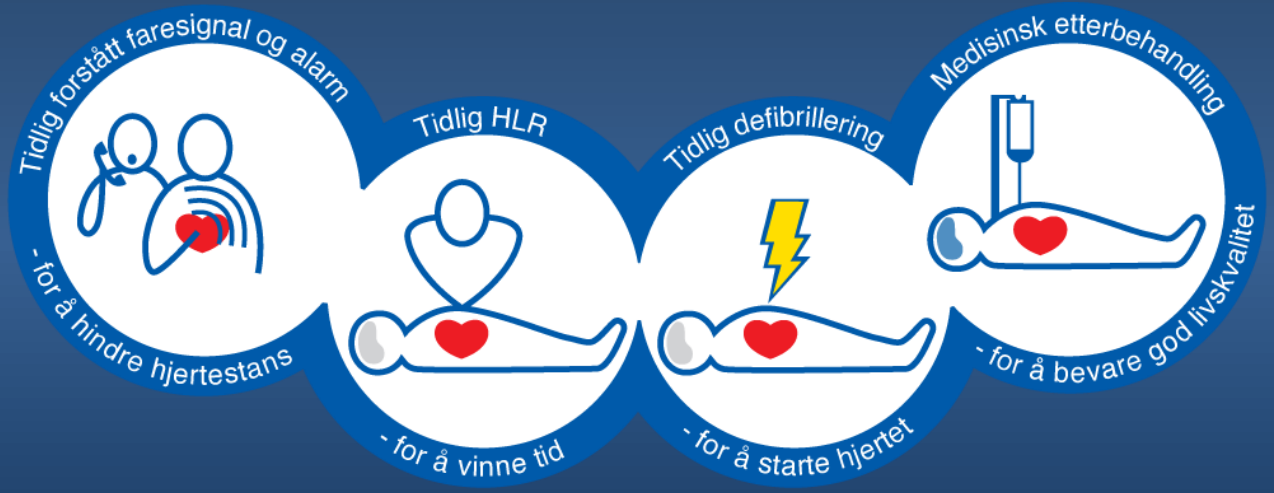
Uløste gåter ved Hjertestans og Hjerte-Lunge-Redning

Kan teknologi og fysiologi redde flere liv?



Daniel Bergum Intensiv St. Olavs H

Intern

Hva er hjertestans?

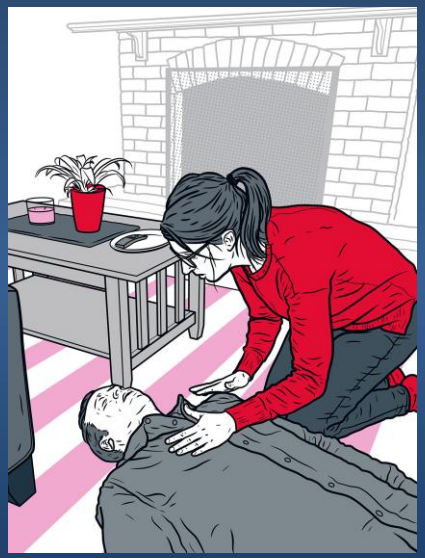
Avansert HLR til voksne

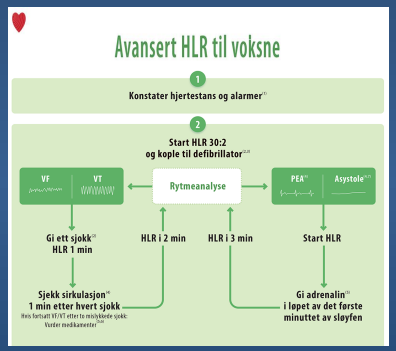
1

Konstater hjertestans og alarmer(1)

MERKNADER

1. Bevisstløs, puster ikke normalt





NRR
NORSK RESUSCITASJONSRÅD

https://nrr.org/

NORSK LUFTAMBULANSE
STIFTELSEN

Intern

Mann 70år sprek

Død dag 5 pga omfattende hjerneskade

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Mann 50år frisk

Død dag 8 pga omfattende hjerneskade

Intern

Kvinne 70år røyk + arv

Død dag 10 pga hjerneskade

Intern

Mann 70år frisk

Våken og klar dag 3

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Norsk hjertestansregister

Nøkkeltall for hjertestans utenfor sykehus i 2023

3036 personer ble forsøkt gjenopplivet av ambulansepersonell etter hjertestans utenfor sykehus



79% fikk hjerte-lungeredning før ambulansen kom frem

18% fikk tilkoblet en hjertestarter før ambulansen kom



40 personer var sjokket av en hjertestarter og hadde puls da ambulansepersonell kom frem

Halvparten fikk ambulanse innen **9** minutter



1073 fikk tilbake egen hjerterytme



439 overlevde til 30 dager

14%



94% av de som overlevde hadde god nevrologisk funksjon ved utskrivelse fra sykehus

Norsk hjertestansregister

Nøkkeltall for hjertestans inne på sykehus 2023

1108 personer ble forsøkt gjenopplivet etter plutselig uventet hjertestans på sykehus. Noen pasienter har flere hjertestans og det var registrert 1231 hjertestanshendelser.





53% fikk tilbake egen hjerterytme

34% av alle hendelser var på sengepost





358 pasienter overlevde til 30 dager

32%

93% av de som overlevde hadde god nevrologisk funksjon ved utskrivelse fra sykehus

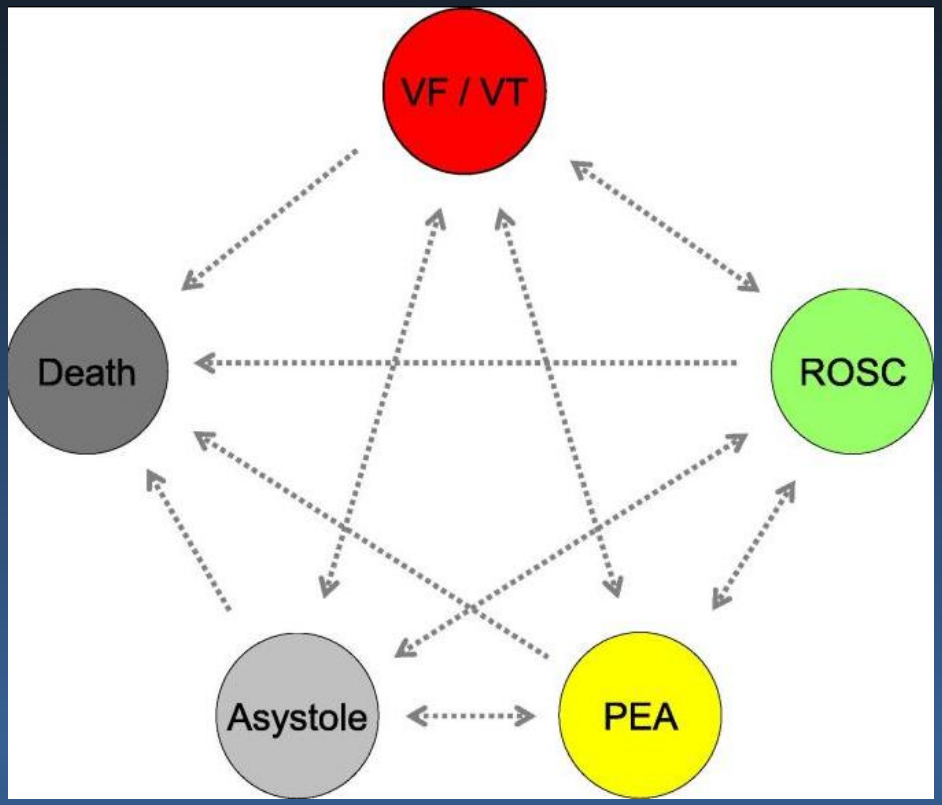


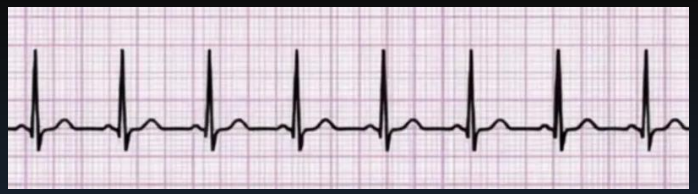
	2014	2023	2024
Døde i alt	40 394	43 803	44 242

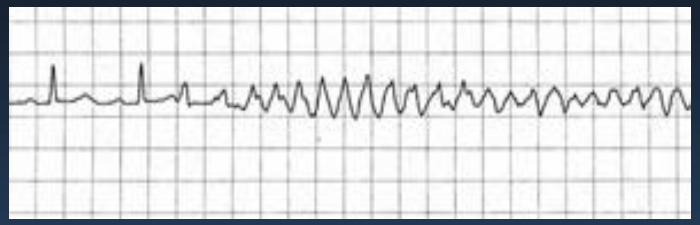
Statistisk sentralbyrå
Statistics Norway

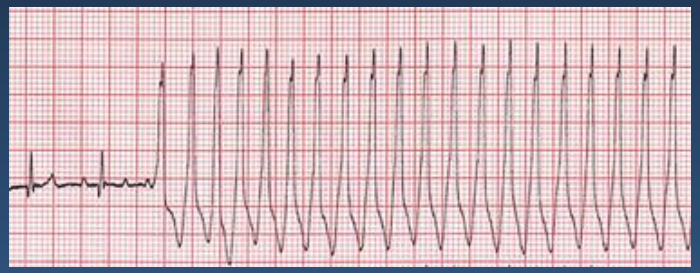
Intern

Typer av hjertestans







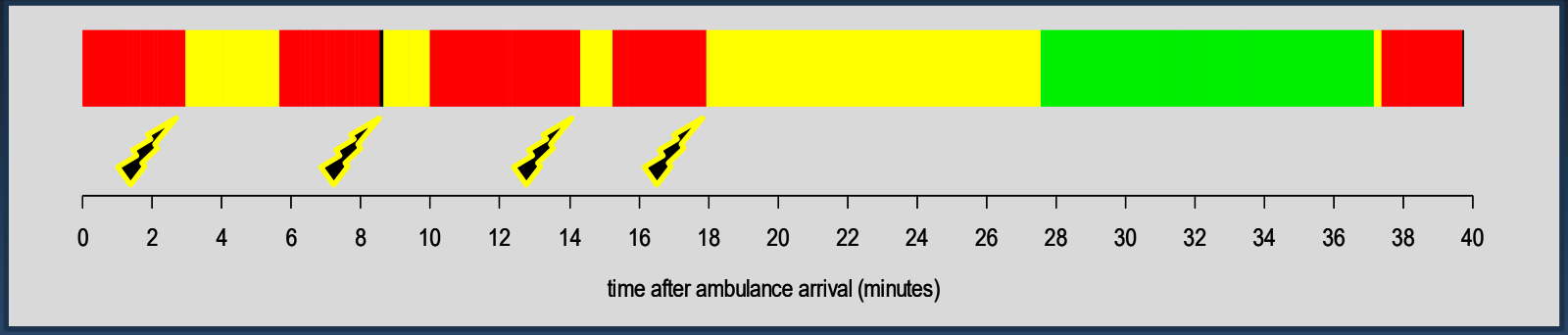




Extracting physiologic and clinical data from defibrillators for research purposes to improve treatment for patients in cardiac arrest Nordseth, T. Eftestoel, T. Resuscitation Plus. 2024; 18.

Intern

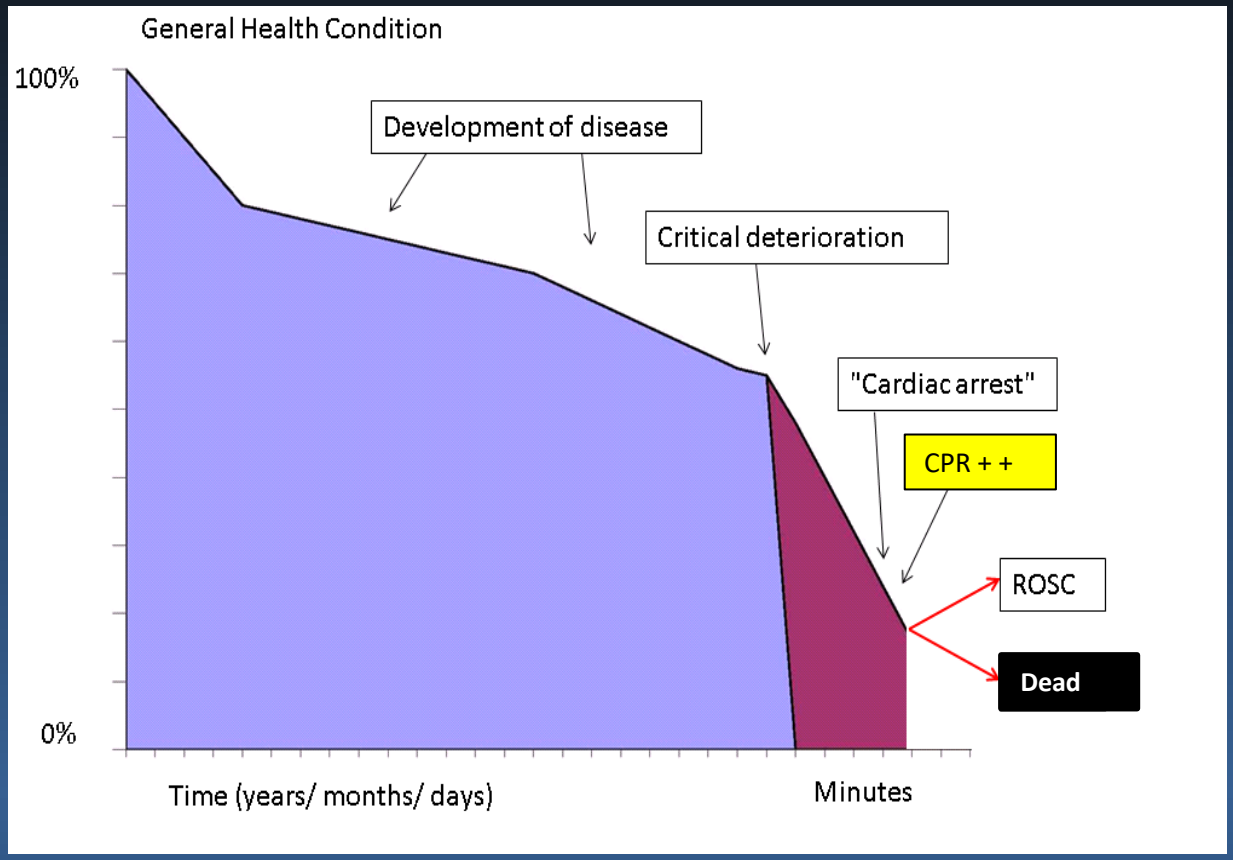
Tidslinje HLR



Skogvoll E. Resuscitation 2008:78;30-7

Intern

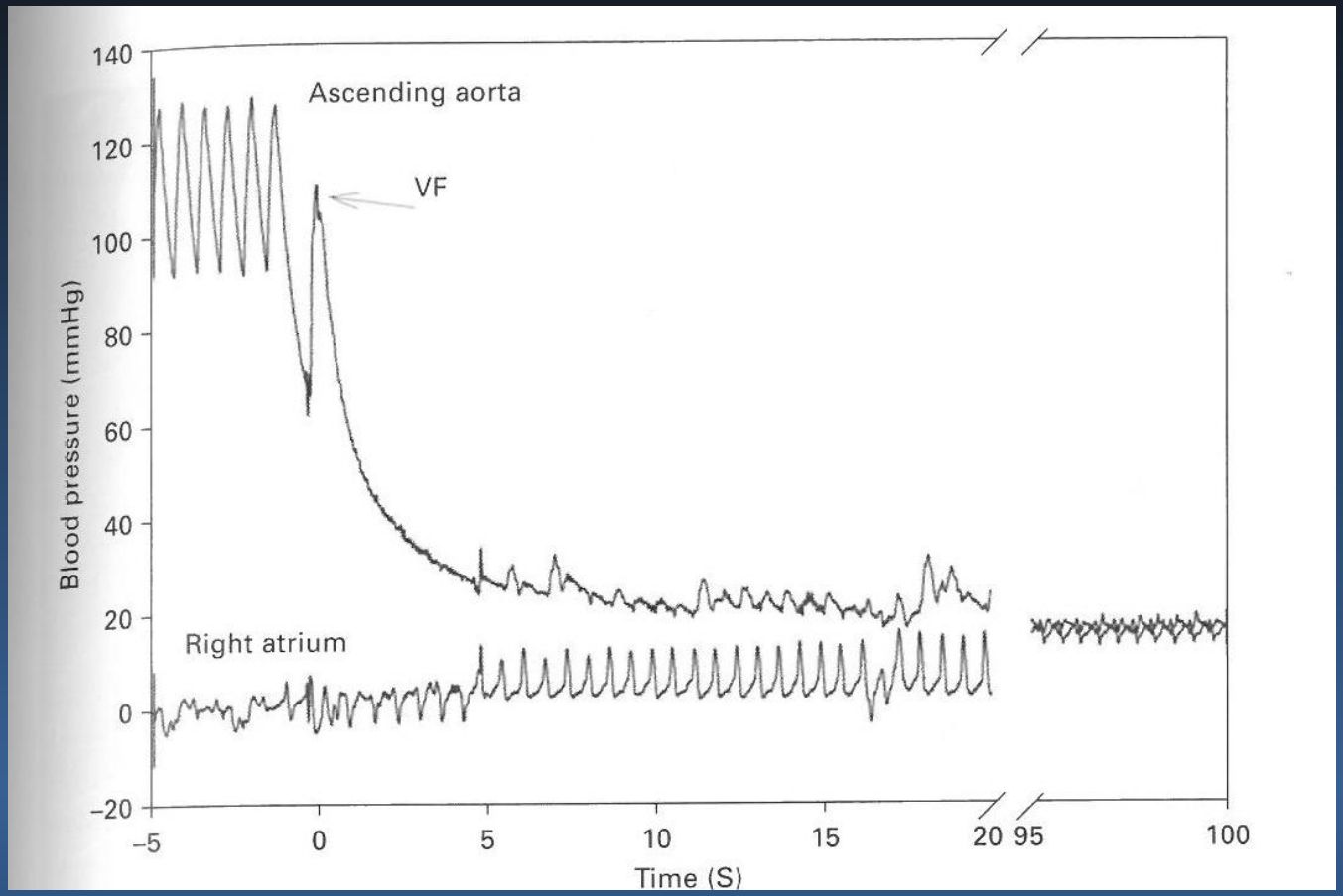
Hvordan få hjertestans?



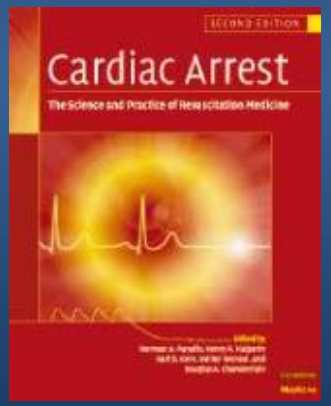
In-hospital cardiac arrest -
Causes, recognition and survival
StO/NTNU 2016

Intern

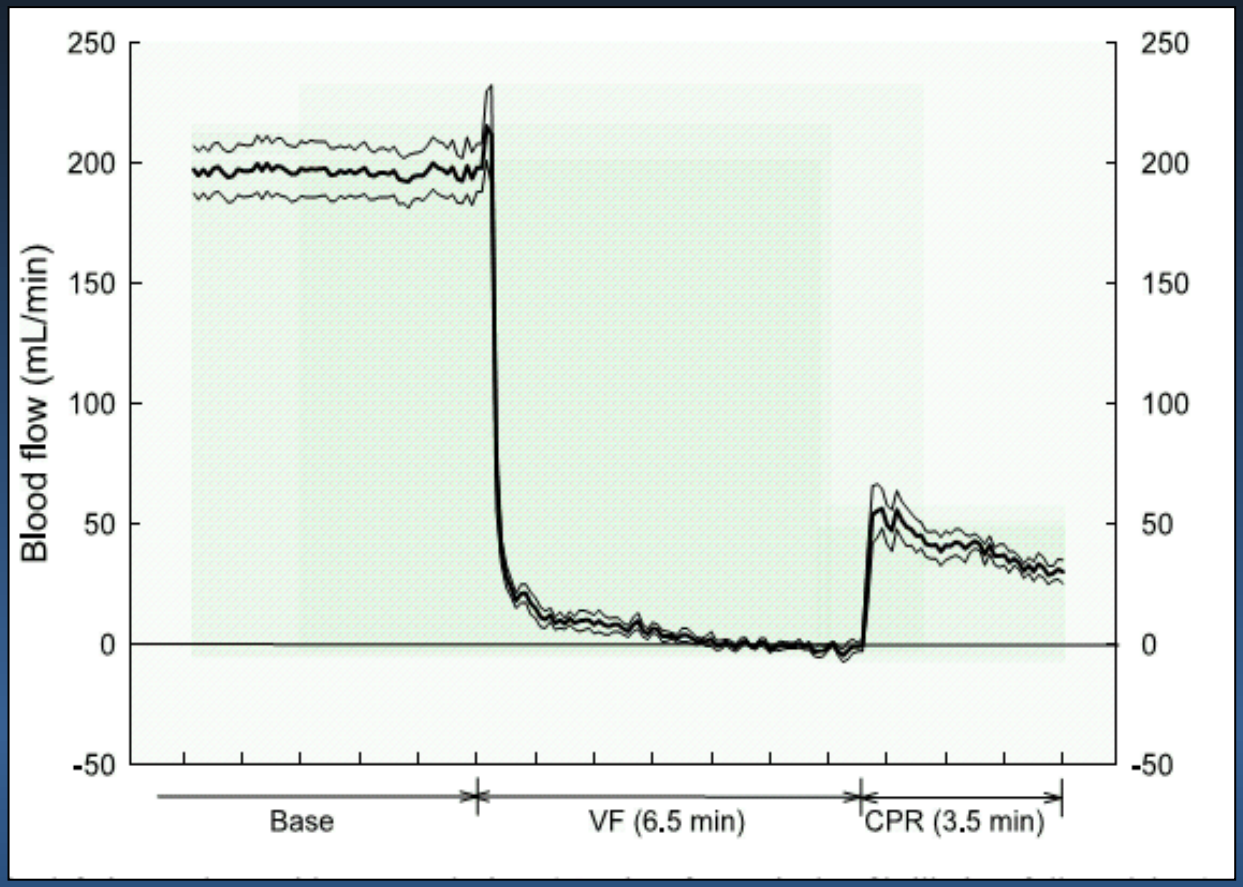
Hva skjer?



Cardiac Arrest
The Science and Practice of Resuscitation Medicine, pp. 347 - 368



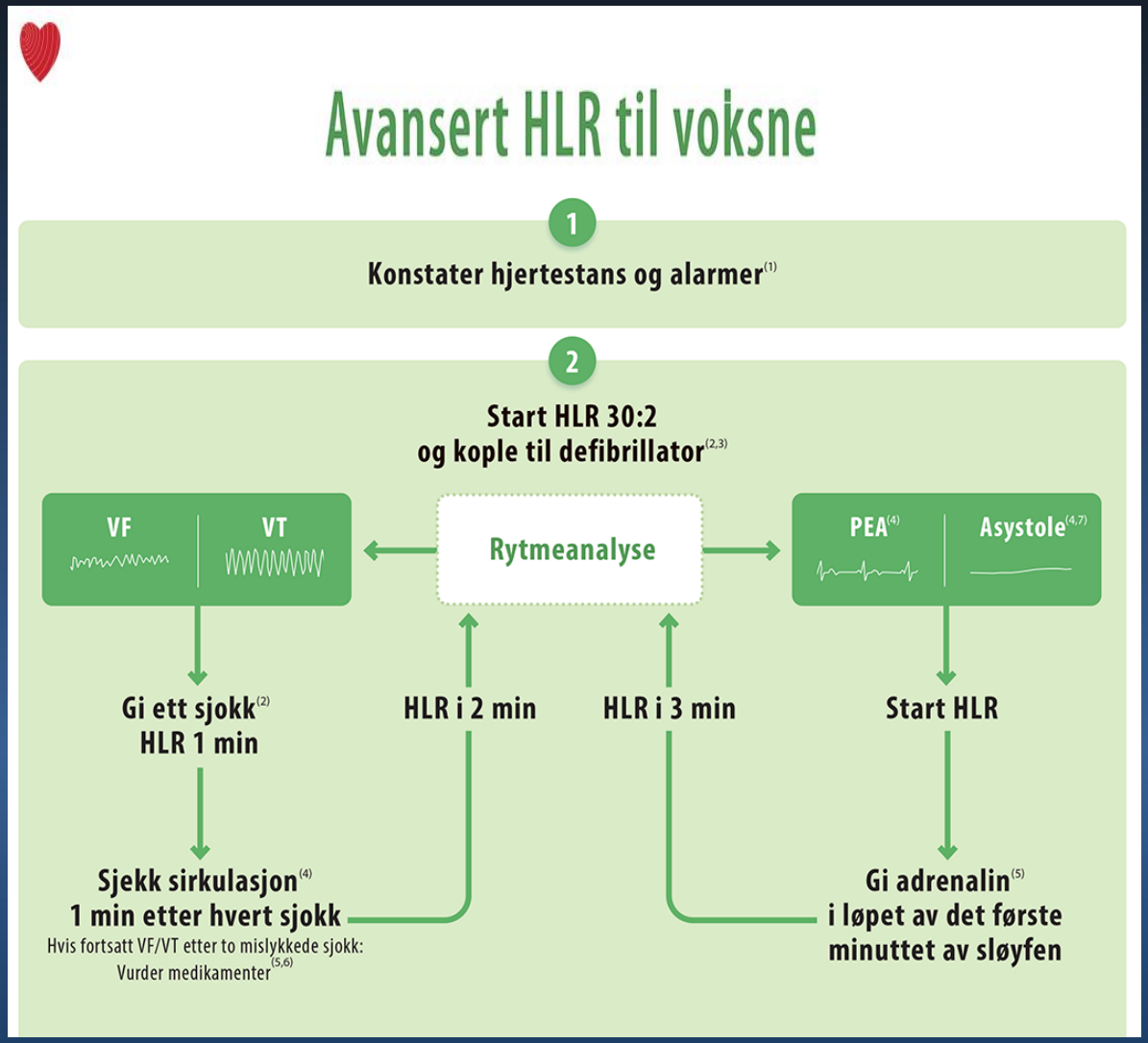
Blodsirkulasjon til hjernen



The critical importance of minimal delay between chest compressions and subsequent defibrillation: a haemodynamic explanation Steen, S. Resuscitation. 2003; 58:249-58.

Intern

Hva er HLR? 30 : 2



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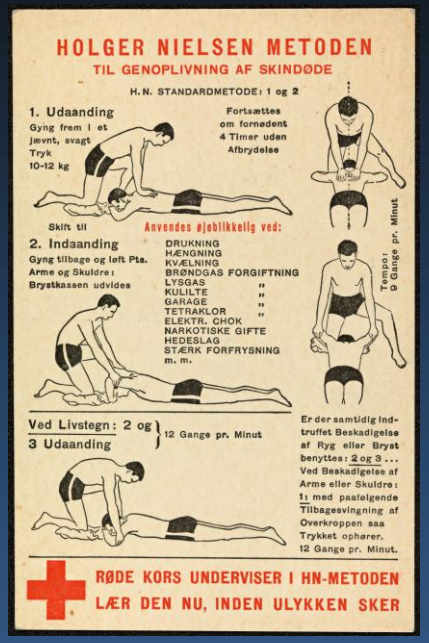
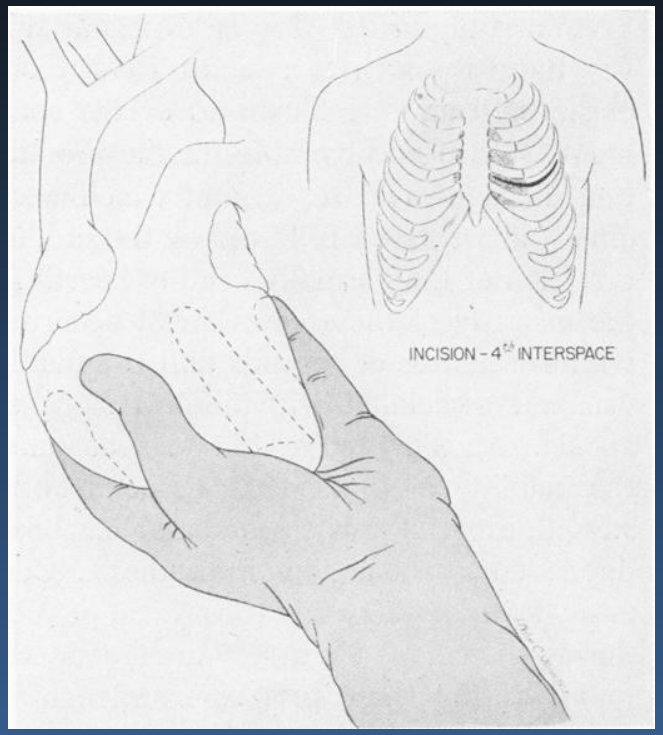
Historisk HLR



«Holger Nielsen Metoden til gjenoplivning af skindøde» dansk postkort utgitt av Røde Kors ca. 1955–57.



SOME COMMON DENOMINATORS IN 1200 CASES OF CARDIAC ARREST*

HUGH E. STEPHENSON, JR., M.D., L. CORSAN REID, M.D., AND J. WILLIAM HINTON, M.D.

NEW YORK, N. Y.

1953



Active compression-decompression cardiopulmonary resuscitation: a population-based, prospective randomised clinical trial in out-of-hospital cardiac arrest

Eirik Skogvoll [a,*], Lars Wik [b]

[a] Department of Anaesthesiology, Faculty of Medicine, Norwegian University of Science and Technology (NTNU), N-7006 Trondheim, Norway
[b] Medinnova, National Hospital, 0026 Oslo, Norway

Received 23 March 1999; accepted 23 June 1999

NORSK LUFTAMBULANSE STIFTELSEN

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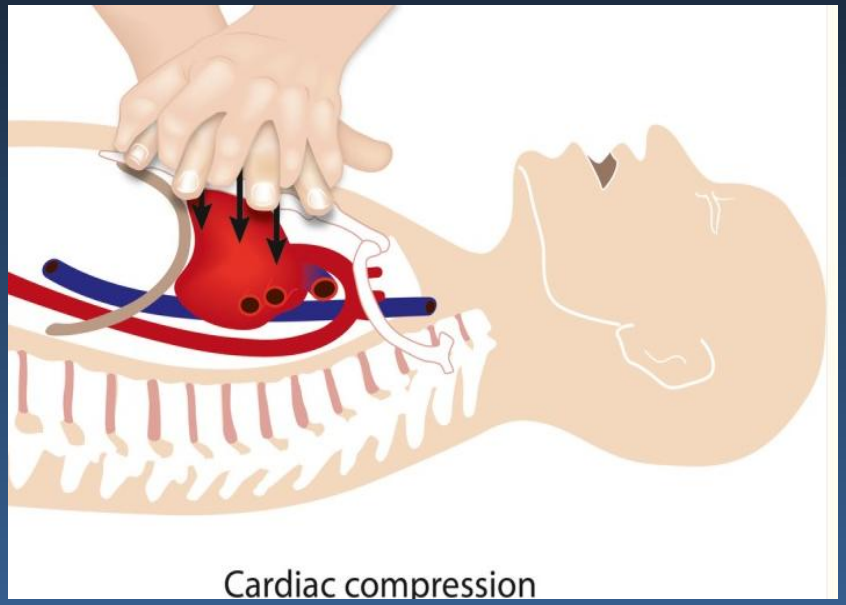
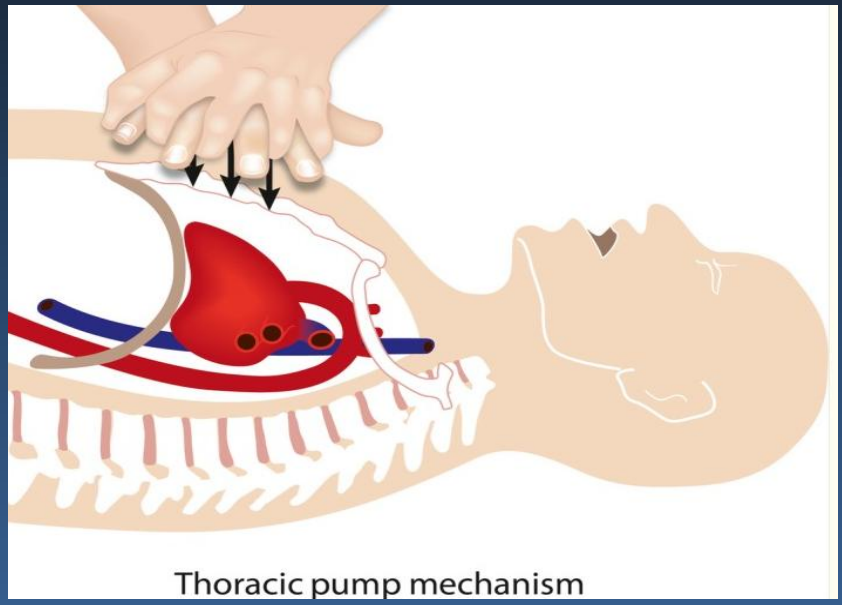
Hvordan virker HLR?

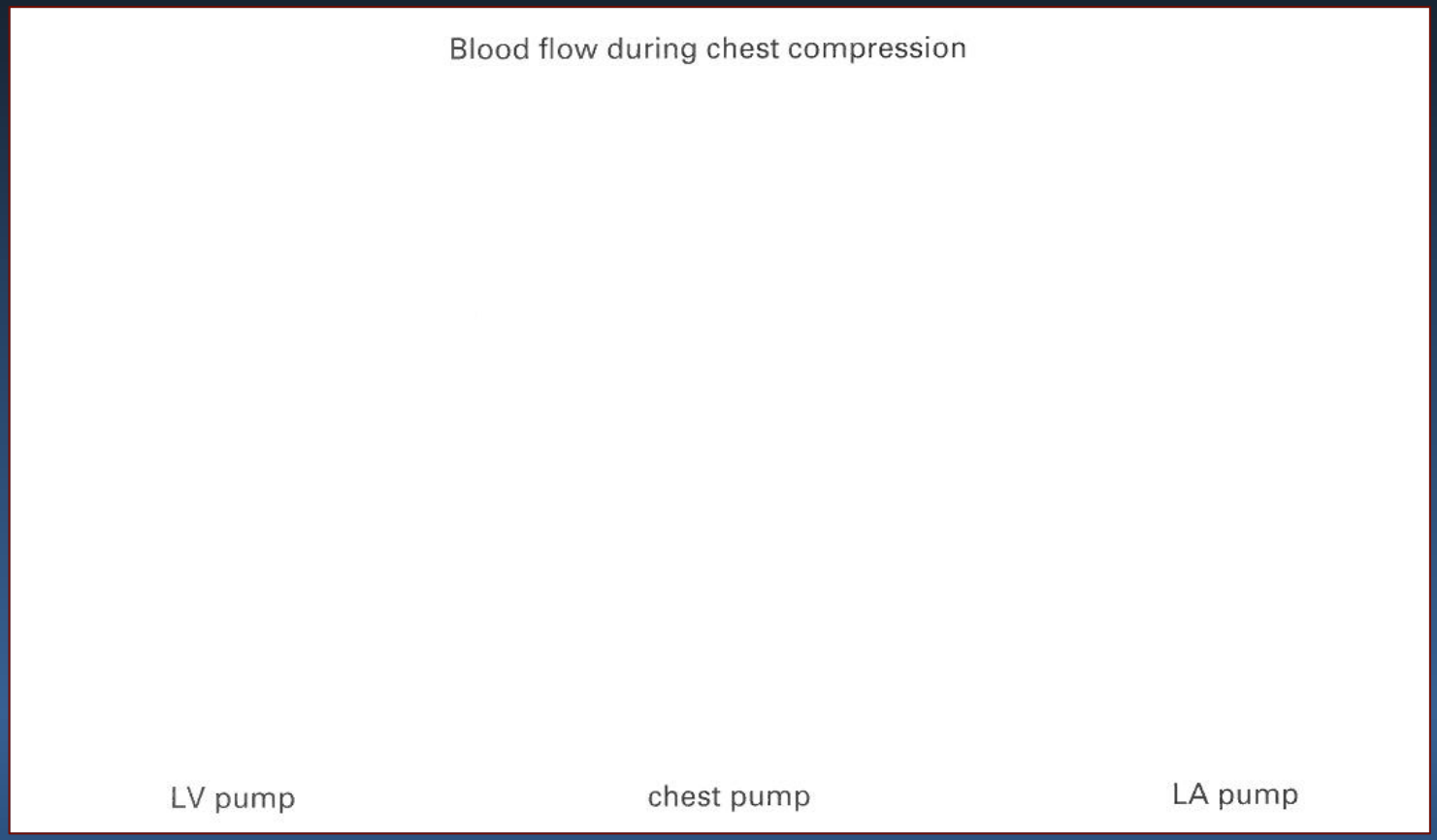




The mechanism of blood flow during chest compressions for cardiac arrest is probably influenced by the patient's chest configuration Ewy, G.A. Acute Med Surg 2018; 5:236-240.

Intern

Hvordan virker HLR?



Transesophageal echocardiographic assessment of mitral valve position and pulmonary venous flow during cardiopulmonary resuscitation in humans. Ma, M.H. Circulation 1995; 92:854-61.

Intern

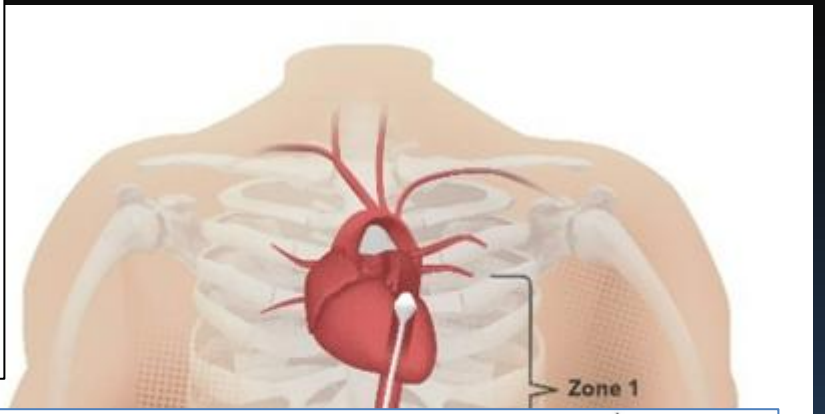
Brede *et al. Critical Care* (2026) 30:324
https://doi.org/10.1186/s13054-026-06057-y

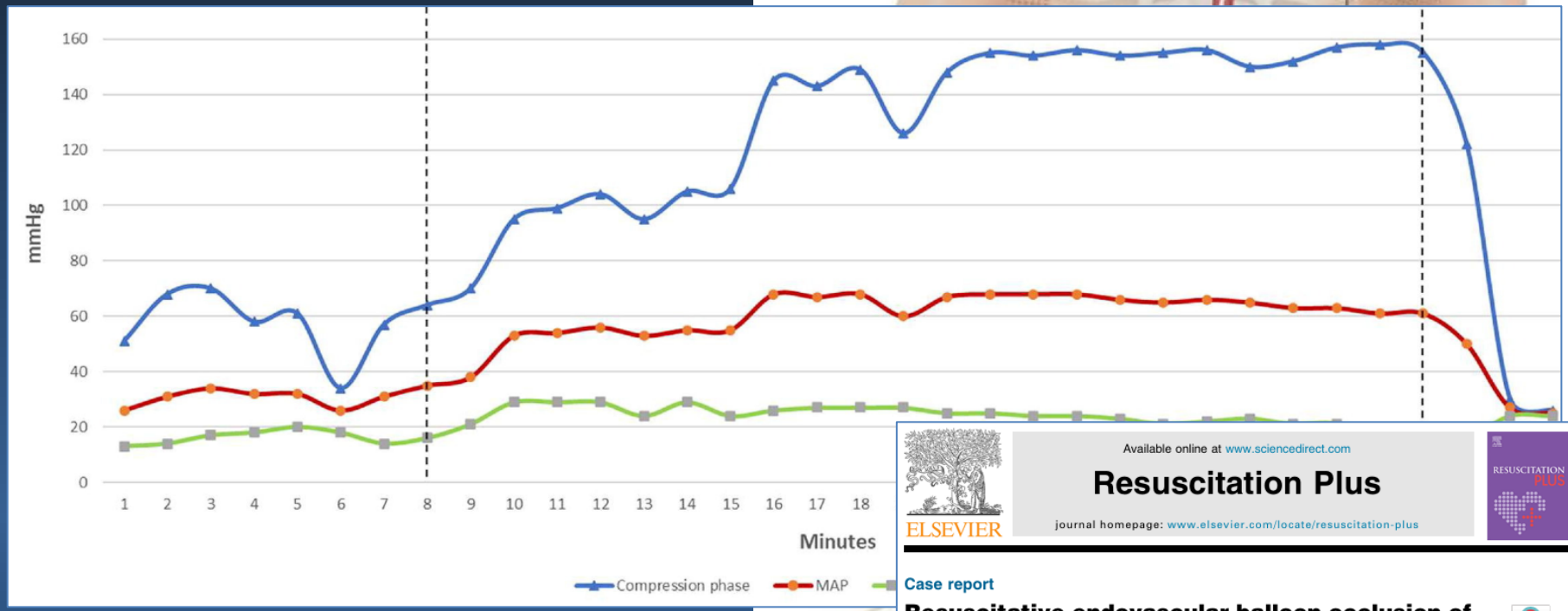
Critical Care

RESEARCH Open Access

Prehospital resuscitative endovascular balloon occlusion of the aorta in non-traumatic out-of-hospital cardiac arrest (REBOARREST): an international, multicentre, open label, pragmatic, randomised, controlled trial

Jostein Rødseth Brede[1,2,3*], Bjørn Hoftun Farbu[2,3], Lorenzo Gamberini[4], Kjetil Thorsen[2], Marius Rehn[2,5,6], Leif Rognås[7], Kristin Tønsager[2,8,9], Geir Arne Sunde[10,11], Magnus Lauritzen[12], Cristian Lupi[4], Marco Tartaglione[4], Eivinn Årdal Skjaerseth[1], Margrete Aaen[1], Rune Wiseth[13,14] and Andreas Jørstad Krüger[1,14]





Available online at www.sciencedirect.com

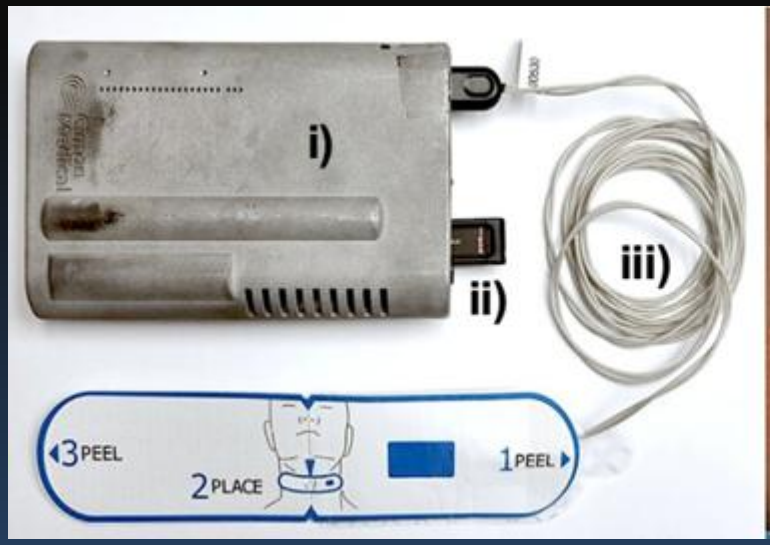
Resuscitation Plus

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

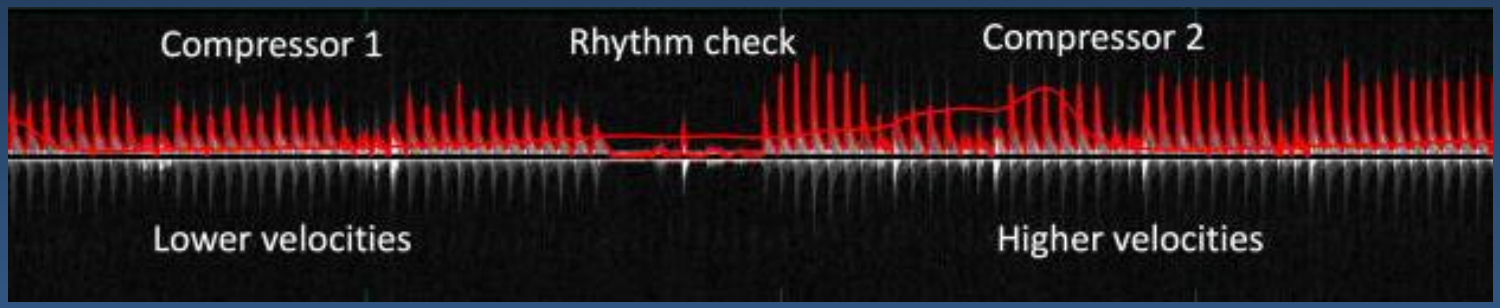
Case report

Resuscitative endovascular balloon occlusion of the aorta (REBOA) during cardiac resuscitation increased cerebral perfusion to occurrence of cardiopulmonary resuscitation-induced consciousness, a case report

Jostein Rødseth Brede[a,b,c,*], *Eivinn Årdal Skjærseth*[a]







RESUSCITATION PLUS 26 (2025) 101080

Available online at www.sciencedirect.com

Resuscitation Plus

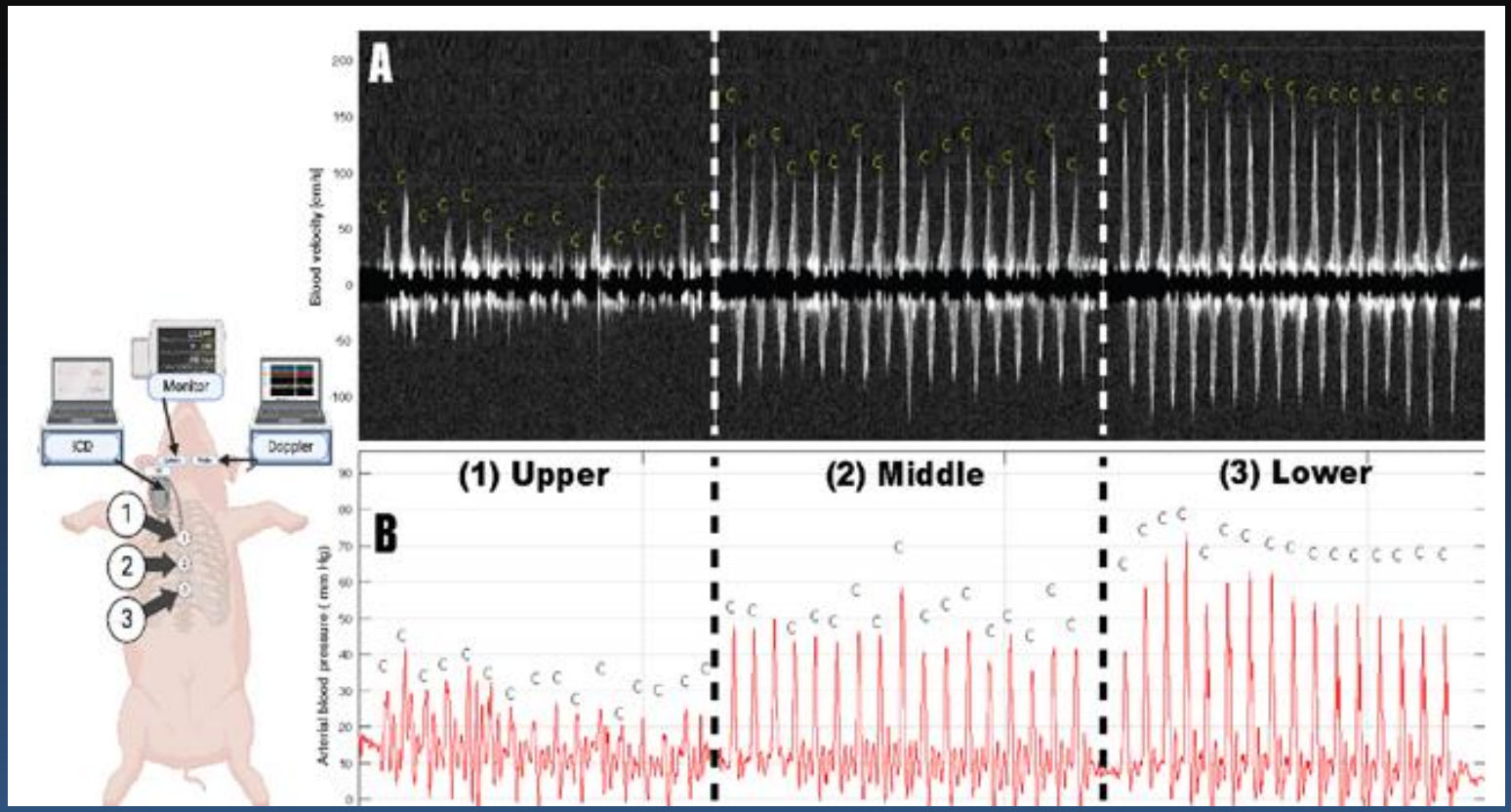
journal homepage: www.elsevier.com/locate/resuscitation-plus

Clinical paper

Realtime detection of spontaneous circulation in humans during cardiopulmonary resuscitation using a continuous hands-free carotid Doppler: a pilot study

Guro Mæhlum Krüger[a,b], *Sunniva Gjerald Birkeli*[a], *Øystein Myrlund Hansen*[c,d], *Bjørn Ove Faldaas*[b,c], *Anders Norvik*[a,b], *Hedda Juni Lund*[b], *Gregory Louis Egil Hautois*[d], *John Helge Flage*[d], *Jon Urteaga*[e], *Torbjørn Hergum*[f], *Hans Torp*[b,f], *Eirik Skogvoll*[a,b], *Charlotte Björk Ingul*[b,c,*]

Intern



Available online at www.sciencedirect.com

Resuscitation Plus

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

Experimental paper

Real-time feedback on chest compression efficacy by hands-free carotid Doppler in a porcine model

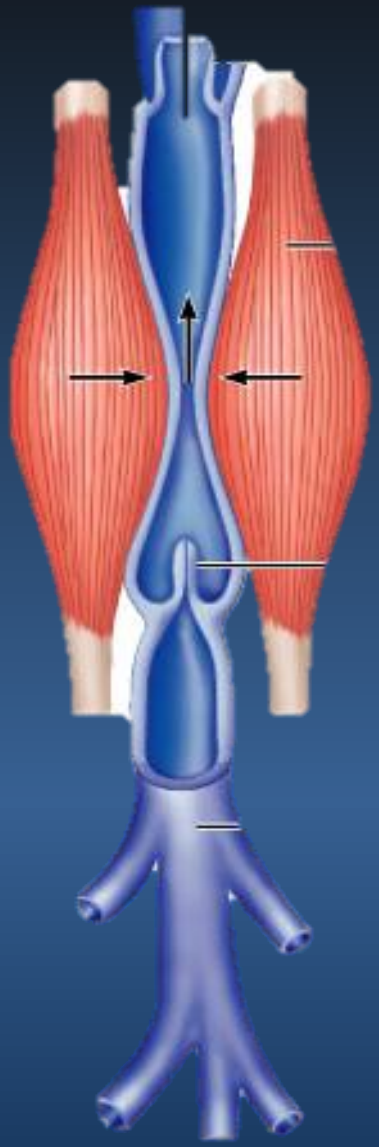
Bjørn Ove Faldaas[a,b], *Erik Waage Nielsen*[a,c,d,e], *Benjamin Stage Storm*[a,c,d], *Knut Tore Lappegård*[c,f], *Bent Aksel Nilsen*[a,d], *Gabriel Kiss*[g], *Eirik Skogvoll*[b,h], *Hans Torp*[b], *Charlotte Björk Ingul*[a,b,*]

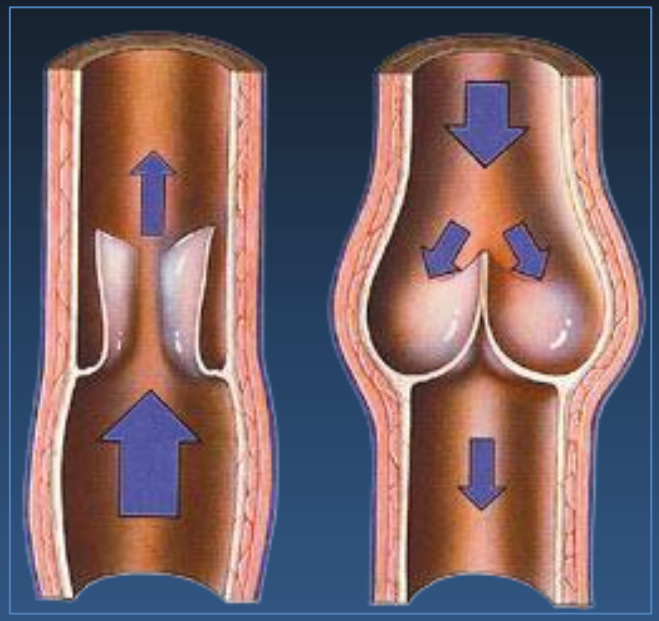
Mekanismer for venøs retur

- Muskel-vene-pumpe
- Veneklaffer
- Hjerteaksjon
- Egenventilasjon/normal pusting

Intern

Mekanismer for venøs retur

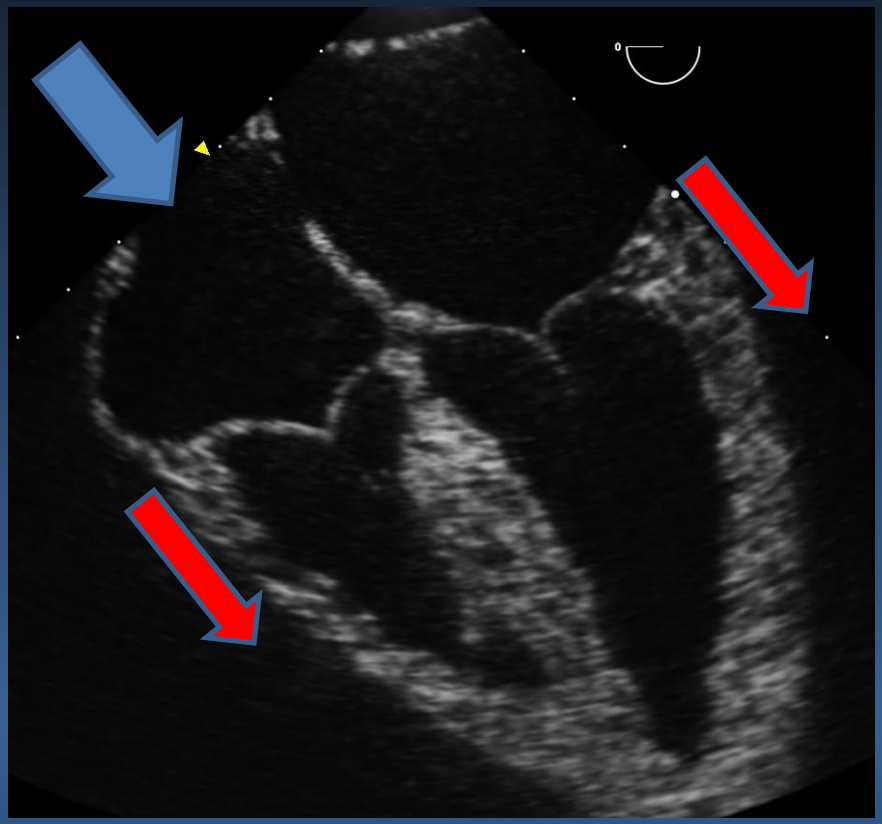


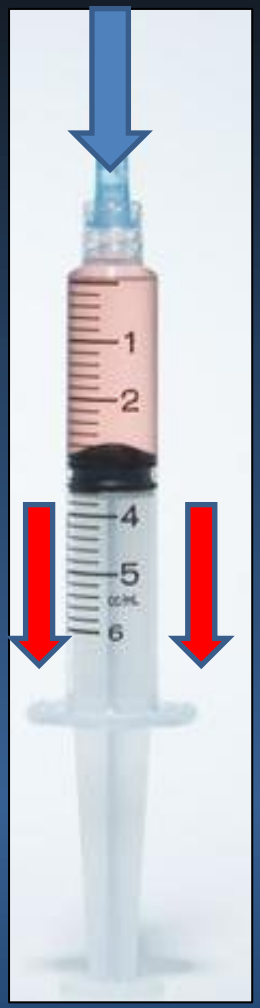


Muskel-vene-pumpe

Intern

Mekanismer for venøs retur

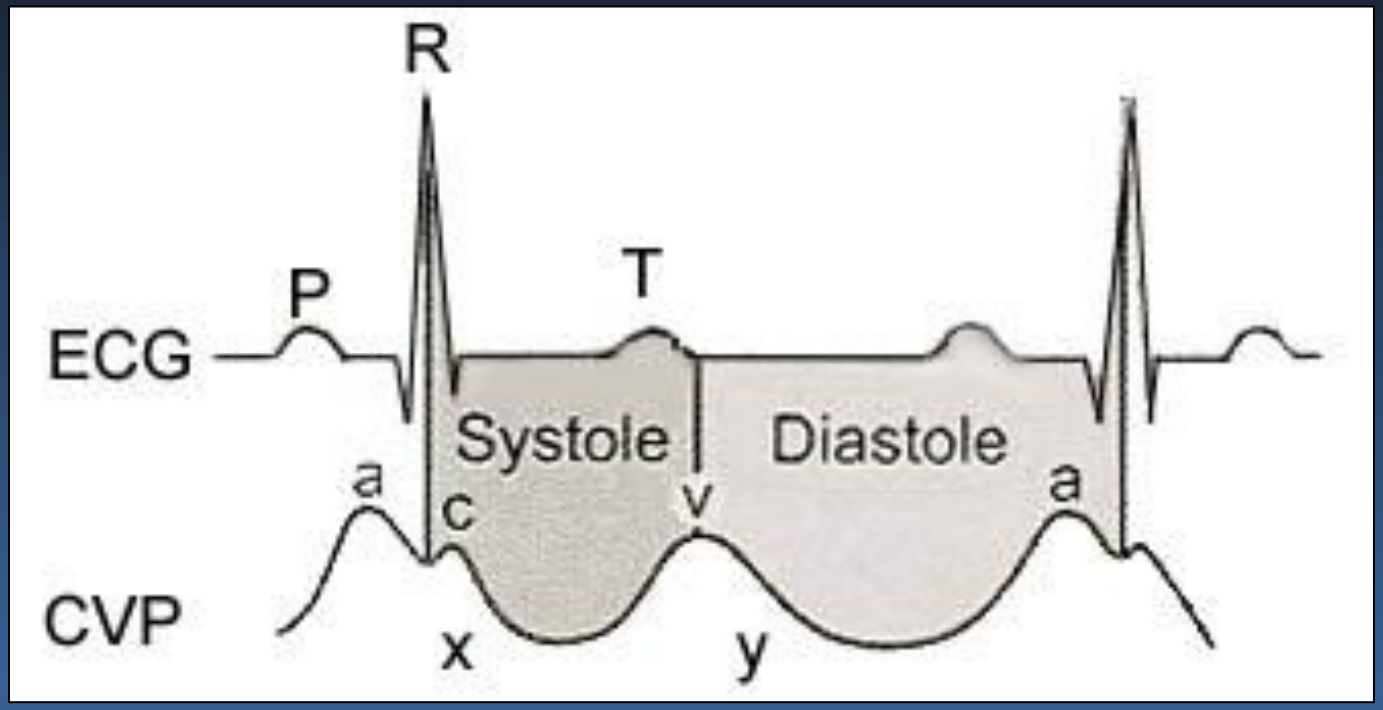




Hjertets innsug

Intern

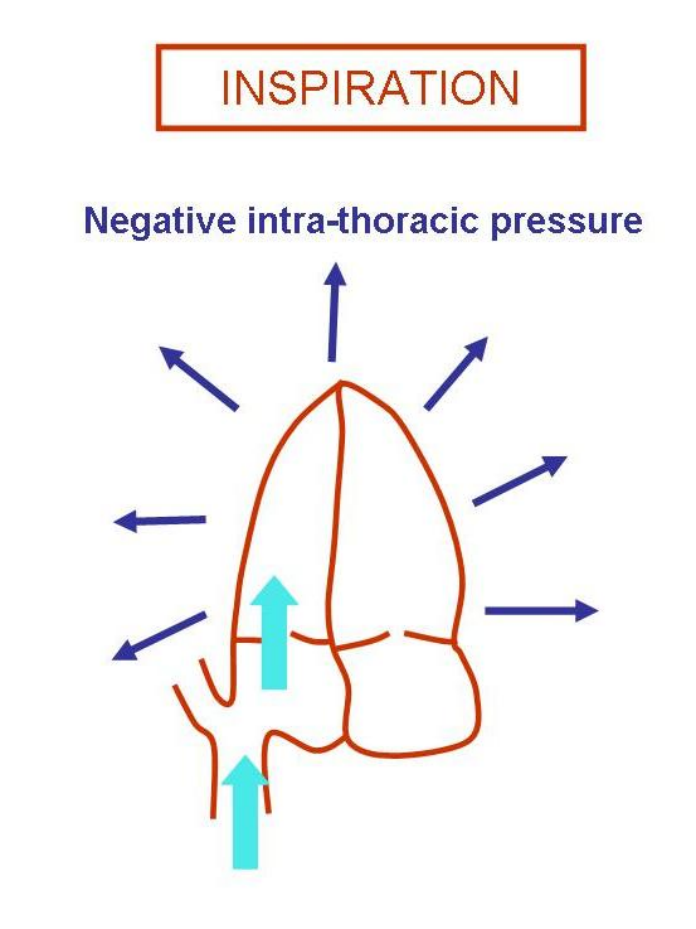
Mekanismer for venøs retur

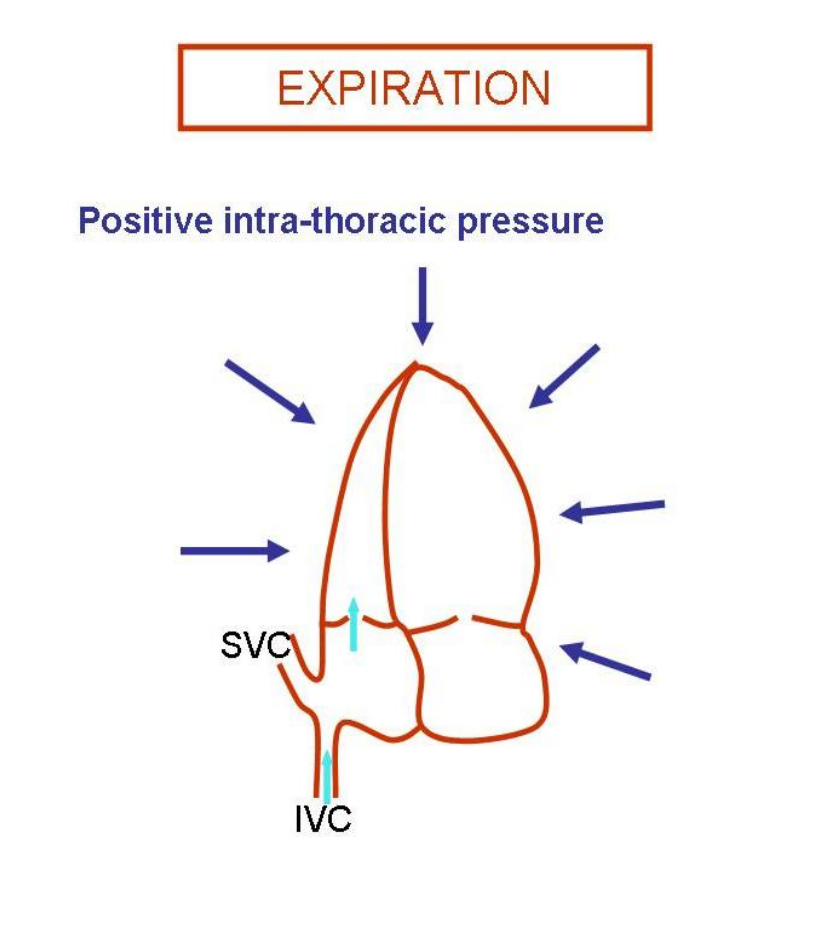


Intern

Mekanismer for venøs retur

Spontanventilasjon – ikke bare innsug av luft





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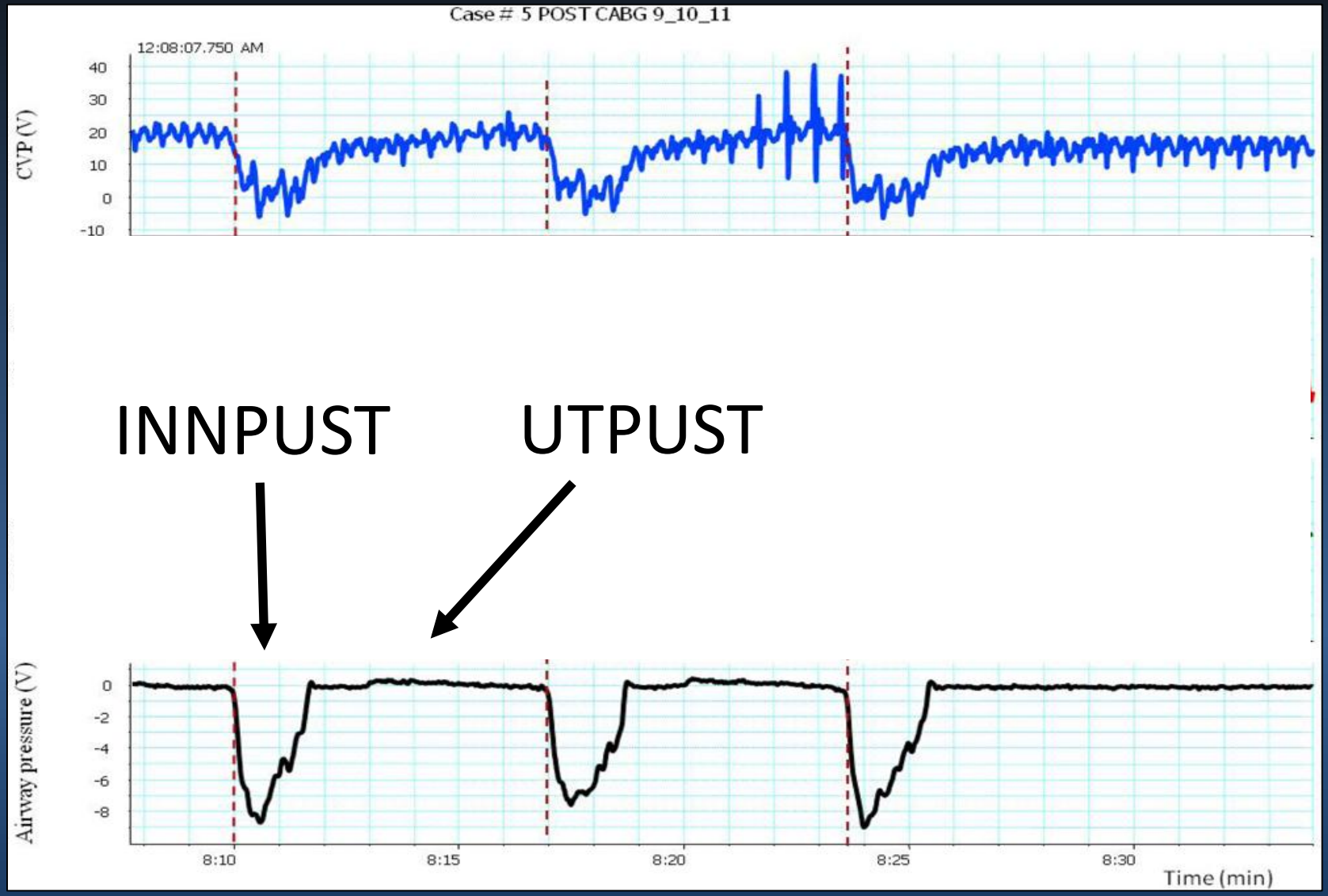

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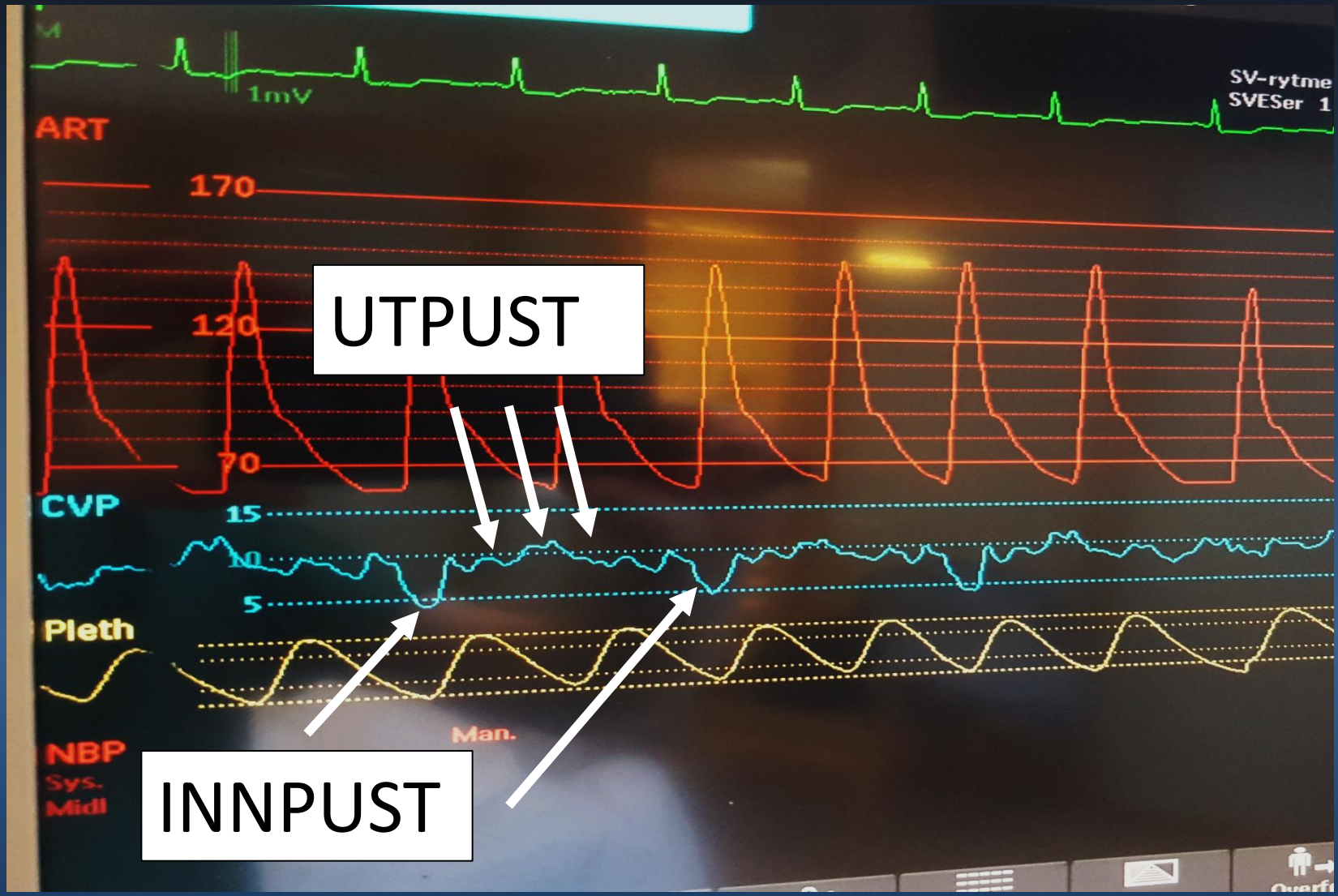
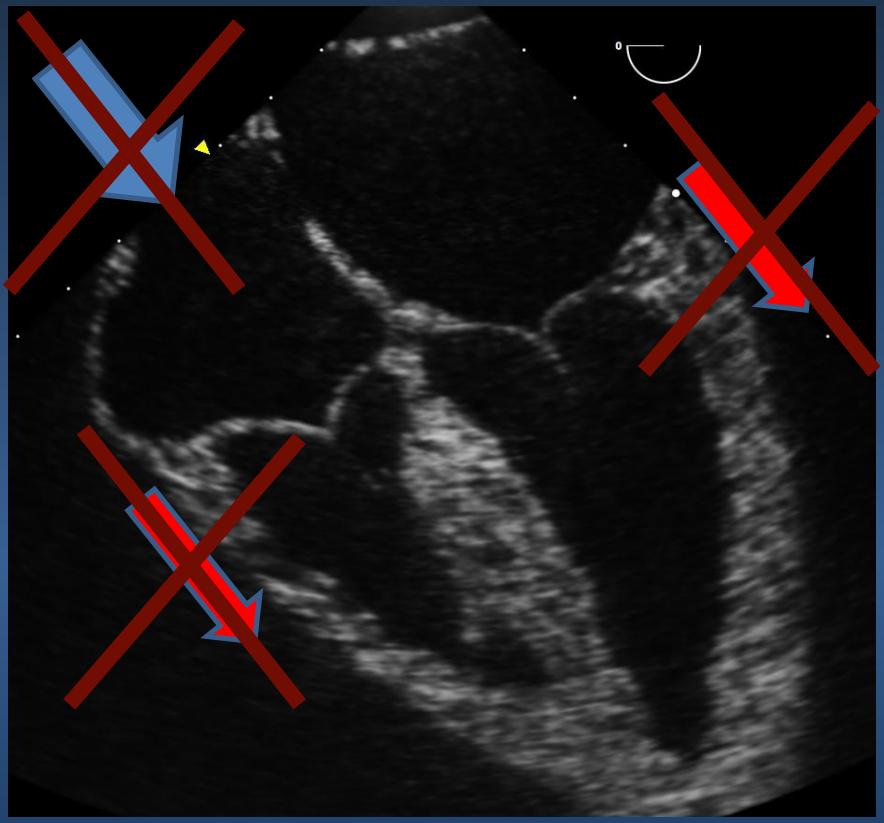


Intern

Hjertestans og venøs retur

- **Problem 1: HJERTESTANS**



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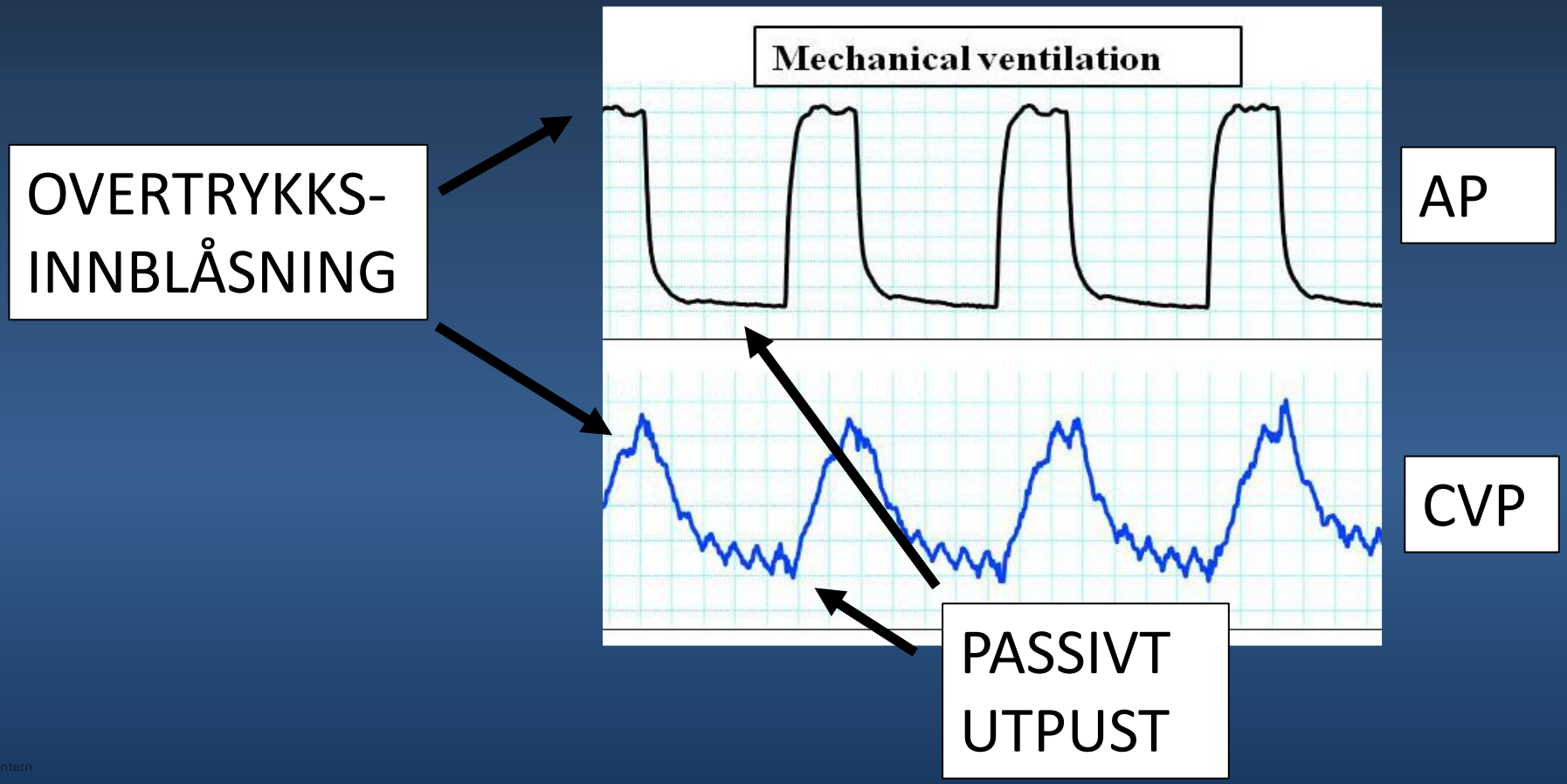
HLR og venøs retur

- **Problem 2: Overtrykksventilering**



Intern

HLR og venøs retur

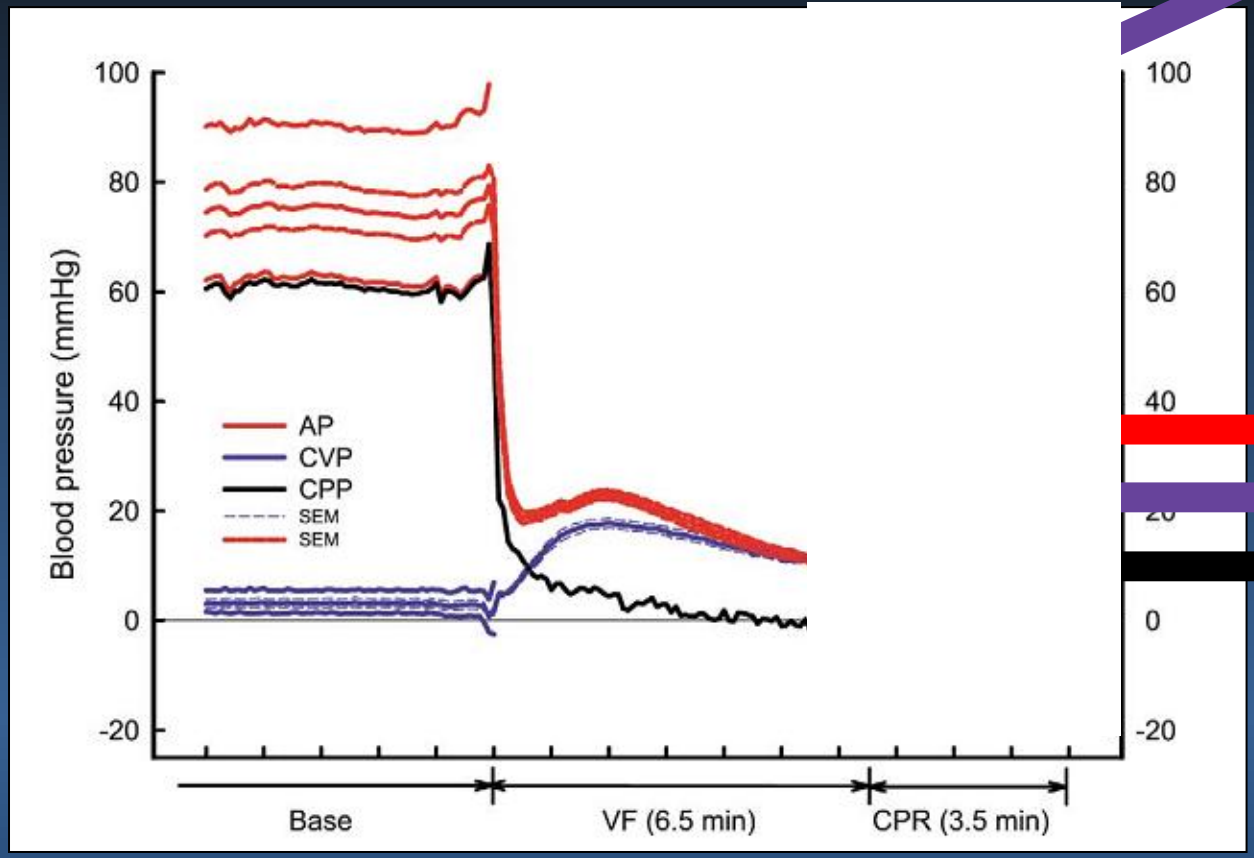
- **Problem 3: Brystkompresjoner**



NORSK LUFTAMBULANSE
STIFTELSEN

Intern

Hjerte-Lunge-redning
Hva skjer?



'CVP systolisk'!!!

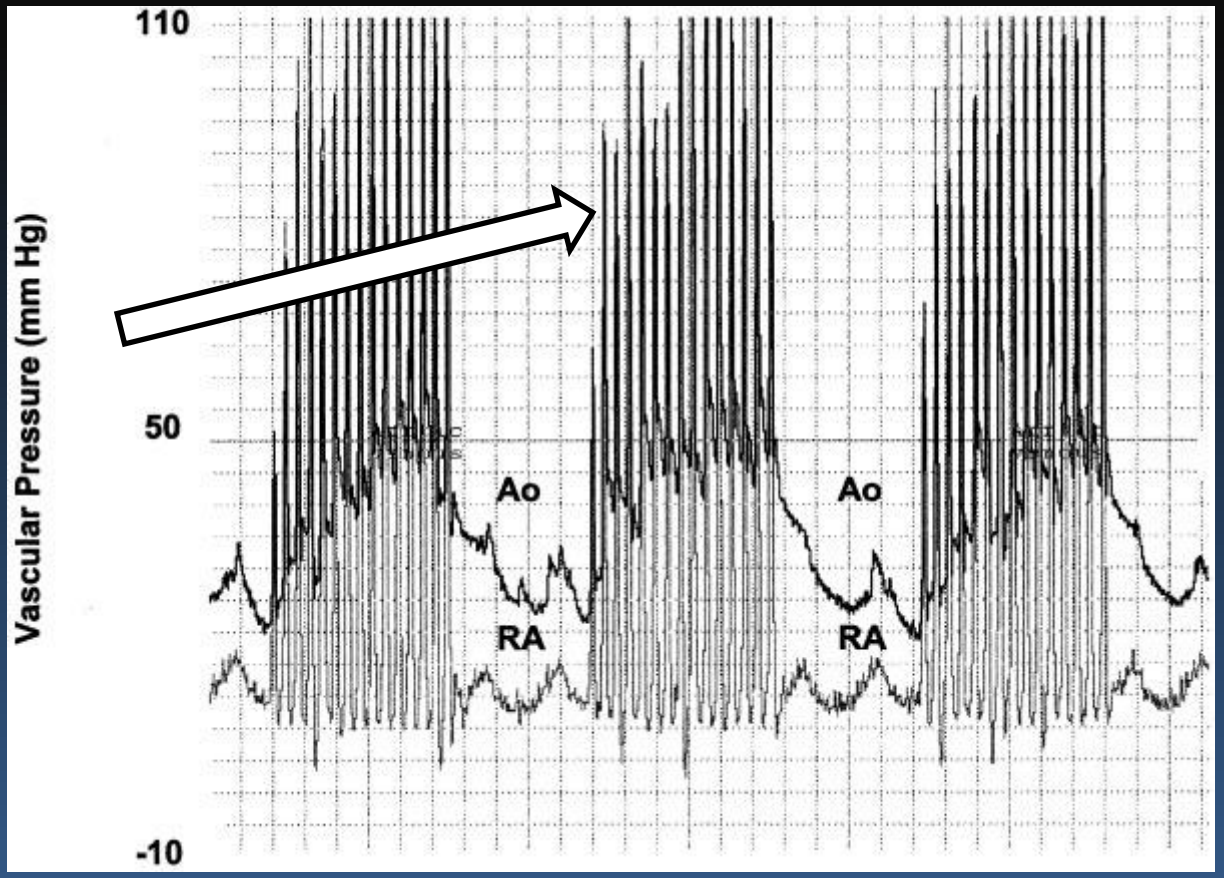
'MAP'

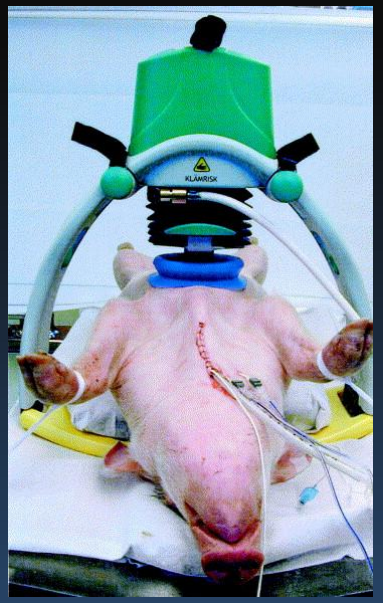
'CVP snitt'

Cerebralt perfusjonstrykk

The critical importance of minimal delay between chest compressions and subsequent defibrillation: a haemodynamic explanation Steen, S. Resuscitation. 2003; 58:249-58.

Intern





15 : 2 → 30 : 2

Adverse Hemodynamic Effects of Interrupting Chest Compressions for Rescue Breathing During Cardiopulmonary Resuscitation for Ventricular Fibrillation Cardiac Arrest.

Berg, R. et al. Circulation. 2001; 104:2465-2470.

Intern

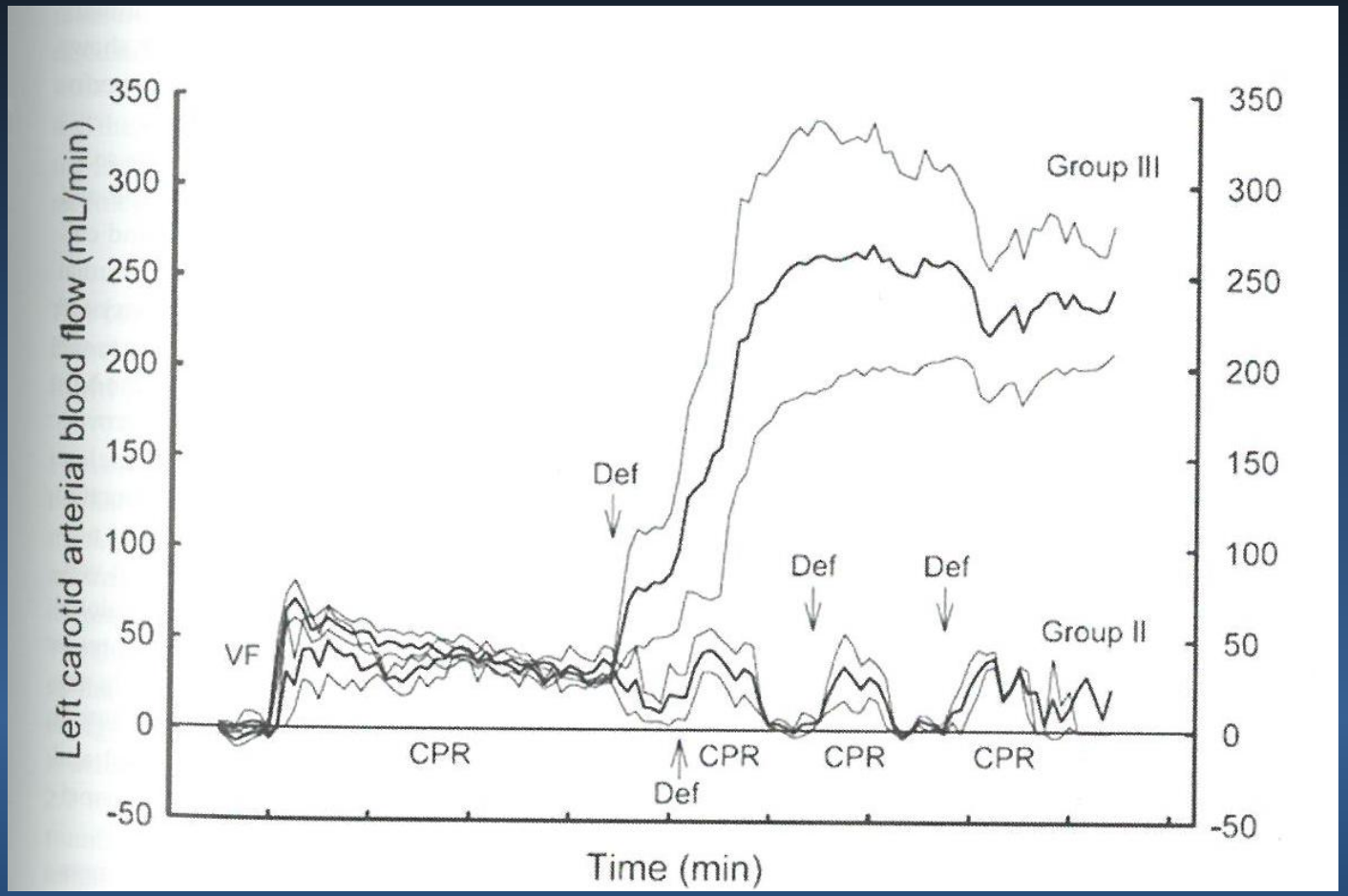
	AoS, mm Hg	AoD, mm Hg	RAS, mm Hg	RAD, mm Hg	CPP	CO, L/min
Baseline						
CC+RB	92±4	67±5		7±1		3.3 (1.9, 4.7)
CC	91±2	63±3		8±1		3.8 (2.0, 5.6)
Early CPR						
CC+RB	88±8	38±4	116±11	13±1	26±3	0.60 (0.3, 0.9)
CC	92±9	41±6	108±22	13±1	29±6	0.90 (0.4, 1.4)
Late CPR						
CC+RB	83±6	35±4	107±6	14±2	21±4	0.50 (0.2, 0.8)
CC	86±5	31±5	110±10	12±1	18±4	0.70 (0.3, 1.1)

Adverse Hemodynamic Effects of Interrupting Chest Compressions for Rescue Breathing During Cardiopulmonary Resuscitation for Ventricular Fibrillation Cardiac Arrest.

Berg, R. et al. Circulation. 2001; 104:2465-2470.

Intern

HLR - ROSC
Blodsirkulasjon til hjernen



The critical importance of minimal delay between chest compressions and subsequent defibrillation: a haemodynamic explanation Steen, S. Resuscitation. 2003; 58:249-58.

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Gåten:
Defekt venøs retur under HLR

- **Problem 1: HJERTESTANS**
- **Problem 2: Overtrykksventilering**
- **Problem 3: Brystkompresjoner**

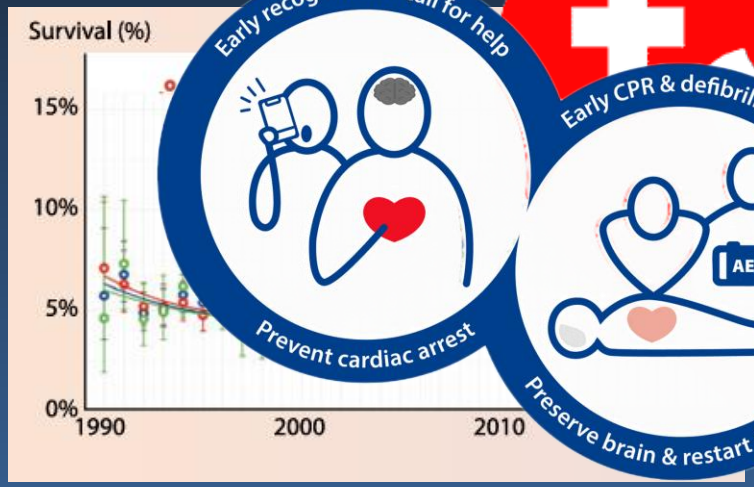
Intern



Verdensrekord: I mai 2008 satte Norsk Luftambulanse Guinness-rekord med opplæring
3692 personer samtidig.

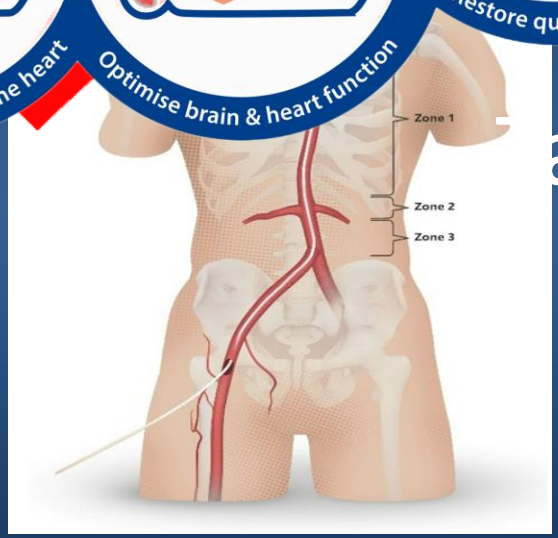
NORSK LUFTAMBULANSE
STIFTELSEN

NRR
NORSK RESUSCITASJONSRÅD









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Intern