

Medi-Vision™ Film Transcript Programme 26

PRACTICAL PROCEDURES (2): Insertion and Care of the Central Venous Pressure Line

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Introduced by
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Introduction

DCA On this video Dr John Low, Senior Lecturer in Anaesthetics and Intensive Care at the Prince of Wales Hospital in Shatin, is going to take us through the technique for the insertion of the central venous pressure line.

Now John, we are going to see video of you doing this on two patients.

What are the main things for the student and doctor to look out for?

JML I will emphasise the use of aseptic technique, and also the importance of looking after the patient: putting local anaesthesia at the site of insertion of the needle; and explaining to the patient as you go along what you are doing. The surface anatomy I will explain during the procedure.

Demonstration of the relevant anatomy

J **The internal jugular vein lies underneath the sterno-cleido-mastoid muscle.**

As you can see there are **two insertions**: the medial and the clavicular insertion.

This forms a triangle, and this can sometimes be seen as a surface landmark.

After successfully anaesthetising the skin, the needle can be inserted at this landmark.

And as the needle is inserted at a 45° angle... you can see if I remove these structures here that it will penetrate the internal jugular which lies just underneath the muscle.

Remembering that there is the phrenic nerve, as well as the recurrent laryngeal nerve, as well as the major thyroid vessels which are very vascular in the midline region.

The direction of the needle should therefore be aiming downwards but lateral rather than midline.

The other approach is to cannulate the subclavian vein.

And the surface landmarks are very clearly outlined by the S-shaped clavicle.

And at the junction between the medial and the middle third of the clavicle one would again identify the superficial landmarks.

After anaesthetising the skin, one can advance the needle until it touches the bone which gives a very definite end point.

And then relocate the direction of the needle to pass at a tangent to the bone.

And as one inserts it, the first structure that one reaches is the subclavian vein which lies superficial and anterior to the subclavian artery.

Preparation

J In order to dilate the veins, the patient is tilted in a Trendelenburg position probably about 20° and this helps to dilate the veins.

I shall be preparing the patient in the normal way with the normal aseptic procedure. As you can see... I am totally scrubbed for this procedure. The Seldinger guidewire approach also makes this procedure particularly safe. The clavicle is extremely well demonstrated with the sterno-cleido-mastoid muscle... the mastoid process here... And there is a very marked apex which is very clearly seen - you can actually see the pulsation of the carotid artery. The path of the internal jugular is lying underneath the sterno-cleido-mastoid muscle, and entering the neck at about this point. So many approaches will use various landmarks to enter the internal jugular along this path. The higher approaches theoretically have a lower incidence of pneumothorax, because you are further away from the apex of the lung.

Subclavian Vein Cannulation

- J I am going to use some iodine first, and then some alcohol. Again we prepare from the site of the actual puncture and then go outwards. My first stage is to use aseptic technique to cover the area, and now I'll put some local anaesthesia into the skin. I'm producing a skin bleb with 2% lignocaine without adrenaline... infiltrating the area, and especially now I'm going to infiltrate the periosteum at this stage. I can feel the bony landmarks... and I will use about 1-2 ml of lignocaine. I'm using a syringe and a rigid needle... the syringe is filled with saline so that I can see immediately if there is any flashback of blood from the subclavian vein. **The subclavian vein is immediately underneath the clavicle and there is a small ligament attaching it to the clavicle.** *(Cantonese to patient)* I can touch the clavicle, and that is a very definite landmark. And then I'm now at a tangent to the clavicle... just inserting very gently... there we go. Just confirm that there is free flow of blood from the needle.
- Now I'm ready to insert the guidewire, maintaining exactly the same position of the needle. I'm now ready to insert the guidewire. I remove the rigid needle now... leaving the guidewire in place, and then I thread the cannula over the guidewire. When I can see the guidewire at the tip of the cannula, it is safe to insert the cannula. Now I'm ready to secure the cannula in position. *(Cantonese)... 3/0 silk, I'll put some local in it.*
- J Again I check that there is free flow of blood through the cannula. *(Cantonese)* Infiltrate a little bit more with some local anaesthetic... *(Cantonese)* Both approaches are safe when they are done properly, knowing the surface anatomy. Both approaches are dangerous in that there is a risk of pneumothorax in either approach. *(Cantonese)*
- The subclavian approach has very marked bony landmarks, and some people prefer the ability to use the clavicle as a very definite bony landmark. For the anaesthetist, the internal jugular approach has advantages; if the patient is already under anaesthesia, and access to the neck is more convenient for the anaesthetist. Again the site of the puncture is sealed with a sterile dressing. Confirmation of the position of the cannula can be done by lowering the bag of saline and observing flush back of blood.

Internal Jugular Cannulation

- J I would normally prepare the area of the subclavian vein in case I fail to do an internal jugular puncture. And then further prep is done with alcohol...

And you can see the outline of the external jugular, the sterno-mastoid muscle which has two insertions: from the mastoid to the manubrium, as well as the other belly which inserts on the median third of the right clavicle.

It forms a triangle, and that will be my entry point.

And I would then infiltrate subcutaneous lignocaine. One sign is to ballot the vein... this is not often described in the books... but by...I can feel a fluid thrill where the vein is lying.

Okay, and it's lying there.

D Right.

J And if I palpate here... I can feel the carotid artery just under middle finger.

My fingers are immediately over the carotid... I'm just going to go about an inch lateral to that. Now **there are a lot of structures medial to this**, including the recurrent laryngeal nerve, the oesophagus, the trachea, and many thyroid veins.

And in order to avoid all of those, I would aim for the nipple on the right-hand side.

There's the bleb that I injected... the sterno-mastoid muscle running there... and there..., and at the apex of this triangle I will insert the needle.....

Aspirating as I insert.....It should be more superficial than this.....Okay I'll come out again. Here we go.

So the needle is now in the internal jugular... free flow backwards and forwards.

And then I would then prepare my guidewire... that's great isn't it... it won't go.

One end of the guidewire is slightly more flexible, so I try that end just in case we have a... there we go.

D Right.

J The guidewire is in position - I'll put a swab to demonstrate that.

And then I can safely retrieve the rigid needle.

The cannula may then be inserted... I make sure that the guidewire is visible at the tip of the cannula, and then I can pass the cannula through safely.

I'll just expose that a bit... and then put a clean gauze behind there... okay.

I'm just preparing a needle and thread to secure the central venous line.

I normally use silk, and then on a needle holder I would then suture the central venous line; taking care not to go anywhere near the line of the external jugular.

So two substantial sutures on either side to secure the cannula.

Withdraw the guidewire, and then it is important to prevent air inlet by blocking the tip.

And then the...

We could let it flush through now Sister.

This connects to the manometer tubing.

One check of the placement of the cannula is by putting the bag of saline onto the floor...

okay? The blood will flush back as soon as the bag is lowered below the level of the patient. And this confirms free flow.

This dressing allows a little window to be exposed as you place it over the site of entry.

Plus ensuring absolute asepsis of the port of entry.

Reading the Central Venous Pressure

J The zero point for the central venous reading will be taken **at the patient's mid-axillary line.**

And the manometer zero should be aligned visually against the mid-axillary line.

At this stage a column of saline is introduced into the circuit.

So we would open the three-way tap to the reservoir bag of saline..., allow a bit of saline to fill the column, and we would then open the column to connect to the patient.

The top of the column settles down slowly, and the intermittent rate at which it falls reflects the change of intra-thoracic pressure.

When it settles to a steady level, then you can see it oscillating very slightly with respiration; or in this situation - with ventilation.

Then we would take the lowest point as the central venous pressure reading.

I would take this reading to be about 10 cm.

Discussion

DCA John, I think we've seen there a very clear demonstration of the two techniques.

First of all, you emphasised the importance of aseptic technique and you're fully gowned and scrubbed. Is that something that you would expect everyone doing a CVP insertion to follow?

JML In the ideal situation, full aseptic technique is obviously desirable.
And it is much easier to avoid contamination, especially using a guidewire, if you gown up properly. But I can understand in certain situations - during resuscitation for instance, and in the field, in the accident area perhaps - it is very difficult to actually gown up fully.

D Right. But I would take it from what you are saying, that you would hope that the medical officers would use a guidewire because it actually makes it safer.

J The guidewire technique is much easier I find. And I think it is much more desirable to reduce complications this way, but then you do have to scrub up for it.

D Right. So the guidewire obviously takes quite a lot of the anxiety I should imagine out of the procedure for the operator. Does it?

J Well let me put it this way - we have never failed using a guidewire.

D Right.

J Whereas using the cannula over the needle technique, it is very easy to get the needle in the right place but the cannula won't thread properly.

D Right. Now having got your patient... and you clearly have an indication for a CVP line insertion. What would determine which approach you use? I mean both approaches seemed to have advantages and disadvantages?

J The subclavian approach has a great advantage because you have bony landmarks, and the needle is touching the bone as you go in. So it is a very very definite approach, and in that respect it is easier.
Anaesthetists like to use the internal jugular approach because they tend to be at the head end anyway. And this is more convenient for the anaesthetist during the operation.

D Would you advise a young doctor starting out to use one approach and tend to stick to the same approach throughout?

J The more you use one approach, the more familiar you are and the easier it becomes.
The main thing is whatever approach you use, to be fully aware of all the structures that you can hit, and then you can be aware of the potential complications and avoid those.

D Right. Now the complications... I mean **what are the major complications that you see?**

J Well as with any technique of cannulation... **haemorrhage** is obviously a problem.
But the main thing with the approach to the central veins is that there are **a lot of important structures, both in the neck and in the apex of the lung.**
Using the internal jugular approach, you can hit **the trachea, the oesophagus, the carotid artery, the recurrent laryngeal nerve.**
And the most irritating is the **many thyroid veins** there are which can bleed quite badly.
Using the **subclavian approach, clearly pneumothorax is a major problem.**
And if you are really clumsy you can hit the **subclavian artery** as well.

D Right. So after the procedure you would do a routine chest X-ray would you in all patients?

J Yes, at **a suitable time you should do a chest X-ray.** That confirms the position of the tip of the catheter, and also it eliminates the possibility of pneumothorax.

D Right. Now let's just turn for a moment to **the indications for central venous pressure line insertion** in the first place. What in broad terms are they?

J **Indications....**

- If you need venous access and the patient has poor peripheral veins, you can use a central vein for that.
- And especially for the introduction of irritant drugs; cytotoxic drugs; and certain inotropic agents are very irritant on peripheral veins.
- The other area of indication would be for monitoring. And in any patient with suspected hypovolaemia where you want to monitor the pressure in the venous compartment, then clearly a central venous pressure line is indicated.

D Right. Now finally could you say something about the **care of the CVP line**, and also I think we saw on the video quite clearly its use... its appropriate use.
But could you say something about the use and the care of the line?

J Yes.
Clearly we want to keep the line free of infection, so the standard precautions for keeping the giving set sterile and the site of insertion sterile is very important.
A low rate of infusion - perhaps 10-15 ml/hour, will prevent any thrombosis within the catheter, although the selection of the catheter is also quite important.

- It is very important not to allow any disconnection in the giving set because this can lead to entrainment of air, and the dangerous complication of air embolism.
- D Right. So that is basically... it's really important - not to be sloppy over the connections, either at the time of insertion or subsequently?
- J That's right.
- D The **transparent dressing** that you used I presume helps there does it?
- J It keeps the site of entry clean, and it is very easy to detect any early separation of the entry site.
- D Right.
- J And that would be an indication for removing the intravenous line.
- D Right. And on the whole can you give any guidance as to how long the line should be left in for? I mean presumably it should be removed as soon as the indication for which it was put in have disappeared.
- J **Many lines can be kept in for at least 10 days if they are looked after carefully.** Some of the modern catheters are **impregnated with antiseptic agents**, and this clearly improves the viability. Thrombosis and infection of the site of entry would be indications for removal and re-siting.
- D And if a line is needed for longer than that?
- J For example, for long-term antibiotic therapy, it should then be a tunnelled line should it?
- J That's right. Yes, **you can tunnel a Hickman line**. It is made of silastic which prevents any thrombosis, and there is a plug of antibiotic that will stop any infection tracking down the catheter.
- D Right. Thank you very much.

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