THE NORTHERN HOSPITAL

ASYSTOLE

Red Army soldiers of General Rodimstev's 13th Guards Division advancing into the ruins of Stalingrad 1942.

Then one night the great freeze-up began, and winter was with us, the second grim winter in that accursed country. Like a black cloak the frost folded over the land. A supplies truck came round and brought us greatcoats, gloves and caps with ear-flaps. Despite this issue we froze miserably in our fox-holes. In the morning we would be numb with cold, our rifles and guns completely coated with hoar-frost. As it left our mouths, our breath was a dense as cigarette smoke and immediately solidified over the side-flaps of our caps its glittering crystals of ice. When shells came over, each detonation rang out with a new, hard resonance and the clods of earth which were thrown high were like lumps of granite…

Completely cut off, the men in the field grey just slouched on, invariably filthy and invariably louse-ridden, their weary shoulders sagging, from one defence position to another. The icy winds of those great white wastes which stretched forever beyond us to the east lashed a million crystals of razor-like snow into their unshaven faces, skin now loose stretched over bone, so utter was the exhaustion, so utter the starvation. It burnt the skin to crumpled leather, it lashed tears from sunken eyes which from over fatigue could scarce be kept open, it penetrated through all uniforms and rags to the very marrow of our bones. And whenever any individual could do no more, when even the onward driving lash of fear of death ceased to have meaning, then like an

engine which had used its last drop of fuel the debilitated body ran down and came to a standstill. Soon a kindly shroud of snow covered the object and only the toe of a jackboot or an arm frozen to stone could remind you that what was now an elongated white hummock had quite recently been a human being.

Benno Zieser,
Memoires of a German 6th Army survivor of Stalingrad,
December 1942.

The battle of Stalingrad was probably the most brutal, pitiless and vicious conflict in human history. Fought on an "industrial" scale that only the 20th century could provide it was the pivotal moment of the Second World War. The German Sixth Army under General Paulus, was the biggest and best equipped army in history and at Stalingrad had reached the Volga river that was to be the designated Eastern boundary of the territories of the Third Reich. However, a desperate and fanatical Red Army and civilian population fought the Germans to a stalemate within the city. Many of the defenders were fighting as much for their homeland as of a terror of Stalin. The German high command had underestimated the vastness of Russian resources in land, men and material. In November 1942 the Russians launched a counter attack on a scale the Germans had not thought possible and despite enormous casualty rates managed to encircle the entire Sixth Army, over a quarter of a million men. A World War One-style battle of attrition followed, within the ruins of the city rather than the trenches of the fields. The Sixth Army may yet still have been saved if not for Hitler's express orders that under no circumstances were they to attempt a breakout, meaning a retreat. General Hoth of the nearby 57th Panzer Division attempted a desperate rescue breakthrough to Stalingrad in operation "Winter Storm", but with out Paulus attempting a simultaneous breakout his efforts came to nothing. Hitler ordered the men of the Sixth army to defend Stalingrad to the last man and the last bullet…which they did. Very few soldiers of the Sixth Army ever returned to their homeland. Russian casualties during the campaign have been estimated at 1.1 million men.

Asystole, like the men of the Sixth Army trapped at Stalingrad, represents the absolute "worst case" scenario. Very few patients will be saved from this situation. Vasopressin, like general Hoth, attempted to offer a glimmer of additional hope for this desperate situation, but like general Hoth's attempts, alas, came to nothing.

Ghostly figures of German Infantry retreating from Stalingrad through a snow blizzard, January 1943.

ASYSTOLE

Introduction

Asystole is defined as the absence of any cardiac electrical activity.

Survival may be possible if a reversible cause is immediately corrected.

Causes

Primary:

Primary asystole is an absence of any cardiac electrical activity as a result of intrinsic irreversible myocardial damage.

Secondary:

Secondary asystole is an absence of any cardiac electrical activity, but which may be reversible if an underlying initiating pathology can be quickly reversed.

Examples here may include: (**4 Hs and 4 Ts**)

1. Hypovolaemia
2. Hypoxia
3. Hyperkalaemia (less commonly hypokalaemia).
4. Hypothermia (less commonly hyperthermia).
5. Tamponade
6. Tension pneumothorax
7. Toxins (in particular organophosphate poisoning)/poisons/drugs
8. Thrombosis (i.e. myocardial or massive pulmonary)

Diagnosis

1. Confirm clinically that the patient is in cardiopulmonary arrest.
2. Confirm asystole on ECG monitor
    - Asystole will appear as a virtually straight or minimally undulating line.
    - A line that is *perfectly* straight is suspicious of a disconnected lead, check that this is not the case. The presence of electrical artifact during external compression will help confirm that the ECG leads are connected and intact.
    - Note that in “fine VF”, a predominant axis that is at right angles to the chosen lead will produce a so-called “isoelectric” VF, ie it will look like asystole. If there is any doubt about the diagnosis, check the recording on **another lead.**

Management

1. Institute immediate Basic Life Support manoeuvres.

2. If there is any doubt as to the diagnosis being asystole check another lead.

3. If the diagnosis is clearly asystole, then it is best to avoid defibrillation, as this will only increase myocardial "stunning".

   - Continue CPR
   - Recheck the rhythm following each LOOP of CPR
     - ♥ **A "loop" is defined as 5 sets of 30:2 cycles (which equals about 2 minutes of CPR).**

4. If not already established obtain IV (see Appendix 1 below) access and secure the airway.

   - Attempts to secure the airway should not delay CPR longer than 20 seconds.
   - A LMA airway is acceptable in the first instance.
   - An ETT can be placed where the expertise to do this is available.

5. Give **IV adrenaline immediately**

   - **1 mg IV (as 1 ml of 1:1000 solution, OR 10 mls of 1:10,000 mls solution)**
   - Repeat doses are then given **every second "LOOP" of CPR**
     - ♥ **A "loop" is defined as 5 sets of 30:2 cycles (which equals about 2 minutes of CPR). Therefore adrenaline is repeated approximately every 4 minutes.**
   - If a response (return of spontaneous circulation - ROSC - with a patient generated pulse) is being obtained from the adrenaline but is short lived then an infusion should be commenced at 5-20 micrograms per minute titrated to clinical response.

   IV vasopressin (Pitressin):

   - Despite some early optimism for this agent in the setting of ALS, a large scale follow-up study showed **no** additional benefit in outcomes for this agent. [2]

6. Consider **IV atropine**

   - There is no evidence that empiric atropine improves survival in asystole, unless there is a specific indication to give it such as organophosphate poisoning.
   - Generally 1mg IV atropine is given to a maximum of 3.0 mg, though much higher doses will usually be needed in the specific case of organophosphate poisoning.

7. Consider **IV bicarbonate:**

- This may be considered in cases of protracted cardiac arrest (> 20 minutes), however it has not been shown to improve outcomes.

- Its main indication is in cases where it is a specific antidote e.g. sodium channel blocking toxicity.

8. Consider the possibility of an underlying reversible pathology and treat as appropriate.

   These are the 4 Hs and 4 Ts listed above.

   For example:

   - Hypovolaemia:

     ♥ IV fluids (empirically this is as a 20mls/kg bolus - then as clinically indicated).

   - Hypoxia:

     ♥ Oxygenate

     ♥ Check ETT/LMA

   - Hyperkalemia:

     ♥ IV calcium, in particular for known hypocalcaemia, calcium channel blocker overdose or hyperkalaemia (especially for patients with known renal impairment)

   - Hypothermia:

     ♥ Warm the patient (warmed IV fluids / warm blanket devices).

   - Tamponade

     ♥ Aspirate the pericardial space.

   - Tension pneumothorax:

     ♥ Decompress the pleural space.

   - Toxins:

     ♥ In particular specific antidotes where these exist e.g. atropine in **organophosphate** poisoning or bicarbonate for sodium channel blocker poisoning.

   - Thrombosis:

     ♥ Consider IV bolus tPA

     ♥ Urgent angioplasty for coronary thrombosis once patient is stabilised.

9. External electrical pacing has **not** been shown to be effective for asystole.

Disposition:

Following a successful ROSC:

1. 12 lead ECG
2. Take blood tests if not already taken:
    - FBE
    - U&Es/glucose
    - Magnesium/Calcium/Phosphate
    - Cardiac enzymes
    - ABGs/VBGs

    Others as clinically indicated.
3. Maintain **normothermia.**
4. Maintain **normoglycaemia**

Successfully resuscitated patients are admitted to a CCU/ICU.

Appendix 1 *Drug Route of Administration:*

There are 3 options:

- IV
- Intraosseous
- ETT

IV:

1. All drugs must be given via IV access (as opposed to IM)
2. Use large peripheral veins (including the external jugular) above the diaphragm.

   Lower limb veins should be avoided if possible due to impaired venous return during cardiac arrest.
3. If a central line is present this should be used, in preference.
4. Following each drug administration give a 20 -30 ml flush of normal saline to further optimized delivery.

   - A more efficient way of "flushing" drugs is by connecting the IV access to an IV giving set with a "pump set" so that drugs can readily be flushed through each time, rather than having to redraw saline flushes with each drug dose given.

Intraosseous:

If IV access cannot be gained within **60 seconds** - then the **intraosseous** route may be used.

This route can be used for both paediatric *and* adult patients.

It is suitable to the rapid administration of fluids, drugs, or blood products, with the marrow cavity functioning essentially as a rigid venous cavity that does not collapse.

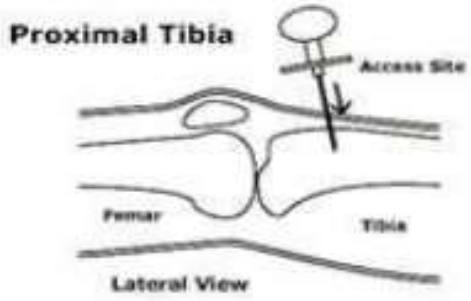
Absorption is rapid, as the marrow sinusoids of long bones drain directly into the medullary venous channels that enter the systemic circulation.

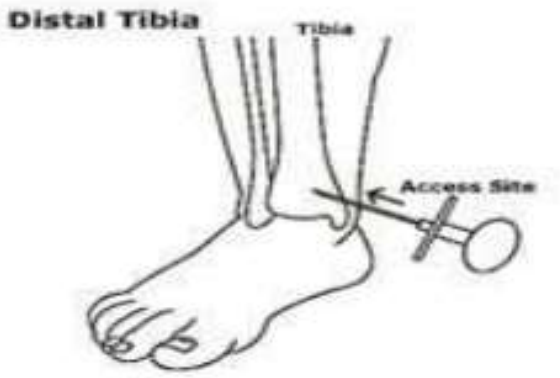
The usual site for intraosseous access is:

- The antero-medial aspect of the tibia 2-3cms below the tibial tuberosity.

Or if this site cannot be used:

- The lower antero-medial tibia 2-3 cm above the ankle joint.





ETT:

This route is not ideal and is **not** routinely recommended, however does provide something as an option of last resort.

Not all drugs can be given by this route.

Drugs that may be given are:

- Adrenaline
- Atropine
- Lignocaine
- Naloxone

Other drugs such as bicarbonate, calcium *cannot* be given by this route.

For optimal delivery:

- Suction the airway first if possible
- Give the drug via a clean suction catheter inserted beyond the tip of the ETT
- Give twice the usual IV dose diluted 1:10 in normal saline
- Give several vigorous ventilations to disperse the drug.

German Infantry of the all conquering 6th Army on the road to Stalingrad, Summer 1942

Pitiful remnants of the 6th Army, being led into captivity, February 1943.

References

1. ARC Guidelines: 11.2, 11.5 2010

2. Gueugniaud P.Y et al. Vasopressin and Epinephrine vs Epinephrine alone in cardiopulmonary resuscitation. NEJM 359 (1): 21, July 3, 2008

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