

# Learning Package



**Health**  
Hunter New England  
Local Health District

## Cannulation: Ultrasound Guided Venous Access

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<b>Sites where Learning package applies:</b>	Clinical areas where cannulation occurs
<b>Target audience:</b>	ED Registered Nurse Medical practitioner
<b>Description:</b>	Learning experience that will guide you through the literature and clinical issues related to ultrasound guided venous access.
<b>Learning Outcomes, On completion of this package you will be better able to:</b>	<ul style="list-style-type: none"><li>•Identify which patients are suitable for USS guided venous access</li><li>•Be aware of the appropriate settings on an ultrasound machine for venous access and how to optimise these images</li><li>•Safely recognise veins and be aware of the ultrasound differences between veins and arteries</li></ul>

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<b>Keywords</b>	Ultrasound, cannula, artery, vein
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<b>Document registration number</b>	
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<b>Replaces existing document?</b>	No
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**Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:**

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<b>Is this package recorded in HETI?</b>	No
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# Ultrasound Guided Venous Access

Maitland Hospital  
Emergency Department

August 2013



**Health**  
Hunter New England  
Local Health District

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**Date:** August 2013

**Purpose:** The purpose of this SDLP is to facilitate the completion of one of the three phases of learning necessary to become accredited in the use of the ultrasound guided venous access device.

These three phases include;

1. Self-Directed Learning – Participants should read the Ultrasound Guided Venous Access learning package.
2. Small group practical session – Participants must attend the small group simulated practical session prior to attempting supervised cannulation attempts.
3. Supervised venous access attempts – Participants to complete eight successful supervised cannulation attempts

**Date for Learning Package Review:** April 2017

**Acknowledgements:**

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## **Introduction**

Venous access in the emergency department can sometimes be very challenging. The use of ultrasound guided venous access allows cannulation of veins that are neither visible nor palpable and reduces the need for a central line and its potential complications (Shokoohi, Boniface, McCarthy, 2013, p198-203 and Au, Rotte, Grzybowski, Ku, Fields, 2012, p1950-4).

The traditional approach carries numerous inherent problems. Anatomically the location of vessels can vary considerably. Veins can be difficult to palpate in patients who are obese/oedematous or distorted as a result of scarring from previous cannulation attempts.

Patients with difficult access are routinely subjected to multiple insertions increasing their risk of complications, discomfort and time to perform lab tests. Ultrasound-guided venous access results in higher overall and first-pass success rates and very low complication rates (Keyes, Frazee, Snoey, Simon, Christy, 1999, p711-4 and Costantino, Parikh, Satz, Fojtik, 2005, p456-61).

In addition to emergency physicians and residents, emergency nurses and technicians can be safely and effectively trained to perform ultrasound-guided venous access. This can result in a reduced work load for medical staff and earlier treatment and initiation of investigation for the patient (Weiner, Sarff, Esener, Shroff, Budhram, Switkowski, 2012; epub ahead of print: and Witting, Schenkel, Lawner, Euerle, 2010, p70-5).

## **Disclaimer**

This learning package has been prepared by health professionals employed in Hunter New England Local Health District in the **Emergency Department at The Maitland Hospital**. While all care has been taken to ensure that the information is accurate at the time of development, the authors recommend that all information is thoroughly checked before use if utilised by another unit, context or organisation.

## **Aim**

After completing this SDLP you should be:

- Able to identify which patients are suitable for USS guided venous access
- Aware of the appropriate settings on an ultrasound machine for venous access and how to optimise images
- Be starting to understand how to safely recognise veins and be aware of the ultrasound differences between veins and arteries

## **Learning Outcomes or Learning Objectives**

Completion of this learning package will enable the Registered Nurse and medical practitioner to complete the related competencies, and therefore demonstrate an understanding of the following:

- To identify which patients are suitable for USS guided venous access
- To be aware of the appropriate settings on an ultrasound machine for venous access and how to optimise these images
- To safely recognise veins and be aware of the ultrasound differences between veins and arteries

## **Pre-requisites**

The target audience for this SDLP include:

- ED Registered Nurses
- Medical Practitioners

**For nursing staff:** In order to complete this package the registered nurse must have met the following requirement:

- Standard venepuncture and cannulation training and competency assessment

## **Learning Package Outline**

The package is designed to be a self-directed learning experience that will guide you through the literature and clinical issues related to ultrasound guided venous access.

This package is developed within an adult learning framework so not all activities need to be documented but it is expected that you will complete them in order to facilitate your learning.

On completion and submission of this learning package and competencies a record of your completion will be added to your professional development record in HETI.

## **Problem based learning**

This program is based on a problem-based approach to learning. This approach has been chosen to enhance critical thinking, and to create a body of knowledge that the RN or medical practitioner can apply to practice. Problem based learning (PBL) is characterised by the use of patient specific problems or situations as a context for developing problem-solving skills and for acquiring clinical knowledge.

## **How to use this resource or Instructions for participants**

- It is expected that this SDLP will take you 2 hours to read
- Completion of this package is equivalent to Continuing Professional Development (CPD) hours which is a requirement for National Registration.
- This package can be used as an introduction for nurses wishing to further their knowledge and skills in this area.
- At the completion of this learning package you are asked to complete the small group practice.
- There is a suggested reference list and it is by no means complete. Please read widely to facilitate your learning.
- This resource has been written from a Hunter New England Area Local Health District perspective so it is not specific to any one health facility.

# Ultrasound Guided Venous Access

Ultrasound scanning (sonography), is a safe, painless technique used to visualise tissues and organs inside the body. It uses high-frequency sound waves, which cannot be heard by humans, to produce images of structures inside the body. When sound waves are directed into the body, some are absorbed by body tissues and others reflect. The sound waves that bounce back are measured by the ultrasound machine, and are transformed into an image of a particular body area.

Ultrasound produces good images of organs that are soft or filled with fluid (such as veins), but it is less effective for examining air-filled organs or bones.

## Inclusions

Suitable opportunities for ultrasound-guided venous access include the following situations:

- Failure of venous access by the traditional technique
- Venous access of a patient who is severely dehydrated or shut down
- Venous access in patients who are obese
- Venous access in the presence of peripheral oedema
- In patients with known difficult venous access (e.g. IVDU or those with previous multiple IV access attempts such as chemotherapy patients)
- Cannulation in the presence of burns that overlie the cannulation site

## Exclusions

Ultrasound guided venous access is suitable for most patients however certain clinical situations may dictate the need for rapid venous access where delays may result in a negative outcome for the patient (such as cardiac arrest). In this scenario intraosseous access may be more suitable, but can be left at the discretion of the physician in-charge.

- History of axillary node dissection
- AV fistula or planned AV fistula in end-stage renal failure
- Infective process (cellulitis, erysipelas, lymphangitis etc) in region close to prospective cannulation site



## Equipment

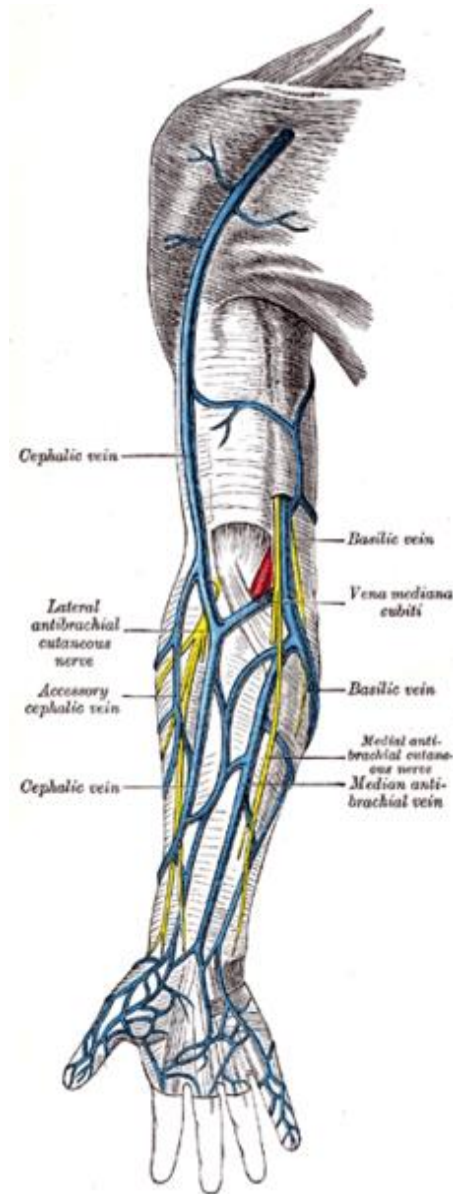
- Ultrasound Machine with Linear Probe



- Sterile Probe Cover – (Mepore Film 10 X 12cm is a good substitute if no formal cover available)
- Sterile Gel
- Skin prep – (BD Persist Plus Protective Barrier Applicator)
- Tourniquet
- IV access equipment (usual venepuncture or cannulation equipment)
- Gauze
- Personal Protective Equipment

## Technique

### Anatomy and Safe Identification of Vessels



As per *Intravenous Peripheral Short Cannula Insertion, Care or, Removal and Intravenous Therapy Management for Adults HNELHD GandP 12\_15* it preferable to access the most DISTAL vein available - more proximal veins are ideally reserved for emergency situations.

In the upper limb, target veins include the:

- Basilic
- Brachial
- Cephalic veins

However in patients with difficult venous access the normal anatomy may be distorted and vein selection may be limited to whatever vein is visible. Choosing which vein to cannulate is based on the 3D's, the veins:

- Diameter (the larger the better)
- Depth (distance from skin surface)
- Direction of travel (straight veins are easier to cannulate)

(Blavias, Brannam, Fernandez, 2003 p1307-11).

It is preferred to select a vein that conforms to the 3D's but in difficult circumstances the operator should choose the best vein on show

Upper limb venous anatomy taken from Wikipedia [http://en.wikipedia.org/wiki/Cephalic\\_vein](http://en.wikipedia.org/wiki/Cephalic_vein)

## Vessels on ultrasound

Fluid on ultrasound typically appears black, as it is a good conductor of sound and reflects very little of the soundwave generated. Vessels are fluid filled spaces and typically in the transverse view will appear as circular structures with a black centre.

Veins and arteries can appear very similar at first glance but it is important we know how to differentiate them.

The following characteristics of each can be used to delineate veins from arteries:

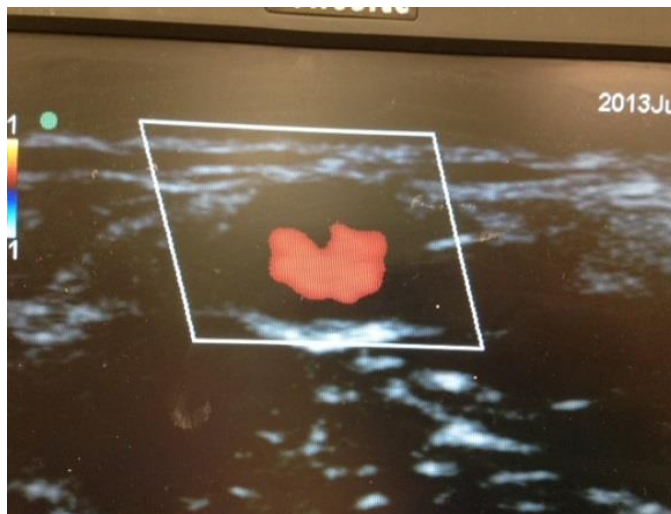
- Veins compress when gentle pressure is applied with the ultrasound probe.
- Arteries can often be seen to pulsate even under compression.



Applying colour mode, allows the direction of flow to be determined and should be applied with caution by experienced users only. Novice users may confuse the colour and direction of flow

**Red or blue colour does not necessarily indicate artery or vein**

Traditionally, most machines and most users use red to signify flow toward the probe and blue as flow away from the probe. However, the colour mode can be set to be the opposite of this.



## Positioning

- Position the patient and equipment so that all involved are comfortable and the operator has a direct line of vision between the desired site of access and ultrasound screen

## Ultrasound set up

- Turn on the machine and ensure the linear probe is selected.
- Attach the sterile probe cover and sterile gel to the ultrasound foot-print
- Apply the tourniquet in a high arm or axillary position and when ready position the probe over the skin (start in the antecubital fossa) with the probe indicator pointing to the patients right side
- Optimise the image on the ultrasound scanner by adjusting the near and far fields and depth
- Identify an appropriate vessel in the transverse view and drag the probe up and down the vessel to determine the depth and direction in which it travels
- Try to pick the best point of entry using the 3D's rule
- sterilise access point with skin preparation
- Choose either the transverse or longitudinal method of entry

(Tip – hold the needle in the dominant hand and the probe in the non-dominant hand)

## Transverse Method

The transverse method involves identifying the desired vein in the transverse plane and centring the vessel on the ultrasound screen. The point of skin entry should be as close to the probe as possible at the midpoint of the transducer footprint.



The operator should then identify the needle tip on the screen by fanning the probe back and forth just beyond the point of needle insertion and advance the needle toward the vein at a 45 degree angle. When advancing the needle, while being careful not to damage the probe with the cannula tip, focus on the ultrasound screen and not on the probe or skin surface. Directly visualize the needle tip by sliding the probe along with the needle as it advances through the skin. It is important to locate the needle tip as failure can lead to misdirection and difficulty assessing the proximity of the needle tip to the target vessel.



(Red arrow indicates the needle as it advances close to the vessel. Image taken from emedicine - <http://emedicine.medscape.com/article/1433943-overview#aw2aab6b8>)

(Tip – If the needle tip is lost, dragging or fanning the probe back and forth over the needle or gently bouncing the needle within the soft tissue may obtain a better sense of where the needle tip is located).

Venous access is confirmed with flashback of blood or with direct visualization of the needle tip within the lumen of the vessel. Blood can now be aspirated or a cannula inserted following the standard technique used when venous access is confirmed from the traditional method. The operator must remember to wipe the gel from the patients arm before securing a cannula or attaching a band aid as the adhesive will not work effectively on a lubricated arm.

### Longitudinal Method

This is an alternative approach with the advantage that the entire needle can be visualized as it advances and enters the vein. The depth orientation is better with this approach and for some operators, this method is more intuitive.

Identify the desired vein as for the transverse approach and centre the probe over the middle of the vessel. In one swift movement rotate the probe perpendicular to the vein. Care must be taken to ensure the correct direction of the vessel is obtained prior to rotation as it may be lost when spun. Rotating either the proximal or distal tip of the probe can help to obtain an adequate longitudinal view which should include a full cross section of the vessel.



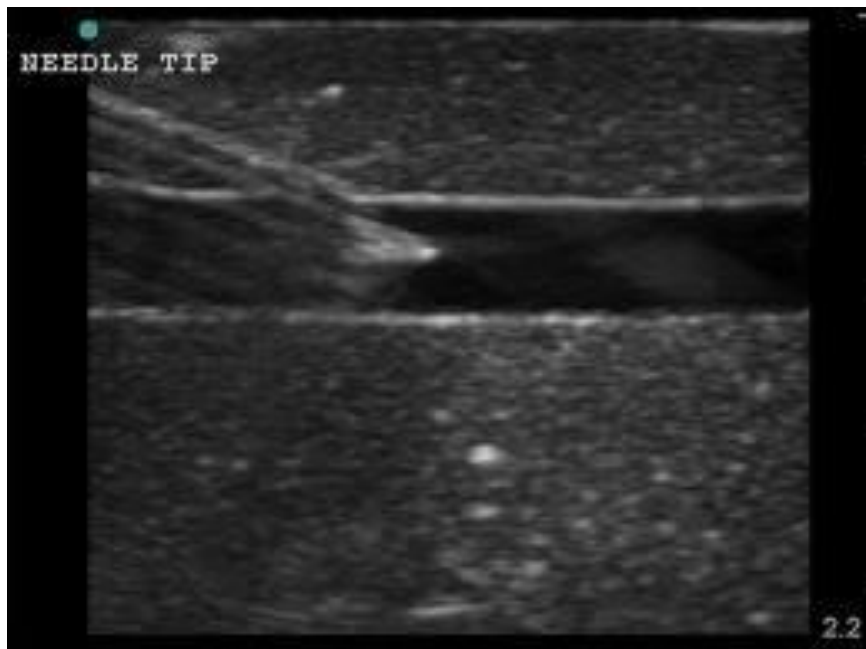
(Transverse view of the left Basilic vein rotated to achieve a longitudinal view)

Once an adequate view has been achieved the needle can be inserted inferiorly from the lateral surface of the probe foot print as close to the middle as possible.





Once inserted the needle should be visualised before advancing. If it is not seen the needle can be fanned left and right until it is seen on the skin. As it advances the needle should be observed under direct vision to pass through the skin and into the vein.



Venous access is confirmed in the same way as for the transverse technique. The main disadvantage with the longitudinal technique is poor lateral resolution. A needle located just to the side of a vessel can appear to be in the same plane,

meaning the vein may not be penetrated or structures either side of the vessel may be accidentally accessed. Therefore this technique should be used with caution in the vein is within close proximity to an artery, in this instance the transverse view may be preferable. Either approach can be used in most cases however the transverse route is thought to be easier for novice ultra-sonographers to pick up (Brown, McNicholl, Wright 2008).

### **Post Procedure Care**

The usual documentation procedures for time, site and date of cannula insertion should be followed and the probe should be cleaned with the recommended cleaning solution after probe cover removal. The Ultrasound machine should then be placed back on charge in the corner of resus bay two.

### **Assessment process**

No assessments are included within this SDLP – Activities as outlined below must be completed in order to complete the accreditation process

## References

- Au AK, Rotte MJ, Grzybowski RJ, Ku BS, Fields JM. Decrease in central venous catheter placement due to use of ultrasound guidance for peripheral intravenous catheters. *Am J Emerg Med.* Nov 2012;30(9):1950-4.
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- Shokoohi H, Boniface K, McCarthy M, et al. Ultrasound-Guided Peripheral Intravenous Access Program Is Associated With a Marked Reduction in Central Venous Catheter Use in No critically Ill Emergency Department Patients. *Ann Emerg Med.* February 2013; 61:198-203.
- Weiner SG, Sarff AR, Esener DE, Shroff SD, Budhram GR, Switkowski KM, et al. Single-operator Ultrasound-guided Intravenous Line Placement by Emergency Nurses Reduces the Need for Physician Intervention in Patients with Difficult-to-establish Intravenous Access. *J Emerg Med.* Oct 25 2012; epub ahead of print:
- Witting MD, Schenkel SM, Lawner BJ, Euerle BD. Effects of vein width and depth on ultrasound-guided peripheral intravenous success rates. *J Emerg Med.* Jul 2010;39(1):70-5.

## **Activities** - Ultrasound Guided Venous Access Practical Session and Accreditation

It is necessary to attend a small group session designed to introduce you to the ultrasound machine as well as the practical skills described in the learning package. An ultrasound simulator for venous access made of chicken fillet and a latex glove finger has been described and used with success to safely imitate vascular access conditions [9]

Once you have gained confidence in this session to gain accreditation you will need to have **eight successful** venous access attempts under direct supervision signed off by a supervisor already accredited in venous access ultrasound. Nursing staff will already need accreditation in traditional venepuncture and cannulation prior to commencing the accreditation process. On completion of this you should feel proficient with USS guided venous access using a direct vision approach



## REFLECTION ON LEARNING following completion of SDLP

Date: \_\_\_\_\_ Self-directed learning package: \_\_\_\_\_

Amount of time spent completing SDLP: \_\_\_\_\_

What are the RN /specialty competency standard (s) this SDLP meets?

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Please outline the key learning you obtained:

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Was the learning useful for your practice? Please explain?

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How will the learning influence your practice?

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Is there further information you need to obtain?

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Signature

Date

## Learning Package Evaluation Form

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**Please circle your response to the following questions:**

1. The aims and objectives of the learning package were clear and appropriate to your learning needs and goals? Yes   No
2. I have achieved my learning goals? Yes   No
3. As a result of completing this package I now have a better understanding of Ultrasound Guided Venous Access Yes   No
4. The small group activities were helpful? Yes   No
5. The package was easy to follow? Yes   No
6. The workload was reasonable? Yes   No
7. The information and skills I can use from the package are:

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8. Some suggestions I would like to make to improve the package are:

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9. Further comments I would like to make are:

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**When complete please return this form to an ED Clinical Nurse Educator**