P2 Topic

Device to Stabilize and Secure IV insertion site for pediatric patients

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Project Guide

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Approval Form:

This is to certify that the Industrial Design Project entitled "Designing a device to stabilize and secure IV insertion site for Pediatrics of age 3 to 5 by Snehal Gaikwad for Semester 3 is approved for partial fulfillment for the Master of Design degree.

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Declaration Form:

I declare that this written report accurately expresses my ideas in my own words, and that where others' ideas or words have been used, I have properly cited and referenced the original sources. I also certify that I followed all academic honesty and integrity rules and did not falsify, misunderstand, or create any idea, data, facts, or source in my work. I understand that any breach of the foregoing will result in disciplinary action by the Institute as well as criminal action from the source from whom sufficient authorization was not obtained or was incorrectly referenced.

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1. Introduction:

1.1 What is Invasive Device?

A device which, in whole or in part, **penetrates inside the body**, either through a body orifice or through the surface of the body.

Period of use: Short term



1.2 What is IV therapy?

In medical terms, intravenous — or IV, for short — refers to the administration of substances into the body **through a vein or veins**. INTRA means IN and VENOUS means VEIN. It is commonly referred to as a drip. IV therapy, therefore, works by **delivering fluids directly into your veins**

1.3 Why IV therapy?

If the patient is dehydrated and weak,

the patient does **not have to take multiple injections for each medicine.**

Controlled flow of IV fluids for a long amount of time

This form of intake is much **faster** than oral or any other external medication.



1.4 Reasons of recieving IV:

- **Dehydration:** Because of surgery or illness
- **Infections:** When patient is unable to take oral antibiotics or is resistant to oral medications
- **Chemotherapy for Cancer Treatments:** Send medication directly into the bloodstream through a vein in order to kill cancer cells throughout the body.

Chronic Conditions:

Lupus

Gout

Multiple sclerosis

Psoriasis

Others

1.5 Fluid administration:

1.5.1 Injection

Rapid injection of medication directly into bloodstream. Injection works by using a syringe to **force a liquid into the body**. IV injection is the fastest delivery method

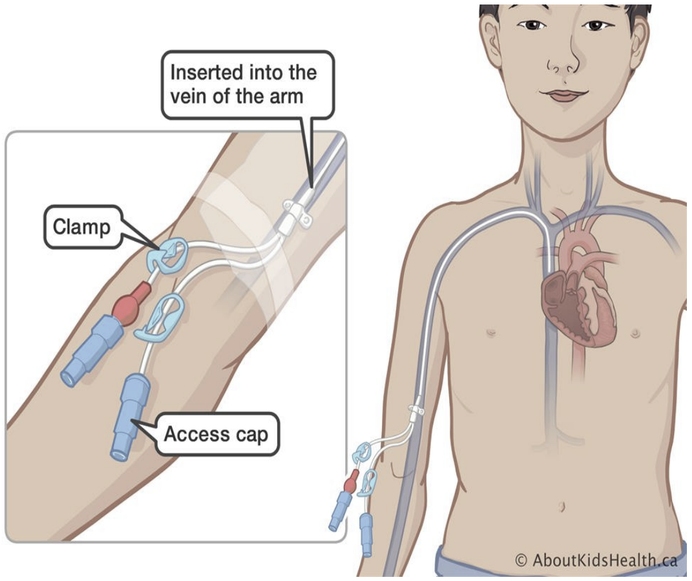
1.5.2 Infusion

Uses a pump or the **natural force of gravity** to deliver fluids into the body.Larger amount of fluid given over a longer amount of time



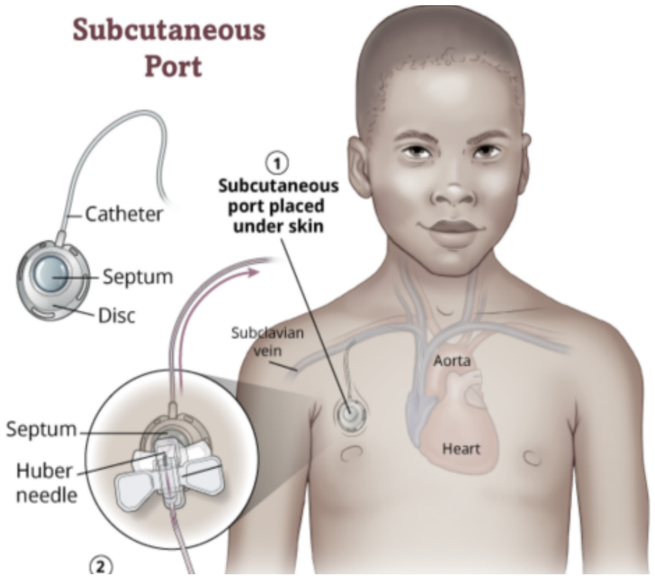


1.6 Types of catheter:



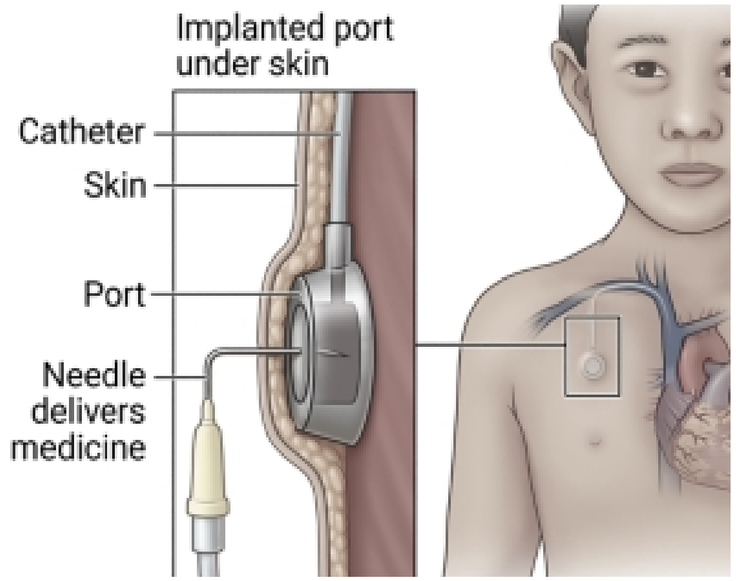
Peripherally inserted IV

A long, thin tube that's inserted through a vein in your arm and passed through to the larger veins near your heart



Tunneled IV catheter

Is a thin tube that is placed under the skin in a vein, allowing long-term access to the vein.

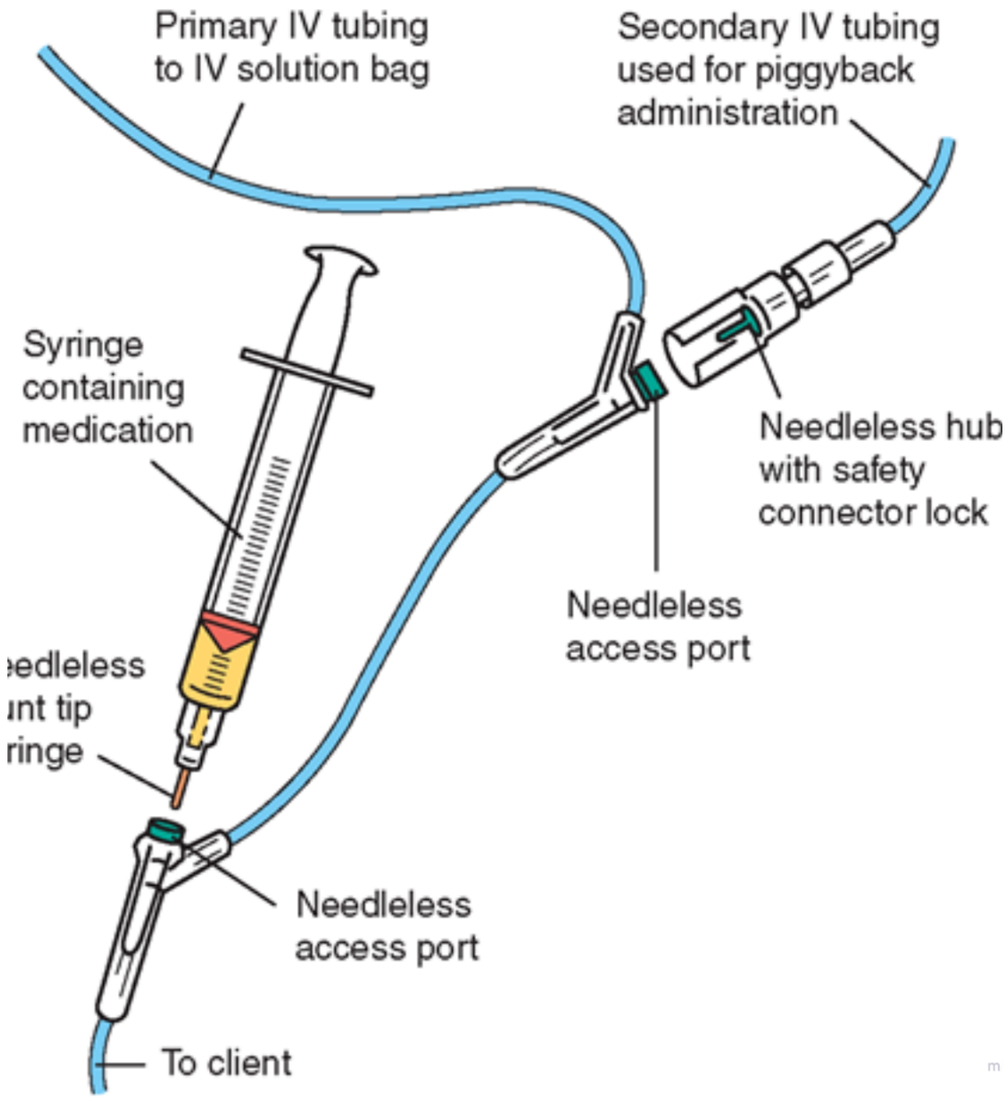


Implanted Port

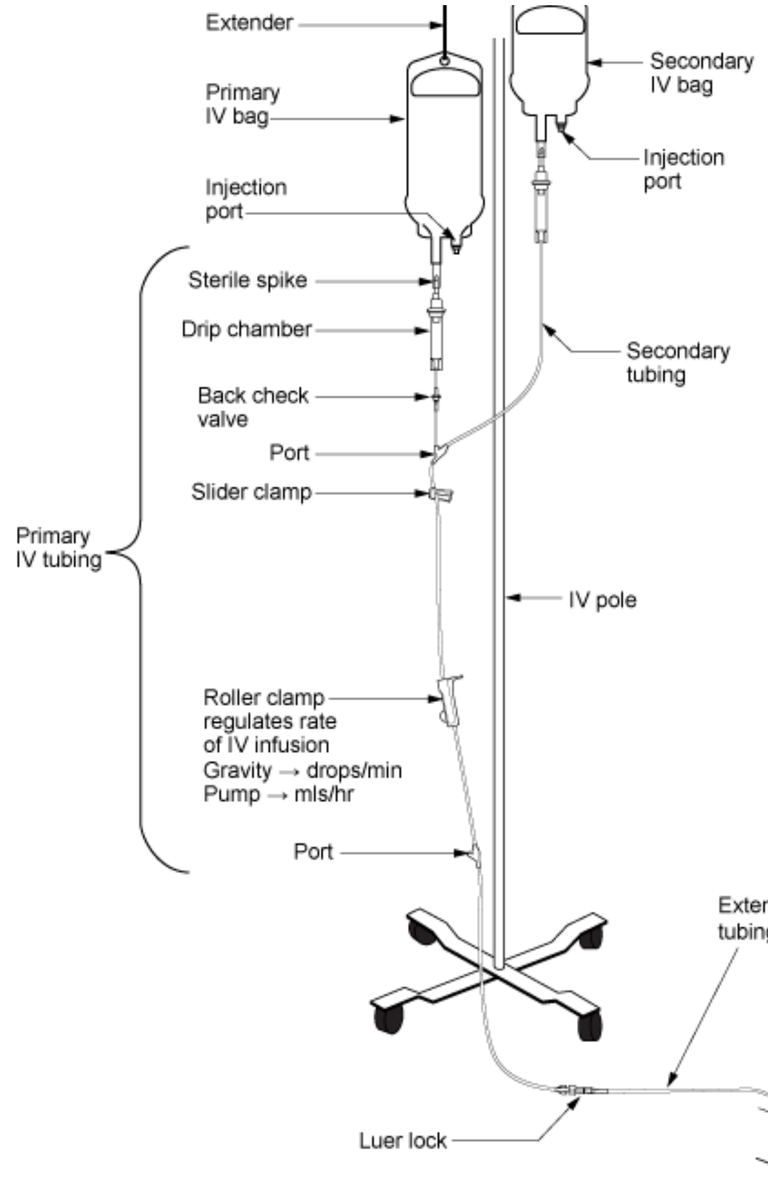
Located completely beneath the skin, a catheter with a small reservoir (port) attached to it.

2. Anatomy:

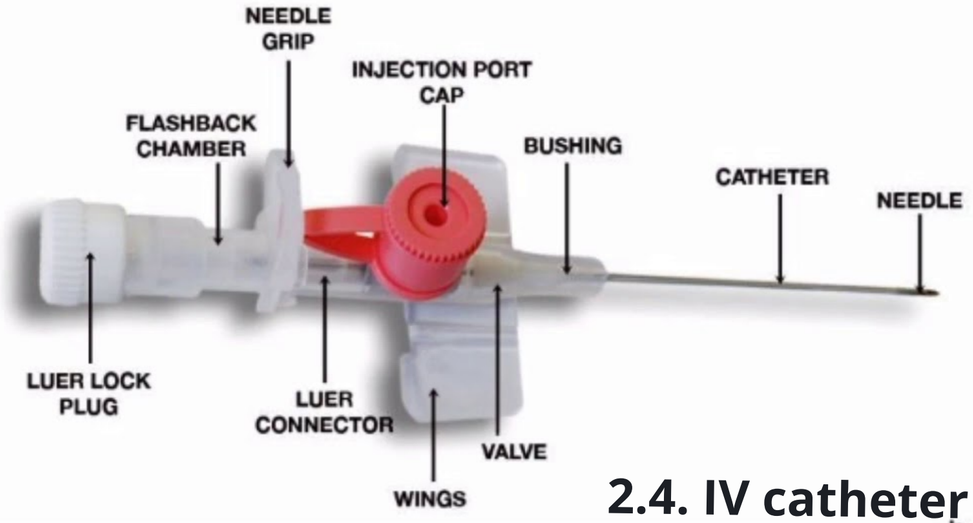
2.1 Anatomy of IV kit:



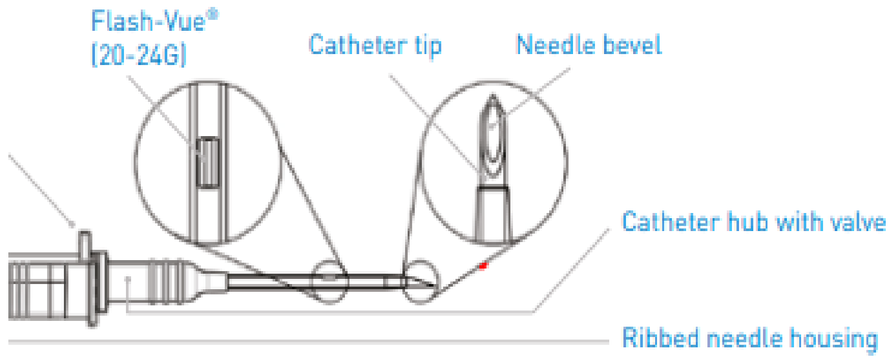
2.2. Kit Mechanism



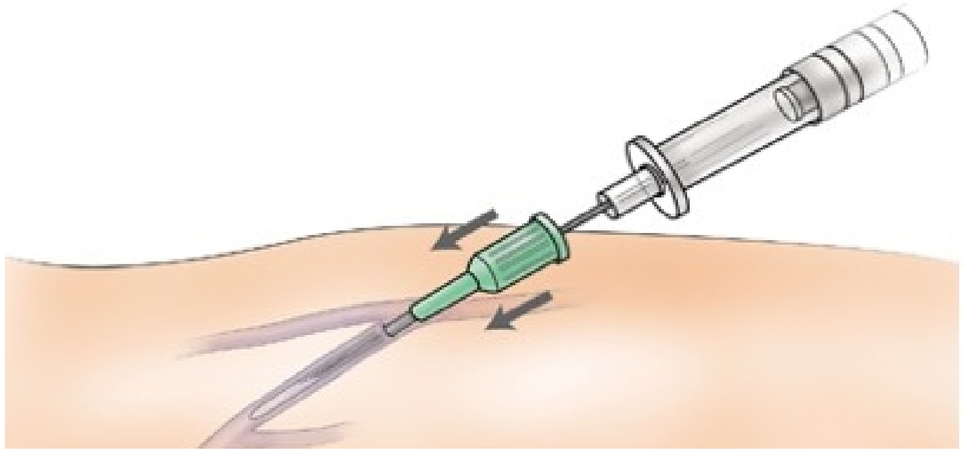
2.3. IV kit



2.4. IV catheter



2.5. Catheter tip



2.6. Catheter insertion

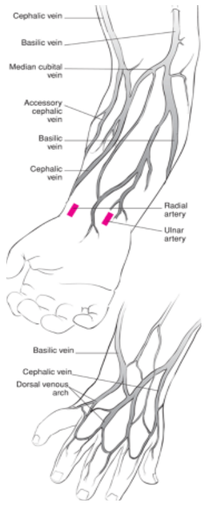


2.7 Catheter Sizes:

IV catheter is inserted inside the vein and through which the liquid is inserted Different catheter guage sizes for different age groups
Ideally 22 and 24 is for pediatric

2.8 IV sites:

1, 2 Hand



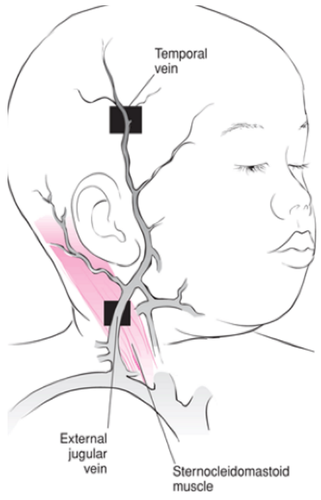
- Upper limb
- Dorsum of hand
- Forearms
- Cubital fossa
- Cephalic vein

3 Leg

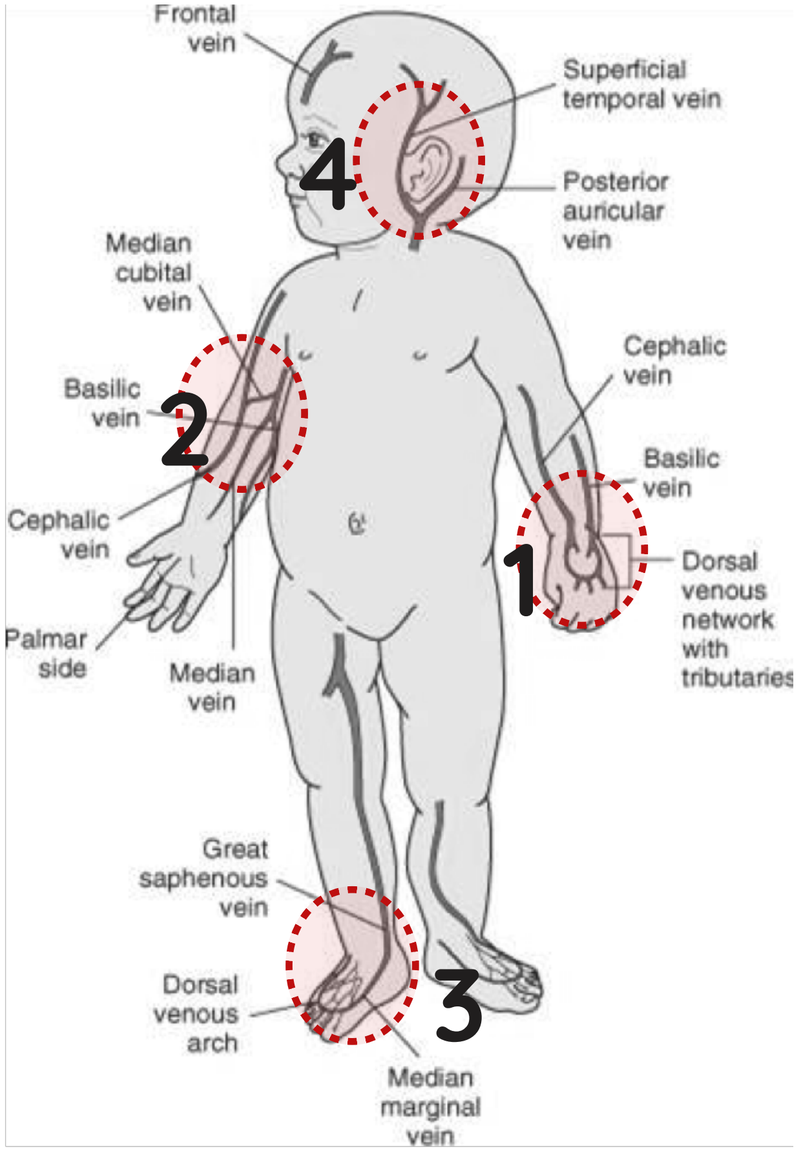


- Lower limb
- Greater Saphanus vein
- Lesser Saphanus vein
- Dorsun of foot
- Popliteal fossa

4 Scalp



- Rarely in emergency
- Externa; Jugular Vein
- Scalp vein



2.9. Anthopometric Data

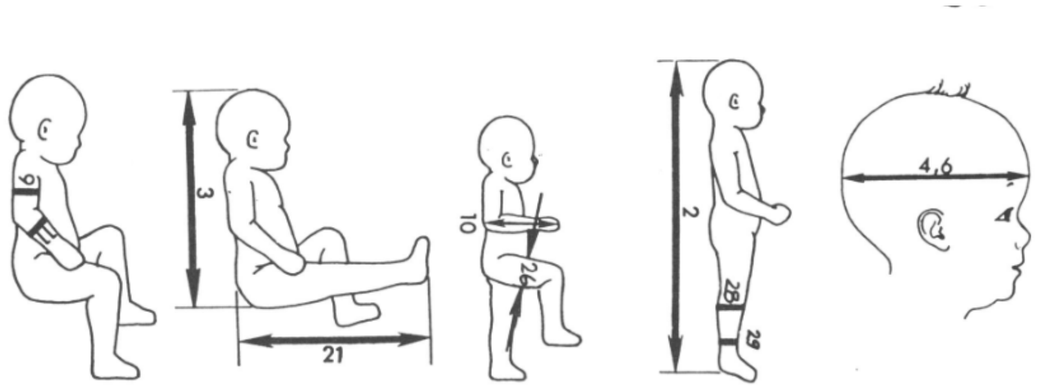


Table 1

Anthropometric data
Male and female children age two to nineteen

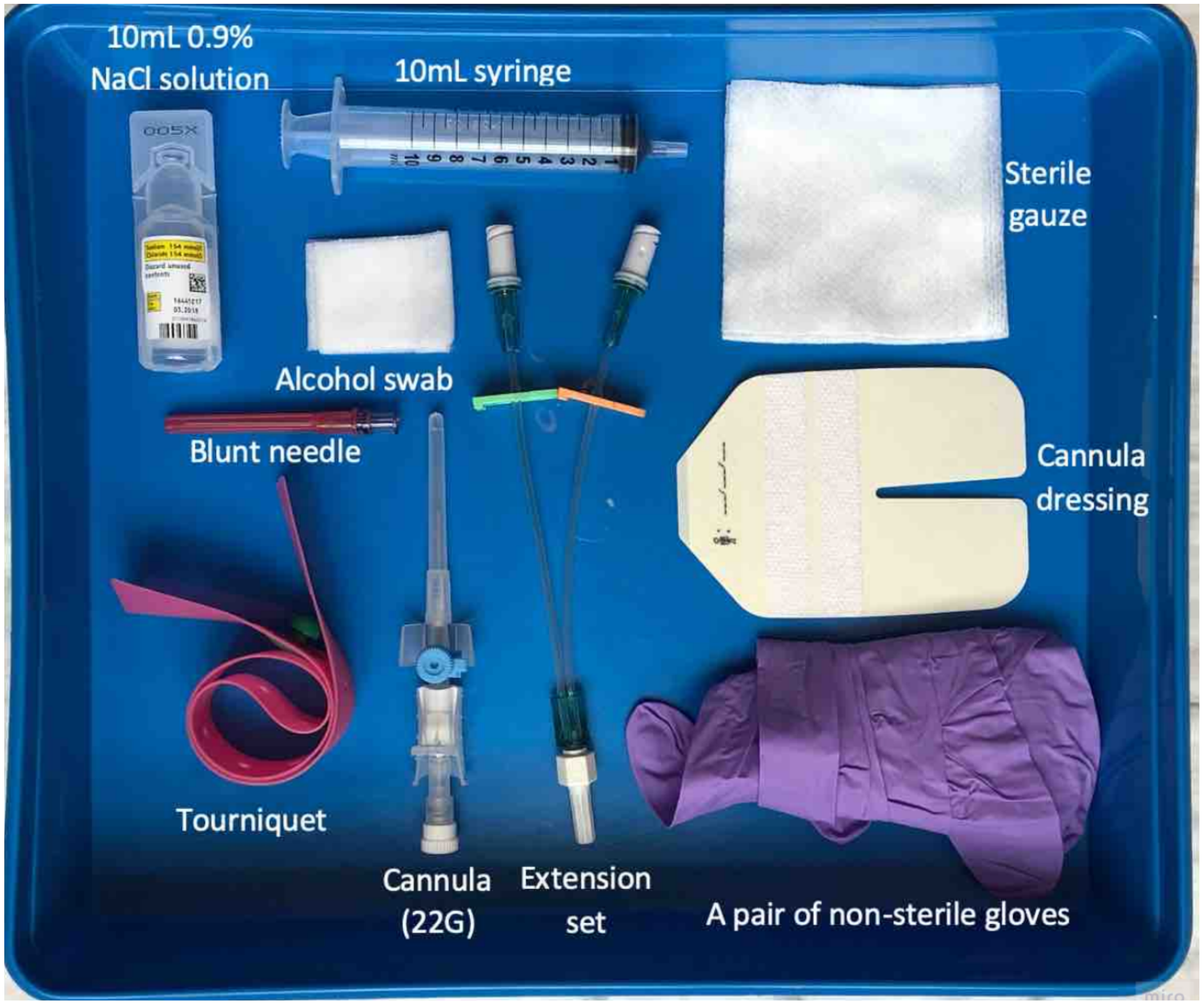
		2.0-3.5	3.5-4.5	4.5-5.5	5.5-6.5	6.5-7.5	7.5-8.5	8.5-9.5	9.5-10.5	10.5-11.5	11.5-12.5	12.5-13.5	13.5-14.5	14.5-15.5	15.5-16.5	16.5-17.5	17.5-19.0
1.	Weight (lbs.)	31.0	35.6	40.3	45.1	52.1	58.5	65.3	72.8	81.8	88.7	100.5	111.8	122.1	133.5	136.8	144.5
2.	Stature	37.4	40.6	43.3	45.8	48.5	50.8	53.2	55.1	57.3	59.5	61.8	64.0	65.7	67.4	67.5	68.4
3.	Vertical Grip Reach	42.9	46.6	50.4	54.2	57.8	60.9	64.3	66.8	69.9	72.6	76.2	78.1	80.0	82.0	82.2	82.6
4.	Frontal Grip Reach	15.9	17.2	18.2	19.4	20.3	21.2	22.2	23.1	24.0	24.8	26.0	26.8	27.1	27.8	28.2	28.3
5.	Lateral Grip Reach	21.2	22.5	23.9	25.4	26.8	28.0	29.4	30.4	31.7	32.9	34.6	35.8	36.6	37.6	38.1	38.4
6.	Step Height	13.3	15.8	17.2	20.2	21.0	22.0	22.8	23.4	24.5	24.8	25.4	26.3	25.6	26.7	27.5	27.2
7.	Supine Stature	38.9	40.9	45.0	46.4	49.2	51.5	53.9	55.4	58.1	60.4	62.9	65.0	66.4	68.2	68.2	69.6
8.	Standing Center of Gravity	22.4	23.8	25.8	26.5	28.0	29.1	30.5	32.1	32.6	33.8	35.1	36.2	36.9	38.0	38.0	38.9
9.	Erect Sitting Height	21.8	23.0	24.2	25.4	26.3	27.3	28.1	28.8	29.8	30.7	31.9	33.0	34.1	35.1	35.4	35.8
10.	Eye Height (Seated)	17.5	18.7	19.9	20.8	21.8	22.8	23.8	24.2	25.0	26.0	27.2	28.4	29.6	30.4	30.8	31.2
11.	Maximum Hip Breadth (Seated)	7.6	8.0	8.3	8.6	9.1	9.6	9.9	10.4	10.9	11.3	12.0	12.4	13.1	13.4	13.7	13.8
12.	Maximum Thigh Breadth (Seated)	7.7	8.0	8.4	8.7	9.1	9.7	10.2	10.6	10.8	11.3	12.1	12.6	13.0	13.4	13.7	13.9
13.	Thigh Clearance	3.2	3.4	3.6	3.8	4.0	4.3	4.6	4.8	4.8	5.1	5.2	5.6	5.6	5.8	5.9	6.2
14.	Buttock-Knee Length	11.4	12.6	13.6	14.4	15.6	16.5	17.5	18.4	19.3	20.1	21.0	21.7	22.3	22.8	22.8	23.1
15.	Knee Height	10.8	12.0	12.9	14.0	14.9	15.8	16.7	17.4	18.2	19.0	19.6	20.3	20.6	21.0	20.8	21.2
16.	Supine Sitting Height	23.2	23.9	25.3	25.8	26.7	28.0	28.8	29.3	30.8	31.8	33.4	34.5	35.4	36.5	36.9	37.0
17.	Seated Center of Gravity (above seat)	8.0	8.2	8.2	8.2	8.2	8.3	8.3	8.2	8.4	8.6	8.8	9.1	9.3	9.7	10.0	10.0
18.	Seated Center of Gravity (from back)	5.2	5.4	5.9	6.1	6.5	7.1	7.2	7.8	8.2	8.5	8.7	9.1	9.3	9.5	9.6	9.8
19.	Head Circumference	19.8	20.1	20.3	20.4	20.6	20.9	20.9	21.1	21.3	21.4	21.6	21.8	22.0	22.2	22.2	22.4
20.	Head Breadth	5.4	5.5	5.5	5.6	5.6	5.7	5.7	5.8	5.8	5.8	5.9	5.9	6.0	6.0	6.0	6.1
21.	Head Length	7.0	7.2	7.2	7.3	7.3	7.4	7.4	7.4	7.4	7.5	7.6	7.6	7.7	7.7	7.7	7.8
22.	Neck Circumference	9.5	9.7	10.0	10.3	10.4	10.8	11.1	11.2	11.3	11.8	12.0	12.5	12.7	13.2	13.3	13.8
23.	Lateral Neck Breadth	2.8	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.5	3.5	3.6	3.8	3.8	3.9	4.0	4.1
24.	Shoulder Breadth	9.8	10.3	10.7	11.2	11.8	12.3	13.3	13.3	13.8	14.1	14.7	15.4	16.0	16.6	16.8	17.3
25.	Shoulder-Elbow Length	7.4	8.1	8.8	9.3	9.9	10.4	11.0	11.4	11.9	12.4	13.0	13.4	13.8	14.0	14.1	14.3
26.	Acromion-Radiale Length	6.7	7.2	7.7	8.3	8.9	9.2	9.8	10.2	10.6	11.1	11.7	12.1	12.1	12.6	12.7	12.7
27.	Upper Arm Circumference	6.3	6.5	6.7	6.9	7.2	7.6	7.8	8.2	8.5	8.7	9.2	9.6	10.0	10.5	10.6	11.0
28.	Elbow-Hand Length	9.8	10.7	11.4	12.1	12.8	13.4	14.1	14.7	15.3	16.0	16.6	17.3	17.7	18.0	18.0	18.4
29.	Radiale-Stylion Length	5.4	5.8	6.3	6.7	7.1	7.4	7.7	8.1	8.4	9.0	9.2	9.6	9.7	10.0	10.0	10.0
30.	Forearm Circumference	6.3	6.4	6.6	6.8	7.1	7.4	7.6	7.8	8.2	8.4	8.8	9.2	9.5	9.8	9.9	10.3
31.	Wrist Circumference	4.5	4.6	4.7	4.9	5.0	5.1	5.3	5.4	5.4	5.7	5.8	6.1	6.2	6.4	6.3	6.5
32.	Hand Length	4.2	4.6	4.8	5.1	5.3	5.5	5.8	6.0	6.2	6.5	6.8	7.0	7.1	7.2	7.2	7.4
33.	Hand Breadth	2.0	2.2	2.2	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.0	3.2	3.2	3.3	3.3	3.4
34.	Minimum Hand Clearance	17.4	18.3	19.1	19.7	20.7	21.2	21.6	22.5	23.4	23.8	24.5	25.6	26.1	27.2	26.7	27.8
35.	Maximum Fist Circumference	6.5	6.8	7.1	7.5	8.0	8.2	8.4	8.7	9.1	9.2	9.7	10.0	10.5	10.6	10.5	11.0
36.	Maximum Fist Breadth	2.3	2.4	2.5	2.5	2.7	2.8	2.8	2.9	3.0	3.1	3.2	3.4	3.5	3.6	3.6	3.7
37.	Maximum Fist Depth	1.8	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.9	3.0	3.1	3.2	3.1	3.2
38.	Suprasternale Height	29.0	31.4	33.7	36.2	38.6	40.4	42.6	44.6	46.4	48.4	50.4	51.9	53.0	54.4	54.8	55.2
39.	Chest Height at Axilla	26.1	28.8	31.3	33.5	35.6	37.6	40.2	41.2	43.2	45.1	47.1	49.1	50.1	51.1	51.2	52.3
40.	Chest Circumference	20.3	21.1	22.0	22.9	24.1	25.0	26.2	27.0	28.3	29.0	30.4	31.7	33.0	34.4	34.9	35.8
41.	Chest Breadth at Axilla	6.4	6.7	6.9	7.2	7.5	7.9	8.3	8.4	8.6	9.1	9.5	10.0	10.3	10.7	10.9	11.2
42.	Waist Height	19.7	22.2	24.2	26.1	27.7	29.6	31.7	32.7	34.2	35.8	37.4	39.0	39.9	40.5	40.7	41.5
43.	Waist Breadth	6.4	6.8	7.1	7.3	7.8	8.2	8.5	8.8	9.0	9.4	9.8	10.3	10.4	10.8	11.0	11.2
44.	Natural Waist Circumference	18.8	19.4	20.4	20.6	21.3	22.5	23.4	24.1	24.1	25.4	26.1	27.2	27.3	28.2	28.4	29.7
45.	Hip Height at Buttocks	16.2	18.5	20.2	21.9	23.4	25.0	26.9	27.7	29.0	30.5	31.7	33.0	33.8	34.1	34.0	35.0
46.	Hip Circumference	20.7	21.4	22.4	23.3	24.8	26.0	27.1	28.3	29.7	30.6	32.4	33.7	35.2	36.2	36.7	37.2
47.	Bispinous Breadth	5.8	6.0	6.3	6.5	6.9	7.0	7.4	7.5	7.8	8.0	8.5	8.6	9.0	9.4	9.5	9.6
48.	Gluteal Furrow Height	15.0	16.7	18.4	20.3	21.9	23.3	24.6	26.0	27.0	28.5	29.4	30.2	30.6	31.3	31.2	31.5
49.	Upper Thigh Circumference	11.6	12.4	13.0	13.6	14.6	15.4	16.1	16.8	17.8	18.2	19.2	20.0	20.8	21.4	21.8	22.1
50.	Tibiale Height	8.9	9.6	10.6	11.6	12.5	13.0	13.9	14.6	15.2	16.0	16.5	16.8	17.2	17.6	17.6	17.7
51.	Calf Circumference Height	6.7	7.4	8.1	8.8	9.4	10.1	10.9	11.1	11.8	12.6	12.7	13.2	13.7	13.6	13.8	14.2
52.	Calf Circumference	8.2	8.5	8.8	9.2	9.8	10.2	10.6	11.1	11.6	11.9	12.5	13.0	13.4	13.8	13.9	14.2
53.	Ankle Circumference	5.9	6.0	6.2	6.4	6.6	6.9	7.2	7.4	7.4	7.8	8.2	8.5	8.4	8.7	8.6	8.8
54.	Foot Length	5.9	6.4	6.8	7.2	7.6	7.9	8.3	8.6	9.0	9.3	9.6	9.8	9.9	10.0	10.0	10.2
55.	Foot Breadth	2.4	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.8	3.9	3.9	4.0

The data in this chart has been compiled by Susan B. Mirrer (1987) from: Society of Automotive Engineers, Inc. (1977). *Anthropometry of Infants, Children, and Youths to Age 18 for Product Safety Design SP-450* (CPSC Contract CPSC-C-75-0068). 400 Commonwealth Drive, Warrendale, PA 15096.

3. The Process:

3.1 Getting the equipment ready

The following equipment shown should be new and sterlized and kept ready before insertion. Only single person can touch the equipment



3.2 Stabilizing the baby



Burrito wrap to **limit movement** of torso and wrist



TO get right angle try **placing towel under the elbow**



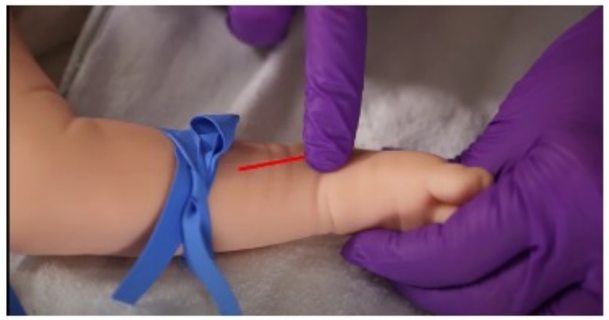
Limit wrist movement with tight cloth

3.3 Finding the VEIN



Apply tourniquet to better expose veins





Find the vein: (vein close to the surface, if you cant see it.. try feeling it by applying pressure with your finger)



Placing a warm blanket can help find a vein

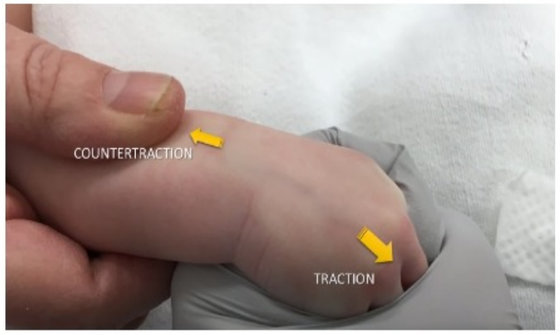


Using a **vein finder** to detect a vein



Holding the baby

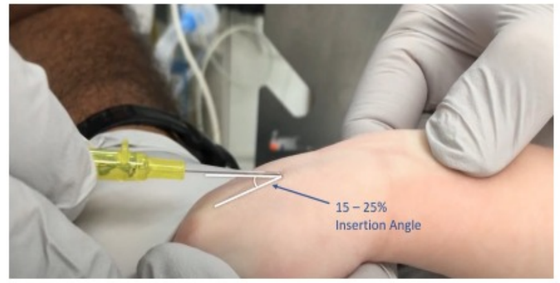
3.4. Inserting IV



Provide a countertraction to further stabilize the vein



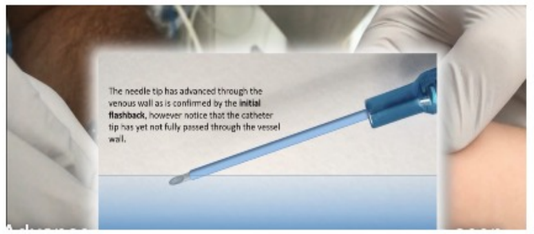
Th vein becomes visibly big



Insert IV cath inserted at 15 to 20 degree angle



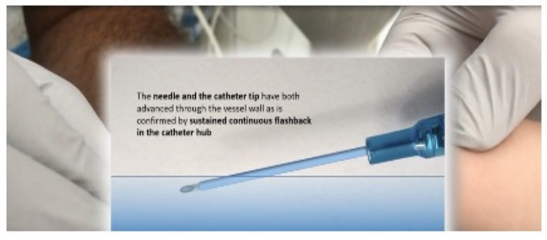
Advance steadily and slowly till the first flashback is seen. The first one confirms that needle is through the wall



Still catheter tip is not fully inside vein



Now advance it a bit further till sustained and continuous backflow



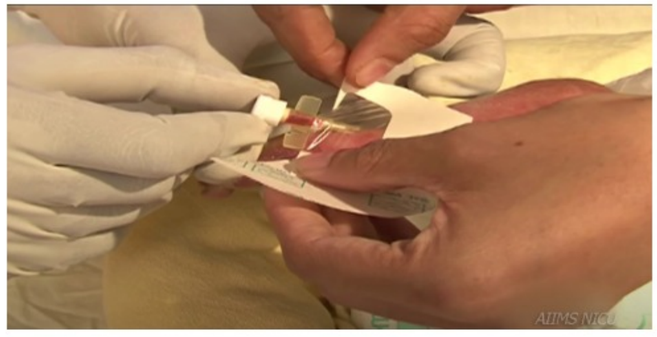
Second flashback confirms that catheter is fully IN



Now gently advance the catheter off the needle into the vein using your index finger

miro

3.5. Taping the IV:



Secure the cannula by fixing a transparent tape Easy access and visibility to cannula site



Fix adhesive tape on top



Put something underneath the hub to protect the skin



Bandage or tape on top, to secure the site



Immobilize the joint so catheter doesn't go out



Use a splint if necesary to immobilise the joint

3.6 IV Assesment:

3.6.1 Assesment of PIVC sites:

Should be checked hourly for pressure sore and any signs of infection

At every asessment check for:

- Catheter position,
- Patency/occlusion,
- Limb symmetry,
- Any signs of phlebitis (erythema, tenderness, swelling, pain etc.),
- Infiltration/extravasation. PIVC are considered as high risk for pressure injury.

3.6.2 Assessment of PIVC dressing and splints:

- Check securement of dressing- if it's intact, clean and dry
- If it's loose or if visible ooze was present underneath the dressing.
- Check splint tapes are not too tight or restrictive.

3.6.3 Assessment of IV lines, equipment and IV fluid infusions:

- Observations of the IV site, type of fluid and volume infused, accurate rate of infusion for patient and pressure alarms of infusion pumps are observed hourly and documented in the fluid balance flowsheet.
- If the patient (inpatient setting) is having intermittent infusion, eight hourly assessments are a minimum.
- Unstable patients who have signs and symptoms of complications are to be assessed more frequently.

3.7 IV Removal:



Make the area wet by applying sterile water





Take a sterile gauze





Remove the Catheter with one hand by holding the gauze with other



Press the gauze for a while and then tapei it

3.8 IV Securement:(Types)

3.8.1 Primary Securement

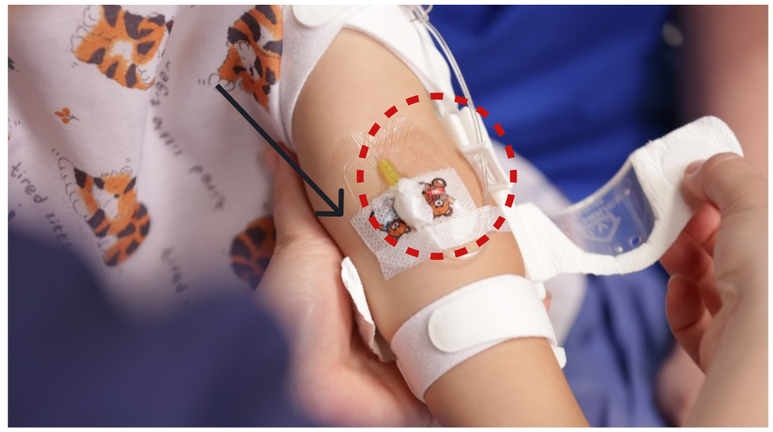
Primary catheter securement (or what the INS refers to as stabilization) directly holds the catheter in place on the skin

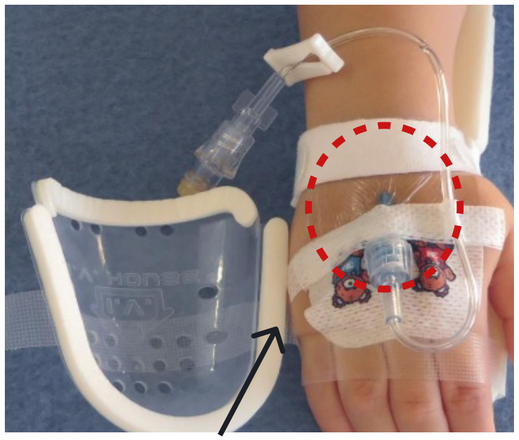




3.8.2 Secondary Securement

Secondary securement acts as an additional anchor for the infusion set tubing or extension set to reduce any force the primary securement receives when energy is applied to the tubing by accident or rapid patient movement.





4. Literature Review:

4.1 The Concern

Nurses reported that **fully one quarter of the sites were infiltrated before 72 hours.**

Due to their **inability to communicate pain,** preemies are at a higher risk for infiltration, which occurs when the fluid leaks out of the vein and into the surrounding tissue.

Of the 16 infiltrated sites, 13 were 22- or 24-gauge catheters, 2 were saline locked, 2 were loosely wrapped

4.2 Observations

IVs are taped so the site directly over the tip of the cannula is visible for observing signs of infiltration.

This generally happens due to the weight of I.V. tubing and other attachments;

This involves unwrapping a site that has been tightly secured and occluded and making flushing attempts,

Pediatric IV care is often at minimum a two person procedure, due to the need to stabilize the site, provide comfort to the child, and perform required aseptic tasks

4.3 Nurse’s frustration

Nurses reported that frequently when patients arrive from other hospital departments, the receiving nurse spends time troubleshooting PIVs that are no longer functioning

Injecting an IV and looking after it is a daunting task for nurses

Pediatric unit nurses also expressed frustration in their perception that other departments do not understand the trauma, difficulty, and added workload that result from losing an IV site

4.4 fixation problems

We find peripheral venous catheters (PVCs) bent at 90-degree angles, kinked, or pulled out, partially or totally dislodged,

Catheters or I.V. tubing gets caught on clothing, bed rails, and under the wheels of strollers or wheelchairs; and simple patient tugging.

The most frequent reason recorded for loss of IV site was infiltration, followed by patient pulling out, clot, and insertion site inflammation.

Whenever an invasive device is used, there is a potential for infection, including healthcare-acquired infections (HAIs), which can lead to sepsis

4.5 Recommendations

The method of stabilization should not interfere with assessment and monitoring of the site and

Without the secondary securement “shock absorber,” the primary stabilization will fail, resulting in a lost catheter.

Catheter stabilization shall be used to preserve the integrity of the access device and to prevent catheter migration and loss of access”

5.1 Questionarrie

Doctor

What are the common types of treatment that require IV?
What are common areas of cannula insertion?
How is inserting IV cannula for infants different from that of adults?
Problems caused while inserting?Why?
What is the IV insertion procedure you follow at your hospital?
Which are the veins you needle first? Is there any sequence you follow?
Possible reasons of dislodgement?
Do you remember any particular case of dislodgement?

Taping
What things do you use for securing the IV for pediatrics? Material?
Is the current method of securement enough for securement of catheter?
How do they tape?
Do they have any prescribed method of taping which is exclusive to their hospital
Do they use arm boards, wrist splints, or any other kind of IV removal Process
Which part is hardest

Emotional:
Does the process seem scary/ daunting to you? Why?
What about the parents of the pediatrics?
Does the site of needle intimidate you?

Removal of IV
What all are the reasons of IV removal apart from procedure completion?'
How do you remove IV?

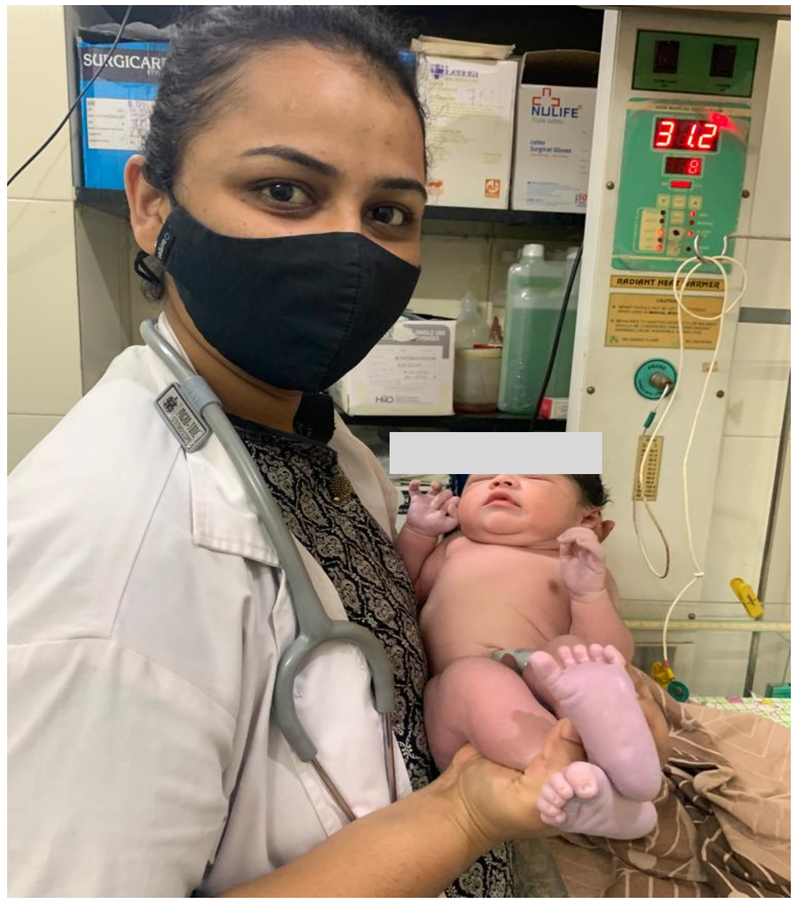
Nurse

Dislodgement
Possible reasons for dislodgement? What happens after dislodgement?
What happens after dislodgement? Problems caused?
How often does dislodgement occour?
Is the current method of securement enough for securement of catheter?
Do you remember any particular case of dislodgement?
Do they use arm boards, wrist splints, or any other kind of securement device? What material?
What are the problems of using Cardboard/wooden splint for a longer amount of time?
What is the reason for swelling?

Medicine administration/Inspection:
What are the forms in which a medication is administered via IV?
How often does an average pediatric needs medication administraton?
Do you inspect IV before injecting? What things/areas do you check while inspecting?
What do you do if you suspect any dislodgement or sepsis?
Do you carry out inspections even without medication administration
How often do you change the dressing?
Possible reasons for dislodgement? What happens after dislodgement?
Do you remember any particular case of dislodgement?

Emotional
Does the process seem scary/ daunting to you? Why?
What about the parents of the pediatrics?
Does the site of needle intimidate you?
What is the parents involvement in the process? Do they play any role?

5.2 Doctors Perspective:



Doctor Kadambari Jadhav
Pediatrician
Jupiter Hospital Baner

Process and problems:

While **inserting we need 4 people** to hold babies below 4 years of age
We use the backflow as blood sample for labs. One prick for both IV and blood sample.
We put a mark instantly after finding the **vein as it disappears in seconds.**
Mostly we fix white gauge then put cotton inside and attach splint on top of it
Only **1 person can touch** as the area might get infected. So it is quite a task to remove the **cover and stick and put 3 tapes** for a single person
If baby moves while inserting: We **may lose the vein, or get thrombo.**
After fixation we cover the complete site and hand alongwith fingers with bandage/ guage like boxing gloves but it **blocks the visibility** while inspection
If **flush occours, then we might need other vein.**

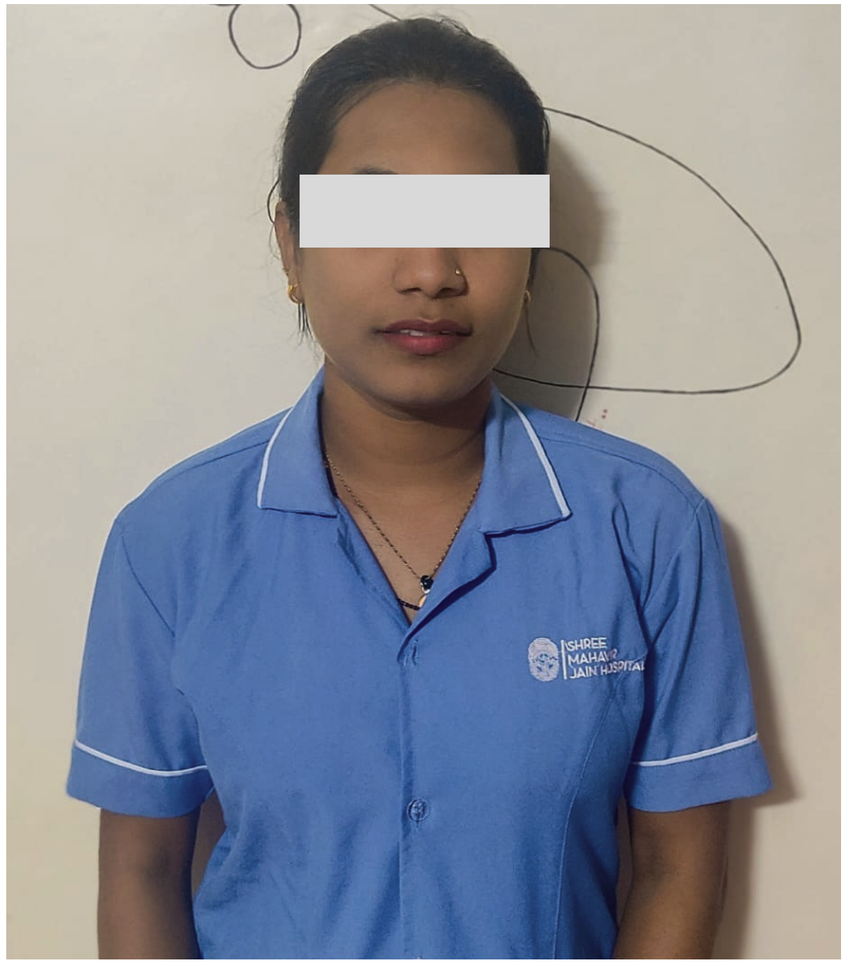
Observational

Generally they make splint on their own- with cardboard/wood/ thermocol to stabilize hand but if patient moves, it might hurt

Process Intervention:

Easy **removal and fixation** of dressing and splint
Visibility of inspection site and intracath while securement and fixation is on
Checking of swelling must be easy
Material should not harm baby's **delicate skin**
Whatever you do, you cannot reduce the pain, so try to make the whole **process a little less painful**

5.3 Nurse's Perspective:



5.3.1 Process and problems:

After inserting intracath we try to **push liquid by syringe.** If liquid goes inside easily then the catheter is **inserted correctly**, otherwise we check again by syringe,

All prominent veins have a course till shoulder. When you touch vein manually, **you feel liquid flowing**, which indicates cannula inserted correctly

While administrating medication: **First you check for swelling, then you push the fluid**,so you **need visibility** through the fixation to check on swelling

If liquid does not go in, then the **catheter is out**. And there is a formation of **thrombo(swelling)**. Thrombo is **spontaneous,** so you get indication on the spot that catheter is not fixed. Also patient has **unbereable pain** if cannula is out.

Then you have to **close the intracath from the bulb** and remove the intracath

3 ports to close intracath

When the catheter tip is out, end of IV process

Removal: The fixation tape is sticking the catheter and skin which is painful to remove so **we soak it with sterile water and remove it.**

5.4 Data Synthesis

5.4.1 User insights:

Need 4 people while inserting IV
Premade splint in bulk in different sizes on their own with cardboard, medical tape in different sizes
Make fixation too on their own with medical tape.
If IV catheter is out(of the vein) and you try to insert IV, the **child agitates and you get a instantaneous swelling**
Check swelling by pressing, and remove the tape every time they want to check for thrombo
Need parents to control agitating child every time they have to administer fluid
If catheter tip is out, they **remove the whole and reinsert** in other site
You **cannot predict reason of dislodgement** other than agitation. Babies who dont move their hand at all also have dislodgement and babies who move too much might not encounter dislodgement at all.

5.4.2 Factual

Catheter sizes: 26 G normal, 23-22 for pediatric, 22 for patients above 10 years
IV dessing and splint is **same for pediatrics and adults,** just the size is different
Splint is to **support intracath and tubing on hand** and limit the hand movement
Same intracath **can stay for 5-7 days** but mostly IV procedure is for 5 days some require 14 days
Avg incubation period is 5 days
Dengue 7 days, Diarrhea 3, Typhoid meninjitis post covid: 14
Catheter and dressing **change: 5 to 7 days**
Inspection is done everytime you inject or salinate the patient.
Removal of IV: need to use washroom,
catheter goes OUT commonly after 3 days, so you need to find other site and prick after every 2-3 days

5.5 Pediatric Ward Visit

5.5.1 Pediatric ward Vedant Hospital, Thane

Location: Pediatric ward Vedant Hospital, Thane

Aim: Observational study and interview

Subjects: Nurses, Parents



Research Objective:

To observe how infants and pediatrics react to the IV administration

To understand pain points of nurses administering and monitoring IV

To understand how Doctors and nurses interact with the patients and their parents in the process

Patient 1

Age **3 years**

Reason: Diarrhea

Site: **Left hand** cephalic vein



The insertion site is fully closed so catheter wont move, but it compromises visibility



Skin discomfort due to adhesives



Parents and kids share same space and bed



Children don't understand seriousness of IV and move too much



No system to place your hand properly while sitting

Patient 2

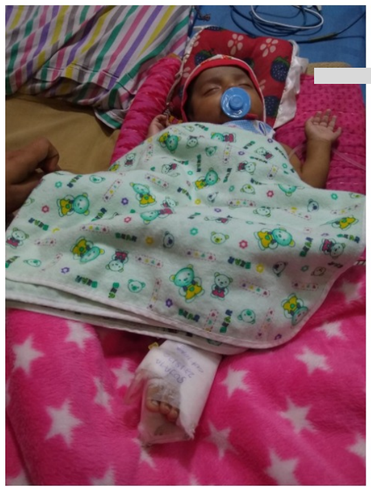
Age 1 **year**

Reason: Dengue

Site: **Left leg** saphenous vein



No secondary securement, the tubing has not attachemnt, prone to dislodgement



Heavy weight of dressing and securement



Dressing information written with pen on dressing itself



Enginnering monitered devices for timely dispense

5.6 Pediatric Ward Visit

5.6.1 Government Hospital, Mumbai

Location: Government Hospital, Mumbai

Aim: Observational study and interview

Subjects: Nurses, Parents

Research Objective:

- To observe how infants and pediatrics react to the IV administration
- To understand pain points of nurses administering and monitoring IV
- To understand how Doctors and nurses interact with the patients and their parents in the process



Patient 1

Age **3 years**

Reason: Diarrhea

Site: **Left hand** cephalic vein



Multiple pricking attempts for finding vein



Sharing same space a small single bed



Blocking of visibility



Catheter resting on ground

Patient 2

Age 5 **years**

Reason: Dengue

Site: **Left leg** saphenous vein



No resting space for catheter,



No secondary securement, prone to dislodgement while wrist movement



Long tubing unhanged which can get caught and cause dislodgement

6. Problems encountered







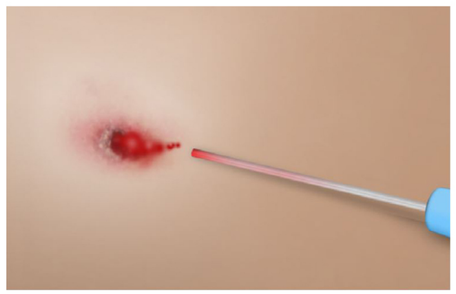






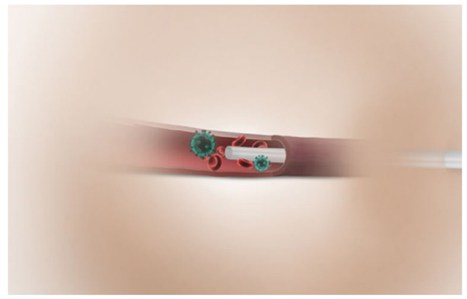
6.1 Medical Complications:

Dislodgement



Inadvertent tugs on the IV line or catheter can cause dislodgemement which results in loss of use, delayed medication delivery, and another insertion procedure. Dislodgement may result in the loss of the line and need for additional IV access.

CRBSI/CLABSI



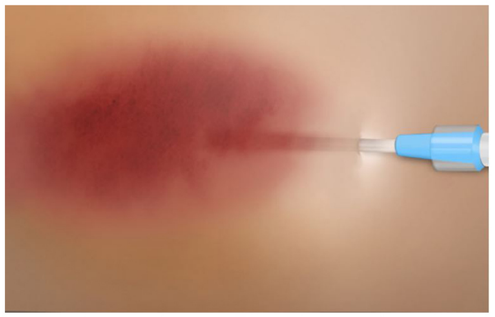
SI can occur with migration of skin flora through taneous entry site. Catheter motion and pistoning ease this risk. The INS & CDC recommend the use ter securement devices to reduce catheter motion motion-related complication risk.

Infiltration/Extravasation



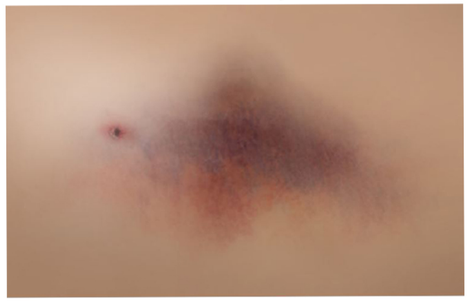
An improperly secured catheter can cause fric against the vessel wall which may cause perfora the vessel leading to infiltration or extravasat Reducing catheter microtugs and micromovemen proper securement may help reduce this ris

Mechanical Phlebitis



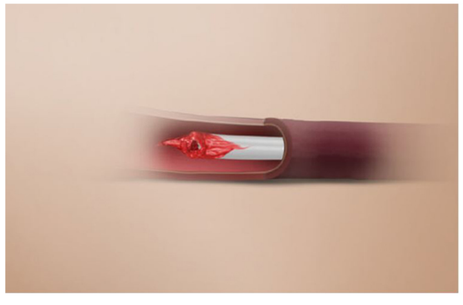
Catheter movement within a vessel causes friction which can trigger the inflammatory response in the vessel.

Pressure Injury



Catheters that are secured in a manner that push the catheter hub down onto the skin can cause device-related pressure injury.

Occlusions/Thrombus



Thrombus formation may occur when the cathete moves and rubs up against the vein wall. Keeping t catheter as stable as possible helps to reduce this r

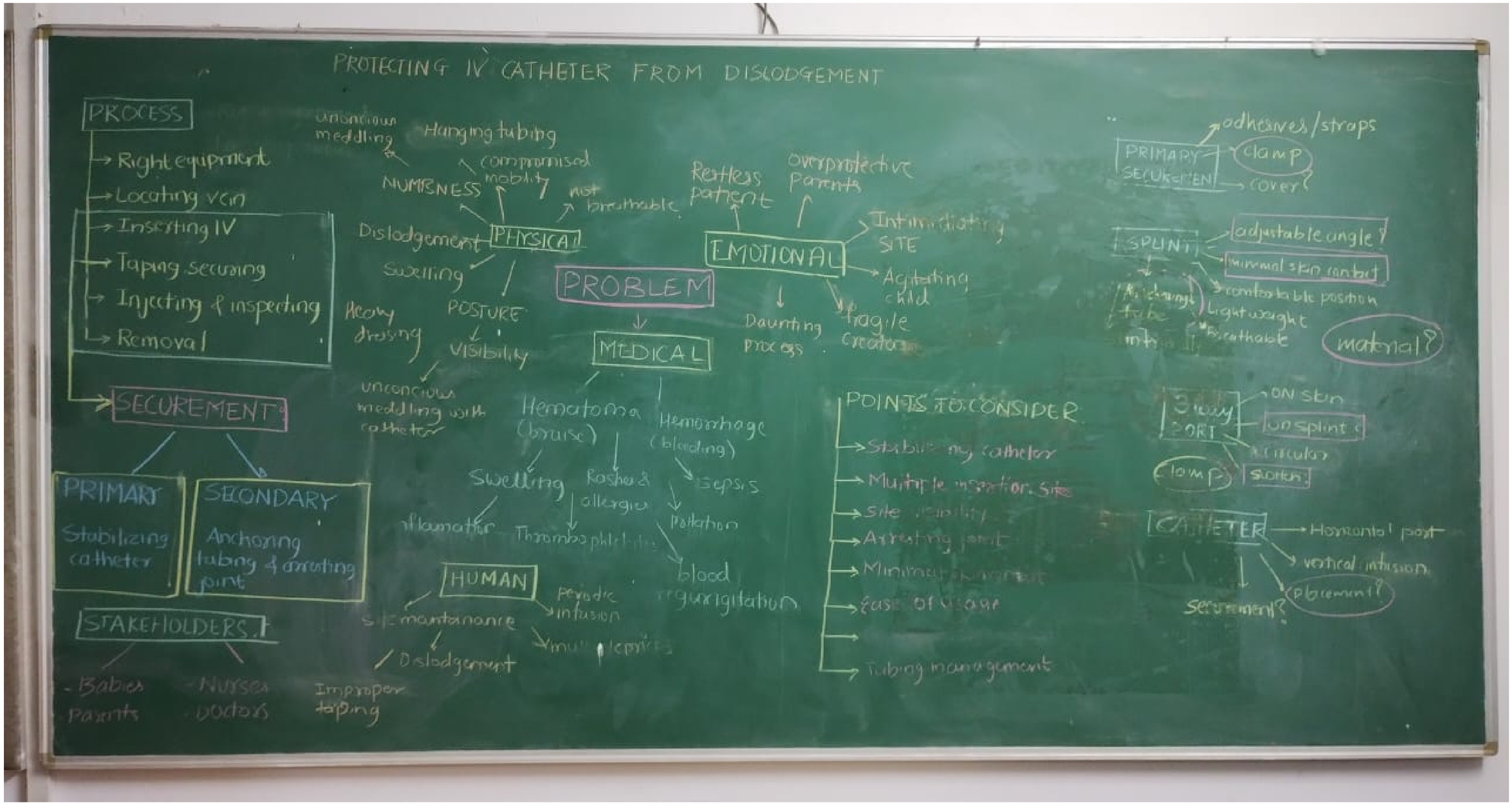
Insertion Site Infection



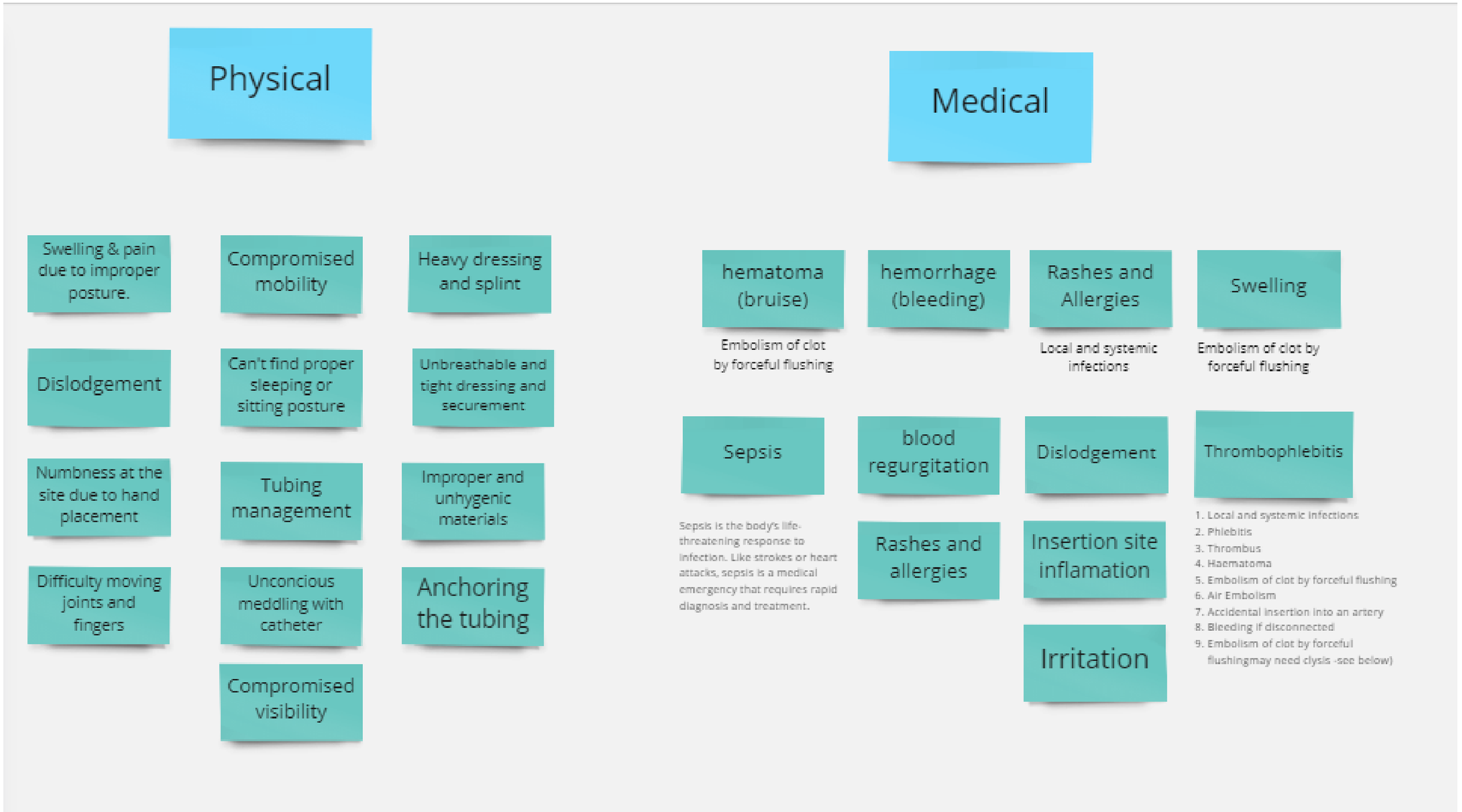
In addition to poor prepping, micropistoning of the catheter and migration of skin flora into the insertion site is a major cause of insertion site infection.

Problems encountered

6.2 Mind Mapping



Problems encountered
6.3 Affinity mapping:



7. Data Synthesis

7.1 User Traits

7.1.1 Babies

- Restless: constantly moving
- Soft/fragile
- Snatches, plays with the securement
- Not equipped to understand severity of situation
- IV site is intimidiating
- Protective parents around



7.1.2 Nurse:

- Daunting process
- Manage babies, parents, doctors

7.2 Stake holders

7.1.1 Primary Stakeholders

Babies The one on that has IV cannula is inserted

Nurse Takes care of patient, and always accompanies the patient

7.1.2 Secondary Stakeholders

Doctor The one who gives medication and carries out inspection

Parents/Guardian One who take care of patient and are always with the them

7.3 Design Direction

An IV system design which is more user friendly.
- An IV catheter with no adhesives.
- Redesign of an IV administration set.
- An IV administration kit

To protect IV catheter from dislodgement and make inspection easy

To make IV insertion easy an prevent catheter from dislodgement

7.4 Design Brief

Stabilizing and Securing IV insertion site for infants and pediatric patient

Design an IV kit for easy insertion, securement, and inspection for babies and pediatric patients such that it is less intimidating

Design an IV catheter for easy insertion, securement, and inspection for babies and pediatric patients such that it is less intimidating

“Design a device for stabilizing and securing IV cannula for infants and pediatric patients such that it is easy to insert, monitor, remove and is less intimidiating to nurses and patients.

7.5 Design Essentials

- Stability of catheter
- Securement of catheter and tubing
- Arrest/restrict joint movement
- Light weight
- Not hurt delicate babies
- Ergonomically sound
- Ease of drug insertion.
- Ease of site inspection
- Protection of site
- Less intimidating
- Access Mobility to fingers and elbows
- Breathable
- Secure during sleep and unconscious state

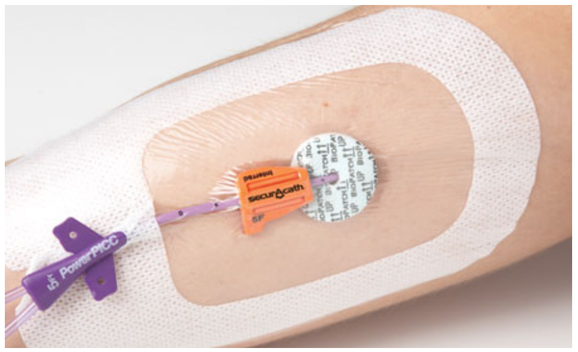
8. Parallel Products:

3M™ Tegaderm™ I.V. Advanced Securement Dressing 1683, 6.5 cm x 7 cm

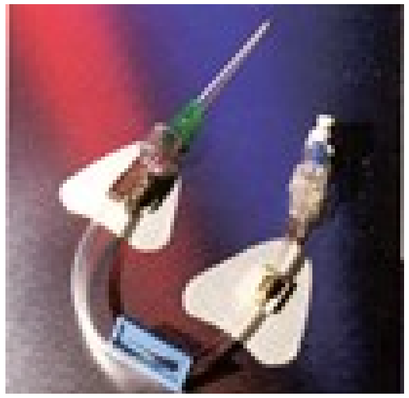


Foley Catheter Fixing Dressing Device

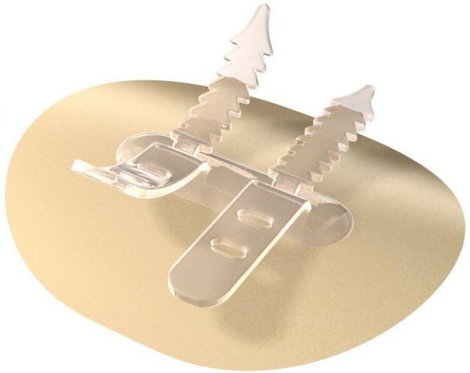




The Statlock-IV Tandem is designed for IV catheter securement over the knuckles and other difficult anatomic locations...

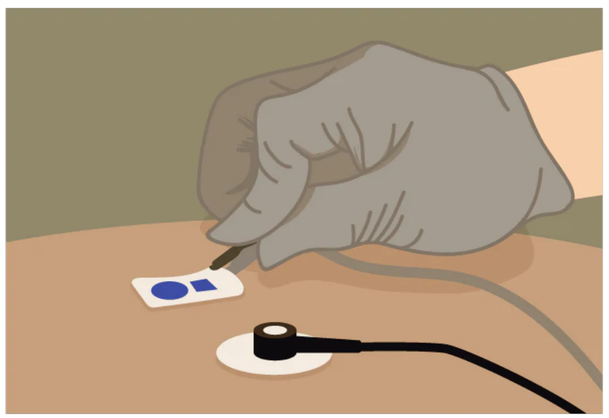


Medsupport Ergosplint:









8.1 Moodboard:
Form language

- **calming**
- **Safe**
- **Peaceful**

Restless patient and intimidiating site, so make something that gives calming and sooting vibe as well as give peaceful and happy feeling













9. Ideations

9.1 Components

- **Splint:** To arrest joint movement
- **3 way port**: To direct the flow of liquid
- **Catheter:** The component that goes inside the vein
- **Cover:** A cover above primary securement
- **Primary Securement? :** A system that stabilizes catheter

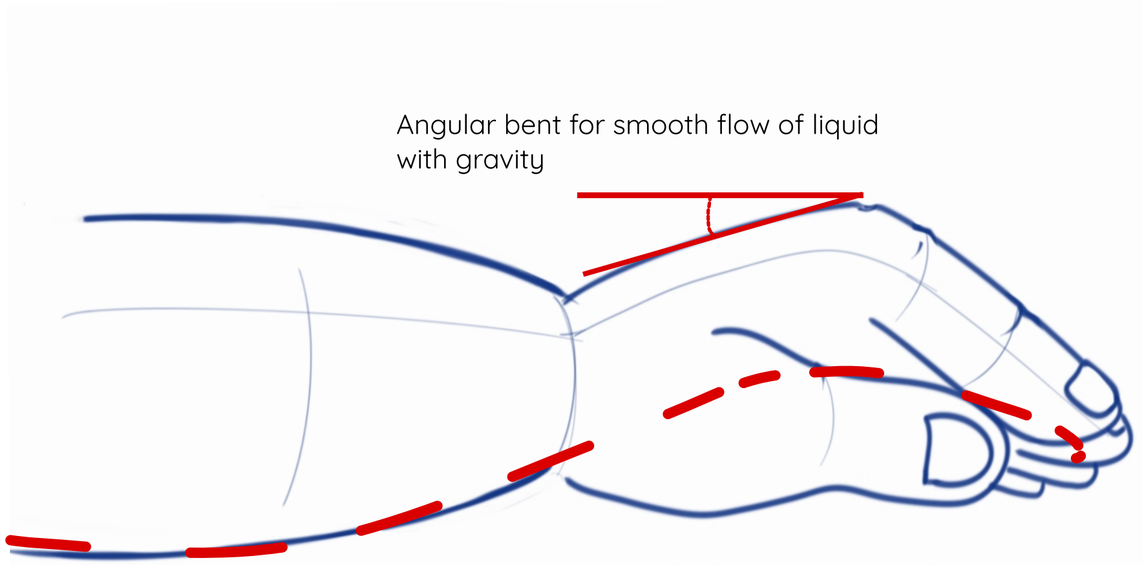
9.2 Resting Posture of Hand:











9.3 Initial Ideations

Component 1

Splint: To arrest joint movement



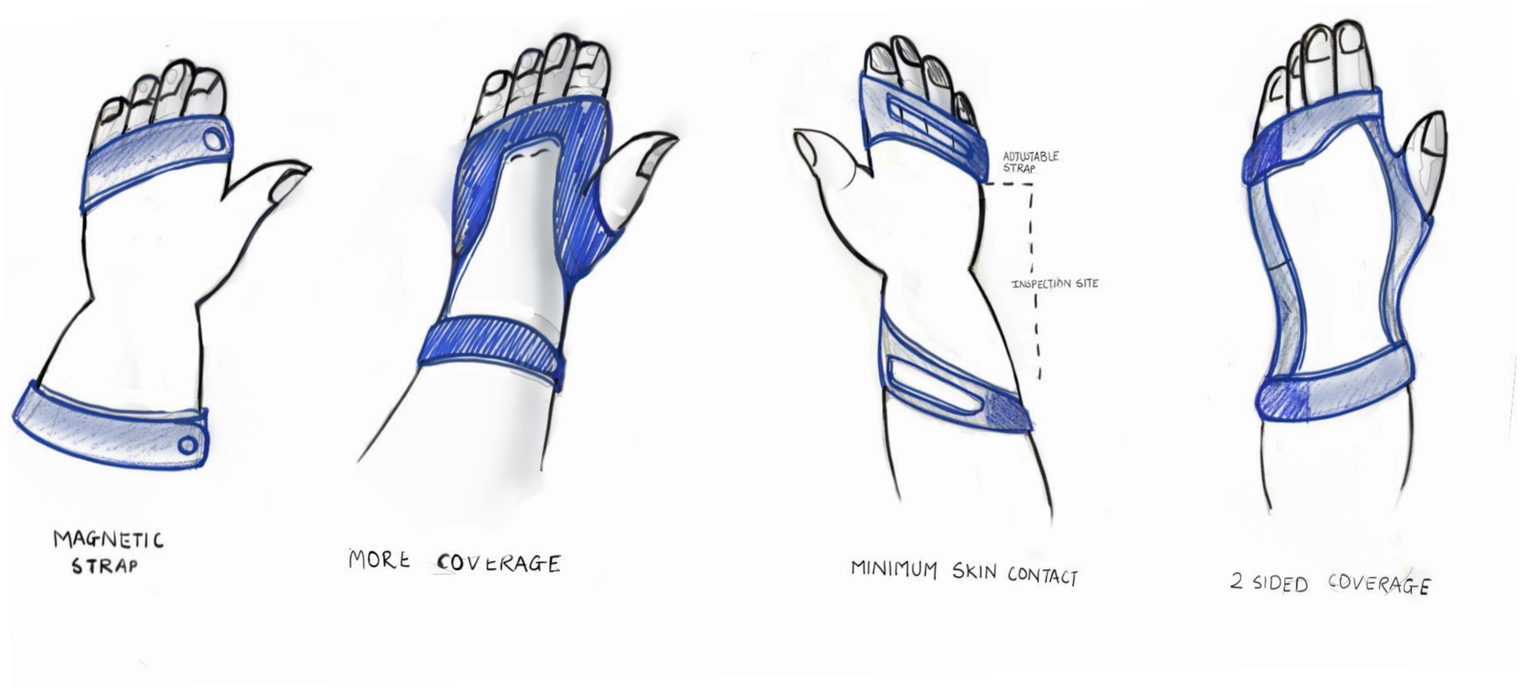
a)Breatbability

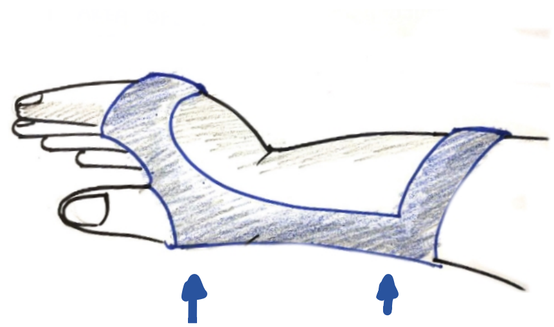
b) Site Inspection:

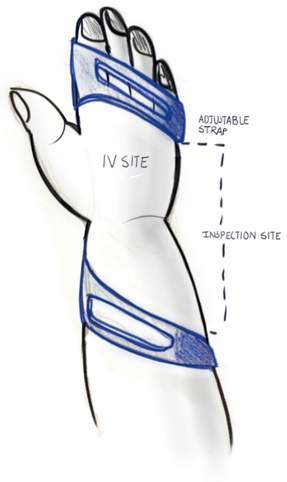
c) Splint: To arrest joint movement

Arresting wrist movement and stabilizing the joint to a comfortable positibn

Initial Ideations

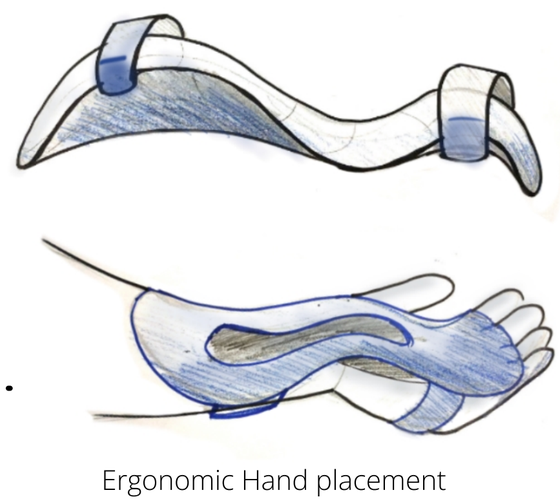


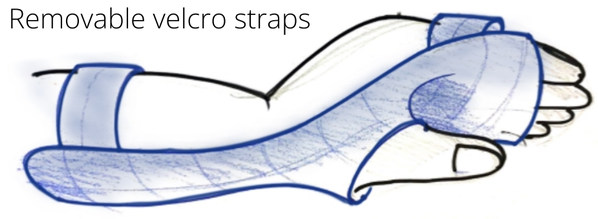


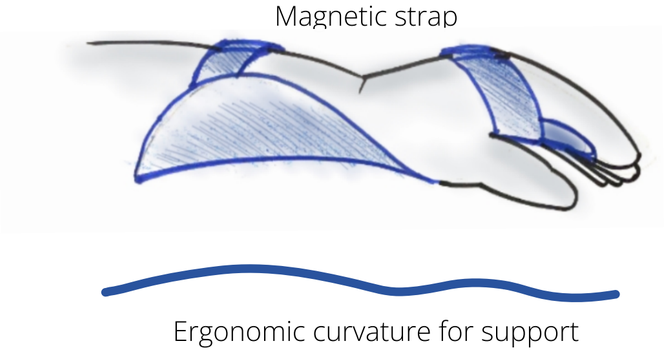












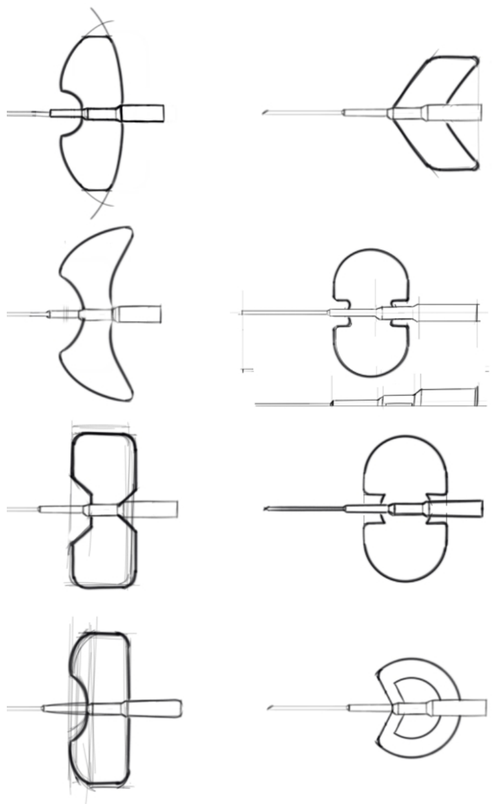


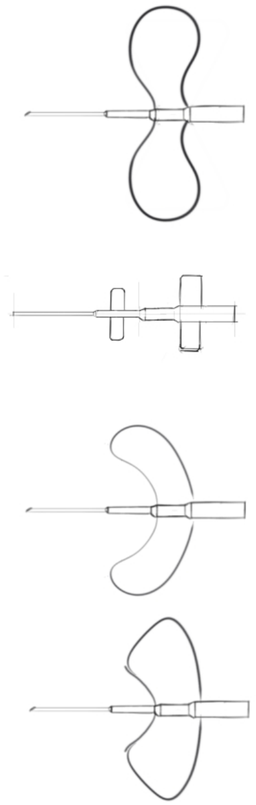


9.3.2 Component 2

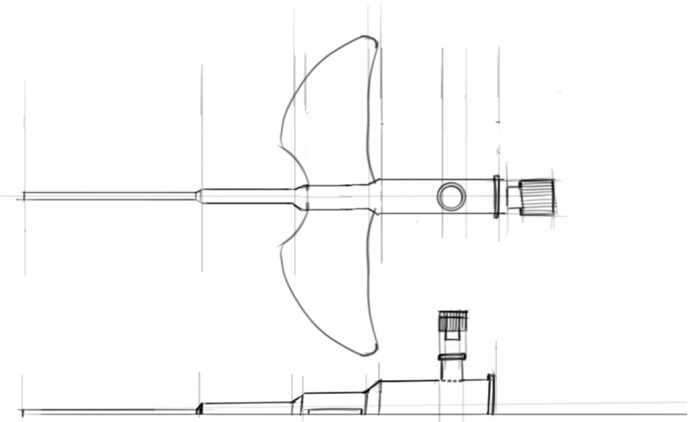
- **Catheter:**

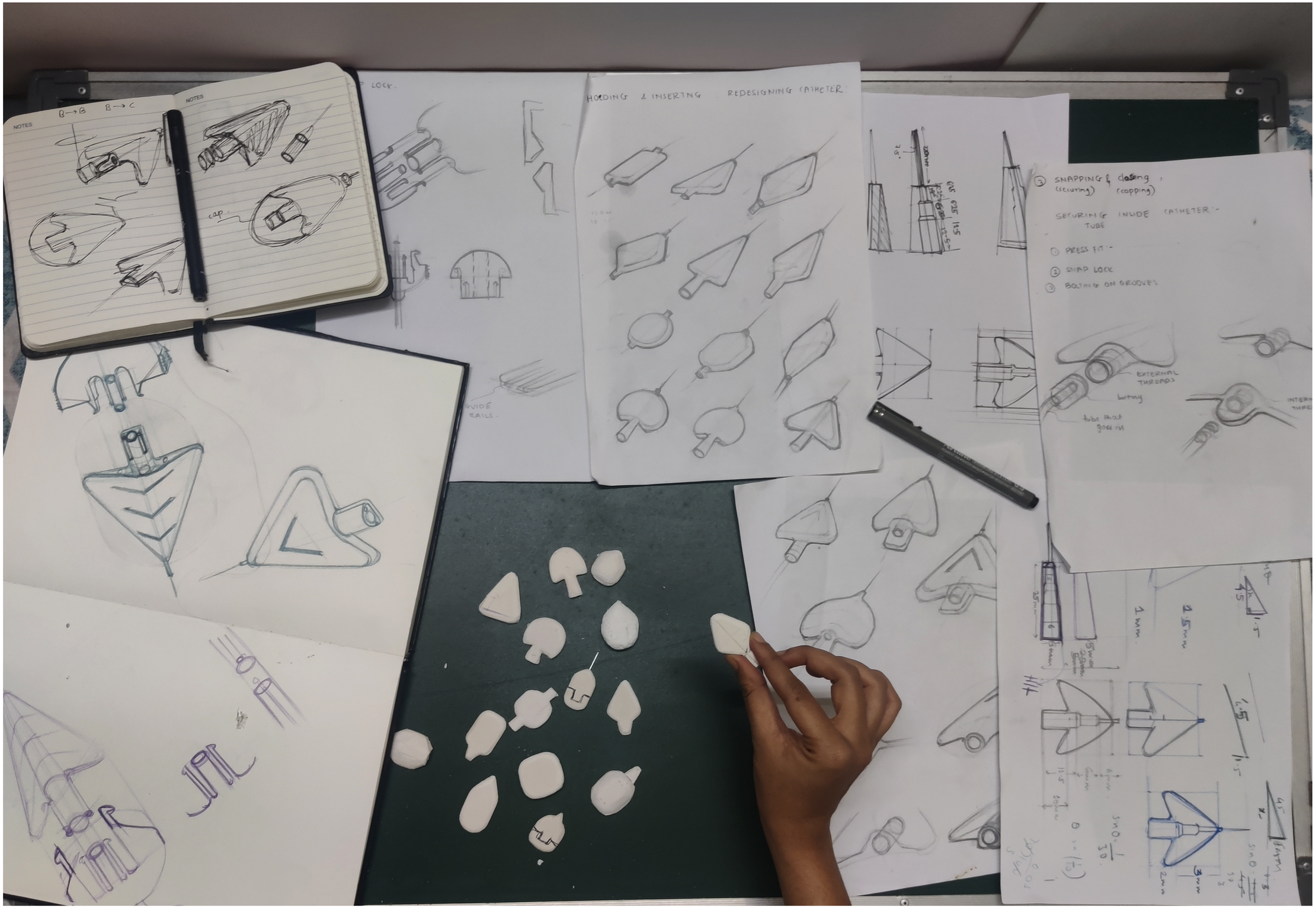




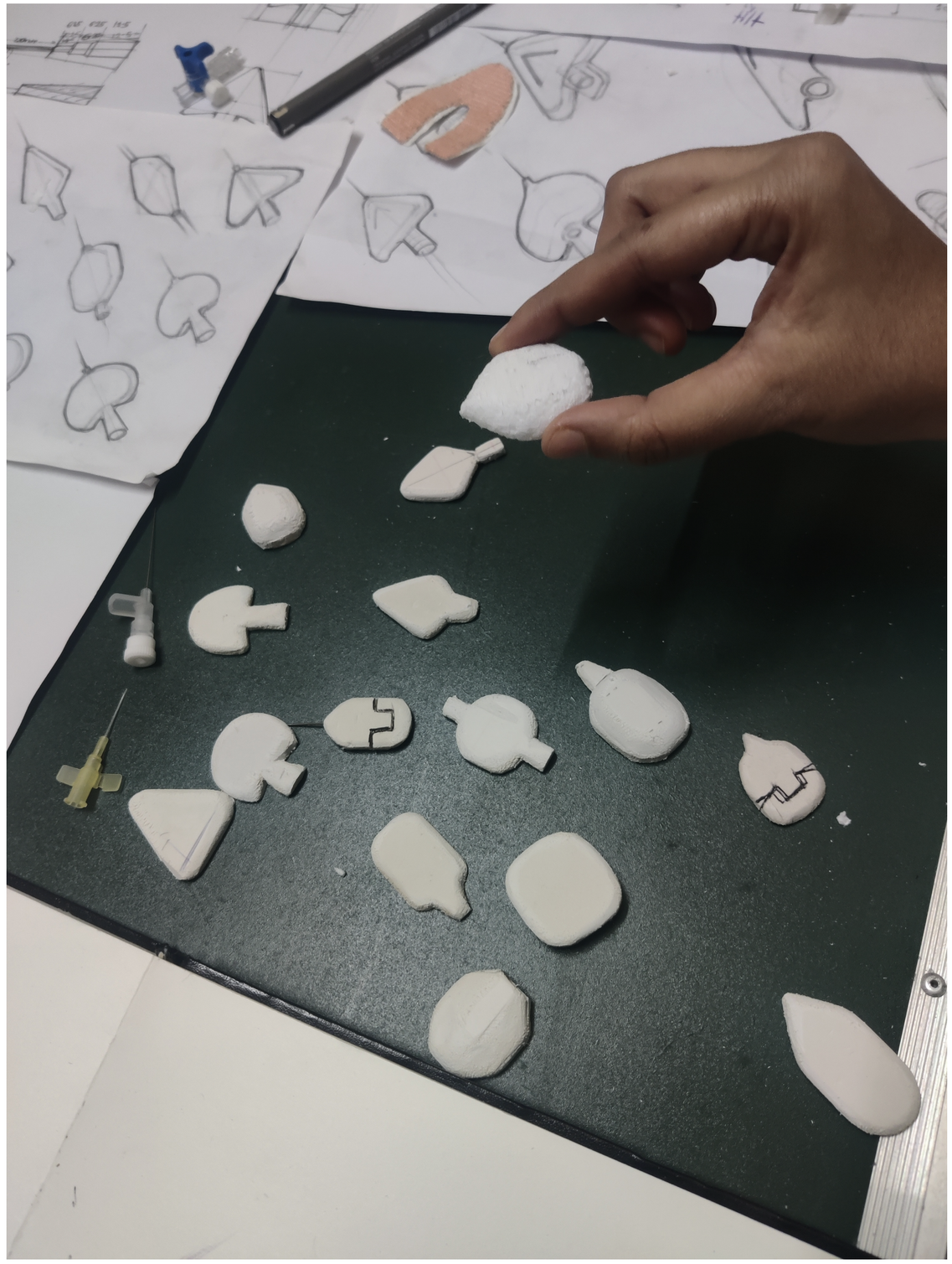


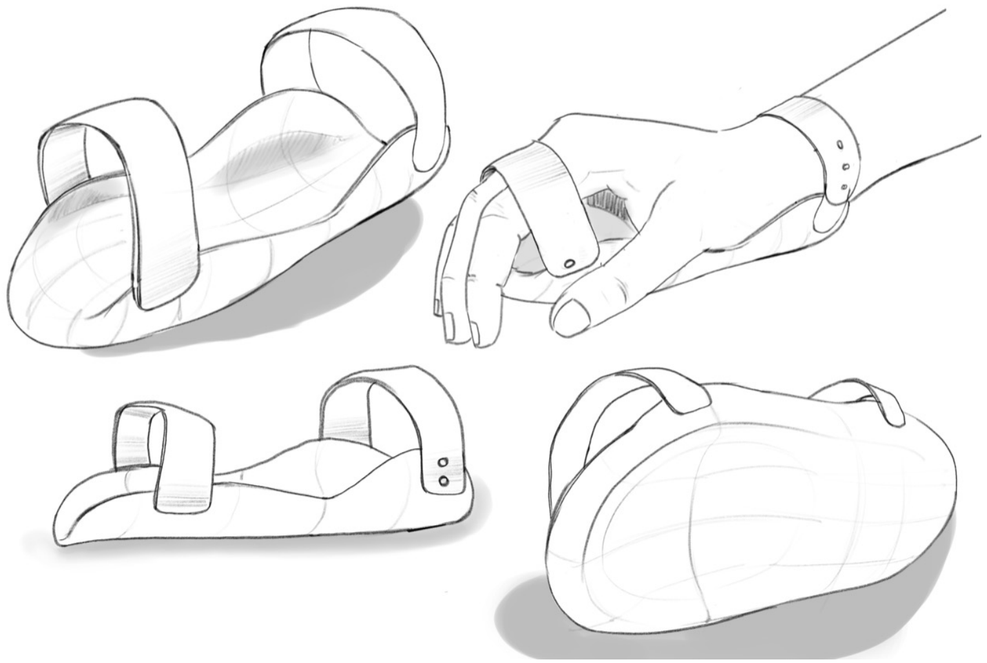


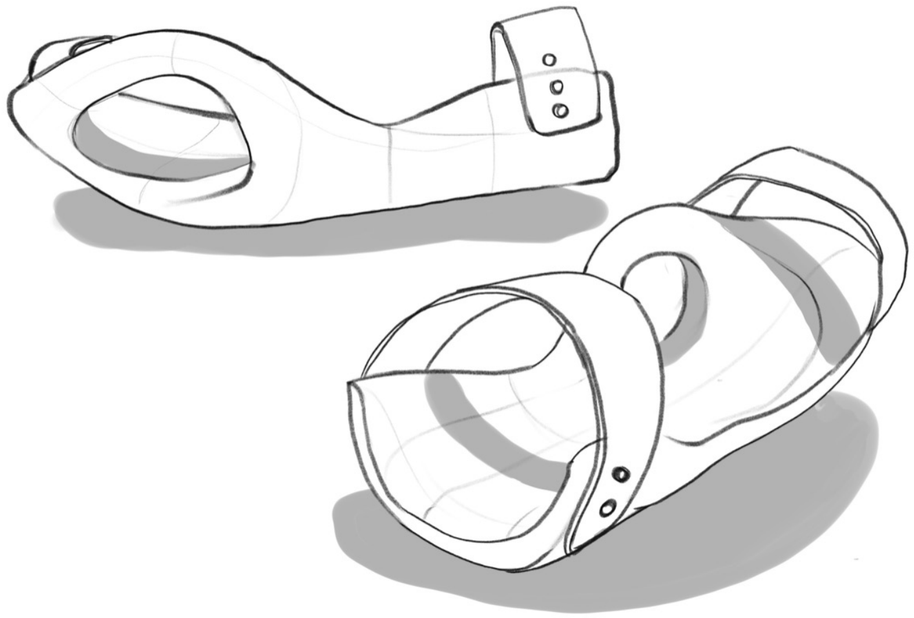


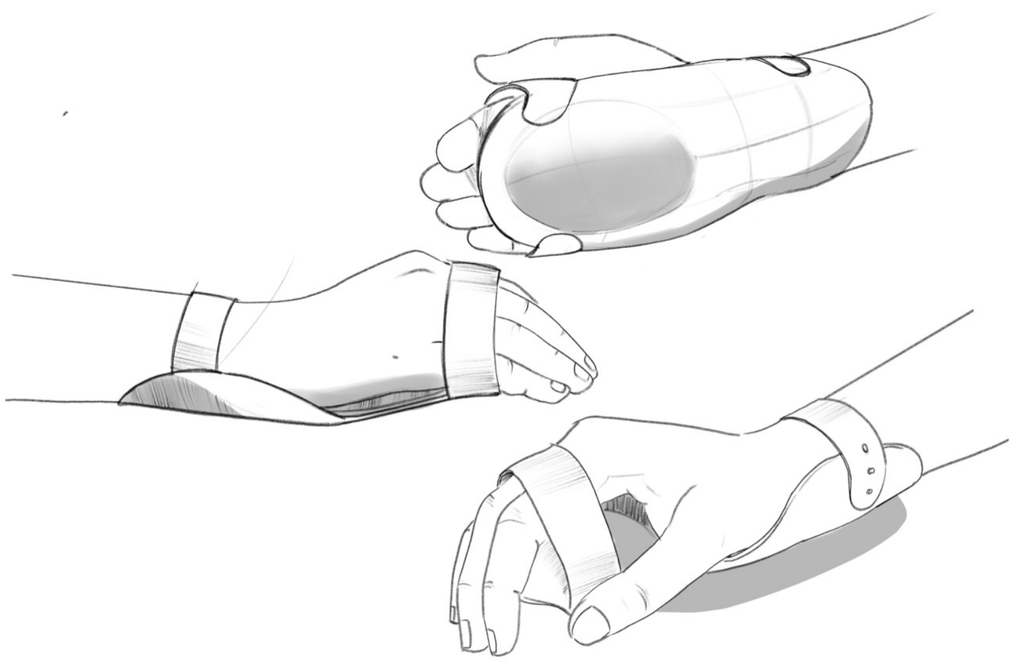

NOTES
B→B
B→C
NOTES
cap
LOCK.
GUIDE RAILS.
HOLDING & INSERTING
REDESIGNING CATHETER.
SNAPPING & closing
(securing) (capping)
SECURING INSIDE CATHETER:-
TUBE
① PRESS FIT:-
② SNAP LOCK
③ BOLTING ON GROOVES
EXTERNAL THREADS
tube must goes in
1mm
2.5mm


HOLDING & INSERTING
REDESIGNING CATHETER
CAP
LOCK
GUIDE RAILS.



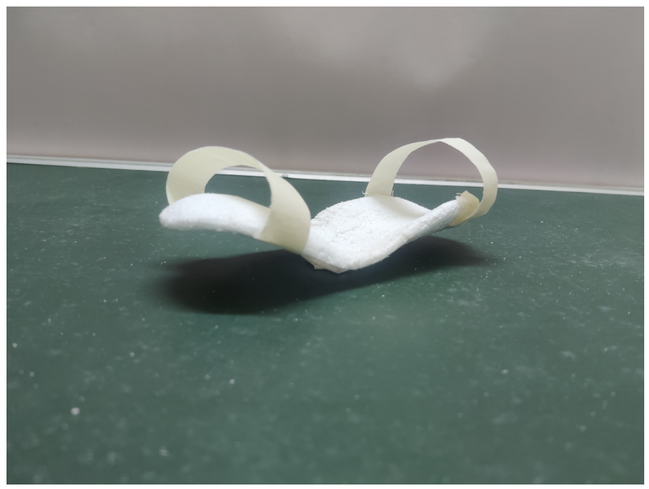








Each photo Single with kid wearing



Product 1

Product 2

Product 4

Product 5

Snap fit lock with just one
touch point

Concept 1

Different Connectors:

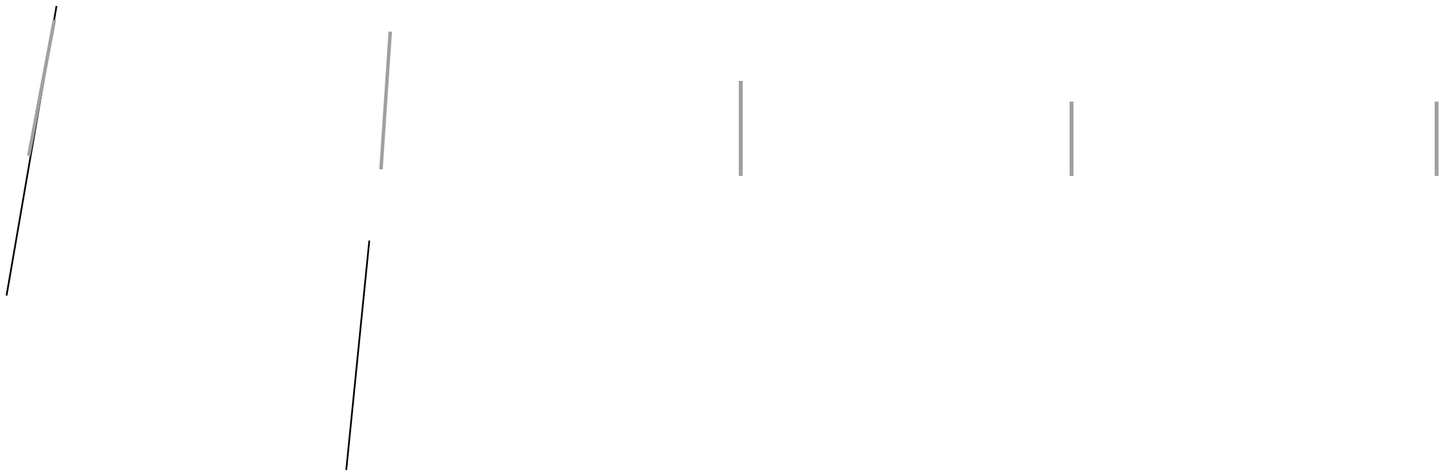


Cap

Syringe end

With Tubing Connector

Attaching mechanism



Syringe end

Remove syringe

Attach cap when not to provide medication

Attach tubing connector when providing medication

Combined Product: **(IV splint and catheter)**

THANKYOU