THE NORTHERN HOSPITAL

TRAUMATIC CARDIAC TAMPONADE

"The Death of Marat", Jacques Louis David, 1793, Oil on canvas, Musees Royaux des Beaux-Arts de Belgique.

"Forgive me dearest papa, for having disposed of my life without your permission. I have avenged many innocent victims and prevented many other disasters. One day when the people have their eyes opened, they will rejoice at being delivered from a tyrant. If I tried to persuade you that I was going to England it was because I wished to preserve my incognito; but I realised that was impossible and I hope you will not suffer my anguish. In any case, I believe that people will stand by you in Caen. I have a lawyer, the Girondin Gustave Doulcet de Pontecoulant but such a crime does not allow for any defence. It is for form.

Adieu dearest papa, I ask you to forget me or at least to rejoice in my fate – its cause is fine. I kiss my sister, whom I love with all my heart, as too my parents. Remember the line in Corneille: "Shame comes from crime not from death on the scaffold"

I face judgement tomorrow"

Charlotte Corday, 16 July 1793, year II of the Republic.

Jean Paul Marat was a Parisian journalist who joined the radical Jacobin party in the early days of the French revolution. Extremist, aggressive, foul-mouthed, regicide, part instigator of the "Terror", he was among the very worst of the brutal revolutionaries of his day. In September of 1792, the infant Republic was under siege from virtually all of her European neighbours. The allied European powers under the Duke of Brunswick had just invaded France and by the Duke's manifesto of Coblenz the aim of the invasion was made perfectly clear to the Republic:

"…to put an end to the anarchy in the interior of France, to check the attacks upon the throne and the altar, to reestablish the legal power, to restore to the king, the security and the liberty of which he is now deprived and to place him in a position to exercise once more the legitimate authority which belongs to him…"

The manifesto provoked an extreme and paranoid reaction from the revolutionaries and Marat in particular who saw enemies not only on the borders of France, but also within them. In an irrational belief that the prison cells were full of "conspirators" a general and indiscriminate massacre of prisoners took place throughout the country. Charlotte Corday although a firm revolutionary felt that the revolution had lost its way and had descended into vicious anarchy. The predominant instigator of this state of affairs she believed to be, Marat. On the 13th July 1793 she gained access to Marat's apartment and killed him instantly with a single knife thrust to his chest. Four days later she was sent to the guillotine by the Revolutionary tribunal. Her body was thrown into an unmarked common grave. Jacques Louis David, a staunch Jacobin himself, deified the memory of Marat in his immortal "Death of Marat". To many other French men and women however who lived through the subsequent "Terror" Charlotte Corday was seen as the real hero.

Marat may well have died from a cardiac tamponade, nothing could have saved him from this in the late Eighteenth century. Charlotte Corday's fate was similarly sealed as soon as she plunged her knife into Marat's chest. The French Revolution brought many good and progressive changes to the Western world but it was achieved with unimaginable violence. Progress has continued in many fields since that time to the extent that over two centuries later Marat may have survived his wound with urgent 21st century medical attention. In many parts of the Western world, though not all, Charlotte Corday would not have been so brutally executed in retaliation.

TRAUMATIC CARDIAC TAMPONADE

Introduction

It is important to realise that **cardiac tamponade** due to **trauma** is a very different entity to that which is caused by most **non-traumatic** conditions.

Despite many textbook descriptions traumatic tamponade may not be clinically detectable by the "classical" signs nor will a pericardial collection be apparent from plain CXR.

The treatment of traumatic cardiac tamponade is also fundamentally different to cardiac tamponade due to non-traumatic causes. Again many textbook descriptions are misleading in their emphasis on needle aspiration to treat traumatic tamponade.

Whilst this is acceptable in cases of large effusions from non-traumatic causes it is far more problematic in traumatic cases and should be reserved only as a last resort.

The treatment of traumatic cardiac tamponade is repair via thoracotomy rather than attempts at needle aspiration.

Pathophysiology

In contrast to non-traumatic cardiac tamponade significant compromise may occur with as little as **100-200mls** of blood because of the acute nature of the insult. This is in contrast to many non-traumatic cases where the slow chronic accumulation of fluid may result in as much as 2 liters of fluid before significant compromise occurs.

Mechanism

Acute traumatic cardiac tamponade should be suspected in any **penetrating** injury of the chest or upper abdomen.

It may also be seen in association with blunt injuries, however this is far less common.

In both cases the onset of symptoms may be rapid or delayed.

Clinical Features

The classical clinical features of cardiac tamponade in general are described by Beck Triad

1. Elevated JVP - or more generally *diffuse venous congestion* above the level of the diaphragm.

2. Hypotension

3. Reduced heart sounds.

The "Classical" signs of **Beck's triad** (elevated JVP, quiet heart sounds, low blood pressure) or pulsus paradoxus however may **not** be seen in acute **traumatic** cardiac tamponade.

- The JVP may not be elevated in volume depleted trauma patients.

- Normotension or even hypertension, (due to the sympathetic response to trauma), will not exclude *early* traumatic tamponade.

- Reduced heart sounds is a non-specific finding and a subjective finding (especially in a *noisy* environment) and in the acute setting significant tamponade may occur with *very little* pericardial fluid.

- Pulsus paradoxus is a difficult sign to elicit and in a hypotensive patient it will not be clinically detectable.

If the signs of Becks Triad are present one important differential diagnosis will be **tension pneumothorax**. This may be distinguished by however by absent breath sounds and ipsilateral hyper-resonance to percussion.

The most important consideration will be the clinical setting together with the patient's vital signs.

The most suggestive scenario will be:

- A penetrating wound of the chest or upper abdomen.

- A tachycardia and/ or low blood pressure.

- A clear CXR

- No other obvious cause for the cardiovascular compromise.

This scenario makes the diagnosis of cardiac tamponade probable and thoracotomy will be required, the urgency of which will depend on the patient's clinical status.

Investigations

The degree of investigation will depend on how unwell the patient is.

If the patient is very unwell the patient should be transferred immediately to theatre if the clinical suspicion for tamponade is high.

Imaging studies may be considered in more stable patients.

Blood tests:

As for any multi-trauma:

1. FBE

2. U&Es/ glucose

2. Cross match blood urgently, (and obtain O negative blood)

CXR

CXR will predominantly be useful for ruling out other pathology, such as pneumothorax or hemothorax.

Do not expect to see the classically described "waterbottle" enlargement of the cardiac silhouette. This is only seen in **chronic large** pericardial effusions. The cardiac silhouette will be **normal** in most cases of trauma.

ECG

Sinus tachycardia will be the most common finding.

FAST Ultrasound

This may be done in the ED, and will be helpful if positive, but even in expert hands will not reliably rule out a small collection of blood or clot that is localized behind the heart.

Echocardiography

If readily available, and in experienced hands, this will be more reliable in making the diagnosis than a FAST scan.

Again however it cannot *definitively* rule out the diagnosis of **traumatic** cardiac tamponade.

CT scan

The diagnosis may be made on CT, but in an **unstable** patient the condition should be suspected and acted upon on clinical grounds before this in most cases.

Management

1. ABC
    - Urgent attention to any ABC issues will be the immediate priority.
2. Fluids and O negative blood as clinically indicated.
    - Fluids in pure cases of cardiac tamponade will merely act as a *temporizing* measure, and should not delay time to definitive management in theatre.
3. **Thoracotomy**
    - In any patient with suspected traumatic cardiac tamponade, the treatment is transfer to theatre urgently or immediately (depending on the clinical status of the patient) for **thoracotomy**, drainage of the pericardial space and repair of the cardiac defect, it is *not* attempts at needle pericardiocentesis.

Thoracotomy is best performed in the operating theatre, however in arrested patients it may be performed in the ED resuscitation cube, providing the equipment and expertise to do this is available.

4. Needle pericardiocentesis

- Needle pericardiocentesis may be attempted in the arrested pre-arrested patient, with ultrasound assistance but is unlikely to be successful.

  Additionally blood can be clotted and may lie posterior to the heart and hence will not be apsiratable.

  Should aspiration be successful, this will not preclude the need for thoracotomy and definitive repair.

References

1. Hayes J: Cardiac Tamponade: Emergency Medicine Vol. 9 June 1997 p.123-135

2. ATLS 10th ed 2017.

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