

Trans-Illumination Device for Vascular Access during Peripheral Intravenous Cannulation

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Abstract:- Peripheral intravenous cannulation is the basic task of nurses which they have to perform skilfully to start treatment modalities in health care sector. Locating veins for insertion is a challenging part of procedure which lead to delayed cannulation and late treatment. There are number of vein finders available in market on the basic of trans illumination technology which help to access veins while cannulation.

I. INTRODUCTION

Intravenous cannulation is basic skill required for nurses. Peripheral Intravenous (PIV) Cannulation is used to administer fluids, blood products, drugs and nutrition through the venous route. Also it is inserted for short term therapy or for bolus injection in outpatient department or in dialysis unit. Most of hospitalized patient require IV cannula for infusion of hydration therapy and intravenous medications. Also it is common procedure which is carried out in emergency department and on high priority, while providing care to unstable or critically ill patient .[1]

According to study every year almost 40million people undergo intravenous cannulation procedure. [2] According to almost all the hospital policy and Centres for Disease Control and Prevention, cannula should be changed every 48-72 hours or 72 -96 hours to prevent cannula site infection. So, the patients required frequent re-insertion of IV cannula and it may difficult to identify the vein due to repeated vein puncture. Phlebitis , pain , infection, occlusion , dislodgment and accidental removal of cannula required reinsertion of cannula.[3]

Failure rate of IV access is vary in literature. According to study of Abhijit Mandal and et al rate of phlebitis found to be 31.4% in 2019.[4] Dragnasimin and et al conducted study in 2019 to determine incidence and severity of complications due to peripheral intravenous cannula and found that 44% incident of phlebitis , 16.3% prevalence of infiltration followed by 7.6% of occlusion and 5.6 % of dislodgement.[5]

Finding vein during cannulation is very crucial steps and den and collapsed veins due to dehydration. patient with complex disease, obesity, use of intravenous drugs, malnutrition fall in category of difficult venous access where venous access is very challenging task even though for experienced health care member due to invisible and non-palpable veins.[6] This situation may lead to delayed

diagnosis and treatment of patient which is against standard medical care. Also multiple pricks may result in pain, irritation and patient may become more anxious. It degrade professionalism of health care fraternity as well. Sometime in such patients need to place central venous lines, which is very complicated and high-risk procedure for patients. Hence there is need to overcome this issue.[7]

There are number of devices are available in market called vein finders which help to find veins easily while cannulation in such crucial cases. These devices are based on technology of near infrared radiation and Light Emitting Diodes (LED) source. These sources pass through skin , absorbed by deoxygenated blood and show location, size and depth of veins so health care member can get easy access for IV cannulation.[8]

II. VEIN VISUALIZATION TECHNOLOGY

It is an innovative and modular technology which help health care fraternity to find best veins for intravenous infusion and also create map of veins on the surface of skin.

Vein visualization device

Vein finder devices are composed of high powered near infrared and LED light sources to produce clear image of veins for easy vascular access.

Vein visualization device principles are specially based on two illumination types that is trans-illumination and reflected light. In trans-illumination technology lights penetrates in the skin and tissues of the selected site and then image will get captured by camera, while in reflected light source light is getting reflected on skin surface to visualize selected area and then camera captured it. [9]

Types of vein finders

Vein finders are of two types depending on use of light sources :

- 1.Vein illumination devices : use near infrared (NIR) technology to locate veins
- 2.Trans-illumination devices: use LED light sources to access veins easily

III. TRANS ILLUMINATION DEVICE

Trans-illumination device use bright colored Light Emitting Diodes (LEDs) which are directly positioned on skin surface during peripheral IV cannulation procedure to access veins. Even though use of trans-illumination device for visualization of vein is old method but still it is not popular or well known in world.[10]



Fig.1 Trans-Illumination Device

Purposes

To easily visualization of veins while performing procedures related to venous access
 To minimize multiple attempts during vascular cannulation
 To minimize duration of venous access procedures
 To reduce intensity of pain

Working of device trans-illumination device

Once device hold on skin then this bright colored LED lights passes through the skin and some light get absorbed by the deoxygenated blood from veins, ultimately it results in presentation of location of veins, its size and depth as well. These devices are able to find veins up to 6mm depth [11]

Advantages

1. Trans-illumination devices are portable and easy to carry anywhere
2. Devices are easy to use
3. Cost of trans-illumination devices are low if we compare with vein illumination devices with NIR radiation technology.

There are number of studies which have supported to positive aspects of vein visualization device. Some studies proved that veins visualization device help to improve first attempt success rate, reduce time required for detection of veins and for total procedure to complete. Some studies revealed that veins visualization device help to increase nurses and patient's satisfaction and reduce pain and anxiety in patient during IV cannulation due to multiple pricking attempts. Even some studies proven that this device is helpful to reduce hospital cost due to failure of first attempt success during IV cannulation.[12,13,14,15]

According to Goren et al (2001) transillumination technique help to access veins easily in infant and it is easy method to use [14]. Ataly et al (2005) in their article titled, 'The use of transillumination for peripheral venous access in pediatric anesthesia' stated that use of transillumination method is useful for successful cannulation among difficult venous access patients to improve first attempt success rate [15]. Transillumination is beneficial for vein visualization and it reduce multiple pricking attempt during venupuncture. (Katsogridakis et al .2008) [16].

K. Hosokawa et al (2010) conducted study to access effect of transillumination during peripheral intravenous cannulation among infants and small children and study revealed that vein detector support to visualize veins properly and to improve first attempt success rate during intravenous cannulation in infants and children as well as device help to reduce total time required for intravenous cannulation procedure[17].

According to K Phipps et al (2012) vein viewer is best method to locate vein during cannulation [18]. Amir Shahzad et al (2014) in their article on Transillumination techniques for vein visualization stated that techniques is useful for vein detection during various procedures and enhance quality of health care [19].

During IV cannulation procedure it is nurse's responsibility to prepare the patient, to collect all articles required for procedure and to select appropriate IV cannula and vein site. Then she has to apply tourniquet above the puncture site and then pressing start button of vein finder device she can able to visualize veins very clearly. Then she can ask the assistant to hold device and insert cannula in vein smoothly and confidently.

IV. CONCLUSION

Invisible, non palpable and collapsed veins are always make a challenge to even experienced operator, to do the intravenous cannulation. It may lead to multiple pricking attempts which are more painful to the patients, also lead to delayed diagnosis and treatment due to delayed cannulation which may threat the patient's life. There are number of studies supported that vein visualization by using trans-illumination device is innovative technology which help to overcome such issues by visualizing vein easily during cannulation also these devices may contribute to increase nurses and patients satisfaction during vascular access.

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