



**NURS2600
NURSING OF ADULT I**

Intravenous infusion & injection

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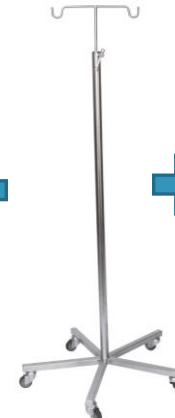
Learning outcomes

By the end of this lecture, the students should be able to:

- Differentiate between crystalloid and colloid solutions;
- Identify different types of intravenous access;
- identify different types of infusion set and infusion methods;
- interpret physician's order on IV infusion correctly;
- calculate the dose of IV medication correctly;
- document IV infusion correctly;
- describe nursing care and education to patient who is receiving IV infusion;
- acknowledge the principle of IV medication administration;
- describe the characteristic of different complications related to IV injection/ infusion;
- propose measures to prevent complications;
- describe appropriate nursing care for different IV related complications.

Administration of Intravascular Infusion

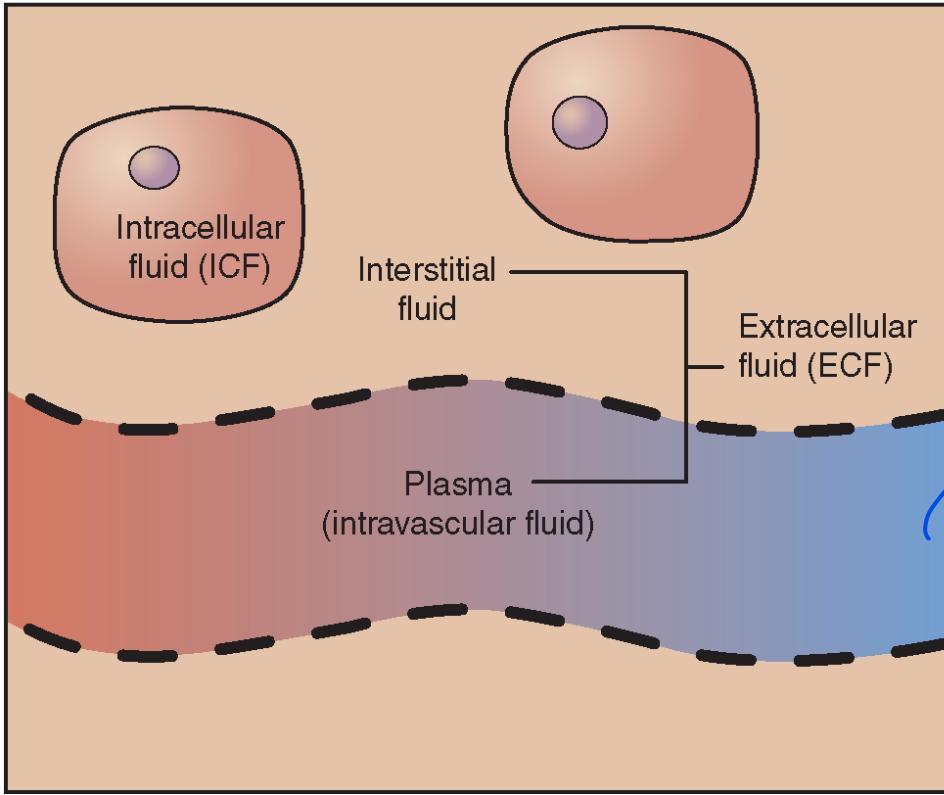
What do you need??





Solutions

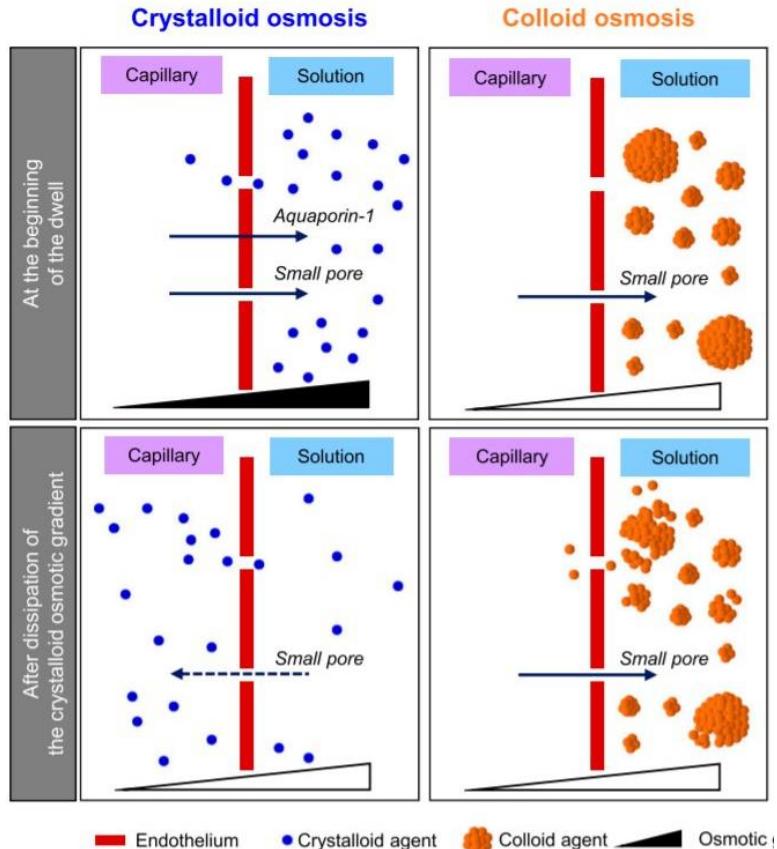
Fluid and Electrolyte Balance



<https://www.pinterest.com/pin/34199278392222465/>

Types of Solutions

Types of Solutions	Characteristics
Crystalloids	<ul style="list-style-type: none"> Contains water-soluble electrolytes Lack of proteins and insoluble molecules
Colloids	<ul style="list-style-type: none"> Contains large insoluble molecules Generally proteins or complex polysaccharides
Blood products	<ul style="list-style-type: none"> Packed cell Whole cell Platelet Fresh Frozen Plasma

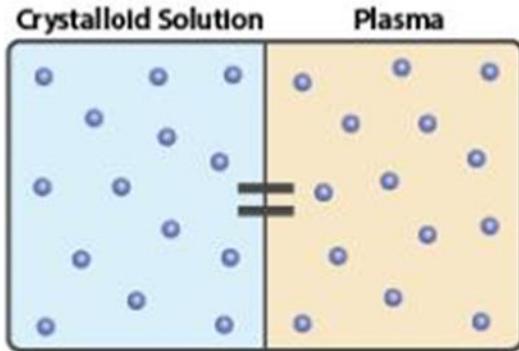


Crystalloids

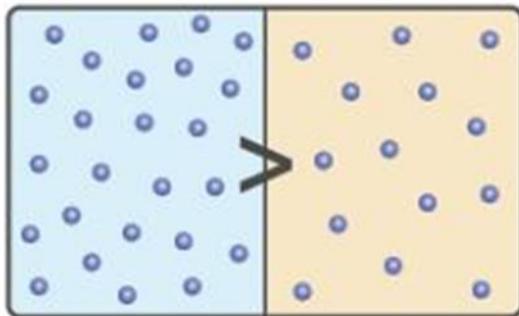
- Isotonic
- Hypertonic (去補充) or (去水)
- Hypotonic (去 loss) or (Gain 水)

有 diffusion, 所以
不可以用於 hypovolaemia.

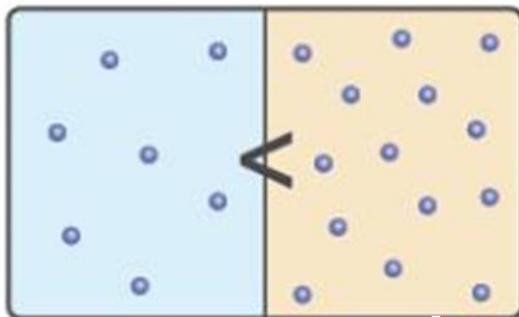
Isotonic
Crystallloid
Solution



Hypertonic
Crystallloid
Solution



Hypotonic
Crystallloid
Solution



Crystalloid – Isotonic

Total osmolarity close to ECF ($\sim 250 - 375 \text{ mOsm/L}$)

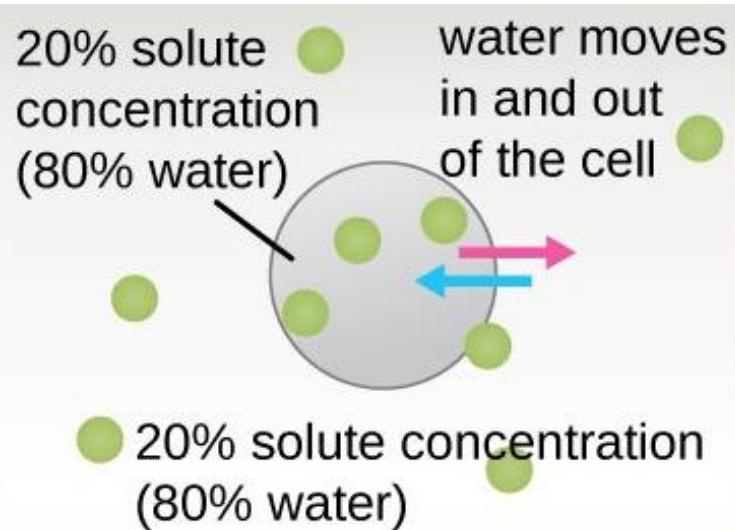
Do not cause any substantial redistribution of body fluid

(Expand ECF volume)

Server Cervot.

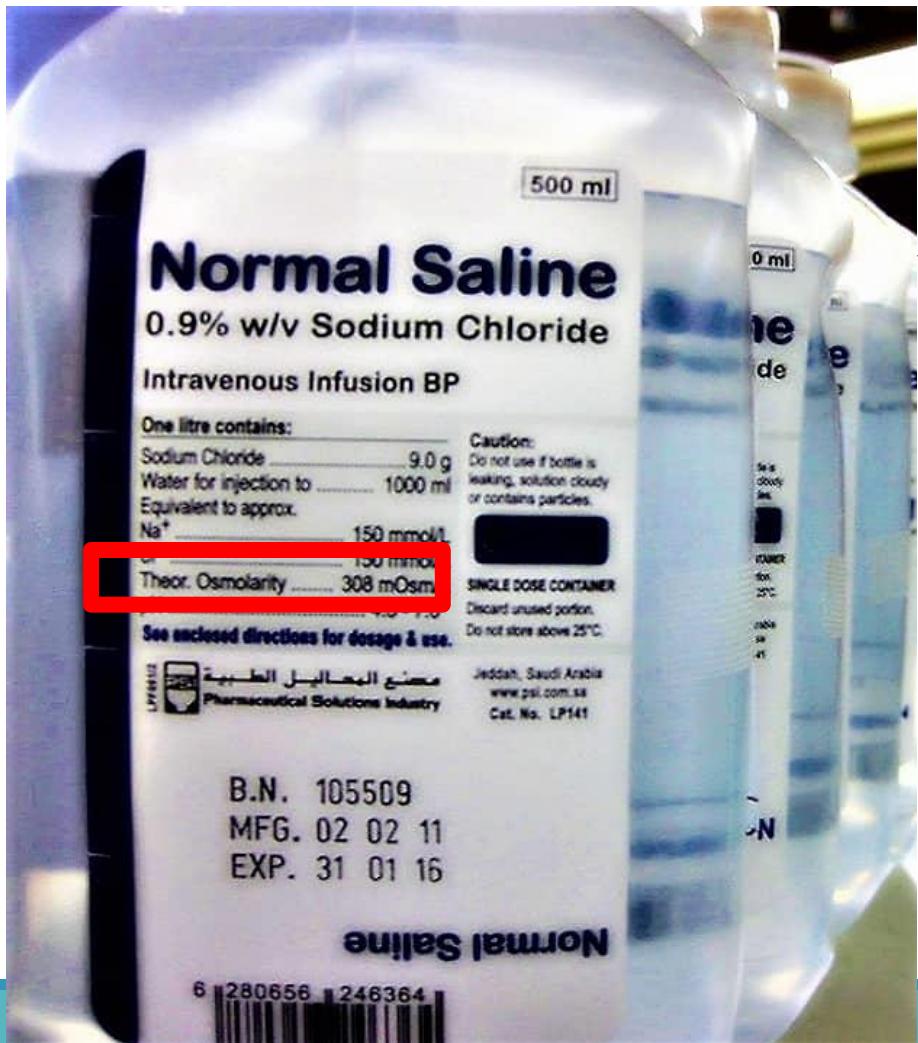
Clinical Indication

- Patient with fluid volume deficit from
 - Severe vomiting or diarrhea
 - Mild hypovolemic condition
 - Surgery



Examples

- Normal Saline (0.9% sodium chloride)
- 5% dextrose (d-5)
- Lactated Ringer/Hartmann's solution
- 2.5% dextrose & 0.45% Sodium Chloride (half half solution) – 著呢水



2.5% Dextrose and 0.45% Sodium Chloride Injection USP

1000 mL

EACH 100 mL CONTAINS 2.5 g DEXTROSE HYDROLYZED USP, 450 mg SODIUM CHLORIDE USP, pH 4.5 (3.2 to 6.5) mEq/L SODIUM 77 CHLORIDE 77 OSMOLARITY 280 mOsmol/L (CALC) STERILE NON-PYROGENIC SINGLE DOSE CONTAINER ADDITIVES MAY BE INCOMPATIBLE CONSULT WITH PHARMACIST IF AVAILABLE WHEN INTRODUCING ADDITIVES USE ASEPTIC TECHNIQUE MIX THOROUGHLY DO NOT STORE DOSAGE INTRAVENOUSLY AS DIRECTED BY A PHYSICIAN SEE DIRECTIONS CAUTIONS SQUEEZE AND INSPECT INNER BAG WHICH MAINTAINS PRODUCT STERILITY DISCARD IF LEAKS ARE FOUND MUST NOT BE USED IN SERIES CONNECTIONS DO NOT USE UNLESS SOLUTION IS CLEAR Rx ONLY STORE UNIT IN MOISTURE BARRIER OVERWRAP AT ROOM TEMPERATURE (25°C/77°F) UNTIL READY TO USE AVOID EXCESSIVE HEAT SEE INSERT

VIAFLEX CONTAINER

PL 146 PLASTIC

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Crystalloid – Hypotonic

- Lower concentration, osmolarity $\leq 250 \text{ mOsm/L}$
- Movement of water from ECF to ICF

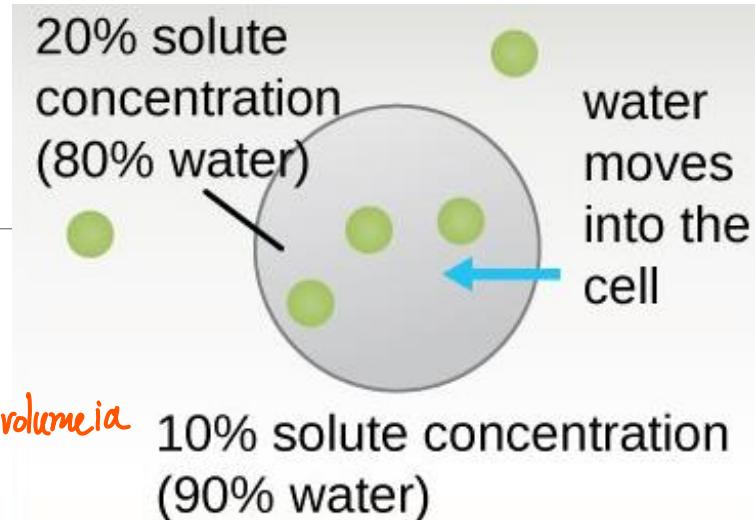
Clinical Indication

- Patient with intracellular dehydration (e.g. diabetic ketoacidosis)

Server hyperglycemia
↳ uncontrolled DM

Examples

- 0.45% NaCl
- 0.33% NaCl
- 2.5% dextrose



Too much hypotonic fluid
⇒ swelling of the cells in the brain & increase cranial pressure

500 mL

NDC 0264-4021-55
S4021-SS

0.45% Sodium Chloride Injection USP

Each 100 mL contains:
Sodium Chloride USP 0.45 g
Water for Injection USP qs



B. Braun Medical Inc.
Irvine, CA USA 92614-5895

0.45% Sodium Chloride Injection USP



NDC No. (01)0302644021555

pH adjusted with
Hydrochloric Acid NF
pH: 5.3 (4.5-7.0)
Osmolality:

155 mOsmol/liter, hypotonic

**Electrolytes (mEq/liter): Sodium 77
Chloride 77**

Sterile, nonpyrogenic.
Single dose container.

For intravenous use only.
Use only if solution is clear and vacuum is present.

Recommended Storage:
Room temperature (25°C).
Avoid excessive heat. Protect from freezing.
See Package Insert.

Rx only

LIFT
HERE

Y37-002-133
Made in USA

“ECF多咗，水ICF出”是錯誤的!!!

Crystalloid - Hypertonic

- High concentrated fluid, osmolarity $\geq 375 \text{ mOsm/L}$
- Unequal pressure gradient between the inside & outside of the cells → draw cellular & interstitial water back to intravascular compartment → the cells and tissue space will shrink

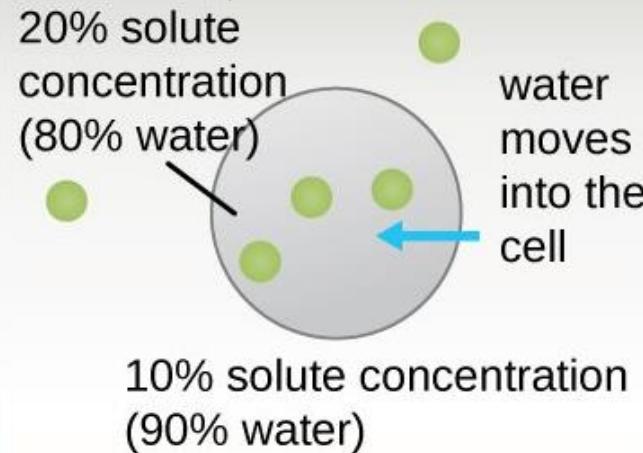
Clinical Indication

- Expand the circulatory volume rapidly
- Patient with severe hyponatremia
- Patient with cerebral edema

Examples

- 10% Dextrose *
- 3% Sodium Chloride *

$\mu\text{ interstitial \& intracellular}$
血管去 intravascular



Too much hypertonic fluid
⇒ intravascular fluid
volume overload &
pulmonary edema

↳ Hypervolemia.

500 mL NDC 0409-7938-19
IN 1000 mL PARTIAL-FILL CONTAINER

10% DEXTROSE

Injection, USP

EACH 100 mL CONTAINS DEXTROSE,
HYDROUS 10 g IN WATER FOR
INJECTION.

505 mOsmol/LITER (CALC.)

**CAUTION: HYPERTONIC. ADMINISTER
ONLY AFTER DILUTION. DEXTROSE
SOLUTIONS WITHOUT SALTS
SHOULD NOT BE USED IN BLOOD
TRANSFUSIONS BECAUSE OF
POSSIBLE ROULEAU FORMATION.**

ADDITIVES MAY BE INCOMPATIBLE. CONSULT WITH PHARMACIST, IF AVAILABLE. WHEN INTRODUCING ADDITIVES, USE ASEPTIC TECHNIQUE, MIX THOROUGHLY AND DO NOT STORE.



CONTAINS DEHP



SINGLE-DOSE CONTAINER. FOR I.V. USE. USUAL DOSAGE: SEE INSERT. STERILE, NONPYROGENIC. USE ONLY IF SOLUTION IS CLEAR AND CONTAINER IS UNDAMAGED. MUST NOT BE USED IN SERIES CONNECTIONS.

Rx ONLY

Colloid

- Contain large molecules that can't pass through semi-permeable membranes
- Colloids remain in the intravascular compartment & expand intravascular volume
→ increase circulating blood volume
- Have longer duration of action than crystalloids

Clinical Indication

- Burns
- Severe hypoglobulinemia
- Resuscitation in severe hypovolemia

Examples

- Gelofusine (severe hypovolemia)
- Albumin (hypoglobulinemia)

liver failure, ↓ p(Albumin)



Summary of IV Solutions



- Hypertonic 高血管 Hyper

Types	Osmolarity	Principles	Clinical indications	Examples
Isotonic crystalloids	250 – 375 mOsm/L	<ul style="list-style-type: none"> ▪ Do not cause any substantial redistribution of body fluid ▪ Expand ECF volume 	<ul style="list-style-type: none"> ▪ Patient with fluid volume deficit from <ul style="list-style-type: none"> ➢ Severe vomiting or diarrhea ➢ Mild hypovolemic condition ➢ Surgery 	<ul style="list-style-type: none"> ▪ Normal Saline (0.9% sodium chloride) ▪ 5% dextrose ▪ Lactated Ringer/Hartmann's solution ▪ 2.5% dextrose & 0.45% Sodium Chloride (half half solution)
Hypotonic crystalloids	≤ 250 mOsm/L	<ul style="list-style-type: none"> ▪ Movement of water from ECF to ICF 	Patient with intracellular dehydration (e.g. diabetic ketoacidosis)	<ul style="list-style-type: none"> ▪ 0.45% NaCl ▪ 0.33% NaCl ▪ 2.5% dextrose
Hypertonic crystalloids	≥ 375 mOsm/L	<ul style="list-style-type: none"> ▪ Draw cellular & interstitial water back to intravascular compartment 	<ul style="list-style-type: none"> ▪ Expand the circulatory volume rapidly ▪ <u>Patient with severe hyponatremia</u> ▪ <u>Patient with cerebral edema</u> 	<ul style="list-style-type: none"> ▪ 10% Dextrose ▪ 3% Sodium Chloride
Colloids	Gelofusine (274 mOsm/L) (no need to memorize)	<ul style="list-style-type: none"> ▪ Contain large molecules remaining in the intravascular compartment ▪ Increase circulating blood volume 	<ul style="list-style-type: none"> ▪ Burns ▪ Severe hypoglobulinemia ▪ Resuscitation in severe hypovolemia 	<ul style="list-style-type: none"> ▪ Gelofusine (severe hypovolemia) ▪ Albumin (hypoglobulinemia)

Intravenous Infusion

Infusion Methods

By Gravity

- Adjust/ count the rate manually
- The height of the solution affects the rate of flow

Electronic infusion

- Infusion pump
 - Administer infusion with higher accuracy (e.g. contain potassium, with medication)
 - Require special tubing that can fit in the designated pump
- Syringe pump
 - Intravenous infusion devices with higher accuracy but the total amount of medication can be prepared is limited

Infusion by gravity – adjust drip rate manually



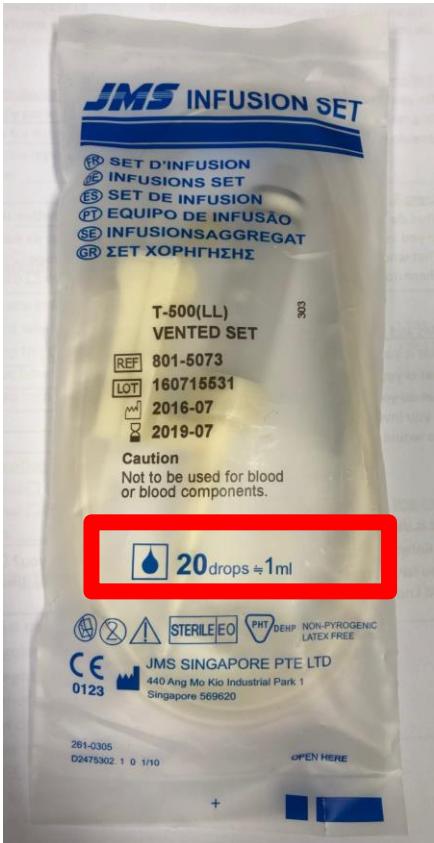
Electronic Infusion



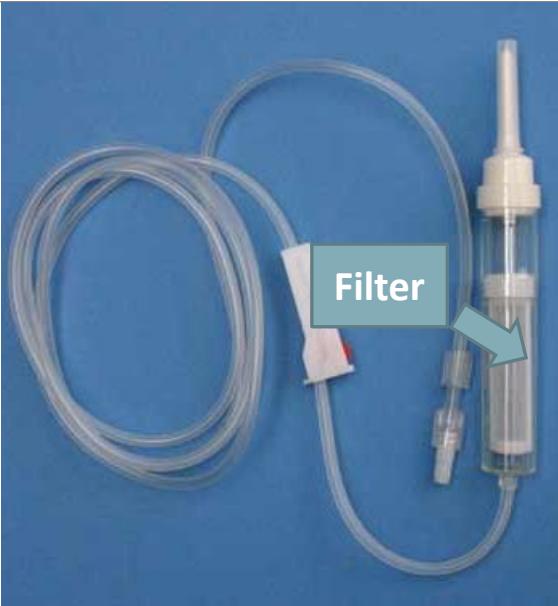
Infusion pump

Syringe pump

Infusion set



Drop factor



Filter



Volume control
burette



Pump set

[https://www.youtube.com/
watch?v=sokeIbE-EdA](https://www.youtube.com/watch?v=sokeIbE-EdA)



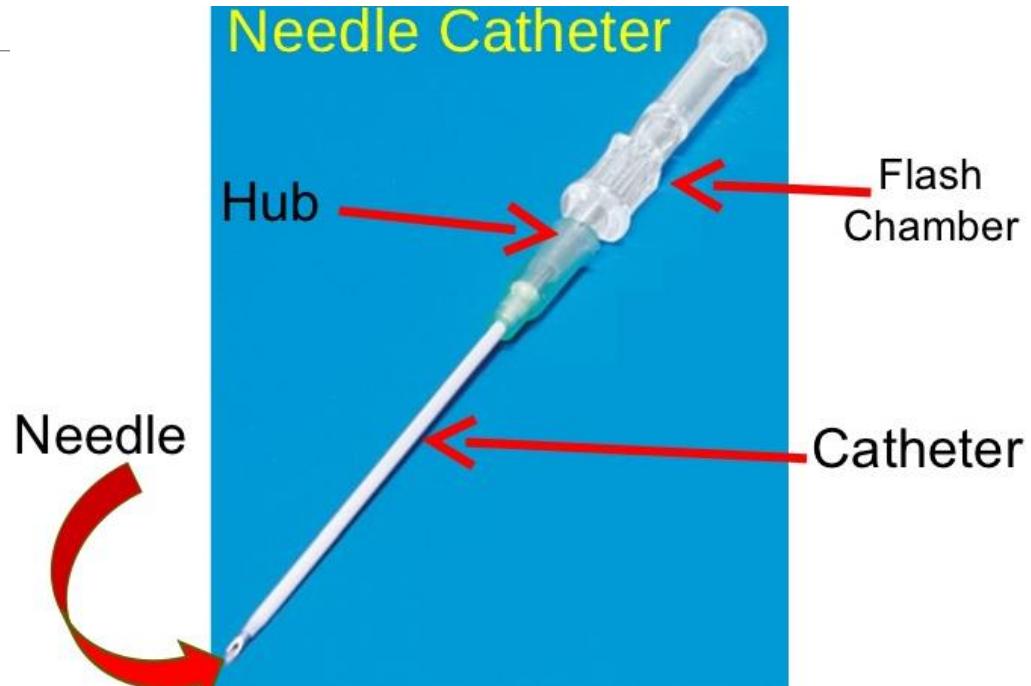


Intravenous Access

Peripheral IV access



Angiocatheter



Peripheral IV access

regular observation, monitoring is needed.

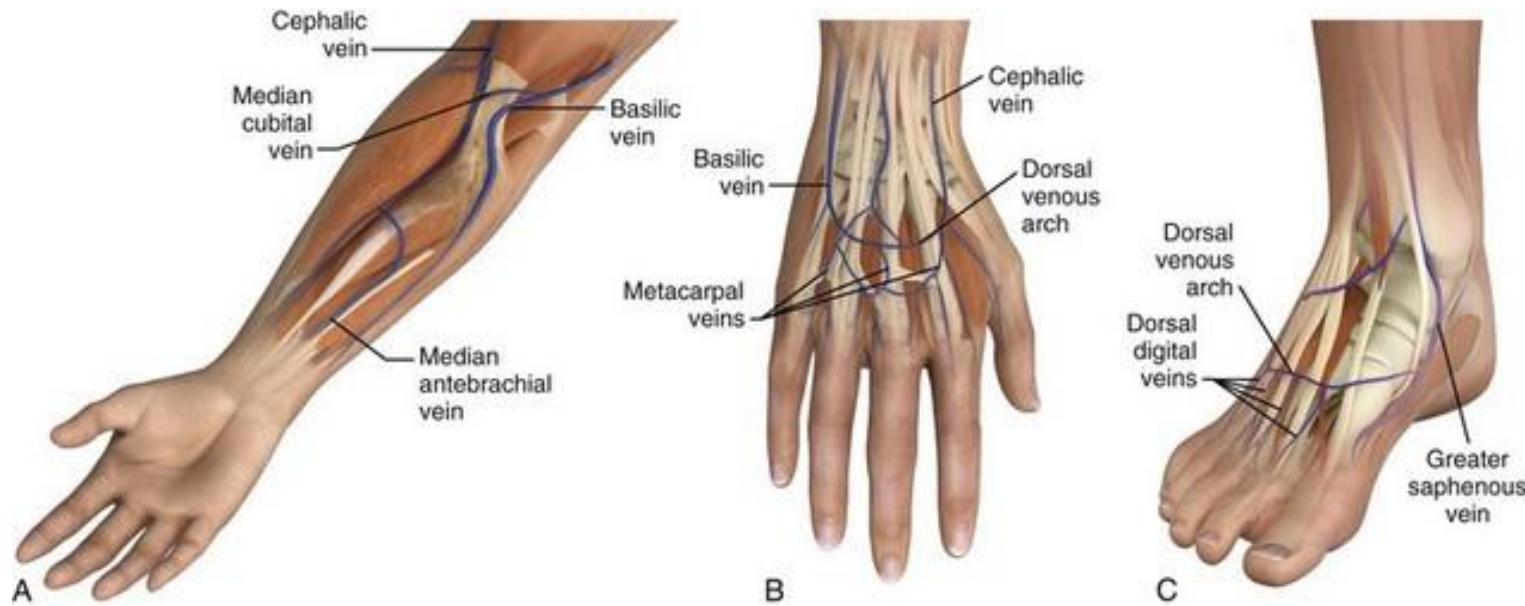


Prevention of needle stick injury

Needleless
device
Or
MicroClave



Common Peripheral Venous Access Sites



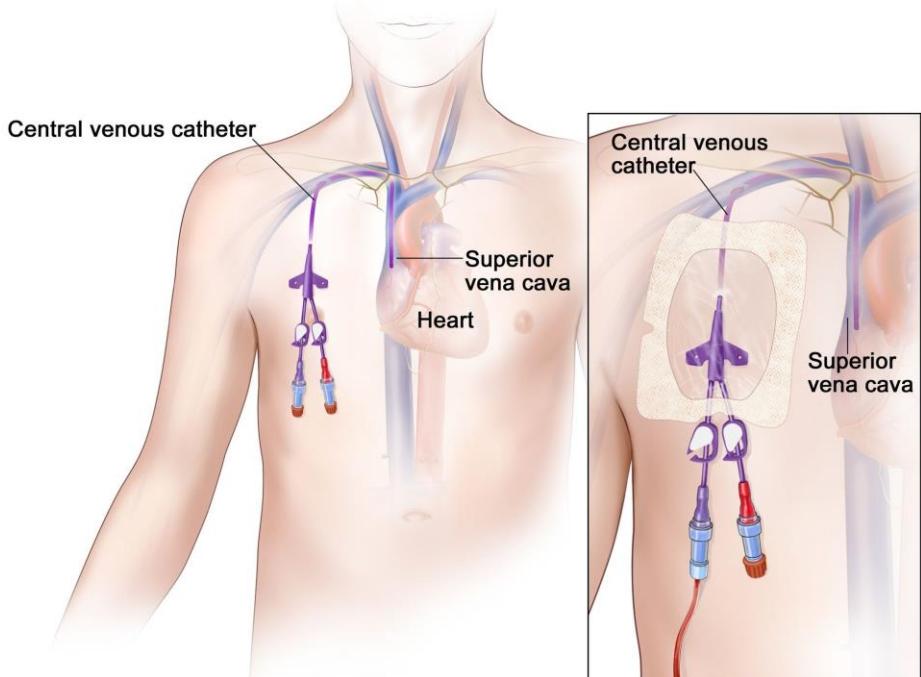
Central Venous Access

Central venous catheter (CVC)

Important
↳ Cancer patient.

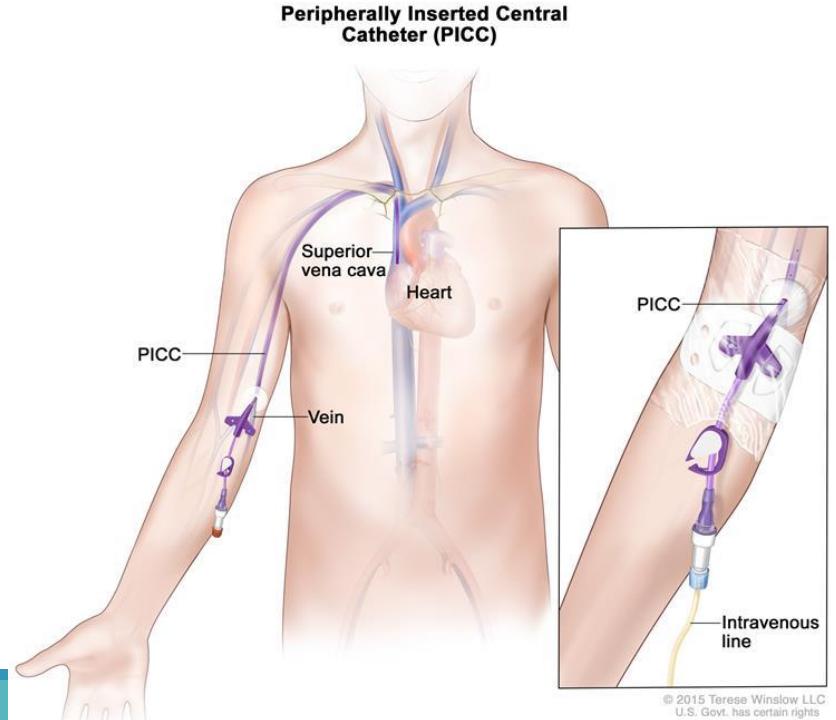


Central Venous Catheter



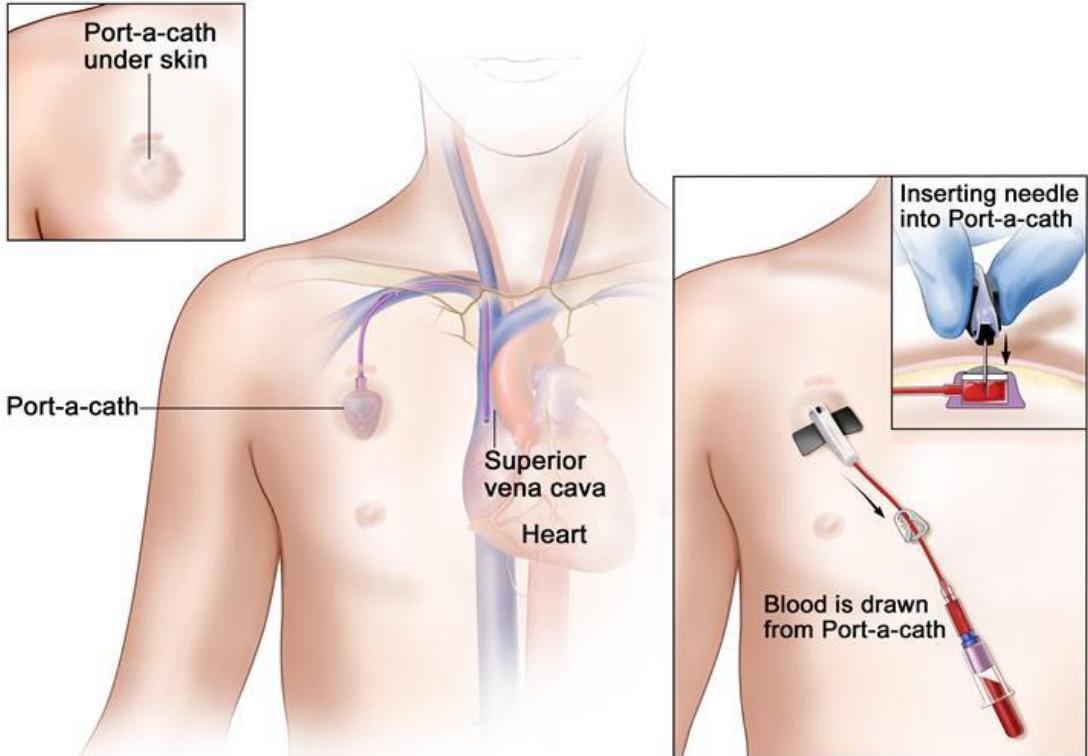
Central Venous Access

Peripherally inserted central catheter (PICC)



Central Venous Access

Implanted infusion port



Three-way



Interpretation of Infusion Prescriptions

Common Medical Abbreviation

D = D5 = 5% Dextrose

D10 = 10% Dextrose

S = NS = Normal Saline (0.9% NaCl)

0.33% NaCl = 0.33% Sodium Chloride

$\frac{1}{2} : \frac{1}{2}$ = 0.45% NaCl & 2.5% D (half half solution)

NS + K⁺ 20mmol = NS with Potassium 20mmol

Date

XX/X/2022

Patient complained of dull pain over right lower abdomen x 1/7 start to have sharp pain this morning.

0900

MED Vomit +, Nausea ++, Diarrhea -, Loss of appetite x 1/7, Fever: 38oC

Abdominal examination:

Tenderness +++

500mL D5 $\xrightarrow{8H}$ 500mL NS $\xrightarrow{8H}$ 500mL D5

Imp: ? Appendicitis

1 D5 solution and then 1 NS solution

Amount

Frequency

Mx: Keep NPO

BP/P/, Temp Q4H

Route

IVF: 1D1S 500ml Q8H

Types of IV fluid 34

Medicine

How about the
following?

IVF: 2D1S 500ml
Q8H



1st bag: D5 500ml
over 8 hour



2nd bag: D5 500ml
over 8 hour



3rd bag: NS 500ml
over 8 hour



4th bag: D5 500ml
over 8 hour

Common Frequency for IVF



Q4H



Q6H

☆(全力輸)



FR (full rate)



Q8H



Q12H

☽(好慢!!)



KVO
(keep vein open)

Infusion Rate (drip rate) Calculation

Volume in ml to be
infused in
prescription



02

Total time in
minutes

Hours interval x 60
mins/ hr



01

Drop factor of IV
set

20/ 60 drops/
ml?

03

Infusion Rate Calculation

By Gravity
(drops/min)

(volume in ml to be infused) x (drop factor)

Total time in minutes

By Infusion pump
(ml/hour)

Total volume in ml to be infused

Total hours to be infused

IVF: 1D1S 500ml Q8H



By Gravity
(drops/min)

500 ml x 20 drops/ml

8 hours x 60 mins

drops/min

By Infusion pump
(ml/hour)

500 ml

8 hours

= 62 ml/hour

When adjusting drip rate, we may convert drops/min to seconds/ drop

$$60 \text{ secs} \div (\text{drops/min})$$

Infusion rate of **1D1S 500ml Q8H** = 21 drops

$$60 \text{ secs} \div 21 \text{ drops/min} = \sim 3 \text{ secs/ drop}$$

How about Q12H?

Q6H?

Q4H?

Documentation

Documentation on I&O chart

1D1S 500ml Q8H

Time	INTAKE(in mls)					
	By Infusion				By Mouth	
	Nature	Amount	Given by/	Nature	Amount	Nature
8:00 PM						
9:00 PM						
10:00 PM						
11:00 PM						
cumulative						
XX/X/2022	12 MN	NS	500	Ada		Mina
1:00 AM						

According to the order, each bag should be infused in 8 hours

Xx/Xx/2023

Time	INTAKE(in mls)			
	By Infusion		By Mouth	
	Nature	Amount	Given by/ Mature	Checked by
8:00 PM				
9:00 PM				
10:00 PM				
11:00 PM				
cumulative				
12 MN	NS	500	<i>Adva</i>	<i>Mina</i>
1:00 AM				

The nurse who performs 3C5R together

The nurse
who
administers
the IVF

Care of Patients receiving Peripheral Intravenous Infusion

Nursing care for patients with IV access

- Assess infusion site for abnormalities
 - Redness
 - Swelling
 - Pain
 - Position of cannula
- Ensure **NO** air in the IV system
- Assess patency of IV site before administrating IV fluid/ IV drug if the IV site is not using currently
 - Inject ~3ml NS (NS flush) to check IV access patency
 - Observe for signs of blockage
 - **Seepage**
 - **Swelling**
 - **Experience of pain**

Nursing care for patient with IV access

- ❑ Regulate infusion rate according to prescribed schedule
- ❑ Check infusion rate regularly, even when infusion pump is used
- ❑ The height of infusion container should not be too low
- ❑ Check the full length of tubing for any kinkage
- ❑ If IV access place on flexion area, position it accordingly to prevent blockage
- ❑ Ensure the dressing over IV access remains clean, dry and adherent to skin at all times
- ❑ Proper securement of IV access and infusion
- ❑ Label IV lines properly when there is more than 1 IV infusions
- ❑ **ALWAYS trace ALL** infusion/ device lines back to their origins before connecting/ disconnecting any device/ infusion

Educate patient:

Inform the nurse if experience pain, redness, swelling & seepage



- Not to self-adjust flow rate
- Don't put the upper arm higher than the level of IV fluid if IV site is on upper limb

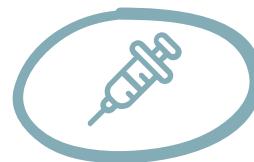


IV Medication Administration

IV Medication Administration



IV push using
syringe (bolus)



Slow infusion
with infusion set



By infusion
pump

Reason medicine not administered

F-Fasting R-Patient refused W-Withheld

V-Vomiting A-Absent from ward

DATE	Drug	Dose	Route	Freq.	Date	Time
xx/xx/2023	Augmentin	1.2 g	IV	Q8H		

Date Off/Sign.	Duration	Sign

DATE	Drug	Dose	Route	Freq.
xx/xx/2023	NS flush	5ml	IV	Q8H

Date Off/Sign.	Duration	Sign



Preparation before IV drug administration

Recommendation of manufacturer/ institution guideline/ pharmacy

- Bolus or Infusion?
- Dilution required? If yes, type and amount of dissolvent

Assess patient's condition and reaction

- IV access & vein condition

If patient is receiving IV infusion with the same IV access

- Check compatibility of IV fluid with IV drug before administration
- Recommend to set another IV access site if they are incompatible

I.V. AUGMENTIN 300 mg / 600 mg / 1.2 g

Amoxycillin and Potassium Clavulanate Injection IP 300 mg / 600 mg / 1.2 g

Method of Administration

I.V. AUGMENTIN may be administered either by intravenous injection or by intermittent infusion. It is not suitable for intramuscular administration.

Instructions for Use/Handling

SINGLE USE VIAL ONLY

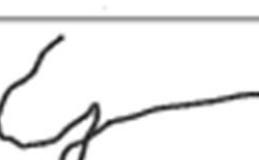
1.2 g vial: To reconstitute dissolve in 20 ml sterile Water for Injection IP (Final volume 20.9 ml)

A transient pink coloration may or may not appear during reconstitution. Reconstituted solutions are normally colourless or a pale, straw colour.

Reason medicine not administered

F-Fasting R-Patient refused W-Withheld

V-Vomiting A-Absent from ward

Reason medicine not administered					Date
F-Fasting R-Patient refused W-Withheld					
V-Vomiting A-Absent from ward					Time
DATE	Drug	Dose	Route	Freq.	
xx/xx/2023	Vancomycin	500 mg	IV	Q12H	
in NS 100ml					
Date Off/Sign.	Duration	Sign			
					



IV ADDITIVE	
Drug _____	Amount _____
_____	_____
_____	_____
_____	_____
Date and Time _____	
Patient's Name _____	
Ward/Bed _____	
Given/Checked by _____	

IV additive label

IV additive label generated by IPMOE

CHEUNG CHING MAN

HNxxxxxxxxxx

Vancomycin (VANCOZIN) injection 500mg
Intermittent IV infusion: 500mg in 100ml Sodium Chloride 0.9%
Over 30 minutes Q12H

Prepared: xx/xx/2023
1) Wong MiMi 2) Chan Lily

Complications related to IV Infusion or Injection

Complications related to IV infusion or injection

Local complications

- At or near the injection site
 - Thrombophlebitis
 - Phlebitis
 - Infiltration
 - Extravasation
 - IV site infection

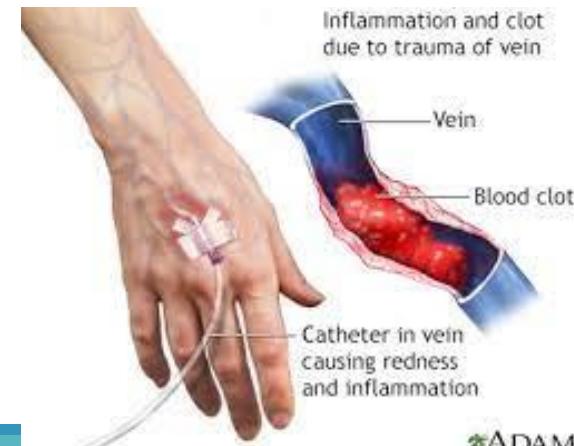
Systemic complications

- Occur remote from IV site, within the vascular system
 - Systemic infection
 - Circulatory overload
 - Pulmonary embolism/ air embolism

Thrombophlebitis

Inflammation that causes formation of blood clot which blocks one or more veins

- Cause
 - Trauma to the endothelial cells of the venous wall causes red blood cells adhere to the vein wall, form clots
- Signs & Symptoms
 - Slowed / Stopped infusion
 - Sudden or gradual swelling at the affected area
 - Tenderness & redness, warm to touch
- Interventions
 - Not to forcefully inject if resistant felt
 - Stop IV infusion & change site to opposite extremity
 - Assess site for circulatory impairment
 - Documentation and notify physician



Thrombophlebitis

- Prevention
 - Regularly check the drip rate facilitates early detection of blockage
 - Replace new pack of IV fluid on schedule/ once emptied
 - Flush IV access regularly with NS to main patency



Phlebitis

Inflammation of vein

- Cause
 - Mechanical cause: insertion technique, lack of catheter securement
 - Chemical cause: irritation cause by fluid/ medication
- Signs & Symptoms
 - IV infusion may or may not slow down
 - Pain at IV site
 - Vein hard (cord-like) with skin redness
- Interventions
 - Stop IV infusion & change IV site
 - Apply warm compress
 - Documentation and notify physician
- Prevention
 - Proper securing of the IV cannula
 - Properly mix and dilute medication before administration



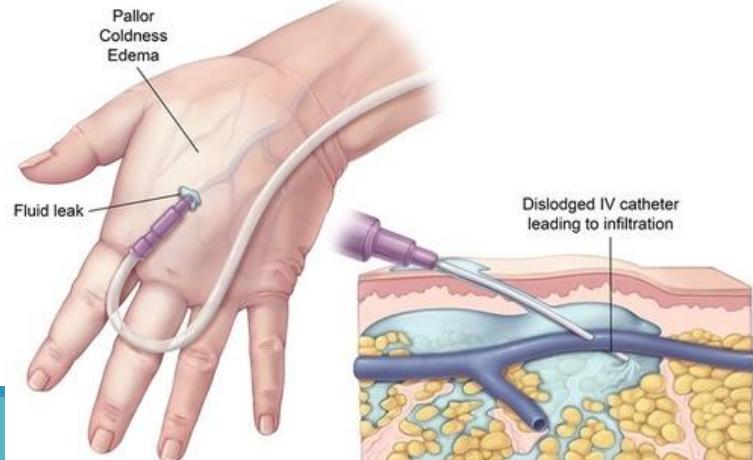
Infiltration

Leakage of non-vesicant IV solution or medication into extravascular tissue

- Cause
 - Dislodgement of catheter from vein
 - Puncture of distal vein wall during venipuncture
 - Lack of catheter securement
- Signs & Symptoms
 - Slowed/ Stopped infusion
 - Increased edema around site
 - Fluid leakage from infusion site
 - Skin tightness, pallor, cool to touch



Intravenous site infiltration



Infiltration

- Interventions
 - Stop IV infusion & change site to opposite extremity
 - Elevate affected extremity
 - Apply warm compress
 - Documentation and notify physician

- Prevention
 - Proper securing of the IV cannula
 - Avoid placing IV access at area of flexion
 - Access IV site frequently, particularly during IV bolus injection

Extravasation

Leakage of vesicant IV solution or medication into extravascular tissue cause tissue damage

- Example of vesicant
 - IV fluid with potassium
 - Chemotherapeutic agents
- Cause
 - Dislodgement of catheter from vein
 - Puncture of distal vein wall during venipuncture
 - Lack of catheter securement
- Signs & Symptoms
 - Slowed/ Stopped infusion
 - **Burning** and edema around the site
 - Fluid leakage from infusion site
 - **Blistering and tissue sloughing** if last for few days



Extravasation



Interventions

- Stop IV infusion immediately and change IV site
- Estimate the amount of extravasated solution, aspirate the medication if possible
- Administer appropriate antidote according to facility's protocol
- Assess sensation, motor function and circulation of affected extremity regularly
- Apply warm/ cool compress to affected area according to manufacturer's recommendation
- Documentation and notify physician



Prevention

- Knowledge of vesicants
- Give vesicant last when multiple drugs are ordered
- Proper securing of the IV cannula
- Avoid placing IV access at area of flexion
- Access IV site frequently, particularly administering vesicant fluid/ medication



Delay treatment might need surgical debridement, skin grafting or amputation

Infection (local & systemic)

Invasion of microorganism at insertion site (local) or in blood stream (systemic)

- Cause
 - Break in aseptic technique during insertion or handling equipment
- Signs & Symptoms
 - Local: Redness, pain, hot and discharge around insertion site
 - Systemic: Fever, chills, malaise
- Interventions
 - Stop infusion and change IV site
 - Clean the IV site appropriately
 - Document & notify physician
 - Send tip of removed IV catheter for culture if necessary
 - Monitor patient's vital signs (? Increase in body temperature, change in BP/P)
 - Obtain blood test if necessary (e.g. CBC for elevated WBC, Blood culture)
 - Administer medications as prescribed (e.g. antipyretics & antibiotics)

Infection (local & systemic)

- Prevention
 - Use strict aseptic technique when placing IV access
 - Ensure the dressing over IV access remains clean, dry and adherent to skin at all times
 - Perform hand hygiene when handling IV access or preparing IV infusion/ injection
 - Disinfect injection port with alcohol swap thoroughly before use
 - Examining IV solution for leaks, cloudiness which indicate possible contamination
 - Proper securing of the IV cannula
 - Assess IV site regularly



Circulatory overload

Excessive fluid in the circulatory system

- Cause
 - Infusion of fluids at rate greater than patient's system can accommodate
- Signs & Symptoms
 - Shortness of breath
 - Tachypnea
 - Increased BP
 - Crackles detected during auscultation of lung field
 - Dependent edema
- Interventions
 - Elevate head of bed
 - Assess vital signs (BP/P, RR, SpO₂)
 - Assess for peripheral edema
 - Administer oxygen and diuretic as ordered
 - Document and notify physician



Circulatory overload

- Prevention
 - Check IV infusion rate regularly to avoid excessive administration, even when infusion pump is used
 - Monitor intake & output chart for fluid imbalance and notify physician as soon as possible
 - Monitor signs of fluid overload particularly in patient with cardiac/ renal disease



Pulmonary embolism/ air embolism

Air embolism

Cause: failure to expel air from the tubing/ syringe before infusion/ injection

Pulmonary embolism

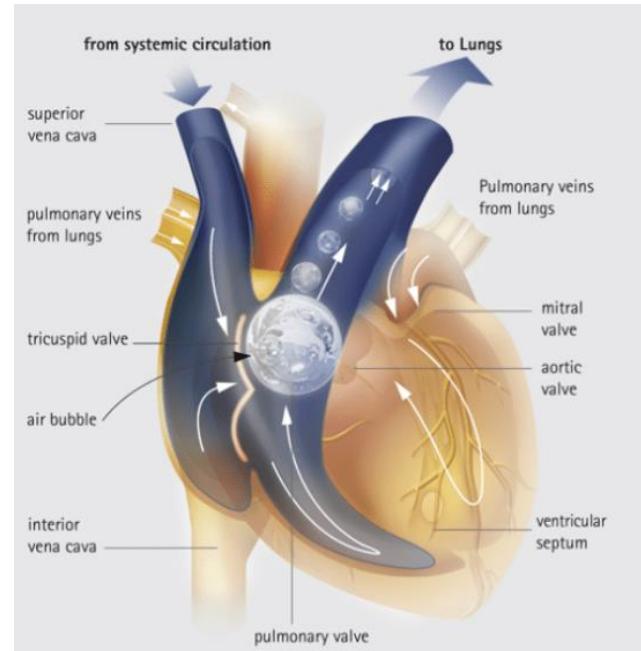
Cause: usually result of a thrombus detached from the wall of vein

- The thrombus / air lock carried by the venous circulation to the right side of the heart and then into the pulmonary artery
- Circulatory and cardiac abnormalities are caused by full or partial obstruction of the pulmonary artery by thrombus
- Air lock will prevent passage of blood into pulmonary artery and result in pulmonary embolism

Pulmonary embolism/ air embolism

- Signs & Symptoms

- Sudden development of shortness of breath
- Chest pain
- Anxiety & agitation
- Tachypnea & Dyspnea
- Dizziness
- Sudden vascular collapse with the hallmark symptoms of:
 - Cyanosis
 - Hypotension
 - Tachycardia
 - Loss of consciousness



Pulmonary embolism/ air embolism

- Intervention
 - Stop infusion/ injection immediately
 - Notify physician immediately
 - Administer 100% oxygen
 - Maintain airway, breathing and circulation
 - Check conscious level
 - Place patient in Trendelenburg position/ left lateral position if not contraindicated
 - Monitor vital signs closely for hypoxemia & respiratory compromise symptoms
 - Prepare for cardio-pulmonary resuscitation



Pulmonary embolism/ air embolism

- Prevention
 - Expel all air from IV system (tubing, syringe) before administration
 - Do not leave tubing attached to fluid but unprimed at the bedside
 - Close roller clamp before puncturing fluid bag to prevent inadvertent air entry into the tubing
 - Examine all equipment for cracks or leaks that may allow for ingress of air
 - Do not forcefully push the IV injection if resistance felt

Video References

- Establish IV access: https://www.youtube.com/watch?v=h5Rby_I5Wos
- Central venous catheter insertion: <https://www.youtube.com/watch?v=mWq77trgvZs>
- PICC: <https://www.youtube.com/watch?v=63W-haF-zr8>
- Pulmonary embolism: <https://www.youtube.com/watch?v=8UnPPZlnfbk>

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