

Autopulse, Lucas & Co

Postreanimationsversorgung

J. Stiepak

- Geschichte der HDM
- Qualität und Outcome
- Mechanische Reanimations-Devices
- Was sagen die Leitlinien –
 und wie setzen wir es um?

- Postreanimationsbehandlung
 - Leitlinien 2015
 - Wohin gehört ein Patient nach ROSC?

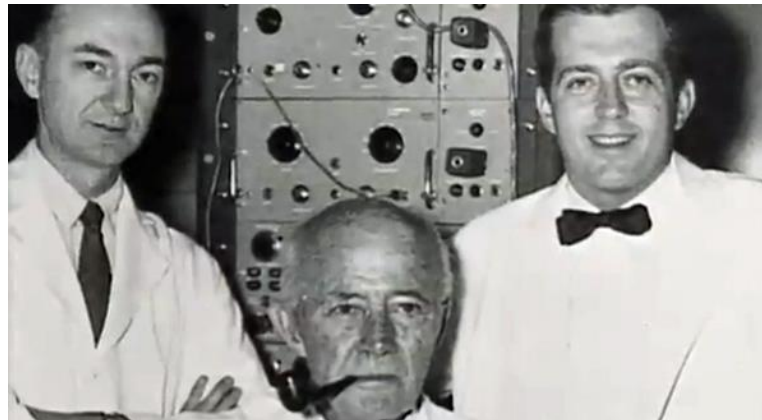
Geschichte

A New Approach to Cardiac Resuscitation *

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and Hospital, Baltimore 5, Maryland*

Annals of Surgery, 1961 Sep;154:311-9.

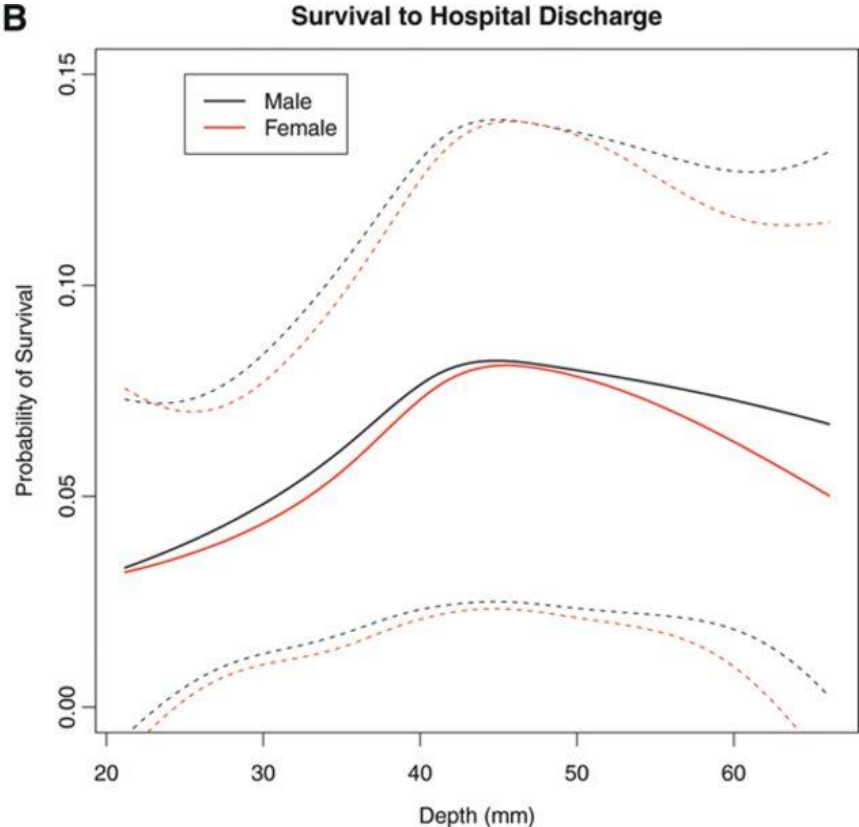
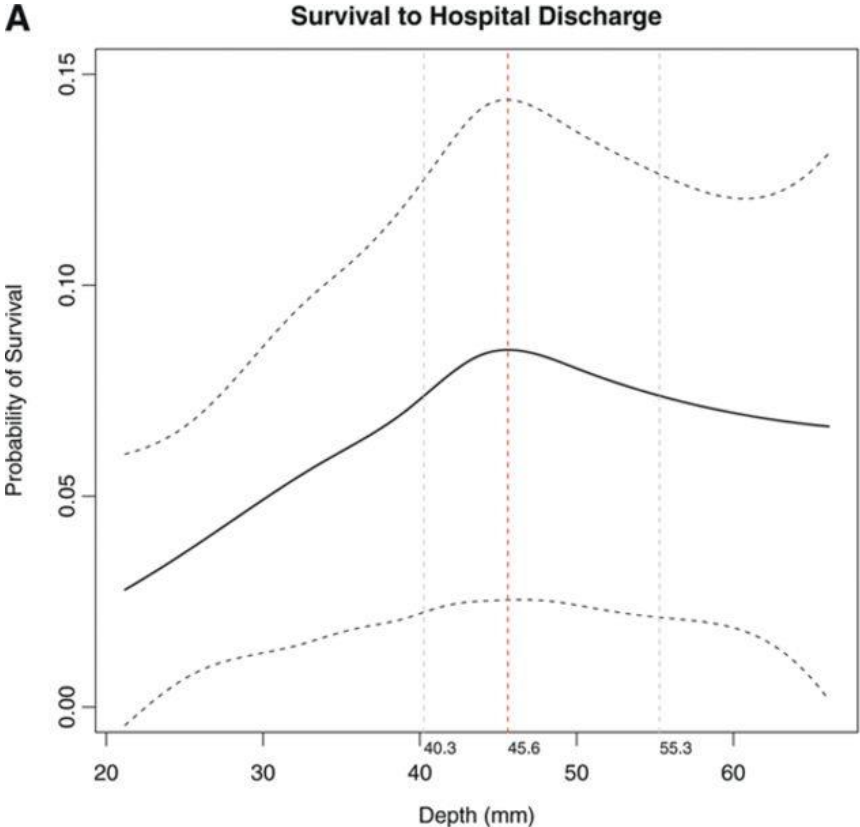


Qualität und Outcome

Qualität und Outcome

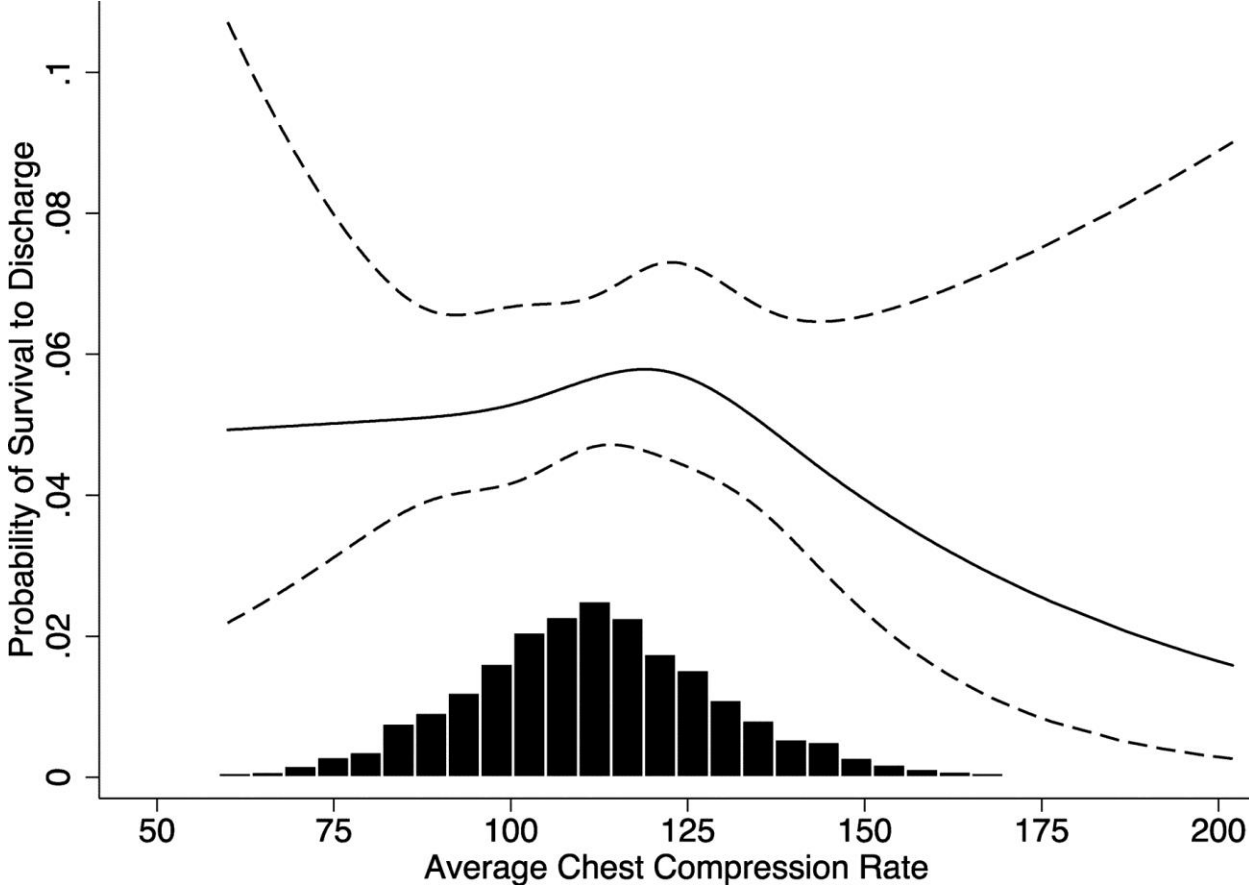
- **Leitlinie 2015:** Empfehlungen zur Drucktiefe und –frequenz:
 - ca. 5 cm - nicht tiefer als 6 cm
 - 100 bis 120 / min

Drucktiefe

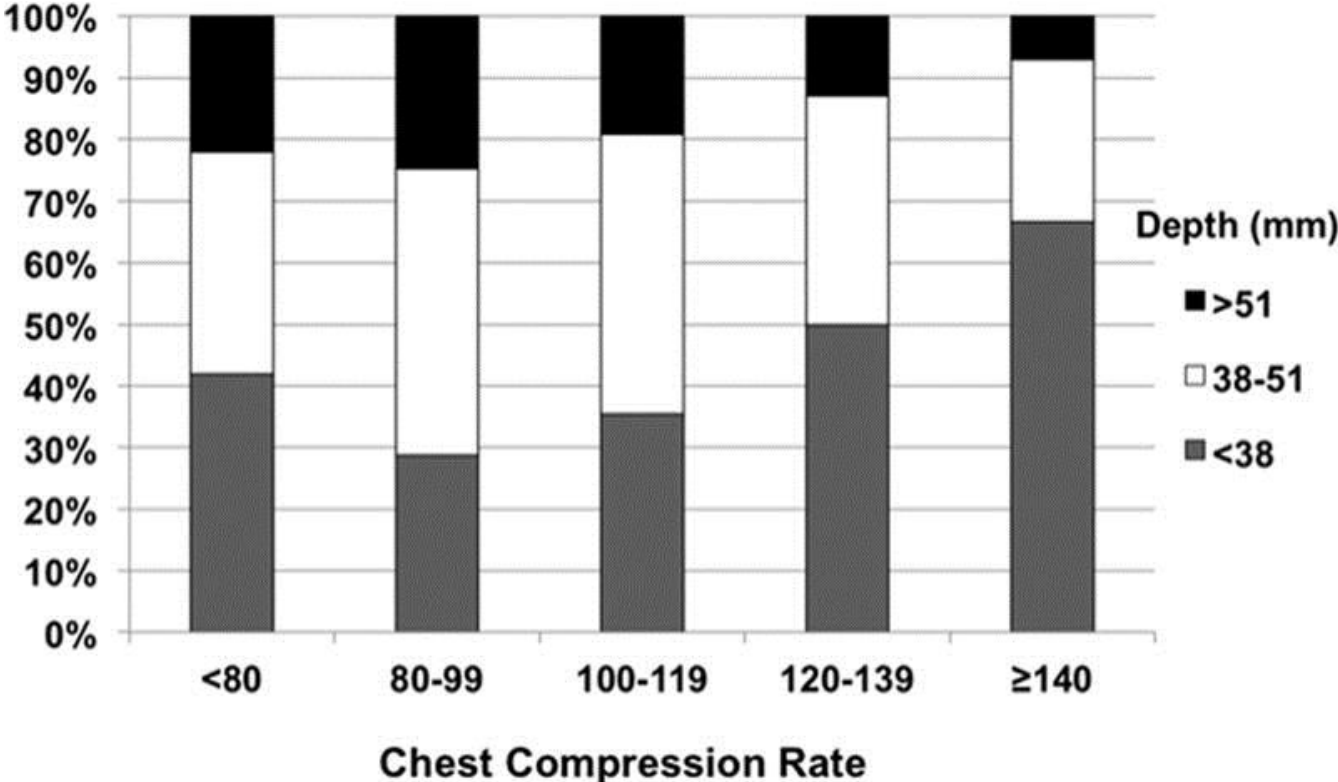


Maximum survival from 40.3mm to 55.3mm

Druckfrequenz



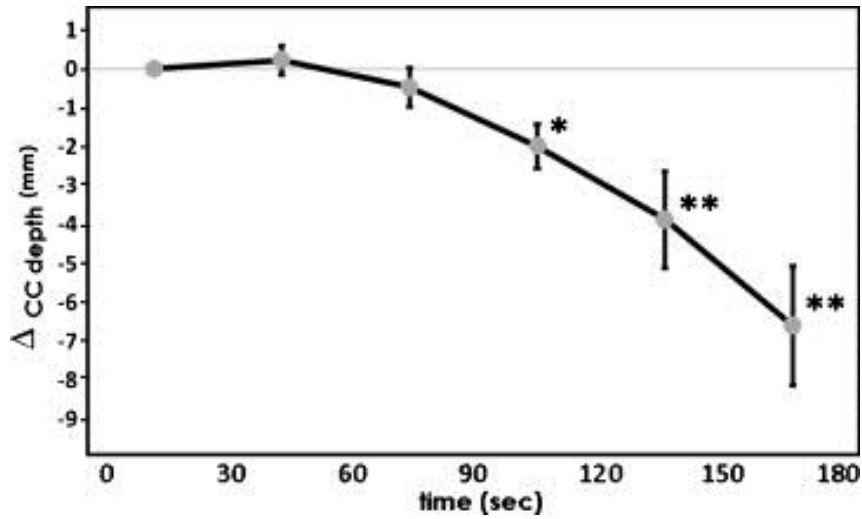
Verhältnis Tiefe/Frequenz



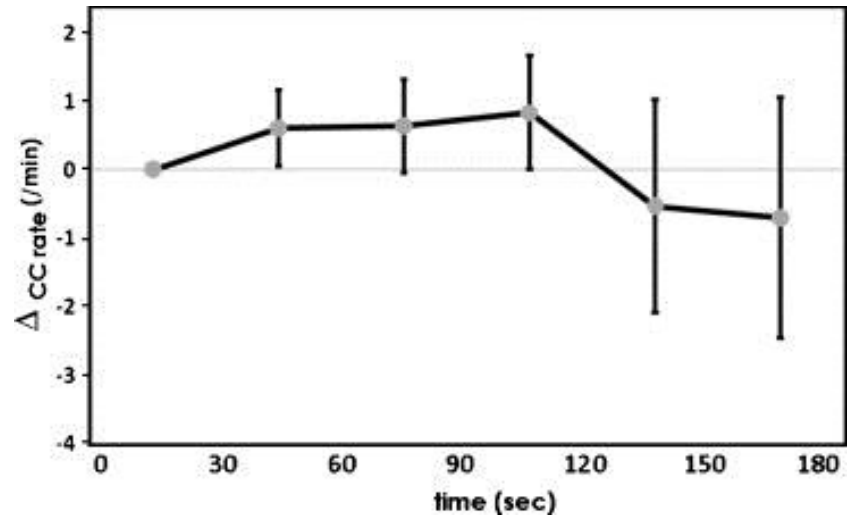
Qualität und Outcome

- Leitlinie 2015: Empfehlungen zur Drucktiefe und –frequenz
- Helferermüdung

Helferermüdung



Drucktiefe



Frequenz

Qualität und Outcome

- Leitlinie 2015: Empfehlungen zur Drucktiefe und –frequenz
- Helferermüdung
- Qualitätsproblem

Qualitätsproblem

Table 2. CPR Parameters During Cardiac Arrest Episodes*

	First 5 Minutes of Cardiac Arrest Episode (N = 67)	Complete Cardiac Arrest Episode (N = 67)
Chest compression data		
Compression rate, /min		
Mean (SD)	102 (19)	105 (21)
<80	12.8	10.8
<90	28.1	23.7
>110	36.5	38.7
Compression depth, mm		
Mean (SD)	42 (13)	43 (14)
<38	37.4	36.3
Ventilation data		
Ventilation rate, /min		
Mean (SD)	21 (12)	20 (13)
<10	7.3	7.5
>20	60.9	58.9
Chest compression interruption		
NFF, mean (SD)	0.24 (0.18)	
30-s segments with NFF >0.20	40.3	

Qualität und Outcome

- Leitlinie 2015: Empfehlungen zur Drucktiefe und –frequenz
- Helferermüdung
- Qualitätsproblem
- Schwierigkeiten beim Transport und in besonderen Situationen

Besondere Situationen

- Transport
- Herzkatheterlabor
- Protrahierte Reanimation z.B. bei Lysetherapie, Dialyse

Mechanische Reanimationsdevices

Mechanische Reanimationsdevices

- ... & Co
- Autopulse
- LUCAS 2

... & Co

- Stempelsysteme
- Studienlage: nicht vorhanden

Autopulse

- Load-Distributing-Band
- Studienlage: Äquivalent zu manueller CPR

CIRC-Studie

Outcomes	M-CPR (<i>n</i> = 2132)	iA-CPR (<i>n</i> = 2099)	Covariate adjusted odds ratio (95% CI)
Survival to Hospital Discharge	233 (11.0%) (7 cases unknown)	196 (9.4%) (5 cases unknown)	0.89 (0.72–1.10)
Survival to 24 h	532 (25.0%) v	456 (21.8%) (10 cases unknown)	0.86 (0.74–0.998) ^b
Sustained ROSC	689 (32.3%)	600 (28.6%)	0.84 (0.73–0.96) ^b
Discharge mRS	(<i>n</i> = 233)	(<i>n</i> = 196)	
Score of 0–3	112 (48.1%)	87 (44.4%)	0.80 (0.47–1.37) ^b
Score of 4–5	61 (26.2%)	50 (25.5%)	
Unknown score	60 (25.8%)	59 (30.1%)	

LUCAS 2

- Stempel + active decompression
- Studienlage: Äquivalent zu manueller CPR

LINC-Studie

Table 2. Primary and Secondary Outcomes

Outcomes	No. (%) of Participants		P Value	Treatment Difference, % (95% CI)
	Mechanical CPR (n = 1300)	Manual CPR (n = 1289)		
4-Hour survival ^a	307 (23.6)	305 (23.7)	>.99	-0.05 (-3.3 to 3.2)
ROSC ^b	460 (35.4)	446 (34.6)	.68	0.78 (-2.9 to 4.5)
Arrival at emergency department with palpable pulse	366 (28.2)	357 (27.7)	.83	0.46 (-3.0 to 3.9)
Survival to discharge from ICU with CPC 1-2 ^c	98 (7.5)	82 (6.4)	.25	1.18 (-0.8 to 3.1)
Survival to hospital discharge with CPC 1-2 ^c	108 (8.3)	100 (7.8)	.61	0.55 (-1.5 to 2.6)
1-Month survival with CPC 1-2 ^d	105 (8.1)	94 (7.3)	.46	0.78 (-1.3 to 2.8)
6-Month survival with CPC 1-2 ^d	110 (8.5)	98 (7.6)	.43	0.86 (-1.2 to 3.0)
Survival to discharge from ICU ^e	158 (12.2)	153 (11.9)	.86	0.28 (-2.2 to 2.8)
With CPC 1	54(4.2)	34(2.6)	.04	1.52 (0.1 to 2.9)
With CPC 2	44 (3.4)	48 (3.7)		
With CPC 3	34 (2.6)	40 (3.1)		
With CPC 4	26 (2.0)	29 (2.2)		
Survival to discharge from hospital ^e	117 (9.0)	118 (9.2)	.89	-0.15 (-2.4 to 2.1)
With CPC 1	89 (6.8)	67 (5.2)	.08	1.65 (-0.2 to 3.5)
With CPC 2	19 (1.5)	33 (2.6)		
With CPC 3	9 (0.7)	15 (1.2)		
With CPC 4	0	1 (0.1)		

Vorteile

- Kontinuierliche High-Quality-CPR
- Interventionen unter CPR möglich (Coro, Dialyse, ECMO)
- Unterbrechungsfreier Transport

Nachteile

- Verfügbarkeit (Preis)
- Ausbildung erforderlich
- Kein Ersatz für fehlende Helfer
- Höheres Verletzungsrisiko

Was sagen die Leitlinien

“We suggest that automated mechanical chest compression devices are not used routinely to replace manual chest compressions. We suggest that automated mechanical chest compression devices are a reasonable alternative to high-quality manual chest compressions in situations where sustained high-quality manual chest compressions are impractical or compromise provider safety.”

Postreanimationsbehandlung

Postreanimationsbehandlung

→ Eigene Sektion in den Leitlinien



Contents lists available at [ScienceDirect](#)

Resuscitation

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



European Resuscitation Council and European Society of Intensive Care Medicine Guidelines for Post-resuscitation Care 2015
Section 5 of the European Resuscitation Council Guidelines for Resuscitation 2015[☆]



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Postreanimationsbehandlung

- Temperaturmanagement
- Beatmung
- 12-Kanal-EKG
- Welches Krankenhaus?

Temperaturmanagement

- Präklinische Kühlung
 - mittels kalter Infusion (2l Bolus)

Table 2. Status at Time of Discharge

	With Ventricular Fibrillation (n = 583)			Without Ventricular Fibrillation (n = 776)		
	No. (%) [95% CI]		P Value	No. (%) [95% CI]		P Value
	Intervention (n = 292)	Control (n = 291)		Intervention (n = 396)	Control (n = 380)	
Vital status						
Dead	109 (37.3) [32.0-43.0]	104 (35.7) [30.5-41.4]	.69	320 (80.8) [76.6-84.4]	318 (83.7) [79.6-87.1]	.30
Alive	183 (62.7) [57.0-68.0]	187 (64.3) [58.6-69.5]		76 (19.2) [15.6-23.4]	62 (16.3) [12.9-20.4]	
Neurological status at discharge						
Full recovery	125 (42.8) [37.3-48.5]	145 (49.8) [40.7-52.1]	.59	36 (9.1) [6.6-12.3]	34 (8.9) [6.5-12.2]	.74
Mildly impaired	43 (14.7) [11.1-19.2]	35 (12.0) [8.8-16.3]		21 (5.3) [3.5-8.0]	17 (4.5) [2.8-7.0]	
Severely impaired	6 (2.1) [0.9-4.4]	8 (2.7) [1.4-5.3]		5 (1.3) [0.5-2.9]	2 (0.5) [0.1-1.9]	
Disabled (severity unknown)	2 (0.7) [0.2-2.5]	0		0	0	
Comatose	4 (1.4) [0.5-3.5]	7 (2.4) [1.2-4.9]		12 (3.0) [1.7-5.2]	7 (1.8) [0.9-3.8]	
Alive (status unknown)	3 (1.0) [0.4-3.0]	2 (0.7) [0.2-2.5]		2 (0.5) [0.1-1.8]	2 (0.5) [0.1-1.9]	

Temperaturmanagement

- Präklinische Kühlung
 - mittels kalter Infusion (2 l Bolus)
- nicht empfohlen
- Andere Kühlmethoden nicht untersucht
- Kann gemacht werden

Beatmung

- In Registerdaten schlechteres Outcome bei Pat. mit $p\text{CO}_2 < 35 \text{ mmHg}$

pCO₂-Werte nach Aufnahme

	OR (95% CI)	p-Value
Mortality		
Hypo- vs. normocapnia	1.12 (1.00–1.24)	0.04
Hyper- vs. normocapnia	1.06 (0.97–1.15)	0.19
Hyper- vs. hypocapnia	0.95 (0.85–1.06)	0.34
Death OR failure to be discharged home		
Hypo- vs. normocapnia	1.23 (1.10–1.37)	<0.001
Hyper- vs. normocapnia	0.97 (0.89–1.06)	0.52
Hyper- vs. hypocapnia	0.79 (0.70–0.89)	<0.001
Discharge home among survivors		
Hypo- vs. normocapnia	0.81 (.70–.94)	0.01
Hyper- vs. normocapnia	1.16 (1.03–1.32)	0.01
Hyper- vs. hypocapnia	1.43 (1.22–1.69)	<0.001

Beatmung

- In Registerdaten schlechteres Outcome bei Pat. mit $p\text{CO}_2 < 35$ mmHg
- Hyperoxie bringt keinen Vorteil

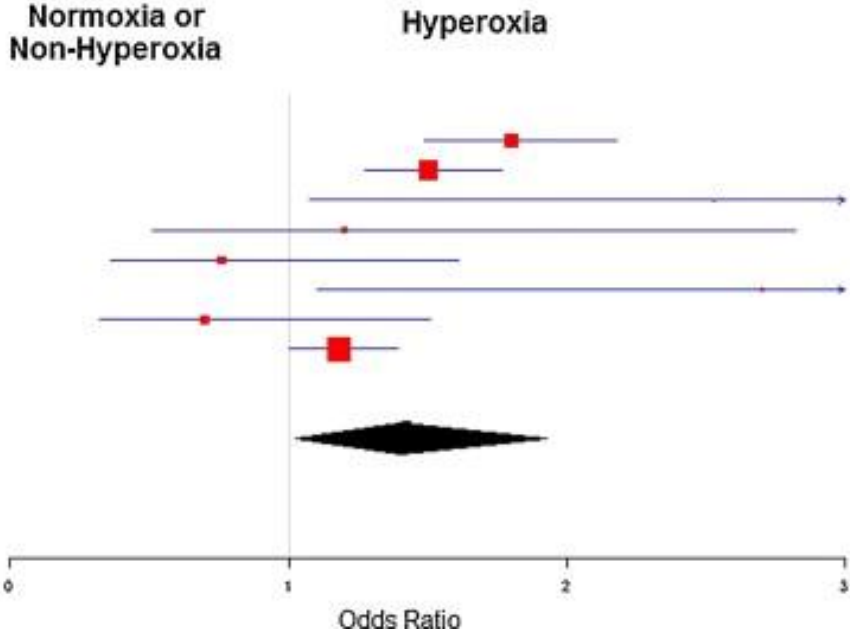
Hyperoxie

Forest Plot for Odds Ratio of In-hospital Mortality

First author (Year)
Kilgannon (2010)
Bellomo (2011)
Janz (2012)
Ihle (2013)
Nelskyla (2013)
Lee (2010)
Gaieski (2012)
Pullalarevu (2012)

Random-Effects Model

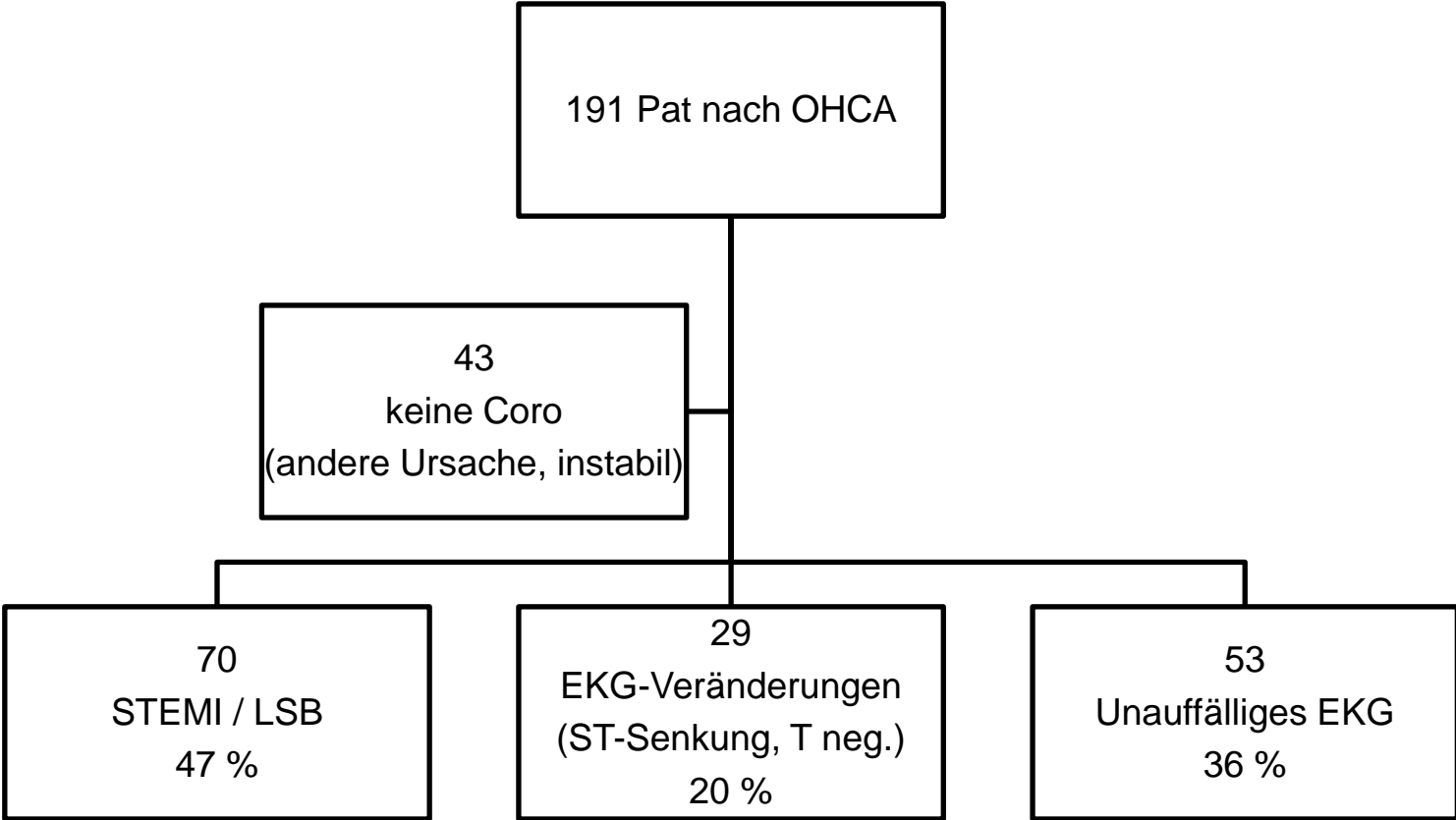
Test for Heterogeneity: p-value = 0.004
I² (% of total variability due to heterogeneity): 69.27%

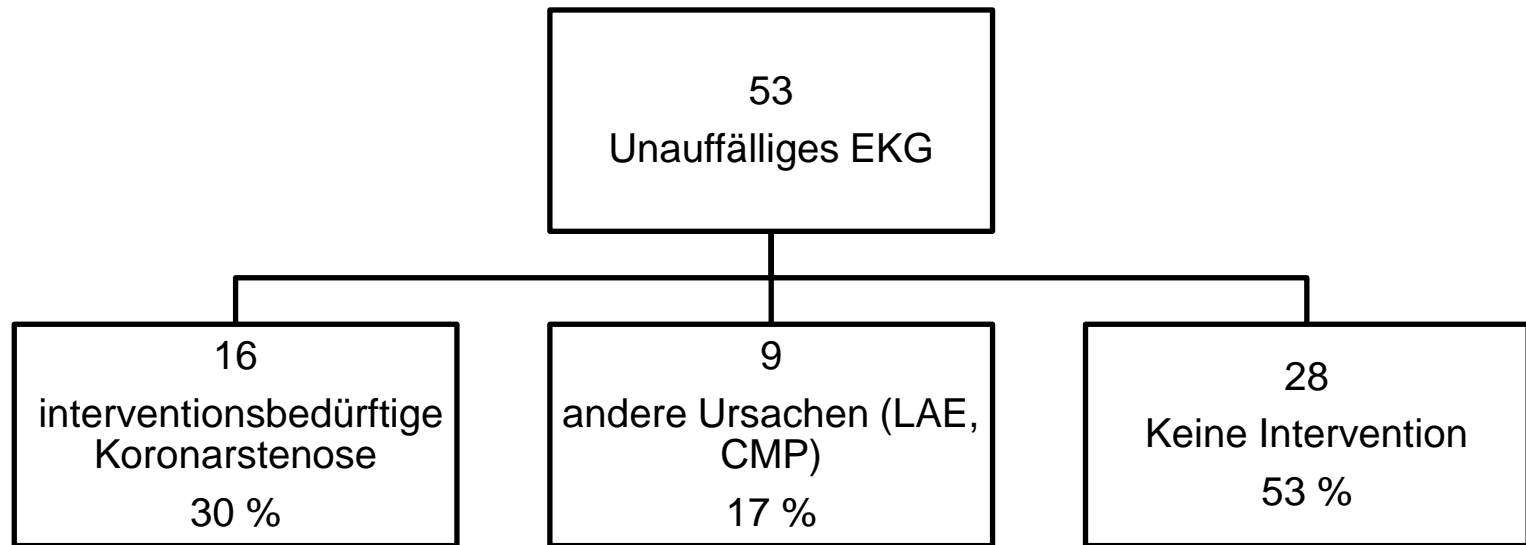


Beatmung

- In Registerdaten schlechteres Outcome bei Pat. mit $p\text{CO}_2 < 35$ mmHg
- Hyperoxie bringt keinen Vorteil
- Normoventilation anstreben
 - SpO_2 94-98%
 - $p\text{CO}_2$ Normwertig, keine Hyperventilation

12-Kanal EKG nach Reanimation





Welches Krankenhaus?

- Zentrum (> 50 Reanimationen /Jahr)
- Herzkatheterlabor
- Kühlung vor Ort möglich
- Ggf. weitere Fahrtstrecke in Kauf nehmen

Zusammenfassung

- Qualitativ gute CPR verbessert das Outcome
- Mechanische Reanimationshilfen in besonderen Situationen hilfreich
- Intensiveres Monitoring nach ROSC
- Behandlung nach ROSC sollte im Zentrum erfolgen


www.cprguidelines.eu



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The European Resuscitation Council Guidelines for Resuscitation 2015 provide specific instructions for how resuscitation should be practiced and take into account ease of teaching and learning, as well as the science. They were developed by Europeans and have been specifically written with European practice in mind.




2015 Guidelines
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CoSTR
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