

SONOGRAPHY IN CARDIAC ARREST - COACHRED



Terracotta Warrior, funerary art for the Emperor Qin Shi Huang, 210–209 BCE.

The great generals of old first ensured that they themselves were beyond defeat and then waited for the enemy to make themselves vulnerable. Thus we can say that although you have it in your own hands to place yourself beyond defeat, you cannot, of yourself bring about the defeat of the enemy.

Whilst you are unsure of victory, defend; when you are sure of victory, attack.

Defence should indicate that you are not in a position to defeat the enemy, attack that you are even stronger than you need to be. A skilled defender digs himself in deeper than the ninth level of the Earth, a skilled attacker falls of the enemy from above the ninth level of heaven. In this way you can both protect yourself completely and ensure total victory.

Only to see victory when it is already clear to all is by no means the height of excellence; a victory that is acclaimed by all and sundry is by no means the greatest of victories. It takes no great strength to lift a feather; you don't need keen eyesight to see the Sun, not keen ears to hear the thunder. The great warriors of old not only won great victories, but won them with ease; because their victories were won without apparent difficulty, they did not bring them great fame for their wisdom or respect for their courage.

Being prepared for all circumstances is what ensures certain victory, for it means you are fighting an enemy who is already beaten. Thus a great soldier first places himself in an invincible position, and then ensures he does not miss the critical opportunity to defeat the enemy. A successful army first ensures invincibility, and only then engages the enemy. A vanquished army will have gone into battle first, and only then looked for the means of victory. A great strategist follows his Moral Compass and adheres to his methods of Regulation, for these are the means by which he determines victory or defeat.

In the Art of War, first comes scoping; then measurement, then calculation, then balancing and finally victory. The Earth is the basis for scoping, scoping the basis for measurement, measurement the basis for calculation, calculation the basis for balancing and balancing the basis for victory. A victorious army is just as an yi is to a shu, and a defeated army is as a shu to an yi. A victorious army carries all the weight of flood water plunging into a thousand foot gorge.

*Sun Tzu, On Deployment, in The Art of War, 6th Century B.C,
(trans. James Trapp)*

There are very few writings that stand the test of over two millennia and are still widely read and even revered in the 21st century. Among these is the legendary Chinese General, Sun Tzu's, "The Art of War", a collection of thirteen "chapters" that record universal wisdoms in the field of armed conflict. The text is so ancient its exact origins have been lost. It is uncertain, as for many figures of far distant antiquity, if Sun Tzu was a true historical figure or if his writings were in fact a composite of more than one person from more than one age. These writings have nonetheless inspired and guided not only countless great military leaders over untold centuries, including Mao Tse Tung, Ho Chi Minh, and General Douglas MacArthur of more recent memory but increasingly in the modern world they have guided the business strategies of the 21st century Captains of Industry. In popular culture, Sun Tzu figures prominently even in the 24th century. In the episode, "The Last Outpost" Captain Jean-Luc Picard, exclaims to Commander William Riker, "I'm glad the Academy still teaches the strategies of Sun Tzu!"

According to very ancient tradition Sun Tzu was a brilliant general in the service of King He Lu of Wu during the archaic Spring and Autumn Annals period of 770 BCE to 476 BCE, before China was unified under a single emperor. This however is a matter of heated debate among Chinese scholars with some experts believing that certain inconsistencies and inaccuracies in the text suggest a later date for the text of the Art of War. Indeed there is not even a "standard" or "definitive" text of the work; as for so many ancient manuscripts initially transmitted by oral tradition and then copied imperfectly by the written word of scribes over countless centuries, anachronisms, contradictions and clear corruptions have accreted. The way classical age Chinese was

written, without punctuations and with ambiguities furthermore creates uncertainties - no two expert interpretations of the Art of War are the same. The most widely accepted version of the text today has its origins in the Song Dynasty, (960 - 1279 CE), well after the uncertain time the text was actually written.

The actual structure of the text is generally not disputed. It is divided into thirteen "chapters", each describing aspects of the strategy and tactics of warfare. Some are more clearly complete than others indicating the likelihood of introduced corruptions in transcription over the centuries. What is certain however is the wisdom that comes through, it is intensely personal and lays heavy emphasis on the mood of soldiers - both one's own and of the enemy's. They are universal observations of human nature that transcend time, space and culture, and this helps explain the work's extraordinary appeal and endurance. What is apparent throughout the work is that it is no mere military technical manual. It is far more than that. Rather it expounds a whole philosophy of life, that heralds later Taoist principles. In the view of Sun Tzu, a general is no mere "commander", he is also a scholar, a philosopher, a gentleman who knows his soldiers and knows the human condition. There is a poignant depth of understanding and empathy which undoubtedly has helped to ensure its universal appeal and its immortality.

We have well laid plans for CPR, however in the 21st century technology proceeds at such an exponential pace that it often becomes a vital and necessary aid to our endeavours. But there are no well laid plans to incorporate the new technologies into our older strategies. During the course of our resuscitation efforts, conjectures arise about plans of attack - should we plunge our needles into the pericardial or pleural spaces blind for example, but risk making things worse if this intervention is not required.

We must recall the wise counsel of the legendary General Sun Tzu, "Whilst you are unsure of victory, defend; when you are sure of victory, attack". And so it is better to defend with CPR until such time as our Echocardiographer tells us it is the right time to attack, only then will victory not be due to blind luck, but rather assured. "A skilled defender digs himself in deeper than the ninth level of the Earth", and so we must do more than the usual deployment. To this end we assign a new soldier, a dedicated Echocardiographer as a part of the resuscitation team. This new soldier must be deployed in just the right manner and in just the right place, so our attack is efficiently coordinated. A great soldier first places himself in an invincible position, and then ensures he does not miss the critical opportunity to defeat the enemy. We don't need keen eyesight to see the Sun, not keen ears to hear the thunder, what we must strive for is to see the hidden enemy. And to only to see victory when it is already clear to all is by no means the height of excellence. Being prepared for all circumstances is what will ensure certain victory!

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Introduction

Focused echocardiography - in the hands of an expert/ experienced operator - can be used in cardio-pulmonary arrest to:

1. Distinguish VF from asystole from PEA (and pseudo-PEA) - thus also aiding prognostication and in turn decisions regarding cessation of CPR.
2. Help determine the causative pathology in combination with an assessment of the QRS complexes of the ECG rhythm
3. Help to gain vascular access
4. Assisting in procedures
5. Determining response to interventions

Many clinicians however, have reservations regarding its widespread adoption due to evidence that it leads to prolonged interruption of cardiac compressions.

Additionally there are no clear protocols for the inclusion of focused echocardiography into ACLS

To this end Finn at al. ¹ have advocated for a novel protocol - **COACHRED** - to guide the use of focused echocardiography **during rhythm checks** in a safe and timely manner.

COACHRED consists of

- **C**ontinue compressions
- **O**xygen away
- **A**ll others stand clear
- **C**harging
- **H**ands off Compressions
- **R**hythm check
- **E**cho off
- **D**efibrillate or Disarm charge.

The strategies aims to **minimise** interruptions to chest compressions to within timeframes prescribed by international guidelines.

Pragmatic Factors in Timing

The most clinically useful ultrasound images are obtained when cardiac compressions are **interrupted**, either for the administration of breaths or during the rhythm check.

Pneumothorax can only be reliably diagnosed during the administration of breaths,

The **rhythm check** period provides the longest interval to perform focused echocardiography.

This means that the echosonographer is the last person in contact with the patient prior to a shock being delivered. Not only does this pose a risk to the echosonographer, but may act as a source of delay both to defibrillation and to recommencing cardiac compressions.

Longer interruptions to chest compressions and delay to delivery of a shock have been associated with both defibrillation failure and reduced survival to hospital discharge. Thus, the use of echocardiography in CPR has remained controversial.

Current international guidelines define an acceptable interruption period to chest compressions as **less than 10 seconds**.

The **COACHRED** protocol was designed to minimise interruptions to chest compressions as well as facilitate safe defibrillation during the period of the **rhythm check at less than 10 seconds**.

Method

Nominated echosonographer:

The **echosonographer** should be **appropriately trained** (that is, they hold at least a basic **echocardiography accreditation**) and should have that as their **sole** role during the rhythm check (i.e, they are **not** also the team leader).

If the team leader is the only practitioner competent in ultrasound and believes ultrasound is required, *another* practitioner should take over the role of team leader when ultrasound is being performed.

Echosonography Preparation:

In order to minimise hands off time and to increase the chance of obtaining interpretable images, the echosonographer must prepare the machine and optimise their view prior to the rhythm check.

The following steps can be taken:

1. Set the machine to record prospectively with a loop duration of 10 seconds.

2. Enter a patient identifier
3. Select the phased or curvilinear array using the machine's cardiac preset
4. Position themselves and their machine so as to avoid obstructing access to the chest for compressions or obstructing the team leader's view of the monitor, (**see Appendix 1 below**).
5. Optimize their view while compressions are ongoing.

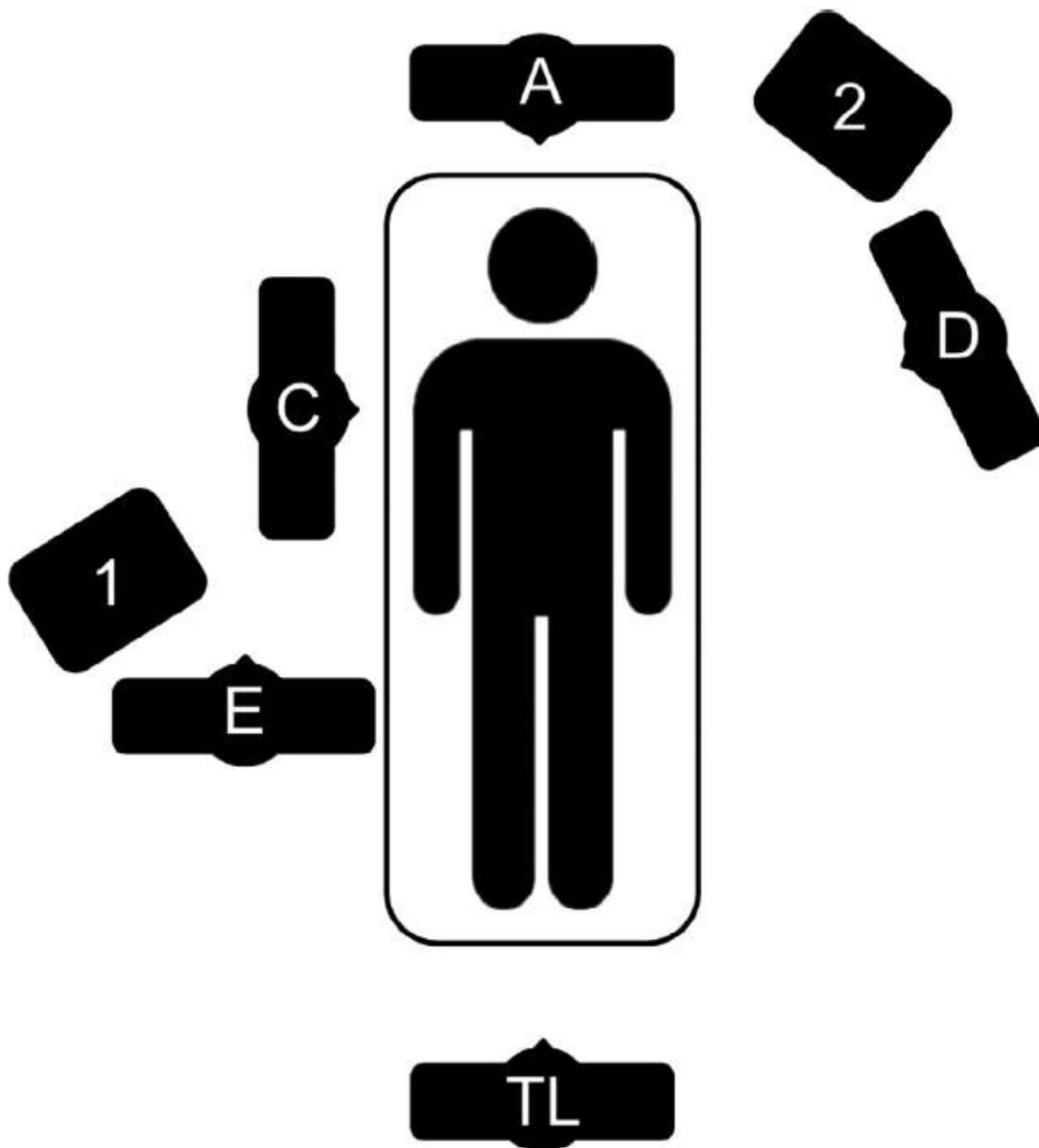
The sonographer is then ready to **commence recording** (i.e 10 second loop) as soon as compressions are interrupted for the **rhythm check**.

The images are reviewed and interpreted *after* the rhythm check is complete and compressions have recommenced. This both minimises the interruption to chest compressions and provides time for a more thorough review.

While obtaining a subcostal view is usually most practicable, the echosonographer may choose any standard view as feasible.

One clinically interpretable view on one rhythm check is usually adequate; routine repeat imaging during subsequent rhythm checks is **unnecessary**.

Appendix 1



Suggested team and equipment deployment, for incorporation of Sonography into a Resuscitation Team for cardiac arrest, (Finn et al).

The echosonographer positions themselves and their machine so as to avoid obstructing access to the chest for compressions or obstructing the team leader's view of the monitor.

Team members and equipment are indicated as follows:

A: airway support provider

C: compressions provider

D; defibrillator operator

E: echosonographer

TL: Team leader

1: Ultrasound machine

2. Defibrillator.

References

1. Thomas E Finn et al. COACHRED: A protocol for the safe and timely incorporation of focused echocardiography into the rhythm check during cardiopulmonary resuscitation. Emergency Medicine Australasia (2019).

- [doi: 10.1111/1742-6723.13374](https://doi.org/10.1111/1742-6723.13374)

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