Venous Access in Children

An essay

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بسم الله الرحمن الرحيم
قالُوا سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ
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Mohamed Ali Abd Elmoneem

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List of Abbreviations

ACT	:	Activated clotting time
AV	:	Atrioventricular
CA	:	Carotid artery
CoNS	:	Coagulase negative Staphylococcus aureus
CPR	:	Cardiopulmonary resuscitation
CRBSI	:	Catheter related blood stream infection
CT	:	Computed tomography
CVAD	:	Central venous access devices
CVC	:	Central venous catheters
CXR	:	Chest X-ray
DVT	:	Deep venous thrombosis
ED	:	Emergency department
EJV	:	External jugular vein
ICU	:	Intensive care unit
IJV	:	Internal jugular vein
IM	:	Intramuscular
INR	:	International normalized ratio
IO	:	Intraosseous
IP	:	In-plane
IV	:	Intravenous
IVC	:	Inferior vena cava
LA	:	Local anasthetic
Mm	:	Melli meter
MRSA	:	Methicellinase resistant staph aureus
MSB	:	Maximal sterile barrier
NICU	:	Neonatal intensive care unit
OD	:	Outer diameter
OOP	:	Out-of-plane
PICC	:	Peripherally inserted venous catheters
PT	:	Prothrombin time
PTT	:	Partial thromboplastin time
PVC	:	Polyvinyl chloride

List of Abbreviations (Cont.)

RA	:	Right atrium
SCM	:	Sternocleidomastoid
SV	:	Subclavian vein
SVC	:	Superior vena cava
TAD	:	Transparent adhesive dressing
TIVADs	:	Totally implantable venous access devices
TPN	:	Total parenteral nutrition
US	:	Ultrasound
VAD	:	Venous access devices

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Introduction

Nothing can be more difficult, time consuming and frustrating than obtaining vascular access in the paediatric patient. This was best described by Orlowski in 1984, who stated, 'My kingdom for an intravenous line **(Nikolaus, 2004)**.

Difficulty in placing a peripheral intravenous line is a very common and frustrating experience ***(Laura, et al., 2009)***.

Conventional peripheral intravenous (IV) lines are simple, inexpensive, and can be used for short-term IV therapy. Veins are typically accessed in the patient's hand or arm, and sometimes in the foot ***(Cheung, et al., 2009)***.

Nurses encounter children with peripheral difficult vascular access *(DVA)* on a daily basis. Early identification of patients with potential DVA gives time to adjust approach and use special techniques that enhance venous access and improve cannulation success rates. If venous access cannot be achieved after 2 to 4 attempts, alternative routes of administration should be considered ***(Laura, et al., 2009)***.

Increased awareness, coupled with better management of DVA, should minimize its immediate and longterm impact on the child, family, and health care provider ***(Laura, et al., 2009)***.

Percutaneous central venous line insertion has replaced peripheral venous cut down as the primary mode of short term venous access in childhood. Venous cut down is regarded as

the method of last resort, but remains useful in emergency situations when other attempts at venous access have failed ***(Nikolaus, 2004)***.

Central lines can be classified as either peripherally inserted or centrally inserted central devices ***(Cheung, et al., 2009)***.

The Central venous catheter can be inserted into the femoral, jugular and subclavian veins, or other influent veins, and in most cases catheter insertion is feasible ***(Nikolaus, 2004)***.

The Intra Osseous (IO) route provides rapid and reliable access to the systemic venous circulation in the pediatric population. This technique is safe, complications are infrequent and the benefits clearly outweight the risks, especially in the pediatric population (**Nikolaus, 2004)**.

Arterial puncture, hematoma, and pneumothorax are the most common mechanical complications during the insertion of central venous catheters. The catheter could be changed over a guide wire. This technique reduces the number of insertion-related complications and is safe, even in patients with sepsis, as long as antibiotic therapy has been initiated. In patients who have septic shock and no other source of infection, the catheter should be removed and replaced with a new one at a new site ***(McGee and Gould, 2003)***.

Aim of the Work

The aim of this essay was to review the classic and recent modalities of vascular access as regard its types, devices, indications, complications, and their managements.

Anatomy of Veins Usually used for Venous Access

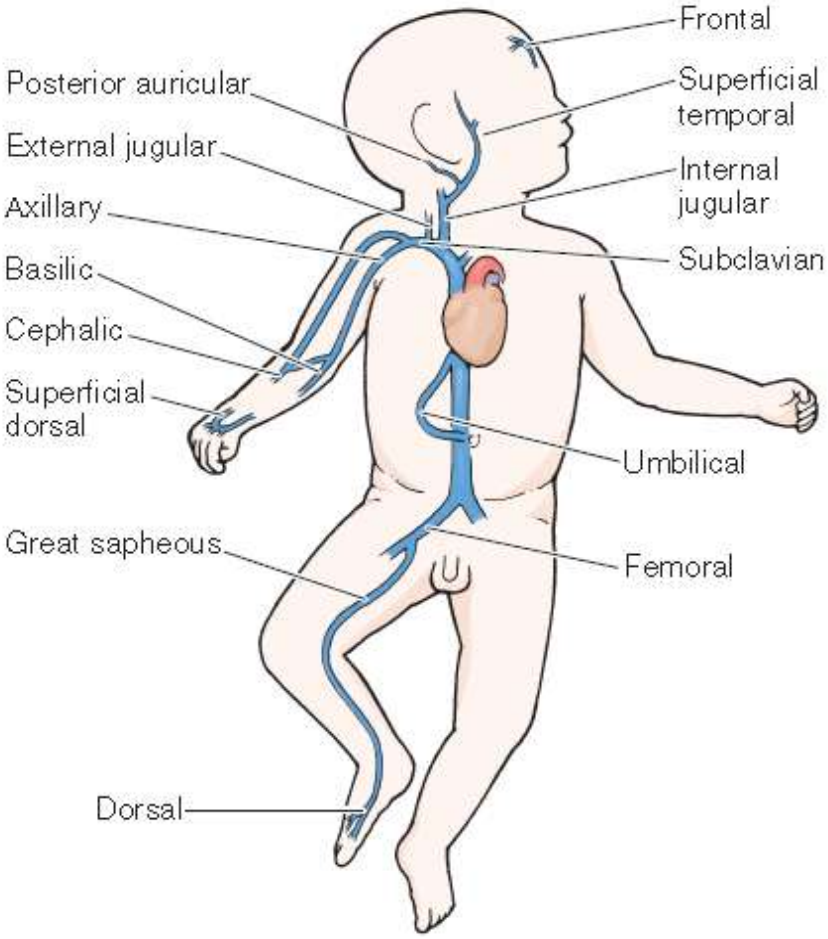

Fig. (1): Venous access sites in the neonate and young infant ***(Lozon M, 2012).***

1- Extremities:

A- Upper extremity:

Cephalic and Basilic

Cephalic and basilic veins are the superficial veins of the arm. Basilic vein is the largest arm vein measuring 6-8 mm. It passes along the medial (ulnar) aspect of the arm from wrist to shoulder. It begins at the dorsum of the hand, crosses the elbow and drains into the brachial vein ***(Last, 2003)***.

Cephalic vein, measuring 4-6mm, runs along the lateral (radial) aspect of the arm also from the wrist to shoulder emptying into the axillary vein **(*Last, 2003)***.

Although the basilic vein is larger, the cephalic vein is more superficial and easier to dissect out. Therefore it is often the preferred vein for dialysis fistulas or grafts. Conversely, the cephalic vein may take an acute angle before it enters the axillary vein sometimes making negotiation with a catheter or wire difficult ***(Andrews et al., 1992)***.

Median antecubital vein

Oblique coursing vein at the elbow that joins the basilic and cephalic veins ***(Last, 2003)***.

Deep forearm veins

These are 2 or 3 veins each that course with and are named like the corresponding arteries of the forearm (radial & ulnar). Brachial veins are the deep veins of the upper arm, usually paired and smaller than the superficial veins. They

travel in the upper arm parallel to (on either side) the brachial artery and join with the basilic vein to form the axillary vein ***(Last, 2003)***.

B-Lower extremity:

Femoral Vein

The femoral vein is the continuation of the popliteal vein beginning at the adductor hiatus. It receives the greater saphenous vein and the deep femoral vein. It continues as the external iliac vein at the inguinal ligament. It usually lays posterolaterally to the femoral artery in the thigh and then moves medially at the groin. In approximately 25% of people the femoral vein is directly posterior to the artery at the groin. Traditionally, femoral veins are not routinely used for venous access except on an acute temporary basis or when all other sites have been exhausted ***(Hartnett et al., 1996).***

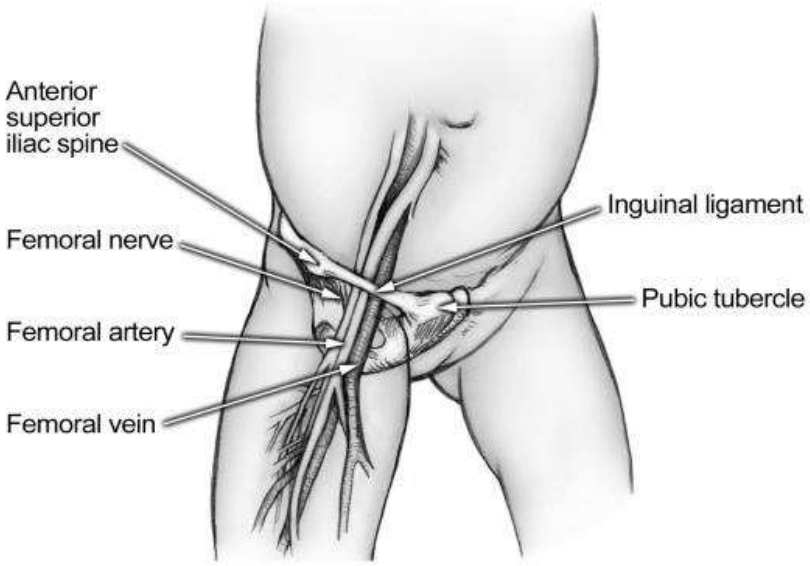

Fig. (2): Femoral vein anatomy ***(Putigna, 2011)***