Approccio al Primo Soccorso

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Informazioni utili

- Per convalidare titoli equipollenti è necessario avviare l'iter tramite la **segreteria della Facoltà di Medicina**
- Titoli riconosciuti comprendono certificati dei corsi BLSD **attualmente validi** erogati da provider affiliati a IRC, ERC, AHA o comunque riconosciuti dalla Regione
- Il materiale didattico è disponibile sulla **pagina del docente**
- La frequenza delle **attività pratiche è necessaria** per accedere all'esame
- Per iscriversi all'esame è necessario compilare il **questionario di valutazione del corso**

Arresto cardiocircolatorio (CA)

Cardiac arrest (CA) is a clinical syndrome defined as the “cessation of cardiac mechanical activity, as confirmed by the absence of signs of circulation”

Varvarousis D, Varvarousi G, Iacovidou N, D'Aloja E, Gulati A, Xanthos T. The pathophysiologies of asphyxial vs dysrhythmic cardiac arrest: implications for resuscitation and post-event management. The American Journal of Emergency Medicine. 2015;33(9):1297-1304. doi:10.1016/j.ajem.2015.06.066

Cenni di emodinamica

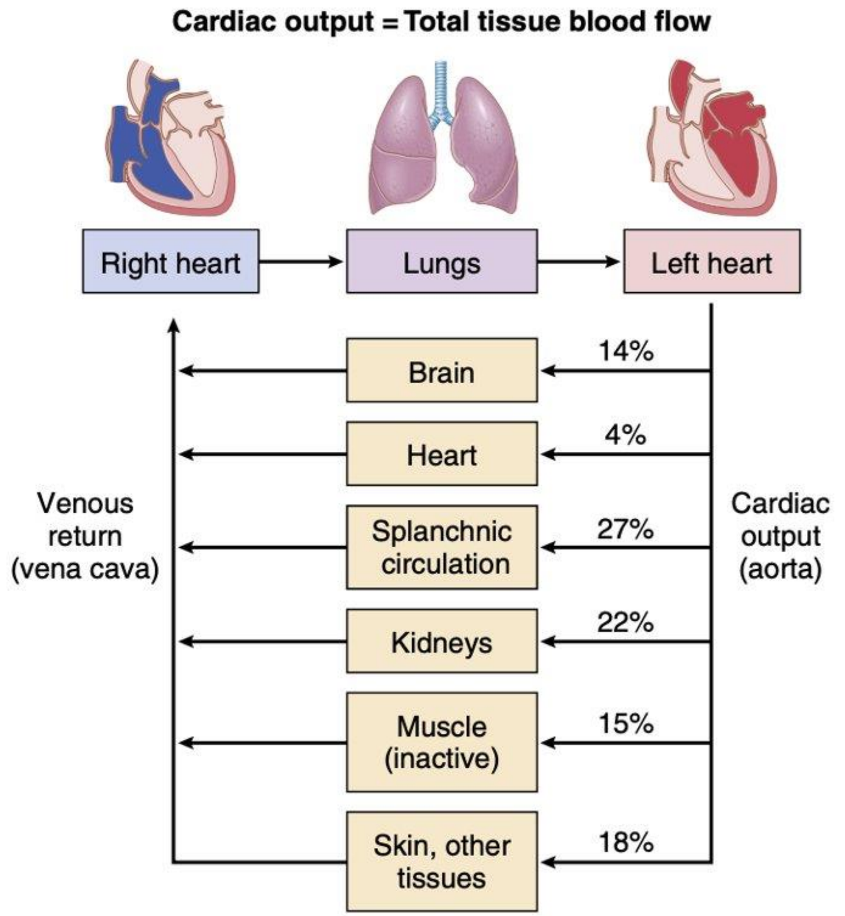


Figure 20-2. Cardiac output is equal to venous return and is the sum of tissue and organ blood flows. Except when the heart is severely weakened and unable to pump the venous return adequately, cardiac output (total tissue blood flow) is determined mainly by the metabolic needs of the tissues and organs of the body.

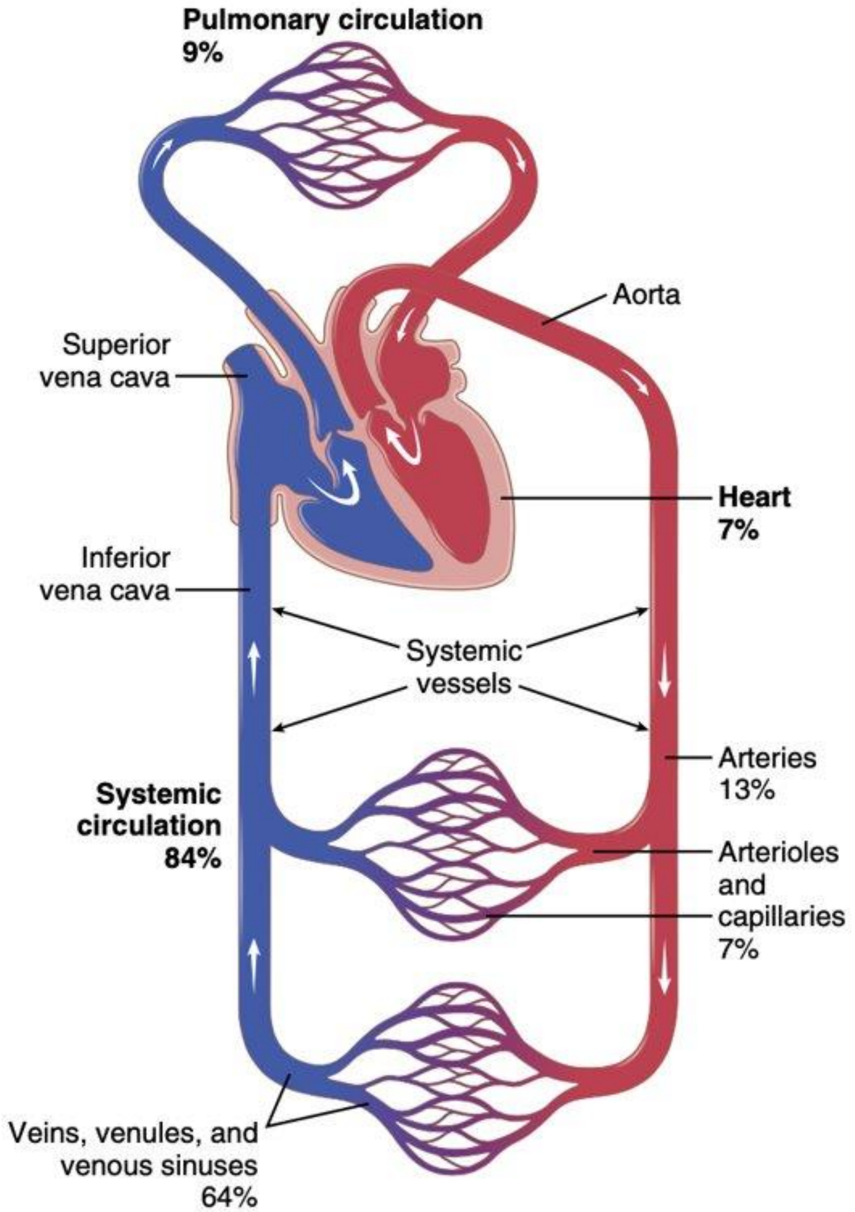


Figure 14-1. Distribution of blood (in percentage of total blood) in the different parts of the circulatory system.

Hall JE. Guyton and Hall Textbook of Medical Physiology. Elsevier; 2020.

Table 1 Hemodynamic variables obtained from the pulmonary artery catheter

Variable	Abbreviation	Equation	Normal range
Mixed venous oxygen saturation	SvO_2	n.a	60–80%
Cardiac output	CO	HR × SV/1000	4.0–8.0 L min^{-1}
Cardiac index	CI	CO/BSA	2.5–4.0 L min^{-1} m^{-2}
Cardiac power index	CPI	(MAP-CVP) × CI/451	0.5–0.7 W m^{-2}, population specific
Central venous Pressure	CVP	n.a	2–6 mmHg
Stroke volume	SV	CO/HR × 1000	60–100 mL
Stroke volume Index	SVi	CI/HR × 1000	33–47 mL m^{-2}
Stroke volume variation	SVV	(SVmax-SVmin)/SVmean × 100	10–15%
Systemic vascular resistance	SVR	80 × (MAP – CVP)/CO	800–1200 dynes sec cm^{-5}
Systemic to pulmonary pressure ratio	MAP/MPAP	MAP / MPAP	4.0 ± 1.4 in uncomplicated cardiac surgey
Pulmonary artery systolic pressure	PASP	n.a	15–30 mmHg
Pulmonary artery diastolic pressure	PADP	n.a	8–15 mmHg
Pulmonary artery wedge pressue	PAWP	n.a	6–12 mmHg
Pulmonary vascular resistance	PVR	80 × (MPAP – PAWP)/CO	< 250 dynes sec cm^{-5}
Pulmonary artery pulsatility index	PAPI	(PASP – PADP)/CVP	population specific
LV stroke work index	LVSWi	SVi × (MAP – PAWP) × 0.0136	50–62 mmHg ml m^{-2}
RV stroke work index	RVSWi	SVi × (MPAP – CVP) × 0.0136	5–10 mmHg ml m^{-2}
RV function index	RFI	PASP/CI	31.7 ± 16.7 in ICU survivors with PH
RV end-diastolic volume	RVEDV	SV/EF	100–160 mL
RV end-diastolic volume index	RVEDVi	RVEDV/BSA	60–100 mL m^{-2}
RV end-systolic volume	RVESV	EDV-SV	50–100 mL
RV ejection fraction	RVEF	(SV/EDV) × 100	40–60%
RV systolic pressure	RVSP	n.a	15–30 mmHg
RV diastolic pressure	RVDP	n.a	2–8 mmHg

Bootsma IT, Boerma EC, de Lange F, Scheeren TWL. The contemporary pulmonary artery catheter. Part 1: placement and waveform analysis. J Clin Monit Comput. Published online February 10, 2021. doi:10.1007/s10877-021-00662-8

In-Hospital vs Out-of-Hospital CA

Epidemiologia di CA

Arresto cardiaco 3° causa di morte in Europa

- The annual incidence of OHCA in Europe is between 67 to 170 per 100,000 inhabitants.
- Resuscitation is attempted or continued by EMS personnel in about 50–60% of cases (between 19 to 97 per 100,000 inhabitants).
- The rate of bystander CPR varies between and within countries (average 58%, range 13%–83%).
- The use of automated external defibrillators (AEDs) remains low in Europe (average 28%, range 3.8%–59%).
- 80% of European countries provide dispatch assisted CPR and 75% have an AED registry. Most (90%) countries have access to cardiac arrest centres for post resuscitation care.
- Survival rates at hospital discharge are on average 8%, varying from 0% to 18%.
- Differences in EMS systems in Europe account for at least some of the differences observed in OHCA incidence and survival rates.

In hospital cardiac arrest

- The annual incidence of IHCA in Europe is between 1.5 and 2.8 per 1,000 hospital admissions.
- Factors associated with survival are the initial rhythm, the place of arrest and the degree of monitoring at the time of collapse.
- Survival rates at 30 days / hospital discharge range from 15% to 34%.

Gräsner JT, Herlitz J, Tjelmeland IBM, et al. European Resuscitation Council Guidelines 2021: Epidemiology of cardiac arrest in Europe. Resuscitation. 2021;161:61-79. doi:10.1016/j.resuscitation.2021.02.007

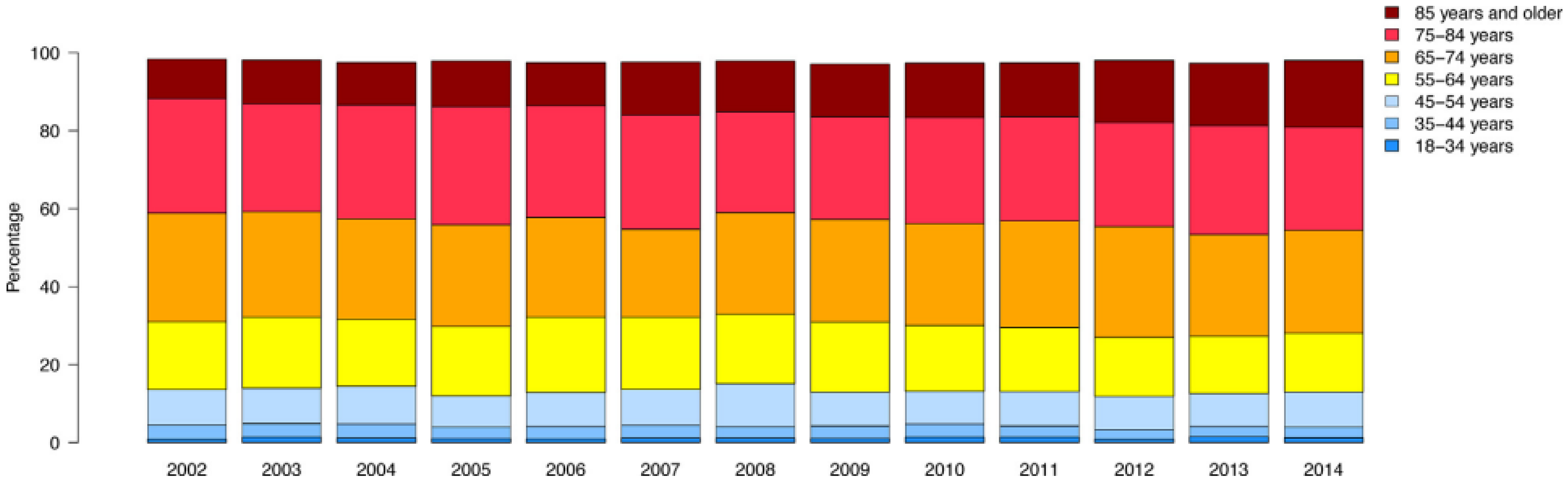


Fig. 1 – Distribution of age groups during the study period.

Rittenberger JC, Raina K, Holm MB, Kim YJ, Callaway CW. Association between Cerebral Performance Category, Modified Rankin Scale, and Discharge Disposition after Cardiac Arrest. Resuscitation. 2011;82(8):1036-1040. doi:10.1016/j.resuscitation.2011.03.034

Prognosi di CA

Long term outcomes

- In European countries where withdrawal of life sustaining treatment (WLST) is routinely practiced, a good neurological outcome is seen in > 90% of patients. Most patients are able to return to work.
- In countries where WLST is not practiced, poor neurological outcomes are more common (50% with 33% in a persistent vegetative state).
- Amongst survivors with a good neurological outcome, neuro-cognitive, fatigue and emotional problems are common and cause reduced health related quality of life.
- Patients and relatives may develop post-traumatic stress disorder.

Gräsner JT, Herlitz J, Tjelmeland IBM, et al. European Resuscitation Council Guidelines 2021: Epidemiology of cardiac arrest in Europe. Resuscitation. 2021;161:61-79. doi:10.1016/j.resuscitation.2021.02.007

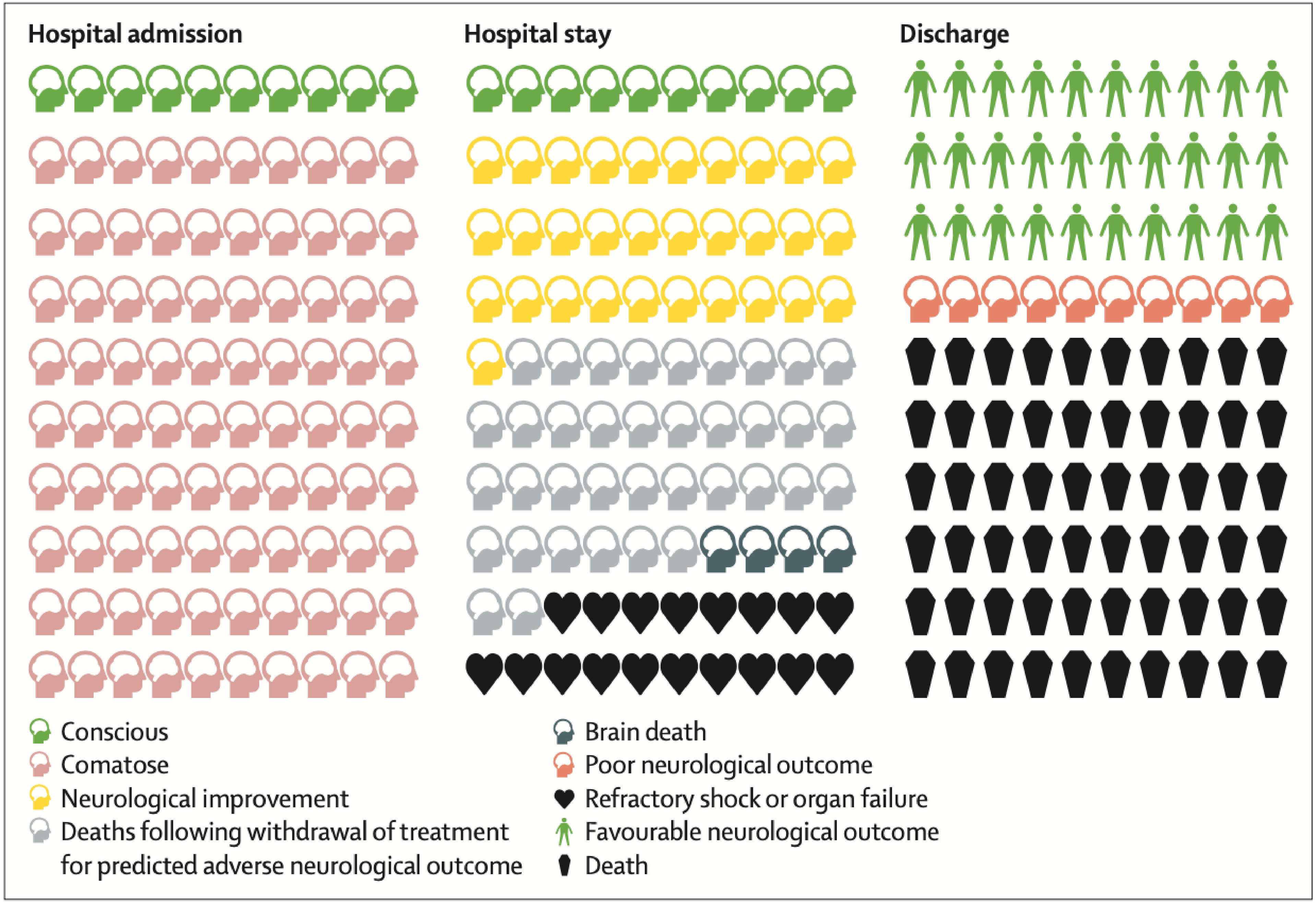


***Figure* 2: Outcomes following admission for out-of-hospital cardiac arrests**

Perkins GD, Callaway CW, Haywood K, et al. Brain injury after cardiac arrest. The Lancet. 2021;398(10307):1269-1278. doi:10.1016/S0140-6736(21)00953-3

Cause of arrest[c]	360		115		245		<0.001	0
- Unknown/not documented	27	8%	3	3%	24	10%	0.024	
- ALTE/SIDS	54	15%	17	15%	37	15%	1.000	
- Airway obstruction	41	11%	7	6%	34	14%	0.047	
- Arrythmia	47	13%	30	26%	17	7%	<0.001	
- Drowning	100	28%	45	39%	55	22%	0.002	
- Electrolyte abnormality	3	1%	0	0%	3	1%	0.554	
- Elevated ICP	10	3%	0	0%	10	4%	0.034	
- Hypotension/shock	30	8%	2	2%	28	11%	0.001	
- Ingestion/toxin	2	1%	2	2%	0	0%	0.103	
- Other repiratory failure	33	9%	8	7%	25	10%	0.336	
- Seizures	13	4%	1	1%	12	5%	0.043	

Albrecht M, de Jonge RCJ, Nadkarni VM, et al. Association between shockable rhythms and long-term outcome after pediatric out-of-hospital cardiac arrest in Rotterdam, the Netherlands: An 18-year observational study. Resuscitation. 2021;166:110-120. doi:10.1016/j.resuscitation.2021.05.015

Table 2 – Timing and source of long-term neurological outcome.

	Deceased after discharge (n = 7)		Scored at hospital discharge (n = 23)		Scored at a regular hospital or clinic visit (n = 47)		Scored at cross-sectional follow-up (2013–2014) (n = 18)		Scored at prospective follow-up (2011 and onwards) (n = 46)	
	Pre-arrest	Post-arrest	Pre-arrest	Post-arrest	Pre-arrest	Post-arrest	Pre-arrest	Post-arrest	Pre-arrest	Post-arrest
PCPC score[a]										
1 – Normal	5	0	18	16	39	26	17	8	40	24
2 – Mild disability	1	0	3	5	3	6	0	6	1	11
3 – Moderate disability	1	0	2	2	3	7	1	3	5	8
4 – Severe disability	0	0	0	0	2	7	0	1	0	3
5 – Coma or vegetative state	0	0	0	0	0	1	0	0	0	0
6 – Brain death	0	7	0	0	0	0	0	0	0	0
FSS score[b]	NA	NA	NA	6.0 [6.0–6.0]	NA	6.0 [6.0–11.0]	NA	6.0 [6.0–6.3]	NA	6.0 [6.0–6.3]
Follow-up (years)[b]	NA	0.6 [0.5–1.7]	NA	0.0 [0.0–0.0]	NA	2.7 [0.8–5.5]	NA	3.7 [2.5–10.5]	NA	2.3 [1.1–3.8]
Age at follow-up (years)[b]	NA	NA	NA	4.2 [1.5–8.9]	NA	6.6 [2.6–12.1]	NA	12.6 [3.8–15.0]	NA	9.0 [4.6–16.0]

Abbreviations: FSS = Functional Status Scale, PCPC = Pediatric Cerebral Performance Category.

[a] Number of subjects.

[b] Median (interquartile range). For patients deceased after discharge follow-up duration represents the median duration to date of death.

Albrecht M, de Jonge RCJ, Nadkarni VM, et al. Association between shockable rhythms and long-term outcome after pediatric out-of-hospital cardiac arrest in Rotterdam, the Netherlands: An 18-year observational study. Resuscitation. 2021;166:110-120. doi:10.1016/j.resuscitation.2021.05.015

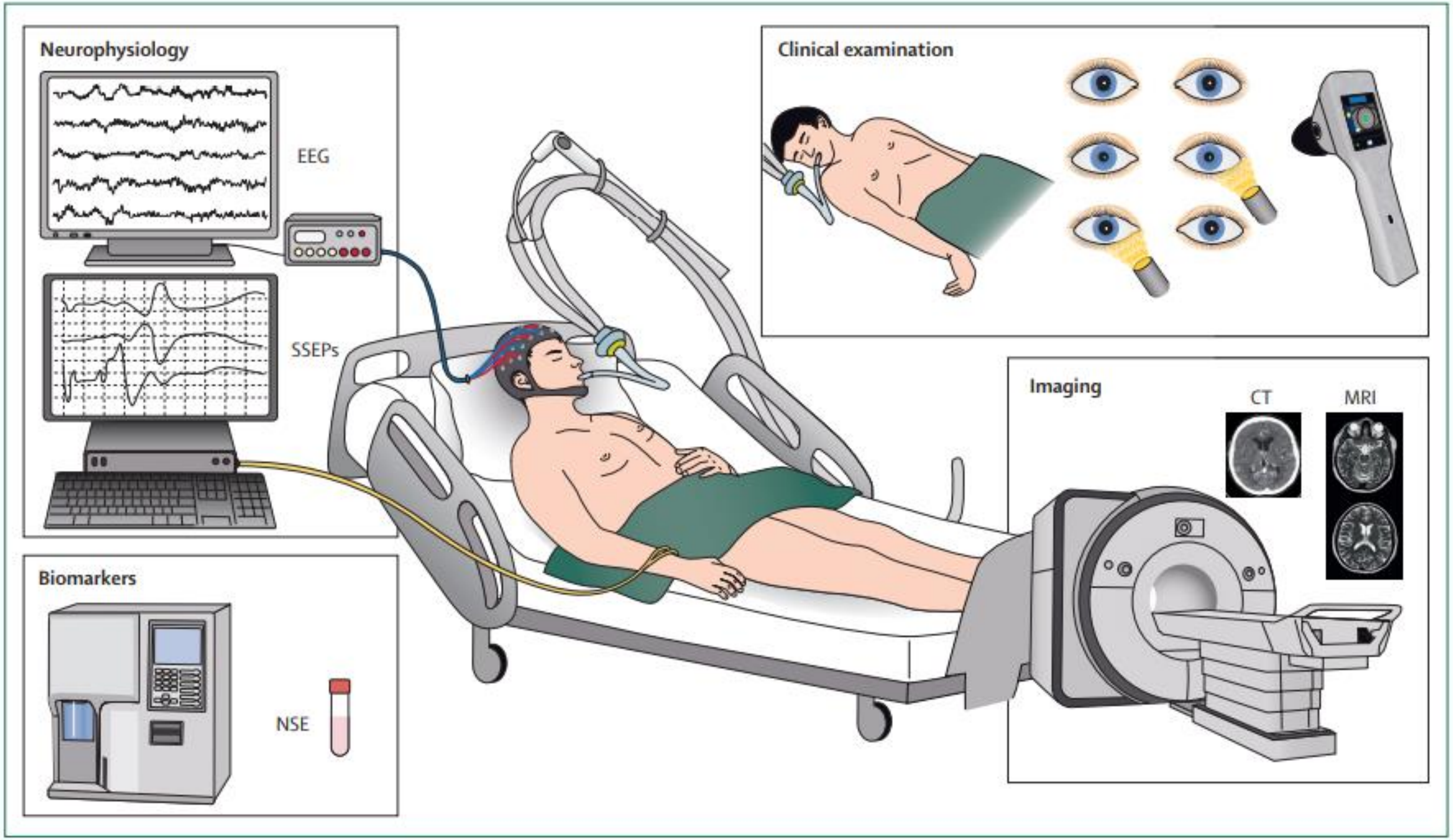


***Figure 4*: Key tests used to assess prognosis after cardiac arrest.**
Reproduced from Nolan and colleagues,[23] by permission of the European Resuscitation Council. EEG=electroencephalogram. SSEPs=somatosensory evoked potentials. NSE=neuron specific enolase.

Perkins GD, Callaway CW, Haywood K, et al. Brain injury after cardiac arrest. The Lancet. 2021;398(10307):1269-1278. doi:10.1016/S0140-6736(21)00953-3

Cerebral Performance Category

○	CPC 1	Conscious, alert, able to work and lead a normal life. May have minor psychologic or neurologic deficits (mild dysphasia, non-incapacitating hemiparesis, or minor cranial nerve abnormalities)
○	CPC 2	Conscious. Sufficient cerebral function for part-time work in sheltered environment or independent activities of daily life (dress, travel by public transportation, food preparation). May have hemiplegia, seizures, ataxia, dysarthria, or permanent memory or mental changes.
○	CPC 3	Conscious. Dependent on others for daily support (in an institution or at home with exceptional family effort). Has at least limited cognition. This category includes a wide range of cerebral abnormalities, from patients who are ambulatory but have severe memory disturbances or dementia precluding independent existence, to those who are paralyzed and can communicate only with their eyes, as in the "locked in" syndrome.
○	CPC 4	Unconscious. Unaware of surroundings, no cognition. No verbal and/or psychologic interaction with environment.
○	CPC 5	Brain dead, circulation preserved.
○	Death at discharge	

Rittenberger JC, Raina K, Holm MB, Kim YJ, Callaway CW. Association between Cerebral Performance Category, Modified Rankin Scale, and Discharge Disposition after Cardiac Arrest. Resuscitation. 2011;82(8):1036-1040. doi:10.1016/j.resuscitation.2011.03.034

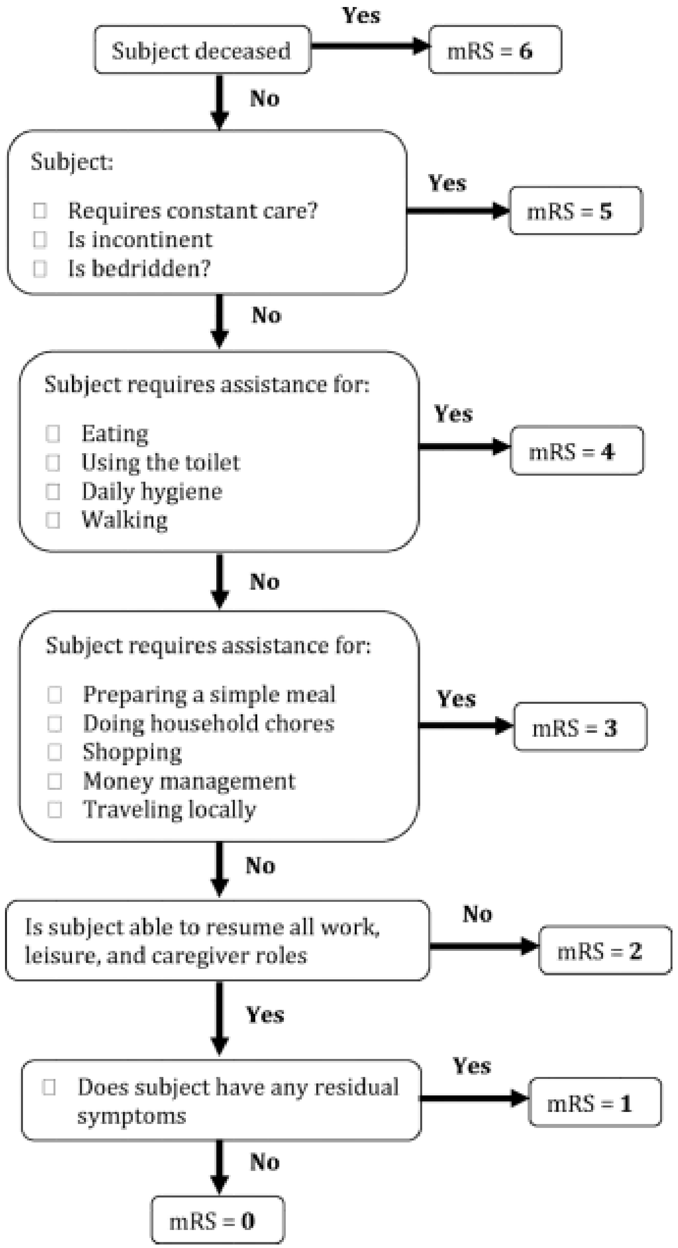


Figure 1.
Classification of the Modified Rankin Scale
Abbreviations: mRS = Modified Rankin Scale

Rittenberger JC, Raina K, Holm MB, Kim YJ, Callaway CW. Association between Cerebral Performance Category, Modified Rankin Scale, and Discharge Disposition after Cardiac Arrest. Resuscitation. 2011;82(8):1036-1040. doi:10.1016/j.resuscitation.2011.03.034

Table 1 – Demographic characteristics of patients with OHCA of any aetiology who survived to hospital discharge in Perth WA between 2004 and 2019, stratified by Cerebral Performance Category (CPC) score.

	Total	CPC 1–2	CPC 3–4	Test for difference (p)
No. (%) of patients	1062 (100)	984 (92.7)	78 (7.3)	
Aetiology of arrest, presumed cardiac	965 (90.9)	899 (93.2)	66 (84.6)	0.05
Median (IQR) age, years	60 (49–71)	60 (49–71)	60 (45–78)	0.88
Sex				
Male	803 (75.6)	747 (75.9)	56 (71.8)	0.42
Female	259 (24.4)	237 (24.1)	22 (28.2)	
Location of arrest, public	395 (37.2)	379 (38.5)	16 (20.5)	0.002
Witnessed arrest				
Paramedic	305 (28.7)	292 (29.7)	13 (16.7)	0.01
Bystander	556 (52.4)	514 (52.2)	42 (53.8)	
Unwitnessed	201 (18.9)	178 (18.1)	23 (29.5)	
Early CPR[a]	910 (85.7)	855 (86.9)	55 (70.5)	<0.001
Initial arrest rhythm				
VF/VT	809 (76.2)	768 (78.0)	41 (52.6)	<0.001
PEA/Asystole[b]	253 (23.8)	216 (22.0)	37 (47.4)	
ROSC on arrival to first ED	978 (92.1)	910 (92.5)	68 (87.2)	0.10
Median (IQR) EMS response time, minutes[c]	8 (6–10)	8 (6–11)	7 (5–9)	<0.001
Survived to 12 months[d]	933 (92.3)	879 (89.3)	54 (69.2)	<0.001

CPR, cardiopulmonary resuscitation; EMS, emergency medical services; IQR, interquartile range; PEA, pulseless electrical activity; ROSC, return of spontaneous circulation; VF, ventricular fibrillation; VT, ventricular tachycardia.

[a] Includes 'bystander CPR' and 'paramedic CPR' for paramedic-witnessed arrests.

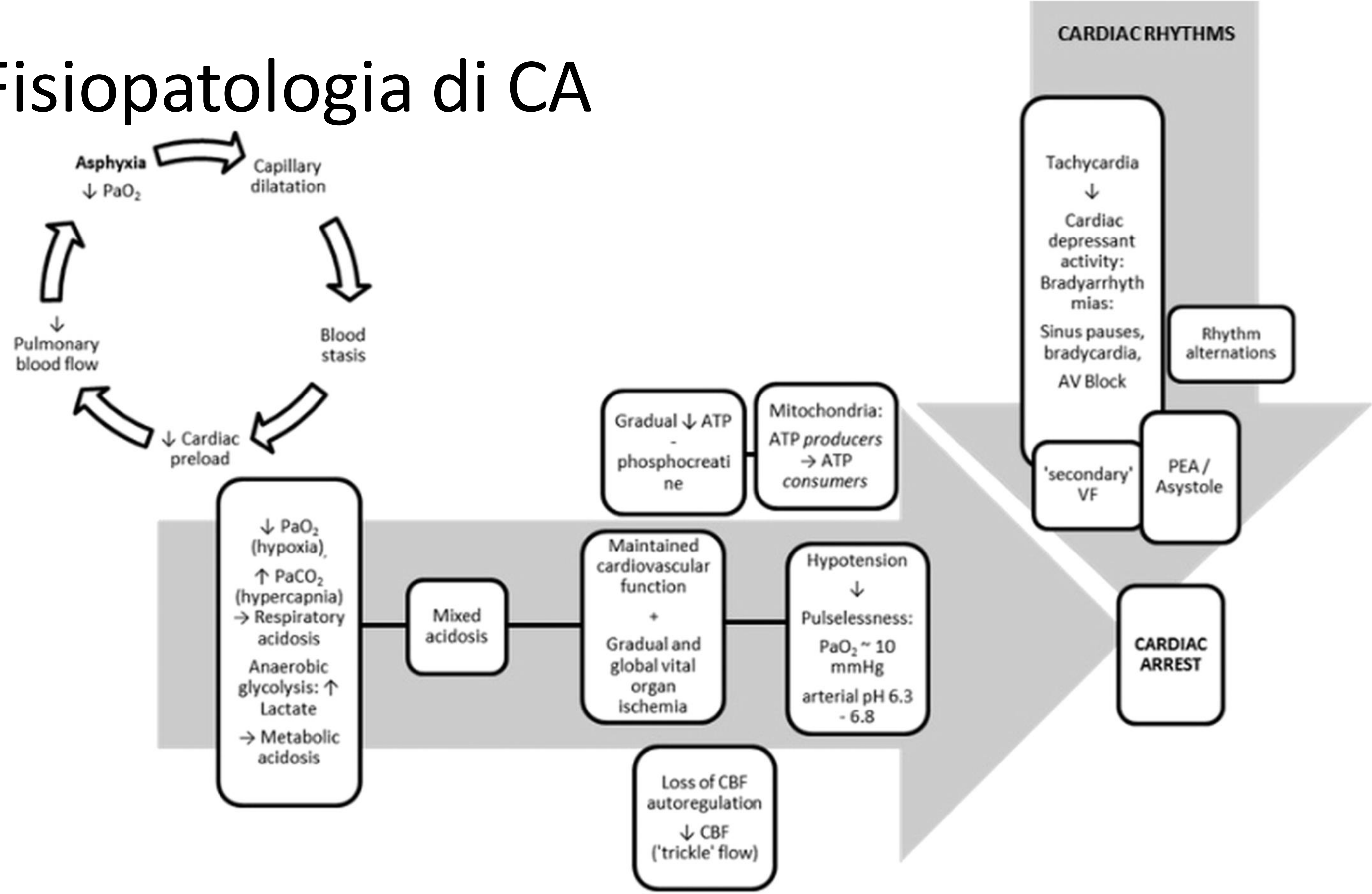
[b] Includes 18 patients where 'initial arrest rhythm' is unknown.

[c] Using time interval from EMS call to arrival on scene.

[d] Denominator is 1,011 WA residents who survived to hospital discharge.

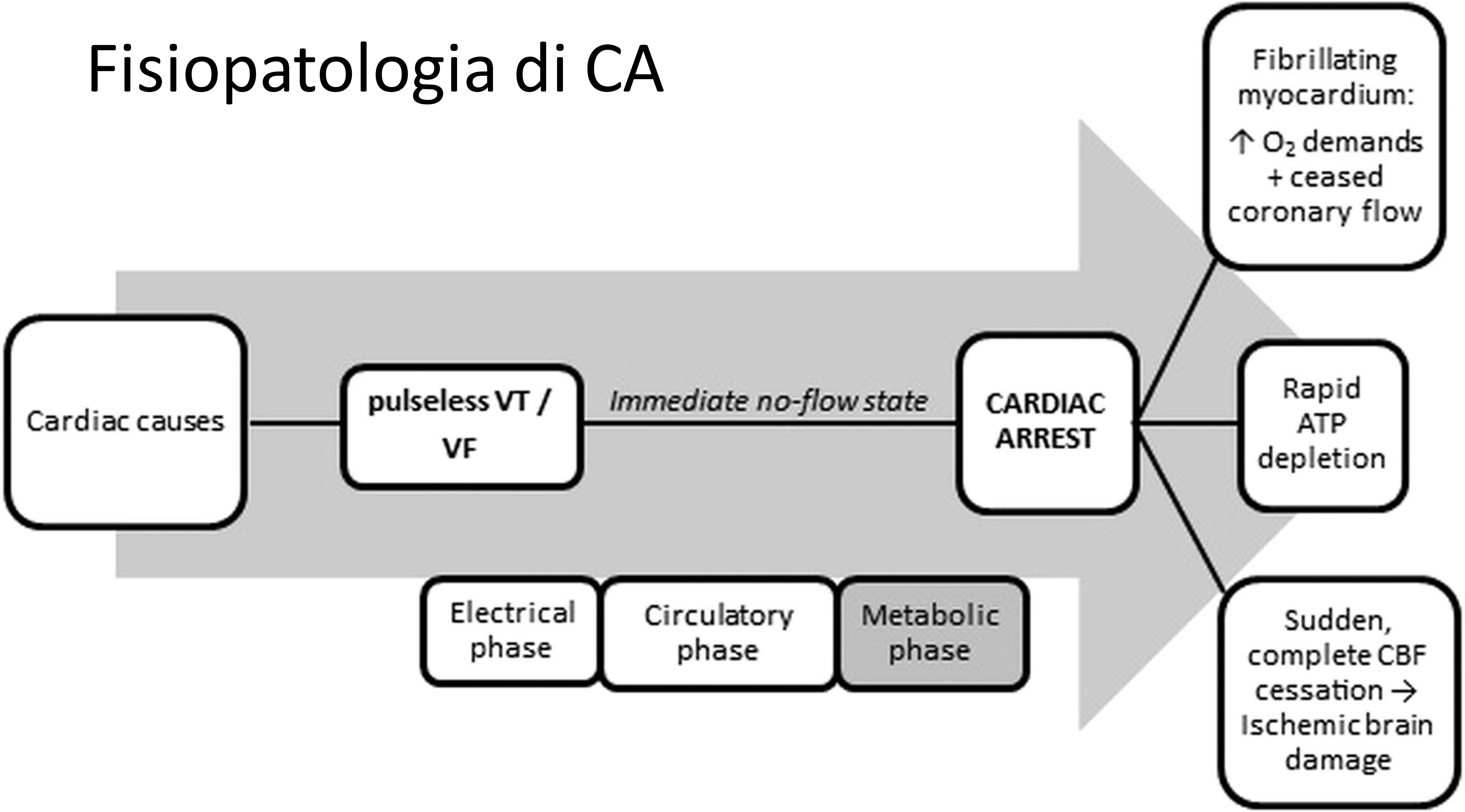
Rittenberger JC, Raina K, Holm MB, Kim YJ, Callaway CW. Association between Cerebral Performance Category, Modified Rankin Scale, and Discharge Disposition after Cardiac Arrest. Resuscitation. 2011;82(8):1036-1040. doi:10.1016/j.resuscitation.2011.03.034

Fisiopatologia di CA



Varvarousis D, Varvarousi G, Iacovidou N, D'Aloja E, Gulati A, Xanthos T. The pathophysiologies of asphyxial vs dysrhythmic cardiac arrest: implications for resuscitation and post-event management. The American Journal of Emergency Medicine. 2015;33(9):1297-1304. doi:10.1016/j.ajem.2015.06.066

Fisiopatologia di CA



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Danno cerebrale da CA

***Panel* 2: Mechanisms associated with brain injury after cardiac arrest**

Primary injury mechanisms

- Impaired oxygen and substrate delivery
- Excitotoxicity
- Disrupted calcium homoeostasis
- Oxidative stress
- Mitochondrial damage and dysfunction
- Pathological protease activation
- Inflammation

Secondary injury mechanisms

- Hypotension
- Hypoxaemia
- Elevated intracranial pressure
- Seizures
- Dysglycaemia
- Hyperthermia

Perkins GD, Callaway CW, Haywood K, et al. Brain injury after cardiac arrest. The Lancet. 2021;398(10307):1269-1278. doi:10.1016/S0140-6736(21)00953-3

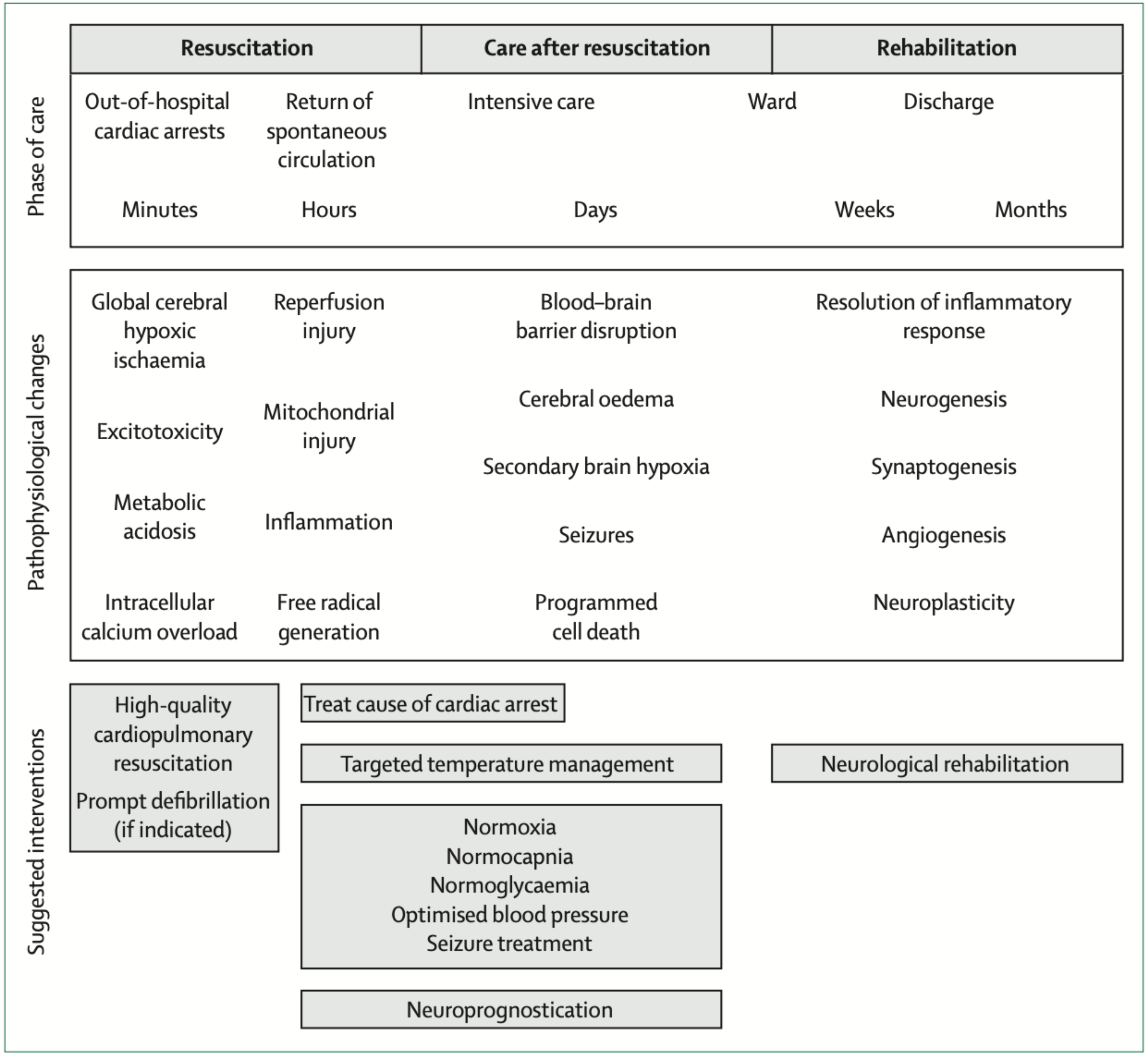


***Figure 3*: Simplified schematic representation of overlapping phases of brain injury after cardiac arrest and timing of therapeutic interventions**

Perkins GD, Callaway CW, Haywood K, et al. Brain injury after cardiac arrest. The Lancet. 2021;398(10307):1269-1278. doi:10.1016/S0140-6736(21)00953-3

La catena della sopravvivenza

Abstract

Objective: To determine which aspects of prehospital care impact outcomes after pediatric cardiac arrest.

Methods: In this study, the authors examine 5 years of consecutive data from their county emergency medical system (EMS), to identify predictors of good outcome after pediatric cardiac arrest, including return of spontaneous circulation (ROSC), survival to hospital admission (HA) and survival to hospital discharge (HD). Three logistic regression models were performed using JMP 14.1 Pro for Windows, each with the following nine predictors: age, sex, ventilation method (endotracheal intubation vs. supraglottic airway), initial rhythm (pulseless electrical activity vs. asystole), epinephrine administration, bystander treatment prior to EMS arrival, time from collapse to EMS arrival, automatic external defibrillator (AED) placement, and whether the arrest was witnessed. Odds ratio confidence intervals were calculated using the Wald method, and corresponding p-values were obtained with the likelihood ratio χ^2 test.

Results: From January 1, 2012 to December 31, 2016, there were 133 pediatric cardiac arrests, of which we had complete data on 109 patients for pediatric cardiac arrest. The median age was 8 months, with an IQR of 2.25–24 months, and a range of 0–108 months (0–9 years). There was return of spontaneous circulation (ROSC) in 20% of cases overall, with 16% making it to hospital admission, and 9% making it alive out of the hospital.

The median time to EMS arrival for witnessed events was 10 min, with an interquartile range (IQR) of 6.5–16 min, and a range of 0–25 min. The median time to EMS arrival for *un*witnessed events was 30 min, with an IQR of 19–62.5 min, and a range of 9–490 min.

Predictors of ROSC included epinephrine administration (p=.00007), bystander treatment before EMS arrival (p=.0018), older age (p=.0025), shorter time to EMS arrival (p=.0048), and AED placement. Predictors of hospital admission included epinephrine NOT being administered (p=.0004), bystander treatment before EMS arrival (p=.0088), shorter time to EMS arrival (p=.0141), and AED placement (p=.0062). The only significant predictor of survival to hospital discharge alive that was identified was shorter time to EMS arrival (p=.0014), as there was insufficient data for many of the predictor variables in this analysis.

Conclusion: Shorter time to EMS arrival from time of arrest, any bystander treatment prior to EMS arrival, and AED placement resulted in significantly higher rates of return of spontaneous circulation. Epinephrine administration significantly improved ROSC, but had the opposite effect on HA. Only shorter time to EMS arrival from time of arrest was significantly associated with survival to hospital discharge. *Each additional minute for the EMS to arrive resulted in 5% decreased odds of ROSC and hospital admission, and 12% decreased odds of surviving to hospital discharge.*

Keywords: Pediatric cardiac arrest, Resuscitation, CPR

Banerjee P, Ganti L, Stead TG, Vera AE, Vittone R, Pepe PE. Every one-minute delay in EMS on-scene resuscitation after out-of-hospital pediatric cardiac arrest lowers ROSC by 5%. Resuscitation Plus. 2021;5:100062. doi:10.1016/j.resplu.2020.100062

ORIGINAL ARTICLE

Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest

Kristian Kragholm, M.D., Ph.D., Mads Wissenberg, M.D., Ph.D., Rikke N. Mortensen, M.Sc., Steen M. Hansen, M.D., Carolina Malta Hansen, M.D., Ph.D., Kristinn Thorsteinsson, M.D., Ph.D., Shahzleen Rajan, M.D., Freddy Lippert, M.D., Fredrik Folke, M.D., Ph.D., Gunnar Gislason, M.D., Ph.D., Lars Køber, M.D., D.Sc., Kirsten Fonager, M.D., Ph.D., Svend E. Jensen, M.D., Ph.D., Thomas A. Gerds, Ph.D., Christian Torp-Pedersen, M.D., D.Sc., and Bodil S. Rasmussen, M.D., Ph.D.

Kragholm K, Wissenberg M, Mortensen RN, et al. Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2017;376(18):1737-1747. doi:10.1056/NEJMoa1601891

BACKGROUND

The effect of bystander interventions on long-term functional outcomes among survivors of out-of-hospital cardiac arrest has not been extensively studied.

METHODS

We linked nationwide data on out-of-hospital cardiac arrests in Denmark to functional outcome data and reported the 1-year risks of anoxic brain damage or nursing home admission and of death from any cause among patients who survived to day 30 after an out-of-hospital cardiac arrest. We analyzed risks according to whether bystander cardiopulmonary resuscitation (CPR) or defibrillation was performed and evaluated temporal changes in bystander interventions and outcomes.

Kragholm K, Wissenberg M, Mortensen RN, et al. Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2017;376(18):1737-1747. doi:10.1056/NEJMoa1601891

RESULTS

Among the 2855 patients who were 30-day survivors of an out-of-hospital cardiac arrest during the period from 2001 through 2012, a total of 10.5% had brain damage or were admitted to a nursing home and 9.7% died during the 1-year follow-up period. During the study period, among the 2084 patients who had cardiac arrests that were not witnessed by emergency medical services (EMS) personnel, the rate of bystander CPR increased from 66.7% to 80.6% ($P<0.001$), the rate of bystander defibrillation increased from 2.1% to 16.8% ($P<0.001$), the rate of brain damage or nursing home admission decreased from 10.0% to 7.6% ($P<0.001$), and all-cause mortality decreased from 18.0% to 7.9% ($P=0.002$). In adjusted analyses, bystander CPR was associated with a risk of brain damage or nursing home admission that was significantly lower than that associated with no bystander resuscitation (hazard ratio, 0.62; 95% confidence interval [CI], 0.47 to 0.82), as well as a lower risk of death from any cause (hazard ratio, 0.70; 95% CI, 0.50 to 0.99) and a lower risk of the composite end point of brain damage, nursing home admission, or death (hazard ratio, 0.67; 95% CI, 0.53 to 0.84). The risks of these outcomes were even lower among patients who received bystander defibrillation as compared with no bystander resuscitation.

CONCLUSIONS

In our study, we found that bystander CPR and defibrillation were associated with risks of brain damage or nursing home admission and of death from any cause that were significantly lower than those associated with no bystander resuscitation. (Funded by TrygFonden and the Danish Heart Foundation.)

Kragholm K, Wissenberg M, Mortensen RN, et al. Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2017;376(18):1737-1747. doi:10.1056/NEJMoa1601891

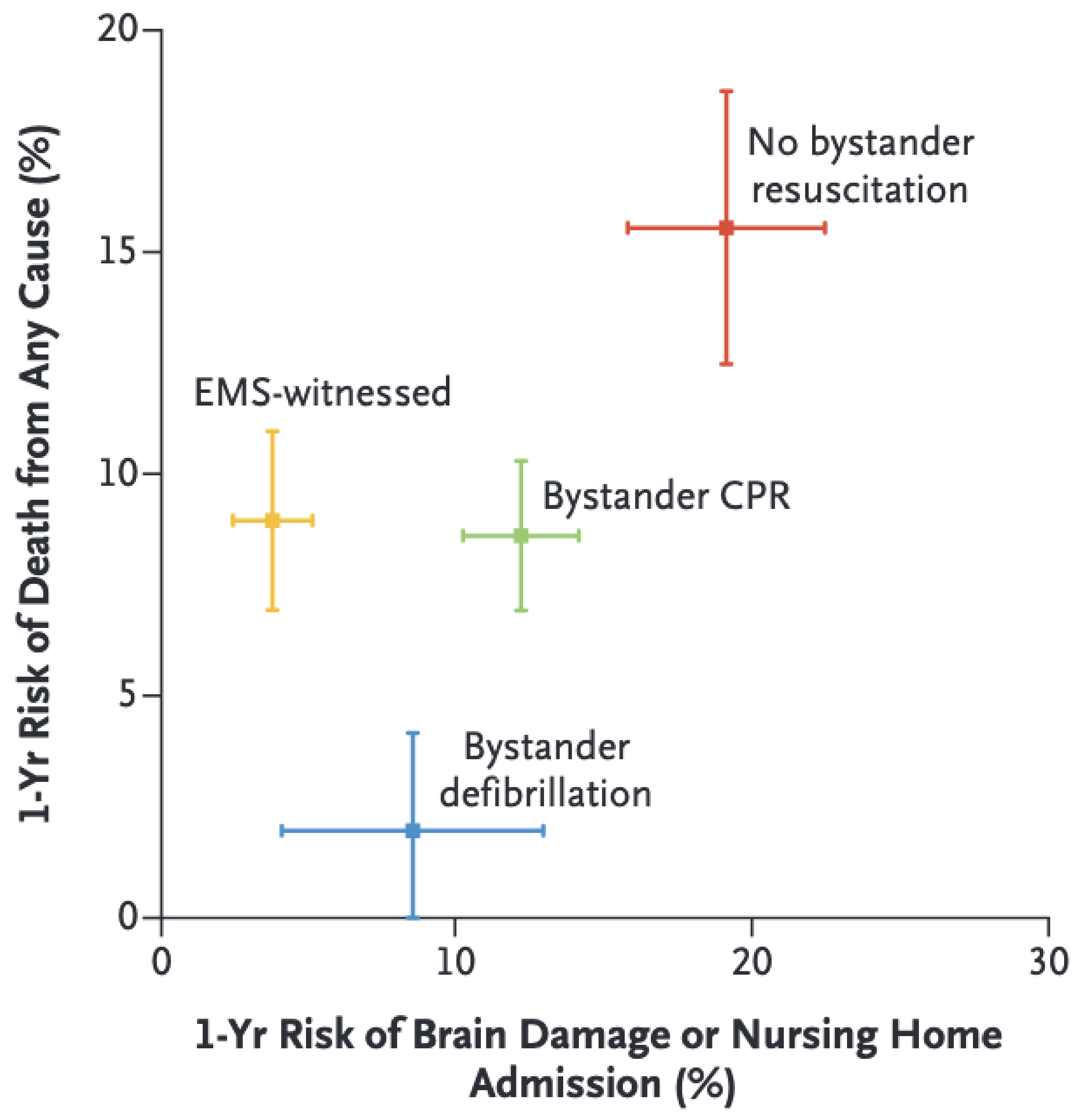


Figure 4. Absolute Risk of Anoxic Brain Damage or Nursing Home Admission and Death from Any Cause at 1 Year of Follow-up According to EMS-Witnessed and Bystander-Intervention Status.

Shown are the 1-year absolute risk of anoxic brain damage or nursing home admission and the 1-year absolute risk of death from any cause in relation to EMS-witnessed and bystander-intervention status. Data for 2527 of 2855 patients are included; those with missing status for bystander CPR or bystander defibrillation (328 patients) are not included in the analyses. Squares indicate point estimates (absolute risks), and I bars 95% confidence intervals.

Kragholm K, Wissenberg M, Mortensen RN, et al. Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest. N Engl J Med. 2017;376(18):1737-1747. doi:10.1056/NEJMoa1601891

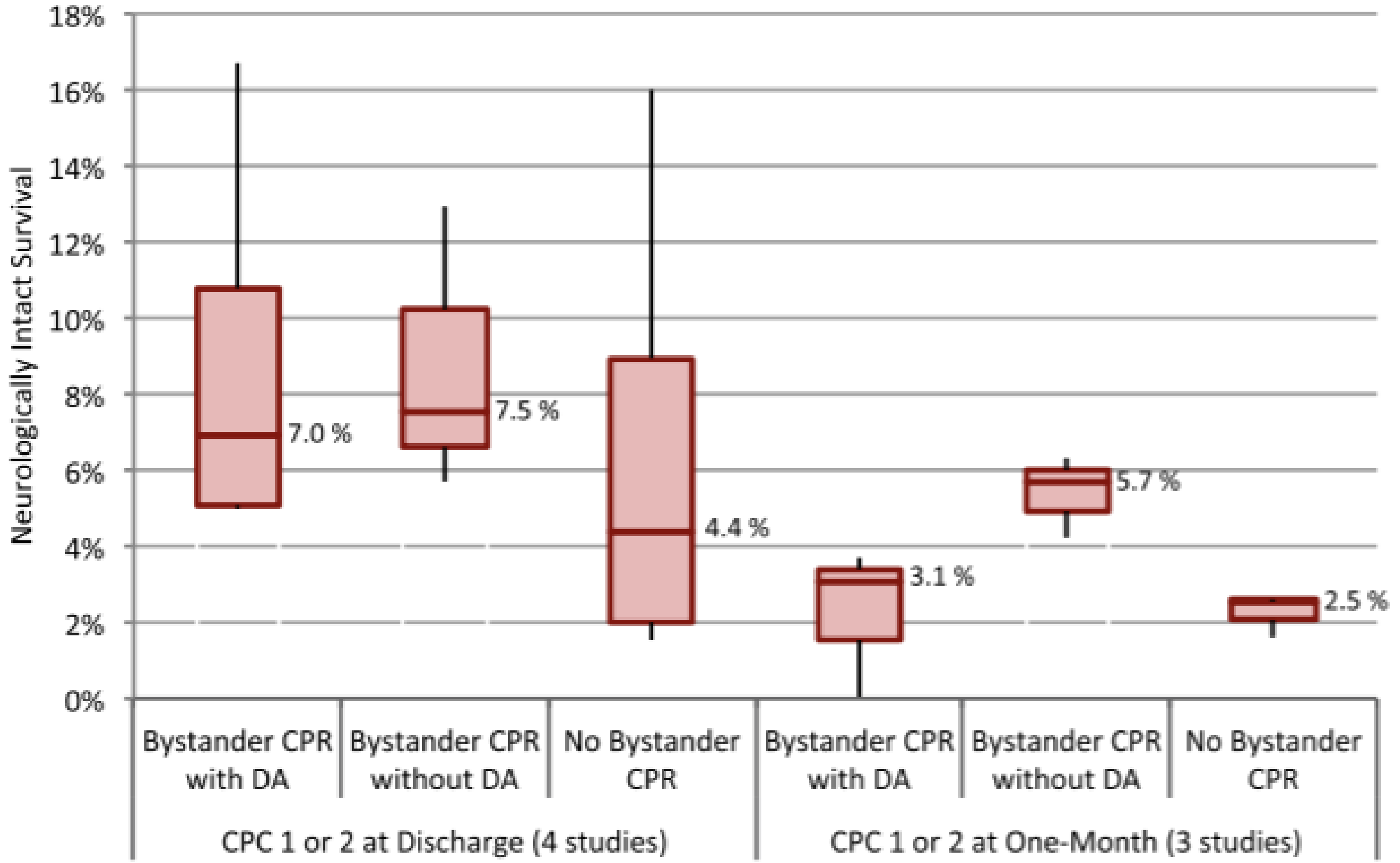


Fig. 3 Median neurologically intact survival defined as Cerebral Performance Category (CPC) 1 or 2 at hospital discharge or one-month with interquartile range (IQR) and minimum/maximum range according to bystander CPR status. Horizontal line within boxes represents median, upper and lower border of boxes reflect IQR, and the black lines show the range of the observations. Details are reported in Table 3. DA, dispatcher assistance; CPC, Cerebral Performance Category; CPR, cardiopulmonary resuscitation

Eberhard KE, Linderoth G, Gregers MCT, Lippert F, Folke F. Impact of dispatcher-assisted cardiopulmonary resuscitation on neurologically intact survival in out-of-hospital cardiac arrest: a systematic review. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2021;29(1):70. doi:10.1186/s13049-021-00875-5

Role of dispatcher

Dispatch-assisted recognition of cardiac arrest

- Dispatch centres should implement standardised criteria and algorithms to determine if a patient is in cardiac arrest at the time of the emergency call.
- Dispatch centres should monitor and track their ability to recognize cardiac arrest and continuously look for ways to improve recognition of cardiac arrest.

Dispatch-assisted CPR

- Dispatch centres should have systems in place to make sure call handlers provide CPR instructions for unresponsive persons not breathing normally.

Dispatch-assisted chest compression-only compared with standard CPR

- Dispatchers should provide chest compression–only CPR instructions for callers who identify unresponsive adult persons not breathing normally.

Eberhard KE, Linderoth G, Gregers MCT, Lippert F, Folke F. Impact of dispatcher-assisted cardiopulmonary resuscitation on neurologically intact survival in out-of-hospital cardiac arrest: a systematic review. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2021;29(1):70. doi:10.1186/s13049-021-00875-5

Dispatch-assisted CPR

ILCOR recommends that emergency medical dispatch centres have systems in place to enable call handlers to provide CPR instructions for adult patients in cardiac arrest.[22] This strong recommendation was based on very-low certainty evidence drawn from 30 observational studies; 16 studies comparing outcomes from patients when dispatch-assisted CPR instruction was offered with outcomes from patients when dispatch-assisted CPR instruction was not offered[23,31,135,140,148,151,153,173–181] and 14 studies comparing outcomes from patients when dispatch-assisted CPR instruction was received with outcomes from patients when dispatch-assisted CPR instruction was not received.[135,140,148,173–176,179,180]

Semeraro F, Greif R, Böttiger BW, et al. European Resuscitation Council Guidelines 2021: Systems saving lives. Resuscitation. 2021;161:80-97. doi:10.1016/j.resuscitation.2021.02.008

Semeraro F, Greif R, Böttiger BW, et al. European Resuscitation Council Guidelines 2021: Systems saving lives. Resuscitation. 2021;161:80-97. doi:10.1016/j.resuscitation.2021.02.008

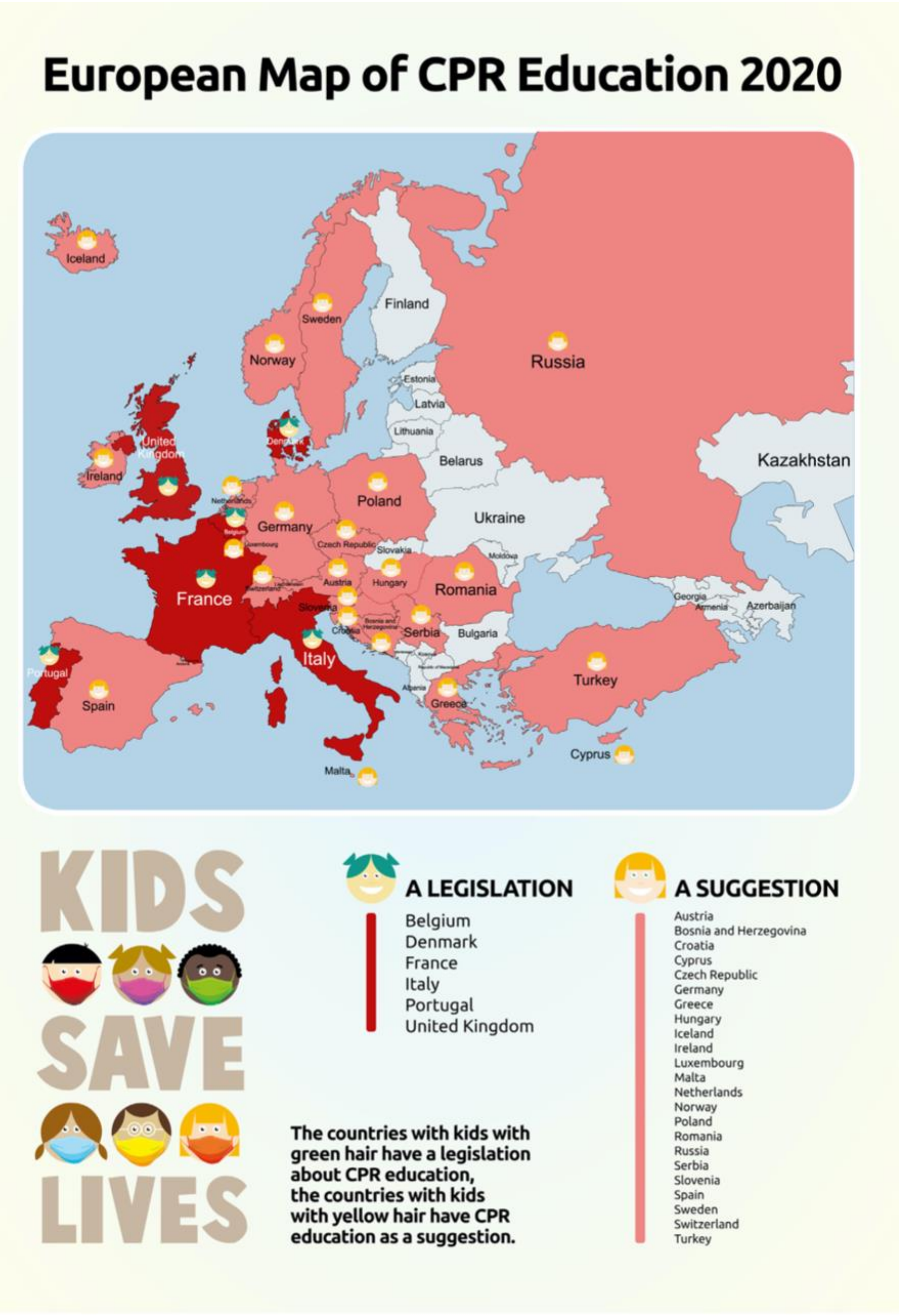


Fig. 2 – Kids save lives: legal requirement for CPR education in schools across Europe.

SYSTEMS SAVING LIVES GL 2021

5 TOP MESSAGES

EUROPEAN RESUSCITATION COUNCIL

1. RAISE AWARENESS ABOUT CPR AND DEFIBRILLATION

- Train as many citizens as possible
- Engage with World Restart a Heart Day
- Develop new and innovative systems and policies that will save more lives

2. USE TECHNOLOGY TO ENGAGE COMMUNITIES

- Implement technologies to alert first responders to cardiac arrests through smartphone apps / text messages
- Develop communities of first responders to help save lives
- Map and share the locations of public access defibrillators

3. KIDS SAVE LIVES

- Teach all school children to do CPR using "check, call and compress"
- Get children to teach their parents and relatives how to do CPR

4. CARDIAC ARREST CENTRES

- Where possible care for adult patients with OHCA in cardiac arrest centres

5. DISPATCH ASSISTANCE DURING CPR

- Provide telephone assisted CPR for people who are unresponsive with absent or abnormal breathing
- Work with dispatch staff to continually monitor and improve telephone assisted CPR

Sanità e affari sociali

Welfare

Utilizzo dei defibrillatori semiautomatici ed automatici

informazioni aggiornate a sabato, 14 agosto 2021

Il **testo unificato A.C. 181 ed abb.-B**, recante *Disposizioni in materia di utilizzo dei defibrillatori semiautomatici e automatici,* definitivamente approvato dalla Camera in seconda lettura il 28 luglio 2021, è diventato legge (con pubblicazione nella G.U, del 13 agosto 2021, L. n. 116 del 4 agosto 2021).

- Utilizzo dei defibrillatori semiautomatici ed automatici

https://www.camera.it/leg17/522?tema=utilizzo-dei-defibrillatori-semiautomatici-ed-automatici-in-ambiente-extraospedaliero

vigente.

L'articolo 3 apporta alcune **modifiche alla** legge n.120/2001 (*Utilizzo dei defibrillatori semiautomatici in ambiente extraospedaliero).* Più in particolare esso, modificando il comma 1 dell'articolo 1 della citata legge, **inserisce i defibrillatori automatici - accanto a quelli semi-automatici - nella previsione della disposizione** diretta a consentirne l'uso al **personale sanitario non medico** nonché al personale non sanitario che abbia ricevuto una specifica formazione nelle attività di rianimazione cardio-polmonare . Inoltre, con l'inserimento di un periodo aggiuntivo nel comma in esame, esso dispone che, in assenza di personale sanitario o non sanitario formato, **nei casi di sospetto arresto cardiaco è comunque consentito l'uso del defibrillatore semiautomatico od automatico anche ad una persona non in possesso dei requisiti citati**. Viene poi espressamente sancita, ai **sensi dell'articolo 54 del codice penale, la non punibilità delle azioni connesse all'uso del defibrillatore** nonché alla rianimazione cardiopolmonare intraprese dai soggetti che agiscano in stato di necessità nel tentativo di prestare soccorso ad una vittima di sospetto arresto cardiaco .

Viene poi modificato **il titolo della legge citata** inserendo anche il riferimento ai defibrillatori automatici.

L'articolo 4 apporta alcune **modifiche all'articolo 7 del D.L 158/2012** , in tema di dotazione ed **utilizzo dei DAE** da parte delle **società sportive dilettantistiche e** professionistiche .

Con una **modifica al comma 11 del citato articolo 7**, viene specificato che **l'obbligo relativo alla dotazione ed all'impiego, da parte di società sportive sia professionistiche che dilettantistiche, di defibrillatori semiautomatici e automatici e di eventuali altri dispositivi salvavita**, sussiste nelle competizioni e durante gli allenamenti.

https://www.camera.it/leg17/522?tema=utilizzo-dei-defibrillatori-semiautomatici-ed-automatici-in-ambiente-extraospedaliero

Ai sensi dell'**articolo 5**, inoltre, si prevede **l'introduzione alle tecniche di rianimazione cardiopolmonare di base e di utilizzo del DAE nelle scuole secondarie di primo e secondo grado**. A tale scopo viene integrato il contenuto del comma 10 dell'articolo 1 della legge 107/2015 (cd. *Buona Scuola*) che ha previsto i**niziative di formazione per gli studenti**, presso le medesime scuole, relative alle **tecniche di primo soccorso**, anche in collaborazione con il servizio di emergenza territoriale 118 del SSN. Con l'integrazione proposta si specifica che le iniziative di formazione citate devono comprendere anche **le tecniche di rianimazione cardiopolmonare di base e l'uso del DAE e la disostruzione delle vie aeree da corpo estraneo**. Nell'organizzazione di tali iniziative devono essere adottate speciali misure di attenzione nei confronti degli studenti delle scuole secondarie di primo e di secondo grado, in modo da tenere conto della sensibilità connessa all'età. Tali iniziative sono estese al personale docente e al personale amministrativo tecnico ed ausiliario.

https://www.camera.it/leg17/522?tema=utilizzo-dei-defibrillatori-semiautomatici-ed-automatici-in-ambiente-extraospedaliero

L'**articolo 6** disciplina la **registrazione dei DAE presso le centrali operative del sistema di emergenza sanitaria 118**, disponendo che, al fine di consentire la tempestiva localizzazione del DAE più vicino in caso di evento di un arresto cardiaco, e di fornire indicazioni per il suo reperimento ai chiamanti o ad altri soccorritori, entro sessanta giorni dall'entrata in vigore della legge, i soggetti, siano essi pubblici o privati, già dotati di un DAE, sono obbligati a darne **comunicazione** alla **centrale operativa del sistema di emergenza sanitaria 118** territorialmente competente. Tale comunicazione deve specificare il numero di dispositivi, le caratteristiche e la loro ubicazione, gli orari di accessibilità al pubblico, le date di scadenza delle parti deteriorabili, nonché gli eventuali nominativi dei soggetti in possesso dell'attestato di formazione all'uso dei DAE. A tale fine, per i DAE acquistati successivamente alla data di entrata in vigore della presente legge, all'atto della vendita, il venditore deve comunicare, attraverso modulistica informatica, alla centrale operativa del sistema di emergenza sanitaria 118 territorialmente competente,sulla base dei dati forniti dall'acquirente, il luogo dove è prevista l'installazione dei DAE e il nominativo dell'acquirente, previa autorizzazione al trattamento dei dati personali. Inoltre, nei luoghi pubblici presso i quali è presente un DAE registrato, deve essere individuato un **soggetto responsabile del corretto funzionamento dell'apparecchio** e dell'adeguata informazione all'utenza sullo stesso. La Centrale operativa del sistema di emergenza sanitaria 118 territorialmente competente, sulla base dei dati forniti, presta un servizio di segnalazione periodica delle date di scadenza parti deteriorabili.

https://www.camera.it/leg17/522?tema=utilizzo-dei-defibrillatori-semiautomatici-ed-automatici-in-ambiente-extraospedaliero

L'articolo 7 demanda ad un **Accordo da adottarsi in sede di Conferenza Stato-Regioni**, entro centoventi giorni dall'entrata in vigore della legge, la definizione delle modalità operative per la realizzazione e l'adozione di **un'applicazione mobile integrata con i servizi delle centrali operative del sistema di emergenza sanitaria "118"** per la rapida geolocalizzazione dei soccorritori e dei DAE più vicini al luogo in cui si sia verificata l'emergenza. I soccorritori, reclutabili attraverso l'applicazione del presente comma, sono individuati tra quelli registrati su base volontaria negli archivi informatici della Centrale operativa del 118 territorialmente competente .

https://www.camera.it/leg17/522?tema=utilizzo-dei-defibrillatori-semiautomatici-ed-automatici-in-ambiente-extraospedaliero

Bystander CPR su vittime NON in ACC

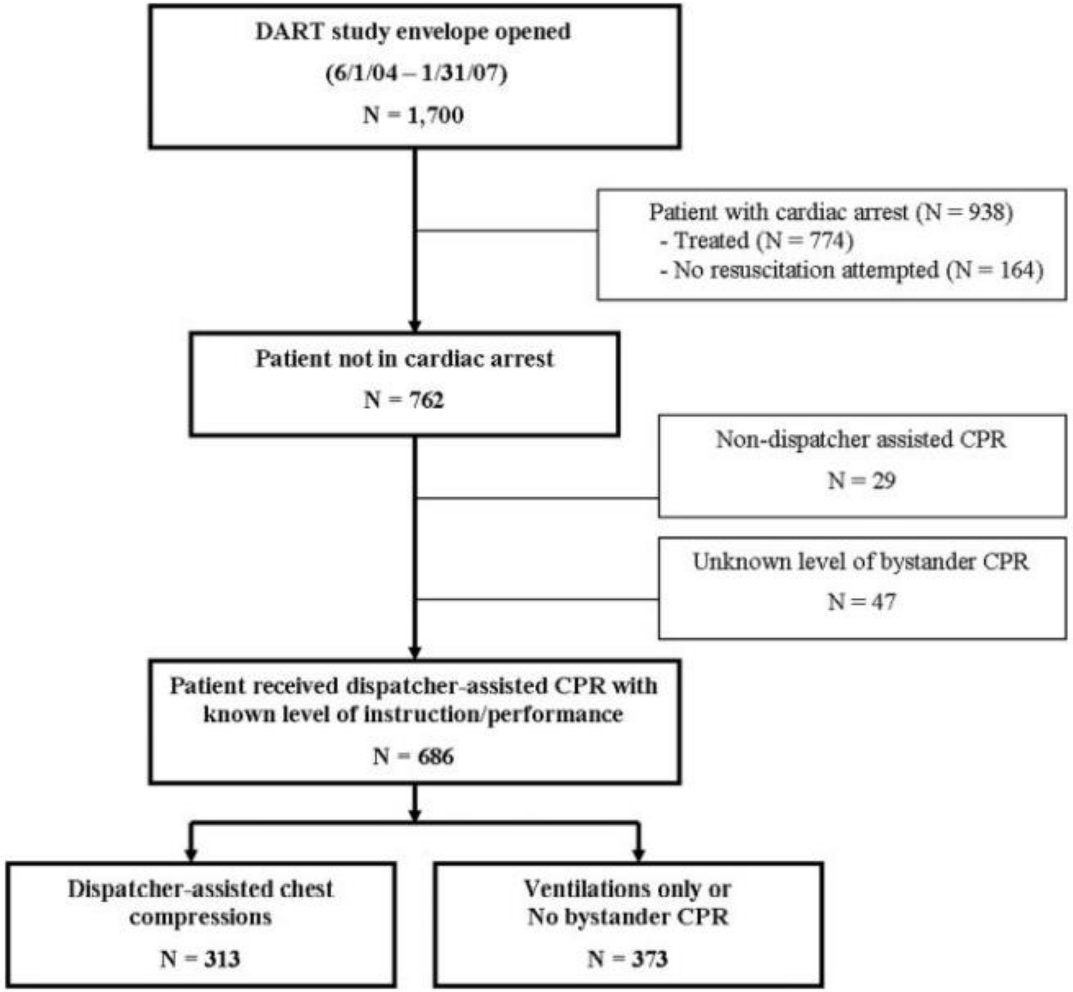


Figure. Flow diagram of subject eligibility.

White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation: risks for patients not in cardiac arrest. Circulation. 2010;121(1):91-97. doi:10.1161/CIRCULATIONAHA.109.872366

Table 1. Characteristics of Patients Not in Cardiac Arrest, Overall and According to Chest Compression Status

	All Patients Not in Cardiac Arrest (n=686)	Chest Compressions(n=313)	Ventilations Only or No Bystander CPR (n=373)	*P*
Age, mean±SD, y	56.8±22.4	53.9±22.0	59.2±22.6	0.002
Male sex, n (%)	367 (53.5)	175 (55.9)	192 (51.5)	0.35
EMS assessment, n (%)				<0.0001
Cerebrovascular event	78 (11.4)	42 (13.4)	36 (9.7)	
Hypoglycemia	62 (9.0)	35 (11.2)	27 (7.2)	
Overdose/intoxication	141 (20.6)	87 (27.8)	54 (14.5)	
Seizure	120 (17.5)	51 (16.3)	69 (18.5)	
Syncope	105 (15.3)	32 (10.2)	73 (19.6)	
Other illness*	180 (26.2)	66 (21.1)	114 (30.6)	
Transport, n (%)				<0.0001
Advanced life support	310 (45.2)	167 (53.4)	143 (38.3)	
Basic life support	275 (40.1)	114 (36.4)	161 (43.2)	
Private vehicle	4 (0.6)	1 (0.3)	3 (0.8)	
No transport	97 (14.1)	31 (9.9)	66 (17.7)	
Randomization, n (%)				<0.0001
Chest compressions alone	340 (49.6)	194 (62.0)	146 (39.1)	
Compressions plus ventilations	346 (50.4)	119 (38.0)	227 (60.9)	

*The other illness category comprised mostly respiratory conditions, cardiovascular emergencies, and psychiatric issues.

White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation: risks for patients not in cardiac arrest. Circulation. 2010;121(1):91-97. doi:10.1161/CIRCULATIONAHA.109.872366

Discussion

In this cohort study of dispatcher-assisted bystander CPR, nearly half of the patients for whom emergency dispatchers offered CPR instructions were not in cardiac arrest. Approximately 18% of dispatcher-assisted CPR instruction resulted in bystander chest compressions for patients not in cardiac arrest. For these patients, EMS most often determined that the patient had a drug or alcohol overdose, seizure, syncope, cerebrovascular event, or hypoglycemia. A total of 9% of these patients experienced discomfort, and 2% sustained injuries likely attributed to the bystander CPR; an additional

3% possibly experienced discomfort, and 1% possibly suffered injuries resulting from bystander CPR. However, only 2% of patients not in arrest suffered a fracture, and no patients experienced visceral organ injury or death as a consequence of bystander CPR.

White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation: risks for patients not in cardiac arrest. Circulation. 2010;121(1):91-97. doi:10.1161/CIRCULATIONAHA.109.872366

This rate of injury is far lower than what has been observed in previous studies of CPR complications, which have reported rates of injury ranging from 21% to 65%.[17,18] These prior studies, however, were primarily autopsy studies conducted on true cardiac arrest patients who had undergone extended resuscitation efforts by medical personnel. Longer duration of CPR is associated with an increased risk of injury.[10] In the present study, patients not in cardiac arrest received only a median duration of 91 seconds of (bystander) CPR. CPR was interrupted by the arrival of EMS or when characteristics indicating that the patient was not in arrest became apparent to the bystander or dispatcher. Moreover, simulation studies suggest that CPR by laypersons often does not produce guideline-directed compression depth and thus would presumably be less likely to cause injury.[19]

White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation: risks for patients not in cardiac arrest. Circulation. 2010;121(1):91-97. doi:10.1161/CIRCULATIONAHA.109.872366

CLOSED-CHEST CARDIAC MASSAGE

W. B. Kouwenhoven, Dr. Ing., James R. Jude, M.D.
and
G. Guy Knickerbocker, M.S.E., Baltimore

Cardiac resuscitation after cardiac arrest or ventricular fibrillation has been limited by the need for open thoracotomy and direct cardiac massage. As a result of exhaustive animal experimentation a method of external transthoracic cardiac massage has been developed. Immediate resuscitative measures can now be initiated to give not only mouth-to-nose artificial respiration but also adequate cardiac massage without thoracotomy. The use of this technique on 20 patients has given an over-all permanent survival rate of 70%. Anyone, anywhere, can now initiate cardiac resuscitative procedures. All that is needed are two hands.

Kouwenhoven WB, Jude JR, Knickerbocker GG. CLOSED-CHEST CARDIAC MASSAGE. JAMA. 1960;173(10):1064-1067. doi:10.1001/jama.1960.03020280004002

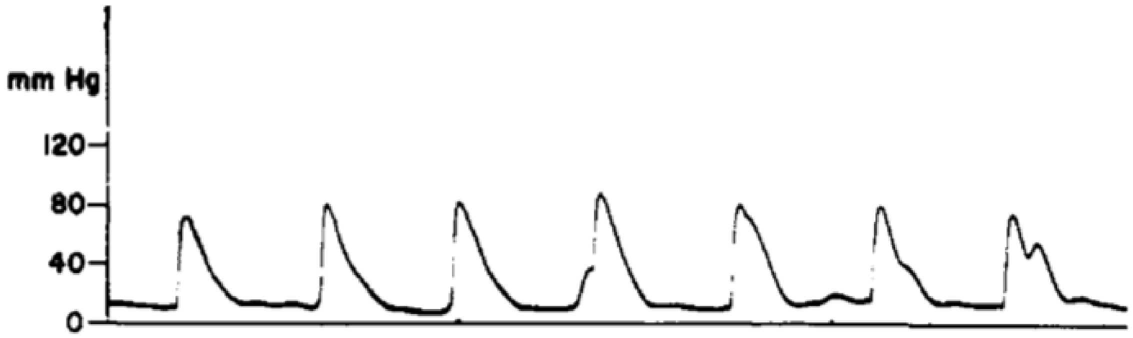


Fig. 3.—Blood pressure produced in an adult by closed-chest cardiac massage.

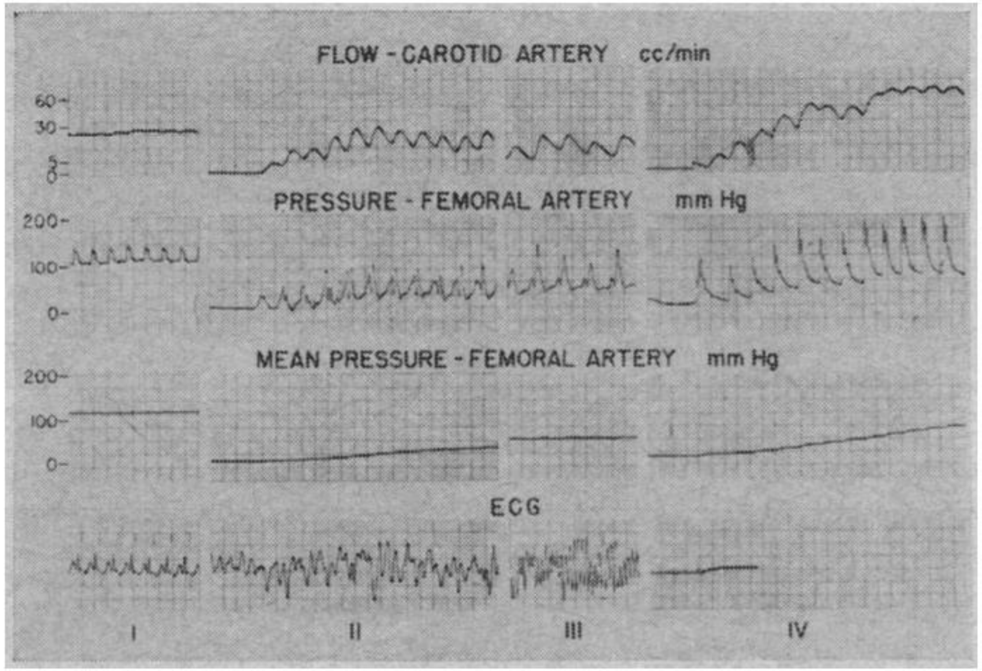


Fig. 1.—Record of blood flow, pressures, and electrocardiogram of dog whose heart was in ventricular fibrillation for eight minutes. I: normal initial values; II: start of closed-chest massage; III: seventh minute of massage; IV: closed-chest defibrillation.

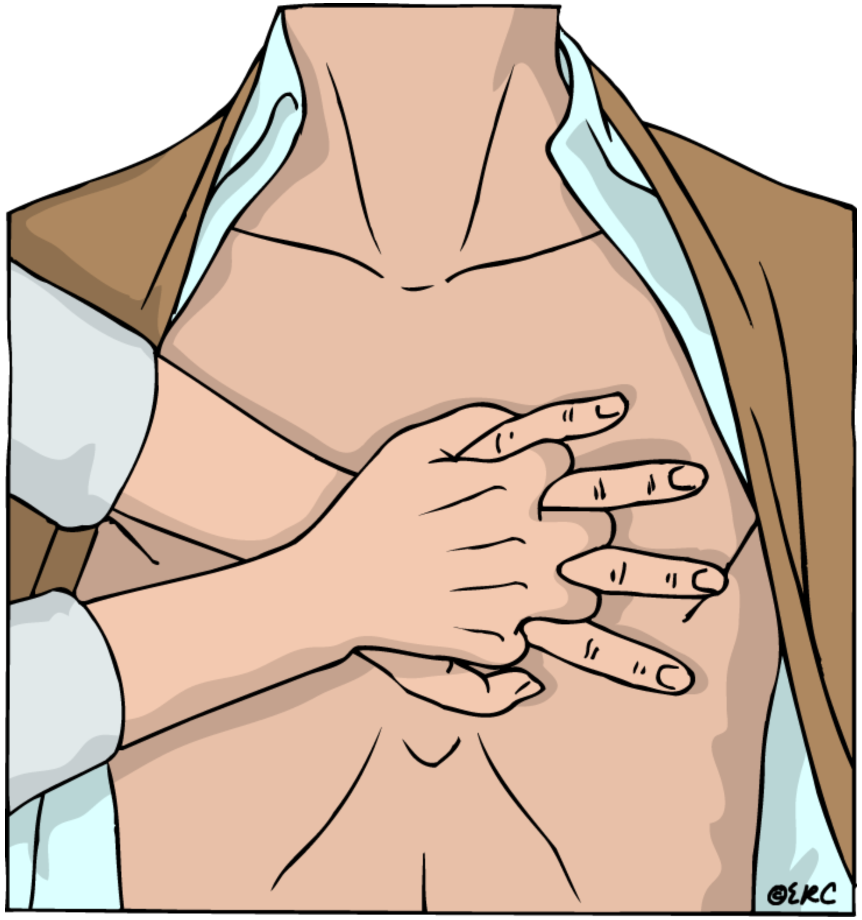
Kouwenhoven WB, Jude JR, Knickerbocker GG. CLOSED-CHEST CARDIAC MASSAGE. JAMA. 1960;173(10):1064-1067. doi:10.1001/jama.1960.03020280004002

Fig 2.—Position of hands during massage of adult.

Compressioni toraciche

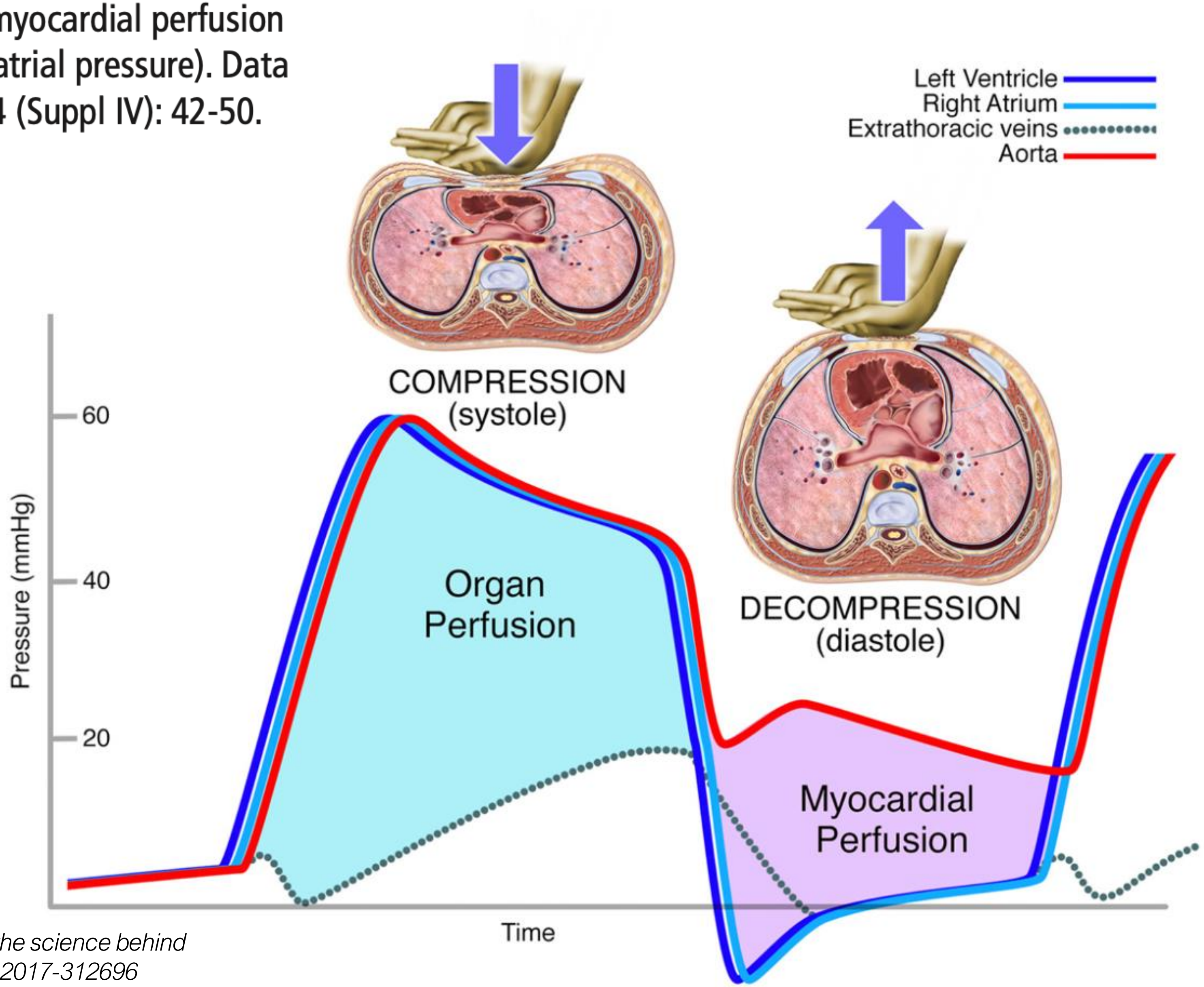
High quality chest compressions

- Start chest compressions as soon as possible.
- Deliver compressions on the lower half of the sternum ('in the centre of the chest').
  Compress to a depth of at least 5 cm but not more than 6 cm.
- Compress the chest at a rate of 100–120 min^{-1} with as few interruptions as possible.
- Allow the chest to recoil completely after each compression; do not lean on the chest.
- Perform chest compressions on a firm surface whenever feasible.



Olasveengen TM, Semeraro F, Ristagno G, et al. European Resuscitation Council Guidelines 2021: Basic Life Support. Resuscitation. 2021;161:98-114. doi:10.1016/j.resuscitation.2021.02.009

Figure 3 Haemodynamic effects of compression and decompression phases of cardiopulmonary resuscitation. Compression phase creates organ perfusion pressure (difference between aortic and extrathoracic vein pressure). Decompression phase creates myocardial perfusion pressure (difference between aortic and right atrial pressure). Data adapted from Criley *et al. Circulation.* 1986; 74 (Suppl IV): 42-50.



Harris AW, Kudenchuk PJ. Cardiopulmonary resuscitation: the science behind the hands. Heart. 2018;104(13):1056. doi:10.1136/heartjnl-2017-312696

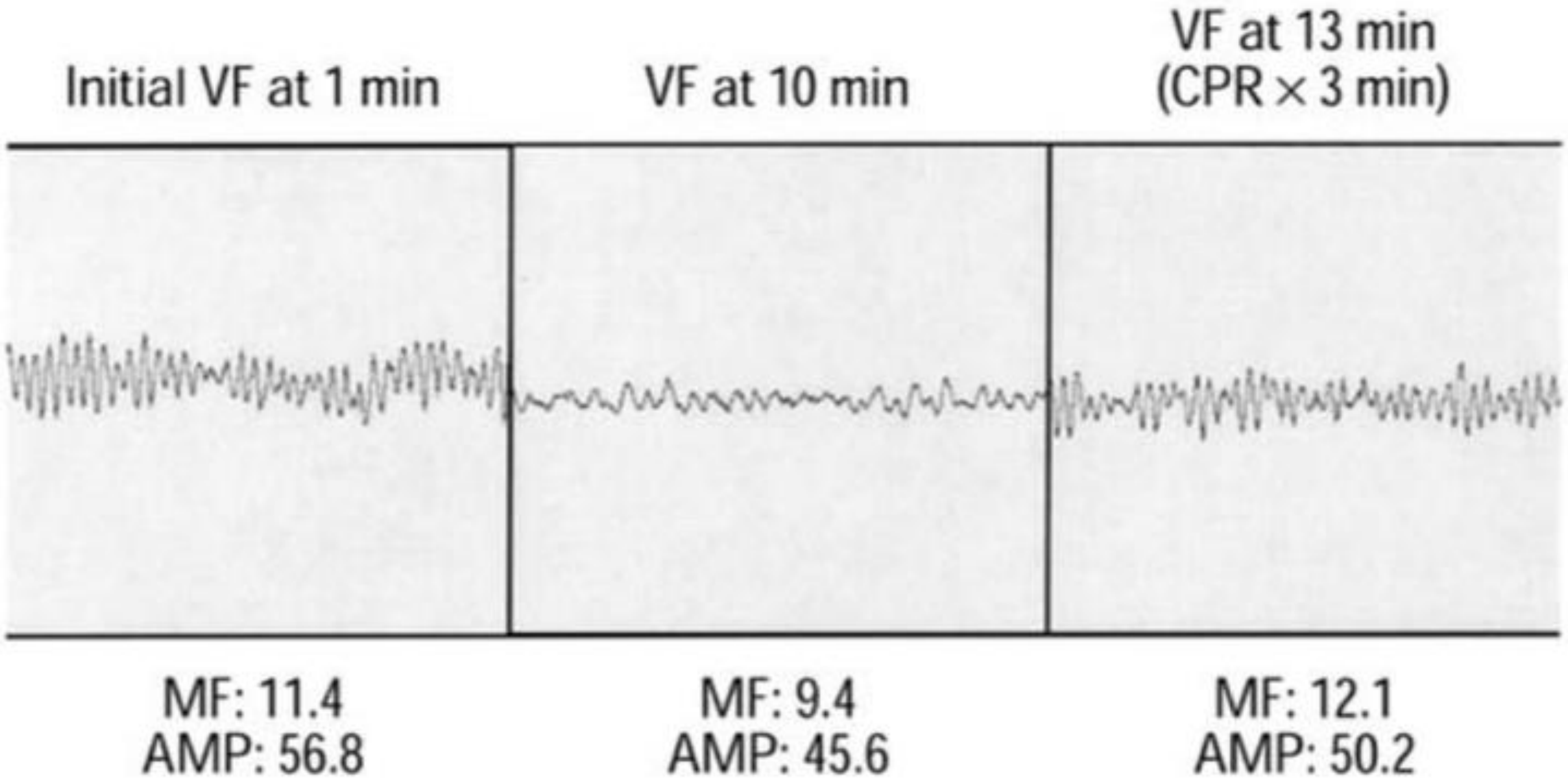
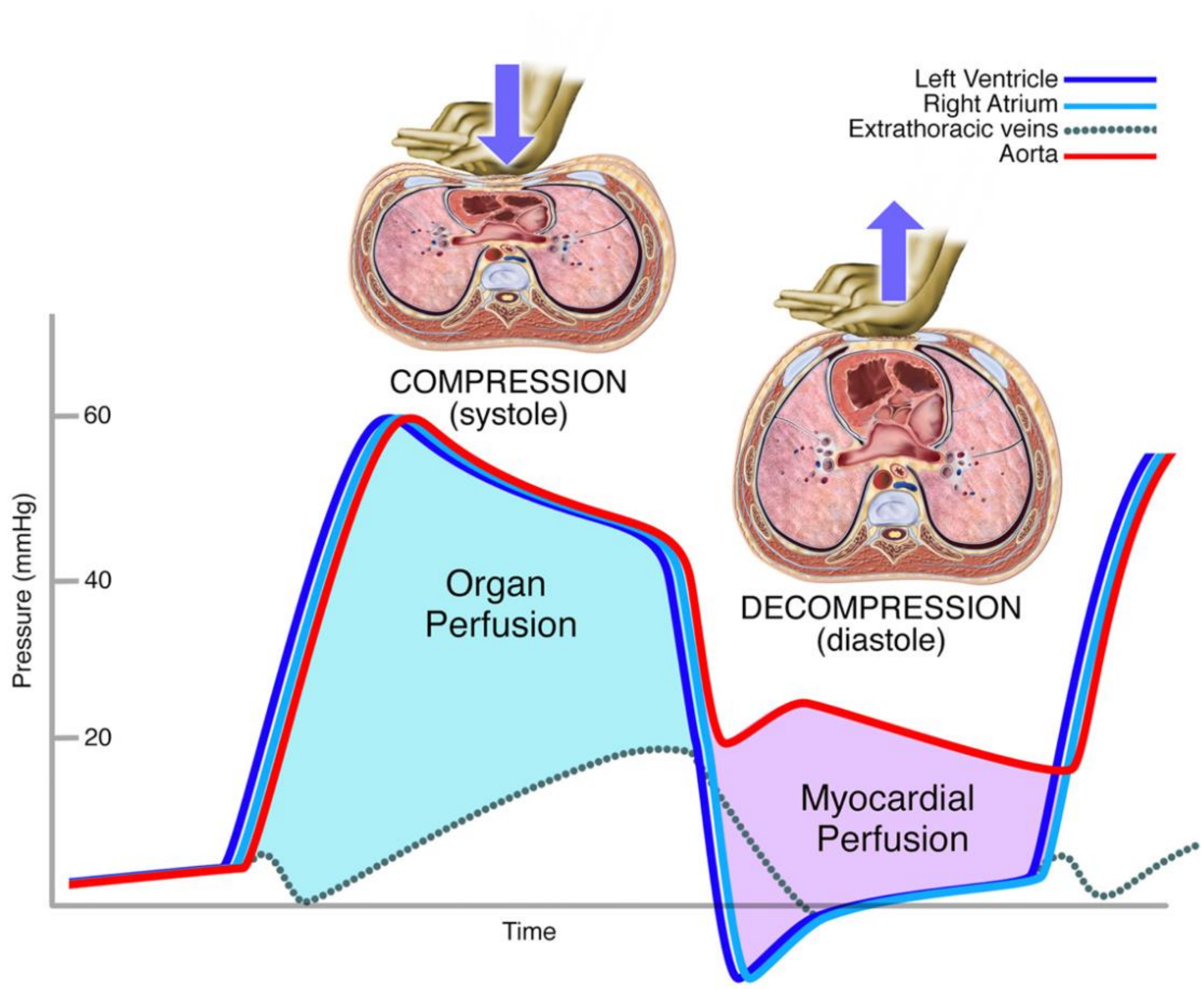


Figure 2 Typical changes in ventricular fibrillation (VF) waveform in untreated VF (after 1 and 10 min) and after 3 min of cardiopulmonary resuscitation-first (13 min) in swine. AMP, amplitude (in mV); MF, VF median frequency (in Hz) (from Berg *et al*[8]). Reproduced with permission from Elsevier.

Harris AW, Kudenchuk PJ. Cardiopulmonary resuscitation: the science behind the hands. Heart. 2018;104(13):1056. doi:10.1136/heartjnl-2017-312696



Harris AW, Kudenchuk PJ. Cardiopulmonary resuscitation: the science behind the hands. Heart. 2018;104(13):1056. doi:10.1136/heartjnl-2017-312696

'Diastole' occurs during the decompression phase of the CPR cycle—when the thorax is permitted to rebound to its normal fully expanded configuration. While seemingly passive and unimportant, CPR decompression may be even more important than its compression phase. During this phase, closure of the aortic valve maintains an aortic pressure that is higher than intracardiac pressures, which fall precipitously beneath the closed valve, driven by the 'vacuum' effect created by the recoiling thoracic cage. This intrathoracic vacuum is what draws blood to return back into the chest from the periphery, filling the heart, lungs and great vessels in preparation for the next chest compression. The result is that the better the decompression, the stronger the vacuum, the better the refilling, and ultimately the more thoracic blood available for subsequent compression.

CPR diastole serves a second useful purpose that is often unappreciated. All organs of the body are perfused during the compression phase of CPR except, ironically, the heart itself, which is not perfused by blood within its chambers, but rather by the coronary arteries. Coronary blood flow is estimated by coronary perfusion pressure (CPP), defined as the difference between pressure in the aorta (where the coronary arteries originate) and in the right atrium (where coronary venous blood ultimately returns).[12] During the compression phase of CPR, all intrathoracic pressures including the aorta and all chambers of the heart equalise with the compressive force of the hands, resulting in no coronary blood flow between the aorta and right atrium. Conversely, in CPR diastole, the higher aortic pressure above its closed valve compared with the falling intrathoracic pressure results in a positive CPP. It is this combination of compressive

Chest recoil (AHA recommendation: allow full chest recoil)

Permitting complete chest recoil during the decompression phase of CPR is essential for refilling the chest and for adequate myocardial perfusion. Incomplete chest recoil or leaving a residual pressure on the chest ('leaning') results in an increase in intrathoracic pressure when it needs to be at its minimum. Among a group of animals that received standard chest compressions with full chest recoil, followed by chest compressions permitting only 75% of full chest recoil, CPP decreased by more than a third during the period of incomplete chest recoil and cerebral perfusion pressures by more than 50% (both $P<0.05$).[25]

Inattention to full recoil is an all too common problem during resuscitation. The problem often arises as a result of fatigue, whereby the chest compressor (who is usually leaning over the patient while performing compressions) unintentionally uses the patient's chest as a resting table during the decompression phase of CPR, rather than permit its full recoil. An observational study of 108 adults with inhospital cardiac arrest at the University of Pennsylvania used force-sensing devices during resuscitation to detect 5 pounds of residual pressure ('lean') left on the chest during the decompression phase of CPR. By this definition, leaning was observed in 91% of the resuscitations, underscoring its all-too-common occurrence.[26]

Harris AW, Kudenchuk PJ. Cardiopulmonary resuscitation: the science behind the hands. Heart. 2018;104(13):1056. doi:10.1136/heartjnl-2017-312696

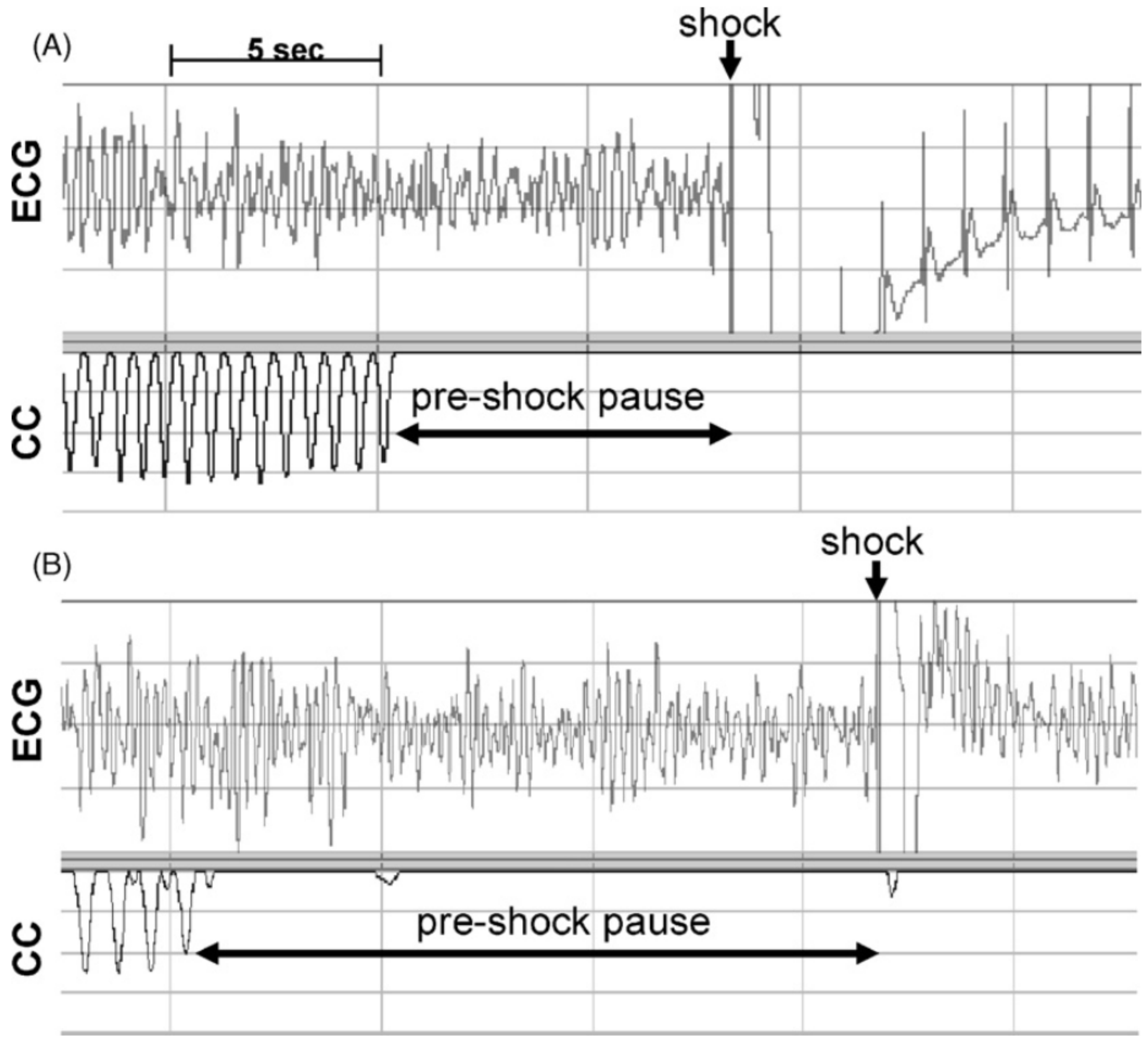


Figure 1 Examples of defibrillation attempts. (A) Successful shock preceded by an 8-s pre-shock pause and deep chest compressions. (B) Unsuccessful shock preceded by a 16 s pre-shock pause and shallower chest compressions. ECG, electrocardiogram; CC, chest compressions.

Edelson DP, Abella BS, Kramer-Johansen J, et al. Effects of compression depth and pre-shock pauses predict defibrillation failure during cardiac arrest. Resuscitation. 2006;71(2):137-145. doi:10.1016/j.resuscitation.2006.04.008

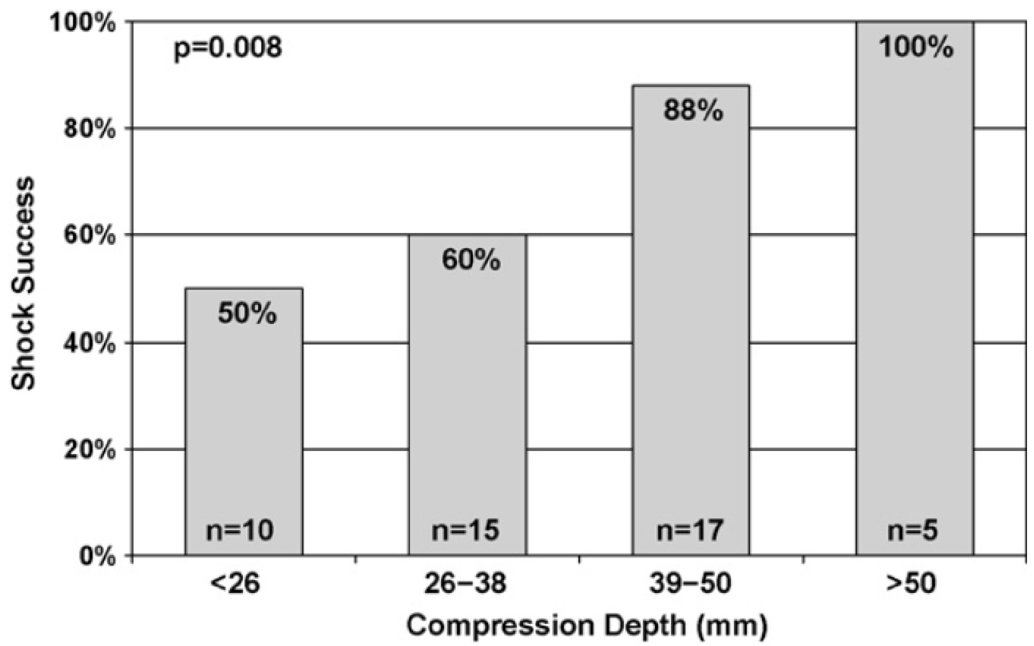


Figure 3 Association between chest compression depth and shock success. Cases are grouped by 30 s average compression depth in approximately 11 mm (0.5 in.) intervals. Chest compression depth of 38—50 mm (1.5—2 in.) represents current CPR guidelines recommendations. Deeper chest compressions are significantly associated with increased probability of shock success.

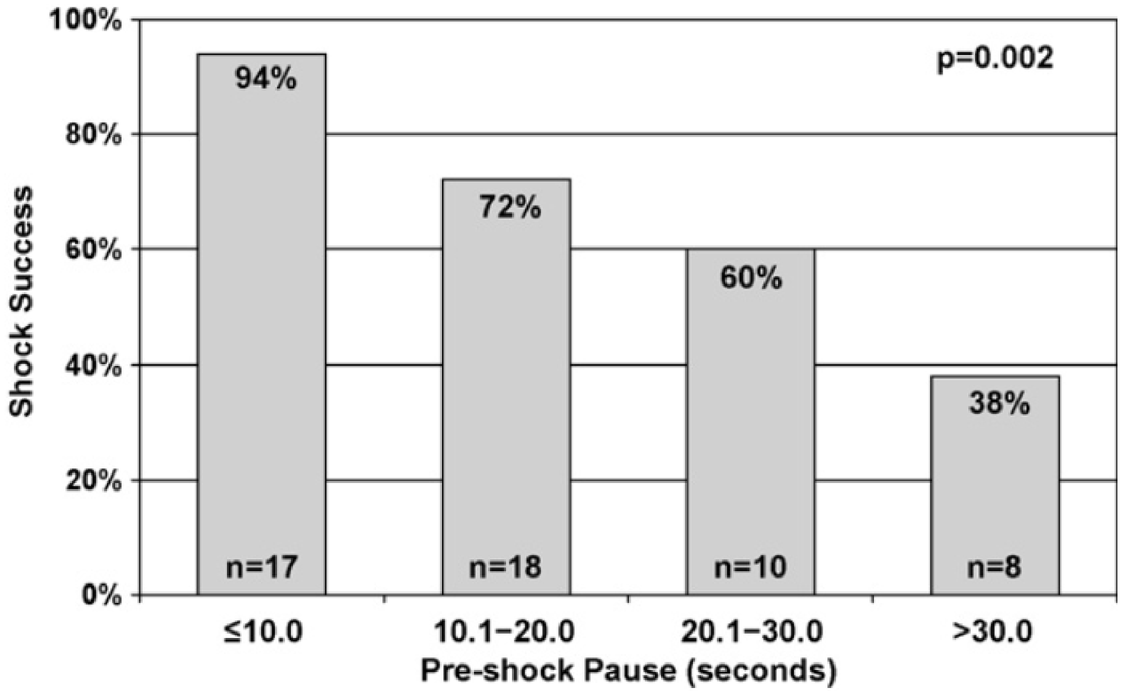


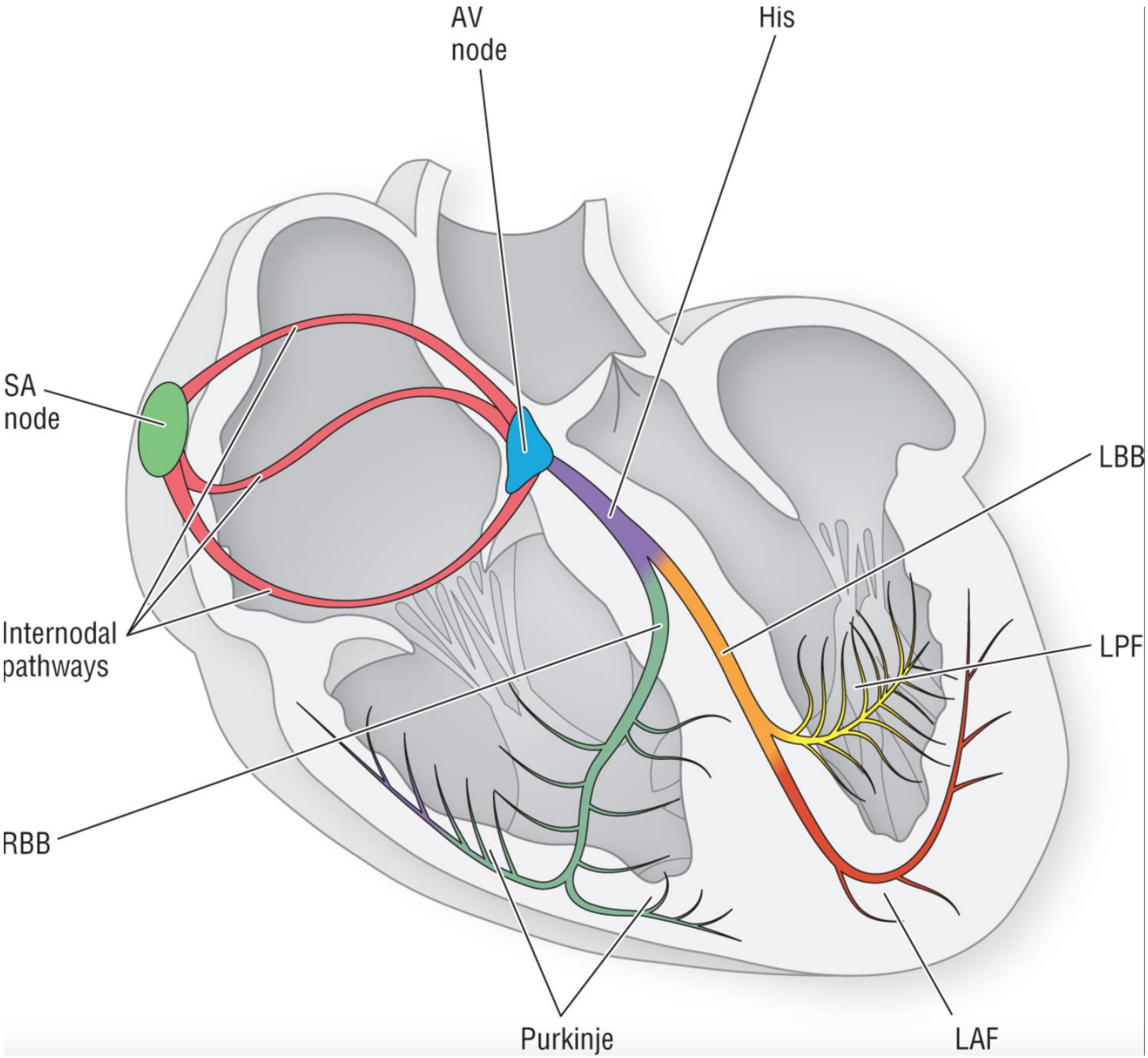
Figure 2 Association between pre-shock pause and shock success. Cases are grouped by pre-shock pause in 10 s intervals. Note that longer pre-shock pauses are significantly associated with a smaller probability of shock success.

Edelson DP, Abella BS, Kramer-Johansen J, et al. Effects of compression depth and pre-shock pauses predict defibrillation failure during cardiac arrest. Resuscitation. 2006;71(2):137-145. doi:10.1016/j.resuscitation.2006.04.008

These findings led ILCOR to suggest performing manual chest compressions on a firm surface when possible (weak recommendation, very low certainty evidence). ILCOR also suggested that when a bed has a CPR mode that increases mattress stiffness, it should be activated (weak recommendation, very-low-certainty evidence), but suggested against moving a patient from a bed to the floor to improve chest compression depth in the hospital setting (weak recommendation, very-low-certainty evidence). The confidence in effect estimates is so low that ILCOR was unable to make a recommendation about the use of a backboard strategy.

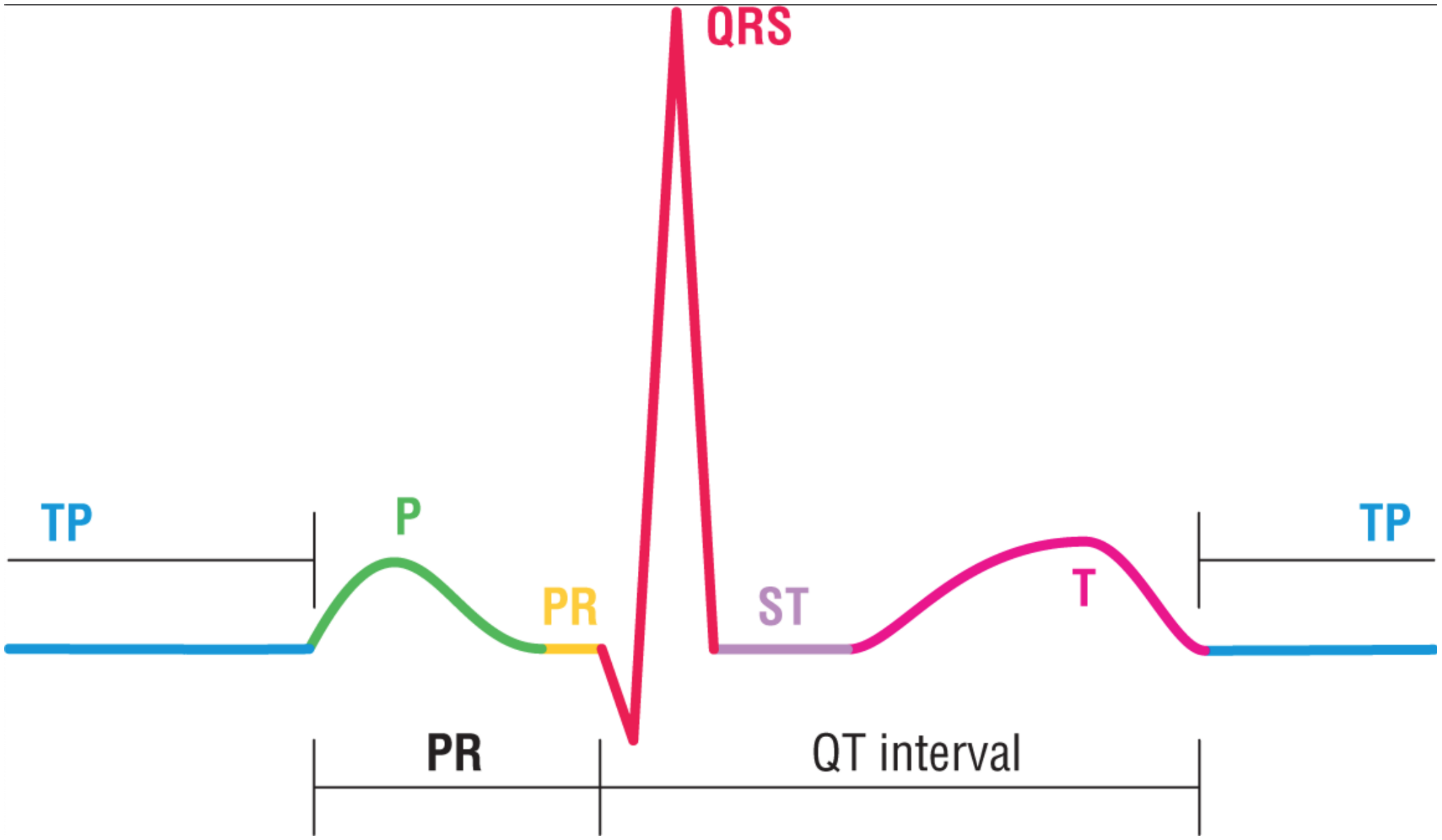
Olasveengen TM, Semeraro F, Ristagno G, et al. European Resuscitation Council Guidelines 2021: Basic Life Support. Resuscitation. 2021;161:98-114. doi:10.1016/j.resuscitation.2021.02.009

Il ritmo normale



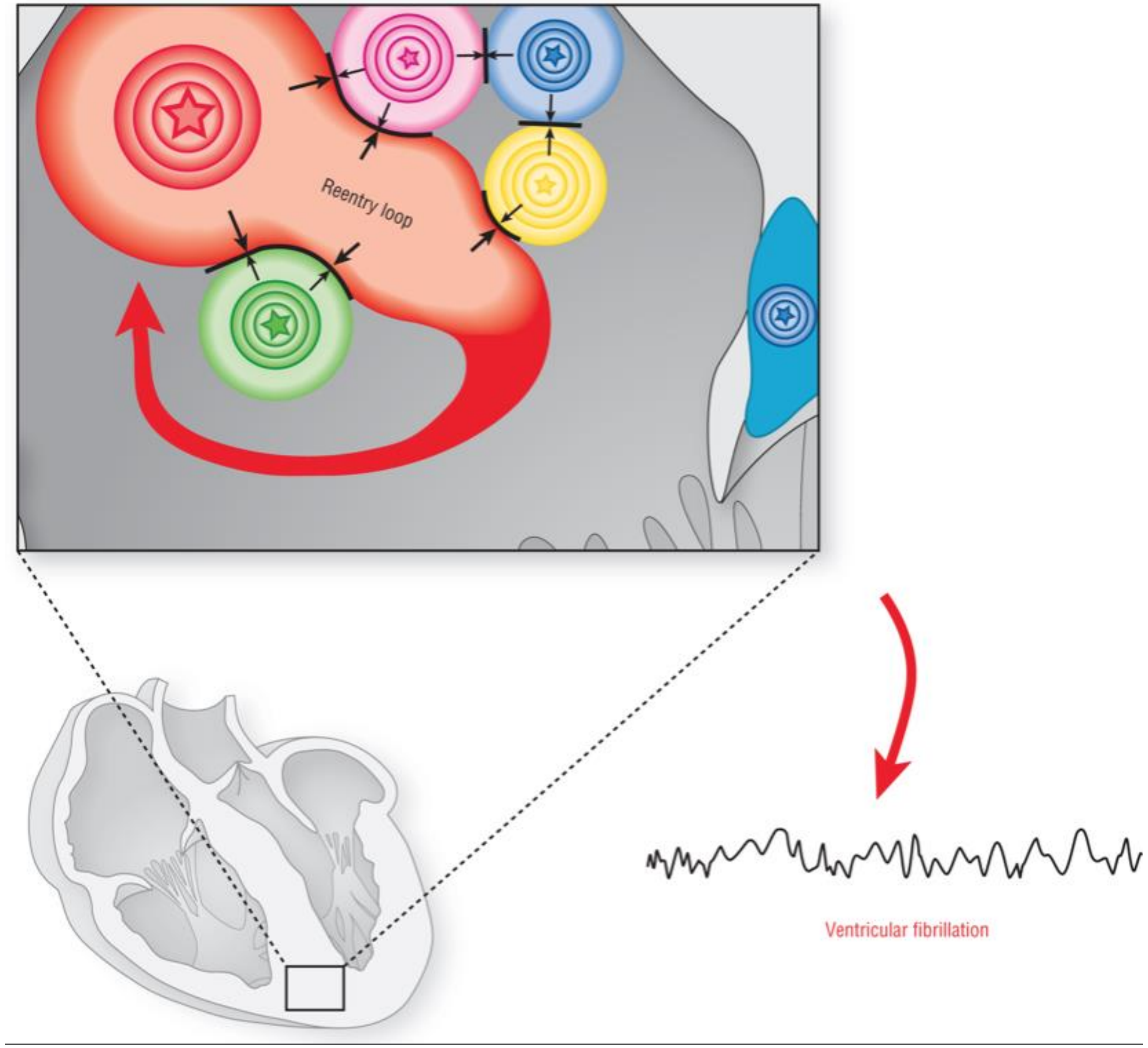
Garcia TB, Garcia DJ. Arrhythmia Recognition: The Art of Interpretation: The Art of Interpretation. Jones & Bartlett Learning; 2019.

Il ritmo normale



Garcia TB, Garcia DJ. Arrhythmia Recognition: The Art of Interpretation: The Art of Interpretation. Jones & Bartlett Learning; 2019.

Ischemia del miocardio e aritmogenesi



Garcia TB, Garcia DJ. Arrhythmia Recognition: The Art of Interpretation: The Art of Interpretation. Jones & Bartlett Learning; 2019.

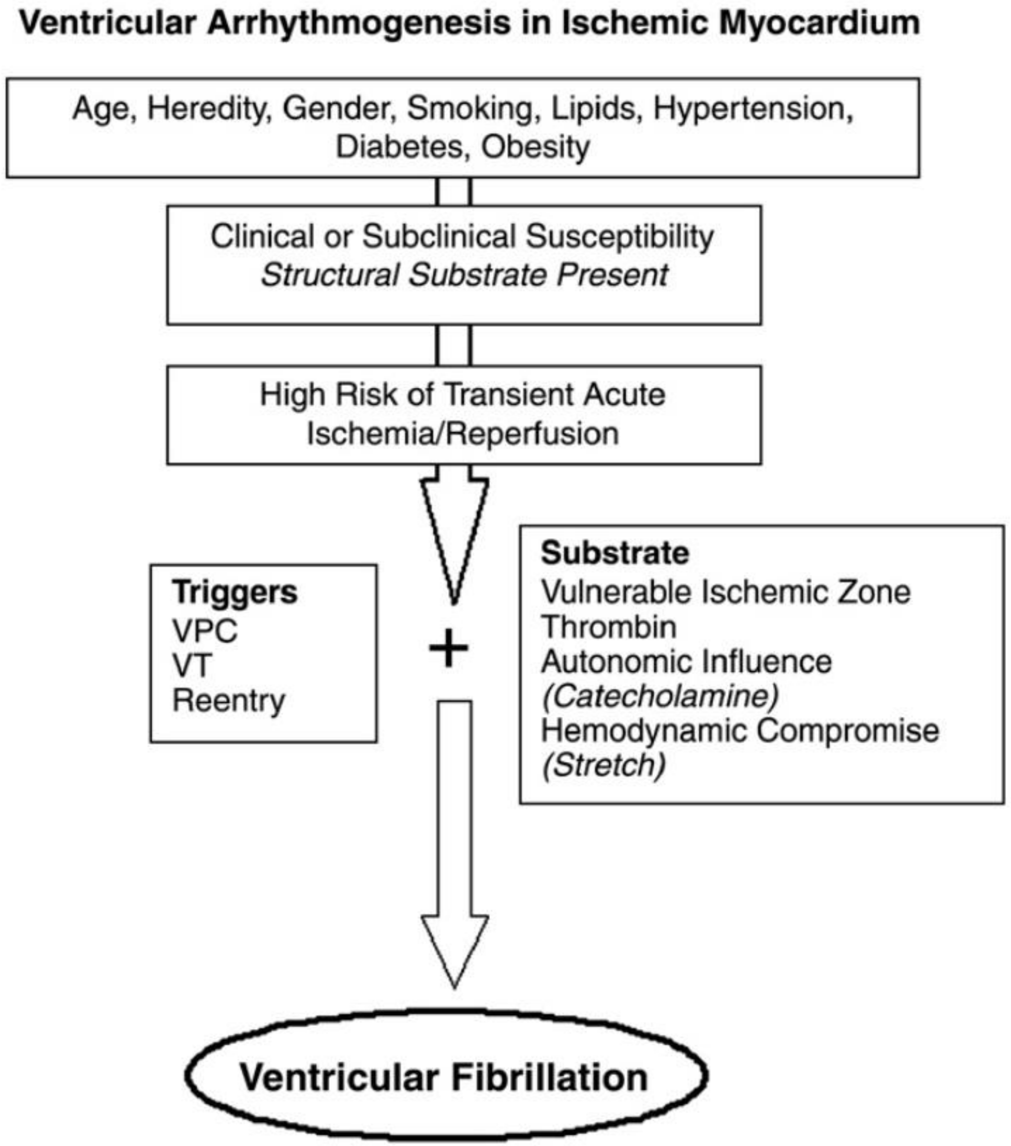
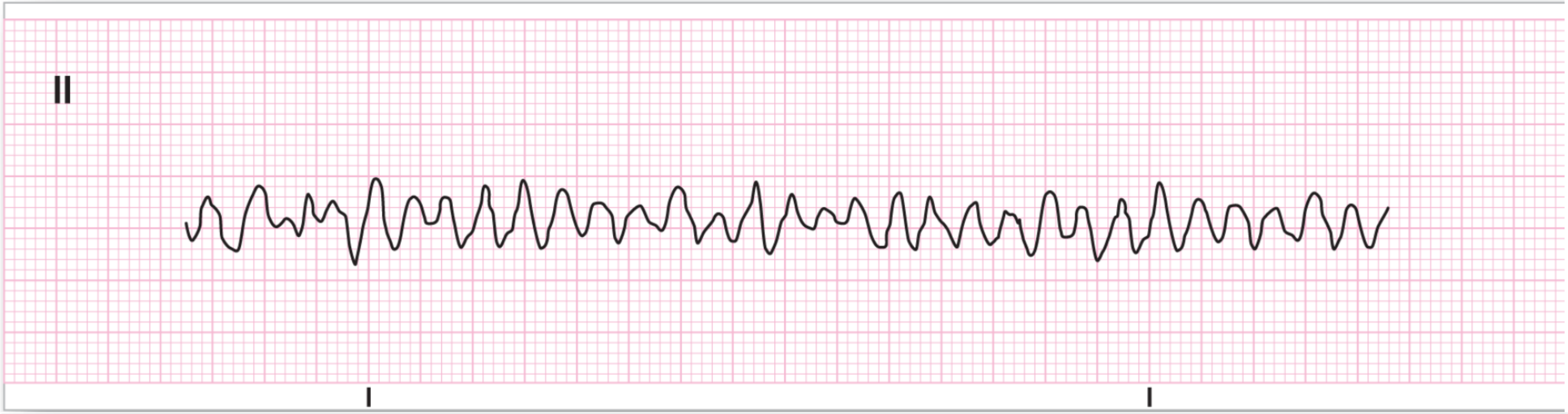


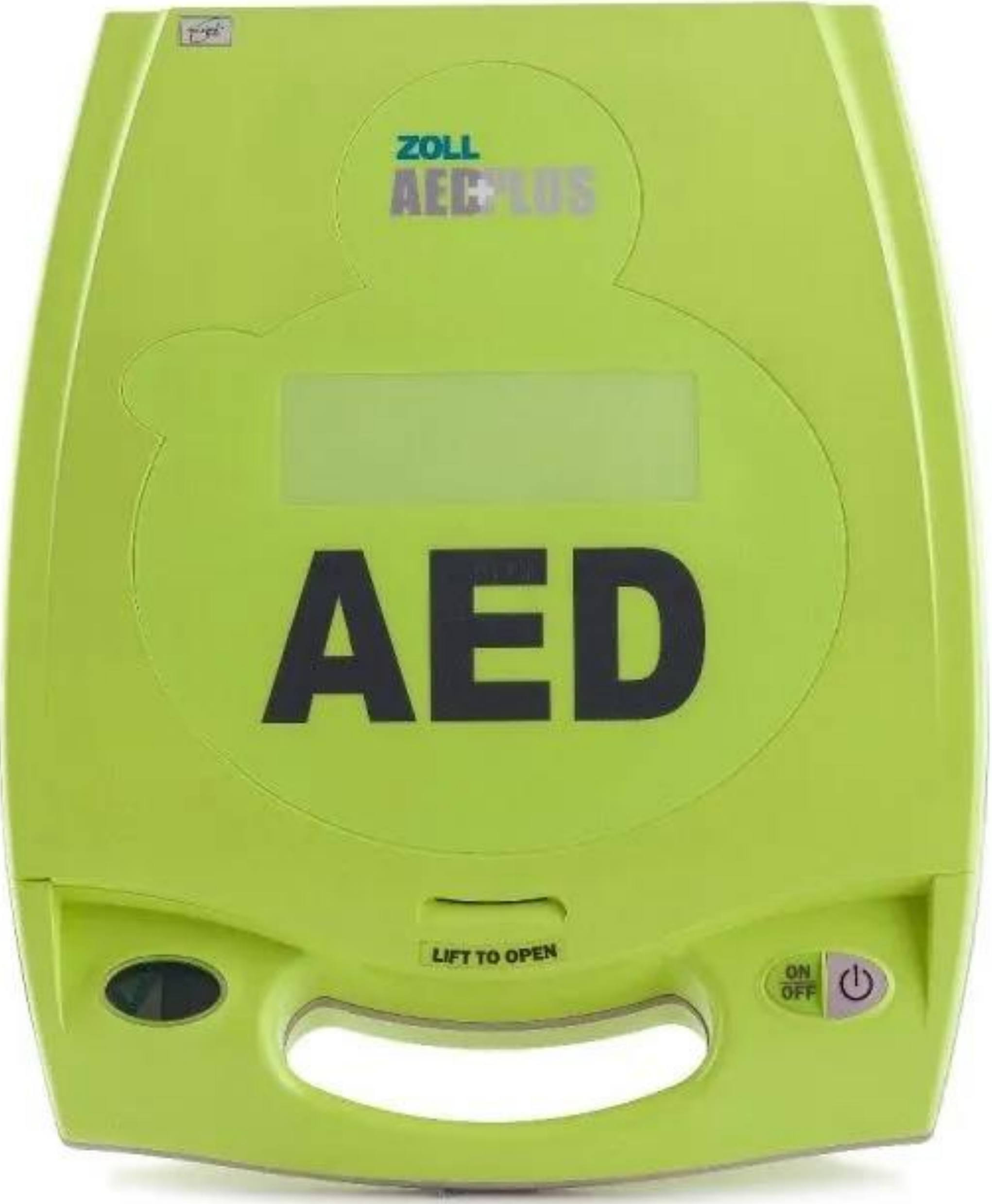
Fig. 1. Showing the cascade of ventricular arrhythmogenesis in ischemic myocardium in relation to the risk factors, triggers and substrate. Abbreviations: VPC, Ventricular premature contraction; VT, Ventricular tachycardia.

Luqman N, Sung RJ, Wang CL, Kuo CT. Myocardial ischemia and ventricular fibrillation: pathophysiology and clinical implications. Int J Cardiol. 2007;119(3):283-290. doi:10.1016/j.ijcard.2006.09.016



Garcia TB, Garcia DJ. Arrhythmia Recognition: The Art of Interpretation: The Art of Interpretation. Jones & Bartlett Learning; 2019.


defibtech
Lifeline AED
ON
OFF
check pads
do not touch patient
analyzing
SHOCK


ZOLL
AED PLUS
AED
LIFT TO OPEN
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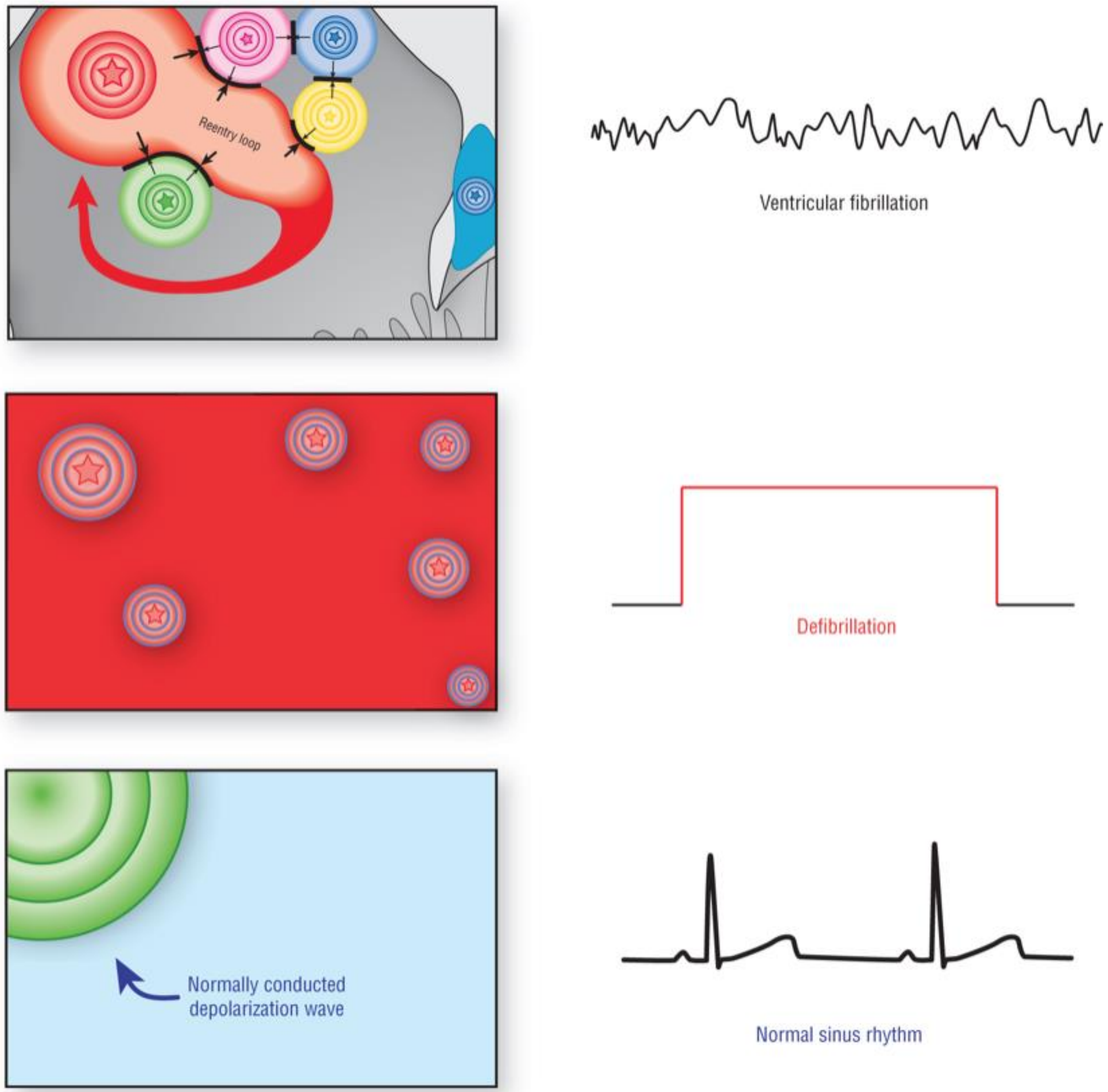
Defibrillazione



Garcia TB, Garcia DJ. Arrhythmia Recognition: The Art of Interpretation: The Art of Interpretation. Jones & Bartlett Learning; 2019.

Defibrillazione

3.2.2. Transthoracic impedance

It refers to the dissipation of energy in the lungs, thoracic cage and the other anatomic structures of the chest. In an animal study, only 4% of the energy supplied reached the heart [43]. The average adult human TTI is ≈70-80 Ω and is determined by multiple factors including energy level, electrode size, interelectrode distance, interface skin-electrode, electrode pressure, phase of ventilation, myocardial tissue and blood conductive properties [44].

When TTI is too high, a low-energy shock will not generate sufficient current to achieve defibrillation [44, 45]. To reduce TTI, the defibrillator operator should use conductive materials. This is accomplished with the use of gel pads or electrode paste [46] with paddles or through the use of self-adhesive pads.

Delgado H, Toquero J, Mitroi C, Castro V, Lozano IF. Principles of External Defibrillators. IntechOpen; 2013. doi:10.5772/52512

Table 2
Electric shocks to healthcare professionals during resuscitation due to equipment failure.

Reference	Circumstances	Consequences, outcome
Gibbs et al.[9]	Shock to operator during defibrillation due to crack in defibrillation paddles	Victim was administered lidocaine for frequent premature ventricular beats, had muscle cramps in arm and chest for several weeks
	Shock due to spontaneous discharge of the device	"Mild shock"
	Shock from touching the charge button	"Mild shock"

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

Table 3

Electric shocks to healthcare professionals during training or device testing. *Abbreviations*: EMT, emergency medical technician; N/R, not reported.

Reference	Circumstances	Consequences, outcome
Gibbs et al.[9]	Accidental discharge to paramedic during testing	Second degree burn to thigh
	Accidental discharge to trainer during demonstration	"Shock to arms"
	Accidental discharge to technician during testing	"Shock to hand and knee"
Trimble[73]	Discharge to EMT during exploration of a new device, paddle position and energy settings N/R	Found "cyanotic and apneic" a few minutes later, had "various ventricular dysrhythmias, including ventricular fibrillation"

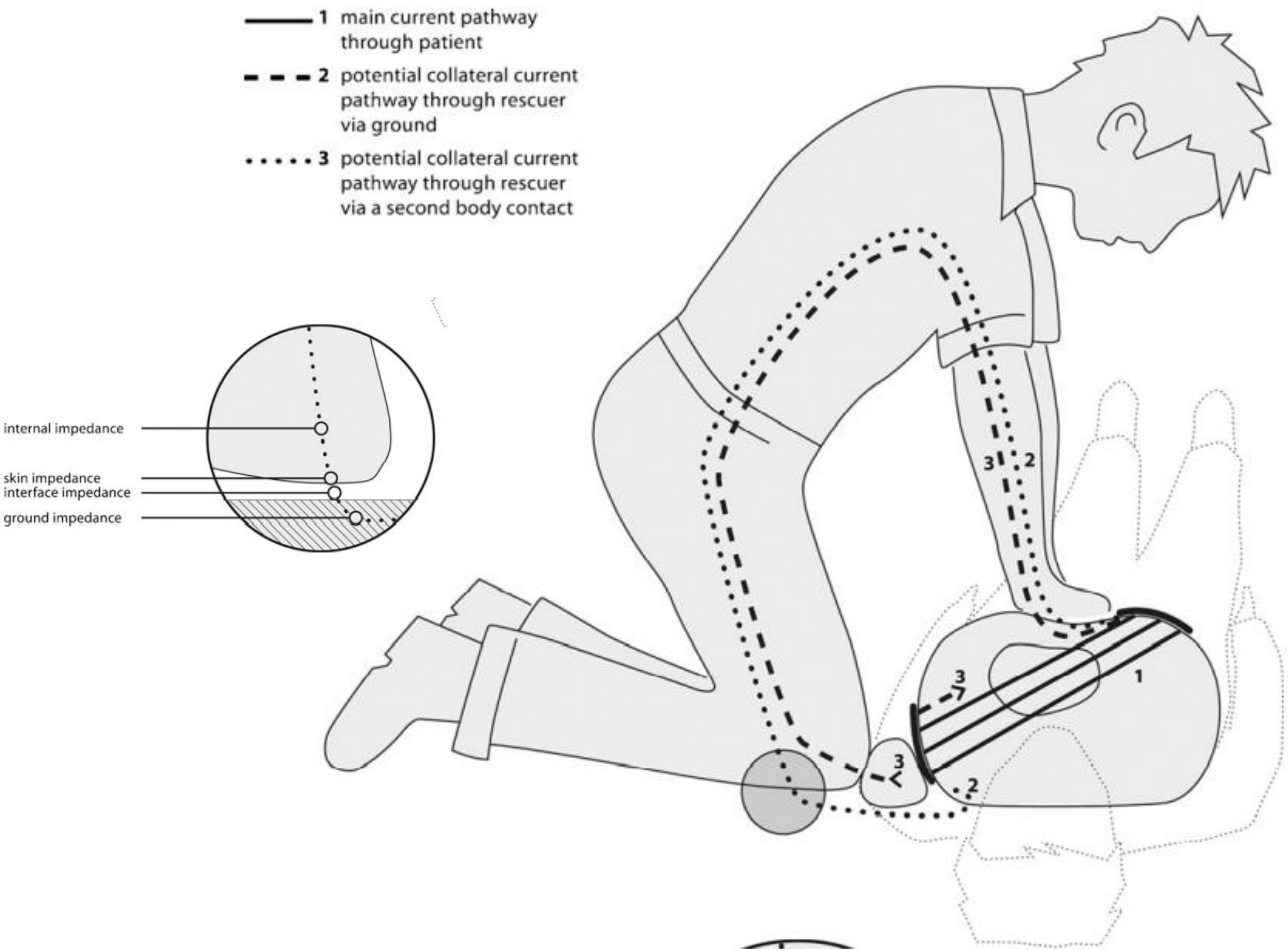
Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

Table 4

Electric shocks to healthcare professionals during resuscitation due to human error. *Abbreviations*: J, joules; EMT, emergency medical technician; N/R, not reported.

Reference	Circumstances	Consequences, outcome
Gibbs et al.[9]	Shock to paramedic in contact with side rail of stretcher during defibrillation	"Tingling in right arm for 30 min"
	Shock to defibrillating paramedic, hand in contact with conduction gel during defibrillation	"Mild soreness to right arm"
	Shock to paramedic checking the femoral pulse of the patient during defibrillation	"Knocked paramedic away from patient"
	Shock to paramedic, leg in contact with the patient during defibrillation	"Mild shock to leg"
	Shock to EMT holding a bag-valve mask during defibrillation	"Mild shock to finger tips"
	Shock to EMT, thumb in contact with chest of patient during defibrillation	"Shock to hand, lethargy for several minutes"
	Shock to EMT, leg in contact with stretcher during defibrillation	"Shock to leg"
	Shock to paramedic during defibrillation	N/R
	Shock to nurse during defibrillation	"Tingling sensation"
	Shock to paramedic during defibrillation	Arm discomfort
	Arching between electrode paddles and patient chest during defibrillation	"Ringing in ears"
	Arching between electrode paddles and patient chest during defibrillation	"Burn to hand"
	Shock to three EMTs due to accidental discharge during charging	"Mild shock"
	Shock to nurse due to accidental discharge during assessment of ECG	"Mild shock"
Dickinson et al.[74]	200 J through self-adhesive pads, shock to rescuer performing chest compressions due to inadvertence of device operator (no gloves worn – personal communication, Dr Jasmeet Soar, May 2008)	Electric charge felt in arms, no immediate or long-term dysfunction

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002



Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

Biomedical consequences of currents through rescuers/bystanders

Twenty-nine cases of electric shock to individuals other than a patient were found in the medical literature. Tingling sensations and minor burns are the medical consequences typically reported. Some of the victims have been admitted to hospital for observation. Obviously, a full capacity discharge to a healthy person can be fatal, and direct discharges to the head may cause severe neurological disturbance. No case report, however, could be identified where medical personnel or bystanders sustained a life-threatening condition or long-term disability of any kind from an accidental electric shock during a medical procedure. In principle, high-voltage discharges are capable of causing arrhythmias, vascular spasm, and vagus nerve stimulation resulting in bradycardia and syncope.[35] Except for premature heart beats such complications have not been described so far in accidental shocks during resuscitation. Thus, their significance remains indeterminate. In the study by Lloyd et al. experimental rescuers neither sensed any of the shocks nor did they encounter any medical problems.[26]

The complication certainly most feared in this regard is induction of cardiac arrhythmia and ventricular fibrillation (VF), respectively, in the rescuer himself.

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

Is induction of ventricular fibrillation possible?

Fundamentally, VF can be induced by an electric stimulus in phases of myocardial non-uniform refractoriness.[36] This phase has been called vulnerable period and extends from about 60 to 90% of the QT-phase on the surface ECG in the normal heart.[37] The excitation susceptibility has a bell-shaped distribution though,[38,39] and VF has also been described as a result of appropriately R-wave triggered external cardioversion shocks and inadvertent external defibrillation of normal sinus rhythm.[40,41] Stimuli that are just not strong enough to cause VF typically provoke other ventricular arrhythmias.[42] Vulnerability of the heart is increased after premature ventricular beats, during hypothermia, ischaemia, acidosis, adrenergic stimulation, or rapid pacing and ventricular tachycardia, respectively.[43–51] Biphasic impulses are generally less effective at inducing VF than monophasic shocks.[52] For external shocks, the least shock energy is required if the negative electrode is placed over the apex of the heart.[53–55] Experiments to define VF threshold for external currents have mainly been performed with household power, i.e. 50–60 Hz sinusoidal AC, in animals. It was demonstrated that fibrillation threshold increases with body weight and is less for currents applied in ECG leads II and III as compared to lead I orientation.[56] The more 60 Hz AC cycles applied the higher the likelihood of VF occurrence, and up to about 120 cycles the fibrillation threshold decreases with the number of cycles applied.[57] Extrapolating from animal experiments, for 50/60 Hz AC of four to 20 ms duration, representing one complete AC cycle or less, travelling from hand to feet, fibrillation threshold has been set to 500 mA root mean square (RMS) current by the International Electrotechnical Commission (IEC) and to 300 mA by Underwriters Laboratory.[25] In a very cautious scenario with a total body impedance of 500 Ω (see above) this requires RMS voltages of 250 V and 150 V, respectively, directly applied to the bare skin, i.e. with path resistances outside the victim's body not taken into account. Caution is generally advisable; experience with neuromuscular incapacitating devices (stun guns) has shown that extrapolation from animal experiments or theoretical models can be misleading. While theory suggested that stun guns should be incapable of stimulating the human heart,[58,59] practice and sound consecutive experiments have disproved this paradigm.[60,61]

Experiments in humans to determine fibrillation current for short-duration external shocks have never been undertaken. Damped sinusoidal shocks at 10 J applied through adhesive defibrillation pads at the peak of the T wave have been shown to induce VF in patients prior to implantation of implantable cardioverter-defibrillators.[62] The corresponding current or voltage was not reported. Some insight can be derived from external cardiac pacing studies. Monophasic rectangular or truncated exponential pulses, at pulse widths of 20 ms, applied transcutaneously via large adhesive electrodes in an ideal left-thoracic anterior–posterior position capture the ventricles at a mean current of around 75 mA.[53,63–65] In healthy volunteers capture thresholds as low as 40 mA have been reported.[64] The current that precipitates ventricular tachycardia or VF is at least five times greater.[66,67] This 'safety factor' for external pacing has been confirmed in numerous animal studies for pulse durations from 0.5 to 50 ms.[38,55] In conclusion, again in a worst-case scenario with a defibrillator shock directly applied over the apex of a rescuers heart through contact impedance minimizing electrodes at the vulnerable period, currents up to 200 mA should be regarded safe.

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

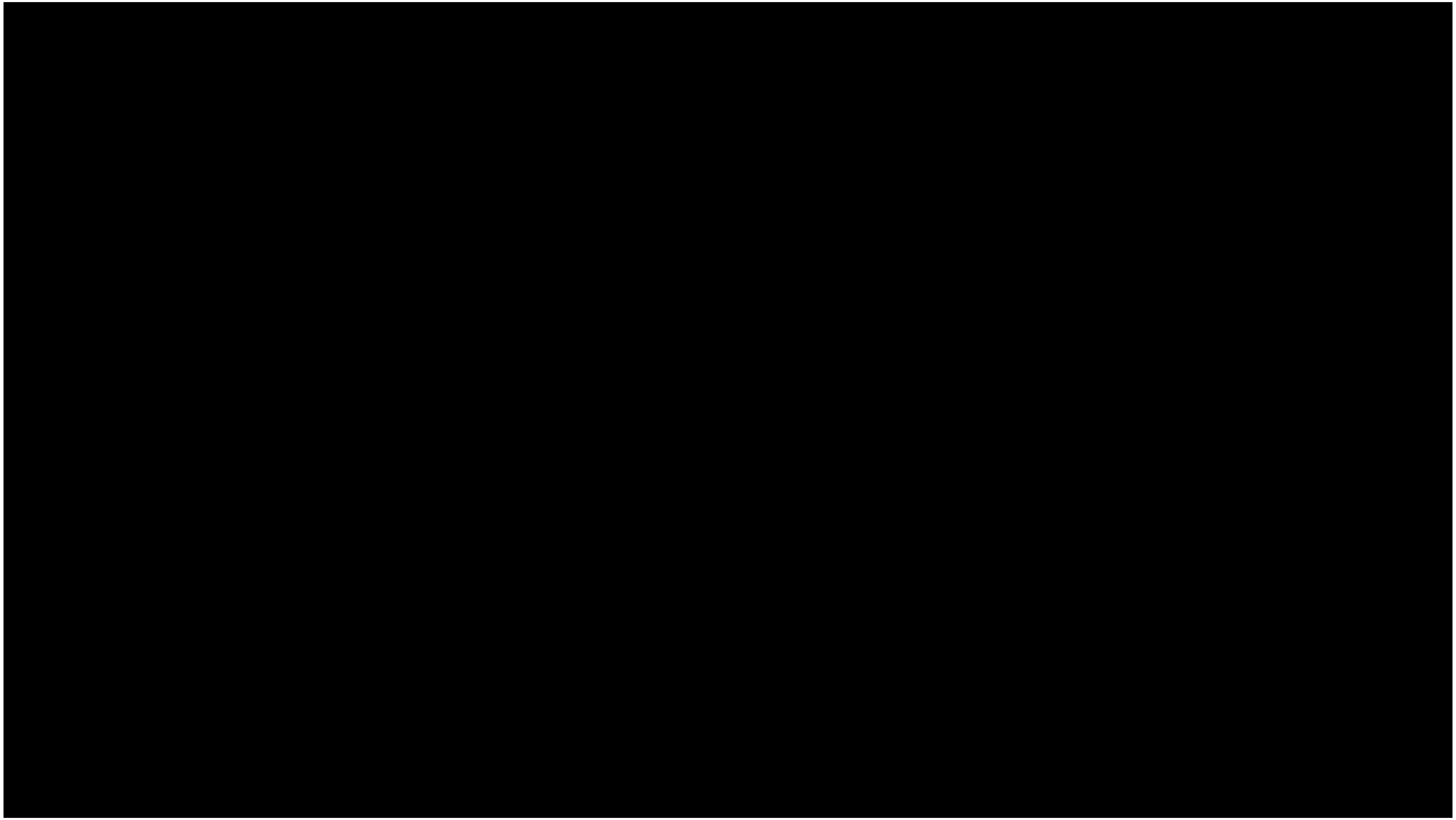
Conclusions

Evident in the medical literature, to the best of our knowledge, no rescuer or bystander has ever been seriously harmed by receiving an inadvertent shock while in direct or indirect contact with a patient during defibrillation. New evidence suggests that it might even be electrically safe for the rescuer to continue chest compressions during defibrillation if self-adhesive defibrillation electrodes are used and examination gloves are worn. According to recent data a continuous compression strategy might even improve outcome after resuscitation from cardiac arrest. Before defibrillation safety recommendations are changed, however, more definite data are needed to make absolutely sure that there is no risk. Such studies must address various scenarios including hand-held defibrillation electrodes, no gloves situations, wet and metal surfaces, light-weight rescuers, persons holding infusions, maximum defibrillation energy, and resuscitation scenarios within confined space.[20] Interpretation of the data must take into account the significant knowledge gap as regards fibrillation thresholds for humans with defibrillator discharge impulses.

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation. 2009;80(4):395-401. doi:10.1016/j.resuscitation.2009.01.002

Sicurezza ambientale

Abdominal thrust



Abdominal thrust e gravidanza

Contraindications

Go to:

Although there are no absolute contraindications, the abdominal thrust maneuver is not recommended by the AHA for infants or unconscious patients. Also, pregnant subjects should receive management with sternal compressions, as opposed to abdominal.[13]

Ojeda Rodriguez JA, Ladd M, Brandis D. Abdominal Thrust Maneuver. In: StatPearls. StatPearls Publishing; 2022. Accessed January 20, 2022. http://www.ncbi.nlm.nih.gov/books/NBK531467/

To clear the airway of a pregnant woman or obese person:

- **Position your hands a little bit higher** than with a normal Heimlich maneuver, at the base of the breastbone, just above the joining of the lowest ribs.
- **Proceed as with the Heimlich maneuver,** pressing hard into the chest, with a quick thrust.
- **Repeat** until the food or other blockage is dislodged. If the person becomes unconscious, follow the next steps.

https://www.mayoclinic.org/first-aid/first-aid-choking/basics/art-20056637#:~:text=To%20clear%20the%20airway%20of%20a%20pregnant%20woman,hard%20into%20the%20chest%2C%20with%20a%20quick%20thrust.

Abdominal thrusts

Don't give abdominal thrusts to babies under 1 year old or pregnant women.

To carry out an abdominal thrust:

- Stand behind the person who's choking.
- Place your arms around their waist and bend them forward.
- Clench 1 fist and place it right above their belly button.
- Put the other hand on top of your fist and pull sharply inwards and upwards.
- Repeat this movement up to 5 times.

If the person's airway is still blocked after trying back blows and abdominal thrusts, get help immediately:

https://www.nhs.uk/common-health-questions/accidents-first-aid-and-treatments/what-should-i-do-if-someone-is-choking/

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expectorated or until help arrives. If the patient is supine, then a similar upward and inward thrust may be attempted while facing the patient. In a pregnant or obese patients, the fist may be placed slightly higher in the abdomen, just below the xiphoid bone.

Abdominal thrust e gravidanza

Complications

Go to:

Ever since the introduction of the Heimlich maneuver, cases of harm inflicted by the forceful displacement of the diaphragm and sudden increase in intrathoracic pressure have driven numerous studies and reviews. Although this maneuver is considered life-saving and generally safe to perform, serious intra-abdominal harm can ensue from incorrect technique and unusually vigorous application.[20] One manikin study mentioned above also concluded that the risk of serious harm ensues if the foreign body is not relieved after the first set of thrusts.[18] The most commonly reported complications are rib fractures and gastric or esophageal perforations. Although other rare traumatic injuries such as splenic rupture, pneumomediastinum, aortic valve cusp rupture, aortic dissection, diaphragmatic herniation, esophageal and jejunal perforation, hepatic rupture, cholesterol embolization leading to arterial occlusion, and mesenteric laceration have been described.[21][22][23][24][25][26][27][28]

Ojeda Rodriguez JA, Ladd M, Brandis D. Abdominal Thrust Maneuver. In: StatPearls. StatPearls Publishing; 2022. Accessed January 20, 2022. http://www.ncbi.nlm.nih.gov/books/NBK531467/

Dislocazione dell’utero gravido >20w

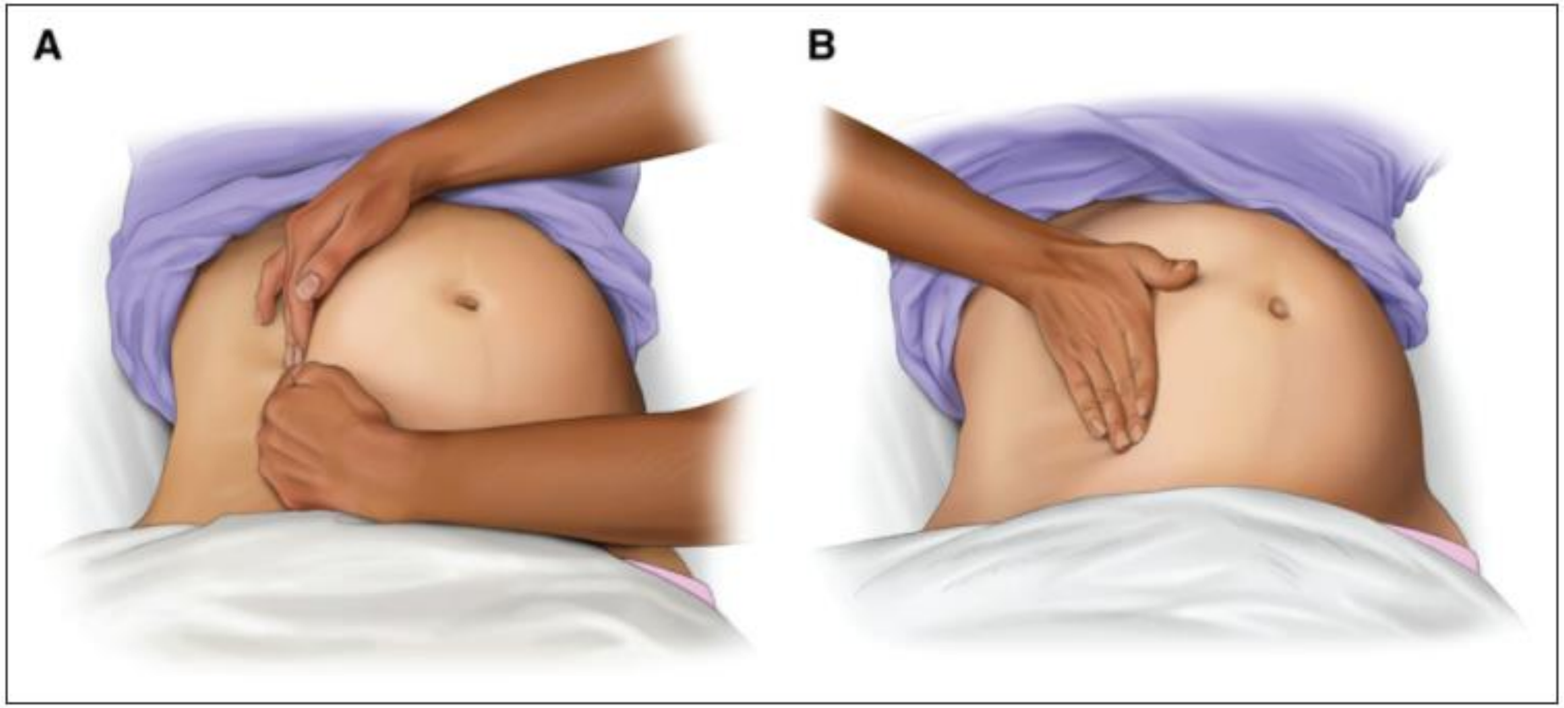


Figure 16. A, Manual left lateral uterine displacement, performed with 2-handed technique. B, 1-handed technique during resuscitation.

Panchal AR, Bartos JA, Cabañas JG, et al. Part 3: adult basic and advanced life support: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020;142. doi:10.1161/CIR.0000000000000916

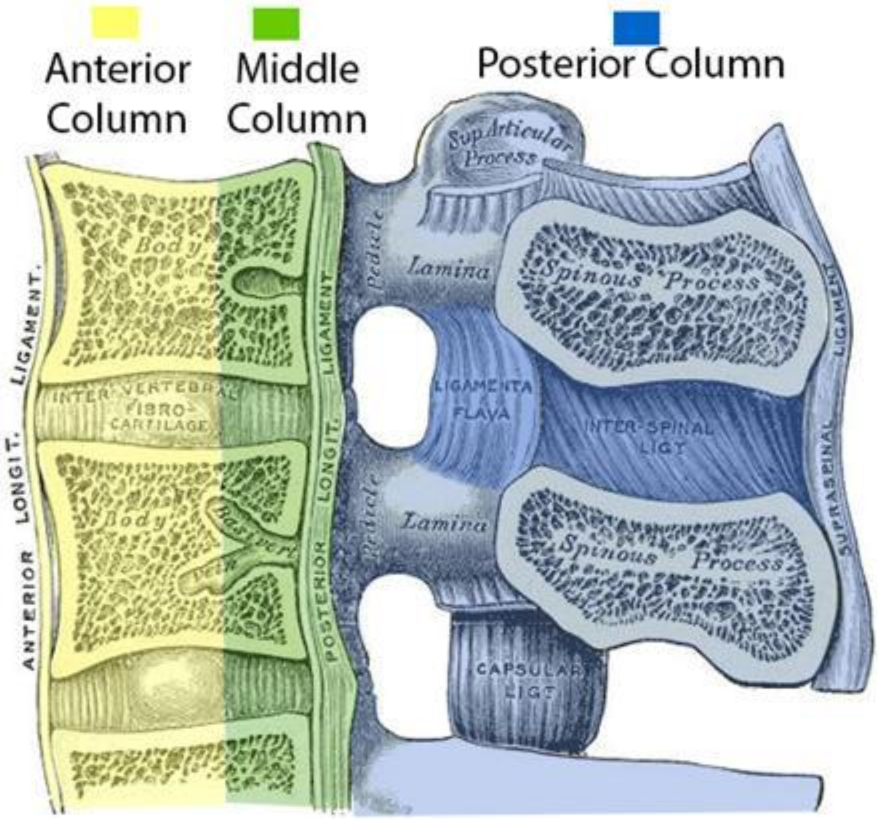
Recovery position e trauma spinale

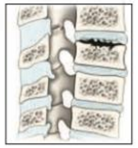
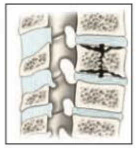
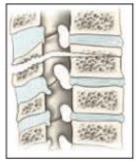
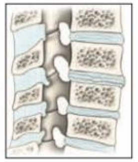
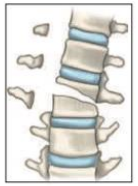
Concise guideline for clinical practice

Recovery position

For adults and children with a decreased level of responsiveness due to medical illness or non-physical trauma, who do NOT meet the criteria for the initiation of rescue breathing or chest compressions (CPR), the ERC recommends they be placed into a lateral, side-lying, recovery position (see Fig. 2). Overall, there is little evidence to suggest an optimal recovery position, but the ERC recommends the following sequence of actions:

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013



Fracture type (AO/OTA)		Stability	Risk of SCI	Management
A-type: Axial compression				
	A1: Impaction/ compression	Stable		Nonoperative
	A2: Split	Stable		Nonoperative
	A3: Burst	Stable/unstable*		Nonoperative/operative*
B-type: Flexion/distraction or hyperextension				
	B1: Flexion/ distraction	Unstable		Operative
	B2: Chance fracture	Unstable		Operative
	B3: Hyperextension	Unstable		Operative
C-type: A or B type with rotation				
	C1: Rotational wedge	Unstable		Operative
	C2: Rotational flexion/ extension	Unstable		Operative
	C3: Rotational shear (Holdsworth slice fracture)	Unstable		Operative

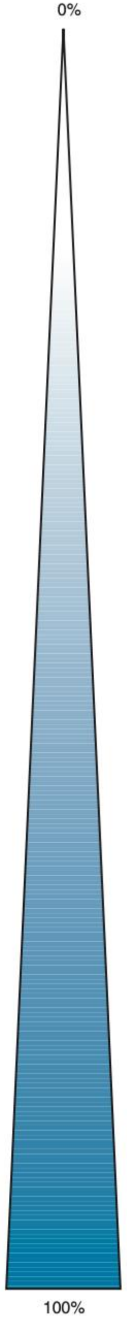


FIGURE 26-3 Spinal fractures, traumatic dislocations, and fracture–dislocations are best classified by the comprehensive AO Foundation/ Orthopaedic Trauma Association (AO/OTA) classification system, which is based on the alphanumeric classification published by Magerl et al[13] in 1994.

Feliciano DV, Mattox KL, Moore EE. Trauma, Ninth Edition. McGraw-Hill Education; 2020.
https://upload.orthobullets.com/topic/2022/images/denis.jpg

Table 11-2: Clues to Spinal-Cord Injury Revealed During Patient Assessment

Mechanism of Injury
Blunt trauma above the clavicle
Diving accident
Motor-vehicle or bicycle crash
Fall
Stabbing or impalement anywhere near the spinal column
Shooting or blast injury to the torso
Any violent injury with forces that could act on the spinal column or cord
Patient Complaints
Neck or back pain
Numbness or tingling
Loss of movement or weakness
Signs Revealed During Assessment
Pain on movement of back or spinal column
Obvious deformity of back or spinal column
Guarding against movement of back
Loss of sensation
Weak or flaccid muscles
Loss of bladder or bowel control
Erection of the penis (priapism)
Neurogenic shock

ITLS, Alson RL. International Trauma Life Support for Emergency Care Providers. Pearson Education; 2015.

Abstract

The lateral recovery position is widely used for the positioning of unconscious patients. Ideally, in the setting of trauma it is avoided because of concerns about spinal cord injury. However, unconscious individuals with unsuspected trauma or trauma victims attended by partially trained first-aiders may be placed in the recovery position, potentially endangering the cord. Excessive movement of the spine in the recovery position may increase the risk of spinal cord injury in these situations. A new recovery position, termed the modified HAINES position, is described and the position of the spine in this position is compared with the lateral recovery position. *Hypothesis:* That the modified HAINES position results in less distortion of the position of the spine than the lateral recovery position. *Methods:* Thirty-eight healthy volunteers were imaged in the two different positions. Measurements of rotation, flexion and lateral flexion of the cervical and thoraco-lumbar spine were made. Two tailed paired t-tests were employed to compare measurements of the two positions and a McNemar test was used to compare the subjects' subjective experiences. *Results:* The modified HAINES position resulted in 13.0° (99% CI: 7.5–18.5) less lateral flexion and 12.6° (99% CI: 9.4–15.9) less extension of the cervical spine while the position of the thoraco-lumbar spine was similar in both positions. Nineteen of 28 subjects found the modified HAINES position more comfortable (not significant). *Conclusion:* The modified HAINES position results in a more neutral position of the spine making it preferable to the lateral recovery position in the management of patients when trauma may have occurred. Further research is required to ensure that the recovery positions in use today are the best possible.

Keywords: Adult; Basic life support; Spinal cord; Resuscitation; Safety

Blake WED, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation. 2002;53(3):289-297. doi:10.1016/s0300-9572(02)00037-0

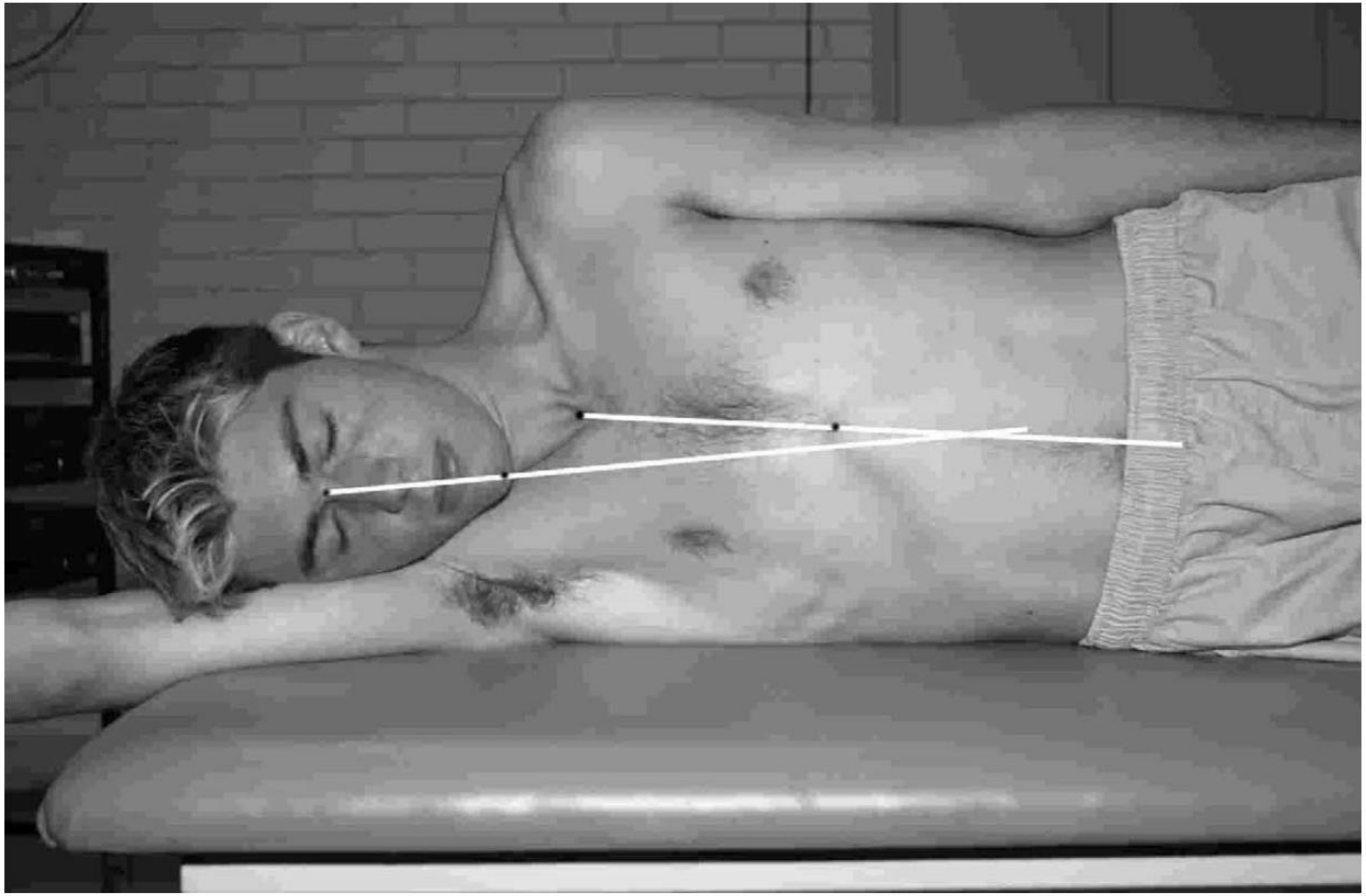


Fig. 3. Cervical lateral flexion was measured by comparing the midline of the face to the midline of the sternum. Here it is 6°.

Blake WED, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation. 2002;53(3):289-297. doi:10.1016/s0300-9572(02)00037-0

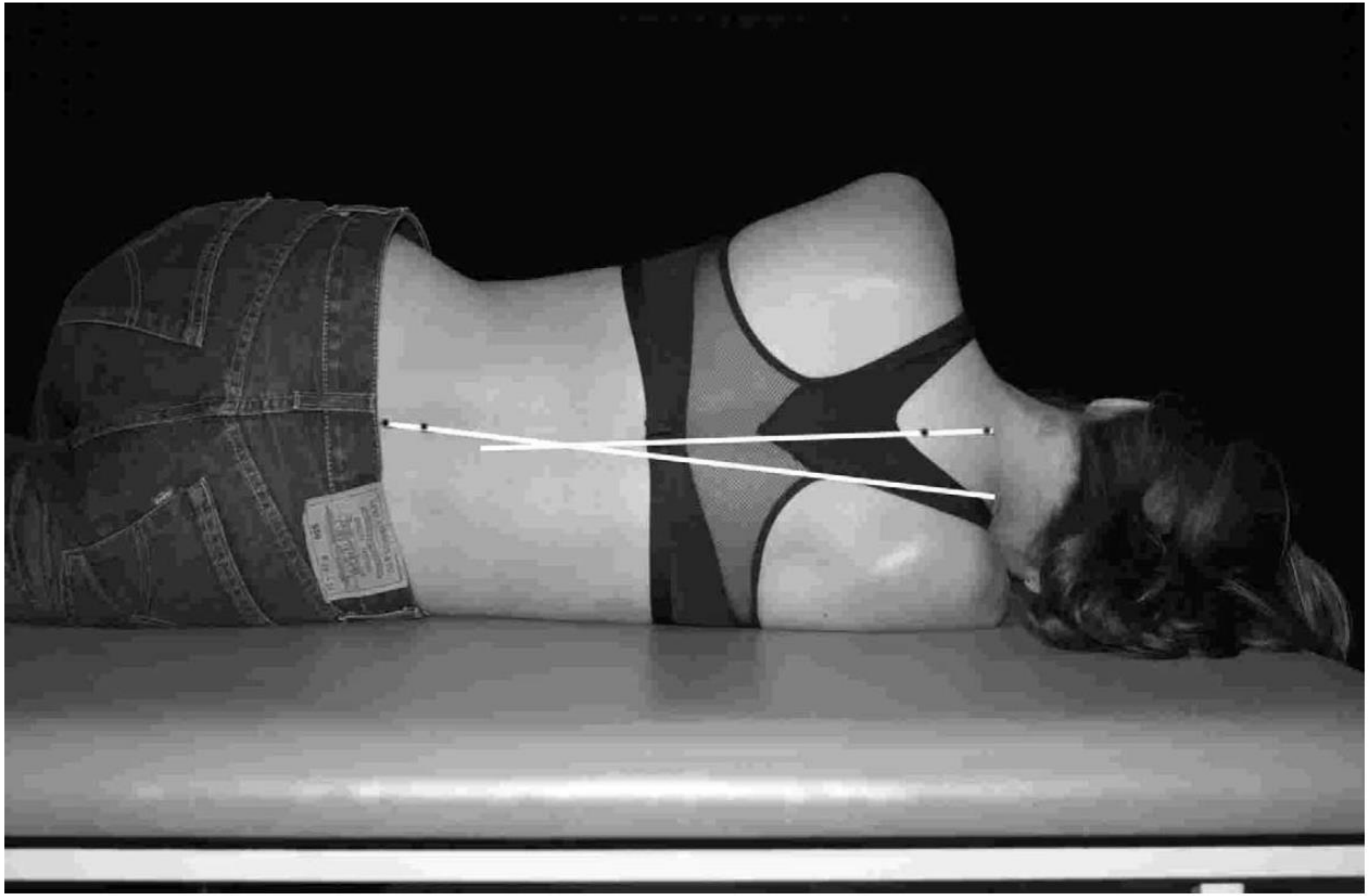


Fig. 4. Thoraco-lumbar lateral flexion was measured by marking the spinous processes of C7, T2, L2 and L4. Here it is 6°.

Blake WED, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation. 2002;53(3):289-297. doi:10.1016/s0300-9572(02)00037-0

Fig. 5. Flexion of the cervical and thoraco-lumbar spine was assessed from above. Here the angles are −25 and 22° respectively. See text for details.

Blake WED, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation. 2002;53(3):289-297. doi:10.1016/s0300-9572(02)00037-0

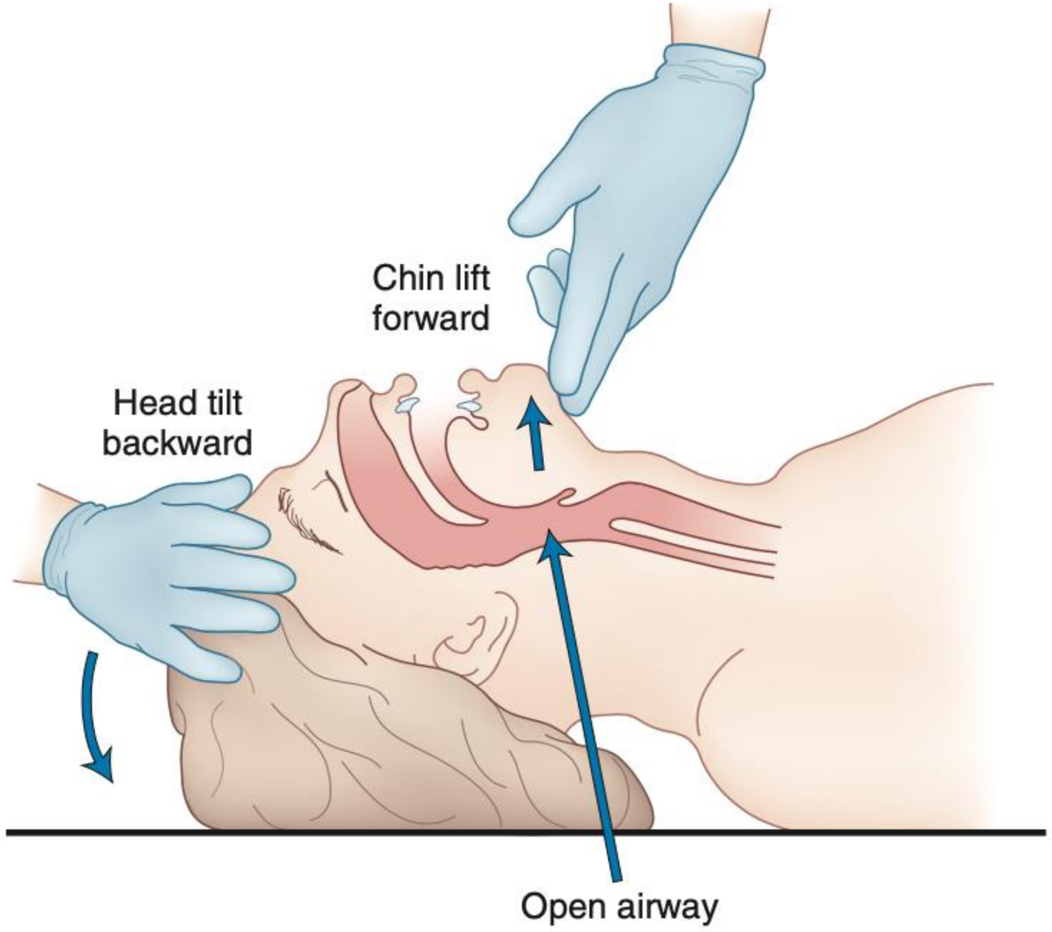
Table 2
Summary of data

	Lateral recovery position	Modified HAINES position	Difference	99% CI of difference	*P* value
Cervical region					
Flexion	−36.89	−23.91	12.98	7.47–18.49	≪ 0.001
Rotation	1.85	2.05	0.20	−4.28–4.68	0.91 NS
Lateral flexion	22.35	9.74	12.61	9.37–15.85	≪ 0.001
Thoraco-lumbar region					
Flexion	23.90	23.44	0.46	−2.17–3.09	0.64 NS
Rotation	−4.64	5.22	9.86	6.41–13.31	≪ 0.001
Lateral flexion	−7.01	−10.72	3.71	0.28–7.14	< 0.01

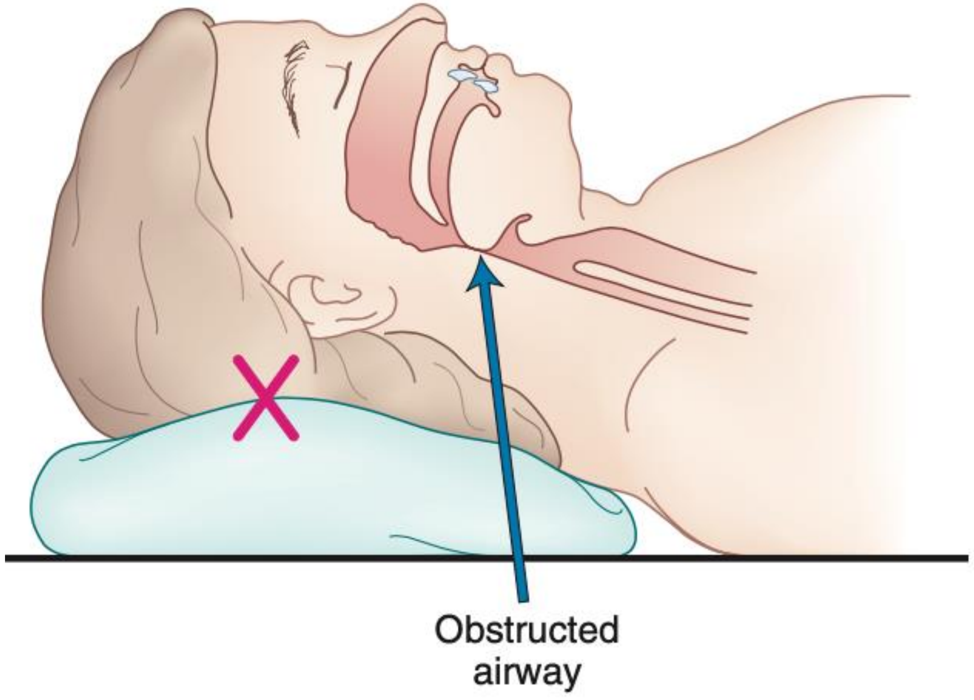
Expressed as mean of 38 observations, all angles in degrees, see text for sign convention.

Blake WED, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation. 2002;53(3):289-297. doi:10.1016/s0300-9572(02)00037-0

Gestione delle vie aeree



B Head tilt and chin lift to obtain extended position



Tongue in apposition to posterior pharyngeal wall

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

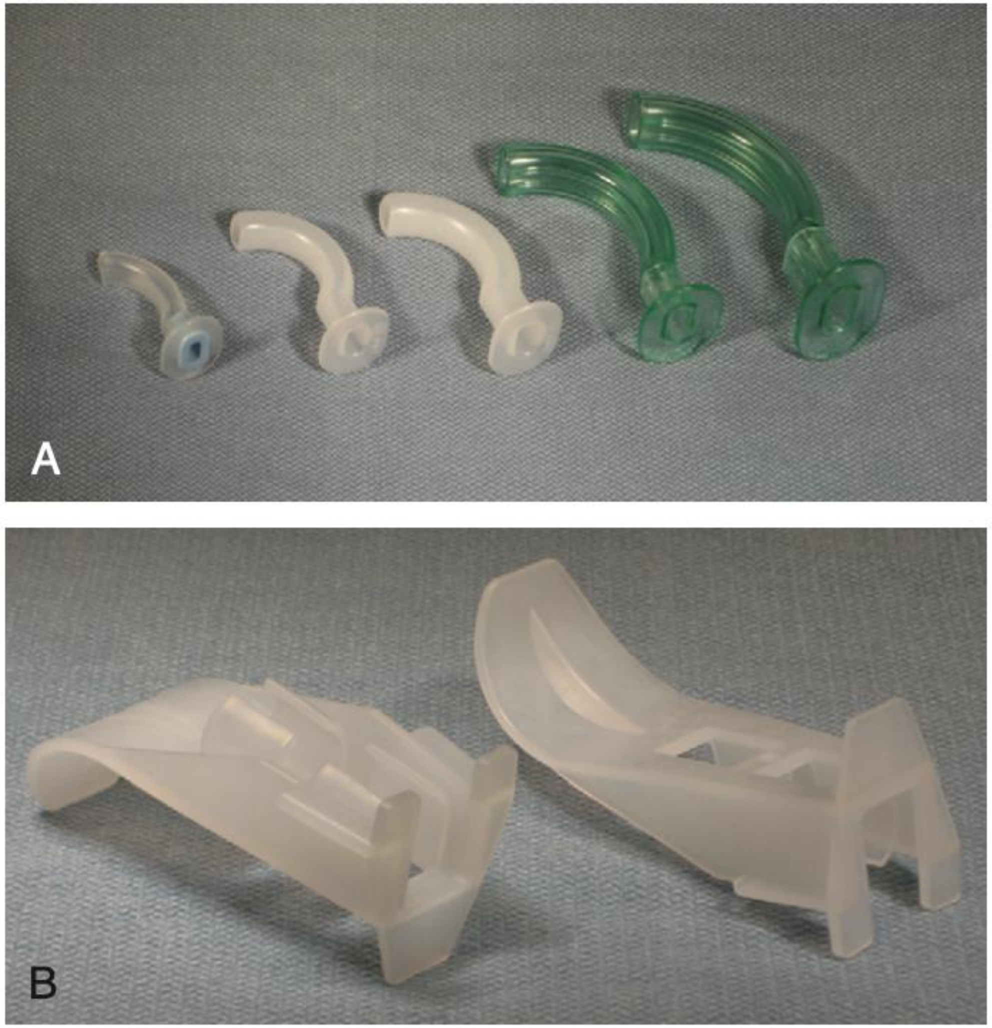
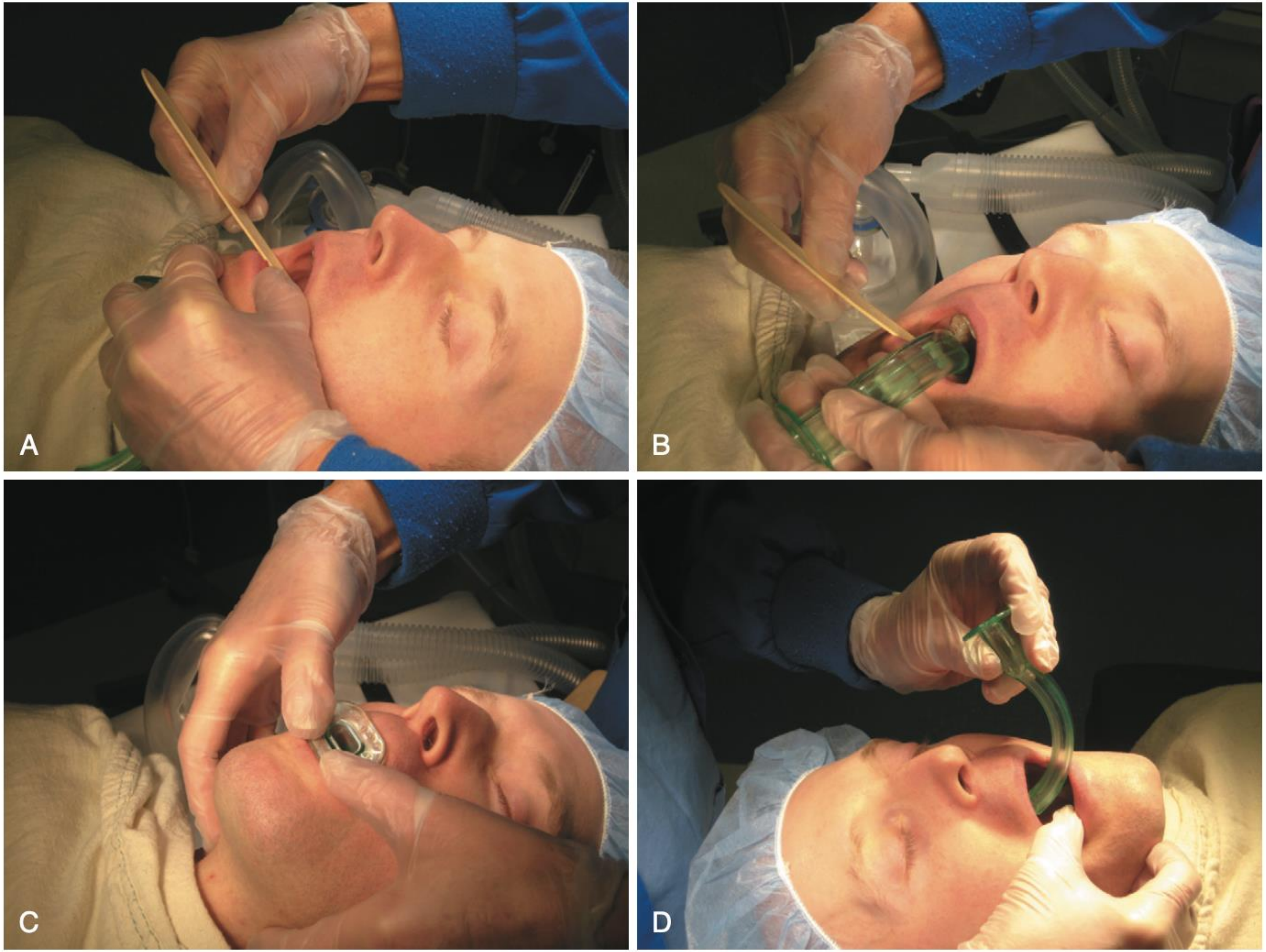


Figure 15-7 Oropharyngeal airways. **A,** Guedel Airways in sizes from neonatal to large adult. **B,** The Ovassapian Airway has a large anterior flange to control the tongue. The airway is open posteriorly (including no posterior flange) so that an endotracheal tube can be inserted with a flexible fiberoptic scope and the assembly later separated.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.



Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

Figure 15-9 Nasopharyngeal airways. A flange prevents the outside end from passing beyond the nares, controlling the depth of insertion. Alternatively, an endotracheal tube may be cut down to provide a longer airway, with its 15-mm adapter reinserted in the cut end.

Figure 15-10 Insertion of a nasopharyngeal airway. The airway is oriented with its concave side toward the hard palate and inserted straight posteriorly. Gripping the airway near the top allows the tube to bend if there is resistance to passage. If it is gripped too close to the naris, the clinician can generate sufficient force to shear off a turbinate.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

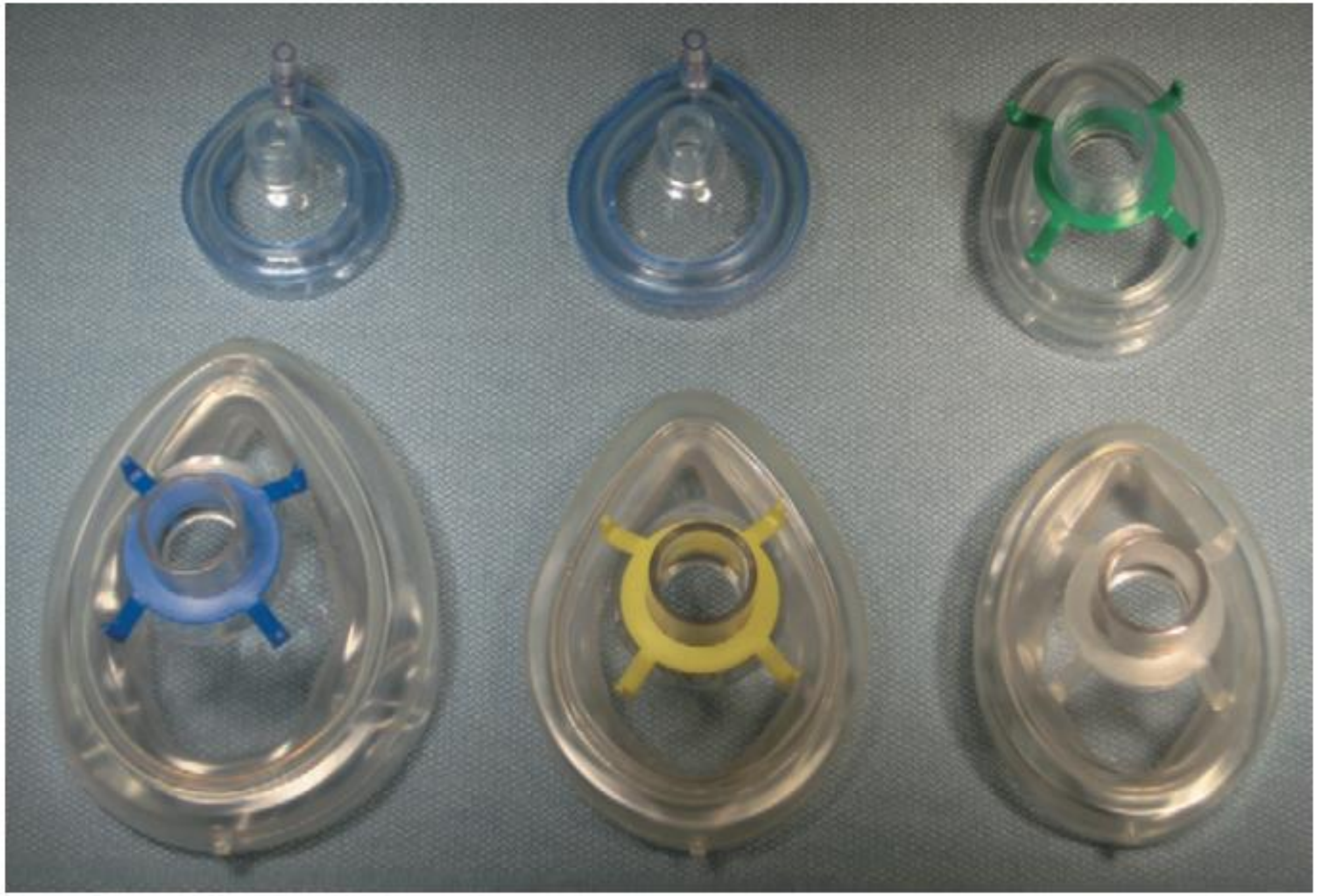


Figure 15-11 Assorted sizes of disposable, transparent face masks. The smallest masks have a 15-mm male adapter, and the larger sizes have a 22-mm female adapter to allow them to be connected to a standard breathing circuit or resuscitator bag.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

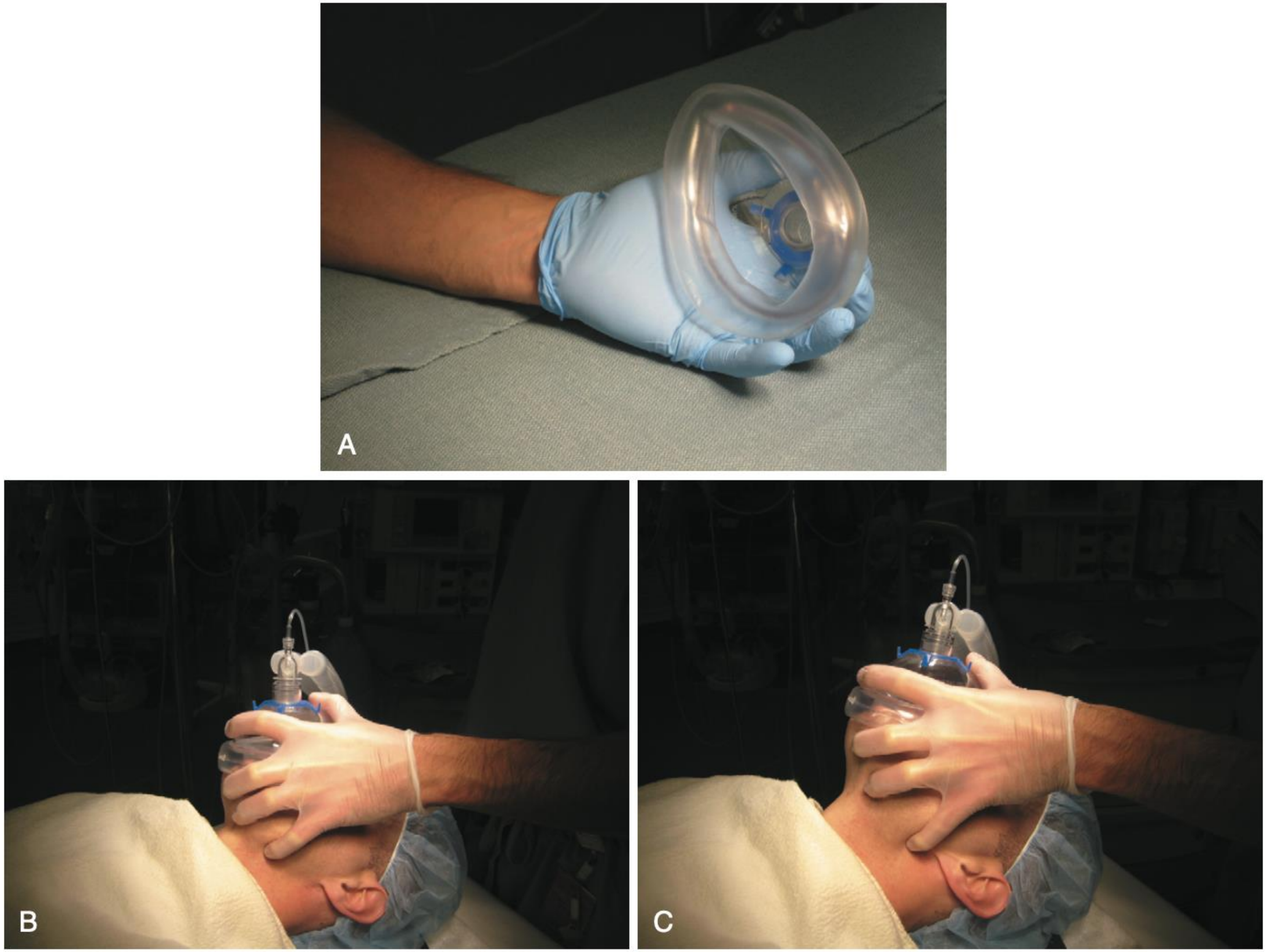


Figure 15-13 Suggested techniques for holding and supporting a face mask. **A,** In the proper hand grip of the face mask, the thumb and index finger encircle the collar while the hypothenar eminence extends below the left side of the mask. **B,** In the side view of the standard one-handed application of the face mask, the thumb and first finger (or first two) encircle the collar of the mask while the remaining fingers pull the mandible up into the mask while gently extending the head. **C,** During the one-handed mask grip with concurrent jaw thrust, notice how the little finger is located at the angle of the jaw, pulling backward and upward to maintain the jaw thrust (subluxation). Because of the increased span of the hand, only the first finger is on the mask while the middle and ring fingers pull the mandible up into the mask and extend the head.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

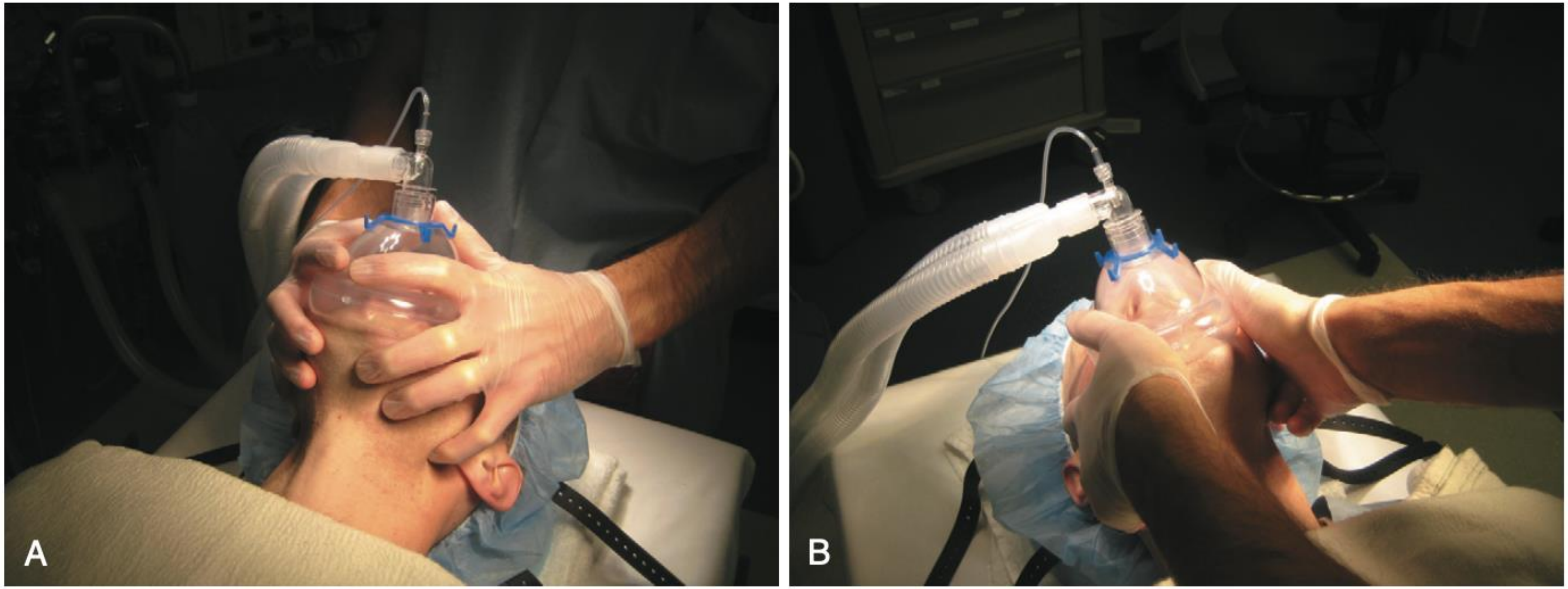


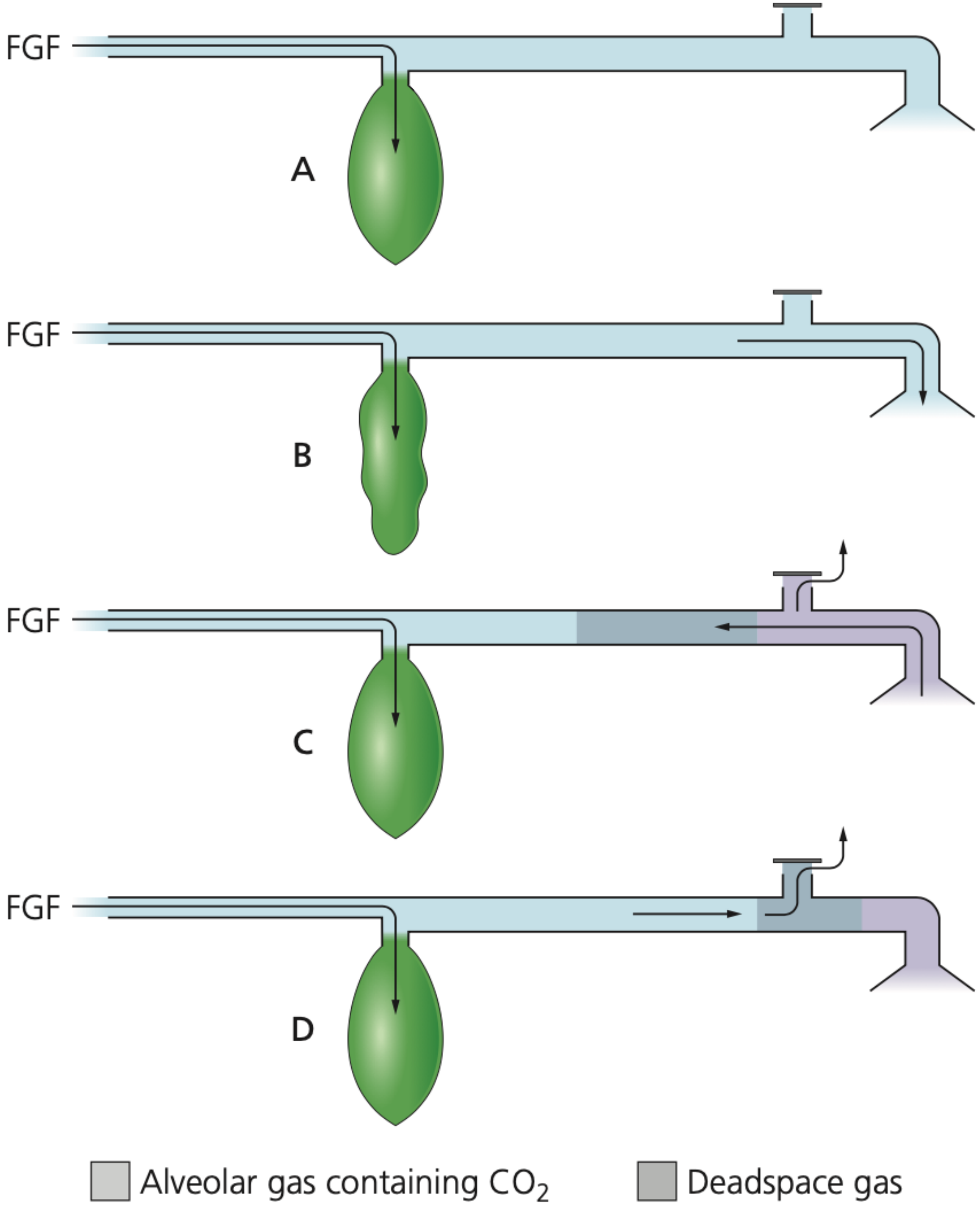
Figure 15-15 Two-hand control of a face mask. In both scenarios, a second provider must ventilate the patient. **A,** In the view of two-hand control of a face mask from above the patient, notice how the lower fingers on both hands apply a jaw thrust while the thumbs seal the mask to the face. **B,** In the view of two-hand control of a face mask from the side of the patient, the person ventilating the patient has improved access to the head as the airway is maintained from the patient's side. This arrangement is beneficial if the ventilating provider is preparing to perform laryngoscopy.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

Figure 15-14 Adult and pediatric sizes of air-mask-bag unit (AMBU). The AMBU is a portable, self-inflating, easy-to-use system for the delivery of positive-pressure ventilation. It can be used with a face mask, laryngeal mask airway, or endotracheal tube.

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

Fig. 4.8 Intersurgical adult Mapleson C system.



Al-Shaikh B, Stacey SG. Essentials of Equipment in Anaesthesia, Critical Care, and Peri-Operative Medicine E-Book. Elsevier Health Sciences; 2017.

BOX 16-1 Benefits of Endotracheal Intubation

1. A patent airway by oral, nasal or tracheal routes
2. Controlled ventilation with up to 100% oxygen
3. Ventilation with high airway pressure
4. Airway protection from aspiration
5. Removal of secretions
6. Lung isolation
7. Administration of medication including anesthetic gases

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

Head and neck position and the axes of the head and neck upper airway

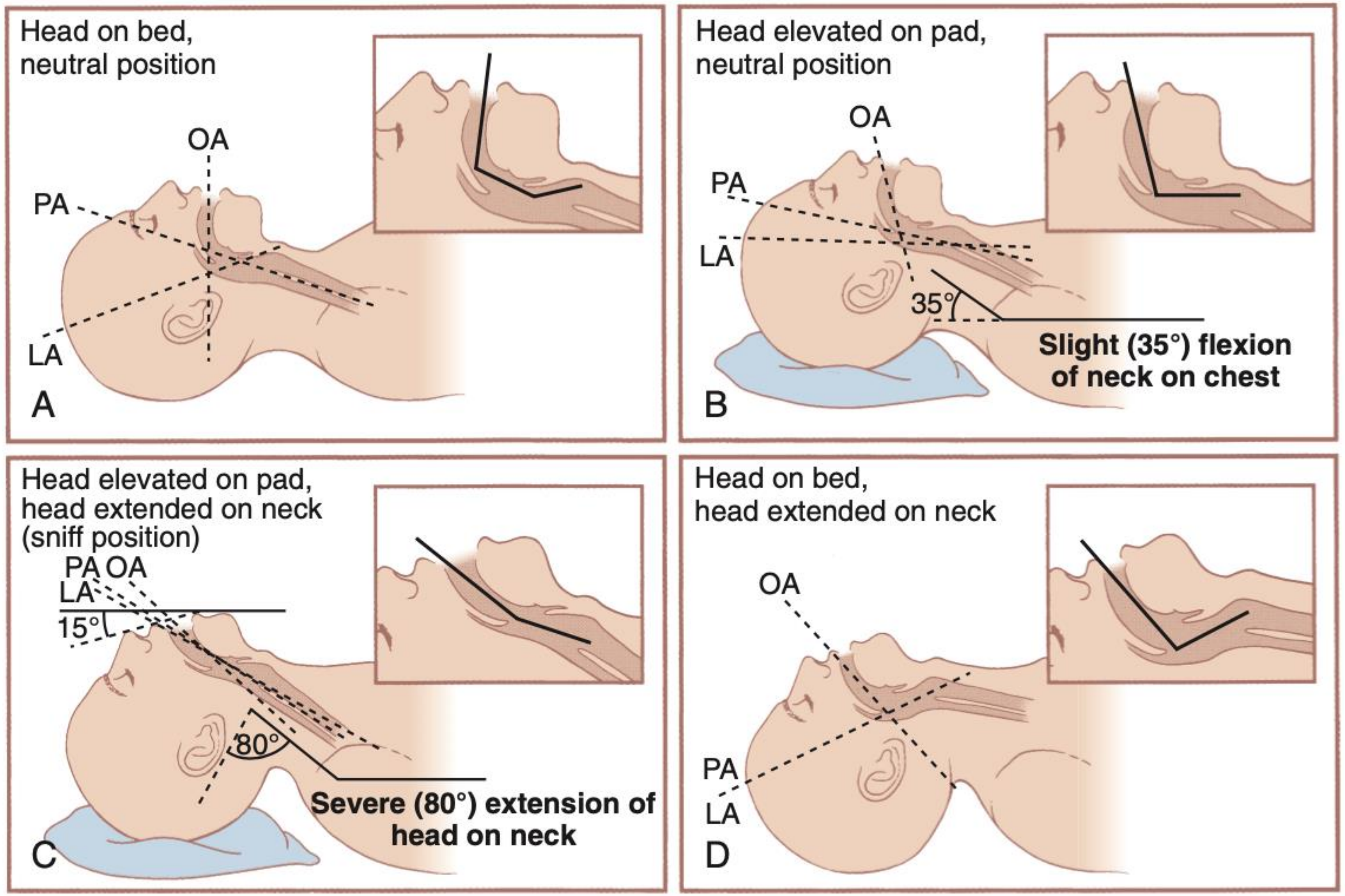


Figure 17-1 Schematic diagrams show the alignment of the oral axis *(OA)*, pharyngeal axis *(PA)*, and laryngeal axis *(LA)* in four different head positions. Each head position is accompanied by an *inset* that magnifies the upper airway (oral cavity, pharynx, and larynx) and superimposes *(bent bold line)* the continuity of these three axes within the upper airway. **A,** The head is in the neutral position with a marked degree of nonalignment of the LA, PA, and OA. **B,** The head is resting on a large pad that flexes the neck on the chest and aligns the LA with the PA. **C,** The head is resting on a pad (which flexes the neck on the chest). Concomitant extension of the head on the neck brings all three axes into alignment (sniffing position). **D,** Extension of the head on the neck without concomitant elevation of the head on a pad, which results in nonalignment of the PA and LA with the OA. (From Benumof JL, editor: *Airway management: principles and practice*, St. Louis, 1996, Mosby, p 263.)

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

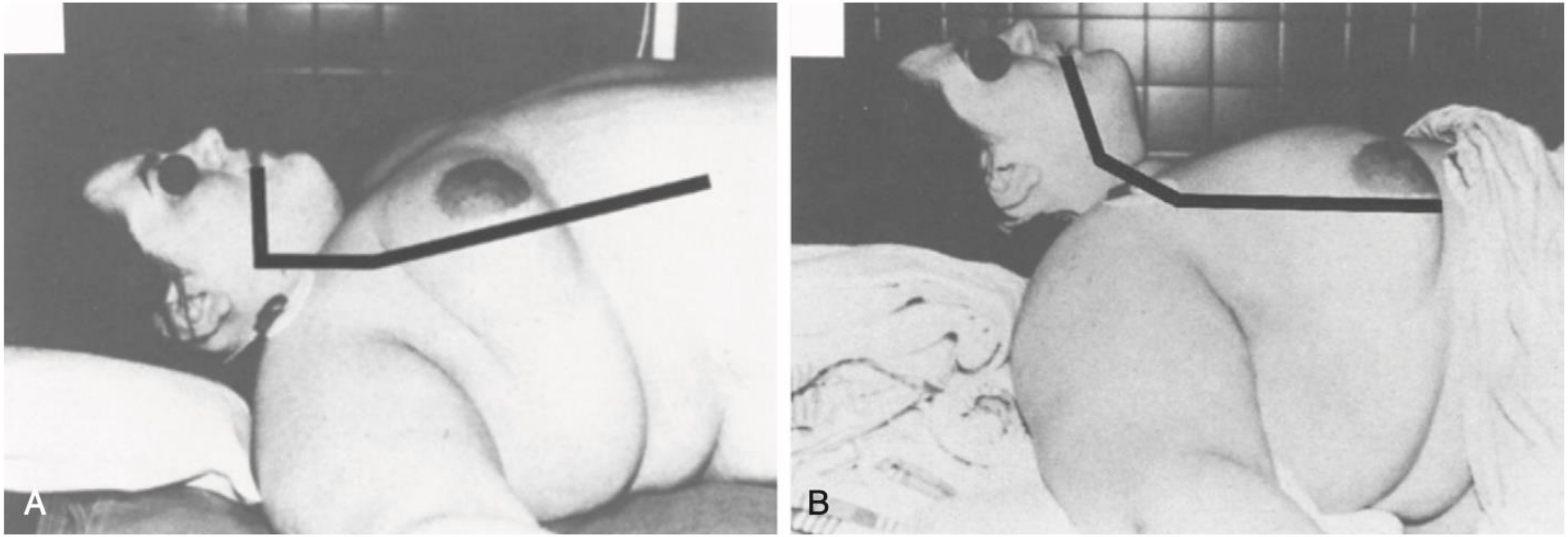
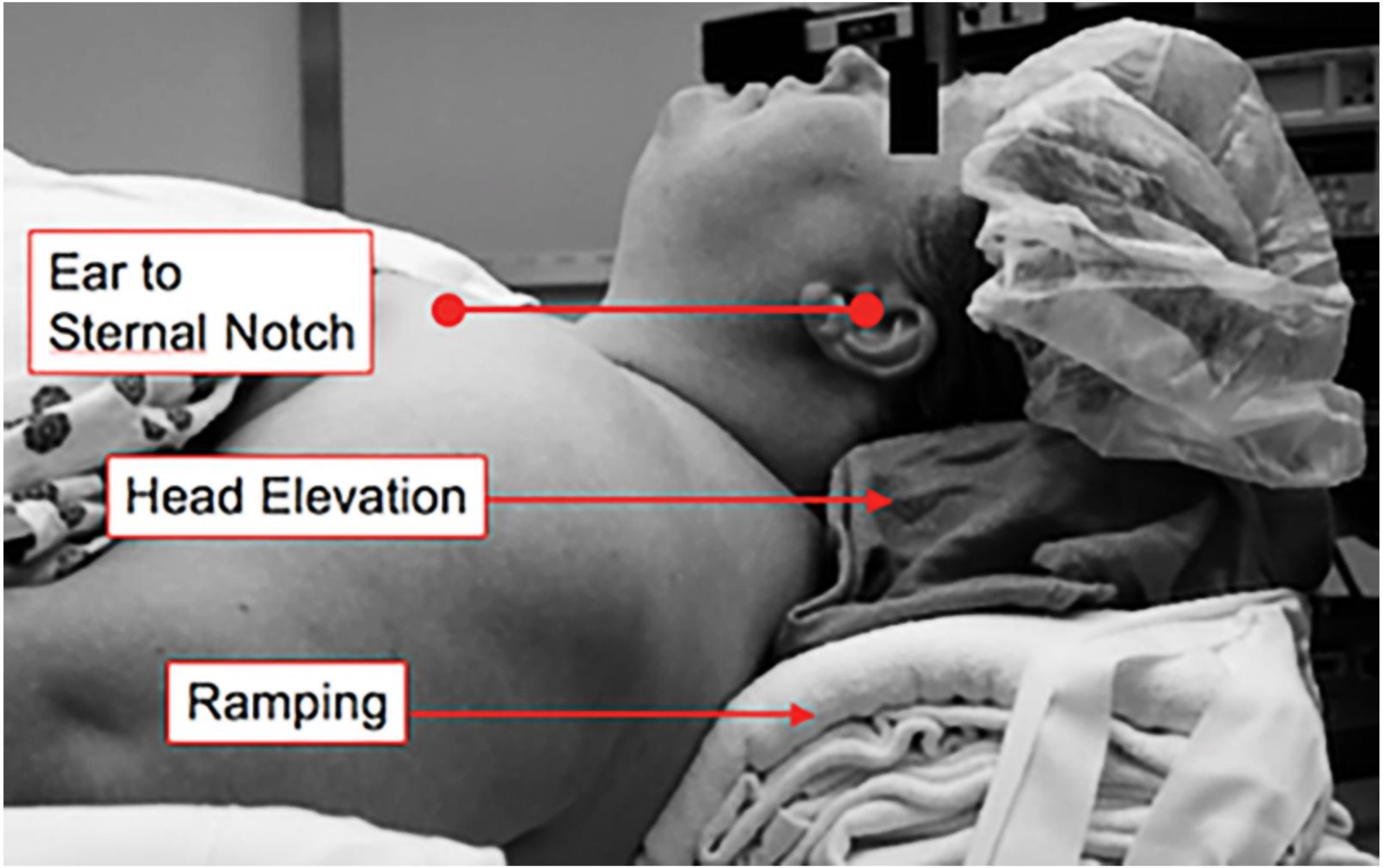


Figure 17-2 **A,** In some obese patients, placing the head on a pillow does not result in the sniffing position; in the obese patient shown and as illustrated by the overlying *bold black line*, the oral and laryngeal axes are perpendicular to one another, the neck is not flexed on the chest, and the head is not extended on the neck at the atlanto-occipital joint. **B,** In the same patient, placing support (e.g., blankets, towels) under the scapula, shoulders, nape of the neck, and head results in a much better sniffing position; the oral, pharyngeal, and laryngeal axes form only a slightly bent curve, the neck is flexed on the chest, and the head is extended on the neck at the atlanto-occipital joint. (From Benumof JL, editor: *Airway management: Principles and practice*, St. Louis, 1996, Mosby, p 264.)

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.



https://first10em.com/intubation/

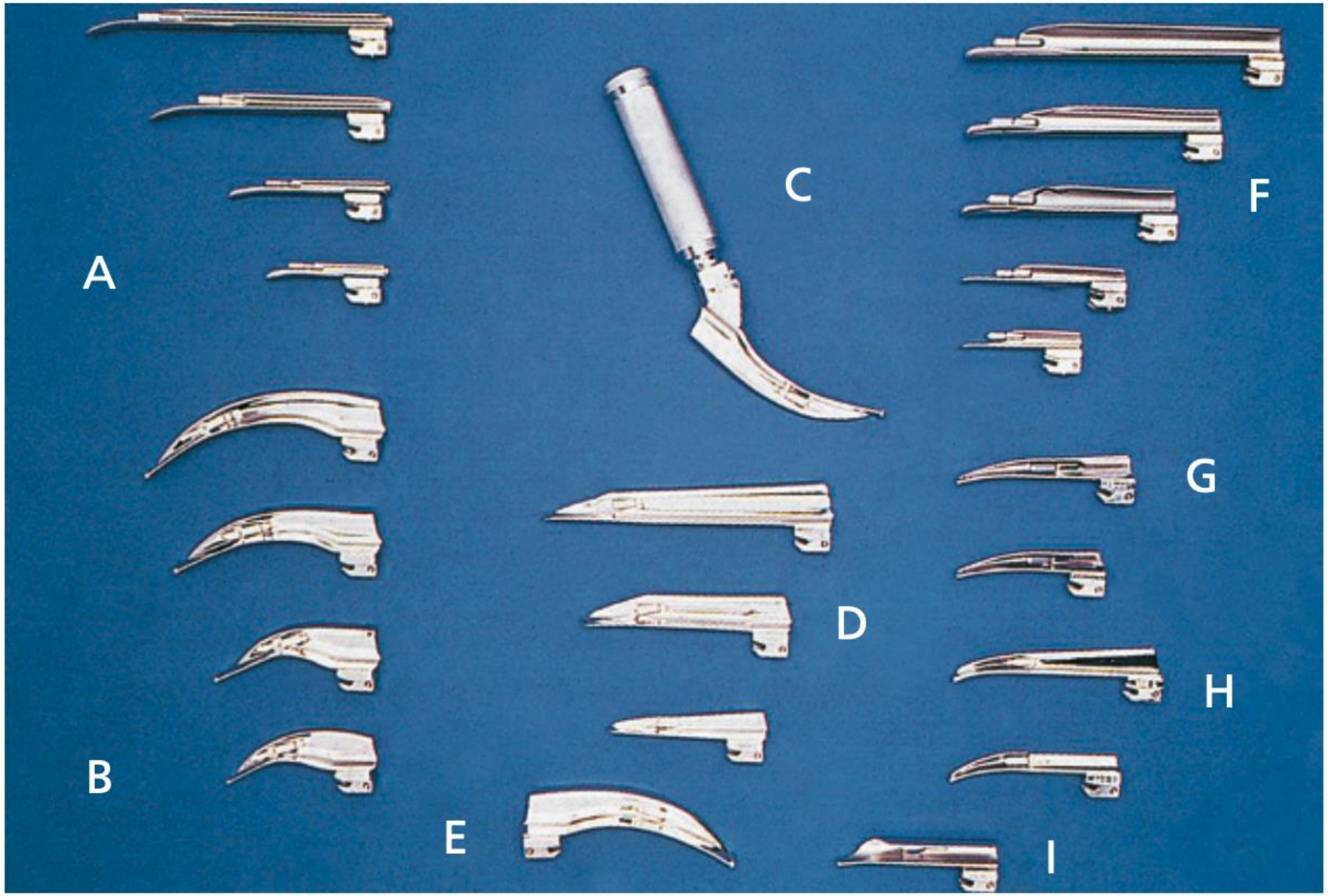


Fig. 7.2 A wide range of laryngoscope blades. (A) Miller blades (large, adult, infant, premature); (B) Macintosh blades (large, adult, child, baby); (C) Macintosh polio blade; (D) Soper blades (adult, child, baby); (E) left-handed Macintosh blade; (F) Wisconsin blades (large, adult, child, baby, neonate); (G) Robertshaw blades (infant, neonatal); (H) Seward blades (child, baby); (I) Oxford infant blade.

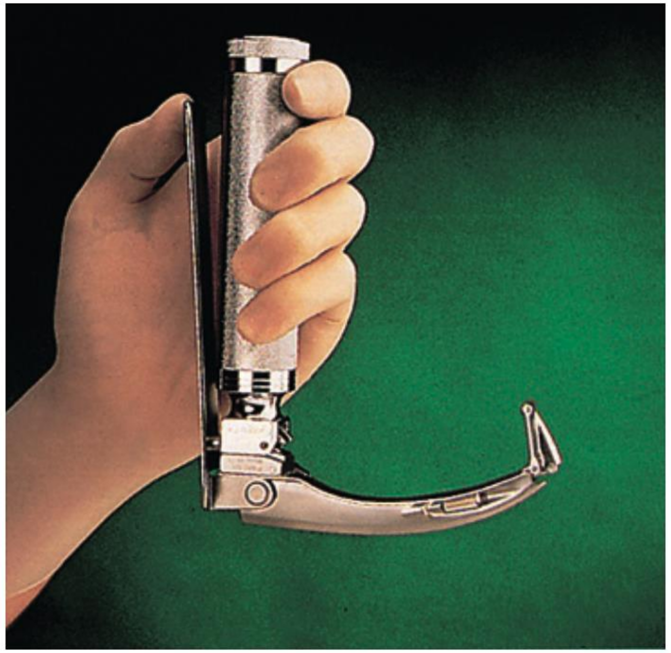
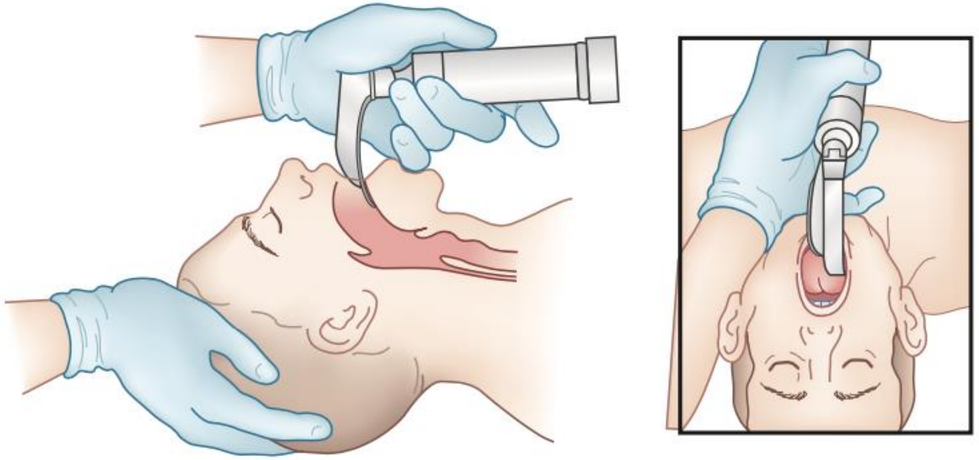


Fig. 7.6 Demonstrating the McCoy laryngoscope's hinged blade tip.

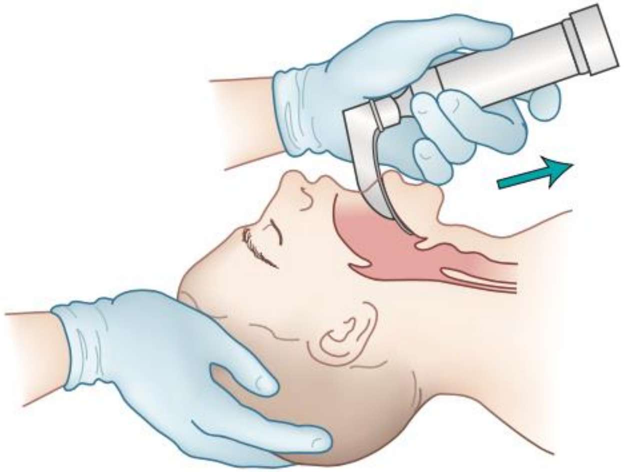
Al-Shaikh B, Stacey SG. Essentials of Equipment in Anaesthesia, Critical Care, and Peri-Operative Medicine E-Book. Elsevier Health Sciences; 2017.

Conventional Laryngoscopy with a Curved Blade

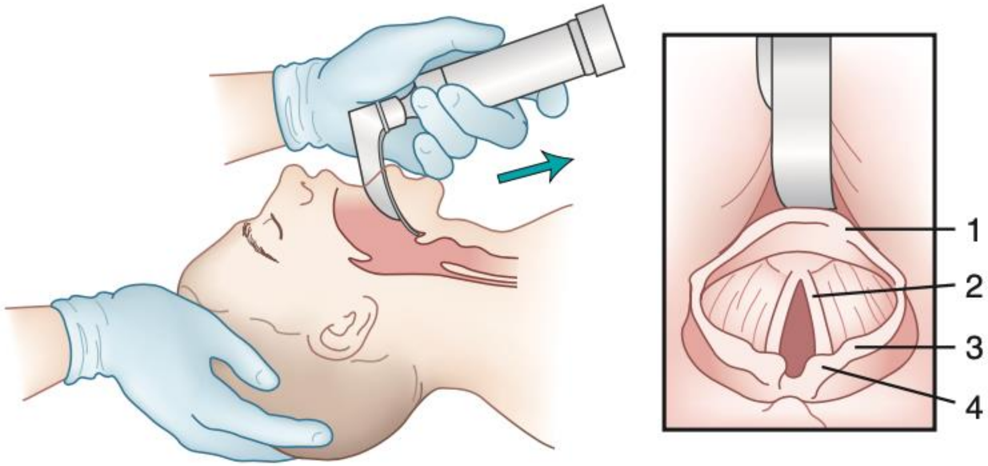


A Insert the laryngoscope blade into the right side of the mouth

B Advance the laryngoscope blade toward the midline of the base of the tongue by rotating wrist



C Approach the base of the tongue and lift the blade forward at a 45° angle



D Engage the vallecula and continue to lift the blade forward at a 45° angle

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

https://www.youtube.com/watch?v=iaAhcUKKDIY

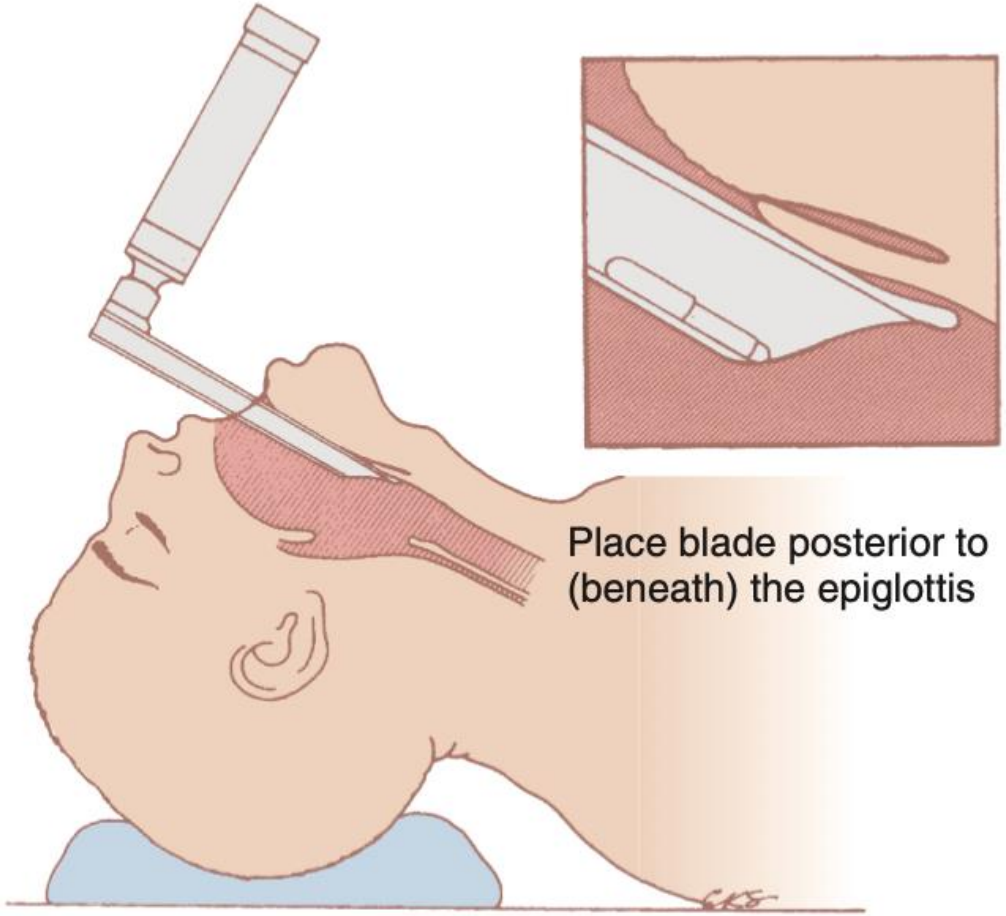
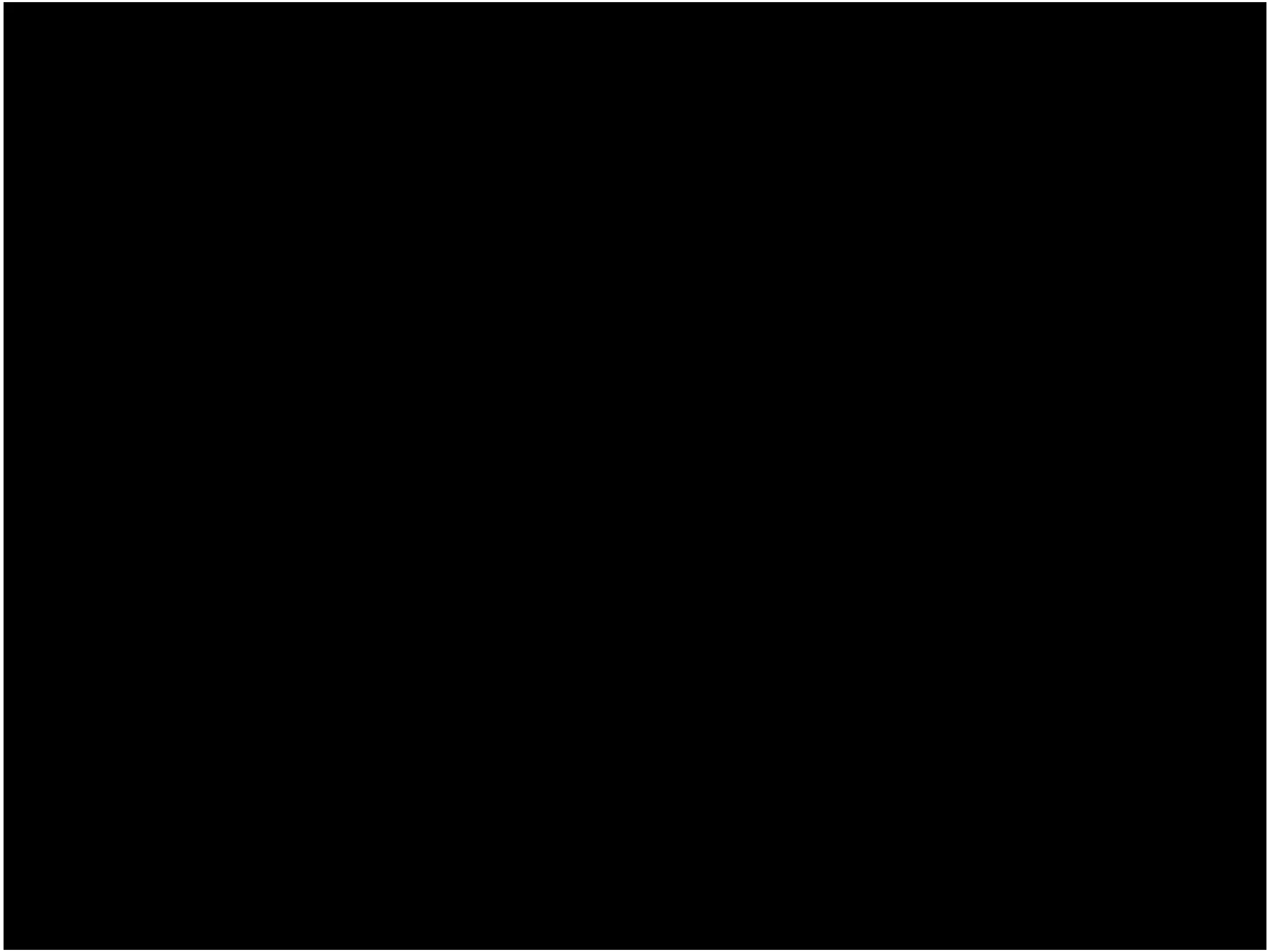


Figure 17-6 Conventional laryngoscopy with a straight blade. A straight laryngoscope blade (Miller blade) should be passed underneath the laryngeal surface of the epiglottis. The handle of the laryngoscope then should be elevated at a 45-degree angle, similar to the lifting that takes place with the use of a curved laryngoscope blade. (From Benumof JL, editor: *Airway management: Principles and practice,* St. Louis, 1996, Mosby, p 268.)

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.



https://www.youtube.com/watch?v=6TgYTw3U-bs

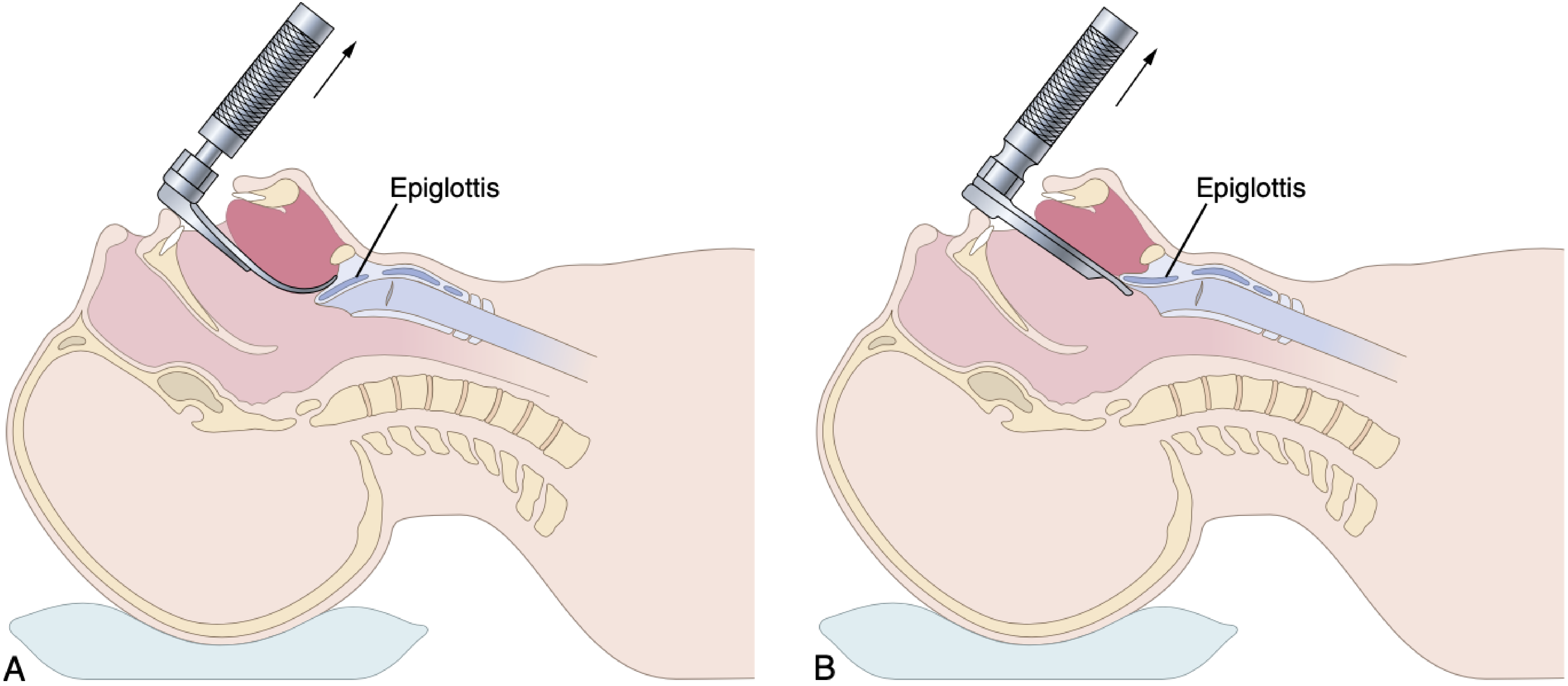


Fig. 16.13 Schematic diagram depicting the proper position of the laryngoscope blade for exposure of the glottic opening. (A) The distal end of the curved blade is advanced into the space between the base of the tongue and the pharyngeal surface of the epiglottis. (B) The distal end of the straight blade is advanced beneath the laryngeal surface of the epiglottis. Regardless of blade design, forward and upward movement exerted along the axis of the laryngoscope handle, as denoted by the arrows, serves to elevate the epiglottis and expose the glottic opening.

Pardo M, Miller RD. Basics of Anesthesia. Elsevier; 2018.

Guiding a nasotracheal tube into the larynx using a Magill forceps

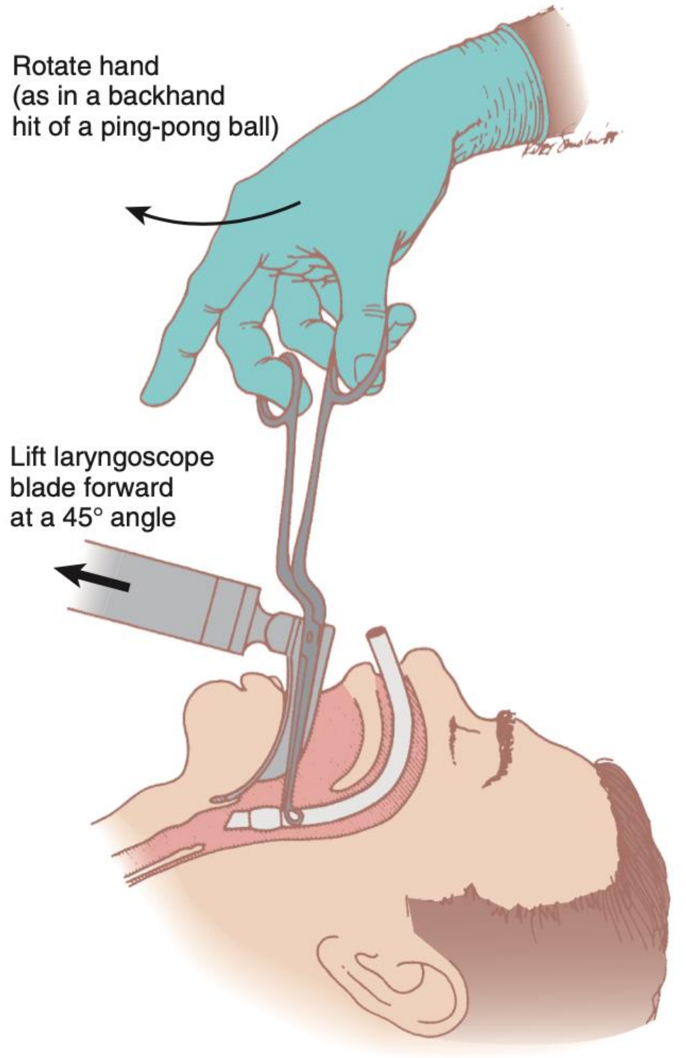


Figure 17-12 A nasotracheal tube can be guided under direct vision (laryngoscopic control) through the laryngeal aperture with a Magill forceps by rotating the hand as when using a backhand motion to hit a ping pong ball. The Magill forceps should grab the nasotracheal tube proximal to the cuff of the ETT. (From Benumof JL, editor: *Airway management: Principles and practice,* St. Louis, 1996, Mosby, p 275.)

Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.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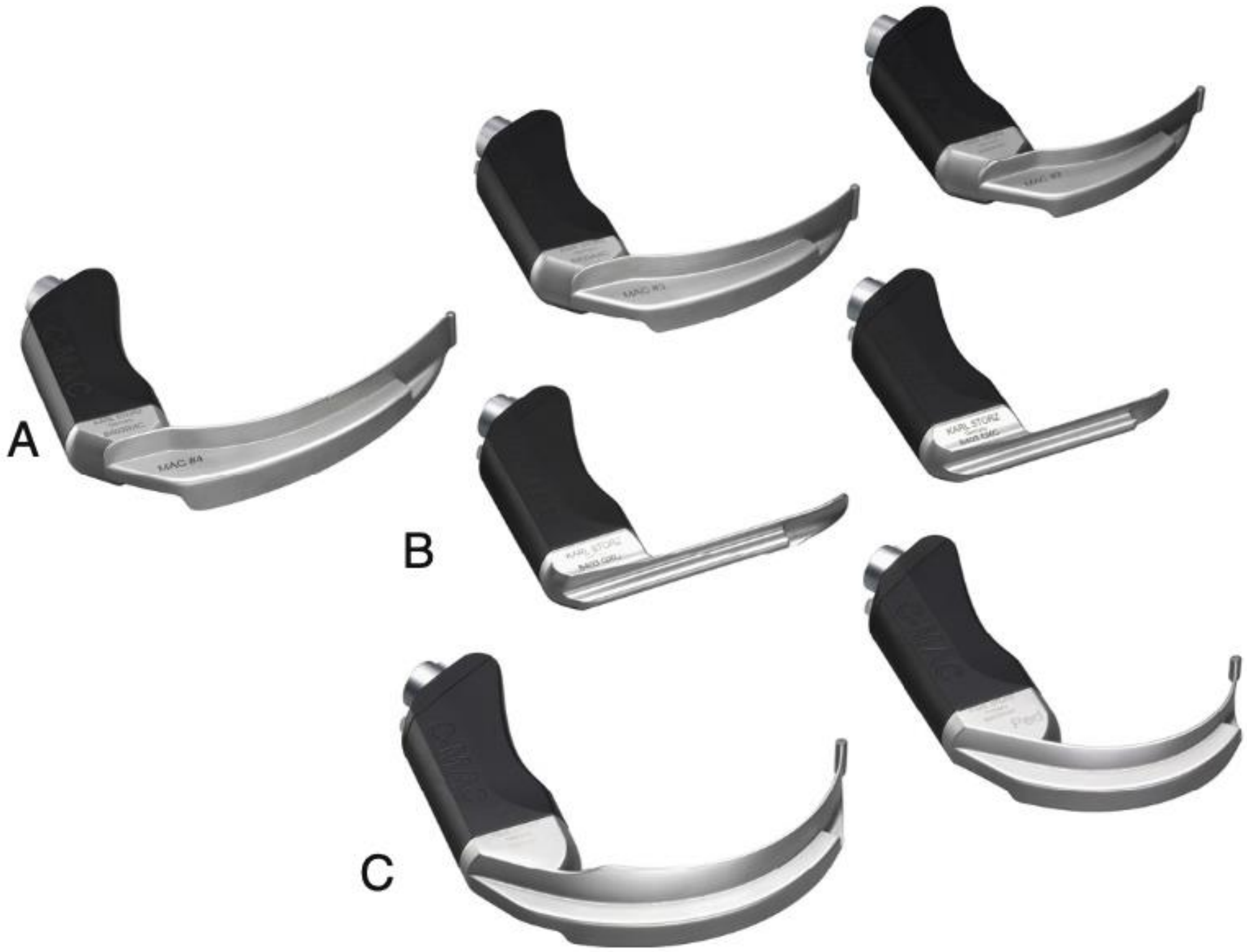


Fig. 16.16 Comparison of the different C-MAC blade types. (A) Macintosh style blade, (B) Miller style blade, and (C) D-blade. (Images courtesy of KARL STORZ Endoscopy, El Segundo, CA.)

Pardo M, Miller RD. Basics of Anesthesia. Elsevier; 2018.

Box 16.2 Complications of Endotracheal Intubation

During Direct Laryngoscopy and Endotracheal Intubation

Dental and oral soft tissue trauma
Systemic hypertension and tachycardia
Cardiac dysrhythmias
Myocardial ischemia
Inhalation (aspiration) of gastric contents

While the Endotracheal Tube Is in Place

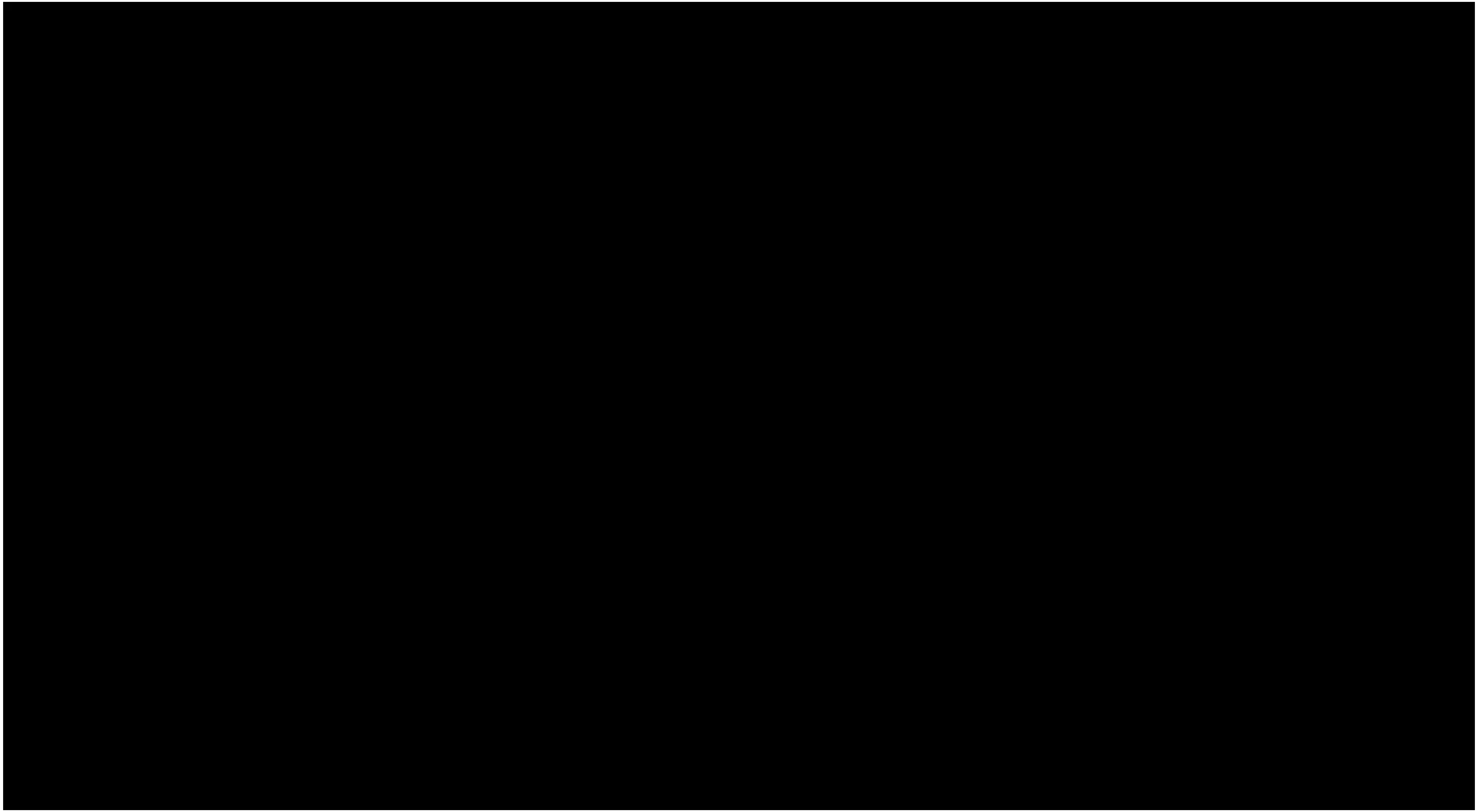
Endotracheal tube obstruction
Endobronchial intubation
Esophageal intubation
Endotracheal tube cuff leak
Pulmonary barotrauma
Nasogastric distention
Accidental disconnection from the anesthesia breathing circuit
Tracheal mucosa ischemia
Accidental extubation

Complications After Endotracheal Extubation

Laryngospasm
Inhalation (aspiration) of gastric contents
Pharyngitis (sore throat)
Laryngitis
Laryngeal or subglottic edema
Laryngeal ulceration with or without granuloma formation
Tracheitis
Tracheal stenosis
Vocal cord paralysis
Arytenoid cartilage dislocation

Pardo M, Miller RD. Basics of Anesthesia. Elsevier; 2018.

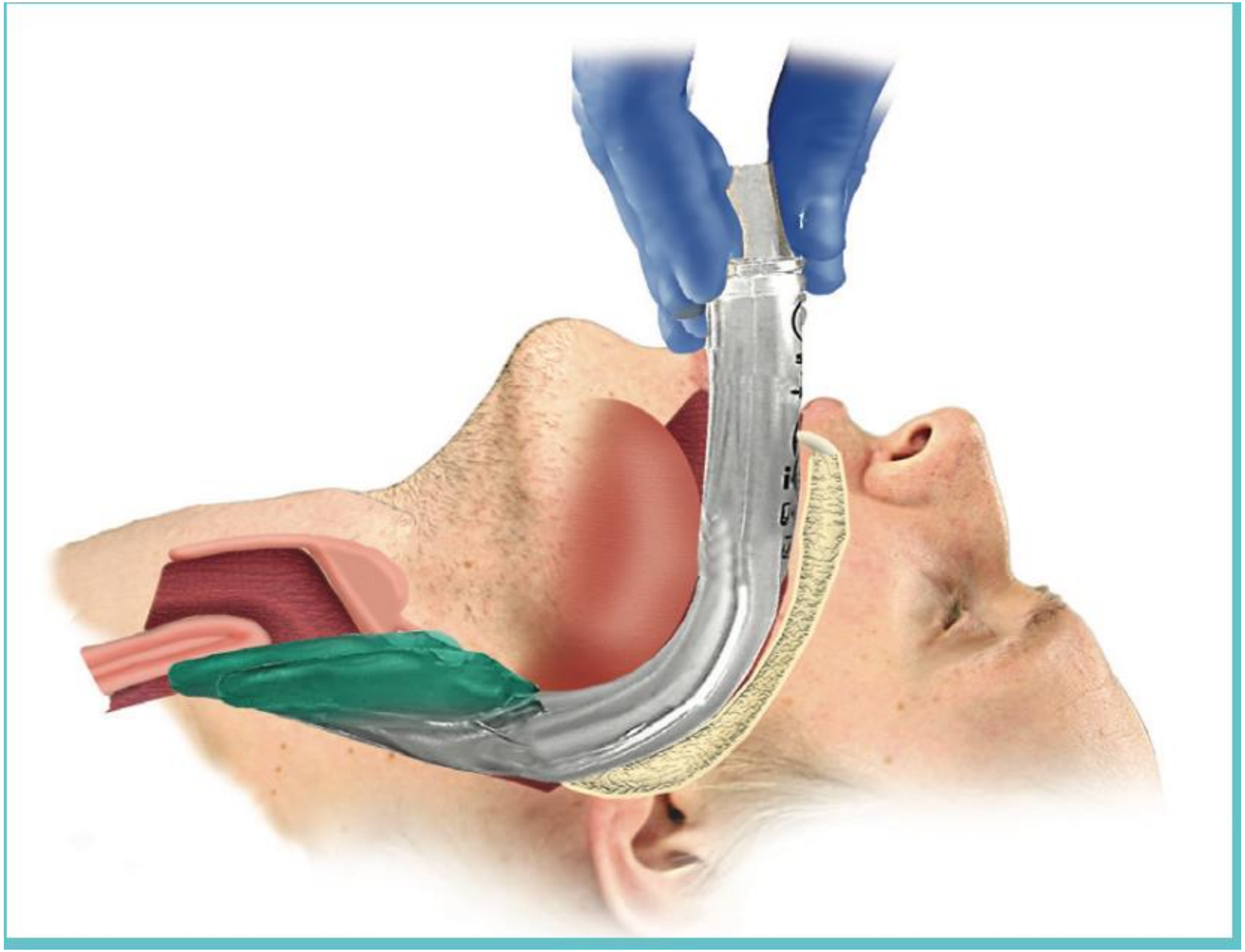
https://airwaymanagement.cookmedical.com/intubation/



https://www.youtube.com/watch?v=MKOrTD6nHa8

FOB

https://www.youtube.com/watch?v=QC6pQNs5AnQ



www.i-gel.com

Preparations for use

Adult patient

1

Open the **i-gel** package, and on a flat surface take out the protective cradle containing the device.

2

Remove the **i-gel** and transfer it to the palm of the same hand that is holding the protective cradle, supporting the device between the thumb and index finger.

3

Place a small bolus of a water-based lubricant, such as K-Y Jelly, onto the middle of the smooth surface of the protective cradle in preparation for lubrication.

4

Grasp the **i-gel** with the opposite (free) hand along the integral bite block and lubricate the back, sides and front of the cuff with a thin layer of lubricant.

5

Place the **i-gel** back into the protective cradle in preparation for insertion.

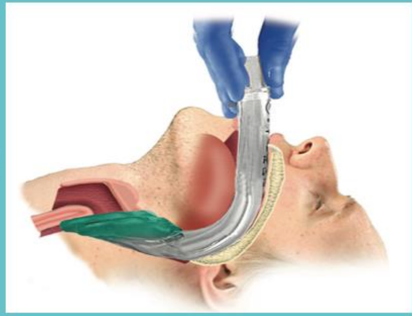
Step 6

Insertion technique

6

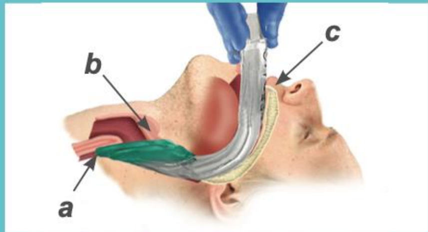
Remove the i-gel from the protective cradle. Grasp the lubricated i-gel firmly along the integral bite block. Position the device so that the **i-gel** cuff outlet is facing towards the chin of the patient. The patient should be in the 'sniffing the morning air' position with head extended and neck flexed. The chin should be gently pressed down before proceeding. Introduce the leading soft tip into the mouth of the patient in a direction towards the hard palate.

7



Glide the device downwards and backwards along the hard palate with a continuous but gentle push until a **definitive resistance** is felt .

8



The tip of the airway should be located into the upper oesophageal opening (a) and the cuff should be located against the laryngeal framework (b). The incisors should be resting on the integral bite-block (c).

9

i-gel should be taped down from 'maxilla to maxilla'.

10

If there is early resistance during insertion a 'jaw thrust' (above) or 'Insertion with Deep Rotation' (right) is recommended.

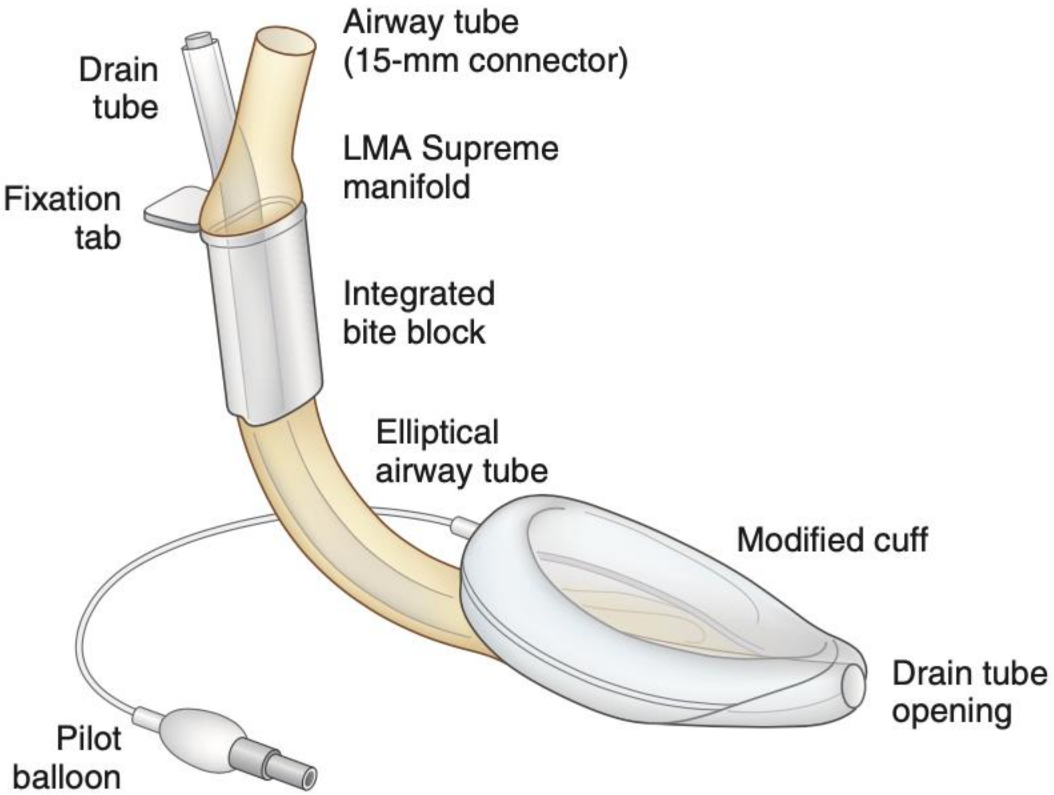


Figure 22-24 The LMA Supreme has a manifold with an integral bite block, an anatomically shaped airway tube enclosing a drain tube, a modified cuff through which the drain tube passes, and a cuff inflation line with pilot balloon.

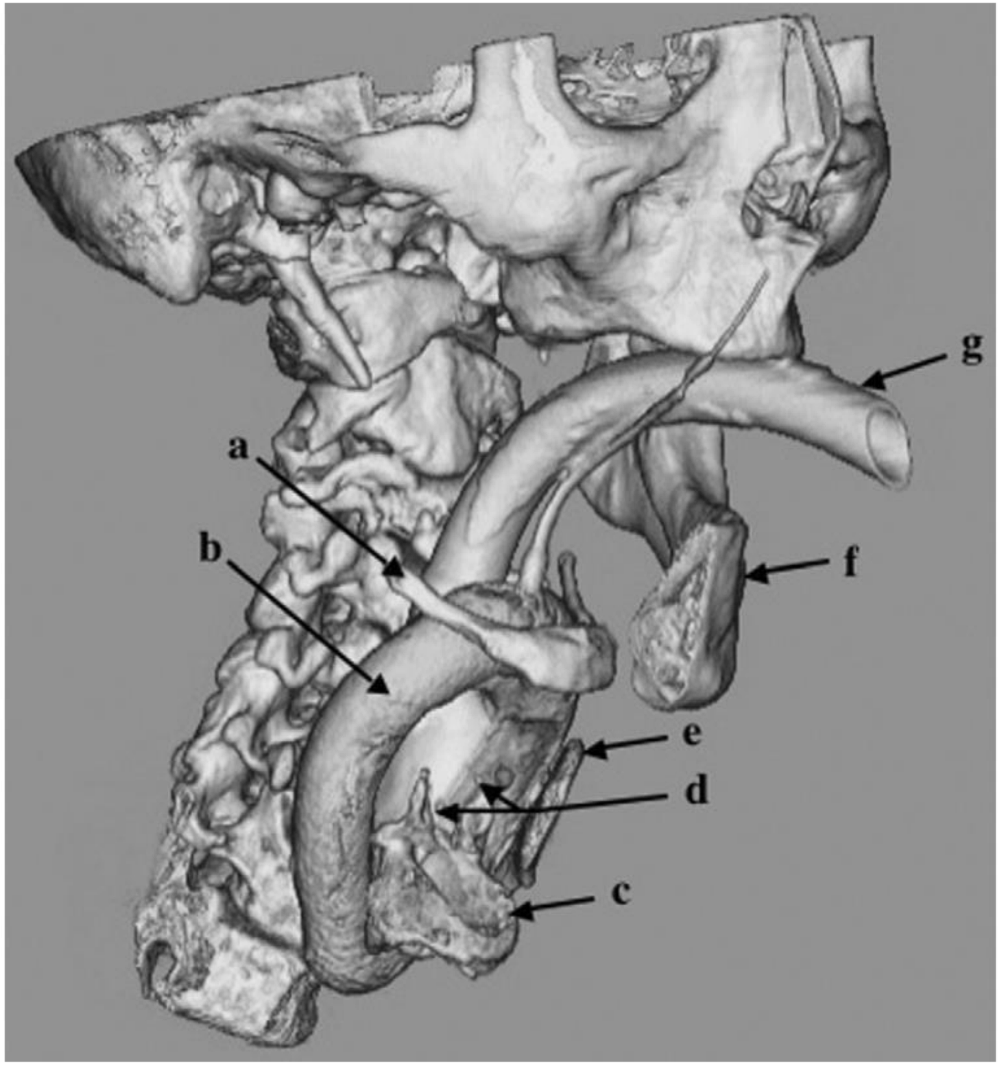
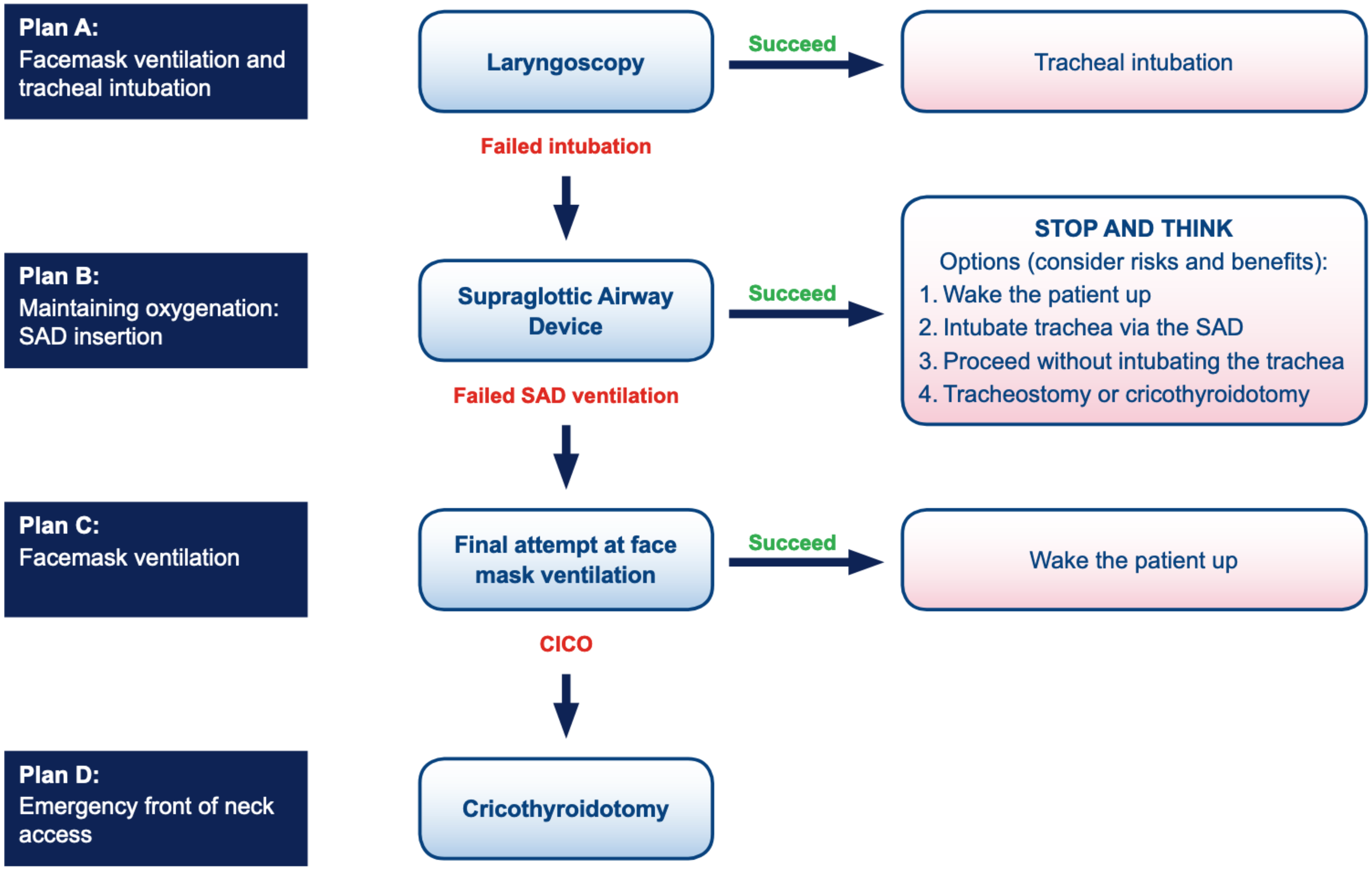


Figure 22-1 Three-dimensional radiologic reconstruction of the human airway with the laryngeal mask airway (LMA) in situ: hyoid bone *(a)*; LMA's cuff *(b)*; cricoid ring *(c)*; arytenoid cartilages *(d)*; thyroid cartilage *(e)*, which is digitally partially removed to demonstrate the position of the LMA; mandible *(f)*, which is digitally partially removed to demonstrate the position of the LMA; and the LMA's shaft *(g)*. The LMA's cuff forms a seal with the periglottic tissues and provides a continuous connection between the natural airway and the device.

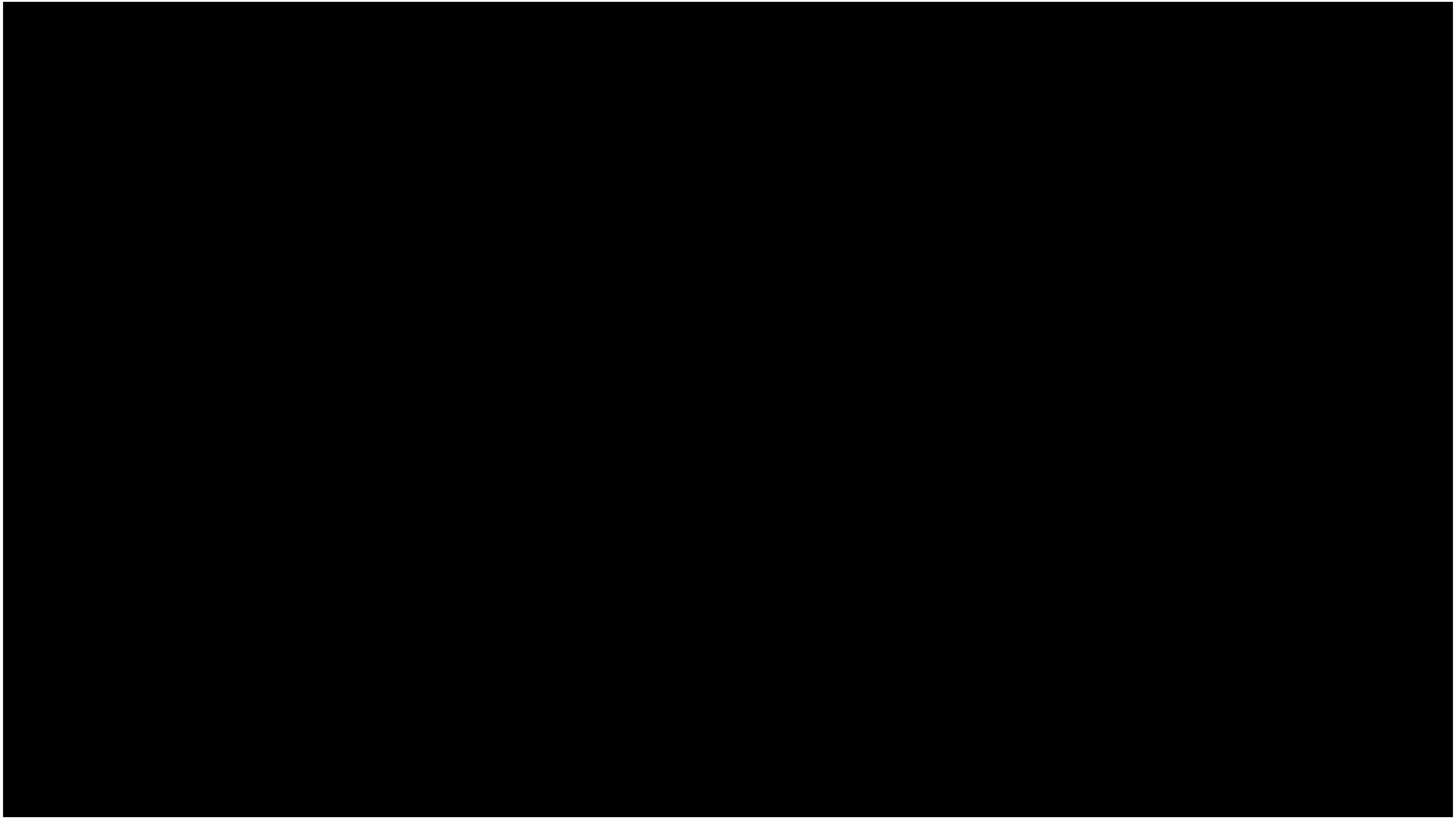
Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

DAS Difficult intubation guidelines – overview

2015



https://das.uk.com/files/das2015intubation_guidelines.pdf



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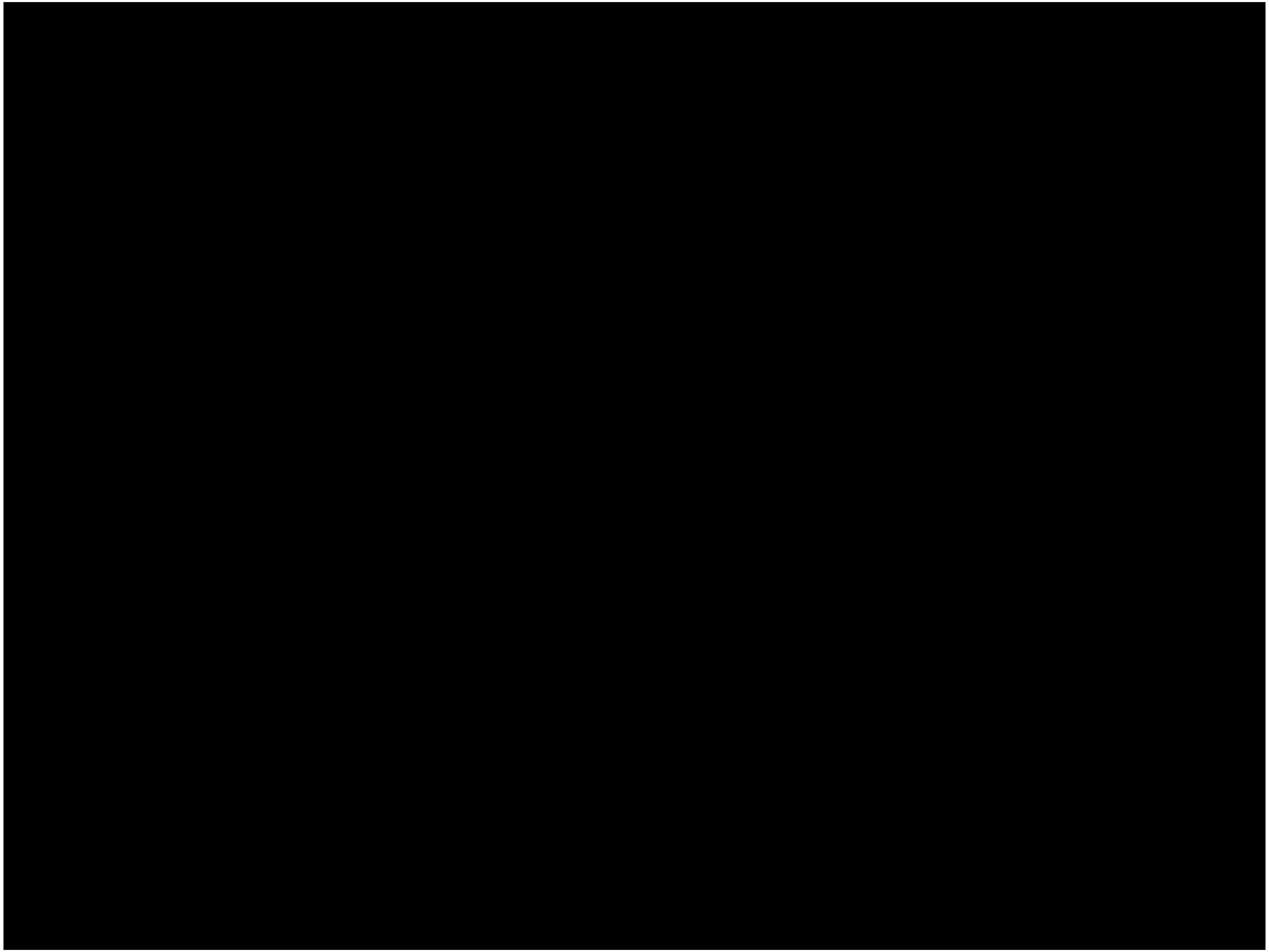

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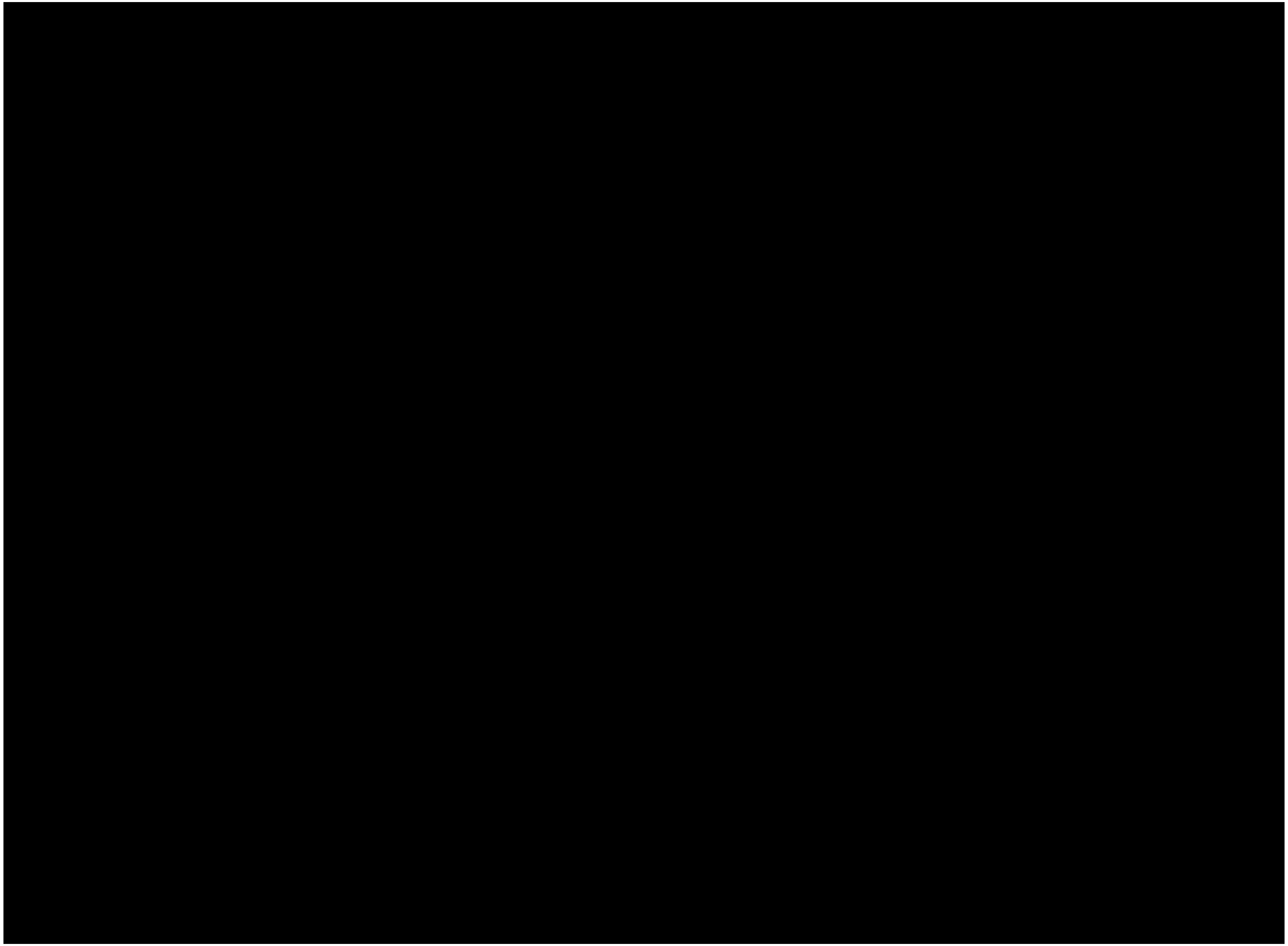

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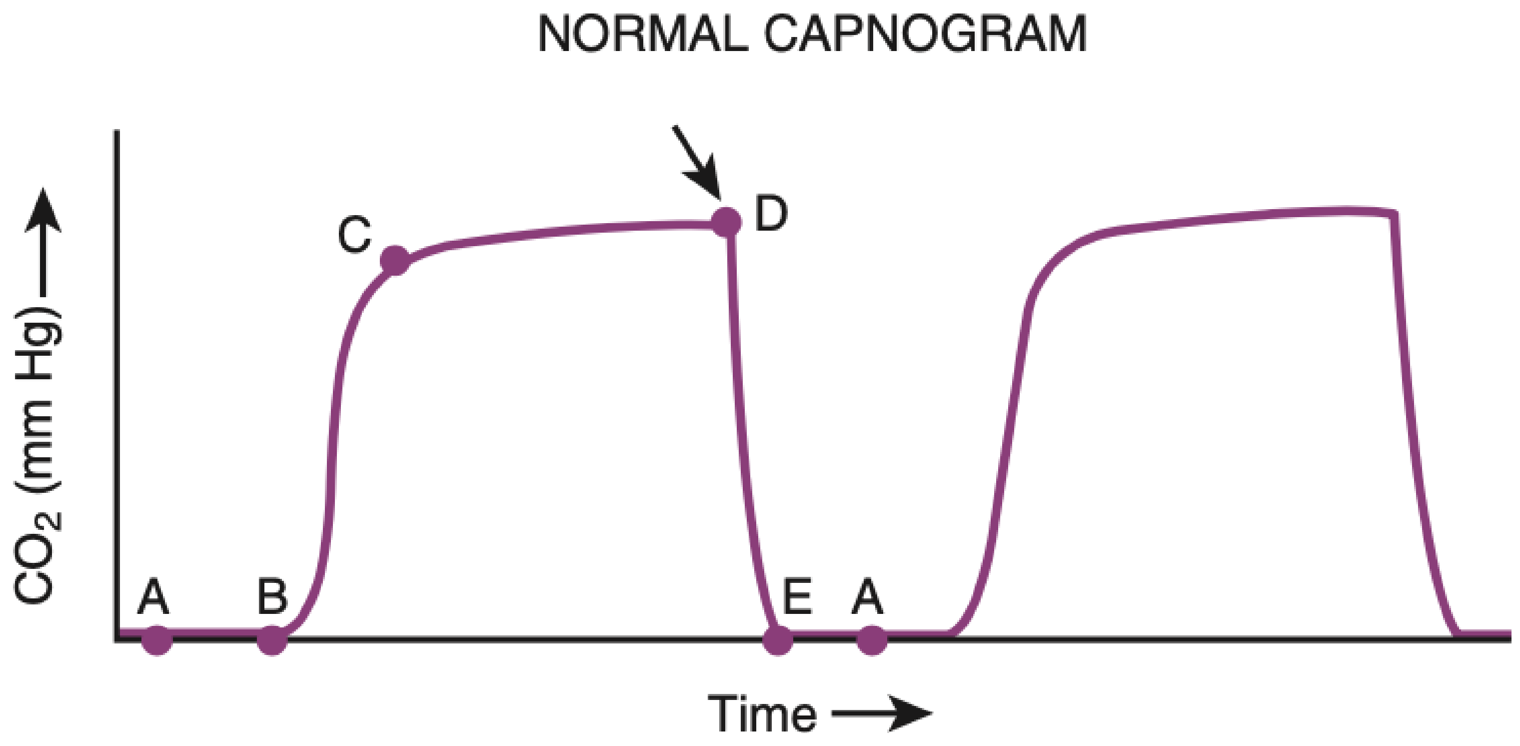
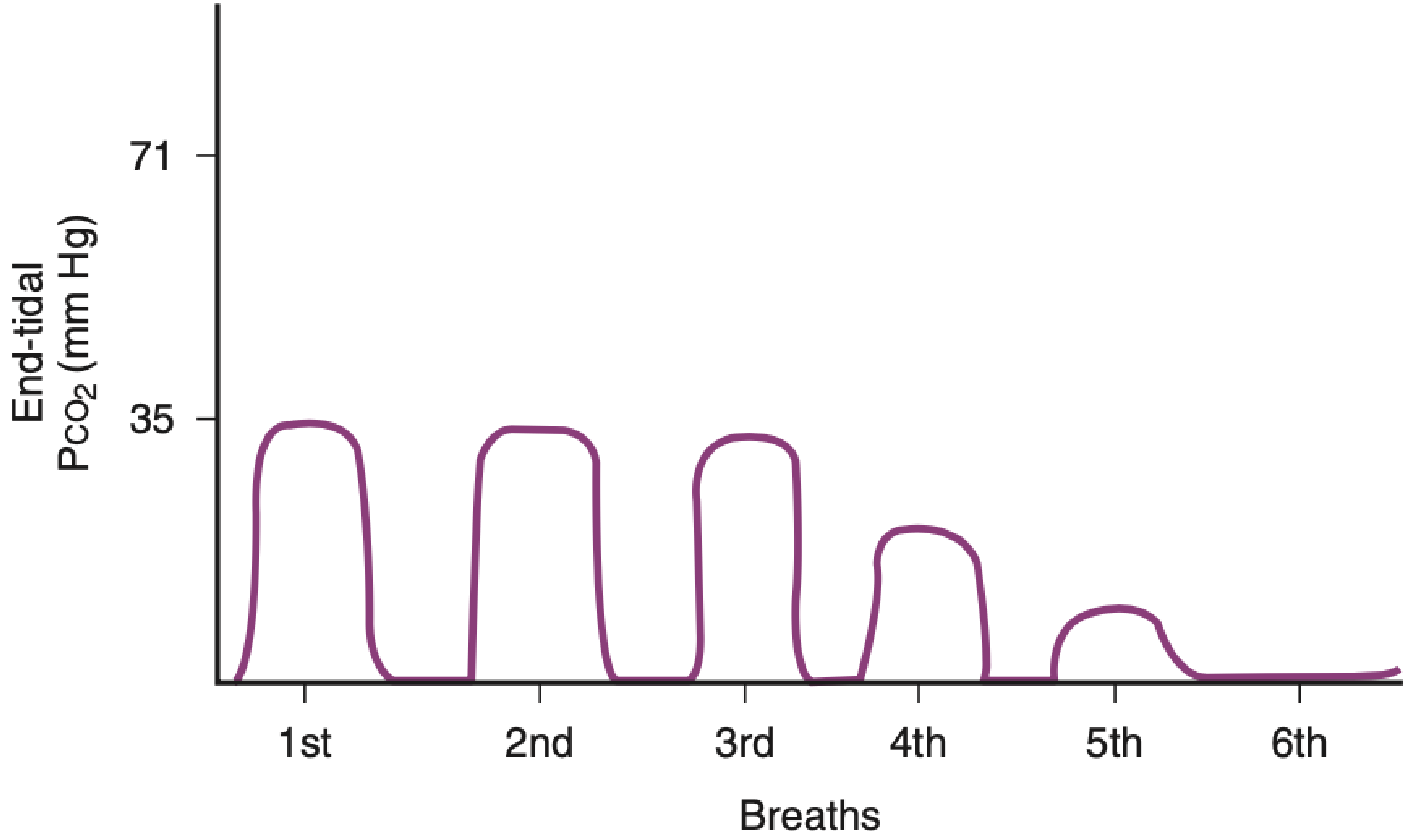


Figure 32-7 The CO_2 waveform. *A,* Expiratory pause begins. *A–B,* Clearance of anatomic dead space. *B–C,* Dead space air mixed with alveolar air. *C–D,* Alveolar plateau. *D,* End-tidal partial pressure of CO_2 registered by capnograph *(arrow)* and beginning of inspiratory phase. *D–E,* Clearance of dead space air. *E–A,* Inspiratory gas devoid of CO_2. (Modified from May WS, Heavner JE, McWorther D, Racz G: *Capnography in the operating room: An introductory directory,* New York, 1985, Raven Press, p 1.)

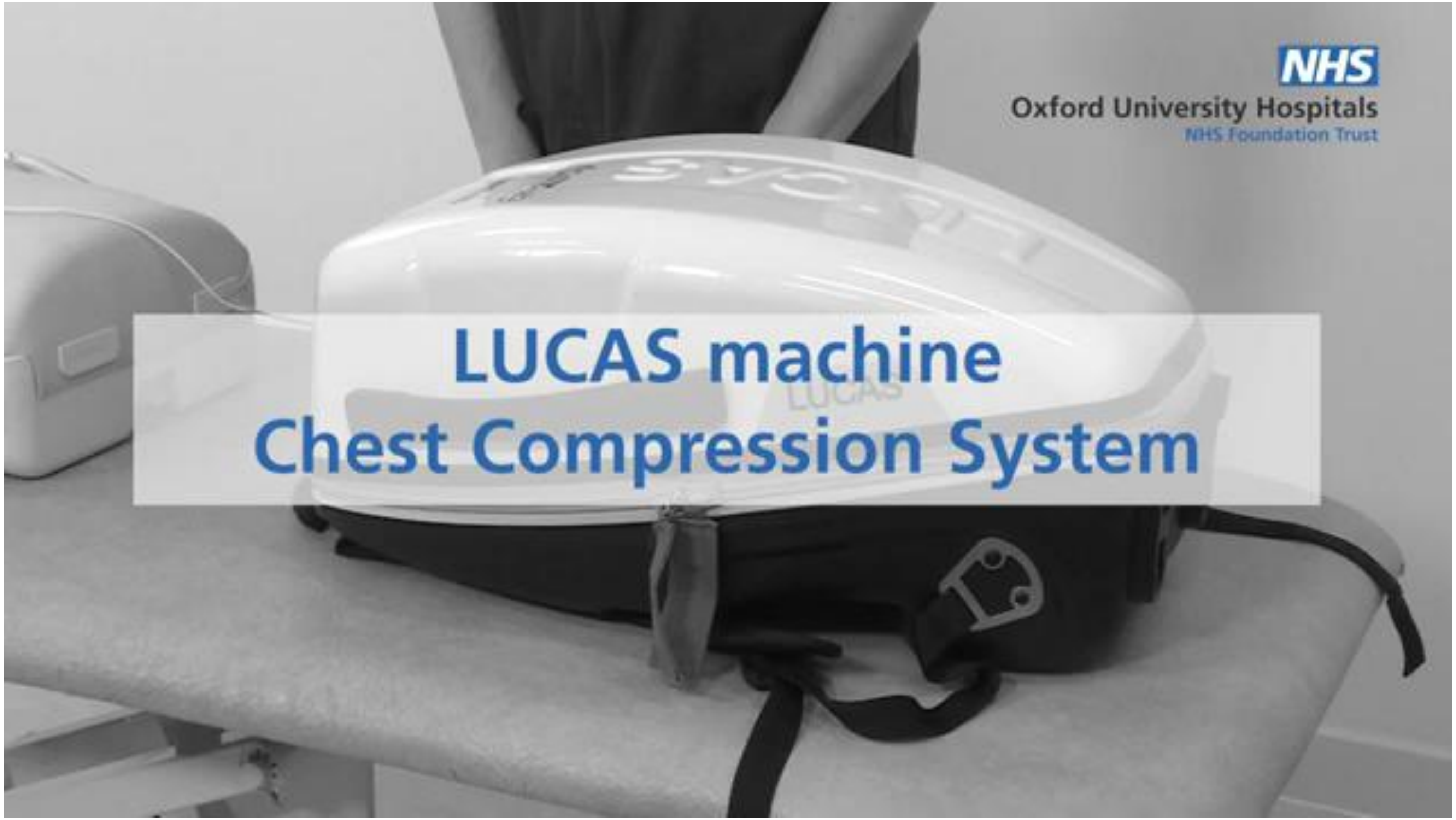
Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.



Hagberg CA. Benumof and Hagberg's Airway Management E-Book. Elsevier Health Sciences; 2012.

CPR

Automated Chest Compression



Conclusions

The provision of high-quality CPR is a key modifiable factor associated with survival in cardiac arrest. Mechanical chest compression devices consistently deliver high-quality chest compressions, but this does not translate into improved patient outcomes when devices are routinely used in OHCA. Further trials are needed to evaluate the routine use of mechanical devices in IHCA.

The use of mechanical devices in specific circumstances (e.g. ambulance/helicopter transport, pPCI) where high-quality chest compressions cannot be safely delivered may be a reasonable strategy. In all situations where mechanical devices are used, clinicians must ensure that the device is deployed with minimal interruption to chest compression delivery.

Poole K, Couper K, Smyth MA, Yeung J, Perkins GD. Mechanical CPR: Who? When? How? Crit Care. 2018;22(1):140. doi:10.1186/s13054-018-2059-0

Rischio infettivo durante CPR

TABLE 1 Pathogens categorized by mode of transmission and examples of procedures undertaken during CPR that can be transmitted

Mode of transmission	Pathogens[a]	Examples of condition(s) leading to transmission during CPR
Direct transmission		
Contact with blood (blood-borne)	HIV*, HBV*, HCV*, Ebola	Needlestick injury during cannulation and blood sampling
Contact with body fluids	Ebola, CCHF virus, *Neisseria meningitidis*, HSV, Norovirus, HAV, *Clostridium difficile*, other gastrointestinal pathogens (*Salmonella*, *Shigella*)	Contact with pleural fluid during insertion of ICD, contact with saliva during mouth-to-mouth ventilation, contact with feces
Contact with skin	VZV, HSV, HPV*, *Staphylococcus aureus** and *Streptococcus pyogenes** (from impetigo lesions)	Chest compressions without gloves, mouth-to-mouth ventilation
Contact with contaminated surfaces	Influenza, *Clostridium difficile* (spores), SARS-CoV-2(?), CMV	Unprotected handling of equipment
Droplet transmission (>5-μm droplet diam)	SARS-CoV-2, MERS-CoV, influenza, CMV	Intubation, suctioning of secretion, administration of nebulized drugs
Indirect transmission		
Airborne transmission	Measles, VZV, *Mycobacterium tuberculosis*, influenza, CMV	Unprotected

[a]*, requires skin breach. Abbreviations: CCHF virus, Crimean-Congo hemorrhagic fever virus; CMV, cytomegalovirus; HAV, hepatitis A virus; HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; HPV, human papillomavirus; HSV, herpes simplex virus; ICD, intercostal chest drain; MERS-CoV, Middle East respiratory syndrome coronavirus; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; VZV, varicella-zoster virus.

Fragkou PC, Dimopoulou D, Latsios G, et al. Transmission of Infections during Cardiopulmonary Resuscitation. Clin Microbiol Rev. 2021;34(4):e0001821. doi:10.1128/CMR.00018-21

Risks associated with cardiopulmonary resuscitation (CPR) in patients with COVID-19

Mechanisms of transmission of SARS-CoV-2

The main mechanism of disease transmission of SARS-CoV-2 is by respiratory secretions either directly from the patient or by touching contaminated surfaces. Viable virus is detectable on some surfaces for up to 72 h.[11] Respiratory secretions are called either droplets (> 5 –10 microns in diameter) or airborne particles (< 5 microns). Droplets fall onto surfaces within 1–2 m of the patient's respiratory tract while airborne particles can remain suspended in the air for prolonged periods.[11–15]

The International Liaison Committee on Resuscitation (ILCOR) has undertaken a systematic review addressing three questions:[16]

1. Is the delivery of chest compressions or defibrillation an aerosol-generating procedure?
2. Do the delivery of chest compressions, defibrillation or CPR (all CPR interventions that include chest compressions) increase infection transmission?
3. What type of PPE is required by individuals delivering chest compressions, defibrillation or CPR in order to prevent transmission of infection from the patient to the rescuer?

The evidence addressing these questions is scarce and comprises mainly retrospective cohort studies[17,18] and case reports.[19–24]

In most cases, delivery of chest compressions and defibrillation are lumped together with all CPR interventions, which means that there is considerable confounding in these studies. Aerosol generation by chest compressions is plausible because they generate small but measurable tidal volumes.[25,26] Chest compressions are similar to some chest physiotherapy techniques, which are associated with aerosol generation.[27] Furthermore, the person performing chest compressions is close to the patient's airway.

The ILCOR systematic review did not identify evidence that defibrillation generates aerosols. If it occurs, the duration of an aerosol generating process would be brief. Furthermore, the use of adhesive pads means that defibrillation can be delivered without direct contact between the defibrillator operator and patient. The ILCOR treatment recommendations are listed in Table 1. The values, preferences and Task Force insights summarise the rationale for recommendations for lay persons and health care professionals.

Nolan JP, Monsieurs KG, Bossaert L, et al. European Resuscitation Council COVID-19 guidelines executive summary. Resuscitation. 2020;153:45-55. doi:10.1016/j.resuscitation.2020.06.001

Table 1 – ILCOR treatment recommendations for cardiopulmonary resuscitation (CPR) in patients with COVID-19.

- We suggest that chest compressions and cardiopulmonary resuscitation have the potential to generate aerosols (weak recommendation, very low certainty evidence).
- We suggest that in the current COVID-19 pandemic lay rescuers consider compression-only resuscitation and public-access defibrillation (good practice statement).
- We suggest that in the current COVID-19 pandemic, lay rescuers who are willing, trained and able to do so, may wish to deliver rescue breaths to children in addition to chest compressions (good practice statement).
- We suggest that in the current COVID-19 pandemic, healthcare professionals should use personal protective equipment for aerosol-generating procedures during resuscitation (weak recommendation, very low certainty evidence).
- We suggest that it may be reasonable for healthcare providers to consider defibrillation before donning aerosol generating personal protective equipment in situations where the provider assesses the benefits may exceed the risks (good practice statement).

Nolan JP, Monsieurs KG, Bossaert L, et al. European Resuscitation Council COVID-19 guidelines executive summary. Resuscitation. 2020;153:45-55. doi:10.1016/j.resuscitation.2020.06.001

Research Question 1.

- Population: Individuals in any setting
- Exposure: Delivery of chest compressions, defibrillation, CPR (all CPR interventions that include chest compressions)
- Outcome: Generation of aerosols
- Study design: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies, case reports/series, cadaver studies) were eligible for inclusion. Unpublished studies (eg, conference abstracts, trial protocols) were excluded.
- Time frame: All years and all languages were included as long as there was an English abstract. Searches were updated in January 2021.

Research Question 2.

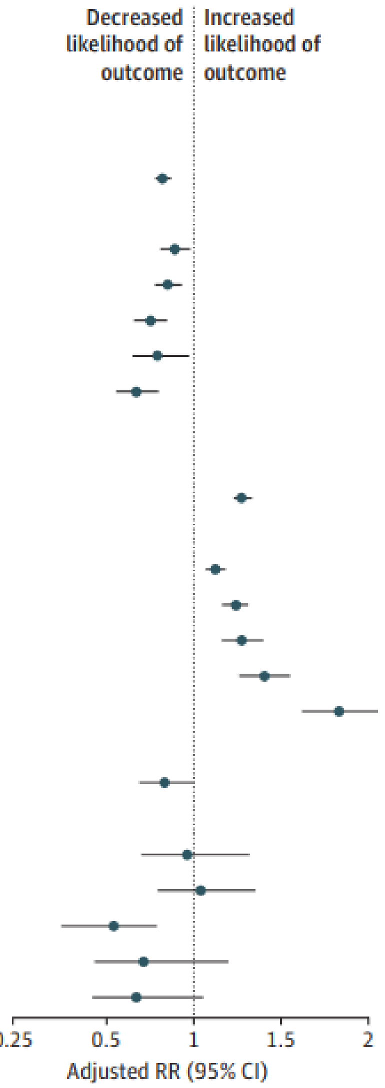
- Population: Individuals in any setting wearing any PPE or no PPE
- Exposure: Delivery of chest compressions, defibrillation, CPR (all CPR interventions that include chest compressions)
- Outcome: Transmission of infection
- Study designs: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies, case reports/series) were eligible for inclusion. Unpublished studies (eg, conference abstracts, trial protocols) were excluded.

Wyckoff MH, Singletary EM, Soar J, et al. 2021 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Neonatal Life Support; Education, Implementation, and Teams; First Aid Task Forces; and the COVID-19 Working Group. Resuscitation. 2021;169:229-311. doi:10.1016/j.resuscitation.2021.10.040

BLSD e Covid-19

Figure 2. Rates of Sustained Return of Spontaneous Circulation (ROSC), Termination of Resuscitation, and Survival to Discharge During the 2020 Pandemic Period vs 2019

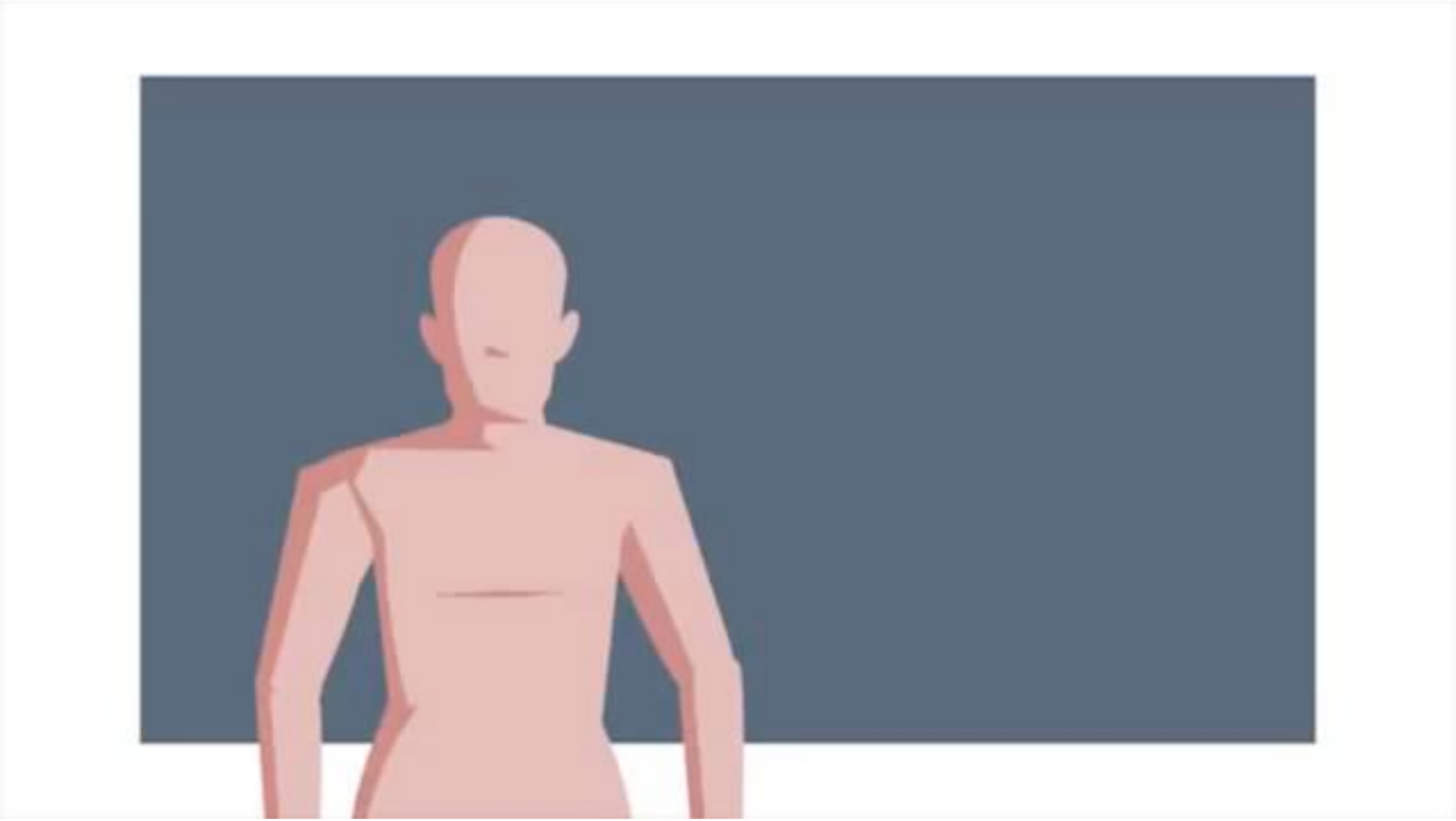
Source	Rate, % 2019	Rate, % 2020	Adjusted RR (95% CI)	Global P value	Interaction P value
Primary outcome					
Sustained ROSC					
Overall	29.8	23.0	0.82 (0.78-0.87)	<.001	
County-level COVID-19 deaths per million population					.03
0-25	29.0	25.2	0.89 (0.81-0.98)		
26-100	31.4	25.4	0.85 (0.78-0.93)		
101-250	30.1	20.4	0.75 (0.66-0.85)		
251-500	27.0	20.0	0.79 (0.65-0.97)		
>500	28.8	17.3	0.67 (0.56-0.80)		
Secondary outcomes					
Termination of resuscitation					
Overall	39.9	53.9	1.27 (1.23-1.33)	<.001	
County-level COVID-19 deaths per million population					<.001
0-25	46.5	53.6	1.12 (1.07-1.18)		
26-100	36.7	48.3	1.24 (1.16-1.31)		
101-250	38.6	52.4	1.27 (1.16-1.40)		
251-500	41.0	62.1	1.40 (1.26-1.55)		
>500	33.1	66.5	1.83 (1.62-2.05)		
Survival to discharge					
Overall	9.8	6.6	0.83 (0.69-1.00)	.048	
County-level COVID-19 deaths per million population					.049
0-25	10.4	8.4	0.96 (0.70-1.32)		
26-100	10.5	8.8	1.04 (0.80-1.35)		
101-250	12.5	5.0	0.54 (0.36-0.79)		
251-500	7.6	4.8	0.71 (0.43-1.20)		
>500	6.2	2.9	0.67 (0.42-1.05)		



Comparisons of rates are shown for the overall cohort and stratified by the county-level coronavirus disease 2019 (COVID-19) mortality rate. The analysis for the outcome of survival to discharge was restricted to emergency medical services agencies with complete data on this outcome. RR indicates rate ratio.

Chan PS, Girotra S, Tang Y, Al-Araji R, Nallamothu BK, McNally B. Outcomes for Out-of-Hospital Cardiac Arrest in the United States During the Coronavirus Disease 2019 Pandemic. JAMA Cardiology. 2021;6(3):296-303. doi:10.1001/jamacardio.2020.6210

Agonal Breathing



The Role of Gasping in Resuscitation

L.P. Roppolo, P.E. Pepe, and B.J. Bobrow

Gasping is a physiologic entity that, among other conditions, is seen typically in mammals who have sustained a global ischemic insult such as sudden cardiac arrest or severe hemorrhagic shock [1–13]. Scientists have defined a gasp formally in nomenclature consensus processes as "an abrupt, sudden, transient inspiratory effort" [13] and it has been described in the published literature since 1812 [11]. The classic gasping that occurs after sudden cardiac arrest is also sometimes referred to as "agonal breaths" or "agonal respirations" [1, 3–6, 9]. However, the term agonal breathing may also be used by some when referring to a broader variety of respiratory efforts or conditions [12, 14]. Agonal breathing may, therefore, refer to various kinds of abnormal breathing observed at the time of clinical death, during certain types of stroke, or in progressive respiratory failure when rapid breathing reverts to slower and often shallow breaths [6, 11, 12, 14]. Classic gasps, according to strict definition, however, are usually sudden, abrupt, and much brisker and larger than normal respiratory efforts [13].

Roppolo LP, Pepe PE, Bobrow BJ. The Role of Gasping in Resuscitation. In: Vincent JL, ed. Yearbook of Intensive Care and Emergency Medicine 2010. Springer Berlin Heidelberg; 2010:83-95. doi:10.1007/978-3-642-10286-8_9

Conclusion

Gasping and other forms of agonal respiratory efforts may not only have positive prognostic value for those with global ischemic events, but they also likely serve as an adjunctive resuscitative intervention for both cardiac arrest and severely injured patients. Gasping is more of a physiologically sound mode of ventilation when compared to the traditional use of positive pressure breathing. Gasps may, therefore, even be more efficient and effective than traditional mouth-to-mouth rescue breathing and other positive pressure ventilatory techniques. Indeed, recent data demonstrate that gasping can enhance pulmonary gas exchange (oxygenation and ventilation) as well as circulation by enhancing venous return and, in turn, cardiac output, aortic pressures, coronary artery perfusion, and cerebral blood flow. Recent studies designed to identify gasping over the telephone at emergency dispatch offices have dramatically increased the ability of dispatchers to detect persons with cardiac arrest. In turn, dispatchers can now prompt earlier performance of chest compressions in a large number of cases in which the life-saving technique might not have been performed until arrival of professional responders. Such studies may provide a model for the future relevant training of laypersons, EMS responders and other medical personnel.

Roppolo LP, Pepe PE, Bobrow BJ. The Role of Gasping in Resuscitation. In: Vincent JL, ed. Yearbook of Intensive Care and Emergency Medicine 2010. Springer Berlin Heidelberg; 2010:83-95. doi:10.1007/978-3-642-10286-8_9

EUROPEAN RESUSCITATION COUNCIL

Management of hypoglycaemia

- The signs of hypoglycaemia are sudden impaired consciousness: ranging from dizziness, fainting, sometimes nervousness and deviant behaviour (mood swings, aggression, confusion, loss of concentration, signs that look like drunkenness) to loss of consciousness.
- A person with mild hypoglycaemia typically has less severe signs or symptoms and has the preserved ability to swallow and follow commands.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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- If hypoglycaemia is suspected in someone who has signs or symptoms of mild hypoglycaemia and is conscious and able to swallow:
  - Give glucose or dextrose tablets (15–20 g), by mouth
  - If glucose or dextrose tablets are not available give other dietary sugars in an equivalent amount to glucose, such as Skittles, Mentos, sugar cubes, jellybeans, or half a can of orange juice
  - Repeat the administration of sugar if the symptoms are still present and not improving after 15 min
  - If oral glucose is not available a glucose gel (partially held in the cheek, and partially swallowed) can be given
  - Call the emergency services if:
    - the casualty is/or becomes unconscious
    - the casualty's condition does not improve

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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    - Following recovery from the symptoms after taking the sugar, encourage taking a light snack such as a sandwich or a waffle
- For children who may be uncooperative with swallowing oral glucose:
    - Consider administering half a teaspoon of table sugar (2.5 g) under the child's tongue.
- If possible, measure and record the blood sugar levels before and after treatment.

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Oral rehydration solutions for treating exertion-related dehydration

- If a person has been sweating excessively during a sports performance and exhibits signs of dehydration such as feeling thirsty, dizzy or light-headed and/or having a dry mouth or dark yellow and strong-smelling urine, give him/her 3–8% carbohydrate-electrolyte (CE) drinks (typical 'sports' rehydration drinks) or skimmed milk.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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- If 3–8% CE drinks or milk are not available or not well tolerated, alternative beverages for rehydration include 0–3% CE drinks, 8–12% CE drinks or water.
- Clean water, in regulated quantities, is an acceptable alternative, although it may require a longer time to rehydrate.
- Avoid the use of alcoholic beverages.
- Call the emergency services if:
  - The person is or becomes unconscious
  - The person shows signs of a heat stroke.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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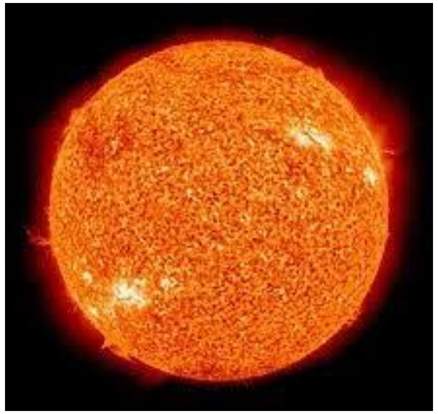

Management of heat stroke by cooling

Recognise the symptoms and signs of heat stroke (in the presence of a high ambient temperature):

- Elevated temperature
- Confusion
- Agitation
- Disorientation
- Seizures
- Coma.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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When exertional or non-exertional heat stroke is suspected:

- Immediately remove the casualty from the heat source and commence passive cooling
- Commence additional cooling using any technique immediately available
  - If the core temperature is above 40 °C commence whole body (neck down) cold water (1–26 °C) immersion until the core temperature falls below 39 °C
  - If water immersion is not possible use alternative methods of cooling e.g. ice sheets, commercial ice packs, fan alone, cold shower, hand cooling devices, cooling vests and jackets or evaporative cooling (mist and fan)
- Where possible measure the casualty's core temperature (rectal temperature measurement) which may require special training
- Casualties with exertional hyperthermia or non-exertional heat-stroke will require advanced medical care and advance assistance should be sought.

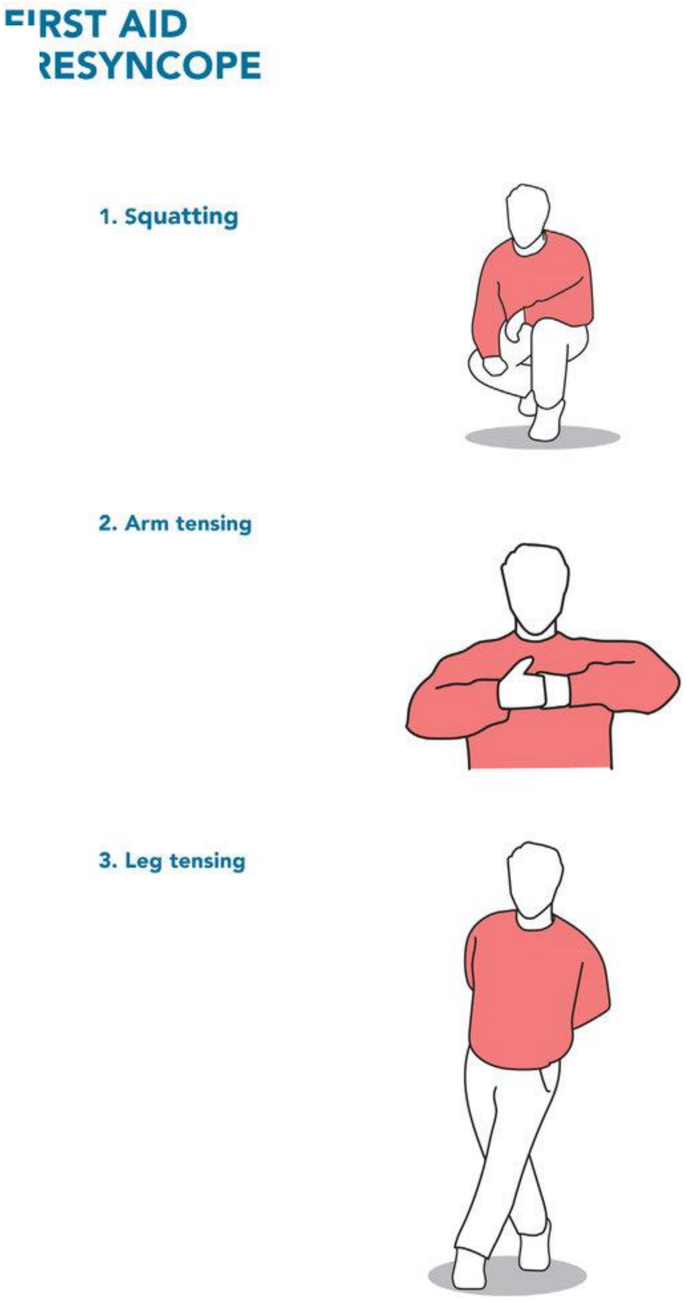
Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021

Management of presyncope

- Presyncope is characterised by light-headedness, nausea, sweating, black spots in front of the eyes and an impending sense of loss of consciousness.

- Ensure the casualty is safe and will not fall or injure themselves if they lose consciousness.
- Use simple physical counterpressure manoeuvres to abort presyncope of vasovagal or orthostatic origin.
- Lower body physical counterpressure manoeuvres are more effective than upper body manoeuvres.
  - Lower body – Squatting with or without leg crossing
  - Upper body – Hand clenching, neck flexion
- First aid providers will need to be trained in coaching casualties in how to perform physical counterpressure manoeuvres.



Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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Dental avulsion

- If the casualty is bleeding from the avulsed tooth socket:
  - Put on disposable gloves prior to assisting the victim
  - Rinse out the casualty's mouth with cold, clean water
  - Control bleeding by:
    - Pressing a damp compress against the open tooth socket
    - Tell the casualty to bite on the damp compress

Figure 1A: Loss of tooth (Source: Dental Trauma Guide, 2010)

Figure 1B: Empty socket appearance (Source: Dental Trauma Guide, 2010)

Figure 1C: Radiographic image (Source: Dental Trauma Guide, 2010)

- Do not do this if there is a high chance that the injured person will swallow the compress (for example, a small child, an agitated person or a person with impaired consciousness).

https://endopracticeus.com/wp-content/uploads/2016/12/CE_Patel_Fig1.jpg

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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- If it is not possible to immediately replant the avulsed tooth at the place of accident:
  - Seek help from a specialist
    - Take the casualty and the avulsed tooth to seek expert help from a specialist.
- Only touch an avulsed tooth at the crown. Do not touch the root
- Rinse a visibly contaminated avulsed tooth for a maximum of 10 seconds with saline solution or under running tap water prior to transportation.
- To transport the tooth:
    - Wrap the tooth in cling film or store the tooth temporarily in a small container with Hank's Balanced Salt solution (HBSS), propolis or Oral Rehydration Salt (ORS) solution
    - If none of the above are available, store the tooth in cow's milk (any form or fat percentage)
    - Avoid the use of tap water, buttermilk or saline (sodium chloride).

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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Control of life-threatening bleeding

Direct pressure, haemostatic dressings, pressure points and cryotherapy for life-threatening bleeding

- Apply direct manual pressure for the initial control of severe, life-threatening external bleeding.
- Consider the use of a haemostatic dressing when applying direct manual pressure for severe, life-threatening bleeding. Apply the haemostatic dressing directly to the bleeding injury and then apply direct manual pressure to the dressing.
- A pressure dressing may be useful once bleeding is controlled to maintain haemostasis but should not be used in lieu of direct manual pressure for uncontrolled bleeding.
- Use of pressure points or cold therapy is not recommended for the control of life-threatening bleeding.

Apply direct pressure on external wounds with sterile cloth or your hand, maintaining pressure until bleeding stops

A.D.A.M.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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Tourniquets for life-threatening bleeding

- For life-threatening bleeding from wounds on limbs in a location amenable to the use of a tourniquet (i.e. arm or leg wounds, traumatic amputations):
  - Consider the application of a manufactured tourniquet as soon as possible:
    - Place the tourniquet around the traumatised limb 5–7 cm above the wound but not over a joint
    - Tighten the tourniquet until the bleeding slows and stops. This may be extremely painful for the casualty
    - Maintain the tourniquet pressure
    - Note the time the tourniquet was applied
    - Do not release the tourniquet – the tourniquet must only be released by a healthcare professional
    - Take the casualty to hospital immediately for further medical care
    - In some cases, it may require the application of two tourniquets in parallel to slow or stop the bleeding.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013
https://www.stopthebleed.org/resources-poster-booklet

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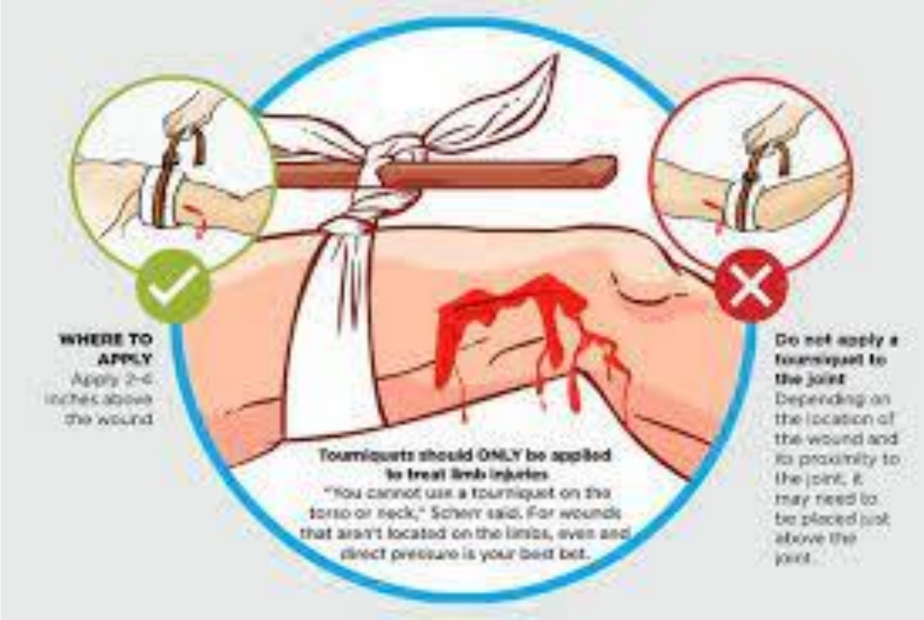
- If a manufactured tourniquet is not immediately available, or if bleeding is uncontrolled with the use of a manufactured tourniquet, apply direct manual pressure, with a gloved hand, a gauze dressing, or if available, a haemostatic dressing.
- Consider the use of an improvised tourniquet only if a manufactured tourniquet is not available, direct manual pressure (gloved hand, gauze dressing or haemostatic dressing) fails to control life-threatening bleeding, and the first aid provider is trained in the use of improvised tourniquets.



Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

What Is a Tourniquet?

A **tourniquet** is a device that is placed around a bleeding arm or leg. Tourniquets work by squeezing large blood vessels. The squeezing helps stop blood loss.

How Do I Put a Tourniquet On?

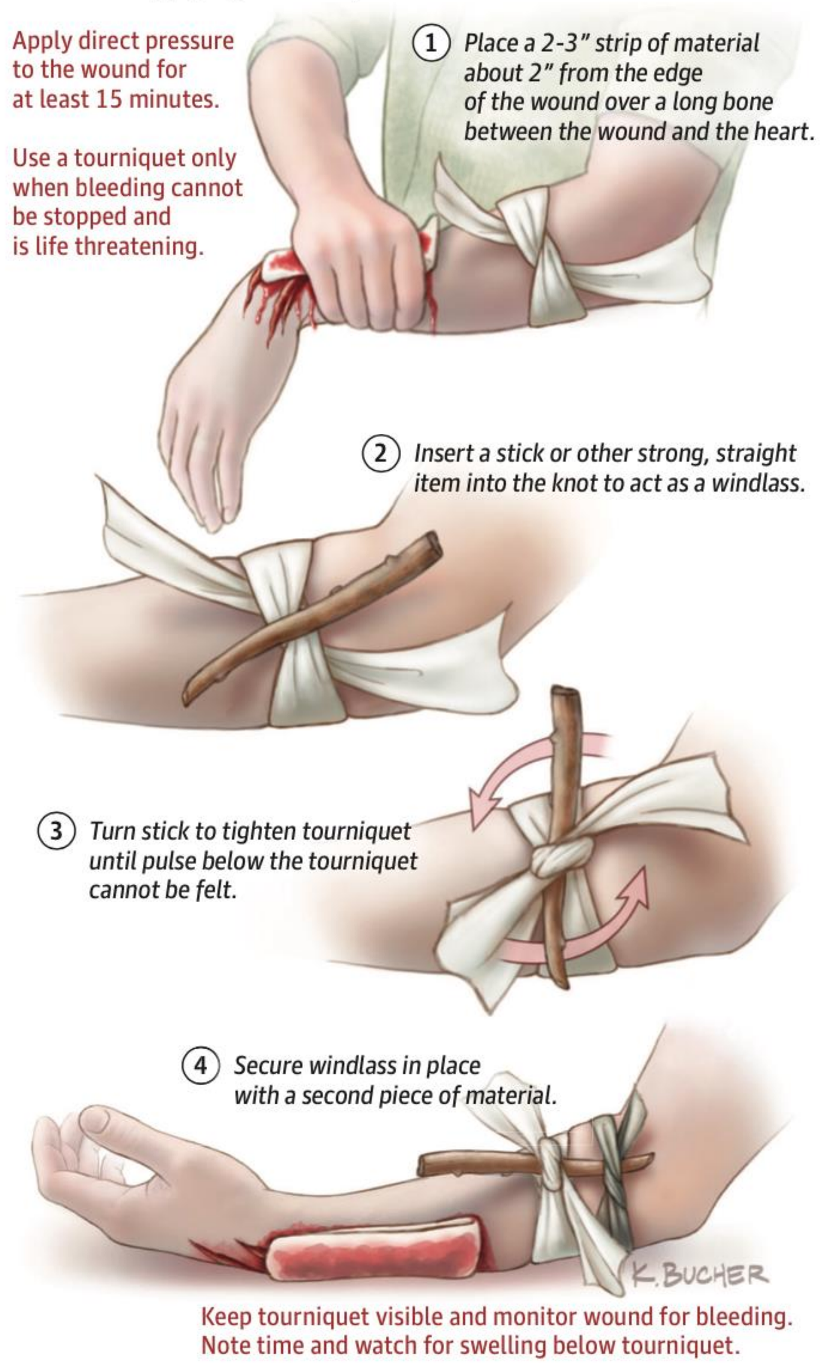
Tourniquets can be made out of any available material. For example, you can use a bandage, strip of cloth, or even a t-shirt. The material should be at least 2 to 3 inches wide. The material should also overlap itself. Using thin straps or material less than 2 inches wide can rip or cut the skin.

Tourniquets often use a windlass device to increase tightening. Inflated tourniquets (for example, those made from blood pressure cuffs) can work well. But they must be carefully watched for small leaks.

The injured blood vessel is not always right below the skin wound. Place the tourniquet between the injured vessel and the heart, about 2 inches from the closest wound edge. There should be no foreign objects (for example, items in a pocket) beneath the tourniquet. Place the tourniquet over a bone, not at joint.

Galante JM. Using Tourniquets to Stop Bleeding. JAMA. 2017;317(14):1490-1490. doi:10.1001/jama.2015.8581

Applying a tourniquet with a windlass device



What Else Do I Need to Know?

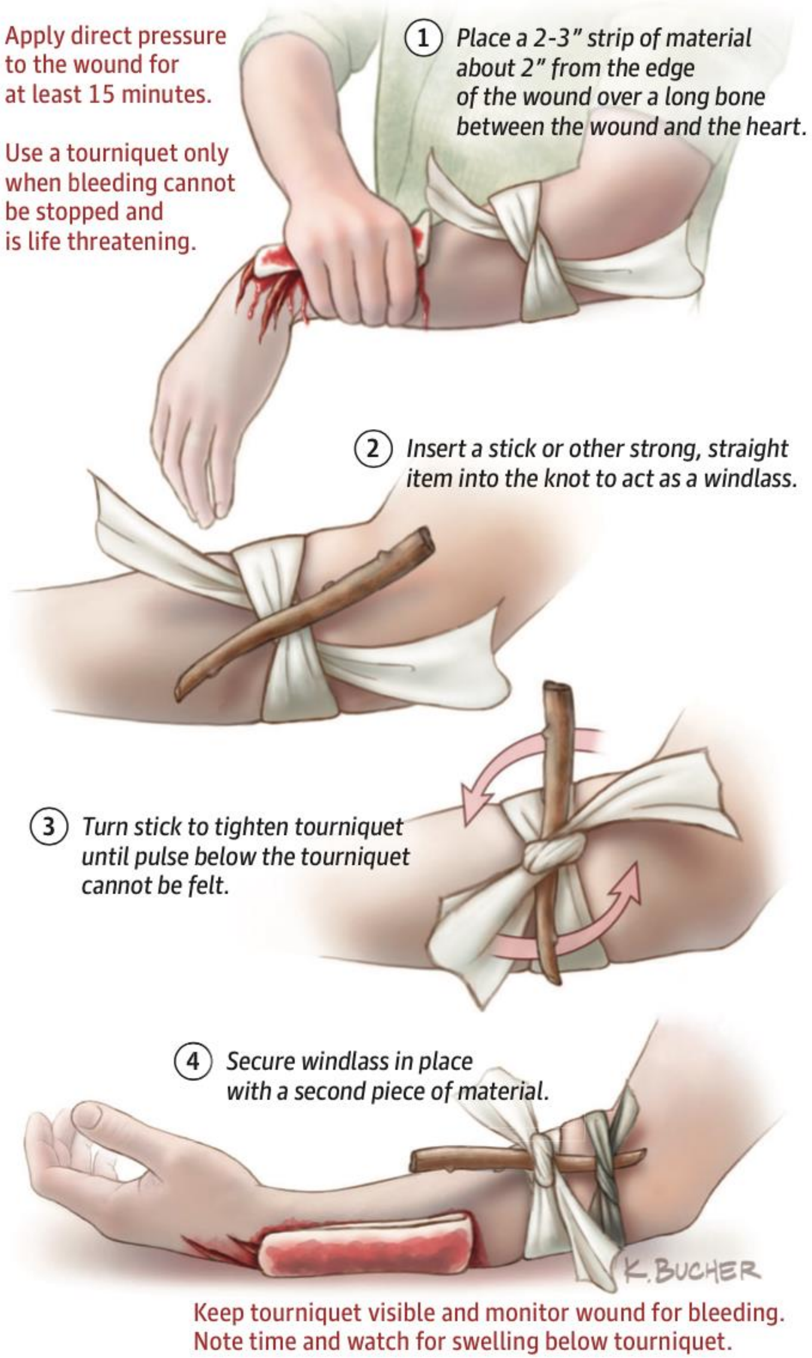
All bleeding should stop soon after you tighten the tourniquet. You must place a second tourniquet above the first if bleeding does not stop and you cannot tighten the tourniquet, or if the arm or leg swells above the tourniquet.

Once bleeding is controlled

- Mark the time on the arm or leg
- Keep the tourniquet visible
- Check the arm or leg every 2 hours for
  - Swelling
  - New bleeding
  - Increased muscle stiffness

Do not remove or loosen the tourniquet until professional care is available.

Applying a tourniquet with a windlass device



Galante JM. Using Tourniquets to Stop Bleeding. JAMA. 2017;317(14):1490-1490. doi:10.1001/jama.2015.8581

EUROPEAN RESUSCITATION COUNCIL

Management of open chest wounds

- Leave an open chest wound exposed to freely communicate with the external environment.

- Do not apply a dressing or cover the wound.
- If necessary:
  - Control localised bleeding with direct pressure
  - Apply a specialised non-occlusive or vented dressing ensuring a free outflow of gas during expiration (training required).

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

EUROPEAN RESUSCITATION COUNCIL

Cervical spine motion restriction and stabilisation

- The routine application of a cervical collar by a first aid provider is not recommended.
- In a suspected cervical spine injury:
  - If the casualty is awake and alert, encourage them to self-maintain their neck in a stable position.
  - If the casualty is unconscious or uncooperative consider immobilising the neck using manual stabilisation techniques.
    - Head squeeze:
      - With the casualty lying supine hold the casualty's head between your hands.
      - Position your hands so that the thumbs are above the casualty's ears and the other fingers are below the ear
      - Do not cover the ears so that the casualty can hear.

https://www.uptodate.com/contents/image?topicKey=ANEST%2F94581&imageKey=ANEST%2F106320&source=see_link

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

- Trapezium squeeze:
  - With the casualty lying supine hold the casualty's trapezius muscles on either side of the head with your hands (thumbs anterior to the trapezius muscle). In simple terms – hold the casualty's shoulders with the hands thumbs up
  - Firmly squeeze the head between the forearms with the forearms placed approximately at the level of the ears.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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1

STAY with the person until they are awake and alert after the seizure.

- ✓ **Time** the seizure
- ✓ Remain **calm**
- ✓ Check for **medical ID**

2

Keep the person **SAFE**.

- ✓ Move or guide away from **harm**

3

Turn the person onto their **SIDE** if they are not awake and aware.

- ✓ Keep **airway clear**
- ✓ **Loosen tight clothes** around neck
- ✓ Put **something small and soft** under the head

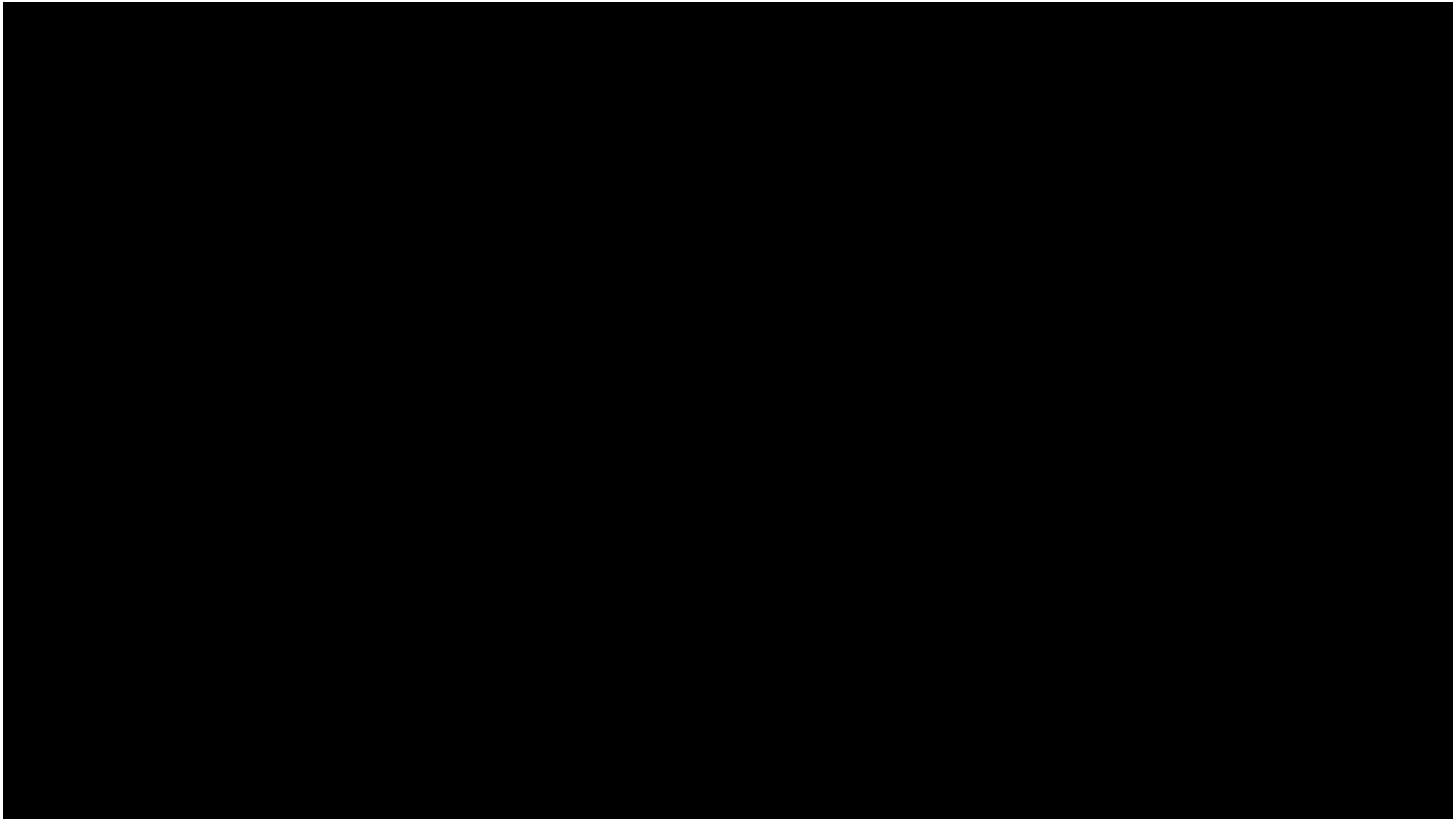
Call 911 if...

- Seizure lasts longer than 5 minutes
- Person does not return to their usual state
- Person is injured, pregnant, or sick
- Repeated seizures
- First time seizure
- Difficulty breathing
- Seizure occurs in water

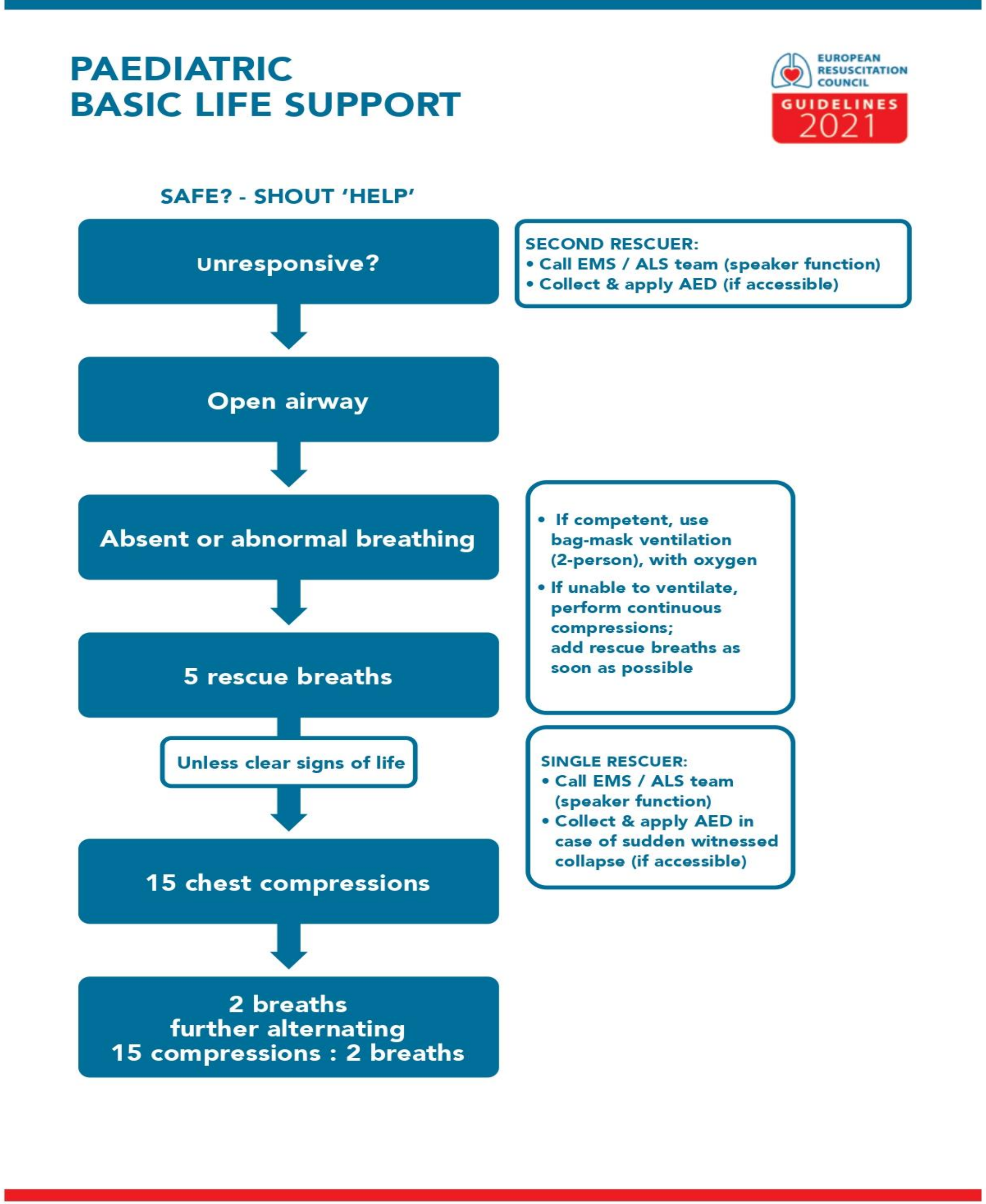
Do NOT

- ✗ Do **NOT** restrain.
- ✗ Do **NOT** put any objects in their mouth.
  - **Rescue medicines can be given** if prescribed by a health care professional

https://www.epilepsy.com/living-epilepsy/seizure-first-aid-and-safety/first-aid-seizures-stay-safe-side

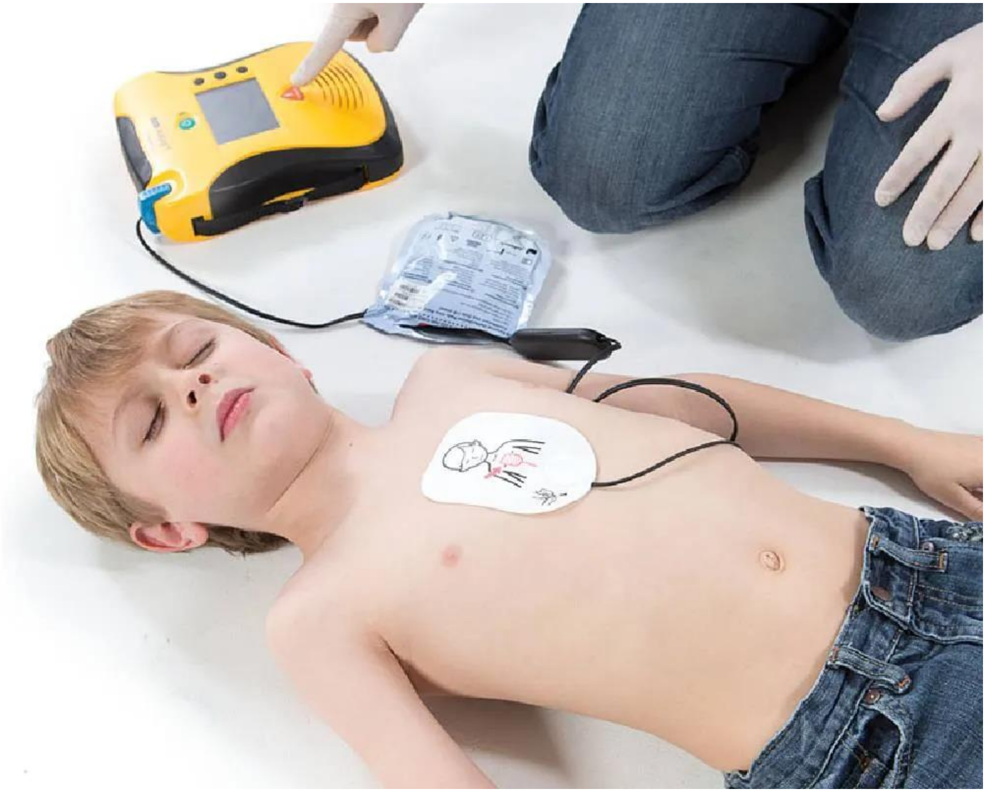


https://www.youtube.com/watch?v=JbRYXnQiSRo

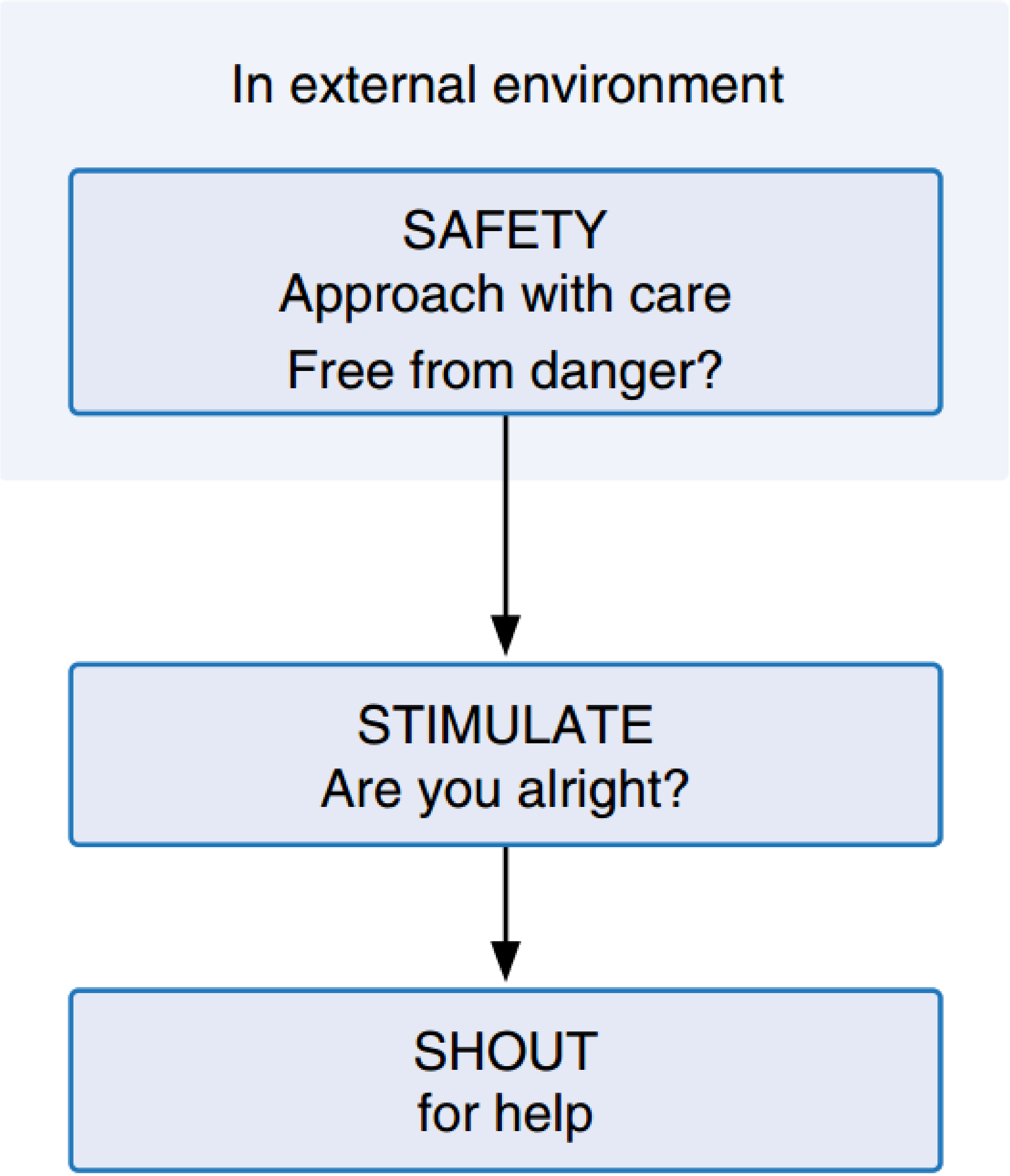


Van De Voorde P, Turner NM, Djakow J, De Lucas N, Martinez-Mejias A, Biarent D, et al. European Resuscitation Council Guidelines 2021: Paediatric Life Support. Resuscitation 2021;161:327–87. https://doi.org/10.1016/j.resuscitation.2021.02.015.

Paediatric basic life support (BLS) is not simply a scaled-down version of the adult algorithm. The epidemiology, pathophysiology and common aetiologies of paediatric cardiorespiratory arrest are different from those in adults. Cardiorespiratory arrest in infants and children is not usually the result of a primary cardiac cause, but instead is the end result of progressive respiratory failure or shock. To reflect these differences, the ideal sequence of BLS is different in the paediatric, newborn and adult populations. This must be balanced against the educational advantages of training using a general BLS algorithm so, where possible, guidelines are standardised for all ages to aid teaching and retention.



Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.



Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

S – Safety

In the external environment, it is essential that the rescuer does not become a second victim, and that the child is removed from continuing danger as quickly as possible. These considerations should precede the initial airway assessment. Within a healthcare setting, the likelihood of risk is minimal and help should be summoned as soon as the victim is found to be unresponsive.

S – Stimulate

The initial simple assessment of responsiveness consists of asking the child loudly 'Are you alright?' and gently applying a stimulus, such as holding the head and shaking the arm. This will avoid exacerbating a possible neck injury whilst still waking a sleeping child. Infants and very small children who cannot talk yet, and older children who are very scared, are unlikely to reply meaningfully, but may make some sound or open their eyes to the rescuer's voice or touch.

S – Shout for help

When more than one rescuer is present, one should commence BLS while others activate the emergency medical services (EMS) system, collect the emergency equipment (e.g. manual defibrillator or automated external defibrillator (AED)) and then return to assist in the BLS effort (including application of defibrillator pads). Bystanders may be asked to help.

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

Figure 16.3 Head tilt and chin lift in infants: neutral position in an infant

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Figure 16.4 Head tilt and chin lift: 'sniffing' position in a child

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LOOK	for chest and/or abdominal movement
LISTEN	for breath sounds
FEEL	for breath

Figure 16.5 Looking, listening and feeling

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

If the head tilt/chin lift manoeuvre is not possible or is contraindicated (e.g. suspected neck injury) then the jaw thrust manoeuvre can be performed. This is achieved by placing one or two fingers under the angle of the mandible bilaterally and lifting the jaw upwards (towards the sky). This technique may be easier if the rescuer's elbows are resting on the same surface as the child is lying on. A small degree of head tilt may also be applied if there is no concern about neck injury. This is shown in Figure 16.6.

(a) (b)

Figure 16.6 (a, b) Jaw thrust

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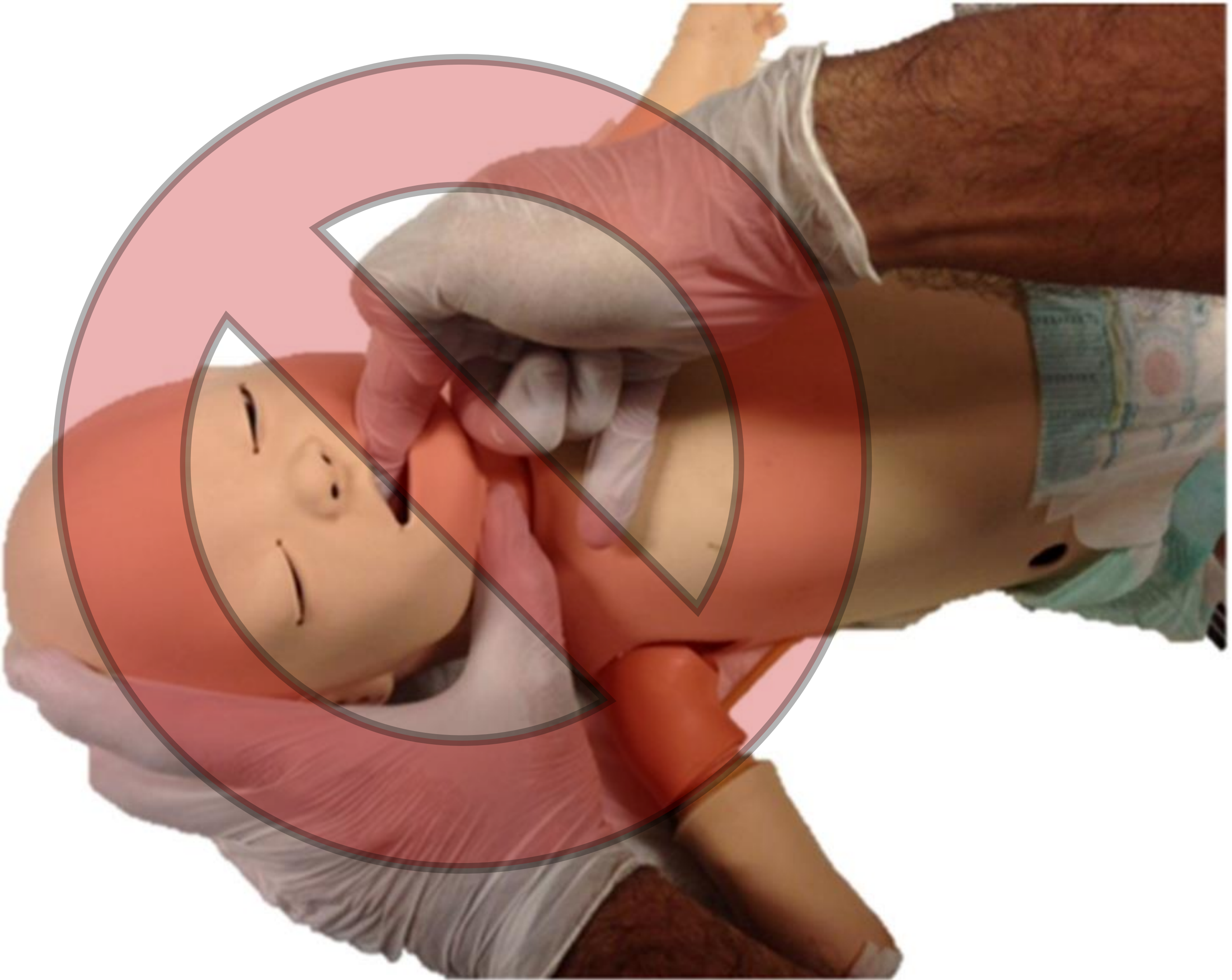
The blind finger sweep technique for removal of a foreign body (see Section 16.4) should not be used in children. The child's soft palate is easily damaged and bleeding from within the mouth can worsen the situation. Furthermore, foreign bodies may be forced further down the airway, becoming lodged below the vocal cords (vocal folds) making removal even more difficult. In the child with a tracheostomy, additional airway opening procedures may be necessary (see Chapter 19).



Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.
Tonson la Tour A, Sanchez O, Gervaix A, Vunda A (2017) Blind Finger Sweep Maneuver is Not Only Dangerous but Could Be Fatal. J Emerg Med Trauma Surg Care 1: 003.

[B] Breathing

If normal breathing recommences after the airway is open, the child should be turned onto their side in the recovery position, maintaining the open airway. Someone should continue to monitor the child for normal breathing while help is sought.

If the airway-opening techniques described earlier do not result in the resumption of adequate breathing within 10 seconds, **five initial rescue breaths should be given**. The rescuer should distinguish between adequate breathing and ineffective, gasping or obstructed breathing. Agonal gasps are characterised by irregular, infrequent, deep breaths. If in doubt, attempt rescue breathing.

While the airway is kept open as described, the rescuer breathes in and seals their mouth around the victim's mouth (for a child), or mouth and nose (for an infant, as shown in Figure 16.7). If the mouth alone is used, then the nose may be pinched closed using the thumb and index fingers of the hand that is maintaining the head tilt. Slow exhalation (1 second) by the rescuer should cause the patient's chest to visibly rise. Too vigorous a breath will cause gastric inflation and increase the chance of regurgitation of stomach contents into the lungs. The rescuer should take a breath between rescue breaths to maximise oxygenation of the victim.

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Figure 16.7 Mouth to mouth and nose in an infant

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General guidance for exhaled air resuscitation

- The chest should be seen to rise
- Inflation pressure may be higher because the airway is small
- Slow breaths at the lowest pressure reduce gastric distension
- As soon as possible, change to a self-inflating bag

If the chest does not rise, then the airway is not clear. The usual cause is failure to correctly apply the airway-opening techniques discussed. Therefore, the first thing to do is to readjust the head tilt/chin lift position and try again. If this does not work, a jaw thrust should be tried. It is not always feasible for a single rescuer to open the airway using this technique and perform exhaled air resuscitation; if two rescuers are present, one should maintain the airway whilst the other breathes for the child. Up to five attempts should be attempted to achieve effective breaths. If still unsuccessful, the rescuer should move on to chest compressions.

Failure of both head tilt/chin lift and jaw thrust should lead to the suspicion that a foreign body is causing the obstruction and appropriate action should be taken (see Section 16.4).

While performing rescue breaths, any gagging or coughing in response to these actions should be noted. These responses, or their absence, will form part of the assessment of 'signs of life' described in the next section.

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- Immediately proceed with 15 chest compressions, unless there are clear signs of circulation (such as movement, coughing). Rather than looking at each factor independently, focus on consistent good quality compressions as defined by:
  - Rate: 100–120 min^{-1} for both infants and children.
  - Depth: depress the lower half of the sternum by at least one third of the anterior–posterior dimension of the chest. Compressions should never be deeper than the adult 6 cm limit (approx. an adult thumb's length).
  - Recoil: Avoid leaning. Release all pressure between compressions and allow for complete chest recoil.

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Children. The rescuer should place the heel of one hand over the lower half of the sternum. The fingers should be lifted to ensure that pressure is not applied over the child's ribs. The rescuer is best positioned vertically above the child's chest and, with a straight arm (elbow extended), the sternum is compressed to depress it by at least one-third of the depth of the chest (at least 5 cm) as shown in Figure 16.10. For larger children, or for small rescuers, this may be achieved more reliably by using both hands with the fingers interlocked (Figure 16.11). The rescuer should choose one or two hands to achieve the desired compression of at least one-third of the depth of the chest. It is important to avoid leaning and to allow for complete chest recoil in between.

Figure 16.10 Chest compressions: one-handed technique in a child
Children's Health Queensland/CC BY 4.0

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

Figure 16.11 Chest compressions: two-handed technique in a child

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EUROPEAN RESUSCITATION COUNCIL

CPR in children

- Adult CPR techniques can be used on children
- Compressions at least 1/3 of the depth of the chest

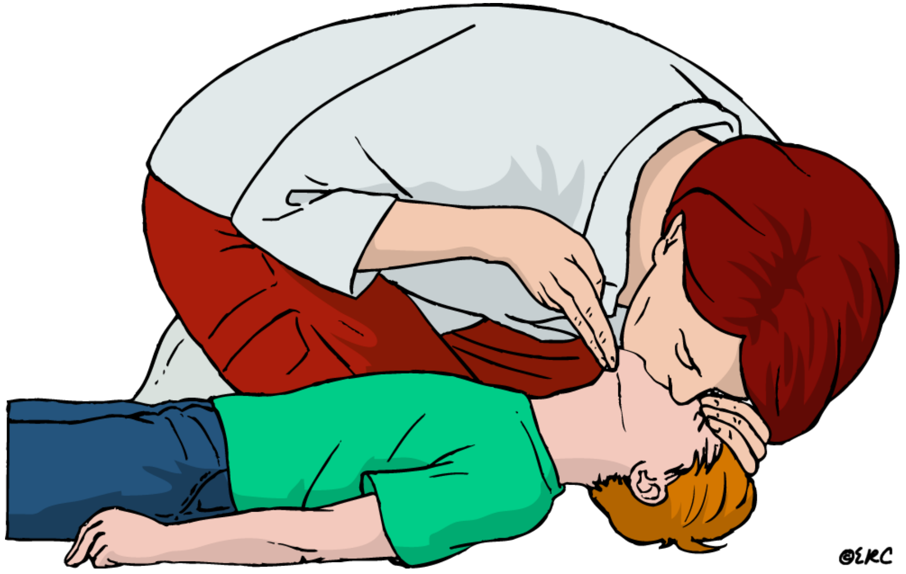

Figure 16.8 Chest compressions: two-thumb technique in an infant
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Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

Figure 16.9 Chest compressions: two-finger technique in an infant

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AED in children

- Age > 8 years
  - use adult AED
- Age 1-8 years
  - use paediatric pads / settings if available (otherwise use adult mode)
- Age < 1 year
  - use only if manufacturer instructions indicate it is safe

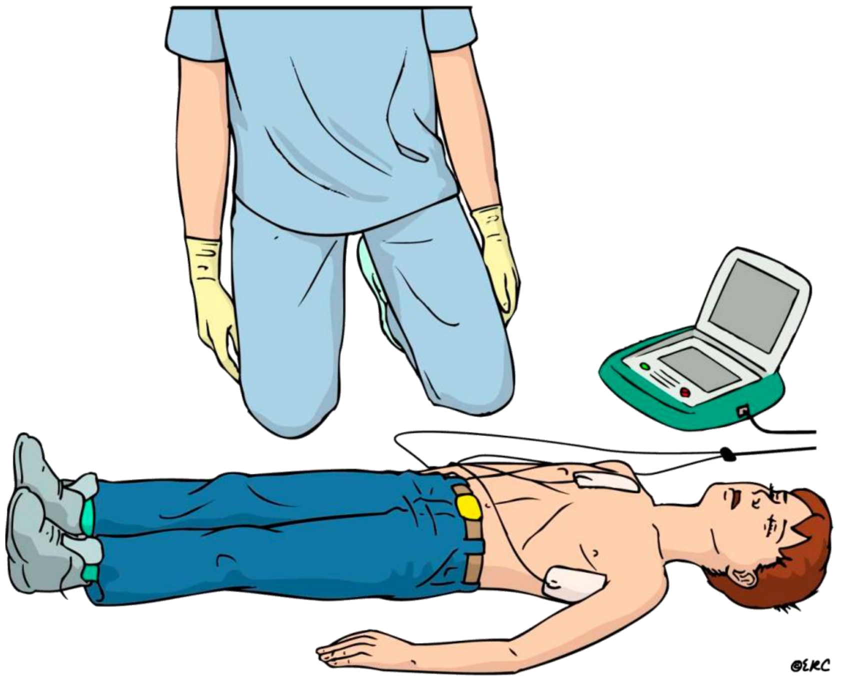
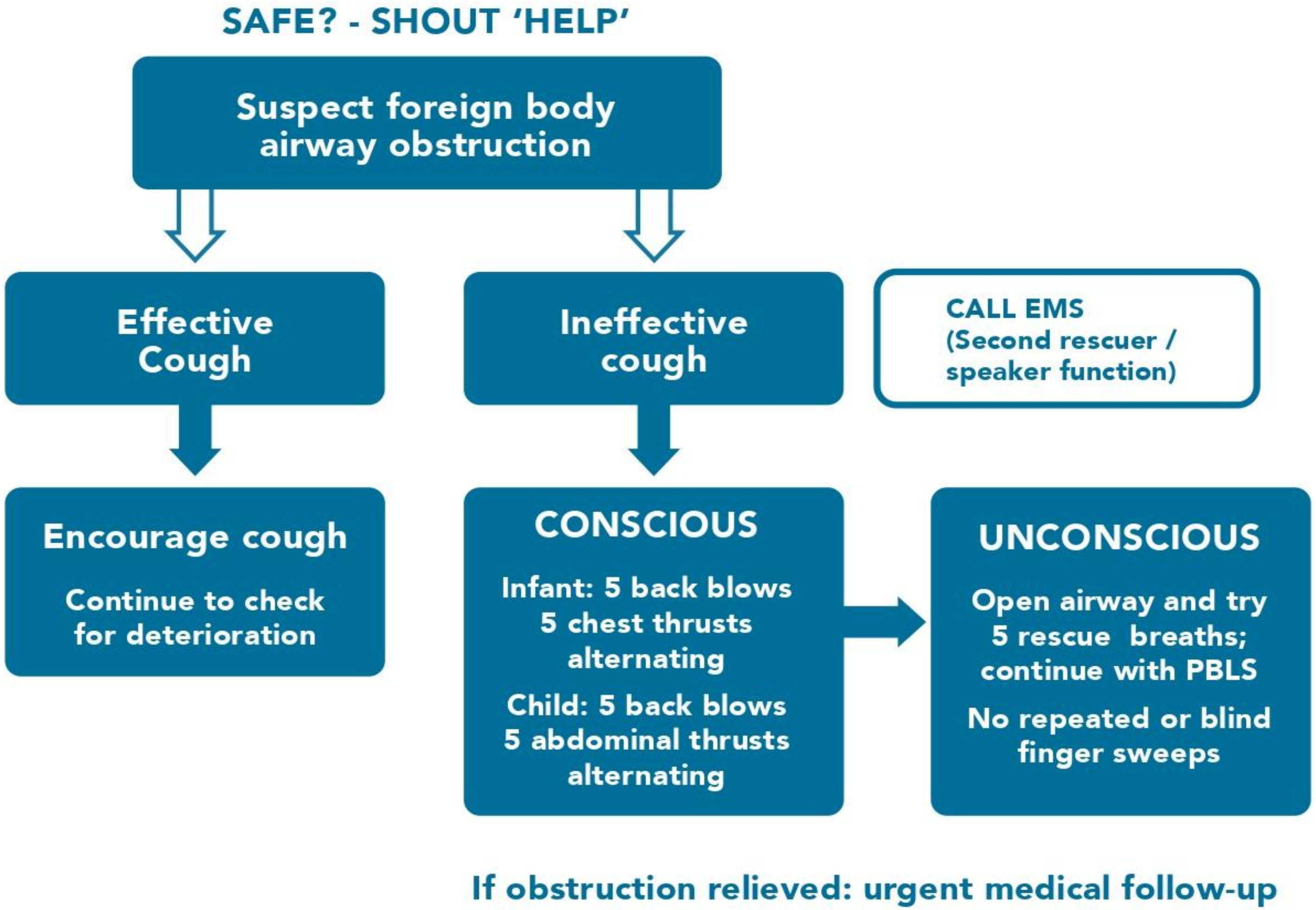


Table 16.1 Summary of basic life support techniques in infants and children

	Infant (under 1 year)	Child (1 year to puberty)
Airway		
Head tilt position	Neutral	Sniffing
Breathing		
Initial slow breaths	Five	Five
Chest compressions		
Landmark	Lower half of sternum	Lower half of sternum
Technique	Two-thumb or two-finger	One-hand or two-hand
CPR ratio	15:2	15:2

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

PAEDIATRIC FOREIGN BODY AIRWAY OBSTRUCTION



Van De Voorde P, Turner NM, Djakow J, De Lucas N, Martinez-Mejias A, Biarent D, et al. European Resuscitation Council Guidelines 2021: Paediatric Life Support. Resuscitation 2021;161:327–87. https://doi.org/10.1016/j.resuscitation.2021.02.015.

Infants

Abdominal thrusts may cause intra-abdominal injury in infants. A combination of back blows and chest thrusts is recommended for the relief of FBAO in this age group.

The baby is placed along one of the rescuer's arms in a head-down position, with the rescuer's hand supporting the infant's jaw in such a way as to keep it open, in the neutral position. The rescuer then rests their arm along their own thigh and delivers five back blows between the infant's shoulder blades with the heel of the free hand.

If the obstruction is not relieved the baby is turned over and laid along the rescuer's thigh, still in a head-down position. Five chest thrusts are given – using the same landmarks as for cardiac compression but at a slower rate of 1 per second and sharper than chest compressions. If an infant is too large to allow use of the single-arm technique described, then the same manoeuvres can be performed by laying the baby across the rescuer's lap. These techniques are shown in Figures 16.14 and 16.15. In a large infant the heel of the hand can be used if the two-finger technique is not effective or deemed too difficult to do.

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Figure 16.14 Back blows in an infant

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Figure 16.15 Chest thrusts in an infant

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Figure 16.17 Abdominal thrust in a child
Children's Health Queensland/CC BY 4.0

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

F.8 Button battery ingestion

Any child who has ingested or is suspected of ingesting a button battery is a **time critical emergency**. Ingestion of button batteries can kill even if the child is asymptomatic. It is also important to suspect button battery ingestion in any presumed 'coin' or other foreign body ingestion.

Button battery ingestion affects all age groups, although most cases involve children under the age of 6 years who mistake the battery for a sweet, or older people with confusion or poor vision who mistake the battery for a pill. Older children, young people and adults may ingest batteries as a means of self-harming (Box F.1). There may be no history of foreign body ingestion (20–40% patients).

Box F.1 Safeguarding and mental health

- For all children of any age it is important to investigate circumstances around the ingestion of a button battery
- Any potentially vulnerable children or young people must be referred to the local safeguarding team
- Consider the possibility of attempted suicide in the older child or adolescent who will need a full CAMHS (Child and Adolescent Mental Health Services) assessment in addition to medical management

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Children at greatest risk are:

- Those younger than 6 years of age
- Ingested battery over 20 mm diameter, which is more likely to become lodged in the oesophagus, and have been found to be responsible for more fatal or serious ingestions (Litovitz et al., 2010)
- Multiple batteries ingested or co-ingestion with strong magnets

Consider the possibility of battery ingestion in those with:

- Acute airway obstruction (stridor), drooling, wheezing or other noisy breathing
- Vomiting, abdominal pain or diarrhoea
- Chest pain or discomfort
- Difficulty swallowing
- Decreased appetite or refusal to eat, or coughing, choking or gagging with eating or drinking

In severe cases, there may be severe abdominal pain, bloody stools, irritability, fever and haemorrhage with subsequent stricture or fistula formation, even after removal of the battery.

Early use of a metal detector may help to confirm the presence of an ingested button battery.

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

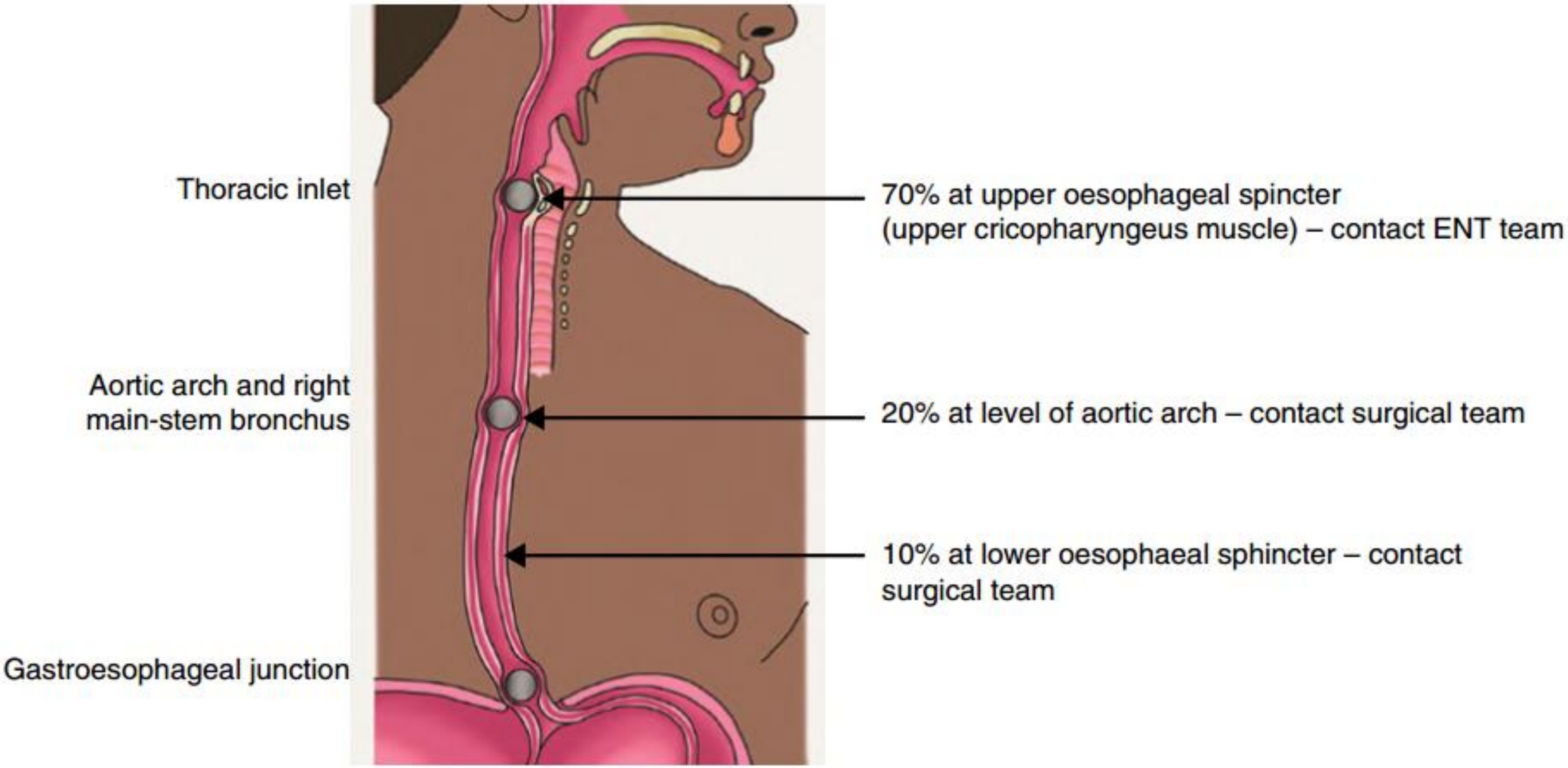
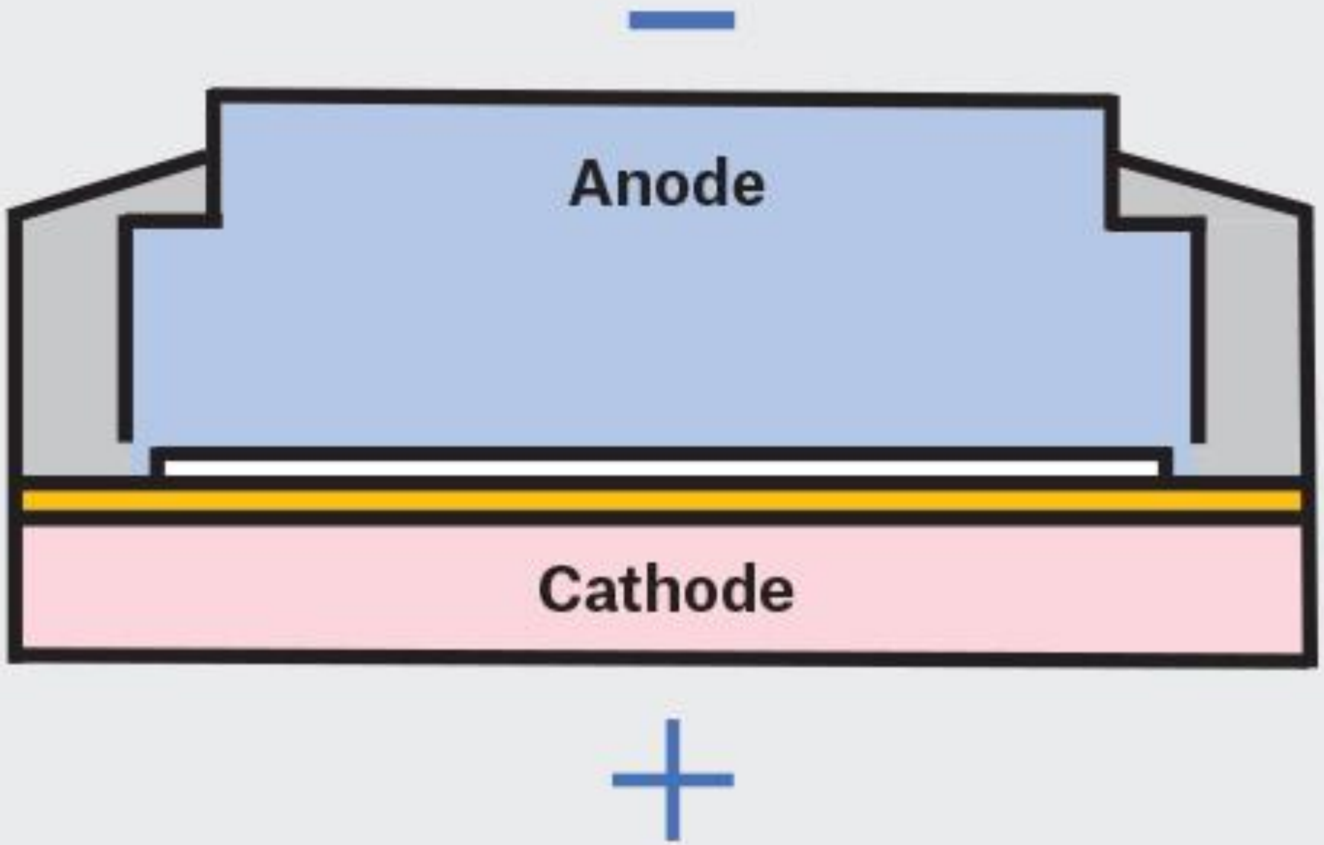


Figure F.3 The most common sites for button batteries to become lodged in children and young people

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

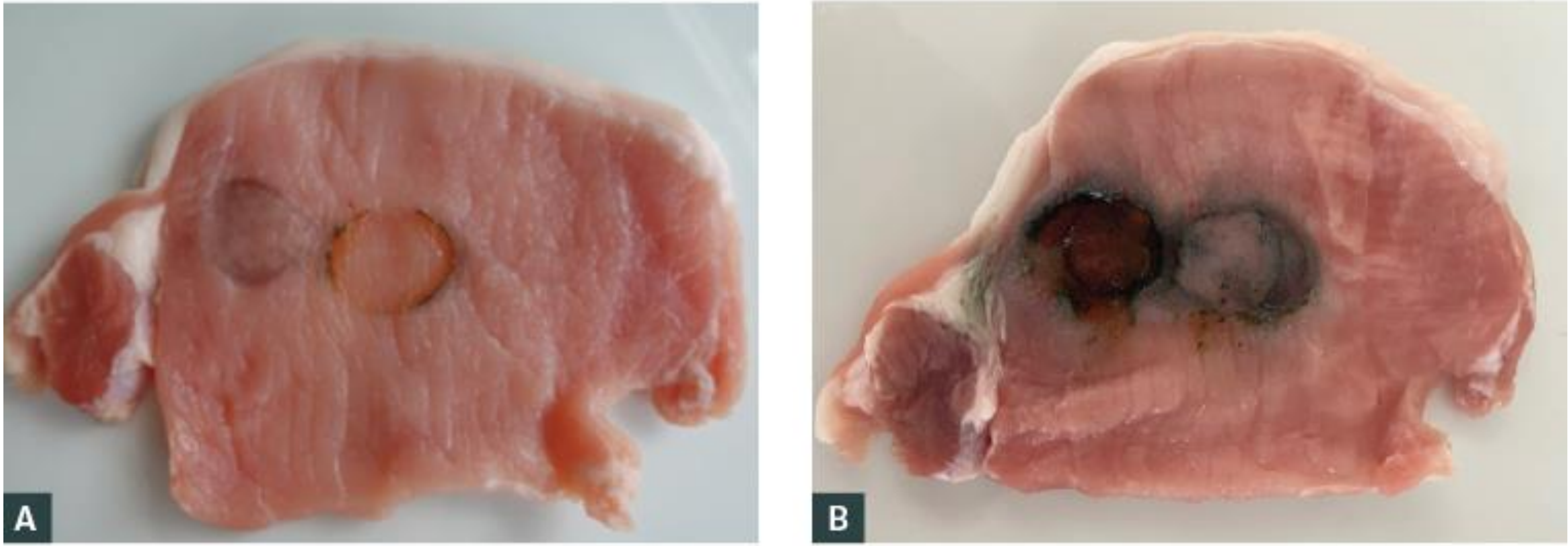
$$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$$

$$Na + OH^- \rightarrow NaOH \rightarrow \text{Liquefactive necrosis}$$



$$2Cl^- \rightarrow Cl_2 + 2e^-$$

Park S-J, Burns H. Button battery injury: An update. Aust J Gen Pract 2022;51:471–5. https://doi.org/10.31128/AJGP-03-21-5873.



Park S-J, Burns H. Button battery injury: An update. Aust J Gen Pract 2022;51:471–5. https://doi.org/10.31128/AJGP-03-21-5873.

Animal studies have been helpful in understanding the pathophysiology of BBI-caused injury[10] to be caustic rather than thermal. When a BB becomes entrapped in the digestive tract, mucosa bridges the positive and negative terminals of the battery, thus completing a circuit and allowing current to flow. Electrical current from the battery results in generation of hydroxide radicals in the esophageal tissue. The presence of hydroxide radicals rapidly raises the pH of the tissue leading to caustic injury and associated coagulative necrosis. Depending on the site of battery impaction, necrosis weakens the esophageal wall over a short period of time and may extend through to adjacent tissue, such as the trachea or great vessels. The process of coagulative necrosis has been demonstrated to start within 15 minutes of contact.[10] Even with batteries that have been ingested after use (and presumably without significant residual capacitance), significant injury may still be possible.[6] This reality provides further evidence of the power of the newer lithium cells, which have a much longer storage life than traditional alkaline cells.

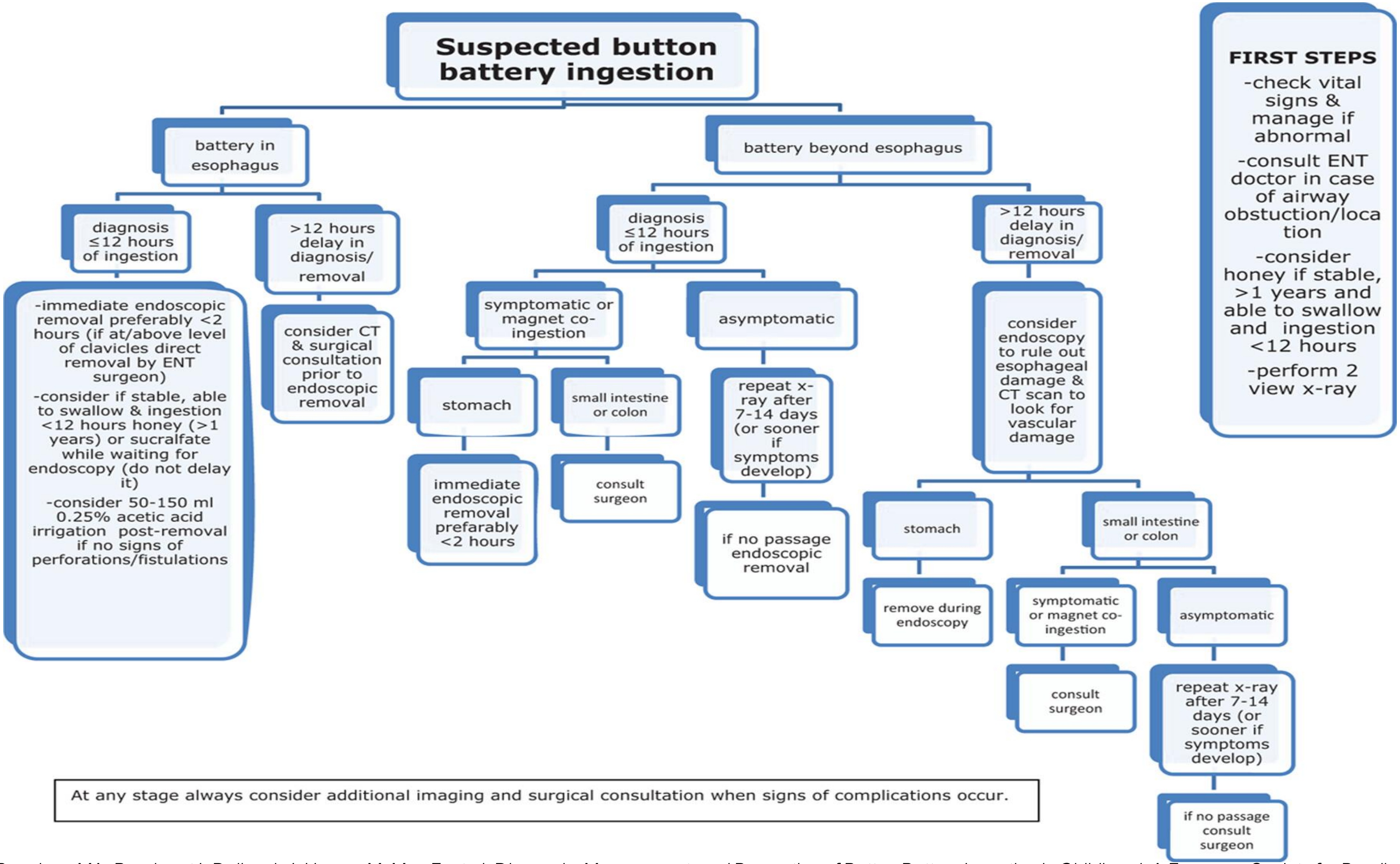
Leinwand K, Brumbaugh DE, Kramer RE. Button Battery Ingestion in Children. Gastrointest Endosc Clin N Am 2016;26:99–118. https://doi.org/10.1016/j.giec.2015.08.003.

Khalaf RT, Ruan W, Orkin S, Wilsey M, Fishman DS, Mallon D, et al. Gastric injury secondary to button battery ingestions: a retrospective multicenter review. Gastrointestinal Endoscopy 2020;92:276–83. https://doi.org/10.1016/j.gie.2020.04.037.

TABLE 1. Button battery complications

Respiratory tract	
	Nasal septal perforation
	Intranasal synechiae
	Tympanic membrane perforation
	Facial nerve paralysis
	Recurrent laryngeal nerve injury
	Thyroid hemorrhage
	Tracheo-esophageal fistula
	Battery aspiration
	Pulmonary hemorrhage
	Bronchial stenosis
	Pneumonia
Gastrointestinal tract	
	Esophageal perforation
	Esophageal stenosis
	Stomach perforation
	Small intestine perforation
Other	
	Aortoesophageal or other major arterial branch fistula
	Massive hemorrhage
	Mediastinitis
	Spondylodiscitis
	Periorbital cellulitis

Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.



Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.

On the basis of the available data, the ESPGHAN task force for BB ingestions concludes that:

1. Presence of a BB in the esophagus is considered to be a medical emergency and endoscopic removal is necessary as soon as possible (<2 hours).
2. Mitigation strategies with honey and sucralfate can be considered in specific cases while waiting for endoscopy, but should not delay it.
3. Imaging (CT scan) is important to uncover vascular injury and should be performed in case of delayed (>12 hours after ingestion) diagnosis/removal (before removal) or if severe mucosal damage is seen during endoscopy.
4. Removal of gastric BB is necessary in symptomatic cases, in case of co-ingestion with a magnet or in delayed diagnosis.

Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.

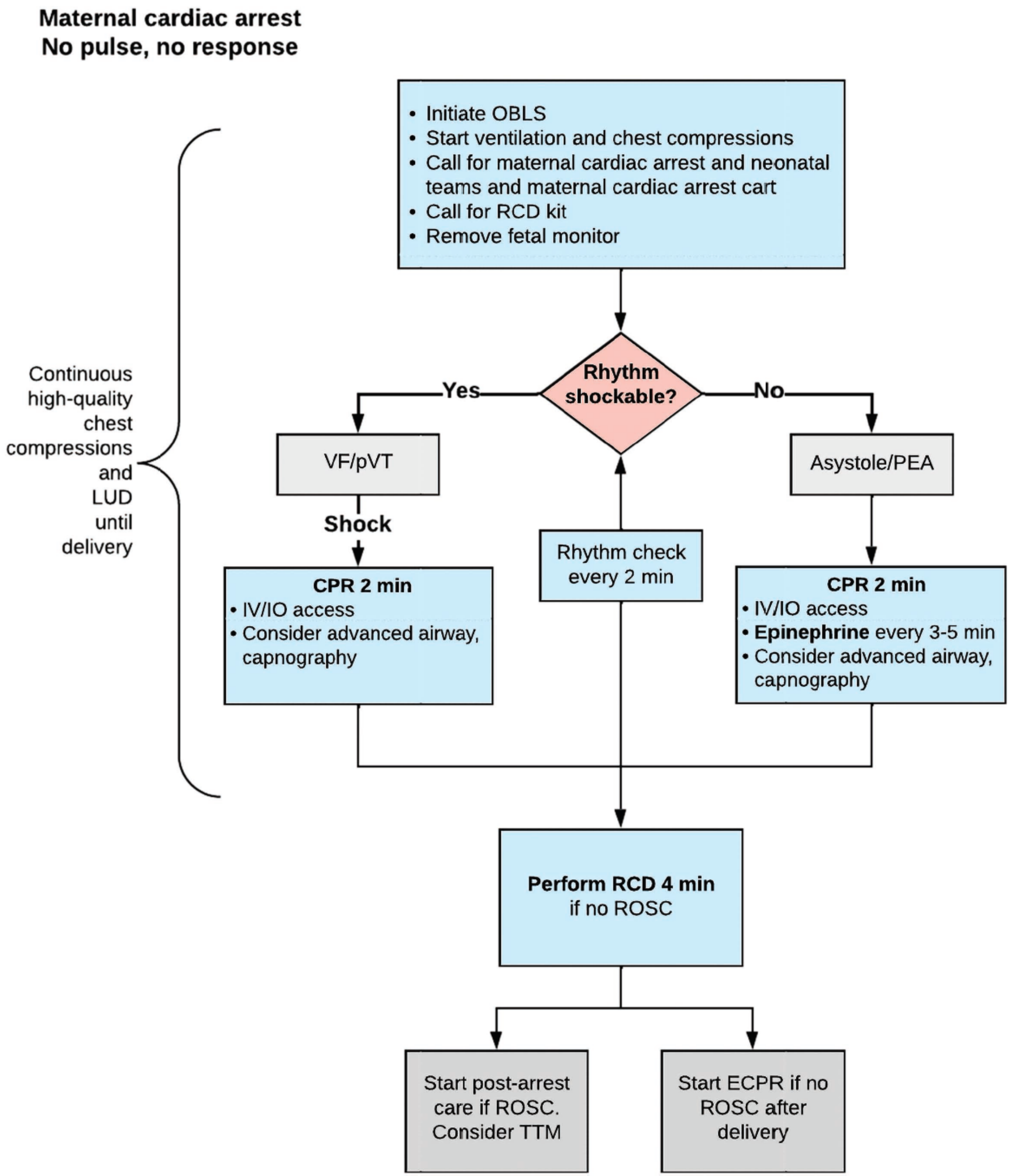
OBSTETRIC LIFE SUPPORT

- Known pregnancy
- Fundus ≥ umbilicus
- In-hospital

Abbreviations

CPR - cardiopulmonary resuscitation
ECPR - extracorporeal cardiopulmonary resuscitation
IO - intraosseous
IV - intravenous
LUD - left uterine displacement
OBLS - Obstetric Life Support
PEA - pulseless electrical activity
pVT - ventricular tachycardia
RCD - resuscitative cesarean delivery
ROSC - return of spontaneous circulation
TTM - targeted temperature management
VF - ventricular fibrillation

B	Bleeding
A	Anesthesia
A	Amniotic fluid embolism
C	Cardiovascular/cardiomyopathy
C	Clot/cerebrovascular
T	Trauma
O	Overdose (magnesium sulfate/opioids/other)
L	Lung injury/Acute respiratory distress syndrome
I	Ions (glucose/K+)
F	Fever (sepsis)
E	Emergency hypertension/eclampsia



Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC Press; 2024.

FIGURE 5.6 Obstetric Life Support algorithm with modifications of cardiopulmonary resuscitation (known pregnancy >20 weeks).

LEFT UTERINE DISPLACEMENT

L'utero gravido a termine può ridurre il ritorno venoso al cuore materno del 25%-30%. In caso di arresto cardiaco materno, l'utero gravido ostacola anche il ritorno di sangue al cuore materno durante la RCP. Pertanto, la dislocazione manuale sinistra LUD è un ausilio fondamentale per eseguire una RCP di alta qualità quando l'utero è a livello dell'ombelico o più in alto. Se la gravidanza è chiaramente visibile all'esame addominale e il può essere percepito all'altezza o al di sopra dell'ombelico, l'utero deve essere spostato manualmente verso l'alto e a sinistra per consentire un migliore ritorno di sangue al cuore.

La LUD può essere realizzata in due modi:

1. Inginocchiarsi sul lato destro della paziente e spingere l'utero verso sinistra e leggermente in alto (Figura 5.4).

2. Inginocchiarsi sul lato sinistro della paziente e, con entrambe le mani, tirare l'utero verso sinistra e leggermente verso l'alto (Figura 5.5).

* Questi passaggi sono fondamentali per garantire una RCP di alta qualità in una gravida

FIGURE 5.4 Proper left uterine displacement from maternal RIGHT side. Use hands to push the uterus up and over toward the maternal left side to lift the uterus off the great vessels.

FIGURE 5.5 Proper left uterine displacement from the maternal LEFT side. Use the hands to pull the uterus up and over toward the maternal left side to lift the uterus off the great vessels.

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC Press;

DEFIBRILLATION

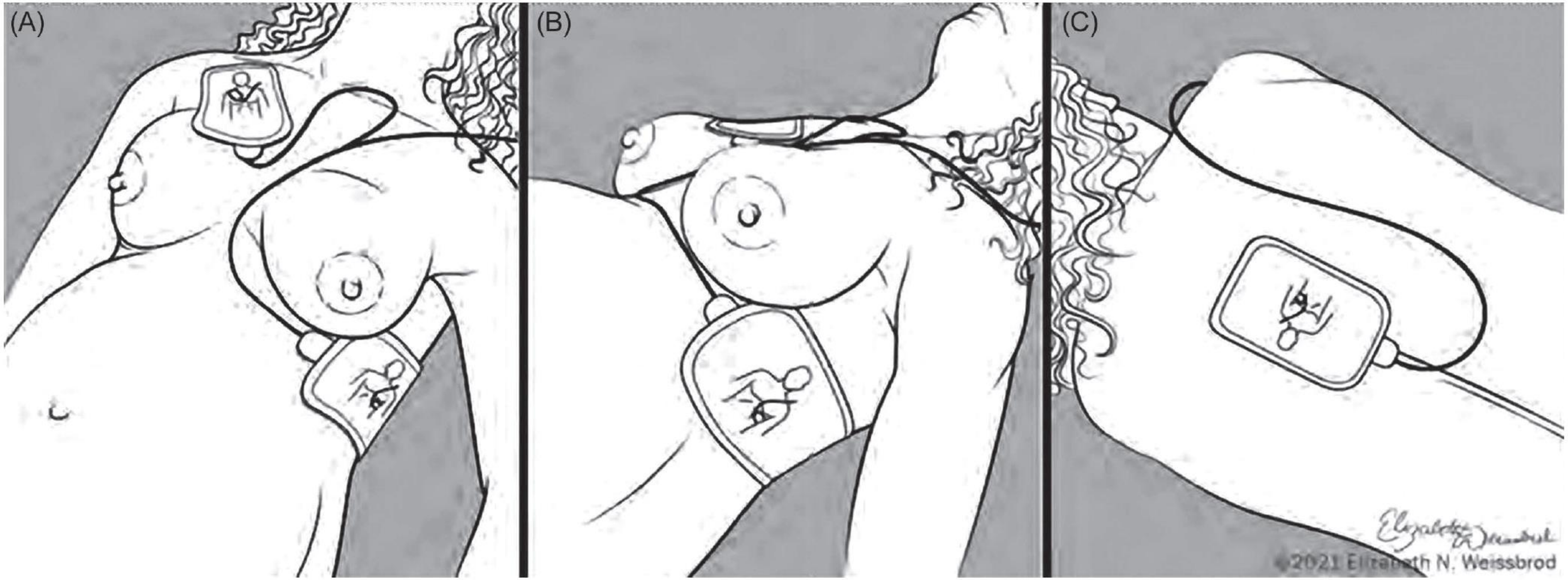


FIGURE 5.3 Proper automated external defibrillator pad placement. (A) Right anterior position. (B) Left anterolateral position. (C) Posterior position. **Note:** Posterior pad placement is not recommended in patients with suspected spinal cord injury, to limit movement that may cause further injury.

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients.* First edition. CRC Press; 2024.

A pregnant patient's large, dense breasts may impede the ability to perform effective chest compressions as the fingers may rest atop the breast in an elevated position. This position may not allow for the proper force to be delivered with each chest compression. If this is the case, keep the heel of the hand on the sternum in the same place and slightly rotate the hand so the fingers point toward the patient's shoulder. This allows the hand to lay flat on the chest and allows maximum force to be applied to the sternum (Figure 5.2).

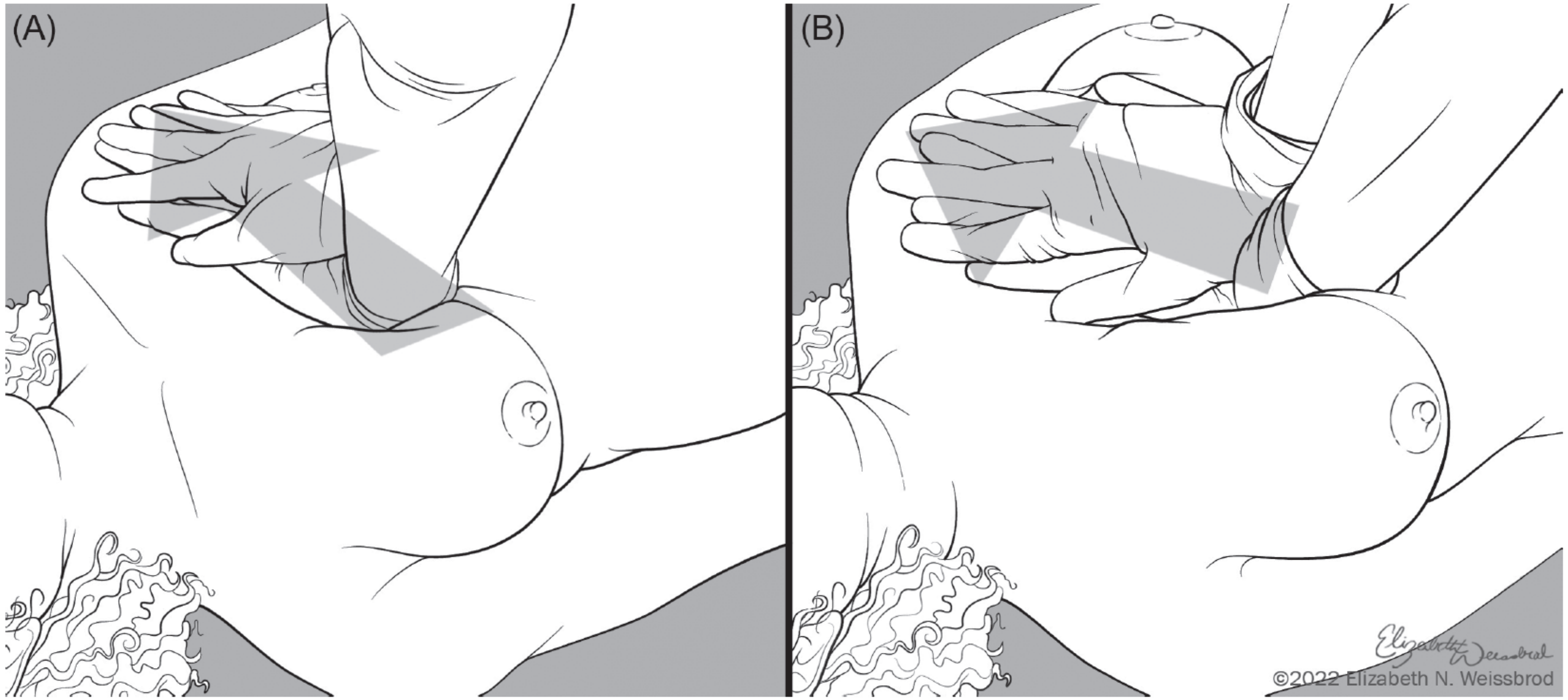


FIGURE 5.2 Proper hand placement for chest compressions on pregnant patients. (A) Proper hand placement on a pregnant patient. (B) If breast tissue is in the way, as can occur with large, pendulous breasts, slightly rotate the hand position toward the patient's shoulder to allow the proper delivery of downward force.

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients.* First edition. CRC Press;

VASCULAR ACCESS

- Accesso IV ottimale in gravidanza: Durante la gravidanza, l'ingrossamento dell'utero può comprimere l'aorta e la vena cava inferiore, rendendo essenziale stabilire un accesso IV al di sopra del diaframma.

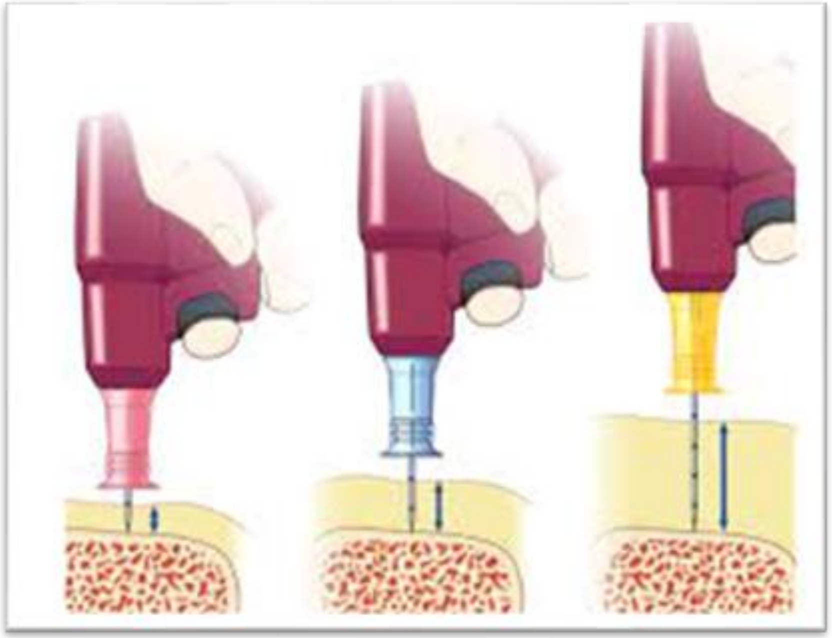
- Vantaggi del posizionamento alto della fleboclisi: L'accesso IV al di sopra del diaframma consente una rianimazione fluida più efficace e la somministrazione di farmaci quando necessario.

- In situazioni specifiche come la preeclampsia grave, il diabete di lunga durata o la malattia renale cronica, ottenere un accesso IV tradizionale può essere difficile.

- Accesso intraosseo (IO) come alternativa: Nei casi in cui l'accesso per via endovenosa è difficile, un'opzione alternativa è l'accesso intraosseo (IO), in particolare nell'omero prossimale. Questo metodo è affidabile, facile da eseguire e offre dinamiche di flusso simili a quelle delle linee centrali.

- Complicanze dell'accesso IO: Le complicazioni associate ai dispositivi IO possono includere disagio, difficoltà nell'aspirazione del midollo osseo e il rischio di aghi IO piegati o rotti. Una complicanza rara è la sindrome compartimentale, che si verifica in una piccola percentuale di pazienti con accesso per via endovenosa, in genere a causa della perdita del sito di penetrazione dell'ago.

- Transizione all'accesso endovenoso a lungo termine: Dopo una rianimazione riuscita, è consigliabile sostituire l'accesso IO con un accesso endovenoso a più lungo termine per l'assistenza continua.



Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC

OBSTETRIC LIFE SUPPORT

Unconscious female, reproductive age.
No pulse, no or agonal breathing
OBLS should be done simultaneously with ongoing, high-quality CPR

Abbreviations
ACLS - Advanced cardiac life support
AFE - amniotic fluid embolism
ARDS - acute respiratory distress syndrome
BDP - biparietal diameter
benzos - benzodiazopenes
CPR - cardiopulmonary resuscitation
ECPR - extracorporeal cardiopulmonary resuscitation
EGA - estimated gestational age
FL - femur length
LUD - left uterine displacement
OBLS - Obstetric Life Support
K - potassium
POC-US - point-of-care ultrasound
RCD - resuscitative cesarean delivery
ROSC - return of spontaneous circulation
TTM - targeted temperature management

B	- Bleeding
A	- Anesthesia
A	- AFE
C	- Cardiovascular/cardiomyopathy
C	- Clot/cerebrovascular
T	- Trauma
O	- Overdose (magnesium sulfate/opioids/other)
L	- Lung injury/ARDS
I	- Ions (glucose/K+)
F	- Fever (sepsis)
E	- Emergency hypertension/eclampsia

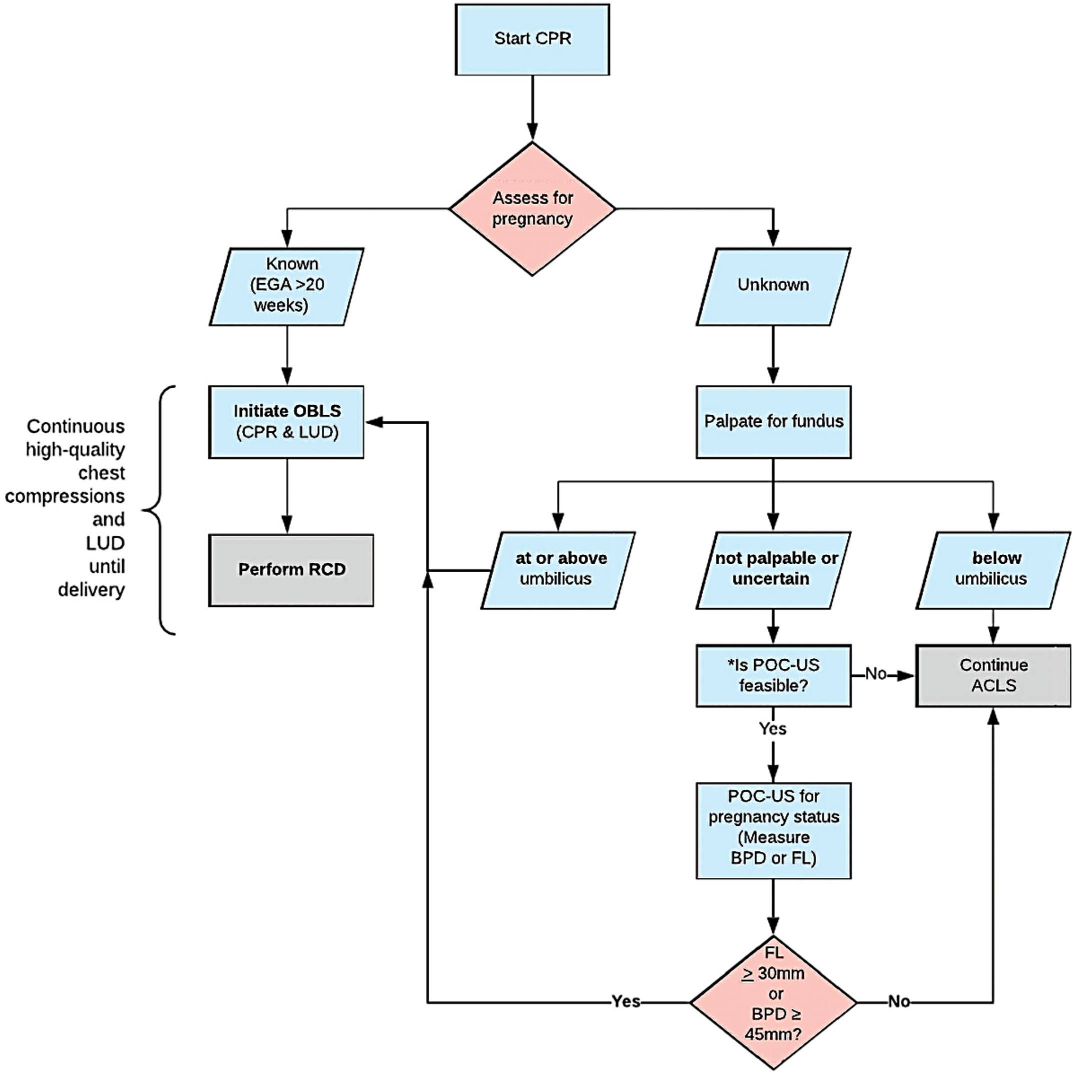


FIGURE 5.7 Obstetric Life Support master algorithm (unknown pregnancy status).

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC Press; 2024.

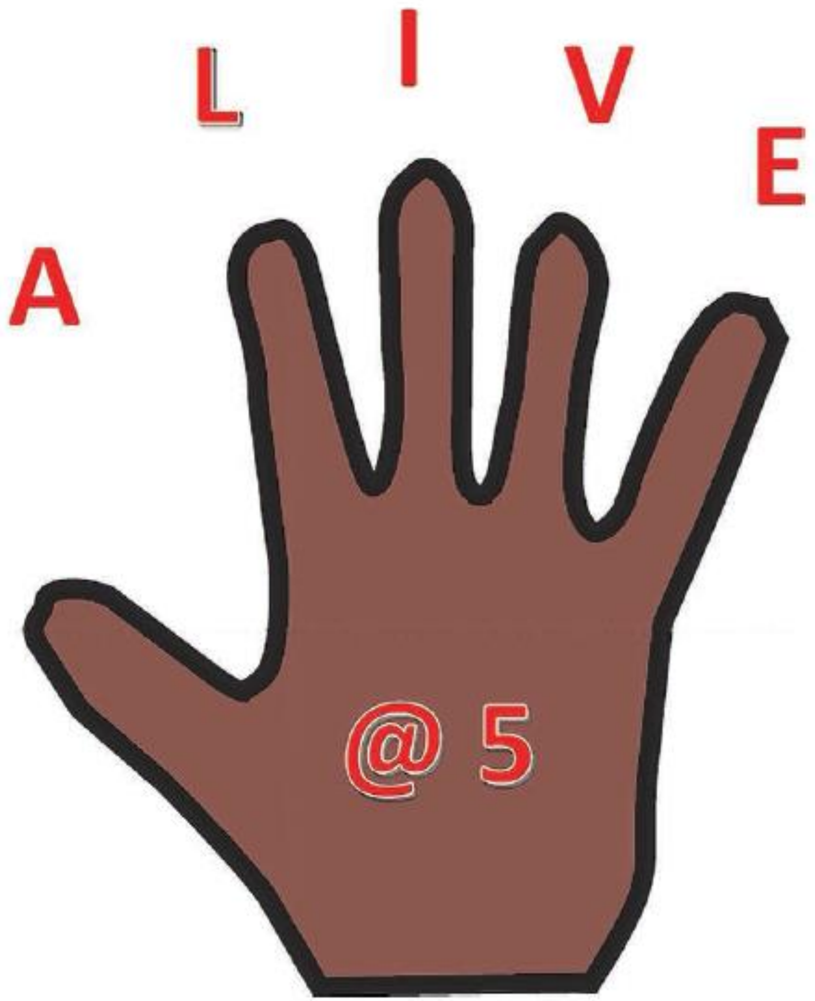
Activate OBLS

Left uterine displacement

IV placement above diaphragm/**I**ntubate early

Ventilate/**V**erify equipment and personnel

Evacuate uterus by 5 minutes



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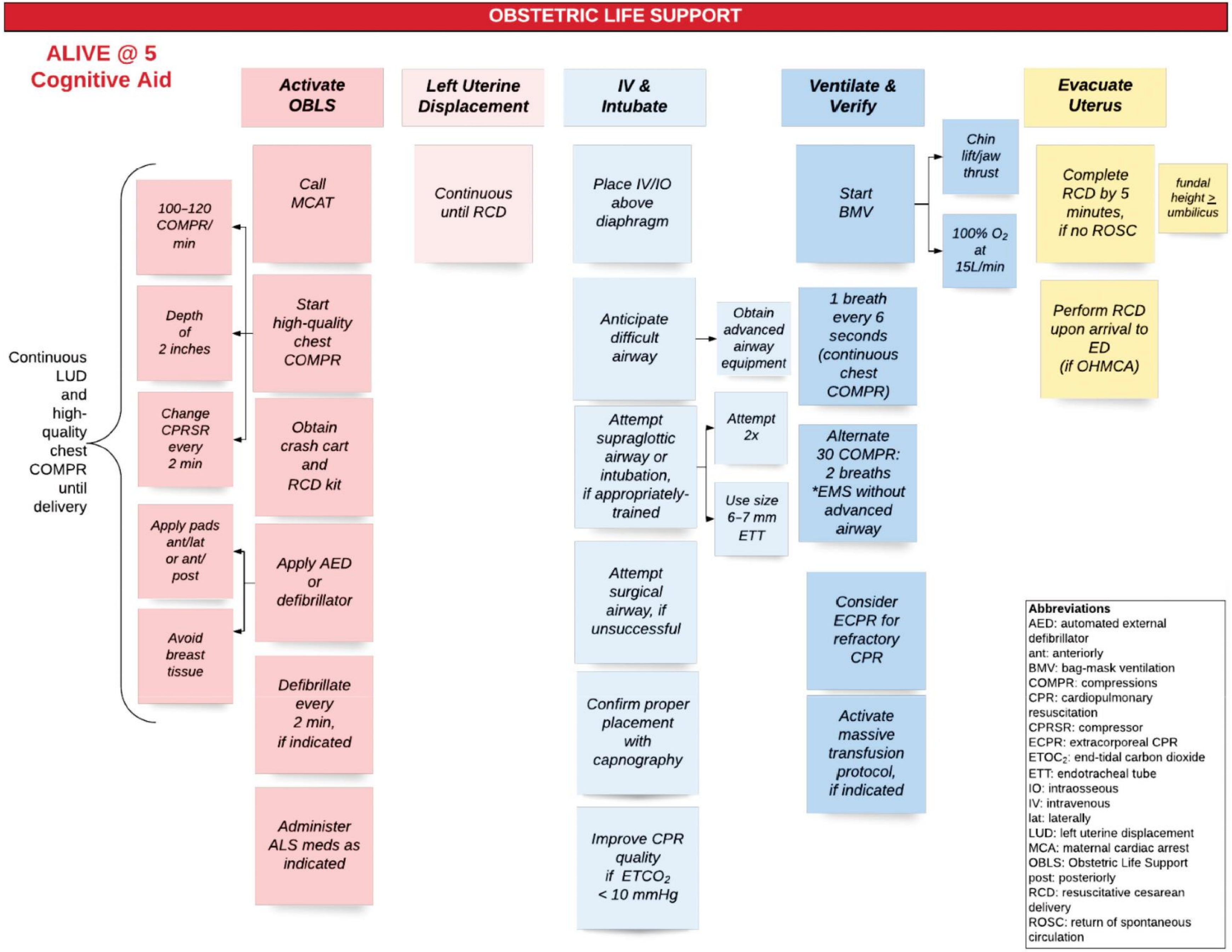


FIGURE 6.8 OBLS cognitive aid.

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetri Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First editi CRC Press; 2024.

TABLE 6.2 Factors That Decrease the Effectiveness of Obstetric Life Support

FACTOR	*REDUCED EFFECTIVENESS IN PREGNANT PATIENTS DUE TO*
Quality of CPR	• Dense/large breasts resulting in incorrect hand placement or shallow compressions • Incorrect technique of rolling or wedging the pregnant patient to reduce aortocaval compression (historical teaching) • Not performing LUD when indicated • Not performing RCD when indicated
Inaction	• Too focused on fetal status, resulting in not performing or delaying RCD • Fear that actions may adversely impact the pregnancy (such as withholding resuscitation medications) • Fear of performing RCD due to limited or no real-life experience

Other	• Resuscitation team:
	  • Does not know about or does not suspect pregnancy
	  • Has poor communication
	  • Lacks knowledge of modifications of CPR in pregnancy
	• No communication with the command center about pregnancy in an OH arrest
	• Crew transports patient to a hospital with inadequate resources to care for MCA

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC Press; 2024.

Table 1. Characteristics of women who survived or died following cardiac arrest

	All women	Women who survived (n = 38)	Women who died (n = 28)	*P*-value	Unadjusted		Adjusted	
					OR	*P*-value	OR	*P*-value
Age								
<35 years	40 (61)	22 (33)	18 (27)	0.59	1.00	0.600	**	**
>35 years	26 (39)	16 (24)	10 (16)		1.31 (0.48–3.58)			
Ethnicity								
White British	35 (53)	17 (26)	18 (27)	0.12	1.00	0.118	1.00	0.117
Other	31 (47)	21 (32)	10 (15)		2.22 (0.82–6.06)		2.74 (0.78–9.67)	
BMI (kg/m^2)								
<30	38 (60)	18 (29)	20 (31)	0.02	1.00	0.027	1.00	0.017
≥30	25 (40)	19 (30)	6 (10)		3.52 (1.15–10.75)		5.86 (1.38–24.97)	
Paid employment								
No	31 (49)	16 (25)	15 (24)	0.38	1.00	0.384	**	**
Yes	32 (51)	20 (32)	12 (19)		1.56 (0.57–4.27)			
Smoked in pregnancy								
No	51 (80)	29 (45)	22 (34)	0.43	1.00	0.968	**	**
Yes	13 (20)	8 (13)	5 (8)		1.03 (0.29–3.67)			
Gestation at arrest (completed weeks)	37 (20–42)	38 (20–42)	35 (20–41)	0.03	1.09 (0.99–1.19)	0.084	1.09 (0.98–1.20)	0.117

Data shown as number (% of those with data) except for gestation, presented as median (range). Unadjusted and adjusted odds ratios (OR) with (95% CI) for associations between sociodemographic variables and survival after cardiac arrest are included.
*Non-white British included; White Irish 1, White other 3, Indian 4, Pakistani 4, Bangladeshi 4, Asian other 3, Caribbean 2, African 8, Black other 1 and Chinese 2.
**Not included in multivariable model as not statistically significant at $P < 0.2$ on univariable analysis.

Beckett V, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG: Int J Obstet Gy*. 2017;124(9):1374-1381. doi:10.1111/1471-0528.14521

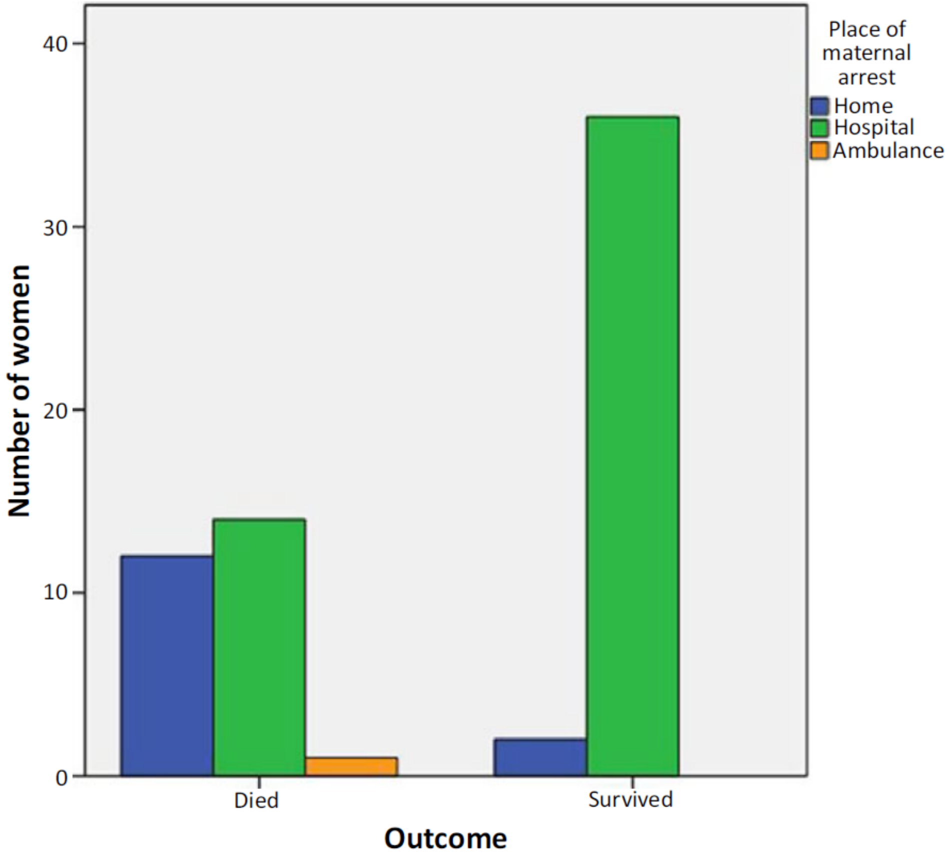


Figure 1. The place where the cardiac arrest occurred (n = 66). $P < 0.001$ chi-square test.

Cardiac output was restored in a total of 48 women, 38 of whom ultimately survived their cardiac arrest. Hence, the survival rate following cardiac arrest was 58%. The time from collapse to delivery in the survivors group was 7 minutes [interquartile range (IQR) 2.5–17.5] compared with 16 minutes (IQR 6.5–43.5) in the group where the women died ($P = 0.04$). For all groups, resuscitation was provided for a median of 24.5 minutes (range 0–164). Time to restoration of cardiac output was 6 minutes (IQR 4–21) in the survivor group compared with 50 minutes (IQR 32–57) in the women who died ($P = < 0.01$).

Beckett V, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG: Int J Obstet Gy*. 2017;124(9):1374-1381. doi:10.1111/1471-0528.14521

Table 3. Factors and decisions concerning perimortem caesarean section, all groups

PMCS factor	Number of women (n = 49)
Decision made by	
Obstetrician	43
Anaesthetist	1
Other clinician	2
Missing	3
Operation performed by	
Obstetrician	46 (26 by Consultant grade)
Other clinician	1
Missing	2
Aseptic precautions	
None	12
Skin preparation	11
Sterile drapes	6
Sterile gloves	11
Full scrub	8
Sterile gown	4
Antibiotics	5
Time from arrest to PMCS	
Less than 5 minutes	30/49 (61%)
5 minutes or more	17/49 (35%)
Not known	2/49 (4%)
Scalpel available on resuscitation trolley	
Yes	27/49 (55%)
No	14/49 (29%)
Not known	8/49 (16%)

Data are presented as number of reports or percentage of all perimortem caesarean sections performed.

PMCS details

Forty-nine women had a PMCS performed, of which 11 were performed in the emergency department. Seventeen women did not have a PMCS performed for the following reasons: cardiac output restored (n = 6), gestation <20 weeks (n = 6), gestation not considered to be interfering with cardiopulmonary resuscitation (n = 1), gestation unknown (n = 1), no equipment available (n = 1) and woman died at home (n = 1). Only two (7%) of the 28 women who died did not have an appropriate PMCS who should have had one, one of these women had already died at home.

Beckett V, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG: Int J Obstet Gy*. 2017;124(9):1374-1381. doi:10.1111/1471-0528.14521

Fetal outcome

Data were available for 58 babies, of whom 46 were born alive; 32 babies to surviving mothers and 14 to women who died. Seven of the mothers of the 12 stillborn babies also died. Data were available for 35 of the 49 cases regarding the time of PMCS and survival. Twenty-four of 25 babies survived (96%) when PMCS was performed within 5 minutes compared with seven of ten babies (70%) when PMCS occurred >5 minutes after cardiac arrest ($P = 0.059$), noting the association between location of maternal collapse and delay in PMCS. Birth weights ranged from 1766 to 2744 g in the babies of mothers who died compared with from 2489 to 3329 g in the babies of women who survived, reflecting a more advanced gestational age (Table 1). When the mother died, the median 5-minute Apgar score was 3 (range 2–5) and cord arterial pH was 6.61 (range 6.33–6.8). These results were statistically significantly worse than when the mother survived, when the median Apgar score was 7 (range 6–8, $P = 0.01$) and arterial pH was 7.05 (range 6.96–7.26, $P = 0.001$). The median stay on neonatal ICU was 13 days (range 3–101) for babies of mothers who died compared with 4 days (range 1–108) in babies of mothers who survived ($P = 0.09$). Some surviving babies had neurological and respiratory complications, in both maternal groups, but the numbers of affected babies reported were too small to make any further comment. In total, seven babies had neurological complications, six had respiratory complications and two had sepsis. We did not collect data following discharge from

Table 2 Recommended equipment set for PMCS.

Personal protective equipment	Double gloves, face mask, apron or gown.
Caesarean section equipment	Scalpel—preferably large, (eg 20 series). Scissors—blunt ended to minimise injury to fetus. Retractors—an assistant's hands can retract if not available. Clamps/haemostats. Gauze swabs—these should be swabs that show up on X-ray. Suction—(although the patient will experience minimal bleeding until ROSC). Large sutures—absorbable. Needle holder. Antiseptic solution and clean linen/incontinence pads.
Neonatal resuscitation equipment	Dry linen, neonatal Bag Valve Mask, Resuscitaire® or baby-warmer, plastic bag (for use if the baby is premature), neonatal airway supplies, appropriately sized suction, equipment for umbilical venous access, resuscitation drugs.

PMCS, perimortem caesarean section; ROSC, return of spontaneous circulation.

Beckett V, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG: Int J Obstet Gy*. 2017;124(9):1374-1381. doi:10.1111/1471-0528.14521
Parry R, Asmussen T, Smith JE. Perimortem caesarean section. *Emerg Med J*. 2016;33(3):224-229. doi:10.1136/emermed-2014-204466

Table 4. Suspected and confirmed (at post mortem) causes for women who died and women who survived

Cause	Women who survived (*n* = 37)	Women who died (*n* = 22)
Presumed premortem causes (*n* = 59)		
Cardiac tamponade	1	0
Hypoxia	4	0
Hypovolaemia	5	8
Venous thromboembolism	1	7
Toxic drug cause	1	0
Anaphylaxis	1	0
Sepsis	0	1
Anaesthetic cause	17	0
Amniotic fluid embolism	5	3
Cardiac cause	5	1
Intracerebral bleed	0	3
Aortic dissection	0	2
Asthma	0	1
Pulmonary artery rupture	0	1
Postmortem causes of collapse (*n* = 19)		
Amniotic fluid embolism		6
Vessel bleed/rupture		5
Thrombembolic		3
Cardiomyopathy		2
Other		3

Data were available for 59 women. Some women were suspected of having more than one cause, where this is the case both causes have been recorded.

Beckett V, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG: Int J Obstet Gy*. 2017;124(9):1374-1381. doi:10.1111/1471-0528.14521

Recommendations[29]

1. **Continuous manual LUD should be performed on all pregnant women who are in cardiac arrest in which the uterus is palpated at or above the umbilicus to relieve aortocaval compression during resuscitation (*Class I; Level of Evidence C*).**
2. **If the uterus is difficult to assess (eg, in the morbidly obese), attempts should be made to perform manual LUD if technically feasible (*Class IIb; Level of Evidence C*).**

Jeejeebhoy FM, Zelop CM, Lipman S, et al. Cardiac arrest in pregnancy: a scientific statement from the american heart association. *Circulation*. 2015;132(18):1747-1773. doi:10.1161/CIR.0000000000000300

Indication

- Maternal arrest with a viable fetus (gestation ≥24 week) within 4 minutes of cardiopulmonary arrest

Contraindications

- Stable mother
- Fetus less than 24 weeks' gestation
- Extreme fetal prematurity
- Maternal hypoxia longer than 15 minutes

Materials and Medications

- Cesarean section instrument tray if available:
  - #10 or #11 scalpel blade, scissors, bladder retractor, two large retractors, gauze sponges, hemostats, suction, forceps, and straight and curved clamps
- Skin antiseptic preparing solution, such as Betadine (povidone-iodine)
- Silk suture with needle driver or skin stapler
- Sterile drapes
- Sterile gloves
- Obstetrical pack (see Chap. 126):
  - Bulb syringe and umbilical cord clamp
- Clean blanket or towels for delivery
- Neonatal resuscitation equipment

Ganti L, ed. *Atlas of Emergency Medicine Procedures*. Springer International Publishing; 2022. doi:10.1007/978-3-030-85047-0

CODA.22

MELBOURNE: 3-6 APRIL 2022

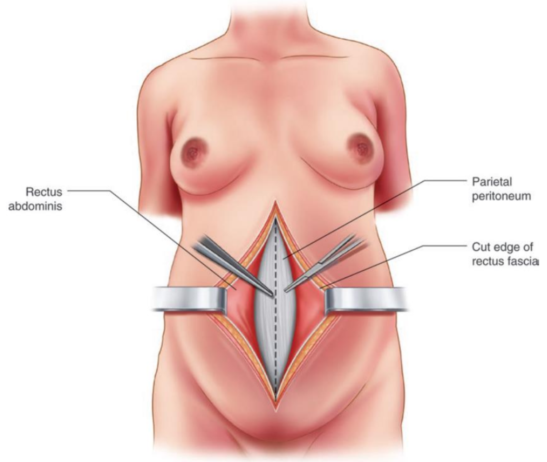
codachange.org

https://www.youtube.com/watch?v=HLmxDP20mvk

RESUSCITATIVE CESAREAN DELIVERY

- Parto cesareo perimortem: Questa procedura prevede il parto del feto (o dei feti) durante l'arresto cardiaco materno o dopo la morte della madre.
- Riconsiderare la terminologia: Gli esperti sono sempre più concordi nel riconsiderare la terminologia utilizzata per questa procedura, per enfatizzarne lo scopo rianimatorio.
- Termini alternativi proposti: I suggerimenti includono la sostituzione di "parto cesareo perimortem" con termini più accurati e positivi come "isterotomia rianimatoria" o "parto cesareo rianimatorio".
- Termine preferito: L'Obstetrics and Gynecology Literature and Education (OBLS) raccomanda di utilizzare il termine "parto cesareo rianimatorio" perché descrive accuratamente la procedura, compreso il parto del feto, ed è facilmente riconoscibile da tutte le équipe mediche.
- Maggiore chiarezza e comunicazione: L'uso di "parto cesareo rianimatorio" o "parto vaginale rianimatorio" (in casi specifici) aiuta a focalizzare l'équipe sullo scopo primario della procedura, riducendo potenzialmente gli errori di comunicazione durante la rianimazione materna. Questi termini sono facilmente comprensibili dagli operatori non ostetrici e dal personale di assistenza.

Fig. 129.2 Exposing rectus sheath



Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*. First edition. CRC Press; 2024.

Raccomandazione per il parto cesareo rianimatorio (RCD) nell'arresto cardiaco materno (MCA):

Il TCR è raccomandato quando la paziente in gravidanza è colpita da MCA e l'utero si trova all'altezza o al di sopra dell'ombelico, indipendentemente dall'età gestazionale o dallo stato fetale.

- Criteri per la RCD: La RCD deve essere presa in considerazione se è soddisfatto almeno uno dei seguenti criteri:
- Nessun ritorno della circolazione spontanea (ROSC) dopo due cicli di RCP.
- ROSC intermittente dopo due cicli di RCP.
- Presenza di un ritmo cardiaco non defibrillabile.
- In caso di MCA extraospedaliero, la RCD deve essere iniziata immediatamente all'arrivo al pronto soccorso (ED) senza ROSC.

Shields A, Battistelli J, Kavanagh L, Nielsen P, Thomson B, eds. *Obstetric Life Support Manual: Etiology, Prevention, and Treatment of Maternal Medical Emergencies and Cardiopulmonary Arrest in Pregnant and Postpartum Patients*.

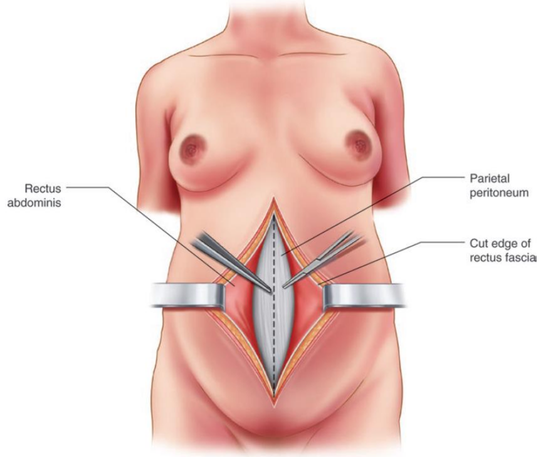
Procedure

1. Continue cardiopulmonary resuscitation until delivery.
2. Prepare the skin with antiseptic solution and a sterile drape.
3. Insert a Foley catheter to empty the bladder.
4. Obtain emergent obstetrician and neonatologist consult if available, but do not delay procedure.
5. Using a #10 or #11 blade, make a vertical midline incision beginning 4–5 cm below the xiphoid process, and extend the incision to the pubic symphysis (Fig. 129.1).
6. Incise through the subcutaneous fat no further than the rectus sheath.
7. Lift the rectus sheath with a toothed forceps, and make an incision with scissors to expose the uterus (Fig. 129.2).
8. With forceps and scissors, lift and incise the peritoneal membrane in the midline.
9. Identify and lift the bowel and cover it with saline-soaked gauze.
10. Retract the rectus sheath and bladder with a bladder retractor, or, if not available, use saline-soaked gauze or a towel.
11. Create a 2- to 4-cm midline vertical opening in the uterus.
12. Place a finger in the opening directed caudally to protect the fetus while making a superior incision through the uterine wall. Once complete, repeat this step in the inferior direction.
13. Use a clamp to rupture the amniotic membranes. Immediately deliver the fetus and clamp the umbilical cord.
14. Expulse the head by placing a hand between the pubic symphysis landmark and the fetal occiput. Then, gently flex the fetus while simultaneously moving the head superiorly and anteriorly until delivery (Fig. 129.3).
15. Suction the mouth and nose with a bulb syringe immediately.
16. Deliver the shoulders, followed by the torso and extremities. Secure the umbilical cord with a hemostat or umbilical cord clamp 10 cm distal to the fetus and a second clamp 2 cm distal to this clamp. With scissors, incise the umbilical cord between the two clamps.
17. Immediately begin resuscitation of the infant (Fig. 129.4).
18. If the patient is still alive or regains vital signs, prepare to deliver the placenta. Begin with an OxyContin infusion at 20 U in 1 L at 10 mL/h. Apply cautious traction to the umbilical cord until the placenta separates from the uterus (Fig. 129.5).
19. Following delivery the uterus should be closed using two layers with either 2–0 or 1–0 suture. In the case of maternal death, skin staples or a running stitch is an acceptable method of skin closure.

Pearls and Pitfalls

- Pearls
  - Perimortem cesarean section, although rarely performed, should be considered in any maternal arrest when the fetus is 24 weeks' or greater gestation.
  - In addition to saving the life of the fetus, this procedure may aid in resuscitation of the mother. Emptying of the uterus may improve thoracic compliance and, therefore, improve maternal ventilation.
- Pitfalls
  - The decision to perform an emergency cesarean section must be made early. There is a higher chance of survival if performed no more than 4 minutes after the onset of maternal cardiac arrest and much worse

Fig. 129.2 Exposing rectus sheath



Jeejeebhoy FM, Zelop CM, Lipman S, et al. Cardiac arrest in pregnancy: a scientific statement from the american heart association. *Circulation*. 2015;132(18):1747-1773. doi:10.1161/CIR.0000000000000300

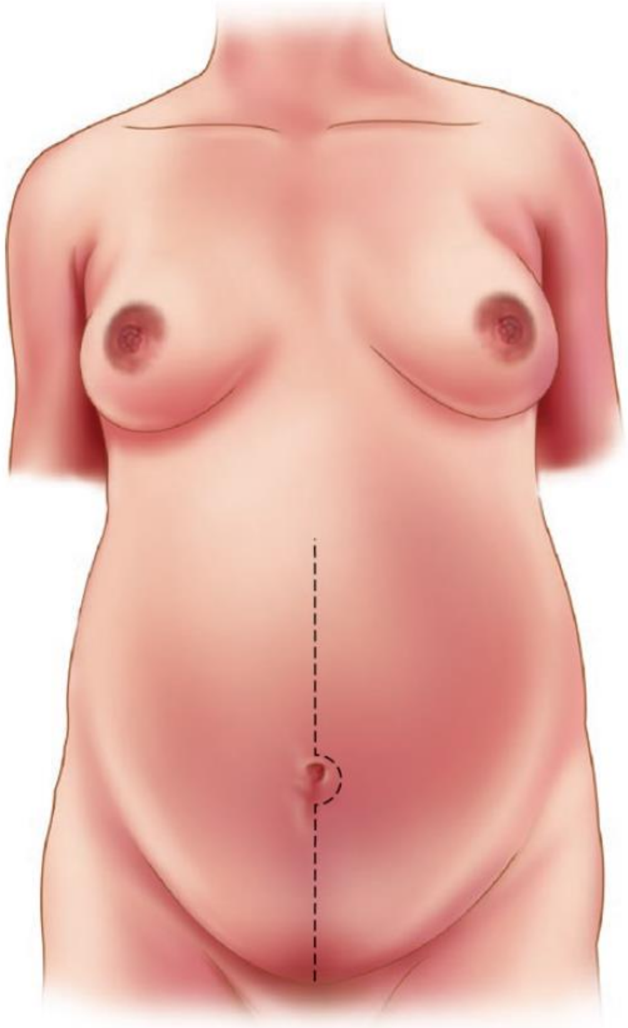


Fig. 129.1 Vertical incision

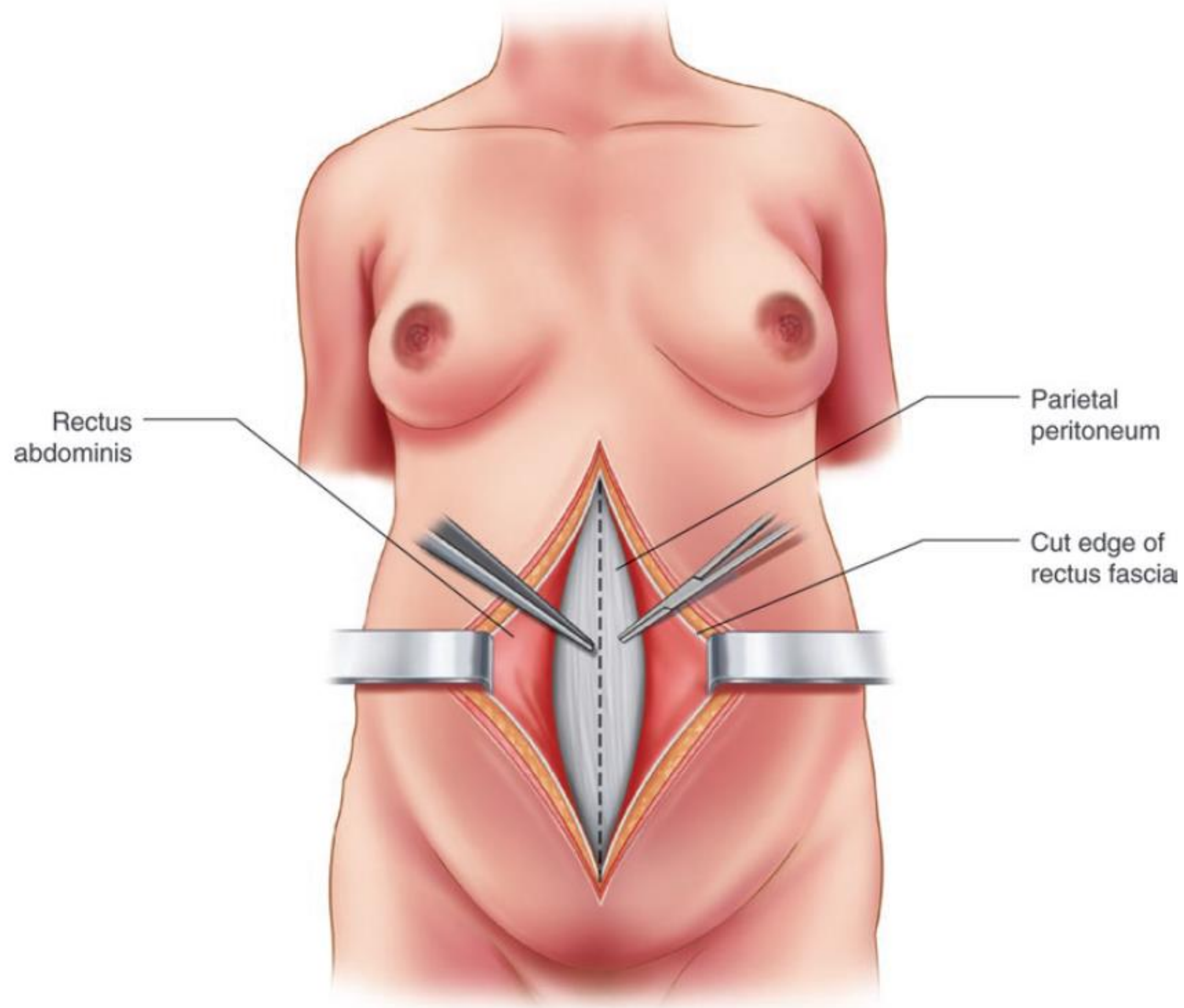


Fig. 129.2 Exposing rectus sheath

Ganti L, ed. *Atlas of Emergency Medicine Procedures*. Springer International Publishing; 2022. doi:10.1007/978-3-030-85047-0

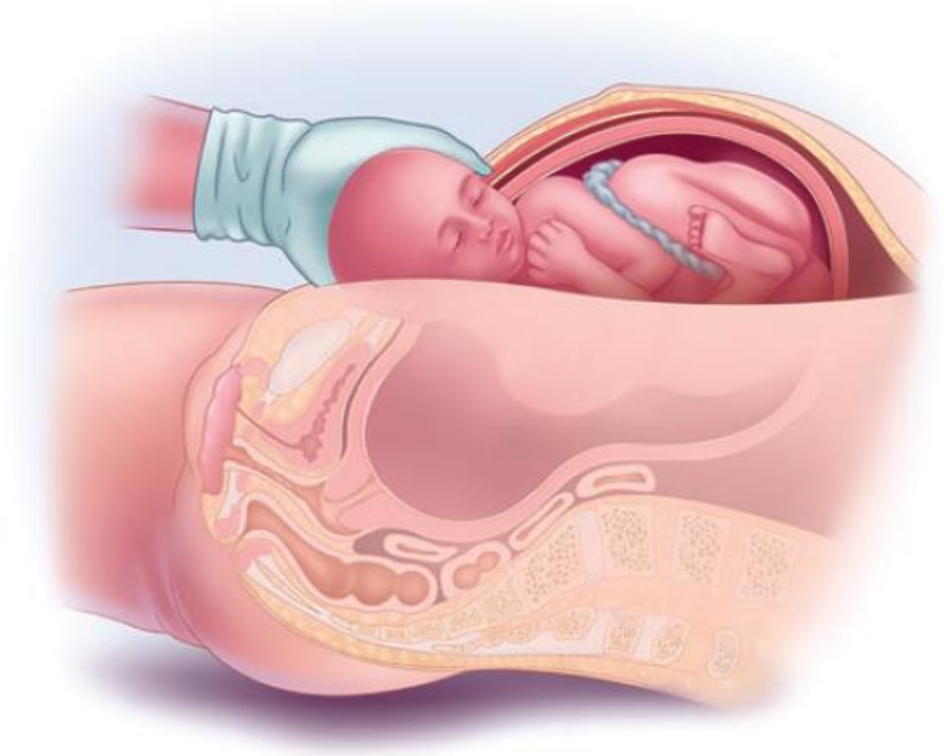


Fig. 129.3 Delivery of the fetus

Fig. 129.4 Suctioning newborn as part of resuscitation

Ganti L, ed. *Atlas of Emergency Medicine Procedures*. Springer International Publishing; 2022. doi:10.1007/978-3-030-85047-0

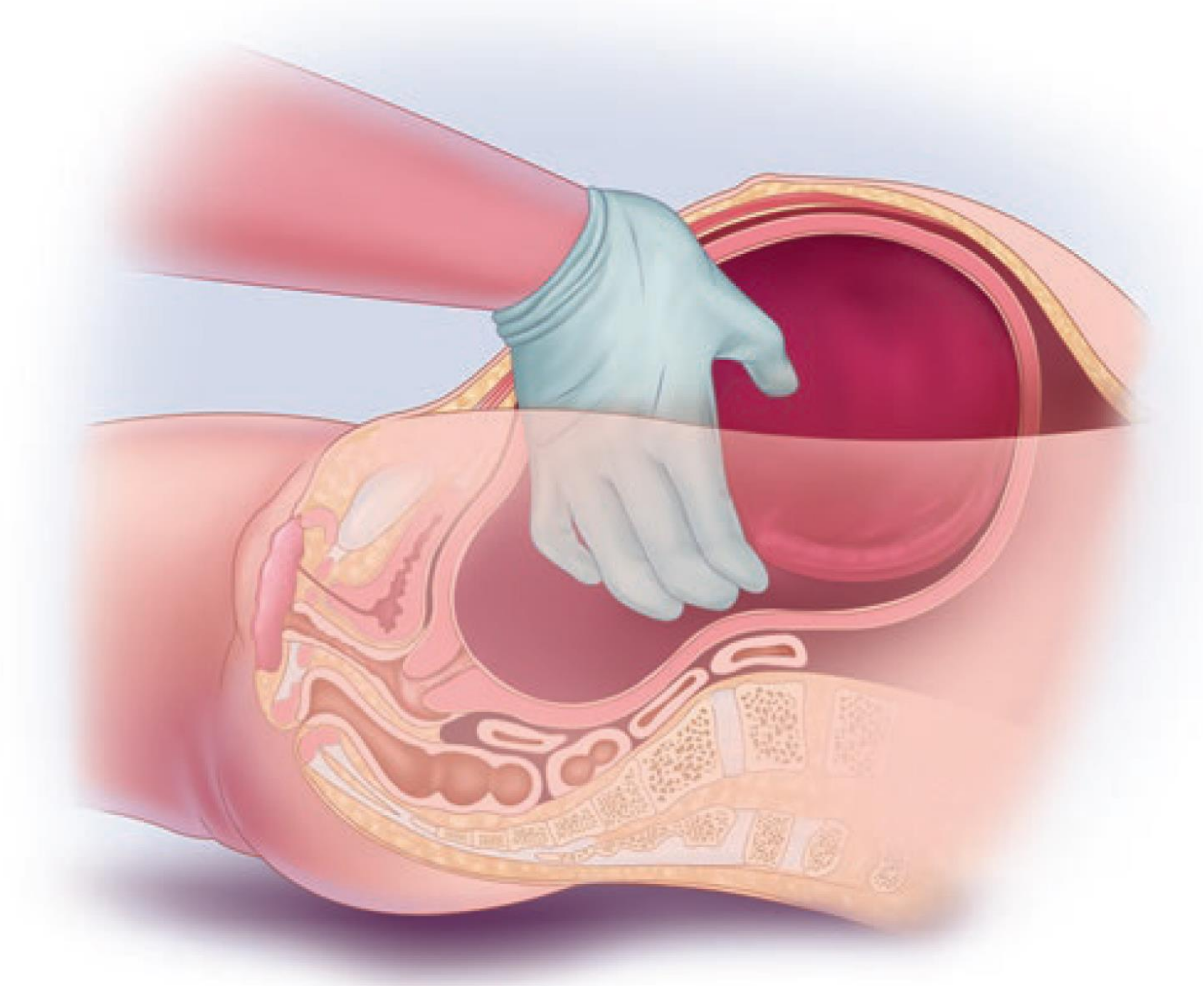


Fig. 129.5 Delivery of the placenta

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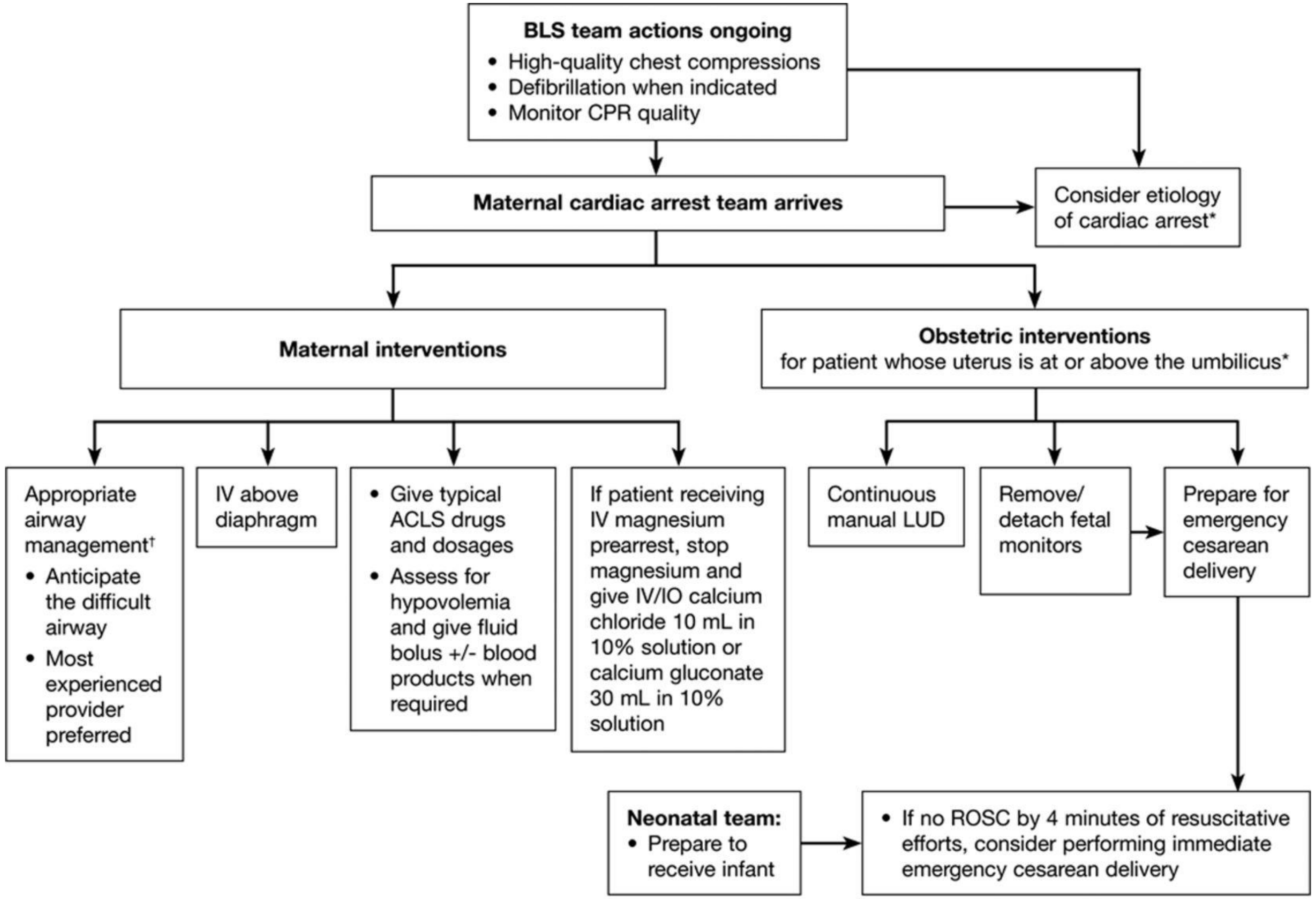

*Potential etiology of maternal cardiac arrest:

- A Anesthetic complications/accidents
- B Bleeding
- C Cardiovascular
- D Drugs
- E Embolic
- F Fever
- G General nonobstetric causes of cardiac arrest (H's and T's)
- H Hypertension

†Appropriate airway management for pregnancy:

- 100% oxygen at ≥15 L/min and continue BLS airway strategies
- Optimally 2 attempts per technique:
  - First intubation attempt—if failed go to
  - Second intubation attempt—if failed go to
  - First supraglottic airway attempt—if failed go to
  - Second supraglottic airway attempt—if failed go to mask ventilation
  - If mask ventilation inadequate—attempt cricothyrotomy
- Avoid airway trauma
- Ventilate with 8–10 breaths/min
- Monitor capnography
- Minimize interruptions in chest compressions during advanced airway placement
- Recommend 6.0- to 7.0-mm inner diameter ETT

Jeejeebhoy FM, Zelop CM, Lipman S, et al. Cardiac arrest in pregnancy: a scientific statement from the american heart association. *Circulation*. 2015;132(18):1747-1773. doi:10.1161/CIR.0000000000000300

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Provider Course CPR/AED

Cardiopulmonary Resuscitation with Automated External Defibrillator

EUROPEAN RESUSCITATION COUNCIL

Objectives

- At the end of this course participants should be able to demonstrate:
  - How to assess the collapsed victim
  - How to perform chest compression and rescue breathing (CPR)
  - How to operate an automated external defibrillator safely
  - How to place an unconscious breathing victim in the recovery position

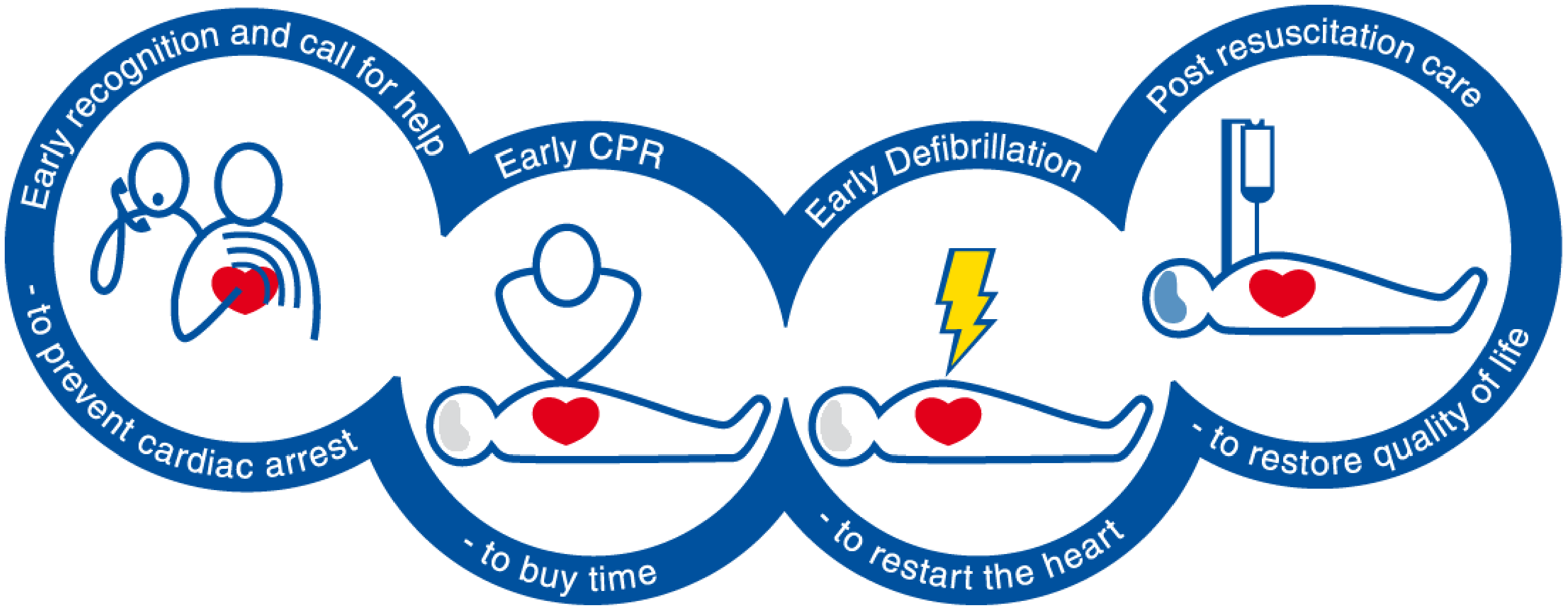
EUROPEAN RESUSCITATION COUNCIL

Background

- In Europe every 45 seconds a cardiac arrest takes place
- Bystander CPR is a vital intervention before arrival of emergency services
- Early resuscitation and prompt defibrillation (within 1-2 minutes) can result in >60% survival

EUROPEAN RESUSCITATION COUNCIL

Chain of survival



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Approach safely

Check response

Shout for help

Open airway

Check breathing

Call 112

30 chest compressions

2 rescue breaths

Approach safely

Approach safely

Check response

Shout for help

Open airway

Check breathing

Call 112

30 chest compressions

2 rescue breaths

EUROPEAN RESUSCITATION COUNCIL

Check response

- Approach safely
- **Check response**
- Shout for help
- Open airway
- Check breathing
- Call 112
- 30 chest compressions
- 2 rescue breaths

Check response

Shake shoulders gently

Ask “Are you all right?”

If he responds

- Leave as you find him.
- Find out what is wrong.
- Reassess regularly.

Shout for help

- Approach safely
- Check response
- **Shout for help**
- Open airway
- Check breathing
- Call 112
- 30 chest compressions
- 2 rescue breaths

Shout for help

SEND FOR AED
Send someone to get an AED

- Send someone to find and bring back an AED if available
- If you are on your own, **DO NOT** leave the victim, but start CPR

EUROPEAN RESUSCITATION COUNCIL

Open airway

- Approach safely
- Check response
- Shout for help
- **Open airway**
- Check breathing
- Call 112
- 30 chest compressions
- 2 rescue breaths

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Check breathing

- Approach safely
- Check response
- Shout for help
- Open airway
- **Check breathing**
- Call 112
- 30 chest compressions
- 2 rescue breaths

Check breathing

- Look, listen and feel for NORMAL breathing

Check breathing

BREATHING
Look, listen and feel for breathing

- Look, listen and feel for breathing for **no more** than 10 seconds
- A victim who is barely breathing, or taking infrequent, slow and noisy gasps, is not breathing **normally**

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Abnormal breathing

- Occurs shortly after the heart stops in up to 40% of cardiac arrests
- Described as barely, heavy, noisy or gasping breathing
- Recognise as a sign of cardiac arrest

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Abnormal breathing

- Start CPR in any unresponsive person with absent or abnormal breathing.
- A short period of seizure-like movements can occur at the start of cardiac arrest. Assess the person after the seizure has stopped: if unresponsive and with absent or abnormal breathing, start CPR.

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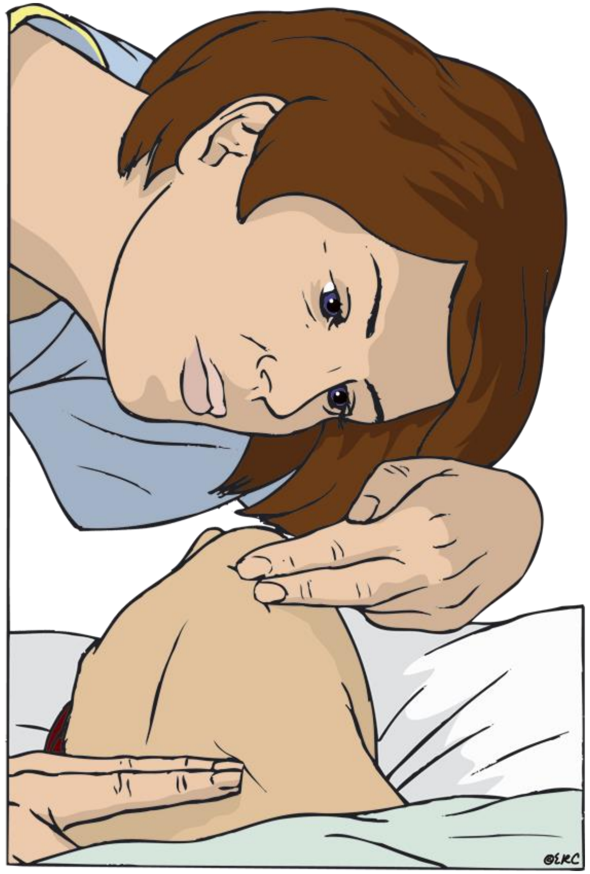
CAROTID PULSE CHECK



- Not recommended for lay rescuers
- Use the index and middle fingers in the groove on *one side* of the neck *only*
- Check for breathing and carotid pulse at the same time
  - Extend neck
  - No more than 10 seconds

CAROTID PULSE CHECK

- Pulse absent or **unsure**
  - Start chest compressions
  - Continue 30 chest compressions : 2 rescue breaths
  - Do not re-check for carotid pulse or signs of life
- Pulse definitely **present**
  - Give rescue breaths on their own at a rate of 10 per minute
  - Re-check for carotid pulse or signs of life after 1 minute

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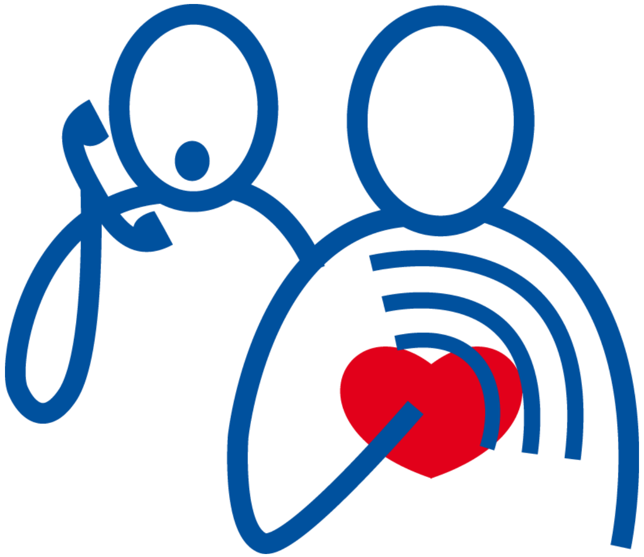
Call 112



- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- **Call 112**
- 30 chest compressions
- 2 rescue breaths

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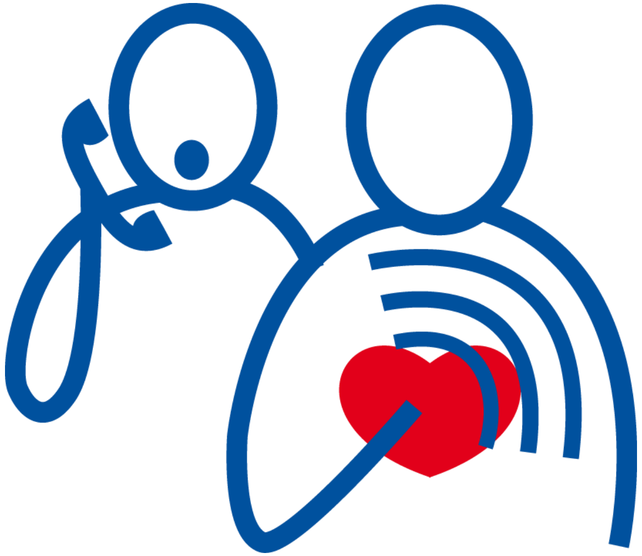
Call 112

ABSENT OR ABNORMAL BREATHING
Alert emergency services

- If breathing is absent or abnormal, ask a helper to call the emergency services or call them yourself
- Stay with the victim if possible
- Activate the speaker function or hands-free option on the telephone so that you can start CPR whilst talking to the dispatcher



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30 Chest compressions

- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- Call 112
- **30 chest compressions**
- 2 rescue breaths

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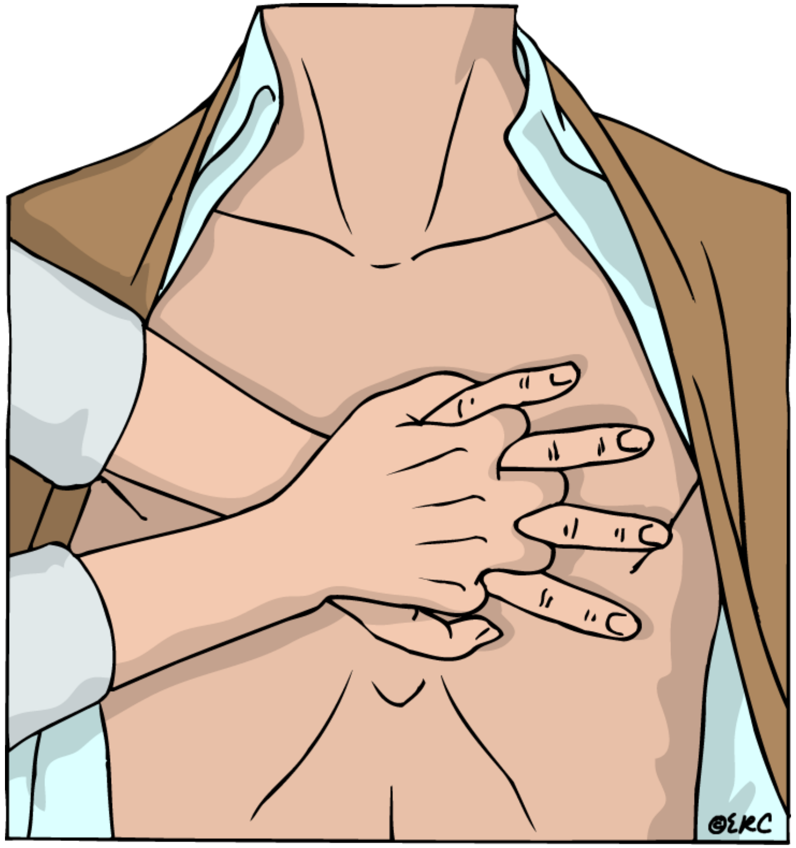
Chest compressions



- Place the heel of one hand in the centre of the chest
- Place other hand on top
- Interlock fingers or avoid putting pressure on the side of the chest
- Compress the chest
  - Rate 100 – 120 min^{-1}
  - Depth 5 – 6 cm
  - Equal compression : relaxation
- When possible change CPR operator every 2 min

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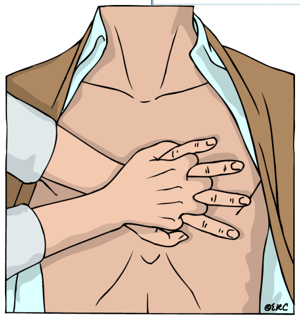
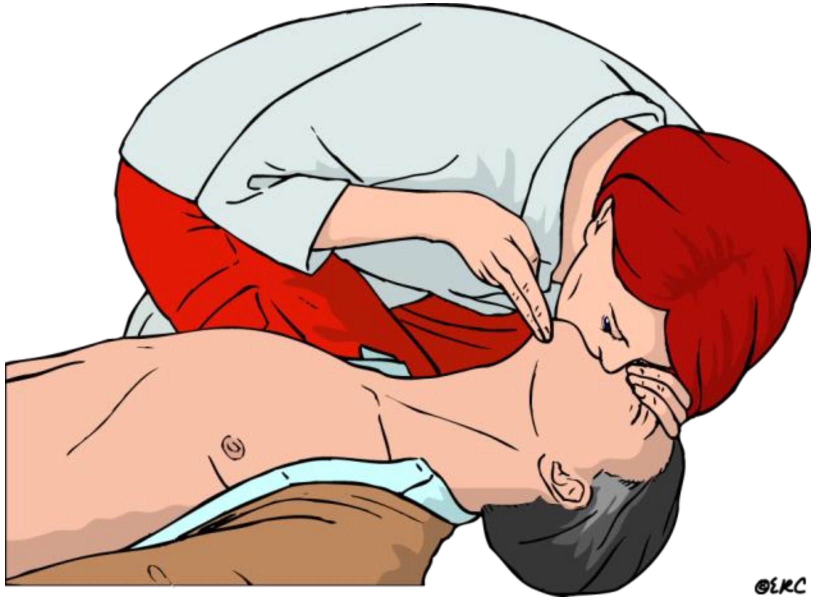
Chest compressions

CIRCULATION
Start chest compressions

- Kneel by the side of the victim
- Place the heel of one hand in the centre of the victim's chest - this is the lower half of the victim's breastbone (sternum)
- Place the heel of your other hand on top of the first hand and interlock your fingers
- Keep your arms straight
- Position yourself vertically above the victim's chest and press down on the sternum at least 5 cm (but not more than 6 cm)
- After each compression, release all the pressure on the chest without losing contact between your hands and the sternum
- Repeat at a rate of 100-120 min-1



2 Rescue breaths



- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- Call 112
- 30 chest compressions
- **2 rescue breaths**

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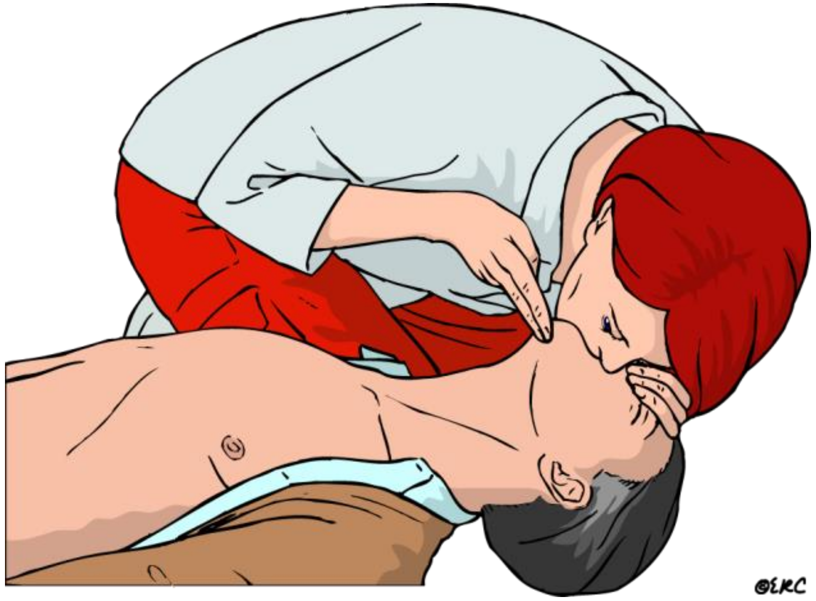
Rescue breaths

- Pinch the nose
- Take a normal breath
- Place lips over mouth
- Blow until the chest rises
- Take about 1 second
- Allow chest to fall
- Repeat



GENERAL POINTS ON USING FACE-MASKS

- Extend neck fully
- Create a good seal between mask and victim's mouth and nose
- Deliver each breath over 1 second
- Blow just enough to make chest rise and fall as in normal breathing
  - Do not over-ventilate
- Combine 30 chest compressions with 2 rescue breaths

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USE OF OXYGEN

- Supplemental oxygen can be used in cardiac arrest if available
- Given via a bag-valve mask or pocket-mask
- **Give as much as possible as soon as possible:** *Flow rates of 10-15L/min*

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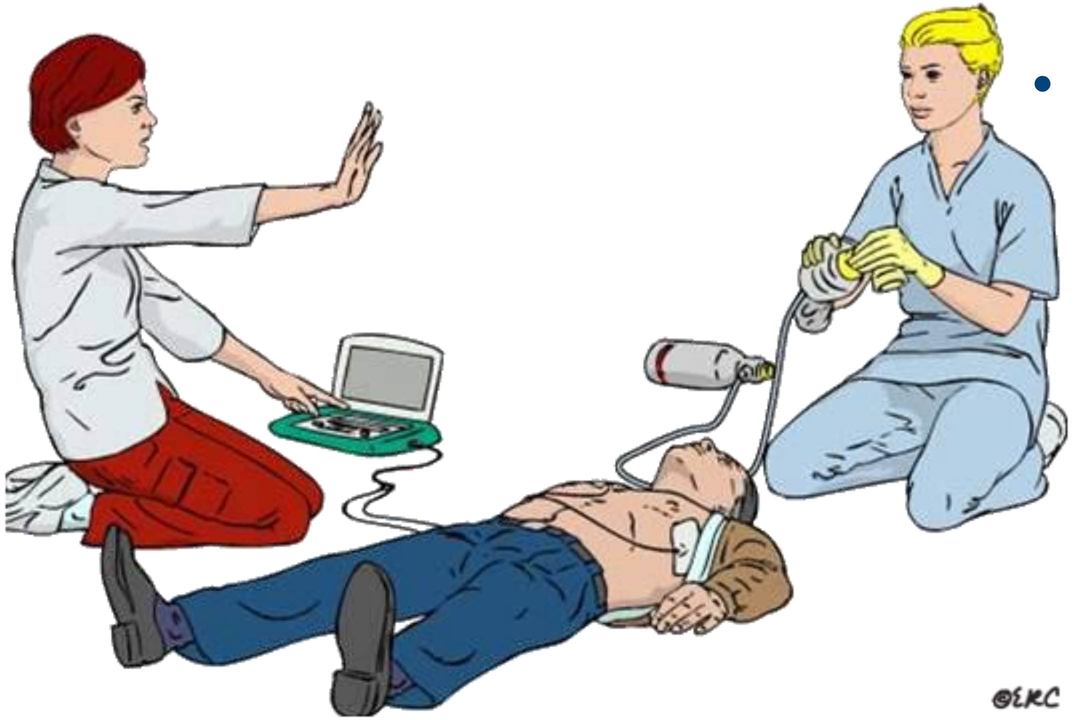
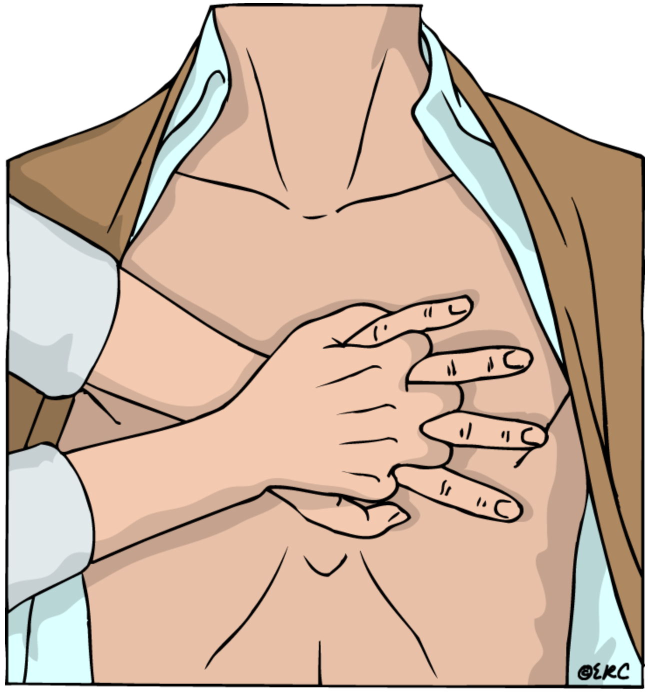
USE OF OXYGEN

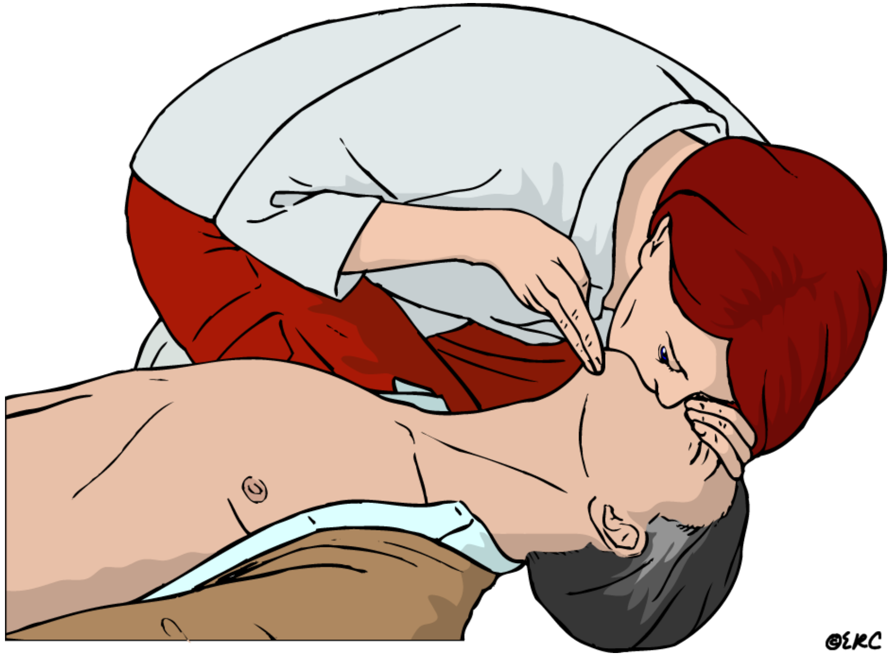


Removal of oxygen from victim during defibrillation

- Take care with automated external defibrillators:
  - Stick pads down firmly
  - Remove oxygen source at least 1 metre from victim's chest during shocks

Continue CPR





30

2

TWO-RESCUER CPR

Continue chest compressions whilst attaching AED pads

- **30 chest compressions : 2 rescue breaths**
  - One rescuer performs rescue breaths
  - The other performs chest compressions
- Use of the AED:
  - One rescuer operates AED and attaches pads
  - Other rescuer performs CPR
  - Only interrupt CPR to analyse and to deliver shock

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COUNCIL

Approach safely

Check response

Shout for help

Open airway

Check breathing

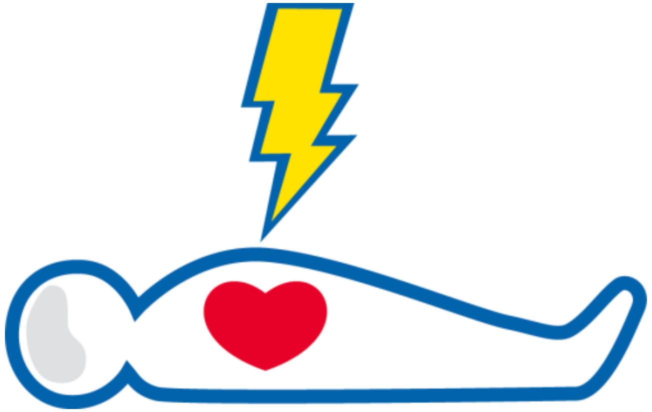
Call 112

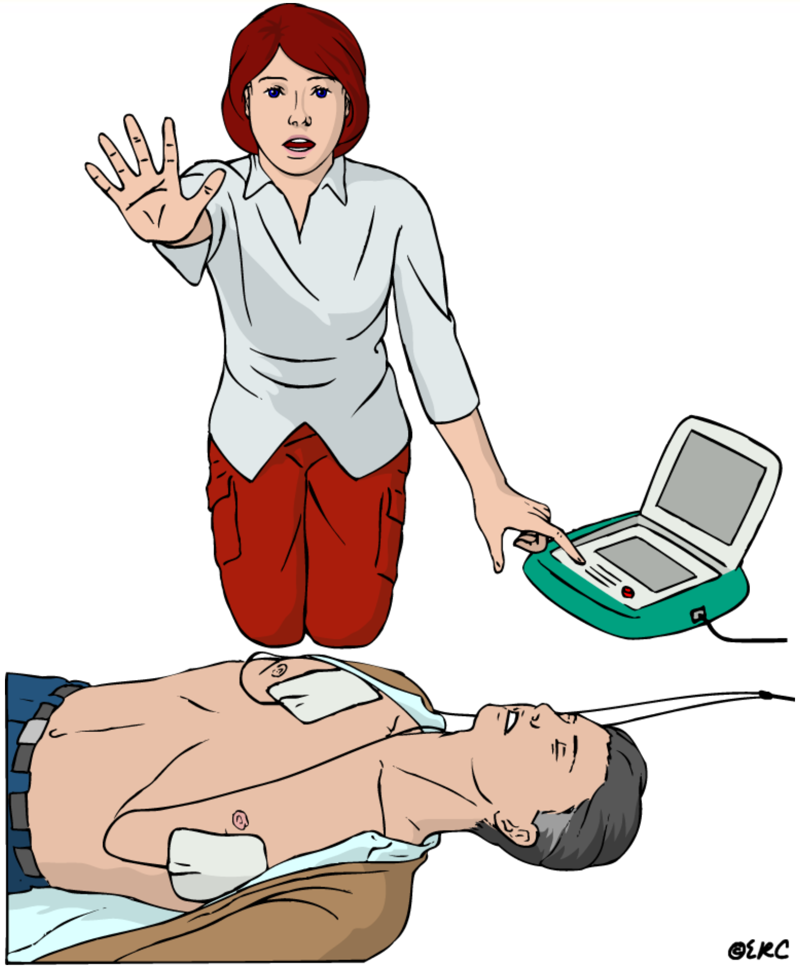
30 chest compressions

2 rescue breaths

Any questions?

Defibrillation





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Approach safely

Check response

Shout for help

Open airway

Check breathing

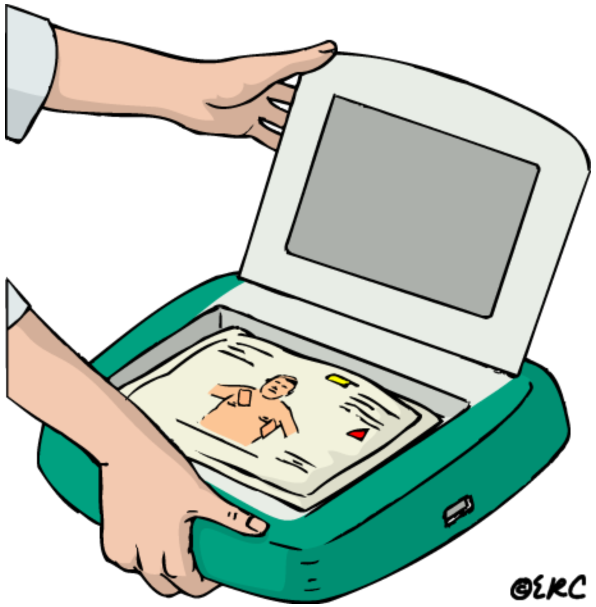
Call 112

Attach AED

Follow voice prompts

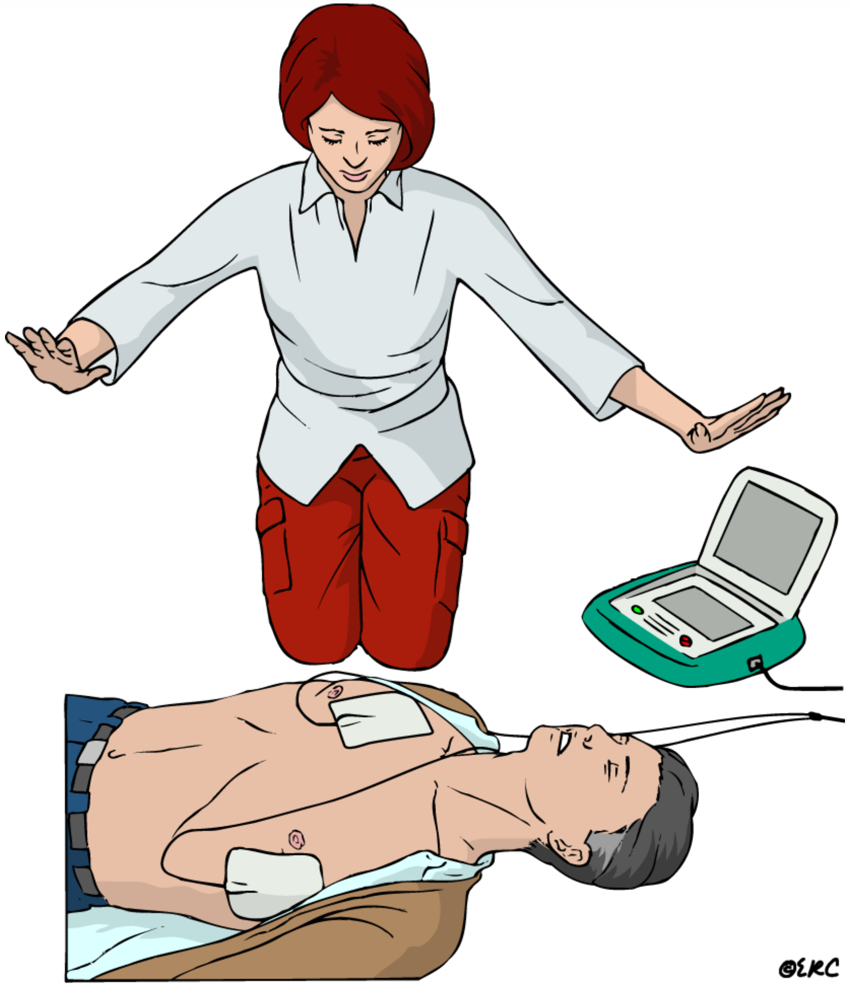
Switch on AED

- Some AEDs will automatically switch themselves on when the lid is opened



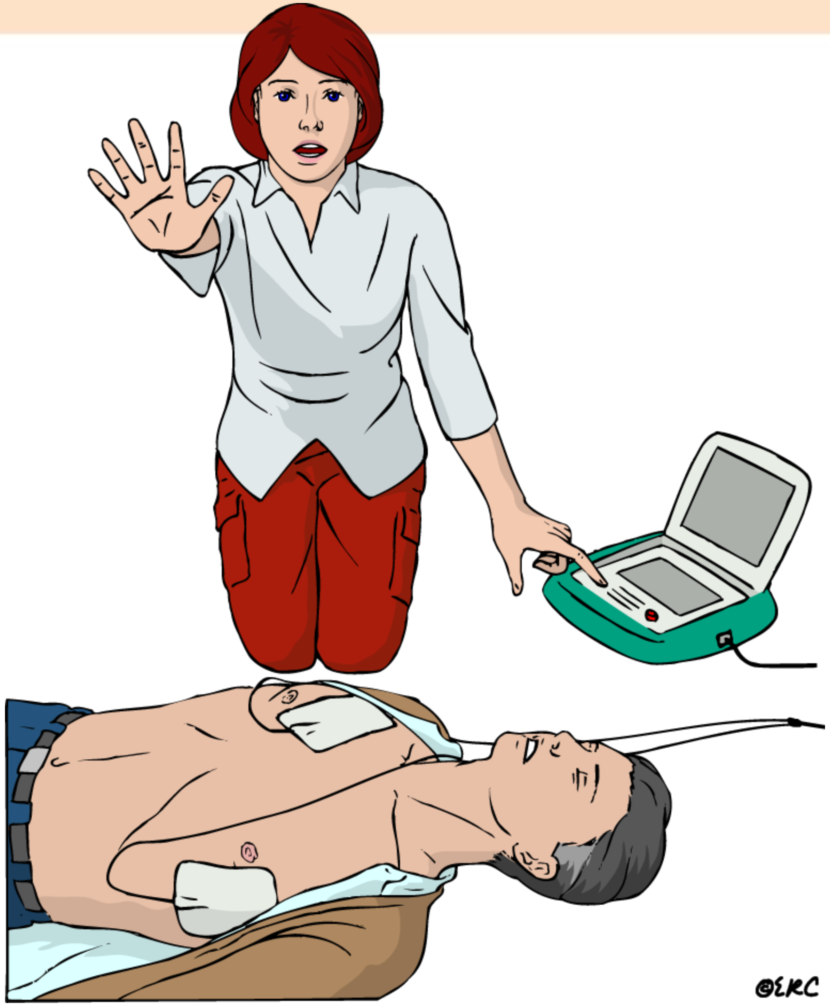
Attach pads to victims bare chest

Analysing Rhythm: Do not touch victim



Shock indicated

- Stand clear
- Deliver shock



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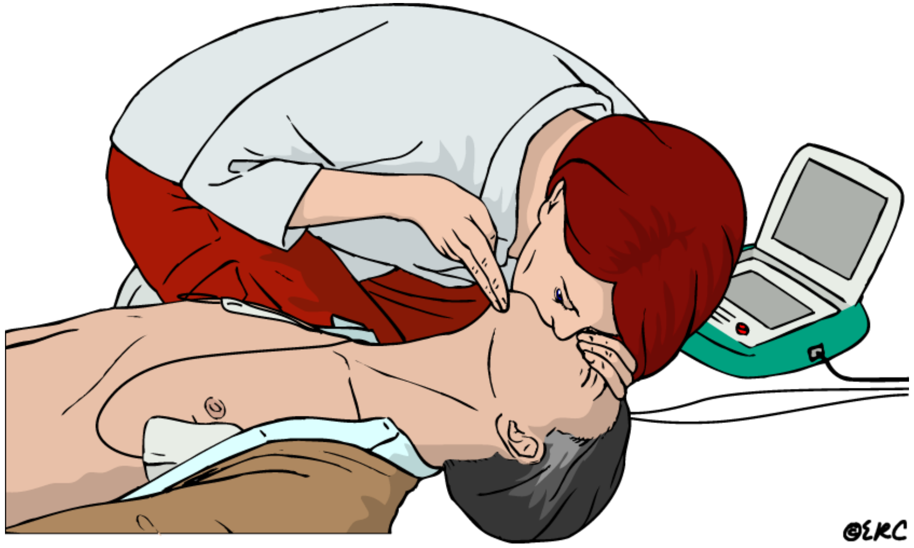
Shock delivered: Follow AED instructions

30



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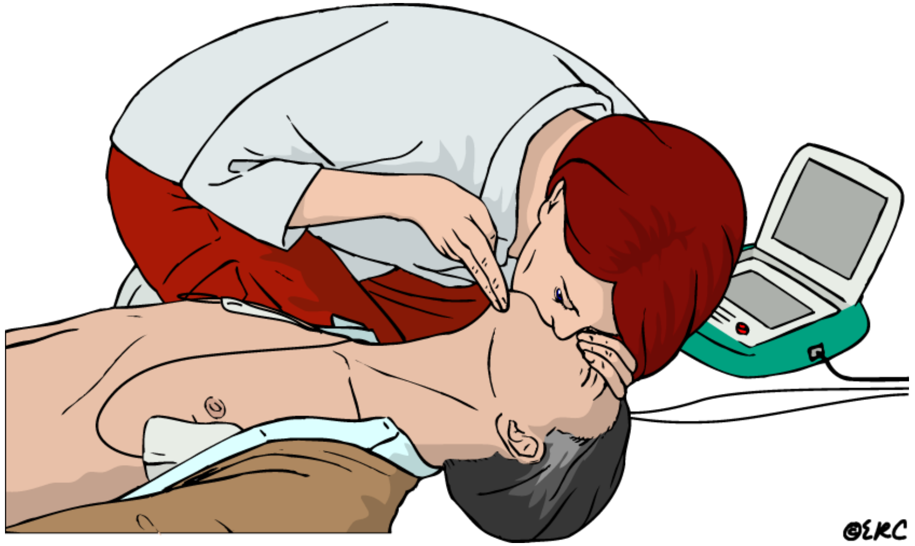
No shock advised: Follow AED instructions

30



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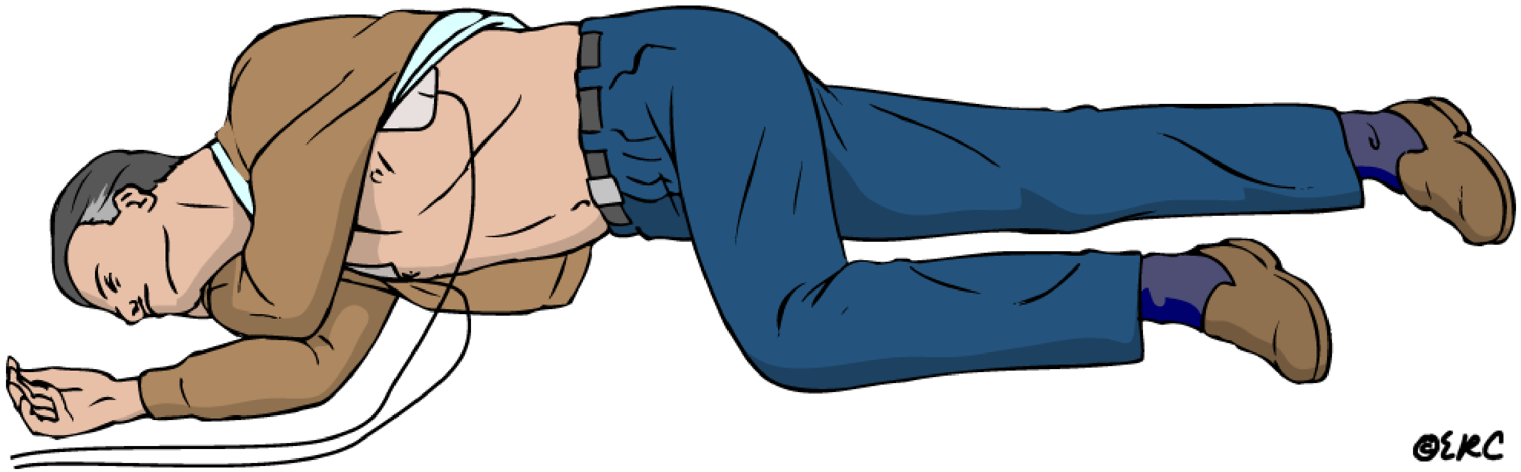
Any questions?

If victim starts to breathe normally place in recovery position



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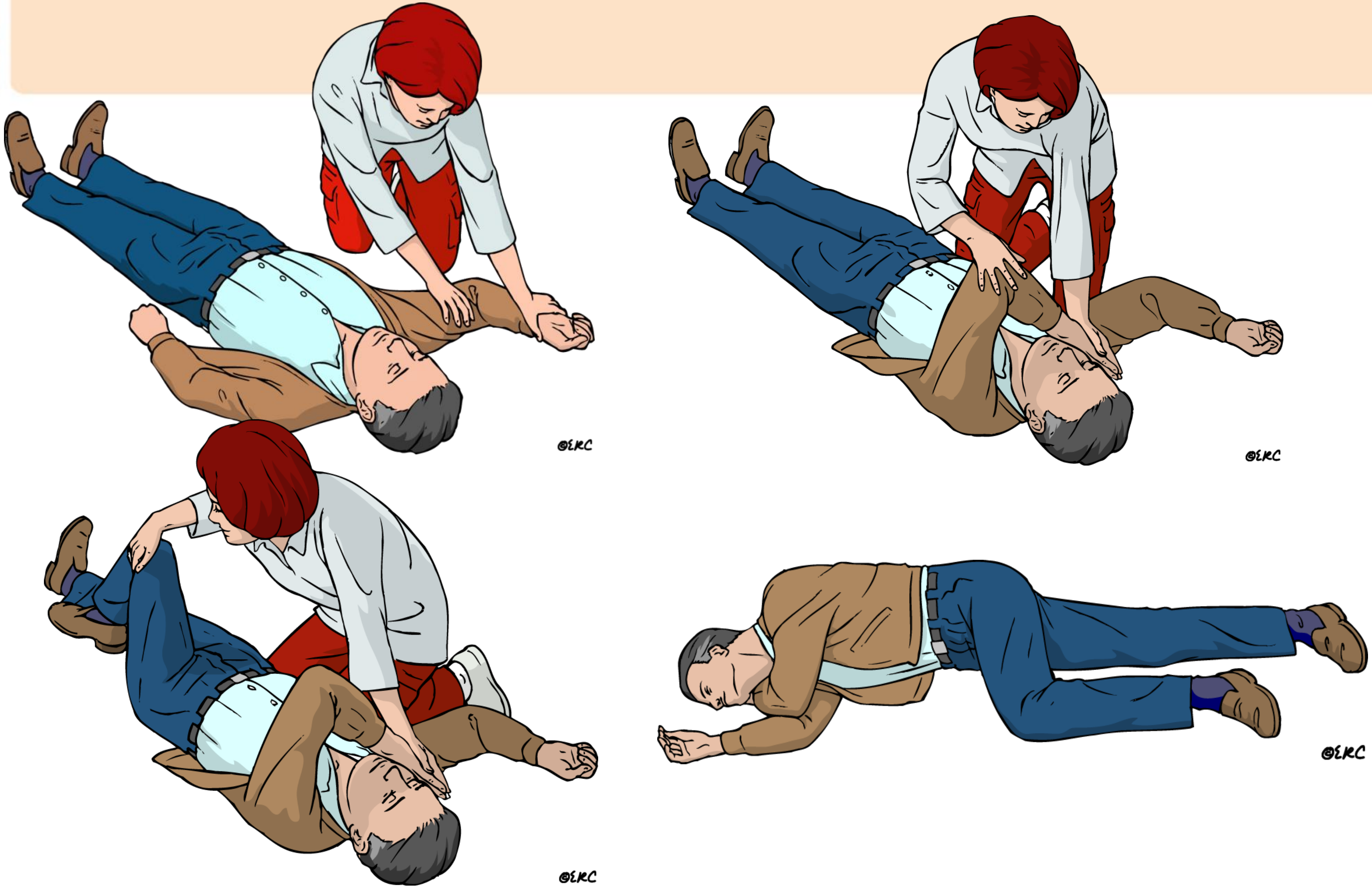
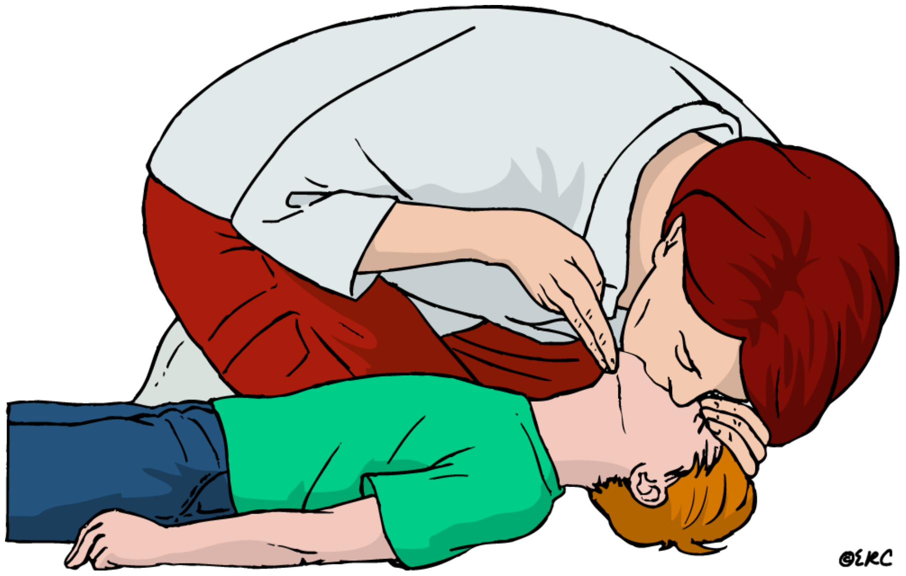


CPR in children

- Adult CPR techniques can be used on children
- Compressions at least 1/3 of the depth of the chest



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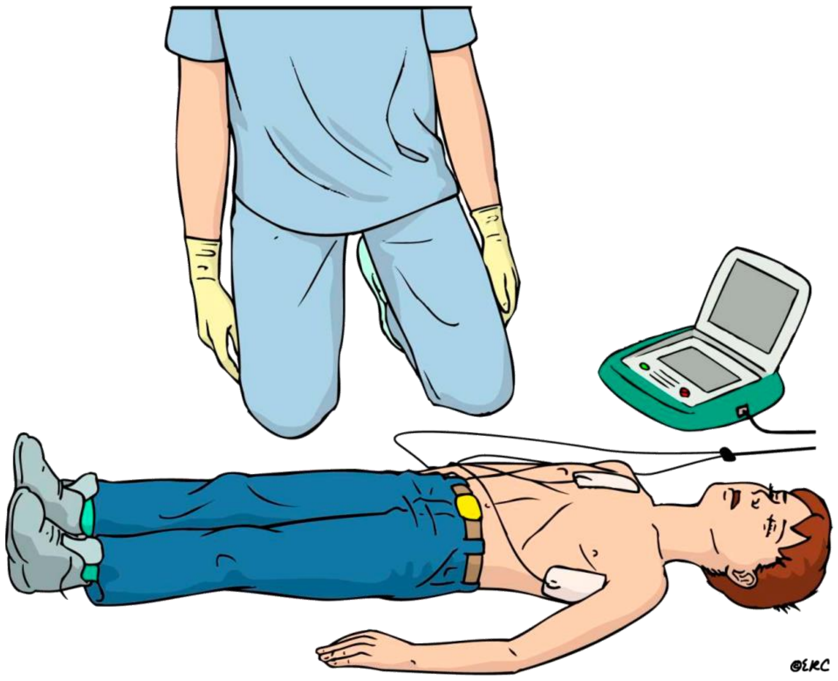
AED in children

- Age > 8 years
  - use adult AED

- Age 1-8 years
  - use paediatric pads / settings if available (otherwise use adult mode)

- Age < 1 year
  - use only if manufacturer instructions indicate it is safe



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Any questions?

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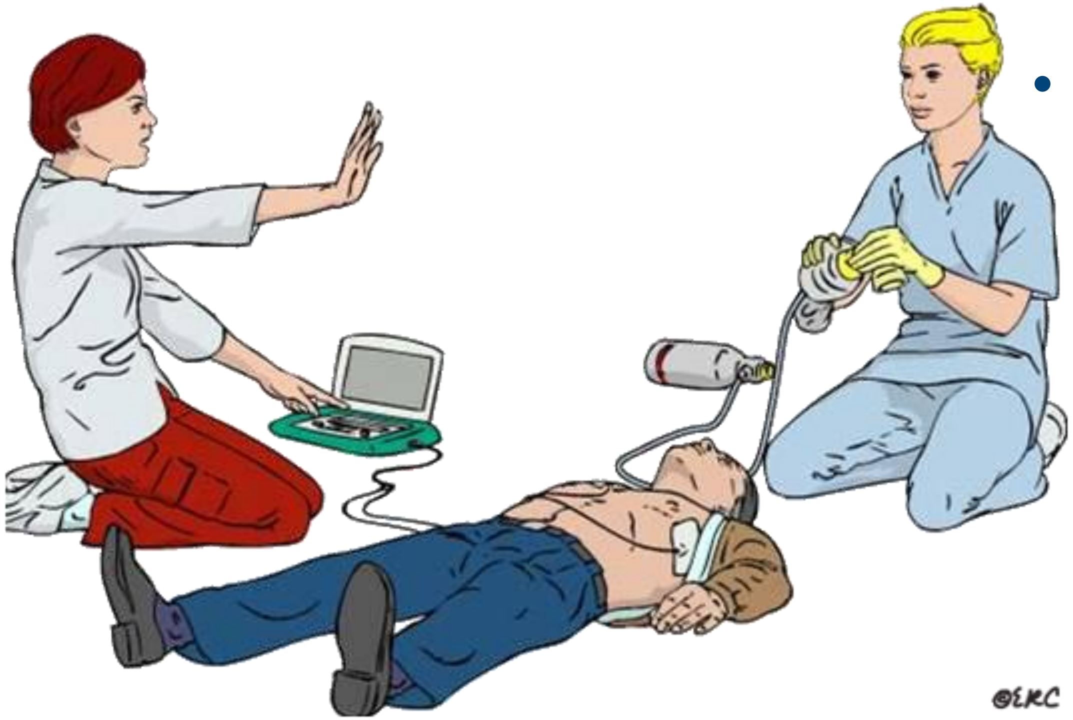
USE OF OXYGEN



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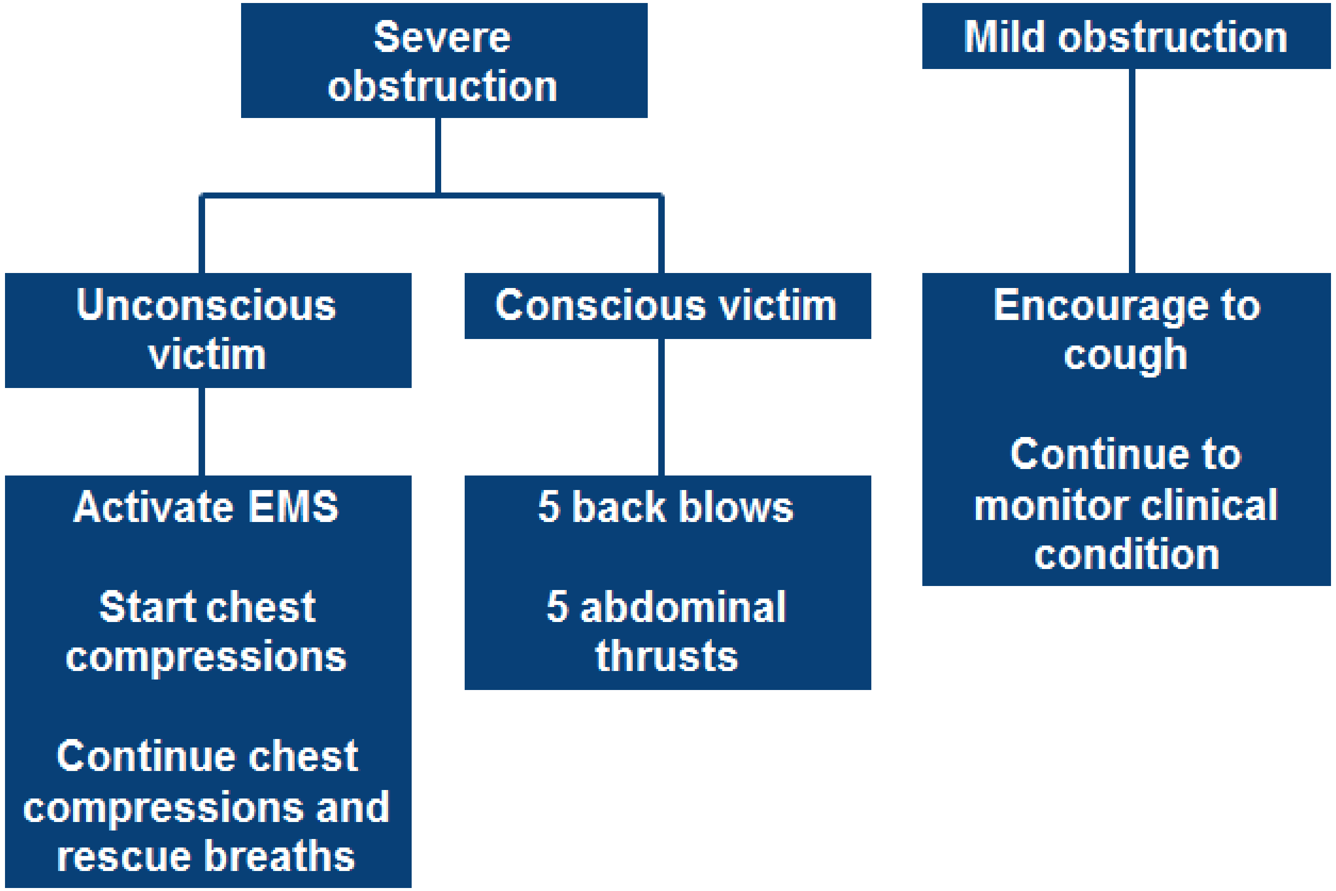
Any questions?

CHOKING: ALGORITHM



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CHOKING

Back Blows

Abdominal thrusts: position of first hand

Abdominal thrusts: position of second hand

DROWNING

- Drowning victims need early rescue breaths
- Safety of rescuer is very important, but victim should be removed from water as soon as possible
- Rescue breaths can be given whilst in the water *if you are trained to do so*
- AED can be used (on dry land or in rescue boat) if victim’s chest is dried

Approach safely

Check response

Shout for help

Open airway

Check breathing

Send someone to call 112

5 rescue breaths

30 chest compressions

2 rescue breaths

If alone, call 112 after 1 minute

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Any questions?

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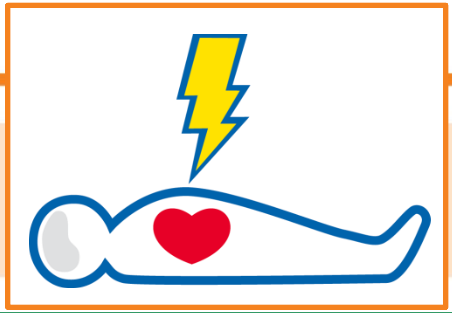

Approach safely

Check response

Shout for help

Open airway

Check breathing

Call 112

30 chest compressions

2 rescue breaths

Approach safely

Check response

Shout for help

Open airway

Check breathing

Call 112

Attach AED

Follow voice prompts