# The Body Fluid and Nursing Management of Fluid Therapy

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Body fluids are very important and basic to human body functions. There are mainly two types of fluids, namely, Extracellular which includes Intravascular and Interstitial; and Intracellular fluids. Body fluids regulate body fluid volume and acid-base balance, control factors that govern gross interchange of fluid between the extracellular and the intracellular compartments, and maintain the osmotic relationship between these compartments.

## Body Fluid

Intracellular and Extracellular fluids together comprise the total body water. The total body water varies with the age and sex of the subject. Its proportion in the total body weight is greater in lean people than in obese individuals. Total body fluid plays a vital role in keeping the body healthy. It carries oxygen ($O_2$) and nutrients to each cell and helps to remove body waste. About two-third of the human body weight is water. Half of this water is contained in muscles and the remaining is in bone, skin, capillary and other tissues. The total amount of water in a healthy man weighing 70 Kg is 45 litres. Approximately 55% of body water is within cells (Intracellular fluid) and the remaining 45% of the body water is outside cells (Extracellular fluid). In a newborn infant the total body fluid may be as high as 75% of the body weight, but it decreases as one grows old, with most of the decrease occurring in the first 10 years of life. Obesity decreases the percentage of water in the body.

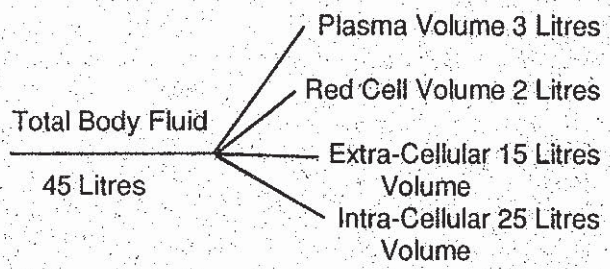


Fig. 1

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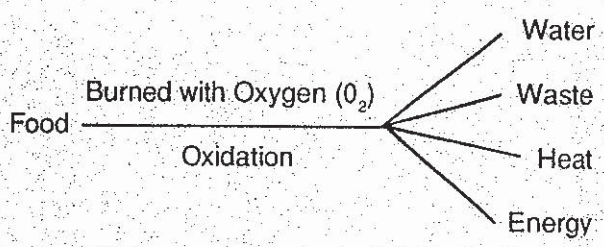
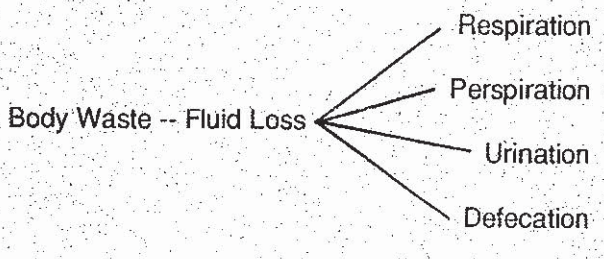
**Table 1 : Total Body Water in Normal Man**

| Age | Males and Females | Males | Females |
|---|---|---|---|
| 0-1month | 75.7% | | |
| 1-12 months | 65.5% | | |
| 1-10 years | 61.7% | | |
| 10-16 years | | 58.9% | 57.3% |
| 17-39 years | | 60.6% | 50.2% |
| 40-59 years | | 54.7% | 46.7% |
| 60 and above | | 51.5% | 45.5% |

## Intake and Output of Water

Water is distributed throughout the body but is described as being contained in three compartments - Intracellular (within cells), Interstitial (between cells) and Intravascular (within blood vessels). Interstitial and Intravascular water together are termed extracellular water.




Most of our daily intake of water is oral, approximately two-third is in the form of pure water or some

other beverage, and the remaining is in the food that is eaten. A small amount is synthesized in the body as a result of oxidation of hydrogen in the food. This quantity ranges between 250 ml and 350 ml per day, depending on the rate of metabolism. The normal intake of fluid, including that synthesized in the body, averages about 2,600 ml per day, and the amount of water consumed daily must equal that excreted. Our intake of fluids consists of a variety of fluids such as water, fruit juices, jelly, soup, custard, popsicles, ice cream and carbonated beverages, and food with high fluid content such as fruits and vegetables.

| Fluid Intake | Fluid Balance | Fluid Output |
|---|---|---|
| Water Intake Ml/Day | | Water Output Ml/day |
| Ingested Water 1400 | | Respiration 400 |
| Water Content of food 850 | | Perspiration 500 |
| | | Urination 1500 |
| Water of Oxidation 350 | | Defecation 200 |
| TOTAL 2600Ml/day | | 2600Ml/day |

Fig. 2

## Body Fluid Electrolytes

Body water contains cells, cell fragments and proteins, as well as numerous dissolved substances that interact chemically. Chemical compounds in solution may be classified as electrolytes or non-electrolytes. Electrolytes in human body need to be balanced in order to keep the body cells healthy. Electrolytes are substances that carry an electric charge when dissolved in fluids. These electrically charged particles are called 'ions'. For instance, when Sodium Chloride (nacl) is dissolved in a fluid, it breaks up into two ions (na) and (cl) and sodium (na) carries a positive charge. This solution is now able to conduct electricity.

Electrolytes are found in food and are taken into the body through a well balanced diet. Excess electrolytes are excreted through kidneys. The body has many ions. These ions are moving through the cell membranes from one compartment to another. This movement occurs to maintain the electrolyte balance of the body. These electrolytes are normally found in the blood stream. A certain amount of each electrolyte must be present in the body for the body to be in electrolyte balance.

Table 2

**Normal Electrolyte Content of Body Fluid**

| Electrolytes | Interstitial Fluid MEQ/L | Intracellular Fluid MEQ/L per Kg $H_2O$ |
|---|---|---|
| CATIONS | | |
| Sodium(Na+) | 145 | 10 |
| Potassium(K+) | 4 | 160 |
| Calcium(Ca++) | 2.5 | 2 |
| Magnesium(Mg++) | 1.5 | 26 |
| TOTAL CATIONS | 153 | 198 |
| ANIONS | | |
| Chloride(Cl-) | 144 | 3 |
| Bicarbonate($HCO_3$-) | 30 | 10 |
| Phosphate($HPO_4$--) | 2 | 100 |
| Sulphate($SO_4$) | 1 | 20 |
| Organic acids | 6 | -- |
| Protein(Prot) | 0 | 65 |
| TOTAL ANIONS | 153 | 198 MEQ/kg |

## Acid-base Balance

A solution can be acid/alkaline (Base) or neutral. The term PH (potential of Hydrogen) is used to indicate acidity or alkalinity. The PH is determined by measuring the number of hydrogen ions in the solution. A solution with PH of 7.0 is neutral; less than 7 is acidic; more than 7 is alkaline or base. Acid-base balance means a normal balance between the acid and alkaline body fluids. These fluids are located in the extracellular and intracellular compartments respectively. Acid-base balance is important for the body's health. It is controlled by the kidneys and the respiratory system. The normal PH of blood is 7.35. If the PH goes higher than 7.45 the body becomes too alkaline (this is called alkalosis). If the PH drops below 7.35 the body becomes too acidic (this is called acidosis).

## Blood Volume

Blood contains both extracellular fluid (the fluid of the plasma) and intracellular fluid (the fluid in the red blood cell). The average blood volume of a normal adult is almost 5,000 ml to 6,000 ml, approximately 3,000 ml of this is the fluid of plasma and the remaining 2,000 ml to 3,000 ml is the fluid of red blood cells. However, these figures vary greatly from individual to individual. Sex, weight and many other factors affect the blood volume. In a newborn infant the average blood volume is 300 ml to 350 ml.

## Imbalance in Body Fluids

Acid-base imbalance, electrolyte imbalance, fluid imbalance and blood and plasma loss are closely related and often occur at the same time. Imbalance in body fluids can occur in the following cases:

- A large amount of fluid and electrolyte loss. This can be caused by vomiting, diarrhoea, bleeding, severe burns, gastric suction and diaphoresis (sweating)

- Failure to replace fluid and electrolyte loss because of not eating, not drinking due to anorexia, loss of appetite, nausea and loss of consciousness.

- Abnormal retention or excretion of fluid and electrolytes by the body. This can happen if a person is suffering from a liver, kidney, heart or circulatory disease.

- Blood and Plasma protein loss from the body. This can be caused by accident, burns or haemorrhage.

- Water loss from the body is usually accompanied by loss of electrolyte, more water than solute may be lost with watery diarrhoea, severe vomiting and large amount of excretion (urine). When too much fluid is lost from the body, the overall effect is called dehydration.

## Symptoms of Fluid Loss

Symptoms of fluid loss are flushed, dry skin, with poor turgor, dry lips, a dry coated tongue, abnormal thirst, sunken soft eyeballs; and atonic muscles, anorexia, dyspepsia, and constipation develop as a result of inadequate fluid for gastro-intestinal functioning. Besides, there is weight loss and inadequate fluids in the body result in severe dehydration. Imbalance of electrolytes can cause severe disturbances in the body and even coma and death.

## Fluid Excess (Water Intoxication)

Excess of fluid in the body can cause oedema (swelling). If fluid is retained in the body in excess it is termed as over-hydration. If there is an excess of water without an increase in sodium or protein, water enters the cells through osmosis causing them to swell (Dilation syndrome). This can occur if there is excessive secretion of ADH, low renal blood flow, e.g. in Congestive cardiac failure, cirrhosis of liver, acute renal insufficiency, Addison's disease, etc.

## Signs and Symptoms

Oedema, swelling, changes in behaviour, confusion, lack of coordination, convulsions, hyperventilation, sudden weight gain, warm moist skin, apathy, sleepiness, anorexia, nausea and vomiting.

## Fluid Therapy

Fluid replacement therapy is to keep the body in balance so that it can carry out normal functions. Fluid therapy first restores balance by replacing lost fluids and electrolytes. It then keeps the body in balance by supplying daily needs and replacing daily losses. The body's fluid and electrolytes can be replaced by:

*Oral Fluid* : This is commonly called pushing fluid or forcing fluid. It requires a daily intake of 2,500 ml to 3,000 ml. The intake should be spread throughout the day, patients who are unable to take fluid by themselves must be helped by the nurse.

*Tube Feeding* : This method is used when the patient cannot take food or fluid through mouth.

*Intravenous Therapy* : In this method, fluid, electrolytes and blood and plasma are infused directly into the bloodstream.

*Hypodermoclysis* : In this method, fluid is infused into the subcutaneous tissue.

*Proctolysis* : In this method, a slow infusion of fluid is given into the rectum where it is absorbed. It is also called Murphy drip or slow drip.

### *Intravenous Therapy*

Intravenous Therapy is ordered by the doctor and carried out by the nurse. Accurate recording of intake

and output is an important guide to the doctor and the nurse. It helps the doctor to decide the type and amount of solution, and also the method that should be adopted for supplying adequate fluid needed by the patient. Measuring all body discharges such as urine, stools, vomits and drainage is important. Recording the type as well as the amount of each secretion helps the doctor to determine electrolyte as well as fluid replacement needs. Intravenous therapy is used in hospitals now-a-days. It is used to

- Replace fluid and electrolyte in patients who cannot take these by mouth.
- Replenish blood supply.
- Give highly irritating medications.
- Restore acid-base balance.
- Speed up the action of certain medications by injecting them directly into the bloodstream.

*Preparation of intravenous solutions*

- Dextrose (Glucose) in water is a solution of sugar in water. It comes in strength of 2.5%, 5%, 10% and 25%. It provides the body with fluid, calories, and carbohydrates.

- Sodium Chloride and dextrose 5% W/V.

- Sodium Chloride (Normal saline 0.9 Solution). It is used to keep IV's open and to maintain the body's daily fluid and its sodium and chloride needs.

- Fluid-M (Maintenance fluid). It comes in strengths of: Dextrose (anhydrous) 5% W/V; Sodium Acetate IP 0.30% W/V; Sodium Chloride IP 0.09% W/V; Potassium Phosphate (Dibasic) 0.13% W/V and PH adjusted with HCL.

STERILYTE - P (ISOLYTE -P). It is paediatric maintenance solution with dextrose. It comes in strength of: Anhydrous Dextrose IP 5.0g; Potassium Dextrose IP 0.130g; Dibasic Potassium Phosphate IP 0.130g; Sodium Acetate IP 0.320g; Magnesium Chloride IP 0.320g, Sodium Metabisulphate IP 0.021g.

- Electrolyte Solution provided indicate the amount of various Electrolytes, e.g. Sodium lactate (1/6 Molar Lactate), (Lactate Ringer's), Normosol - M and Normosol - R.

- Plasma expanders are solutions containing carbohydrates, e.g. Dextran; Serum Albumin and plasmanate. They are given in emergencies to restore blood volume and prevent shock till plasma or blood is made available.

- The nurse has to be careful as to when medications have to be added to IV solutions. Strict aseptic technique is used when mixing IV solutions to prevent contamination of the solution. The nurse should read carefully the literature and specific instructions provided with the medication.

- The nurse should keep a constant watch on the solution. If any precipitates (clumps or particles) or crystals appear in the solution, or if there is change in colour or cloudiness or gas bubbles, etc. in the solution, she should inform the physician.

*Nursing management of intravenous therapy*

Starting an Intravenous: Intravenous are usually started by a doctor and nurse, using aseptic technique. Many hospitals now have IV teams that consist of specially trained nurses. These teams are responsible for starting IVs and drawing blood in the entire hospital.

The nurse should prepare the equipment usually needed. The nurse must check with the physician's order to find out what type of fluid is to be given and should check solution label and the identity of the patient.

*Preparation of equipment*

Equipment consists of the following:

- Prescribed IV solution
- IV infusion set (Tubing and drip chamber)
- IV stand
- Tray containing tourniquets, alcohol or spirit swabs, adhesive tape, arm-boards, cotton balls, 2x2 gauze squares, plastic strips, razor and razor blades, small emesis basin, IV needles and catheters of various types and various sizes.

- The nurse should be able to explain the procedure to the patient, and should prepare the patient physically and psychologically. This relieves anxiety and helps him to relax and cooperate. The patient should be asked to remain still while the needle is being inserted because if the patient moves then the needle may have to be reinserted.

- The nurse should provide a comfortable bed, draw the unit curtain and provide good lighting.

- The nurse should wash the hands before starting the procedure.

- The nurse must first choose site, and choose IV cannula, cut strips of adhesive about one to two inches wide and four inches long, hang them from the table, place the tourniquet and spirit or prescribed IV solution and tubing and connect (to avoid contamination). Hang the bottle from the IV stand. Fill the drip chamber with solutions, take off the cover of the tubing, and allow the solution to run through the tubing, then close the clamp. Cover the end of the IV tubing which enters the needle or catheter (this prevents contamination). Shave the skin of the selected IV site. This reduces discomfort of pulling out hairs when removing adhesive tape later.

- Apply tourniquet 5 cm above the injection site, check the radial pulse below tourniquet.

- Prepare the site by scrubbing with iodine solution for one minute in circular motion, moving outward from the injection site. Allow two minutes to dry then wipe off spirit or alcohol swab pledget.

- Holding needle level up and at 45 degree angle, pierce skin to reach but not penetrate vein.

- Decrease angle of needle until nearly parallel with skin; then enter it into the vein either directly above or from the site.

- Assist, as necessary, in the connecting and stablizing of the tubing.

- Assist, as needed, to release the tourniquet, and attach infusion tubing, open the drip regulator and allow the solution to flow. Adjust the drip rate.

- The needle or catheter and tubing is taped securely but comfortably to help keep the IV in place.

The nurse should make the patient comfortable and secure use of an armboard to hold the part in the desired position. An armboard is usually used when the IV is started with a needle, and movement can cause the needle to come out of the vein. Armboard is also used near a joint like the elbow or the wrist, because movement of the joint can cause the catheter to become kinked or break off and may flow into the bloodstream.

Chart the procedure in Nurse's notes as follows:

Patient's Name _____ I.P. No. _____ Bed No. ___
Age ___ Sex ___ Occupation _____ Religion ____

| Date | Time | Nurse's Note |
|---|---|---|
| 1-2-92 | 10 AM | 1000ml Dextrose Normal Saline 50% started by IV left arm by |
| | | Dr. V.K. Bharthi ____ Staff Sign. ____ |
| 1-2-92 | 10.30 AM | Resting. No Complaints, IV infusion satisfactory. 30 drops/minute |
| | | Staff Signature _____ |

- It is the duty of the nurse to observe the IV and make sure it is running correctly. The nurse should observe frequently to check the rate of flow, and should indicate the need to slow down, speed up, or stop the infusion.

- Check the IV at least every half an hour. The tissue at the site of the inserted needle should be checked at regular intervals for signs of infiltration or inflammatory reaction.

- Maintain the correct rate of flow, ensuring that the patient is receiving the prescribed number of drops per minute in a prescribed period of time (e.g. 3,000 ml in 24 hours). The nurse must be able to calculate the number of drops per minute. Devices which help the nurse to check the number of drops per minute are available. There are electronic devices which sound an alarm when the IV solution drips too fast or too slow. If the IV stops dripping, check for kinks in the tubing, patient lying on the tubing, infiltration (swelling of the site of IV), amount of fluid left in bottle, position change, etc. If these measures do not help, the nurse should start the IV again and report the problem to her superior or physician.

- Check the position of the extremity. Change in the position of the limb can speed up, slow down or even stop the drip by moving the needle against the wall of the vein.

- Always check the solution before adding a new bottle.

- When medication is added, make sure bottles are labelled accurately giving the name of medication (e.g. ascorbic acid, B-complex, Aminophylin, Heparin, Insulin, Dopamin, Aramine, Hydro-Cortisone, Keflin, Terramycin, Ampicillin, Chloromycetin, Sodium bicarbonate, Calcium Gluconate, Potassium chloride, etc.; some are diluted with large volumes of fluid and given over a period of hours) and amount of medication.

- Support the arm while the patient is turning or changing side in bed.
- The nurse should observe the patient for complications, such as, swelling and discomfort at IV site, shortness of breath (noisy, rattling respirations), rapid respiration, rapid bounding pulse, elevated blood pressure, cough, cyanosis, circulatory overloading, pulmonary oedema, very young (infants) patients may have heart or kidney problems, pain, redness and swelling in and along the path of the vein indicating a phlebitis (inflammation of the vein), sudden malaise, sudden shock and loss of consciousness can be due to an air embolism. If any of these symptoms is observed, the IV should be stopped at once by closing the clamp. The doctor should be called to see the patient. Care should be taken to prevent further complications. In many hospitals, all IV tubings and solutions are changed at least once every 24 hours. IV sites may be changed every 48 hours to prevent this type of complication.

*Discontinuing the intravenous*
- Explain the procedure to the patient.
- Obtain the needed equipment.
- Perform the procedure smoothly and gently.
- The removal of an intravenous cannula is associated with two dangers: haemorrhage and catheter embolism. To prevent excessive bleeding, a dry sterile sponge should be held over the withdrawal site and as the cannula is removed pressure should be applied until all bleeding has stopped. Place a sterile dressing over the site. Clean the tape marks with tape remover. Make the patient comfortable and relaxed.
- Remove all equipment from the patient's unit and dispose of properly.
- Record the amount of fluid infused on the intake and output sheet or case file and also chart the procedure in nurse sheet at bedside, and/or case file.

## REFERENCES


1. Brunner et al., *Textbook of Medical Surgical Nursing* (5th edition).
2. Shafer et al., *Surgical Nursing* (7th edition). NJI