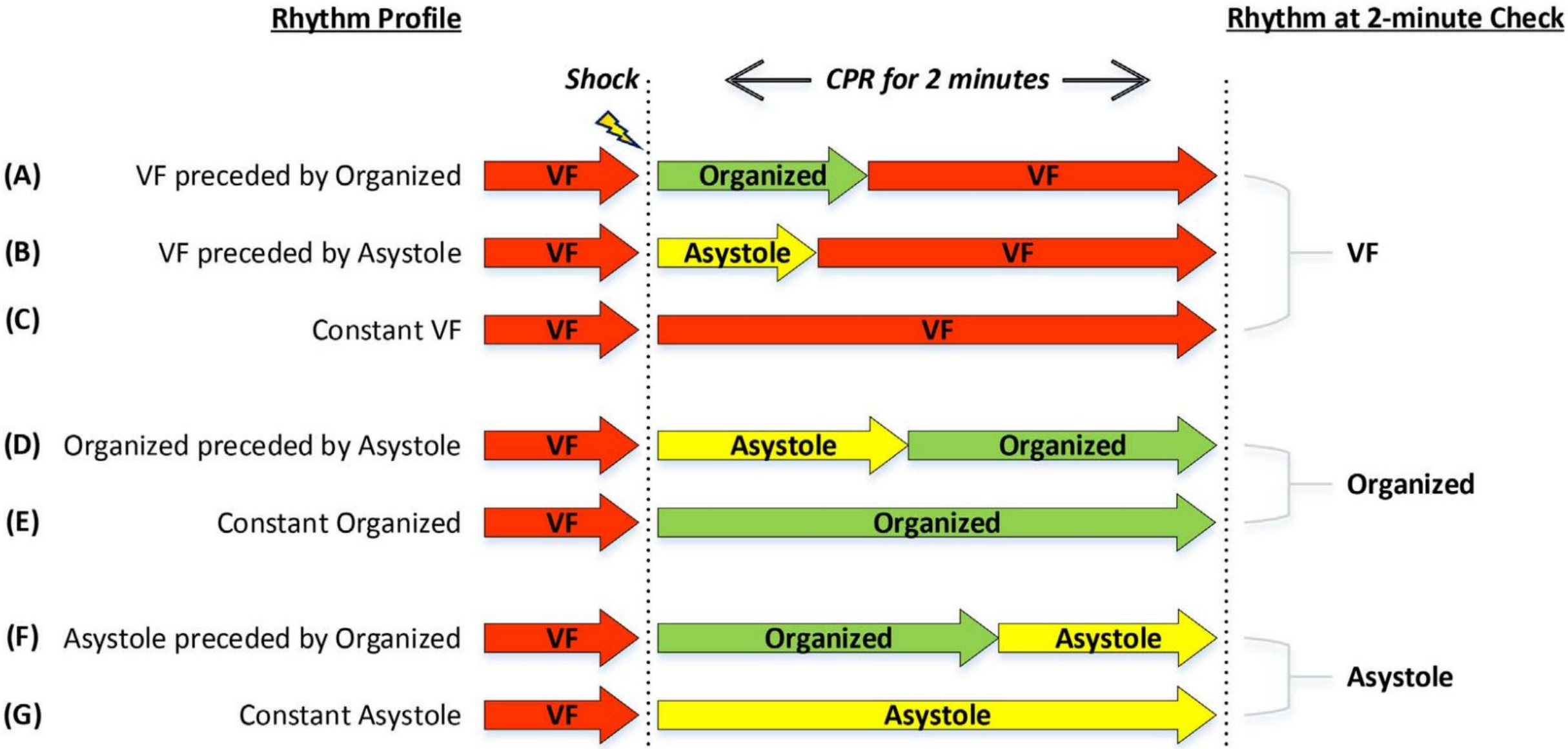
72% pacientů mělo při odjezdu EMS ROSC

Rhythm change EMS to ED	
None	0 (0.0%)
Shockable to ROSC	1 (2.0%)
Shockable to Nonshockabl	13 (26.5%)
Nonshockable to ROSC	4 (8.2%)
Nonshockable to Shockable	2 (4.1%)
ROSC to Shockable	1 (2.0%)
ROSC to Nonshockable	28 (57.1%)

		Rhythm Change Group n = 49	No Rhythm Change Group n = 576	Total Sample n = 625	*p*–Value
Cardiac arrest characteristics	Witnessed arrest	38 (77.6%)	451 (79.0%)	489 (78.9%)	0.855
	Bystander CPR	33 (70.2%)	415 (72.4%)	448 (72.3%)	0.737
	Low flow time (min)	45.0 (32.0–59.3)	15.0 (6.0–39.3)	15.0 (6.3–45.0)	< 0.001
	No flow time (min)	0.0 (0.0–5.0)	0.0 (0.0–4.8)	0.0 (0.0–5.0)	0.258
	Total arrest duration (minutes)	49.5 (34.8–66.0)	17.0 (8.0–45.0)	18.0 (8.0–47.5)	< 0.001
	Number of shocks administered	1 (0–6)	1 (0–4)	1 (0–4)	0.989
	Mechanical CPR	4 (8.2%)	55 (9.6%)	59 (9.5%)	1.000
	AED connected	24 (54.5%)	272 (51.6%)	296 (51.8%)	0.755

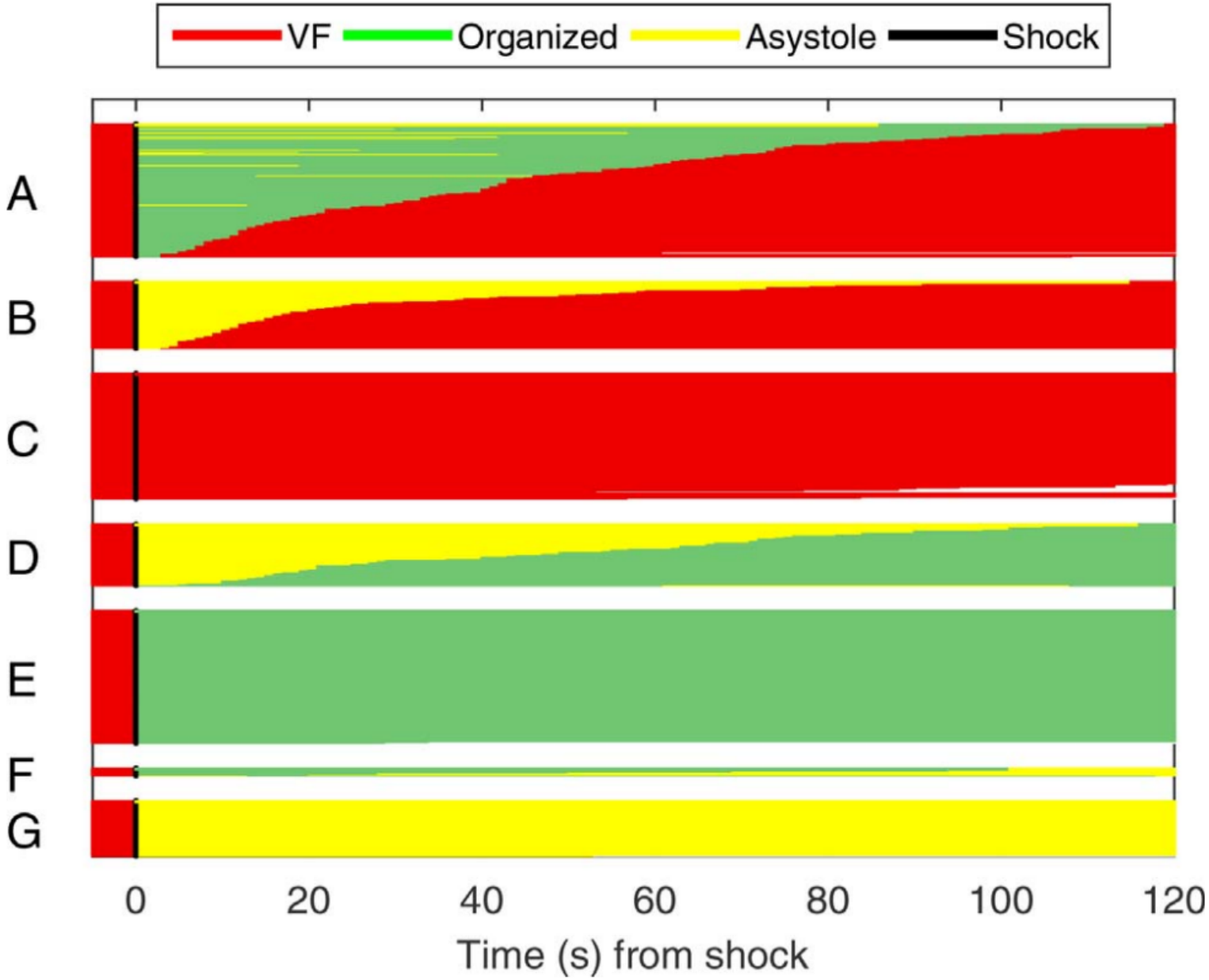
Mandigers L., et al. J Emerg Med 2023;65:e180-7.

Změna rytmu



Bhandari S., et al. Resuscitation 2018;125:22-27.

Změna rytmu



Bhandari S., et al. Resuscitation 2018;125:22-27.

Prognostický význam změny rytmu

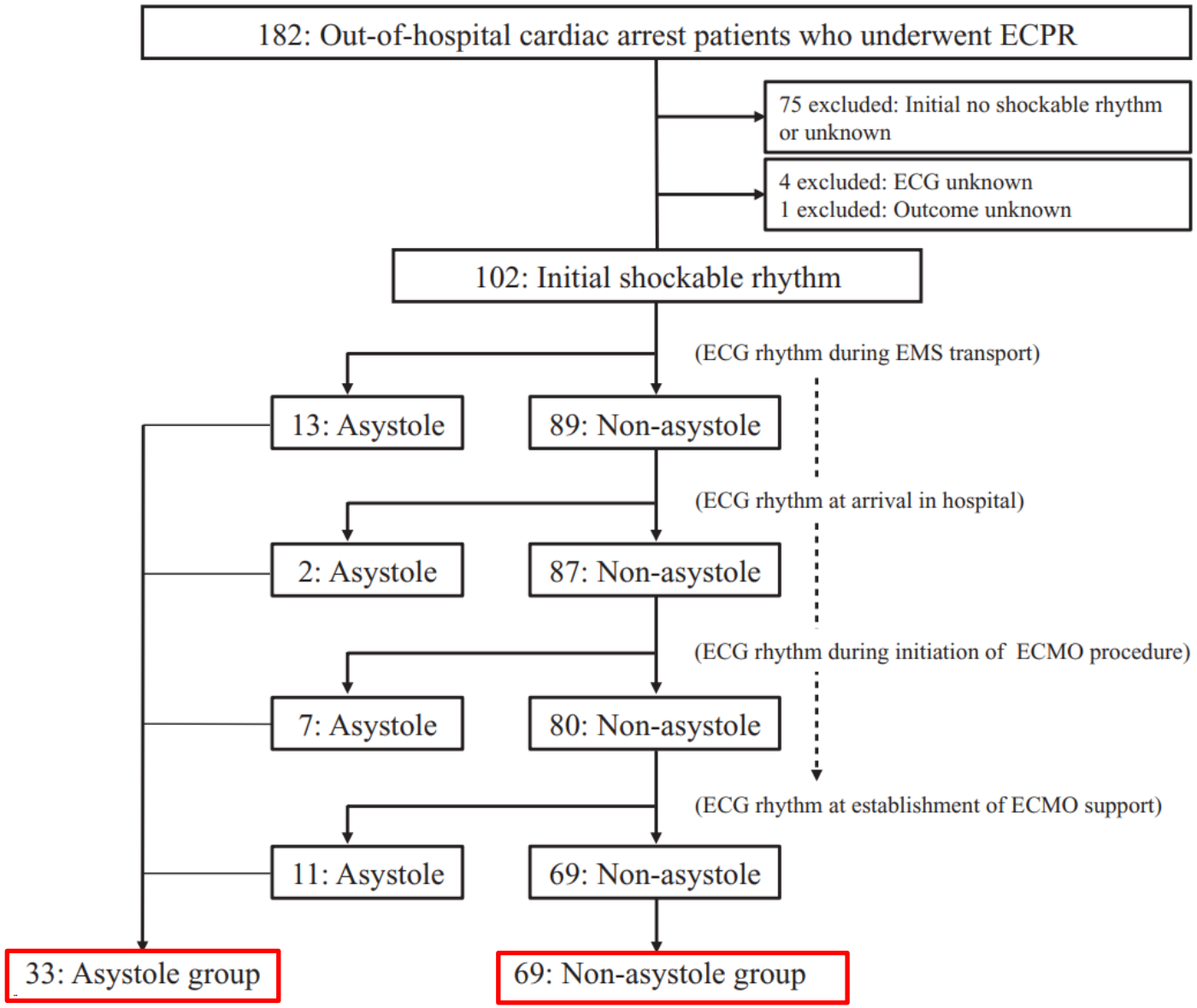
Defibrilovatelný → nedefibrilovatelný

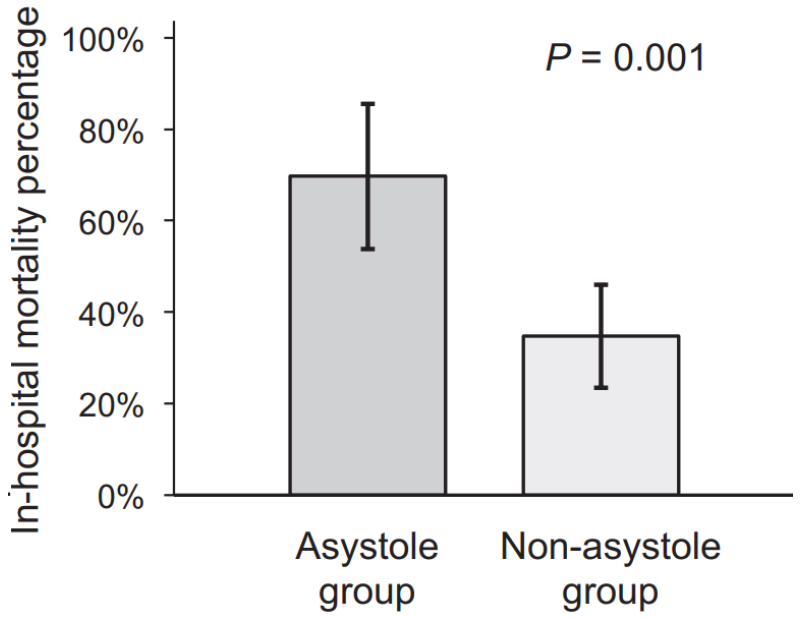
Změna rytmu

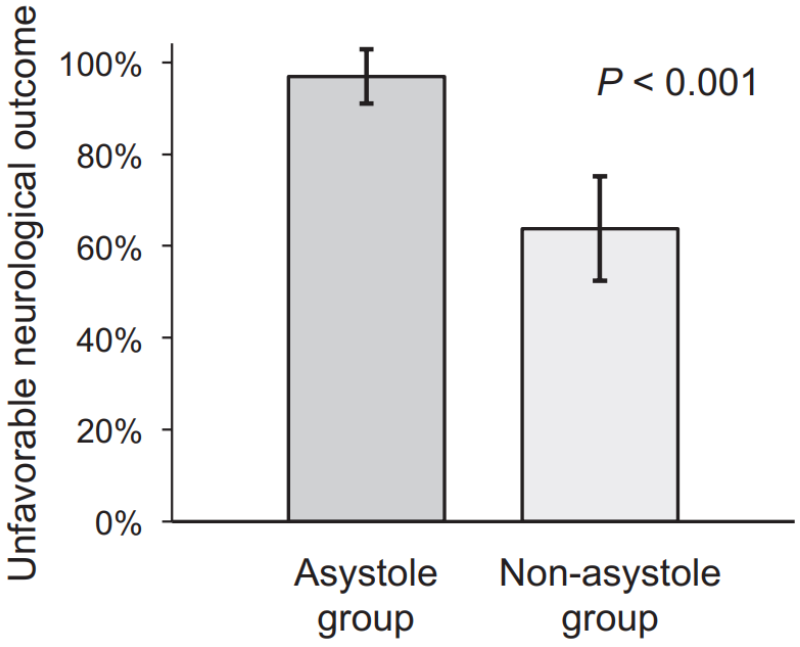
Shock Number	Rhythm Profile	Two-minute rhythm check	N	Survival, n (%)	Survival difference (95% CI)	p value
One			569	269 (0.47)		
	VF preceded by Organized	VF	130	89 (0.68)	0.37 (0.24, 0.49)	< .001
	VF preceded by Asystole	VF	65	18 (0.28)	−0.04 (-0.19, 0.11)	.69
	Constant VF	VF	123	39 (0.32)	referent	
	Organized preceded by Asystole	Organized	60	31 (0.52)	−0.10 (-0.26, 0.07)	.26
	Constant Organized	Organized	130	80 (0.62)	referent	
	Asystole preceded by Organized	Asystole	7	2 (0.29)	0.10 (−0.33, 0.53)	.9
	Constant Asystole	Asystole	54	10 (0.19)	referent	
Two			330	158 (0.48)		
	VF preceded by Organized	VF	123	76 (0.62)	0.29 (0.15, 0.43)	< .001
	VF preceded by Asystole	VF	33	10 (0.30)	−0.03 (-0.23, 0.17)	.95
	Constant VF	VF	94	31 (0.33)	referent	
	Organized preceded by Asystole	Organized	18	3 (0.17)	−0.62 (-0.87, −0.37)	< .001
	Constant Organized	Organized	47	37 (0.79)	referent	
	Asystole preceded by Organized	Asystole	0	0		
	Constant Asystole	Asystole	15	1 (0.07)		

Bhandari S., et al. Resuscitation 2018;125:22-27.

Změna rytmu a ECPR







Retrospektivní data u nemocných napojených na ECPR, single centre

Maeda K., et al. Shock 2021;56:701-8.

Změna rytmu a ECPR

Nemocniční mortalita

The ECG rhythms at each point	Survival (n = 55)	Death (n = 47)	*P* value
During transport to the hospital			0.173
Shockable (n = 71)	40 (56.3)	31 (43.7)	
Asystole (n = 13)	4 (30.8)	9 (69.2)	
PEA (n = 12)	6 (50.0)	6 (50.0)	
ROSC (n = 6)	5 (83.3)	1 (16.7)	
At hospital arrival			0.041
Shockable (n = 73)	43 (58.9)	30 (41.1)	
Asystole (n = 8)	1 (12.5)	7 (87.5)	
PEA (n = 21)	11 (52.4)	10 (47.6)	
ROSC (n = 0)	N/A	N/A	
From hospital arrival to initiation of the ECMO procedure			0.001
Shockable (n = 64)	41 (64.1)	23 (35.9)	
Asystole (n = 11)	2 (18.2)	9 (81.8)	
PEA (n = 23)	8 (34.8)	15 (65.2)	
ROSC (n = 4)	4 (100)	0 (0)	
At establishment of VA-ECMO support			< 0.001
Shockable (n = 55)	37 (67.3)	18 (32.7)	
Asystole (n = 21)	3 (14.3)	18 (85.7)	
PEA (n = 24)	13 (54.2)	11 (45.8)	
ROSC (n = 2)	2 (100)	0 (0)	

Maeda K., et al. Shock 2021;56:701-8.

Změna rytmu a ECPR

Neurologický outcome

The ECG rhythms at each point	Favorable neurological outcomes (n = 26)	Unfavorable neurological outcomes (n = 76)	*P* value
During transport to the hospital			0.032
Shockable (n = 71)	21 (29.6)	50 (70.4)	
Asystole (n = 13)	0 (0)	13 (100)	
PEA (n = 12)	2 (16.7)	10 (83.3)	
ROSC (n = 6)	3 (50.0)	3 (50.0)	
At hospital arrival			0.022
Shockable (n = 73)	24 (32.9)	49 (67.1)	
Asystole (n = 8)	0 (0)	8 (100)	
PEA (n = 21)	2 (9.5)	19 (90.5)	
ROSC (n = 0)	N/A	N/A	
From hospital arrival to initiation of the ECMO procedure			0.020
Shockable (n = 64)	23 (35.9)	41 (64.1)	
Asystole (n = 11)	1 (9.1)	10 (90.9)	
PEA (n = 23)	2 (8.7)	21 (91.3)	
ROSC (n = 4)	4 (100)	0 (0)	
At establishment of VA-ECMO support			<0.001
Shockable (n = 55)	23 (41.8)	32 (58.2)	
Asystole (n = 21)	0 (0)	21 (100)	
PEA (n = 24)	3 (12.5)	21 (87.5)	
ROSC (n = 2)	0 (0)	2 (100)	

Maeda K., et al. Shock 2021;56:701-8.

Vlastní data

Průběžně analyzovaná data z Prague OHCA study

Změna rytmu v Prague OHCA

Fibrilace komor 156 pacientů

- Bez jiné arytmie: 80 (51%)
- Epizoda EMD: 43 (28%) - typické střídání bezpulzové aktivity a fibrilace komor
- Epizoda asystolie: 32 (21%)

Přednemocniční a nemocniční mortalita

- Bez jiné arytmie: 34 z 80 (43%)
- Epizoda EMD: 26 z 43 (60%)
- Epizoda asystolie: 27 z 32 (84%)

Doposud nepublikovaná data.

Závěr

Zprvu defibrilovatelný rytmus a nyní si nejsem jist

Pokud se jedná o asystolii pak prognóza pacientů je výrazně zhoršená

Nelze říci, že tito pacienti nemají podstoupit ECPR, ale tato indikace je vysoce diskutabilní
- logistika
- donor program
- etický problém
- data nejsou konstantní ve 100% neúspěchu

Příčinou horší prognózy může být
- odlišná etiologie (spíše se projeví asystolií primárně)
- délka oběhové zástavy (čím delší, tím vyšší pravděpodobnost nedefibrilovatelného rytmu)
- celková kondice organismu
- kvalita přednemocniční péče

Přednáška pouze generuje další otázky a otevírá další nejasná témata

Děkuji za pozornost!