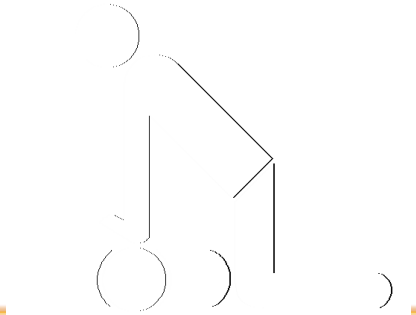

Cardiac **a**rrest **U**ltra-**S**ound **e**xam

Original Articles

RESUSCITATION OF THE HEART*

...T F. BARBER, M.D. AND CAPTAIN JOHN L. MADDEN
...sor of Clinical Surgery,
... College of Medicine
... MEDICAL CORPS,
... ARMY OF THE UNITED STATES

Carrel[20] differentiates between general and elemental death. The former is manifested by a complete stoppage of the circulation in which the organs are still living and could be completely revived if they were given back their normal physicochemical conditions by re-establishment of the circulation. When, however, protoplasmic degeneration and death of the tissues occur as a result of a prolonged interruption of the circulation, it is spoken of as elemental death. Immediately following the cessation of the heart beat the organism is placed in a position intermediary between general and elemental death. Nevertheless, as long as elemental

Reversibiliteit

shock

ON A

NEW MODE OF EFFECTING ARTIFICIAL RESPIRATION.

By MARSHALL HALL, M.D., F.R.S.,
MEMBER OF THE INSTITUTE OF FRANCE, ETC.

To the Editor of THE LANCET.

SIR,—The following document cannot fail to interest your readers.

Artificial respiration is the *sine quâ non* of our treatment of suspended animal animation by drowning, strangulation, &c. and the *only* efficient mode of accomplishing it is [illegible] that here described.

"*Attended* [illegible] *Hospital* [illegible] *ments made* [illegible] *respiration without the aid of a bellows, as proposed by* MARSHALL HALL, M.D., &c.

"The mouth and one nostril were carefully closed by means of sticking-plaster, to prevent the possibility of air finding its way through them. In the other nostril was inserted a caoutchouc tube, about three feet long, at the end of which was fixed a bent glass tube of the same size, into which was poured a teaspoonful of water.

"The operator then took hold of the subject (which was lying in the prone position) by the left shoulder and hip, and gently raised it, until the whole body was resting on the right side. This movement caused the air to enter the glass tube, creating bubbles in the water as it passed on into the lungs; and on the body being slowly replaced on the stomach, the air was freely expelled from the lungs, and caused the same agitation in the water as it made its exit through the glass tube.

A Mirror
OF THE PRACTICE OF MEDICINE AND SURGERY IN THE HOSPITALS OF LONDON.

Nulla est alia pro certo noscendi via, nisi quam plurimas et morborum et dissectionum historias, tam aliorum proprias, collectas habere et inter se comparare.—MORGAGNI. *De Sed. et Caus. Morb.* lib. 14. Procemium.

MONTHLY REPORT
OF
OPERATIONS PERFORMED AT THE METROPOLITAN HOSPITALS.

GUY'S HOSPITAL.

THE return for the month, sent to us by Mr. Wallace, the house-surgeon of Guy's Hospital, shows that during the time between the 1st and 31st of January, there were twenty-two operations.

AMPUTATIONS.

CASE 1.—A man of cachectic constitution, aged forty-six, with compound fracture of the tibia and fibula, at the junction of the middle and lower third. On the 3rd of January, Mr. Cock performed amputation below the knee, the skin having ulcerated, and the soft part sloughed. The patient died five days after amputation, and twelve days after injury.

CASE 2.—Primary amputation of the humerus, about three inches below the shoulder, by Mr. Poland. The patient, a male aged forty-seven, had suffered extensive injuries. The arm was only attached to the trunk by a small portion of

Respiratie

THE PHYSIOLOGIC BASIS FOR CARDIAC RESUSCIT
FROM VENTRICULAR FIBRILLATION—METHOD
FOR SERIAL DEFIBRILLATION

CARL J. WIGGERS, M.D.
CLEVELAND, OHIO

THE high incidence of death from ventricular fibrillation se
to coronary occlusion and the increasing mortality from ac
electrocution resulting from the widespread use of electrical ap
in our homes, on our farms, and in our trades and professio
the subject of ventricular fibrillation of special interest in the
preventive and curative medicine alike. It is obviously imperat
scientists should continue experimentation for the purpose of d
ing the conditions under which electric currents become dange
attempting to render the ventricles less susceptible to fibrillating
and of devising means for the resuscitation of fibrillating hearts
the rescue of human lives has not yet been achieved, it ap
many that we may be on the threshold of success, certainly in
cases. However, our hope of crossing that threshold does n
the continuance of haphazard modes of experimentation, b
methodical approach based on an understanding of the phy
factors which determine success or failure in any given inst

From the Department of Physiology, Western Reserve University Medical School, Cleveland, Ohio.

Presented before the Eighth American Scientific Congress, Washington, D. C., May 13, 1940.
Received for publication July 1, 1940.

As Garrey[2] has properly emphasized, the idea of earlier investigators that fibrillation is a terminal process when hearts do not recover spontaneously has been amply disproved by abrogating fibrillation in excised hearts by cooling, by reducing the mass of fibrillating tissue, or by perfusing hearts with potassium chloride solution, followed by Locke's solution. It was, therefore, not entirely unexpected that the prompt u[illegible] solutions containing an excess of potassium might likewise abolish fi[illegible]at[illegible] i[illegible] t[illegible]t heart. Two problems existed, however: (1) to get the potassium ions to the fibrillating ventricle when the circulation is at a standstill and (2) either to remove the excess potassium or to neutralize it with calcium. The former was achieved in 1904 by d'Halluin,[3] who injected KCl solution into a jugular vein and then massaged the heart. Hooker,[4] following an earlier procedure of Crile, introduced a weak solution of KCl into a carotid artery under pressure, while I[5] injected it directly into the ventricular cavities. These various procedures generally proved efficacious in defibrillating the ventricles, and the subsequent use of an excess of calcium sometimes caused a resumption of spontaneous, coordinated beats. Although such

RESUSCITATION FROM "IRREVERSIBLE" SHOCK BY INTRA-ARTERIAL TRANSFUSION

ARNOLD DANZIGER
M.R.C.S., D.A.

ANÆSTHETIC REGISTRAR, THE LONDON HOSPITAL; FORMERLY REGISTRAR, KING GEORGE V HOSPITAL, ILFORD

MANY cases of intra-arterial transfusion have been reported. It was undertaken to treat shock from various causes were the indications for its use. These causes included hæmorrhage, toxæmic states due to peritonitis or to loss of body fluids, and postoperative shock which could not be overcome by intravenous transfusion.

All reports bear witness to the superiority of the intra-arterial over the intravenous route: recovery was more rapid and better sustained, and resuscitation was successful when intravenous transfusion had either failed or held out no prospect of success. Recovery is described in cases of very severe shock, in some of which cardiac and respiratory arrest had supervened (Negovsky 1945, Bilsland 1951, Haxton 1952, 1953, Good 1953, Pryer 1953, Horton et al. 1953).

CARDIO-RESPIRATORY RESUSCITATION

Alan Gilston and Leon Resnekov pp. xiii + 275. William Heinemann Medical Books Ltd., London, 1971; £4.50.

Snelheid

In a dying person, first the respiration stops and then the heart slows, so that blood continues to circulate with a diminishing oxygen content. The usual immediate cause of death from whatever condition is hypoxia of the brain, so that in resuscitation the problem is to restart the respiration, and then the heart. The first 4 min after cardiac arrest are always considered critical, because irreversible brain damage occurs in normothermia in about that time. This is well recognized, and is part of the catechism of every medical student.

Resuscitation (1972), **1**, 1

The second step in resuscitation—the treatment of the 'post-resuscitation disease'

V. A. NEGOVSKY

Laboratory of Experimental Resuscitation, Academy of Medical Sciences of the U.S.S.R., 9, October 25th Street, Moscow, U.S.S.R.

In the first stages of the development of the science of resuscitation, 'reanimatology', research workers have been limited mainly to the study of the pathology of death, and to the elaboration of a series of techniques of resuscitation. We now have at our disposal some knowledge of the process of disintegration of physiological functions during the dying of an organism, and of their restoration during resuscitation. We also have at our disposal a number of methods available to a large circle of practising doctors. Extensive experimental studies and clinical findings have clearly proved that after the first step in resuscitation when heart function and respiration have been restored, the second step in resuscitation arises—the more complicated problems of treating the after-effects of a general hypoxia. There are characteristic disturbances in the functions of the central nervous system and internal organs, in metabolism and in homeostasis among other systems.

There is much evidence that the organism experiences a specific pathological condition after resuscitation. We are inclined to call this condition 'the post-resuscitation disease', and to examine it as an independent nosological form. Indeed, irreversible changes occur during clinical death and after resuscitation.

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-
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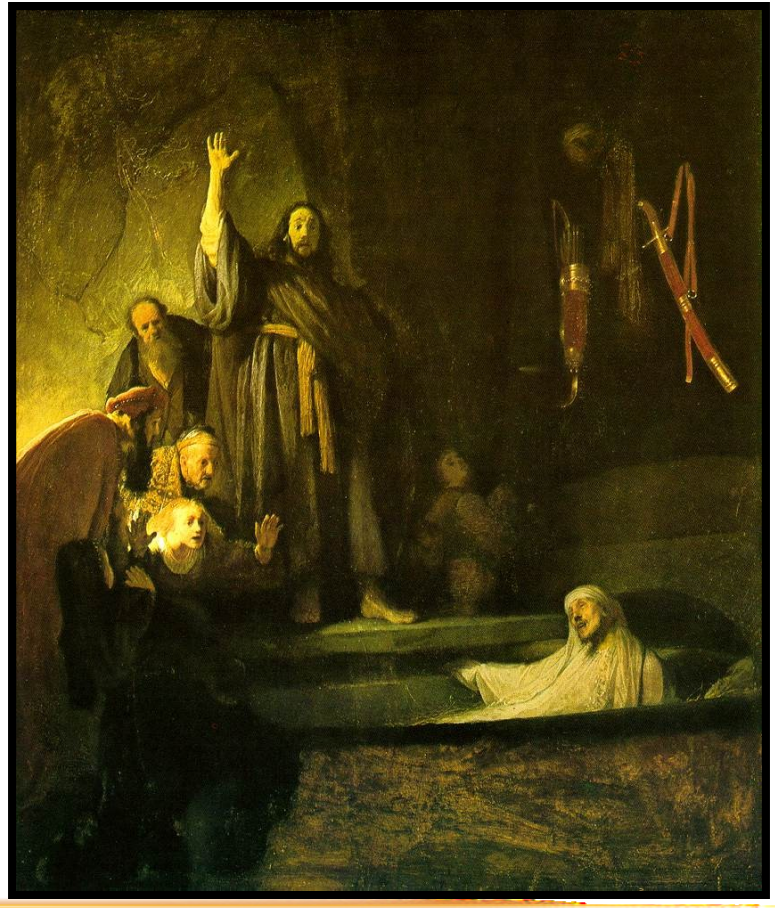
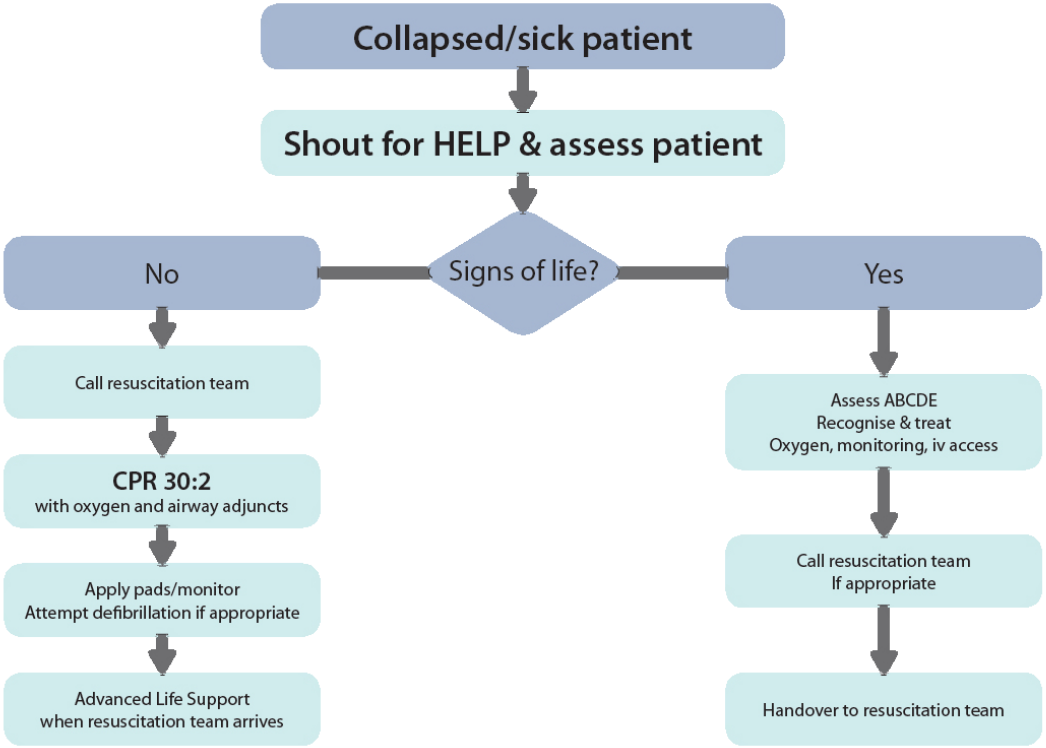
Resuscitatie





2006 N=173	Totaal	ROSC	Overleden	Overleven
VF	61 35%	55 90%	30 49%	31 51%
Polsloos VT	9 5%	6 67%	4 44%	5 56%
Asystolie	29 17%	19 66%	26 90%	3 10%
EMD	41 24%	21 51%	38 93%	3 7%
Respiratoir	14 8%	13 93%	6 43%	8 57%
Trauma	1 0,5%	0 0%	1 100%	0 0%
Drenkeling	3 2%	2 67%	2 67%	1 33%
Choking	5 3%	4 80%	4 80%	1 20%
Overigen	10 6%	6 60%	7 70%	3 30%

2007 N=163	Totaal	ROSC	Overleden	Overleven
VF	55 34%	49 89%	22 40%	33 60%
Polsloos VT	3 2%	2 67%	1 33%	2 67%
Asystolie	39 24%	19 49%	37 95%	2 5%
EMD	42 26%	17 40%	40 95%	2 5%
Respiratoir	9 6%	8 89%	4 44%	5 56%
Trauma	3 2%	2 67%	2 67%	1 33%
Drenkeling	1 0,6%	1 100%	0 0%	1 100%
Choking	0 0%			
Overigen	11 7%	11 100%	4 36%	7 64%

1.
2.
3.
4.
5.

-
-
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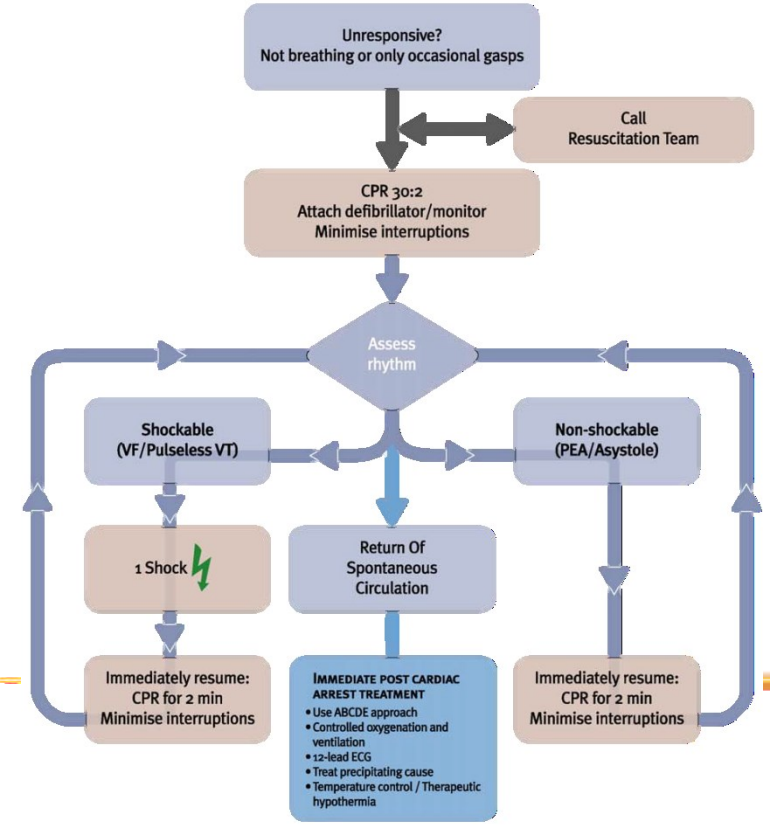
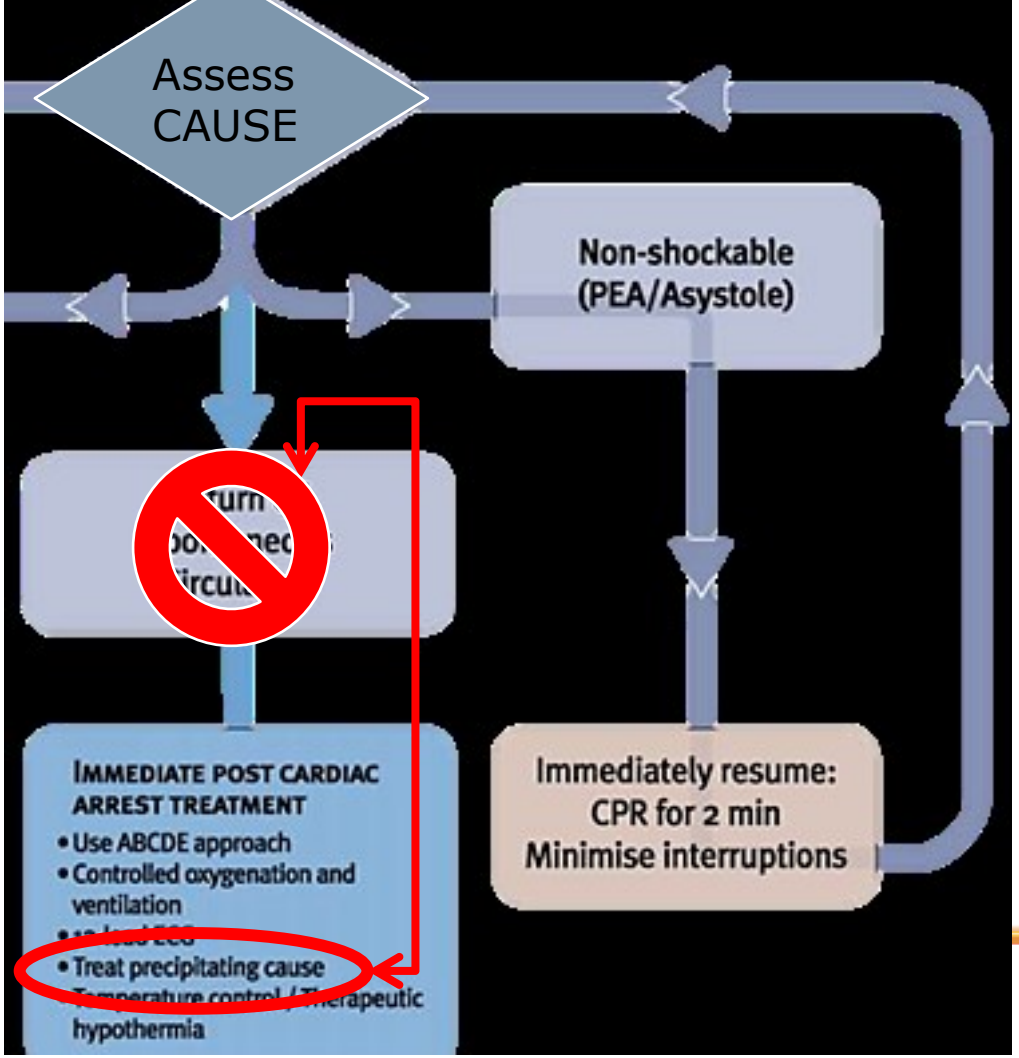


DURING CPR

- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Correct reversible causes

REVERSIBLE CAUSES

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tamponade - cardiac
- Toxins
- Tension pneumothorax

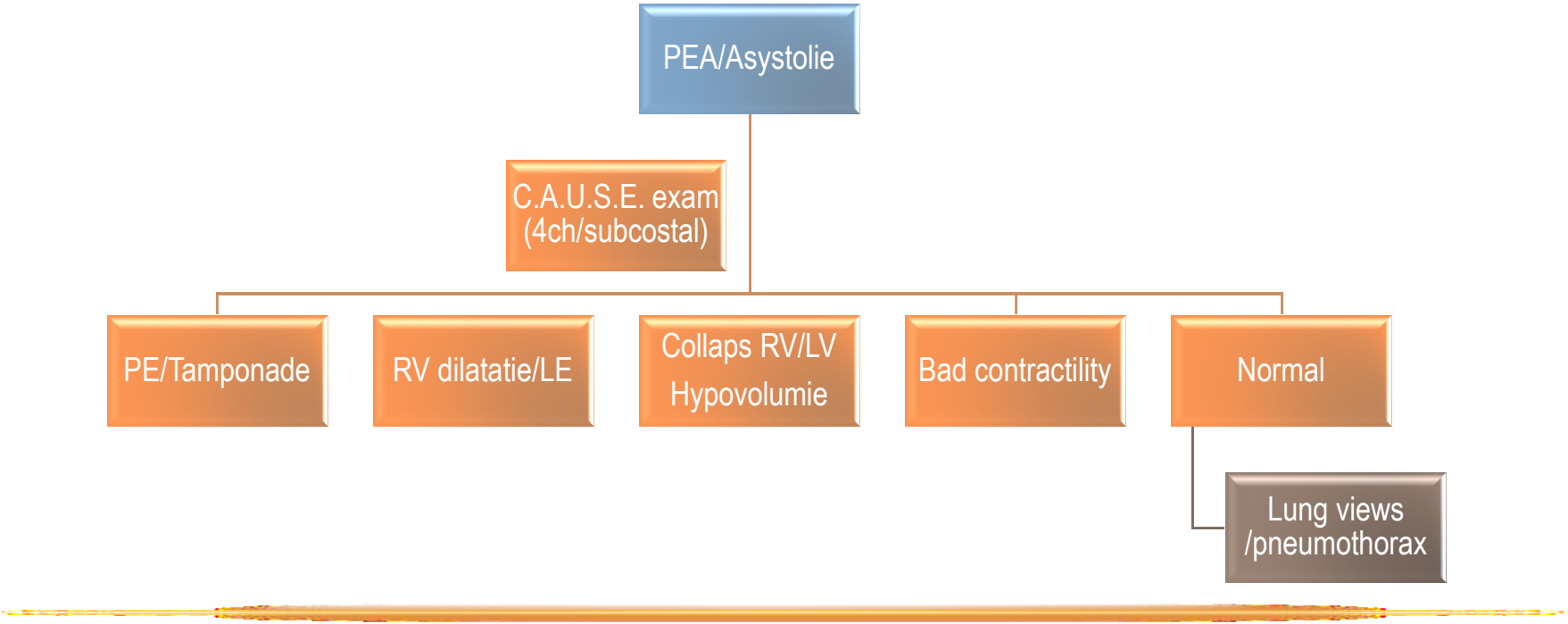

Assess CAUSE
Non-shockable (PEA/Asystole)
IMMEDIATE POST CARDIAC ARREST TREATMENT
• Use ABCDE approach
• Controlled oxygenation and ventilation
• Treat precipitating cause
hypothermia
Immediately resume:
CPR for 2 min
Minimise interruptions

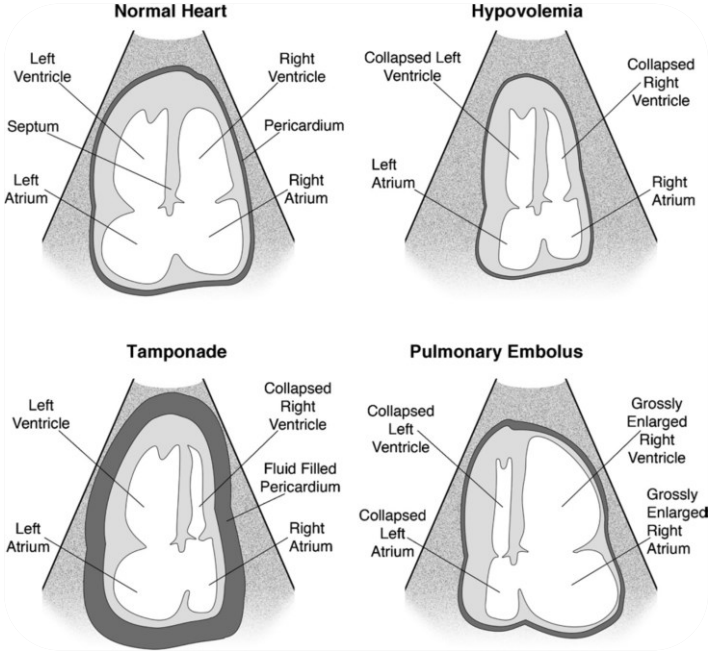
Use of ultrasound imaging during advanced life support

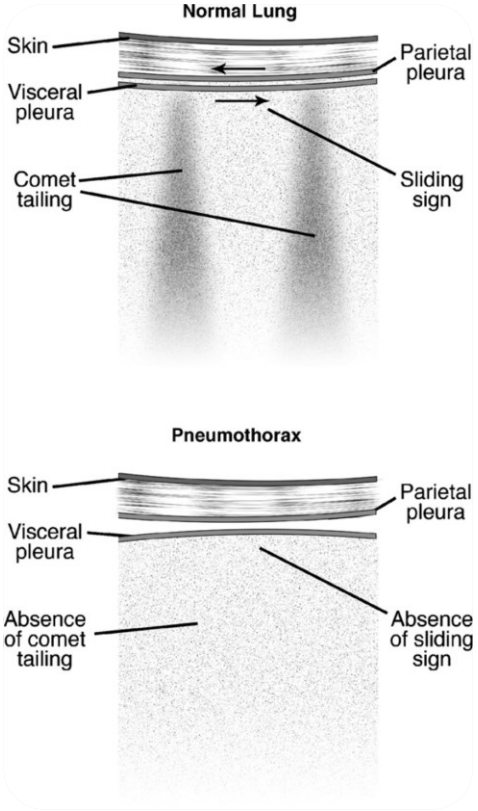
Several studies have examined the use of ultrasound during

studies have shown that use of this imaging modality improves outcome, there is no doubt that echocardiography has the potential to detect reversible causes of cardiac arrest (e.g., cardiac tamponade, pulmonary embolism, aortic dissection, hypovolaemia, pneumothorax).[261–268] When available for use by trained clinicians, ultrasound may be of use in assisting with diagnosis and treatment of potentially reversible causes of cardiac arrest. The integration of ultrasound into advanced life support requires considerable training if interruptions to chest compressions are to be minimised. A sub-xiphoid probe position has been recommended.[261,267,269] Placement of the probe just before chest compressions are paused for a planned rhythm assessment enables a well-trained operator to obtain views within 10 s. Absence of cardiac motion on sonography during resuscitation of patients in cardiac arrest is highly predictive of death[270–272] although sensitivity and specificity has not been reported.


RICH MEDICAL


PEA/Asystolie
C.A.U.S.E. exam (4ch/subcostal)
PE/Tamponade
RV dilatatie/LE
Collaps RV/LV Hypovolumie
Bad contractility
Normal
Lung views /pneumothorax


Normal Heart
Left Ventricle
Right Ventricle
Septum
Pericardium
Left Atrium
Right Atrium
Hypovolemia
Collapsed Left Ventricle
Collapsed Right Ventricle
Left Atrium
Right Atrium
Tamponade
Left Ventricle
Collapsed Right Ventricle
Fluid Filled Pericardium
Left Atrium
Right Atrium
Pulmonary Embolus
Collapsed Left Ventricle
Grossly Enlarged Right Ventricle
Collapsed Left Atrium
Grossly Enlarged Right Atrium


Normal Lung
Skin
Parietal pleura
Visceral pleura
Comet tailing
Sliding sign
Pneumothorax
Skin
Parietal pleura
Visceral pleura
Absence of comet tailing
Absence of sliding sign

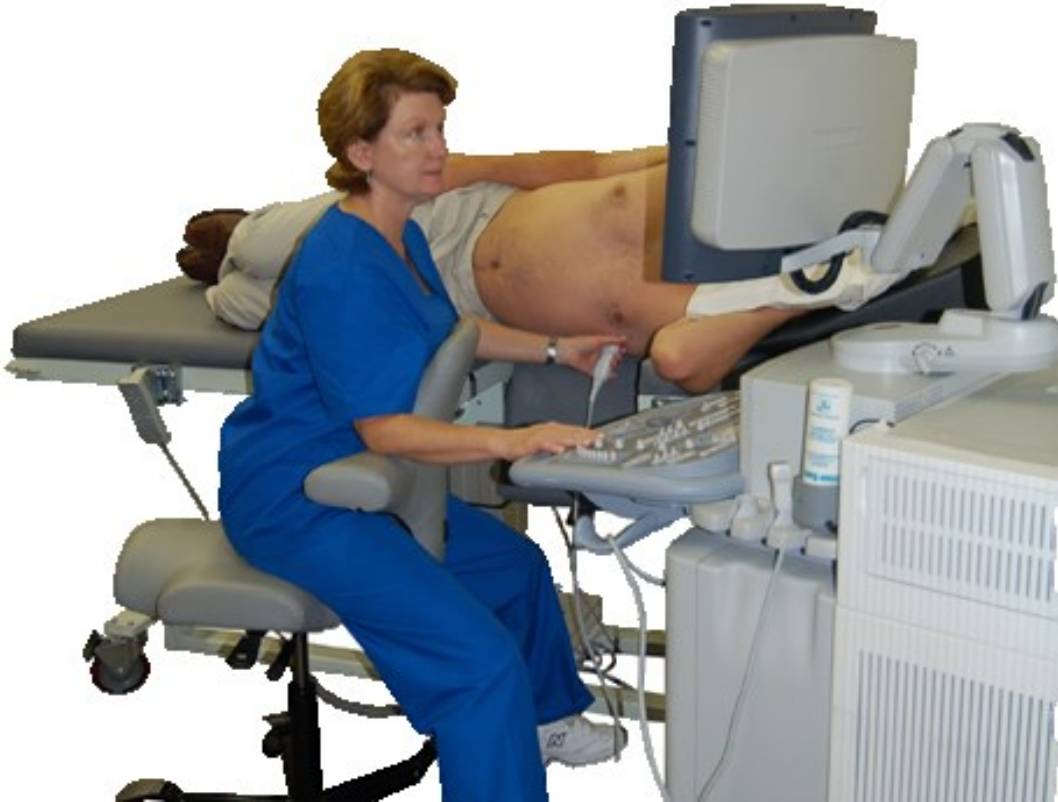
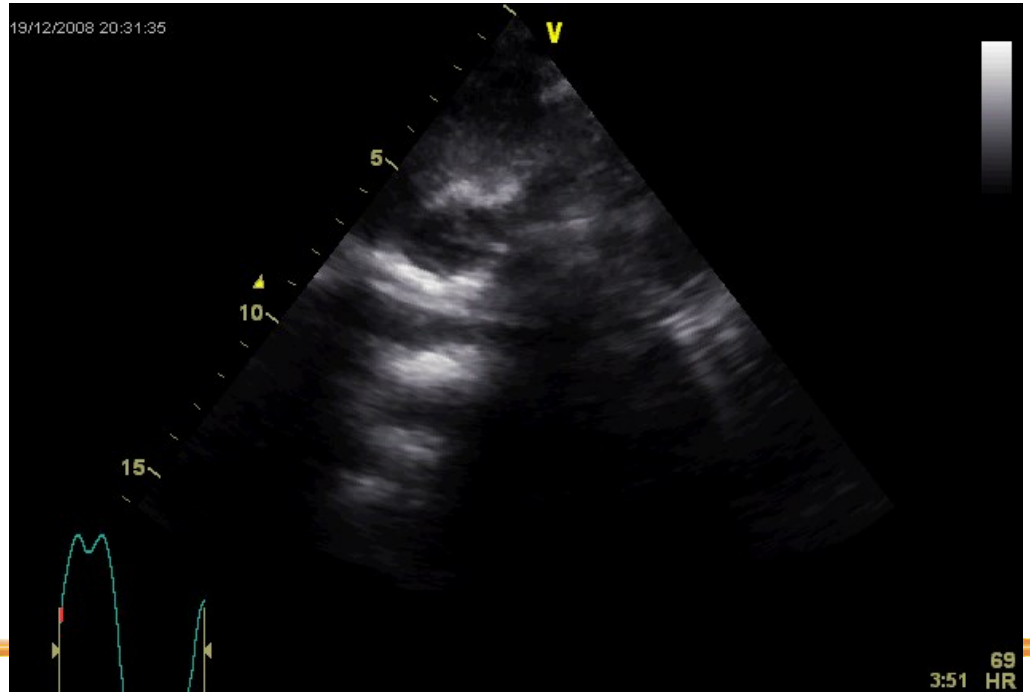
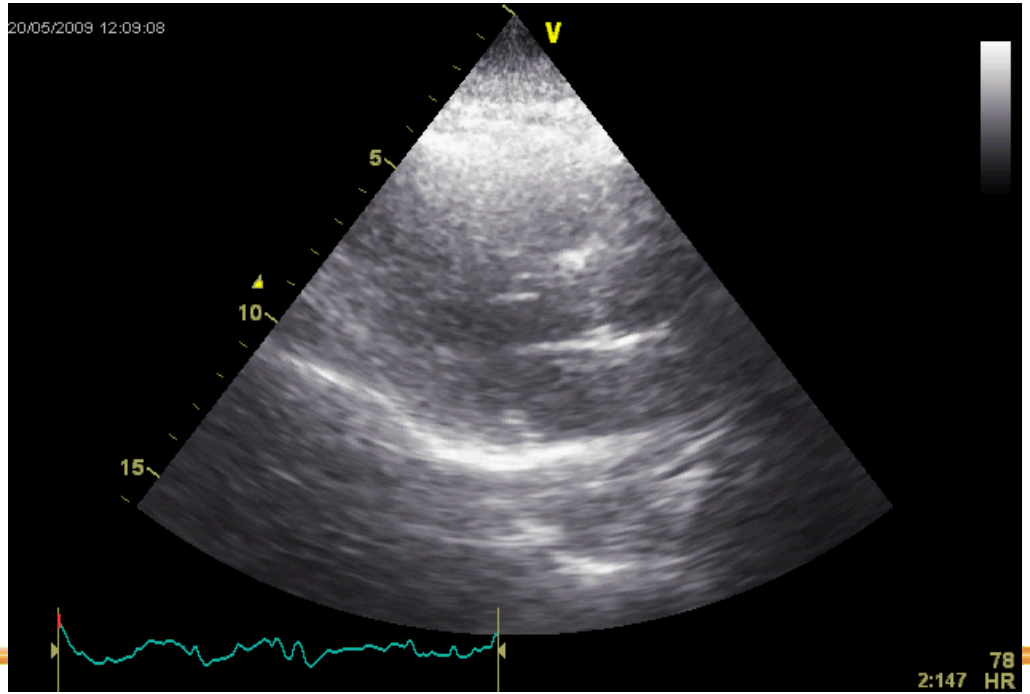
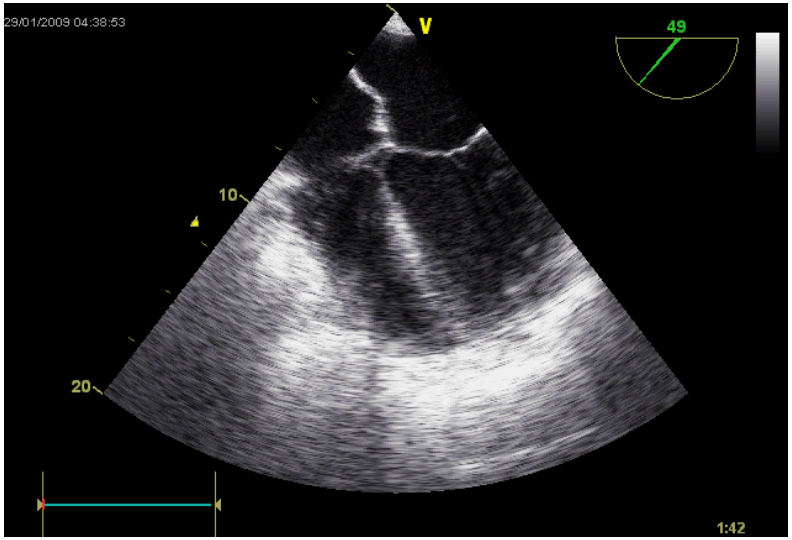


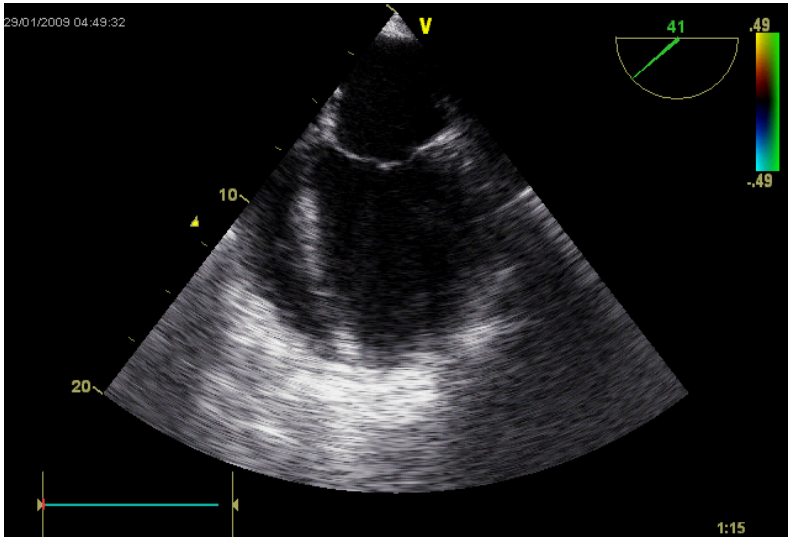
Table 1 Technical aspects of echo in life support

View	Number (% of total)	Adequate view (n)	Adequate view (%)	Number within single 10 s window	Success rate (adequate view and within 10 s)
Subxiphoid	40 (80%)	38	95%	38	95%
Parasternal	20 (40%)	19	95%	17	85%
Apical	4 (8%)	3	75%	2	50%
Combined	50	47	94%	45	90%

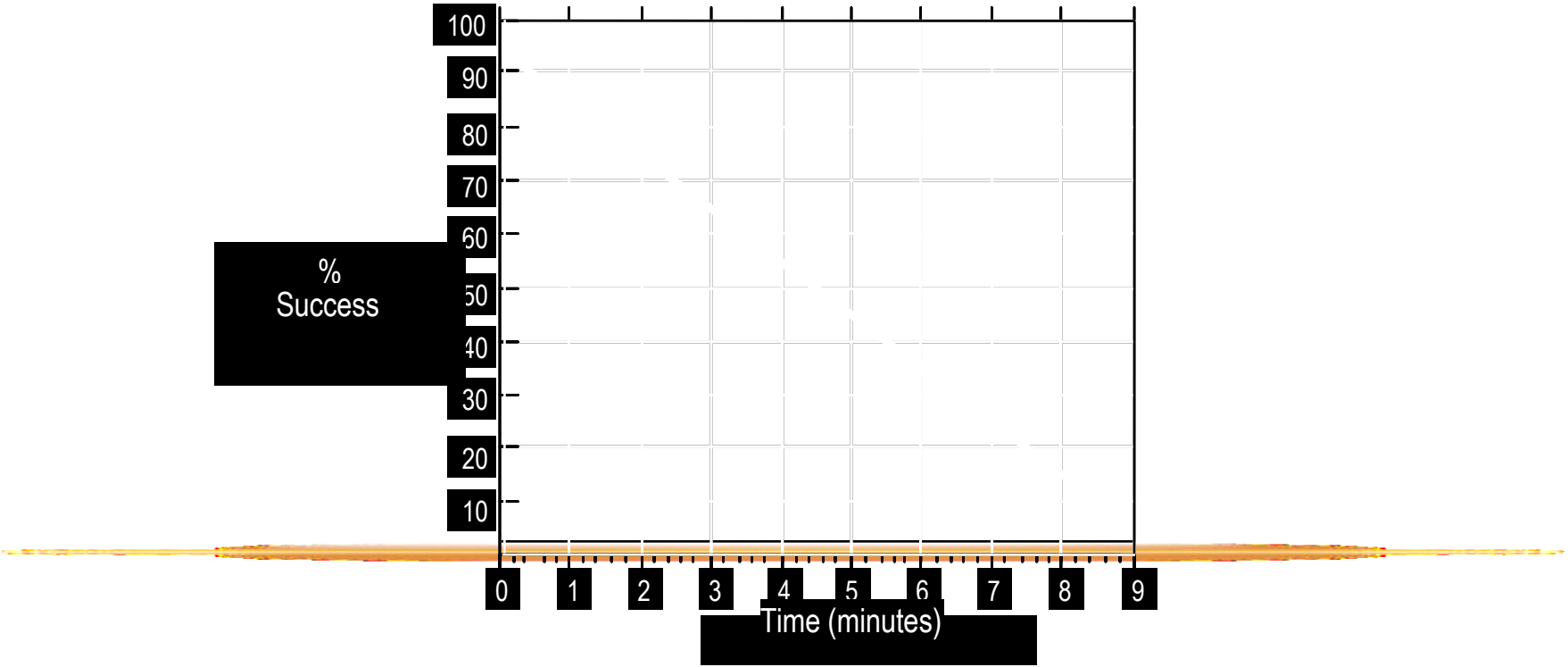

19/12/2008 20:31:35
V
5
10
15
69
3:51 HR

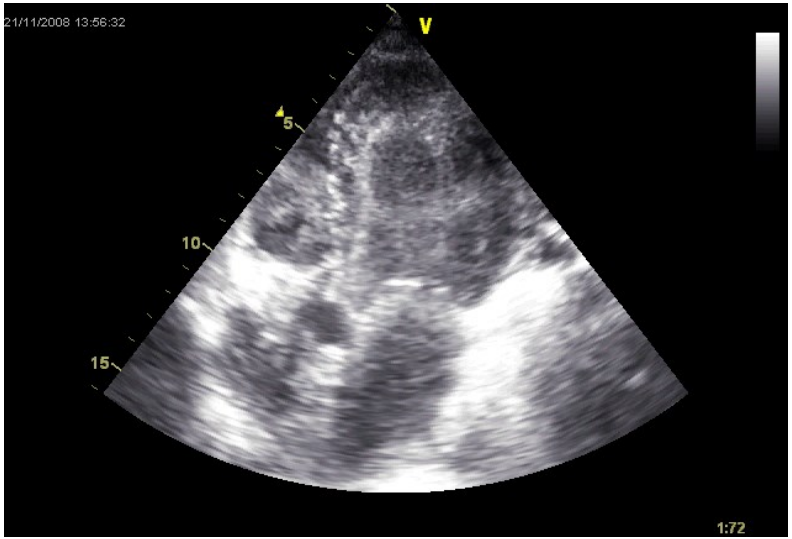

20/05/2009 12:09:08
V
5
10
15
78
2:147 HR

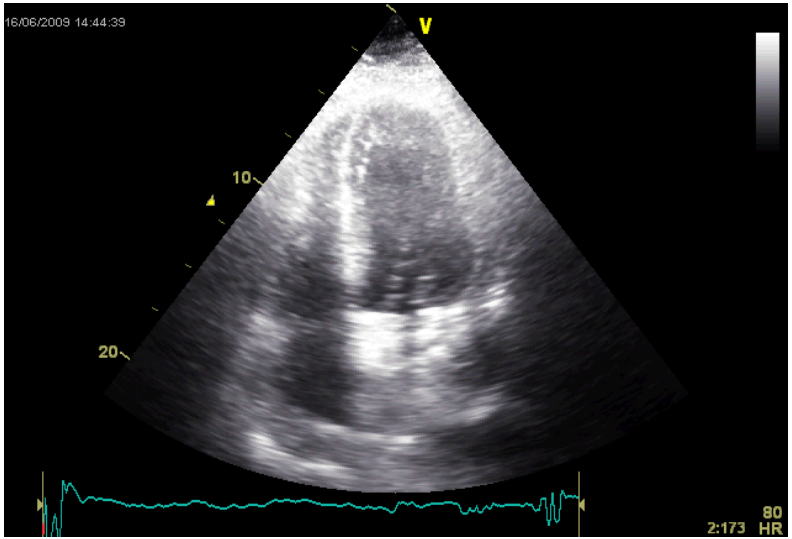

29/01/2009 04:38:53
V
49
10
20
1:42

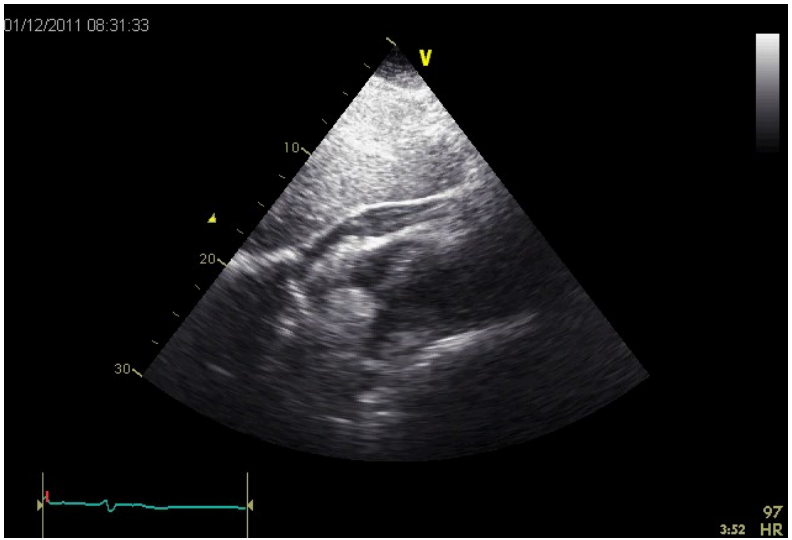

29/01/2009 04:49:32
V
41
.49
-.49
10
20
1:15

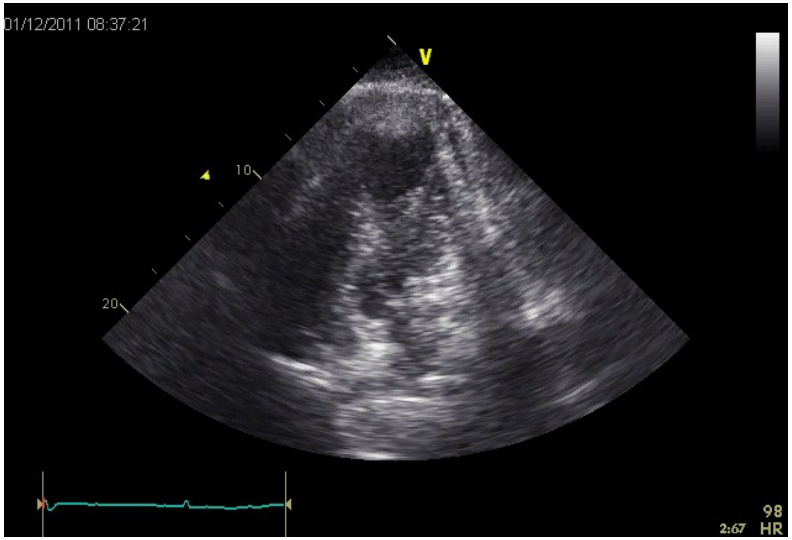

LifeBand

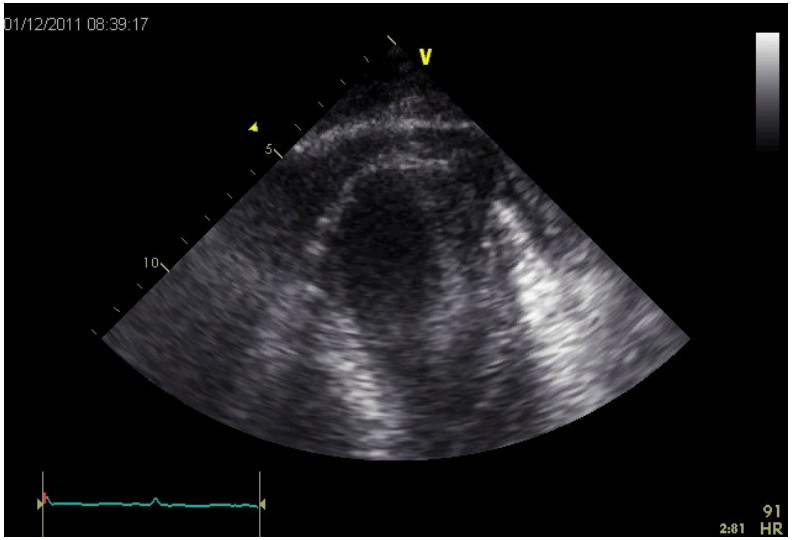

100
90
80
70
60
50
40
30
20
10
% Success
0
1
2
3
4
5
6
7
8
9
Time (minutes)


21/11/2008 13:56:32
V
5
10
15
1:72


16/06/2009 14:44:39
V
10
20
80
2:173 HR

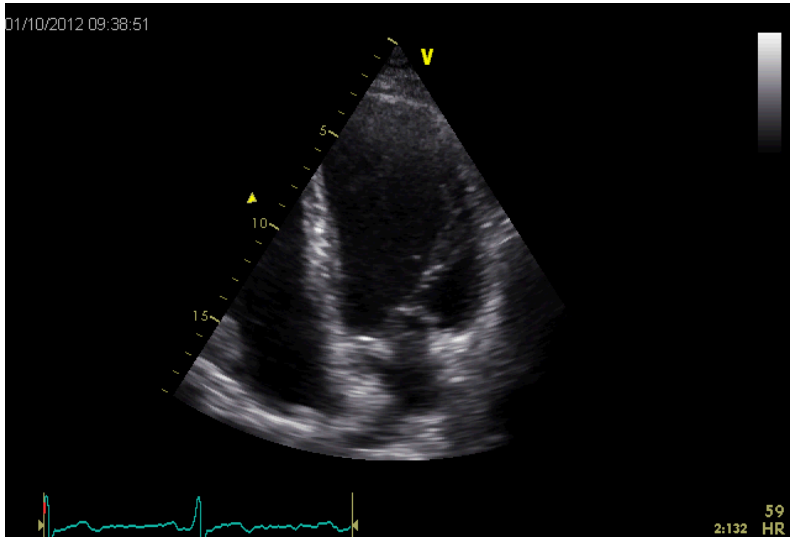

01/12/2011 08:31:33
V
10
20
30
97
HR
3:52

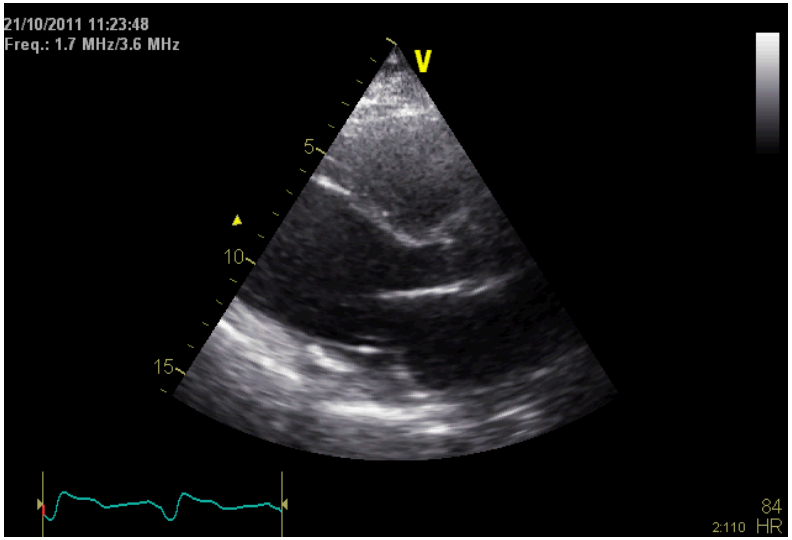

01/12/2011 08:37:21
V
10
20
98
2:67
HR

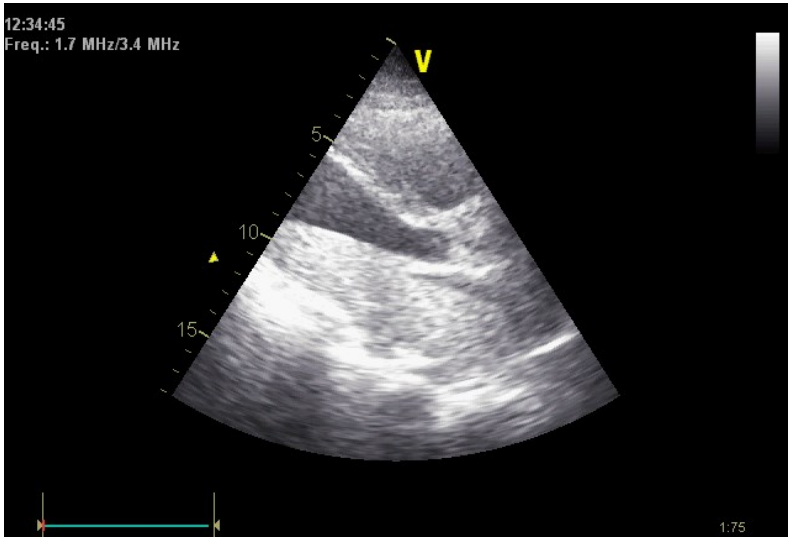

01/12/2011 08:39:17
V
5
10
91
2:81
HR

Operatieverslag:

Patient komt in shock op de OK, maar is nog wel enigszins aanspreekbaar. Er wordt direct na inductie met spoed een mediane sternotomie verricht.
Ritme bij openen: sinusritme. Pericard pral gespannen. Na openen grote hoeveelheid bloed en grote stolsels weggehaald. Hierna verbetering van de haemodynamiek.
Arteriële canulatie via de aorta ascendens. Veneuze canulatie via het rechter atrium (two-stage). Venting via de aortabasis. Perfusietijd is 68 min. er wordt niet geklemd. Bij manipuleren ontstaat VF.
Er blijkt sprake van een geruptureerd aneurysma cordis. De hele voorwand is een groot litteken en hierin is een zwakke plek ontstaan waar een klein blaasje zit ter grootte van een hazelnoot en dat zeer dunwandig is. Hierin zit ook een minimaal gaatje waaruit de lekkage is opgetreden. Het defect wordt overhecht door aan weerszijden twee reepjes vilt te plaatsen en dan het defect te sluiten met staande prolene 3/0 hechtingen en vervolgens nog overhechting. Het defect is dan droog.
Sinusritme na defibrillatie.
Weanen vindt plaats met lage dosering inotropica. Ritme bij sluiten: sinusritme.
Het pericard is niet gesloten, 2 drains in het pericard. De linker pleura is dicht. De rechter pleura is dicht.
Er wordt lang gewacht met sluiten tot de stolling goed is. Sluiten in lagen (Luijten).




21/10/2011 11:23:48
Freq.: 1.7 MHz/3.6 MHz
V
5
10
15
84
2:110 HR


12:34:45
Freq.: 1.7 MHz/3.4 MHz
V
5
10
15
1:75

"Well, Bob, it looks like a paper cut, but just to be sure let's do lots of tests."