BASIC DUTIES AND PROFESSIONAL ACTIONS OF NURSE IN CHILDREN'S HOSPITAL

Manual for practical classes for 3rd-year international students of medical faculty

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

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ОСНОВНІ ОБОВ'ЯЗКИ ТА ПРОФЕСІЙНІ ДІЇ МЕДИЧНОЇ СЕСТРИ ПЕДІАТРИЧНОГО ВІДДІЛЕННЯ

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CHAPTER 1

1.1 The features of deontology in the nurse's work with children and their relatives

"***Deontology***" is a Greek origin derivative from words: *deon* – obligation and *logos* – science. The science of the duties and rights of the doctor and medical staff in relation to their patient is called deontology. Deontology may also be defined as a set of rules and principles of medical ethics. "Deontological ethics" means the theories that place special emphasis on the relationship between the duty and morality of human actions. Not only the level of the professional knowledge and skills determines the effectiveness of the treatment and caring for the sick. Any illness, especially a chronic one, a critical state of a patient's health may cause a serious psychological trauma which leads not only to a worse physical state but also to severe disorders in the psycho emotional state. All patients' thoughts are concentrated on the process of receiving an effective help as soon as possible. To gain a patient's confidence is a great progress on his way to the quickest recovery.

That is why the medical worker should possess not only such a quality as a high professionalism but also be decent, kind and responsive. The successful therapy greatly depends on the authority of the doctor. The doctor must gain the patient's confidence, show his sympathy for the patient. However, having established confiding relations with your patient, never demonstrate your confusion or helplessness. On the contrary, you should be able to reject strictly and firmly any unnecessary demands of your patient (to persuade him in the inexpediency of these demands).

The appearance of the medical staff is also of great importance, and it is quite natural that any dirty gown, hands, nails, careless clothes and hairdo are unacceptable for medical workers. Speech also plays an important part in the process of a patient's treatment – a wrong word addressed to the sick with psychic disorders may do a lot of harm.

This is the reason why no discussions of any illness progress, unfavorable complications or examination results are acceptable in the patient's presence. One should not express regret about the fact that the sick consulted a doctor too late, which the illness was neglected and is difficult to cure at present, or "comfort" the patient by saying that the present state of medicine does not have enough possibilities to treat him in the way he heeds. Do not tell the patient's relatives about an unfavorable outcome of his illness at his bedside even if he is unconscious. You should take into consideration that there are other patients in the same ward with the same diagnoses who may be very sensitive to any negative information. It is necessary to realize that ill (especially seriously ill) people "catch" every word said by the medical staff, that is why you should talk in a calm and restrained way and see that unfavorable results of examinations and case reports with diagnoses of serious (sometimes fatal) diseases were not seen by your patients; do not discuss the possible outcomes of these patients' illnesses in other wards either.

At the hospital, the doctors and nurses spend most of their time with patients. The patients confide their secrets to them. Everything the physician knows about his patient should be kept secret; otherwise, the patient will suffer moral and sometimes material loss.

This, however, does not hold for cases where keeping a secret may do harm to other people. People close to the patient should sometimes be informed of the disease so that they must strictly follow sanitary rules and that any new cases, if they are revealed, must be treated in due time. The diseases caused by negative interrelation of the medical staff and patient are called **iatrogenic** ones.

The aspects of deontology in the practice of medical workers with children and their families are still one of the most relevant problems in pediatrics at present time. At hospital, children are cared not only by the medical staff (doctors, nurses), but also by the children's relatives. The duration of the contact of the medical personnel with the sick child and his relatives may differ. Sometimes the contact can last several weeks and even months.

1.2. Basic functional duties of the nurse in the children's department

The basic duties of the nurse on duty:

1. Execution of the doctor's prescriptions in accordance with their list.
2. Exercising of sanitary state control in the wards under responsibility.
3. To control how the patients carry out hygienic measures; to be responsible for a change of the patients' clothes and bedclothes.
4. Material sampling for laboratory researches and exercising control over getting the results back.
5. Getting the necessary instruments and equipment ready for work.
6. Examining skin and scalp of the children admitted to the department, sending them in appropriate wards, and getting them know the rules of staying in the hospital.
7. Taking the patients' temperature, checking the pulse and respiratory rate and register the data in the temperature chart; measure diurnal urine discharge, carry out an anthropometry of the patients.

Prepare the sick for different examinations and transport them to diagnostic rooms. Take care of the proper medical feeding of the sick (dietetic therapy), check the food quality.

Every morning all the medical personnel gathers in the staff lounge: the persons who were on duty the previous night and those who must be on duty during the new day. The nurse on duty is not allowed to leave her post in any case without delegating her duties to the next nurse on duty. The nurse on duty must turn over her duty to another nurse on duty. The nurse who changes the previous one and the nurse who finished her duty should check the sanitary condition of the department. The nurse who turns over her duty reports about the patients' conditions, the doctors' prescriptions which she performed and about those prescriptions which need to be performed, the number of the admitted and discharged patients.

Possible reasons of deterioration in the condition of other children (a rise in their body temperature, problems with defecation, etc.) and the maximum help rendered to them are described.

Then the nurse on duty reports about all the patients who have some increase in temperature, or whose condition became worse, gives the list of those who did not hand over some analysis with the indication of the reason, possible peculiarities of giving and taking medicines.

1.3. Medical documentation. The rules of filling in and keeping the documentation. It is impossible to overemphasize the importance of keeping exact records of all treatments and medications as well as a record of the patient's behavior. The medical card is a written and legal evidence of his treatment during the hospital stay or of occurrences at home. The card reflects facts only and not judgments. Careful and accurate documentation is vital for the patient's welfare.

Careful documentation is perhaps the most important thing you can do to protect yourself against a lawsuit. If a treatment or medication was not documental legally, the procedure is not considered to have been done or the medication have been given.

There are uniform letterheads of medical documentation for prophylactic and treatment establishment activity control. Taking into account the fact that the pediatrician is the main organizer of this activity and of the medical aid provided to children under 18 years old, one must know this documentation.

The Main Documentation of the Children's Department:

1. Medical card (registration form No. 003).
2. An abstract from the hospital patient's medical card (No. 027).
3. The register of patient’s transfer.
4. The list of doctor’s prescriptions.
5. The list of temperature chart.
6. The register for pediculosis and scabies examination.
7. The register of infectious patients.

A hospital patient's medical card (case history) is the main initial medical document filled in for each patient of the in-patient department. It is a legal document; the term of its keeping is 25 years. There is also a special register, which shows the patients' transfer (the duty of the medical personnel is to write the information into it).

1.4. The keeping and calculation of drugs. There is also the order of drugs admission to a department:

- a doctor writes down the prescription to the prescription list;
- a nurse composes demands for necessary medicinal agents and hands them to the senior nurse every day;
- on this basis the senior nurse composes a special demand signed by the chief of the department and sends it to a drug store. It should be borne in mind that narcotics, poisons, and spirit are prescribed on separate demands.

The drug store hands the necessary medicinal agents on the basis of these demands.

The senior nurse checks the correspondence of the obtained medicinal agents to the demand, the presence of labels, and their correspondence to the agents' titles and dosage. The term of validity must be checked thoroughly. If the nurse has any doubts as for agents or their term of realization, the drugs are returned to the drug store. The drugs suitable for use are given by the senior nurse to the nurse on duty's post.

Liquid medicines (mixtures), decoctions, vaccines, and eye drops cannot be preserved for a long period of time; that is why they are to be kept in a fridge. Other drugs are preserved in special cupboards, which are marked and closed. There are separate shelves for agents, which are introduced intravenously, for external application, sterilized solutions, smelly substances, inflammable substances (spirit, etc.), and bandaging materials.

Drugs are to be kept in corresponding vessels: infusions and mixtures in jars of one liter and half a liter capacity, drops – in small bottles, ointments – in small jars; drugs, which are destroyed in the sunlight (iodine, bromine) are to be kept in dark vessels.

The nurse cannot change drug package herself, pour drugs from one vessel to another. It is strictly prohibited to tear the label off, cross any writings, stick non-standard labels, put different pills and powders into one pack. It is necessary to keep an eye on drugs term of validity.

Mixtures, infusion, decoctions, mucilage, and eye drops are to be preserved for not more than 2 days. The term of validity of sterilized solutions and emulsions is 3 days, of other drugs – 10 days. The term of validity of industrial drugs is 2–5 years. All liquid forms of medicinal agents, protein agents included serums, insulin, some antibiotics; ointments are to be kept in the fridge at +2–10 °C.

Small safes are used for storage of poisonous and strong medicines. Poisonous and narcotic medicinal agents are kept in a safe labeled with "**A**" letter (narcotics, atropine), and strong medicines (adrenalin, caffeine) – in a safe labeled with "**B**" letter.

The list of preserved agents, single and daily doses for different age and antidote (antipoisoned) scale are set on the inner side of the safe's door. The quantity of poisonous and narcotic agents must not exceed 5 days; the quantity of strong medicines must not exceed 10 days.

The senior nurse keeps the safe's key and the book of "A" and "B" agent groups calculation. The senior nurse conducts drugs calculation; she has the notebook of medicinal agents calculation signed by the head doctor. The book of narcotic, poisonous, and strong medicines calculation is conducted separately. This book is to be strung together, numbered, signed by the head doctor, and contains an official stamp. The senior nurse conducts calculation of narcotics used, puts in the number of the case history, the patient's name, and the quantity of drugs used.

1.5. Organization of feeding in hospital

Children are fed at hospitals by doctors' orders under a direct control of nurses. Two main principles are followed in the organization of children's feeding: individual and group. An individual diet is administered by a doctor: in this case food is cooked especially for each child; in the group principle some generally accepted diet is followed and this produces a certain therapeutic effect. The number of diet or dietary menu as well as the feeding schedule for each particular child depends upon his age and the character of his disease. The nurse should know which dietary menu each ill child is to follow and see to it.

Depending upon their diseases, older children are provided with that clinical nutrition, which is the most important component of their complex therapy. The main purpose of its administration consists in restoring functions of some affected organ and the organism as a whole. Clinical nutrition should take into account pathogenesis of the disease, its clinical picture and dynamics of its development, as well as to fully satisfy the ill child's needs in food ingredients. This is achieved by means of adaptation of the ration composition to the patient's state with help of choice of foodstuffs and ways of their cooking.

The technique of feeding children from a bottle in artificial feeding

Formula feeding is the alternative to breast feeding. When feeding, baby's head should be slightly raised, resting in the bend of your elbow, close to you. Be sure to hold the bottle so that the nipple is always full (*Fig. 1*). This will prevent the baby from swallowing too much air. Watch the level of formula and also the teat, which shouldn't flatten totally. If it does, pull it out of her mouth slightly to break the vacuum and then give it back to her. Never prop the bottle.

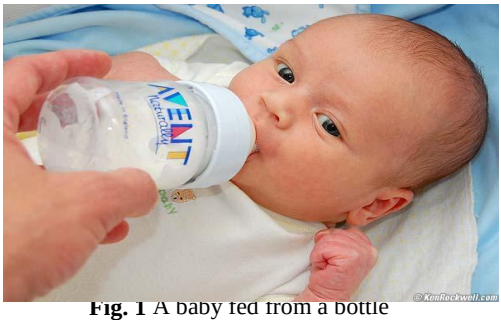


Fig. 1 A baby fed from a bottle

Steps to Prepare Infant Formula. Commercial infant formula may come in three different forms: ready-to-feed, concentrated liquid and powder. Powder formula is the most commonly used and economical form.

Wash your hands with soap and water before you begin. Wash all the bottles and equipment in hot soapy water. Rinse well with hot water.

Sterilize all bottles and equipment for baby's first three or four months of life. To sterilize: cover the containers and equipment completely with water and boil for five minutes. Cool. Remove with sterile tongs. Disposable bottle liners do not require sterilization. For older babies, everything can be washed in hot soapy water and rinsed well or cleaned in the dishwasher. Modern bottles are difficult to sterilize in boiling water because they tend to float. Bottles were originally composed of glass which was dangerous when babies learned to feed

themselves and held the bottle. Mainly for cost reasons, modern bottles are unbreakable plastic. While bottles were traditionally sterilized in the past, unless there are infant health concerns, or concerns about water contamination, the current recommendation is that baby bottle sterilization can be replaced by cleaning with hot soapy water.

Mix. Follow the mixing instructions on the label to the letter. The water for formula should be boiled for 5 min then cooled. The formula label gives directions on how much concentrated liquid or powder to add to the water. Measure exactly. If too much water is added baby will not get enough nutrients. If too little water is added baby may become dehydrated.

Before even let baby suck, make sure the formula is coming through the nipple at the right speed. If baby seems to be fussing and sucking very hard, it may not be flowing fast enough. If baby is gulping and sputtering, it's probably flowing too quickly.

You can test the flow of formula by turning the bottle upside down. You should see just a few drops come out of the nipple. If you are using a powdered formula, be sure that no lumps of powder are clogging the nipple.

Store. Prepared formula should be either fed to baby or refrigerated immediately. If baby does not finish all the formula in the bottle during a feeding, discard what is left in the bottle. Prepared bottles of formula can be stored up to 24 h in the refrigerator. The formula should never be left at room temperature for longer than 1 h. Bacteria that can make baby sick grow quickly in warm formula.

1.6 A tube feeding. Tube feeding can be initiated for a wide variety of reasons. Premature infants under the gestational age of 33 weeks have not reached the stage of development where strong sucking and swallowing patterns can support oral feedings. Some children have such severe respiratory or cardiac problems that they do not have the energy to suck and swallow. Because the respiratory system and the feeding system use the same passageway in the upper portion of the pharynx, difficulties with swallowing or breathing can cause a child to aspirate, or draw food or liquid into the lungs rather than into the esophagus. Other children may lack the neurological coordination required to organize the collection and movement of food in the mouth, and to propel it to the back of the tongue and the pharynx for swallowing. Sucking and swallowing may be very slow or very uncoordinated, and the child might be unable to take in enough calories before becoming exhausted.

A feeding tube is a thin, soft, flexible plastic tube placed through the nose (NG) or mouth (OG) into the stomach. Fluids and special feed can be given down this tube to help prevent dehydration and weight loss. These tubes are used to provide feedings and medications into the stomach until the baby can take food by mouth.

Tube feeding. When preterm or low birth weight infants are too immature or unwell to suck feeds they can receive their milk through a feeding tube passed via either the nose or the mouth (*Fig. 2*) Although tubes placed via the nose may be more stable and less prone to displace than tubes passed via the mouth, there is concern that nasal tubes will partially obstruct breathing.

Fig. 2 Orogastric tube feeding

Implementation of nasogastric tubes

1. Put on gloves.
2. Position the patient.
3. Place a protective pad/towel on the patient's chest as well as provide the patient with a basin to minimize contact with aspirated gastric contents.

a. Using the NG tube as a measuring device determine the length of the OG tube to be passed by measuring the length from: nose to earlobe or earlobe to xiphoid process;

4. Add the measurements together and mark this total distance with a small piece of tape.
5. Inspect both of the patient's nostrils for patency. Have the patient blow nose if able.
6. Lubricate the end of the lavage tube with the water-soluble lubricant or anesthetic ointment.
7. Insert the NG tube through the nostril to the oropharynx slowly and gently; direct the tube through the nostril aiming down and back. Introduce the tube until the selected mark (indicated by the tape) is reached.
8. Verify NG tube placement in the stomach by two of the following:

a. aspirating gastric contents with the irrigation syringe;

b. while listening over the epigastrum with a stethoscope quickly instill a 30cc of air with the irrigation syringe. Air entering the stomach will produce a "whooshing" sound;

c. coughing, cyanosis or choking may indicate that the NG tube has passed through the larynx.

9. If unable to positively confirm that the NG tube has been placed is in the stomach the tube must be removed immediately and re-attempted.

The disadvantages of NG feeding include nasal or esophageal irritation and discomfort (especially if used long-term); increased mucus secretion; and partial blockage of the nasal airways. Nasogastric feeding may contribute to recurrent otitis media and sinusitis. With infants, NG feeding can decrease the suck/swallow mechanism. Two additional disadvantages are the possibility that the tube will perforate the esophagus or the stomach and the possibility that the tube will enter the trachea, delivering formula into the lungs.

CHAPTER 2

Duties and actions of the nurse at the paediatric's department

2.1. Admission and registration of the patients in the hospital reception. The patient is admitted either according to the planned order (planned hospitalization – from out-patient department) or brought to hospital by an ambulance (urgent hospitalization). A sick person is admitted to hospital through the admissions department where admitting, registration, examination, sanitary treatment and transportation of patients are performed.

In the hospital reception the nurse records the title page of a medical card, which include such information as full name, age, permanent address, drug intolerance, etc.; records the information about the sick down in the hospital admission register; records the information about the sick down in the alphabetical register (surname, first name, date of birth, date of admission, department, etc).

If the sick was unconscious while being admitted to hospital the information about him is received from his relatives or people accompanying him. At the lack of documents the information about the unconscious sick is registered with the description of his appearance and this information is sent to the police immediately.

If the sick is in a grave condition, a complete emergency medical aid is provided in a treatment procedures room of the admitting office. In the case of admitting the sick under 18 without any people accompanying him (a casualty), a nurse has to inform his relatives.

After registration the sick is referred to medical examination room where a doctor examines him and identifies diagnosis. If there are some difficulties to identify diagnosis the patient is isolated and consultations with specialists are held.

If the sick has a referral to be hospitalized (according to the planned procedure from the out -patient department) the diagnosis of his illness identified by the doctor referring him is put down on the title page. If no symptoms of an illness are identified the sick is let home. This fact is written down in the register of hospitalization rejection. In some cases (if they suspect an infectious disease), according to the doctor's prescription a nurse takes a smear from the pharynx or nose. Corresponding information should be sent to the sanitary-and-epidemiologic institution; the clothes are disinfected. If the patient's condition is very serious hair is completely shaven off and burnt.

In addition, the affected child and parents need emotional support, reassurance and vigorous instruction.

2.2. Measurement and recording of patient's vital signs. Body temperature, pulse, respiration, and blood pressure (BP) are important data collected by nurses. By using these data, assessments can reflect changes in the patient's condition. Respiration and BP are called vital signs or cardinal symptoms because these measurements are indicators of vital functions that are necessary to sustain life.

Temperature, pulse, and respiration are usually observed together. It has been the practice in many acute care hospitals to require this observation at least morning and evening as a routine procedure for every patient. In some illnesses it is important to make more frequent observations of the cardinal signs. Changes in one of these signs may affect the others, which is one of the reasons for observing them at the same time. The physician will order the frequency for obtaining vital signs. The nurse, however, also may use nursing judgment in obtaining vital signs.

Elevated temperature is characterized as follows: temperature from 37.2 °C to 38 °C is called ***subfebrile***, from 38.1 °C to 39.0 ° C – ***febrile***, from 39.0 °C to 41.0 °C – ***highly febrile***, and over 41.1 °C – **hyperpyretic**. Temperature over 41 °C is dangerous to the patient's life.

Body temperature is the measure of the heat inside the body; it is the balance between heat produced and heat lost. The body responds to fever by increasing the heart rate, breathing rate and blood circulation to the skin. This is how the body tries to reduce the heat caused by fever.

The signs of an elevated temperature are easy to recognize: a flushed face, hot skin, unusually bright eyes, restlessness, and thirst. A lifeless manner and pale, cold, and clammy skin are often signs of a subnormal temperature.

Body temperature is usually lowest in the morning and highest in the late afternoon and evening. The normal temperature for newborn infants and children is usually higher than the normal adult temperature.

The following conditions can cause a fever: infectious diseases; certain medications; heat stroke; blood transfusion; disorders in the brain.

Note. Never leave child unattended while you're taking his or her temperature.

Types of Thermometers

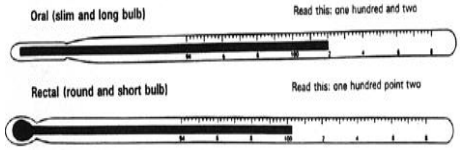


Fig. 3. Types of clinical thermometers

1. <u>Clinical thermometer</u> is a hollow glass tube, or stem, with a mercury-filled bulb on one end; the other end is sealed (*Fig. 3*). Heat expands the mercury, causing it to rise into the stem; the stem is marked off in full degrees and in 2/10 of a degree. The markings range from 33.9 °C or 34.45 °C to about 42.2 °C. The reading remains on the thermometer until you briskly shake it down. They have some disadvantages. They measure temperatures slowly and are often hard to read. If broken, they cause a mercury spill which can be harmful and difficult to clean up.

There are two types of clinical thermometer tips: thin and slender and bulb shaped.

The thermometer with the bulb-shaped tip is used for taking rectal temperature because it makes insertion safer. The slender-tipped oral thermometer is used for taking temperature by mouth.

Oral and rectal thermometers must not be used interchangeably.

2. <u>Digital electronic thermometer</u> measures temperatures with a heat sensor and require a button battery (*Fig. 4*). It measures temperature quickly, usually in less than 30 seconds. The temperature is displayed in numbers on a small screen.

Fig.4. Digital electronic thermometer

3. <u>Infrared ear (tympanic) thermometers</u> use an infrared sensor to measure the temperature of energy radiating from eardrum (*Fig. 5*)**.** In general, the eardrum temperature provides a measurement that is as accurate as the rectal temperature. The biggest advantage of this thermometer is that it measures temperatures in less than 2 seconds. It also does not require cooperation by the child and does not cause any discomfort. The tympanic thermometers may not be accurate for newborns and require careful positioning to get an accurate reading.

Fig. 5. Infrared ear thermometer

4. <u>Digital electronic pacifier thermometers</u> have a heat sensor and are powered by a button battery (*Fig. 6*). These pacifiers let measure oral temperature in younger children. It takes approximately 3 minutes to get a reading.

Fig. 6. Digital electronic pacifier thermometer

5. <u>The Temporal Scanner Thermometer</u> is a totally non-invasive system with advanced infrared technology providing maximum ease of use with quick, consistently accurate measurements (*Fig. 7*). The Temporal Scanner has patented software, providing arterial heat balance. Advanced, patented technology measures temperatures with a gentle stroke across the forehead. With a gentle stroke of the forehead it captures the naturally emitted heat from the skin over the temporal artery,

Fig. 7. The Temporal Scanner Thermometer

6. <u>Temperature strips</u> put on the forehead have been studied and have been found to be inaccurate. They do not detect an elevated temperature in most children with fever. Touching the forehead is somewhat reliable for detecting fevers over38.9°C but tends to miss mild fevers (*Fig. 8*).

Fig.8. Temperature strip

Technique of taking body temperature. The oral method is the easiest to use, and patients do not find it as uncomfortable as other sites. The oral method is not used if the patient is unconscious, delirious, or otherwise not responsible for his or her actions. This method also is not used with an infant or young child, because of the danger of injury from a broken thermometer. It is contraindicated in surgery or injury to the nose or mouth or in conditions in which

the patient must breathe through the mouth (*Fig. 9*).

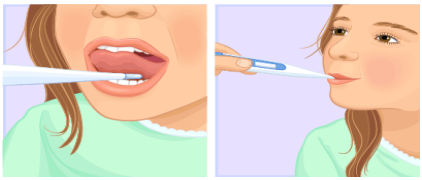


Fig.9. Taking oral temperature

1. Be sure a child has not had a cold or hot drink in the last 30 minutes.

2. If you are using a digital thermometer, turn it on.

3. Place the tip of the thermometer under one side of the tongue and toward the back.

4. Have a child hold the thermometer in place with his lips and fingers (not his teeth). He should breathe through his nose, keeping his mouth closed. If a child can't keep his mouth closed because his nose is blocked, suction out the nose.

5. Leave the digital thermometer in the mouth until you hear the correct signal (usually a series of beeps).

6. Read the temperature. Fever is an oral temperature over 99.5 °F (37.5 °C).

Fig.10. Taking an electronic pacifier temperature

How to take an electronic pacifier temperature?

1. Have a child suck on the pacifier until the temperature stops changing and you hear a beep (*Fig. 10*). This usually takes 3 to 4 minutes.

2. Read the temperature. A child has a fever if the pacifier temperature is over 37.8 °C.

How to take a rectal temperature?

The rectal temperature is the most accurate because the thermometer is placed in an enclosed cavity. It is recommended for children younger than age 6 or for anyone who cannot hold an oral thermometer in the mouth.

Rectal temperatures are always taken with unconscious or irrational patients and with infants and young children unless contraindicated. For easier insertion, a lubricated probe cover is used. The method is contraindicated in such conditions as diarrhea, rectal disease, or following rectal surgery.

1. If you are using a digital thermometer, turn it on.

2. Have a child lie belly-down across your lap or on a firm, flat surface and keep your palm along the lower back (*Fig. 11*).

Fig. 11. Taking a rectal temperature

3. Before you insert the thermometer, lubricate the end of the thermometer and the anus.

4. Insert the thermometer gently into the bottom about 1.3 cm for an infant and 3.8 cm for an adult. Gently direct the thermometer along the rectal wall toward the umbilicus. This will avoid perforating the anus or rectum or breaking the thermometer. It will also help ensure an accurate reading because the thermometer will register hemorrhoidal artery temperature instead of fecal temperature. Never try to force it past any resistance. Forcing could damage the bowel.

5. Hold a child still while the thermometer is in.

6. Take the thermometer out when you hear a series of beeps and write down the number on the screen, noting the time of day that you took the reading.

7. Clean the digital thermometer's tip with cool, soapy water, or wipe it with 70 % isopropyl alcohol. Then wipe the patient's anal area to remove any lubricant or feces.

After a thermometer has been used to take a rectal temperature, do not use it to take an oral temperature. Rectal temperature is generally higher than oral and armpit temperature. The normal rectal temperature of a child is between 36.7 °C and 37.9 °C.

How to take an armpit (axillary) temperature? Axillary (armpit) temperatures are taken only when conditions make it impossible to use any other method. The axillary temperature is the least accurate because the skin surfaces in the axillary space may not come together to form a tightly closed cavity around the thermometer tip.

1. Place the tip of the thermometer in a dry armpit (*Fig. 12*).

2. Close the armpit by holding the elbow against the chest for 4 or 5 min. Do not remove it before 4 min have passed.

3. Remove the thermometer after you hear the signal (usually a series of beeps) and read the temperature on the screen.

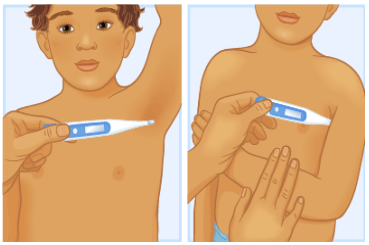


Fig.12. Taking an axillary temperature

4. The child has a fever if the armpit temperature is over 37.2 °C.

How to take temporal artery (TA) temperature? The Temporal Scanner is fast accurate, easy to use and gentle enough to be used even on a sleeping patient. The thermometer reads the infrared heat waves released by the temporal artery which runs across the forehead just below the skin.

1. Place the sensor head at the center of the forehead midway between the eyebrow and the hairline (*Fig. 13*).

2. To scan for a child's temperature, depress the scan button and keep it depressed.

3. Slowly slide the TA thermometer straight across the forehead toward the top of the ear keeping in contact with the skin.

Fig.13. Taking a temporal artery temperature

4. Stop when you reach the hairline and release the scan button.

5. Remove the thermometer from the skin and read a child's temperature on the display screen.

How to take an ear temperature (syn. tympanic)?

1. If a child has been outdoors on a cold day, he needs to be inside for 15 minutes before taking the temperature. (Earwax, ear infections, and ear tubes, however, do not interfere with acurate readings.)

2. Pull the ear backward to straighten the ear canal (*Fig. 14*).

3. Place the end of the thermometer into a child's ear canal and aim the probe toward the eye on the opposite side of the head. Then press the button. In about 2 seconds you can read the temperature.

4. A child has a fever if the ear temperature is over 38 °C.

Fig.14. Taking an ear temperature

How to take a forehead temperature?

1**.** Make sure the forehead is clean and dry.

2. Firmly apply the thermometer onto the middle of the forehead, holding it at both ends, without touching the numbers (*Fig. 15*).

3. Wait until colors stop changing, usually 15–20 sec.

4. For the correct temperature, read the green color only.

5. Disregard blue and tan colors.

6. Do not use the thermometer directly exposed to sunlight or very bright lamps.

Fig. 15. Taking a forehead temperature

Counting Respirations

Breathing should be counted for one full minute (60 sec). If the breathing is regular, it can also be counted for 30 seconds and the number multiplied by two.

1. Prepare to count respirations by keeping fingertips on the patient's pulse. (A patient who knows you are counting respirations may not breathe naturally.)

2. Count respirations for 1 full minute for an infant, holding the stethoscope at the nostrils (*Fig. 16*). Children normally have an irregular, more rapid rate.

3. Respirations can also be counted by placing a hand lightly on the patient's chest or abdomen (*Fig. 17*). Observe the rise and fall of the patient's chest. One full cycle of respiration consists of an inspiration and an expiration.

Fig. 16. Counting respirations by stethoscope in infant

Fig. 17. Counting respirations by placing a hand on the patient's chest

Assessing the pulse. The pulse is the number of heart beats per minute. Measuring the pulse can give very important information about the health of a person. Any deviation from normal heart rate can indicate a medical condition. Fast pulse may signal the presence of an infection or dehydration. In emergency situations, the pulse rate can help determine if the patient's heart is pumping. The pulse measurement has other uses as well.

Reading a pulse. Pulses are manually palpated with fingers (*Fig. 18*). To obtain a reasonably accurate resting pulse rate, make sure the person is calm and has been resting for 5 min before reading the pulse. Bear in mind that any stimulants, taken prior to the reading will affect the rate. Place fingertips of first, second and third fingers over the artery, and count the pulse beats for 1 full minute.

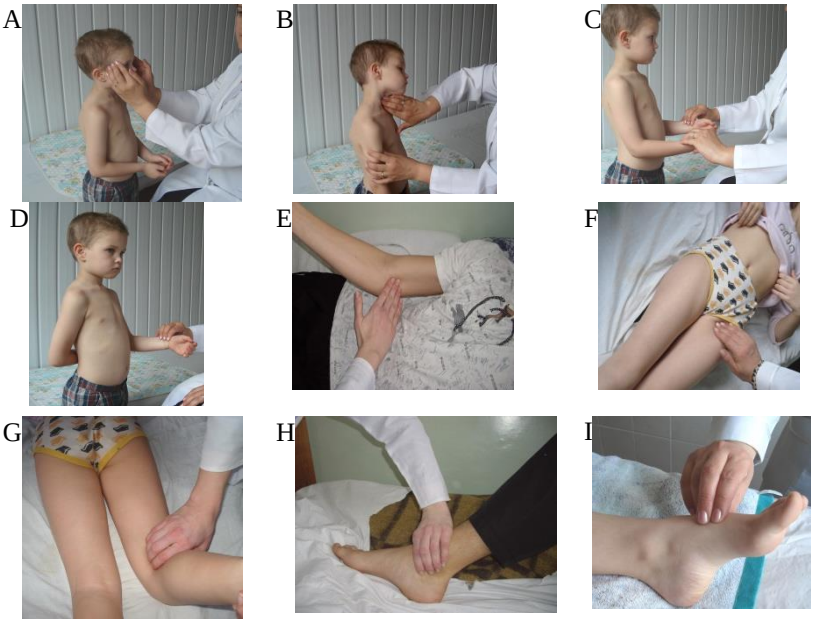


Fig. 18. Common pulse sites: A – a. temporalis. B – a. carotis. C – a. radialis on both hands. D – a. radialis on one hand. E – a. ulnaris. F – a. femoralis. G – a. poplitea. H – a. tibialis posterior. I – a. dorsalis pedis.

Normal ratio of pulse and respiration in health is **4 : 1**. The ratio is increased in primary cardiac disease and decreased in respiratory pathology.

Measuring the blood pressure (BP). Blood pressure is the force exerted on the walls of blood vessels as blood flows through them. When heart contracts, it sends a surge of blood through the blood vessels and pressure increases. This is called systolic pressure. When heart relaxes between beats, blood pressure decreases. This is diastolic pressure.

When we take the blood pressure, we measure both systolic arterial pressure (SAP) and the diastolic one (DAP), and record them as numbers. For example, if a blood pressure reading is 126/76, the systolic is – 126 and the diastolic – 76. The numbers are calculated in millimeters of mercury and recorded as 126/76 mmHg. The blood pressure varies during the day. The factors influencing the blood pressure include physical activity, medications, emotional and physical condition.

Blood pressure measurement using the sphygmomanometer. To take the blood pressure, the person should be sitting comfortably and relaxed (*Fig. 19*).

1. Position the patient's arm so the anticubital fold (inside elbow area) is level with the heart. Support the patient's arm with your arm or a bedside table.

2. Center the bladder of the cuff over the brachial artery approximately 2 cm above the anticubital fold. The arrow should line up with the artery. Proper cuff size is essential to obtain an accurate reading. Be sure the index line falls between the size marks when you apply the cuff. Position the patient's arm so it is slightly flexed at the elbow.

Fig. 19. Measuring blood pressure using the sphygmomanometer

3. Palpate the radial pulse and inflate the cuff until the pulse disappears. This is a rough estimate of the systolic pressure.

4. Place the stethoscope diaphragm over the brachial artery and the earpieces in your ears.

5. Inflate the cuff to 30 mmHg above the estimated systolic pressure and hold it there by tightening the knurled knob.

6. Release the cuff pressure slowly by turning the knurled knob just until you hear the hiss of air being released (no greater than 5 mmHg per second).

7. The level at which you consistently hear the heartbeats through the stethoscope is the systolic pressure. The needle on the gauge should also start a pulsing movement at this point. Record this value as the systolic pressure.

8. Continue to release the cuff pressure until the sounds muffle and disappear. The point at which you no longer hear sounds and the needle on the gauge stops its pulsing movement is the diastolic pressure. Record the value from the gauge.

9. Record the blood pressure as systolic over diastolic ("120/70" for example).

Table 1 lists normal ranges of pulse (heartbeats per minute), respiration (breaths per min) and blood pressure (BP) for different ages.

Table 1

Age	Pulse ranges	Respiration ranges	SAP	DAP
Newborns	140–160	40–60	70	35
6 mo	130–135	35–40	90	1/2–1/3of SAP
1 yr	120–125	30–35	90	60
2 years	110–115	30–35	92	1/2–1/3of SAP
3-4 years	105–110	30–35	95	1/2–1/3of SAP
5 years	100	25	100	1/2–1/3of SAP
6-8 years	90–95	20–25	102	1/2–1/3of SAP
10 years	80–85	20	105	1/2–1/3of SAP
above12 years	70–75	16–18	110	1/2–1/3of SAP

Blood pressure measurement using a digital monitor

Because the digital monitor is automatic, it is the most popular blood-pressure measuring device. The blood pressure measurement is easy to read, because the numbers are shown on a screen.

The digital monitor is easier to use. It has a gauge and stethoscope that is one unit, and the numbers are easy to read. It also has an error indicator, and deflation is automatic. Inflation of the cuff is either automatic or manual, depending on the model. This blood pressure monitoring device is good for hearing-impaired patients, since there is no need to listen to heart sounds through the stethoscope.

1. Put the cuff around the arm. Turn the power on, and start the machine.

2. The cuff will inflate by itself with a push of a button on the automatic models. On the semiautomatic models, the cuff is inflated by squeezing the rubber bulb. After the cuff is inflated, the automatic mechanism will slowly reduce the cuff pressure.

3. Look at the display window to see blood pressure reading. The machine will show systolic and diastolic blood pressures on the screen. Write down blood pressure, putting the systolic pressure before the diastolic pressure.

4. Press the exhaust button to release all of the air from the cuff.

To repeat the measurement, wait 2 to 3 minutes before reinflating the cuff.

● Routine blood pressure measurements in children may be performed in children beginning around age 3 years. In younger children and infants, measure the blood pressure only if the history or physical exam suggests a problem.

● As in adults, proper cuff size is essential. The bladder width should cover no more than 2/3 of the child's upper arm and the bladder length should cover approximately 3/4 of the arm circumference. A cuff that is too small will inflate the pressure reading and a large cuff will give an artificially low pressure.

● Unlike in adults, the diastolic reading in children is the point at which the sounds first become muffled rather than the point at which they disappear completely.

Sustained hypertension over several readings in children should prompt a search for its cause. In infants and young children, hypertension is most often due to a specific cause. In older children and adolescents, a specific cause is less likely to be found and may resolve by adulthood.

BP is relatively low in infants owing to the low pumping force of the heart and the greater width of the vessels, and the greater elasticity of the arterial walls.

BP values after one-year also can be calculated by the following formula:

- SAP averages *90+2n.* (Max. level – *105+2n* and Min. level – *75 + 2n);*

- DAP averages *60+n* (Max. level – *75+n* and Min. level – *45 + n),* where ***"n"*** is the child's age in years.

The sum of the pulse rate and SBP values in all periods of childhood after 1 year old is about 200.

The information about vital signs are registered into the temperature chart

2.3. The oral administration of drugs. Because oral administration is usually the safest, most convenient, and least expensive method, most drugs are administered by this route. Drugs for oral administration are available in many forms: tablets, enteric-coated tablets, capsules, syrups, elixirs, oils, liquids, suspensions, powders, and granules. Some require special preparation before administration, such as mixing with juice to make them more palatable; oils, powders, and granules most often require such preparation.

Sometimes oral drugs are prescribed in higher dosages than their parenteral equivalents because after absorption through the GI system, they are immediately broken down by the liver before they reach the systemic circulation.

The oral route is convenient and economical but has drawbacks. Some drugs have an unpleasant taste or odor; others injure the teeth or irritate the lining of the stomach. Patients who are nauseated or vomiting cannot take drugs by mouth. Digestive enzymes destroy the effectiveness of certain drugs. In some instances, patients may be uncooperative and refuse to swallow the medication. Furthermore, there is the danger of an unresponsive patient aspirating a medication into the lungs. Patients should be told if a solid medication is to be chewed or swallowed wholly.

Children are not to be given medicinal agents into hands. The nurse must be sure the child has swallowed the pill and washed it down with little frequent draughts.

As for little children, it is better to introduce peroral medicinal agents as liquids (syrups, drops). However, in case of necessity, pills may be triturated, and in order to ease swallowing and aspiration prophylaxy of respiratory tract, the obtained powder is to be dissolved in a small quantity of liquid. As for infants, it is better to divide the prescribed dose of medicinal agent into some consequent small draughts.

Sublingual administration. A sublingual (SL) drug is placed under the patient's tongue, where it dissolves and is absorbed. Some medication used for certain emergencies are given via this route. They should be placed under the tongue until they are dissolved, trying not to swallow saliva for the longest time possible. The patient must be able to understand instructions to keep the drug under the tongue and not chew or swallow it. The patient should not drink anything until the drug is absorbed.

Buccal administration. Buccal refers to the cheek or mouth. Buccal administration involves placing the medication between the cheek and gum. Actions will depend on patient's ability to self-administer the medication. If patient requires assistance, the nurse must wear gloves.

2.4. Medical care in fever. In case, when heat production corresponds to its emission, the child's skin is bright pink, with moderate or increased moisture, the extremities are warm at a touch. This fever is termed *"**pink"*** **or** ***"red"***. In this type of temperature response, the child's general state and his behaviour are usually affected to a slight degree. If this course of fever takes place, in addition to medicinal agents for temperature correction prescribed by a physician, one must provide the child with rest, humid air and drinking of a sufficient amount of fluid.

It should be remembered that *a temperature rise by one degree necessitates an additional taking of fluid at a rate of 10 ml/kg of the child's body weight*. The fluid in such forms as cooled (warm) weak tea, stewed fruit, fruit water, and rehydration solutions is to be given by small portions, taking into account the baby's state in order not to cause development of vomiting in it. For the purpose of increasing heat emission, the child should be freed of tight clothes or undressed. It is possible to lightly sponge down the child with warm (but not cold!) water and, if prescribed by a physician, give him a cool enema. If physical methods of cooling are used, one is obliged to observe the skin state, i.e. the response of skin vessels to the cold factor effect. If the infant is in a nappy, the latter must be taken off, because it covers one-third of the body surface and may affect the process of heat emission.

In case when a rise of temperature is against a background of centralization of blood circulation and spasm of skin vessels, the child develops chills, paleness, marbled skin, cyanosis of lips and extremities, headaches,

some worsening of the general state, and his extremities are cold at a touch. This is so-called ***"white fever"***, where processes of heat production increase and those of heat emission are not adequate.

The care for such children, besides attention and creation of comfortable conditions, should include such measures, which facilitate normalization of processes of heat production and emission. First of all, it is necessary to eliminate spasms of peripheral vessels. For this purpose, side by side with giving warm drinks, one should cover the child with a blanket *for a little* and apply a hot water bottle (its water temperature is 37.0–38.8 °C) to the extremities. These measures result in some dilation of skin blood vessels and improvement of heat production. A chill having been avoided and the skin colour normalized, the child is dressed as usual, according to the ambient temperature and how well he feels. If the infant perspires, its clothes should be changed for dry ones. Antipyretics and spasmolytics are given to the child as prescribed by a physician.

Hyperthermic syndrome belongs to pathological variants of fever. This is characterized by *a rapid and inadequate rise of body temperature, accompanied by disturbances of microcirculation and metabolism plus a progressively increasing dysfunction of vital organs and systems*.

Hyperthermic syndrome requires urgent aid; therefore, as soon as its first signs appear, the medical staff should immediately inform a physician about the child's state.

Particular care in a fever is necessary for infants during the first few months of their life, premature babies, as well as for cases with disturbances of the central nervous system, because their thermoregulation centre is immature and febrile cramps may develop.

Body temperature in children may decrease *critically*, that is rapidly from its high level to a low one, or *lytically*, i.e. gradually. In the former case, an infant may develop weakness, profuse perspiration, some lowering of temperature of its extremities, and a thready pulse. Hot water bottles should be put round the ill child; the latter is given sweet warm tea, and his clothes are changes for dry ones. A gradual lowering of the body temperature is accompanied by moderate weakness and skin moistening.

Diets for children with high temperatures should correspond to their age, the food being digestible and with a thin consistency. It is necessary to take into consideration the child's appetite and his ability to eat at all.

If a bed position of a feverish child is forced or passive, one should turn him in bed at day- and nighttime more frequently, smooth out creases of his bedclothes and underwear, as well as, if necessary, carry out a proper hygienic toilet.

In children, a fever that is equal to or greater than 38.5 °C should be treated. Children between the ages of 6 months and 5 years can develop seizures from a high fever (called febrile seizures). If a child does have a febrile seizure, there is a chance that the seizure may occur again, but, usually, children outgrow the febrile seizures. A febrile seizure does not mean that child has epilepsy.

There are different things that can be done to take care of a fever. Since fevers work in the body to fight off infection, medicine should only be given if needed. For example, if the oral temperature is over 39°, Acetaminophen (Tylenol) or Ibuprofen (Advil) may be given. Aspirin is dangerous for children.

When a child has a fever, he or she needs to stay well hydrated. The child should drink a lot of healthy liquids like water, milk or 100 % juices. It should be remembered that the increase of temperature on 1 °C requires introduction of liquid of 10 ml/kg of body weight.

A child with a fever should be kept comfortable and not overdressed. Overdressing can cause the temperature to rise further. If the fever is still over 40.0° 30 min after medicine is given, the child should be given a sponge bath. A sponge bath involves sponging off a child in a bathtub with a lukewarm water.

Heat removal is generally by wet cloth or pads, usually applied to the forehead, but also through bathing the body in tepid water. This is particularly important for babies, where drugs should be avoided. Tepid water (30 °C) baths may help bring down a fever. Use lukewarm water (32° to 35°). Sponge for 20 to 30 minutes. Stop if the child starts to shiver. If a child doesn't like the sponge bath or doesn't feel better after the bath, there is no need to give another one.

Never use cold water or alcohol for a sponge bath to reduce fever, because:

A. Cold water can cause vasoconstriction and shivering, which raises the central body temperature.

B. Alcohol reduces fever too rapidly and may lead to convulsions, especially in a small child.

C. Alcohol fumes are toxic.

D. Both can make the child uncomfortable.

Sponge with tepid water

A. Child may be placed in tub for sponge bath or in bed using a basin of water.

B. Use gentle friction and slowly stroke the wet washcloth over body.

C. Sponge for 12–30 minutes unless child becomes chilled.

D. Pat child dry with a towel and redress in lightweight clothing.

E. Take child's temperature immediately after discontinuing sponging and again 30 minutes later.

2.5. Giving eye, ear and nose drops

Giving eye drops. Explain to a child what you are going to do before you start.

• Describe what you are doing as you do it.

• Speak in a calm, reassuring voice.

• Praise a child when you are done.

1. If the medicine is cool, warm it to body temperature.
2. Wash you hands carefully before giving the drops.
3. Read prescription label and directions carefully.

4. If the eye has drainage or crusts, wipe the eye from outer corner to inner corner with a cotton ball and water. If both eyes are being treated, use a separate cotton ball for each eye.

5. Have a child lie down on his or her back

6. To instill eye drops, pull the lower lid down by your thumb to expose the conjunctival sac (*Fig. 20*).

7. Rest your other hand against the child's forehead and hold the dropper about 5cm from a child's eye.

8. Put prescribed number of drops inside the lower eyelid, not on the eyeball. Do not touch the dropper to the eye.

9. It can be hard to open the eyelids of infants and young children. If so, put the drop into the inner corner of the eye. When the child opens the eye, the medicine will flow into it.

10. Instruct the patient to close his eyes gently, without squeezing the lids shut. If you instilled drops, tell the patient to blink. Use a clean tissue to remove any excess solution or ointment leaking from the eye. Remember to use a fresh tissue for each eye to prevent cross-contamination.

11. Wash your hands.

To apply an ointment, squeeze a small ribbon of medication on the edge of the conjunctival sac from the inner to the outer can thus (*Fig. 21*). Avoid touching the tip of the tube to the patient's eye. Then release the eyelid, and have the patient roll his eye behind closed lids to distribute the medication

Fig. 20. Administration of eye drops

Fig. 21. Administration of eye ointments

Giving ear drops

Before using the drops, the container should be placed in the hand for a few minutes. The patient should be placed on the side opposite the affected ear. Then straighten the patient's ear canal to help the medication reach the eardrum. For an infant or a child under age 3, gently pull the auricle down and back because the ear canal is straighter at this age (*Fig. 22*). For an adult, gently pull the auricle up and back (*see Fig. 23*). Avoid pacing the dropper inside the duct. The patient must remain in the same position for a few minutes to prevent the medication from coming out. The eardrops are of individual use.

Fig. 22. Giving ear drops for an infant

Fig. 23. Giving ear drops for an adult

Giving nasal drops.

Lay child on back and tilt head back, holding arms down if possible (you may need someone to help). Gently hold baby's head with one hand and insert the dropper just inside the nares and instill the prescribed number of drops in each nares as ordered (*Fig. 24*). Elevate the nares slightly by pressing with the thumb. Try not to touch the nares with the dropper. Wash your hands. Record medication given and the patient's response.

Fig. 24. Giving nasal drops

If using a Spray**,** the patient should be sitting up. The tip of the bottle is placed just inside the nares aimed toward the midline of the nose.

Squeeze the bottle while the patient inhales (*Fig. 25*). Instruct the patient to maintain this position for approximately 5 minutes.

This position will allow the medication to maintain contact with the nasal mucosa. Teach the patient that decongestant sprays can cause increased heart rate and blood pressure and rebound nasal congestion. Frequent use can stimulate the sympathetic nervous system. Wash your hands. Record medication given and the patient's response.

Fig. 25. Using a nasal Spray

2.6. Rules of using pocket and permanent inhalers. The application of pocket **(**metered dose inhaler**)** and permanent inhalers becomes more widespread at the modern stage of treatment of sick children. At the treatment of children with respiratory disorders the inhalation introduction is not only pathogeneticaly conditioned, but it gives fast therapeutic effect thanks to the direct effect on respiratory system. It is needed to remember that respiratory function disorder in childhood leads to hypoxic disturbances fast because of immaturity of cerebral structures. Thereby the support of sufficient oxygenation for child with respiratory disorders will help to avoid complications of central nervous system. The technique of humid oxygen delivery and rules of using pocket and permanent inhalers should be known and given by every doctor.

A metered-dose inhaler (MDI) is a handheld device that delivers a measured dose of medication directly to the lungs. The medication is usually in an aerosol form. This medication is pushed out of the MDI and delivered straight to the lungs by a chemical gas propellant. These inhalers include a pressurized canister with measured doses of medication inside (*Fig. 26*). Squeezing the top of the canister converts the medication into a fine mist. Some metered-dose inhalers are breath actuated and don't require to squeeze the inhaler. Patient places lips on or near the inhaler's mouthpiece to inhale the mist.

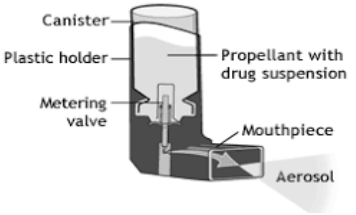


Fig. 26. The metered-dose inhaler

Rules of using pocket (metered dose inhaler) inhalers

I. Testing of inhaler. Before the first application of inhaler or after an interruption in the use more than one week take off the hubcap of cannon-bit, slightly pressing on him on each side, well shake an inhaler and do one dispersion in air, to make sure in his adequate work.

II. Using an inhaler

1. The inhaler should be shaken well before use (3 or 4 shakes).
2. Remove the cap.
3. Instruct the patient to breathe out, away from inhaler.
4. Then the patient brings the inhaler to mouth, places it in mouth between teeth and closes mouth around it.
5. Have the person start to breathe in slowly, press the top of inhaler once and keep breathing in slowly until have taken a full breath.
6. Have a patient hold breath for about 10 sec, and then exhale slowly with pursed lips.
7. If it is needed a second puff, wait 30 sec, shake inhaler again, and repeat steps 3–6.
8. Repeat for each "puff" ordered, waiting 5 min or as prescribed between puffs.
9. Store all puffers at room temperature.

A spacer is a chamber that can be attached to a metered-dose inhaler (MDI) (*Fig. 27*). The spacer chamber may have a one-way valve that allows the medication to be held in the chamber before it is inhaled. This way patient can inhale the medicine in one or many breaths, depending on his ability. A spacer is recommended for use with most inhalers, especially those that contain corticosteroids.

Fig 27. Using a spacer

Spacers also should be used by children, who may have difficulty using a metered-dose inhaler correctly. A dry powder inhaler (DPI) is not used with a spacer.

Using a steam inhalers. Steam inhalers help to relieve the symptoms of sore throat and sinus problems, coughs and colds, by warming and moisturizing the airways; loosening and softening mucous, and reducing inflammation.

In the inhaler, the medicine is crushed, warmed up and immediately allocated through the tube at the end of which there is a mouthpiece, placed to the mouth of the patient (*Fig. 28*). Duration of inhalation is 5–10 minutes.

Fig. 28. Using a steam inhalers

A patient should breathe normally and let the steam particles fully infiltrate respiratory passages. In case of inhalation, trunk and extremities of a small child are fixed; the nose is directed to the tube of the inhaler. This procedure is painless; nevertheless children are usually afraid of it and cry, that may cause mother's anxiety and refusal of inhalation.

The crying of the child is not dangerous. Besides, during his/her crying the child makes a deeper breath which promotes the penetration of medicine into the inner parts of respiratory tract. One of few contraindications of inhalation for the child of early age is stenosis of the throat (the anxiety during the procedure may result in greater edema of respiratory tract).

CHAPTER 3

The basic duties of a nurse of manipulation room of children's department

3.1 The basic duties of a nurse of manipulation room:

1. To do all doctor's prescriptions and manipulations (injections on doctor's orders).
2. Blood sampling for biochemical, serological and other investigations.
3. To help the doctor to carry out doctor's manipulations (blood transfusion, skin test, etc.).
4. To follow all instructions of aseptics and antiseptics while doing all manipulations.
5. To follow all instructions for preventing injection complications, anaphylactic shock, etc.
6. To store in good order medical equipment, instruments; to provide with sterile dressings, medicines, dropping glasses (bottles) and syringes.
7. To store medicines of group "**A**" and "**B**" in a special safe, to take their stock.
8. With the help of a senior nurse to order medicines, instruments, etc.

9. To provide the proper sanitary and antiepidemic regimen.

10. To improve professional qualification regularly.

The equipment of manipulation rooms includes:

- a table for documents;
- a couch;
- a working table for sterile dressing storage, ethyl alcohol, tweezers, tourniquets, tray sets;
- metal medical safes with glass walls for storing medicines. These medicines are used for urgent and current care;
- a refrigerator (for serum store, sets for blood groups identification, stands with clean test-tubes for blood collection);
- supports for infusion;
- a bactericidal lamp.

3.2. Introduction of medicinal agents into children. Drugs may be administered by many routes. The ***topical, or dermatomucosal*** route includes aural, ocular, nasal, and vaginal administration, oropharyngeal inhalation and transdermal absorption.

The enteral route, the most commonly used one, involves drug absorption through the GI tract. This can include oral, sublingual, buccal, feeding tube, or rectal administration.

The parenteral route includes intradermal, subcutaneous, I.M., I.V., intrathecal (into the spinal canal), and intraosseous infusions or injections. The endotracheal route involves administering a drug into the respiratory system through an endotracheal tube. The epidural route involves giving a drug (usually an anesthetic or an opioid analgesic) through a catheter inserted near the spinal cord by a lumbar puncture. The intrapleural route involves injecting a drug through the chest wall into the pleural space.

More than any other factor, the administration route determines the onset of a drug's effect. For example, drugs administered I.V. act almost instantly because they're immediately available in the bloodstream. Antibiotics, for instance, are commonly given I.V. to provoke a quick, continuous response. Other drugs must be given I.V. because they're ineffective, or even dangerous, when given by other routes.

Drugs administered intrathecally, such as spinal anesthetics, also act rapidly. Drugs administered orally must be absorbed into the bloodstream before they can take effect.

Before administering any medication, the following items should be remembered:

If the medication is to be administered several times a day, try to adjust the hours so as to respect the patient's rest. Immediately after administering the medication, put down the date, hour, quantity, and route of administration.

When medication is administered, certain safely rules, called «**Seven Rights»**, must be followed:

1. Right patient. 2. Right drug. 3. Right dose. 4. Right time. 5. Right route. 6. Right technique. 7. Right documentation.

Parenteral administration. Injection is a method of introducing liquid drugs into the tissue through a needle. The injection may be *intradermal, subcutaneous, intramuscular, or intravenous.* When an intravenous route is used, the method is usually known as an *infusion*. (Other routes such as intracardiac, intramedullar, intrathecal, intraosseous, and intraperitoneal are used only by physicians or specially trained nurses). The parenteral routes commonly used by nurses, are presented in detail information on general principles and preparation of medication.

General principles of parenteral administration. Injections are given in various ways, but the basics discussed here apply to every method.

A drug may be administered by injection for the following reasons:

- the drug is most effective when given by this route or is unavailable in any other route;
- the desired action is needed quickly;
- it is necessary to ascertain the accuracy of the dose of drug injected or retained;
- the patient is nauseated or vomiting;
- the patient's mental or physical condition renders him or her unable to swallow oral medication;
- the drug cannot be absorbed by way of the digestive system.

Injected drugs are absorbed faster than those administered orally, and they are absorbed even more quickly as the routes move from the tissues to the bloodstream. The faster method is generally the intravenous one, with the exception of intracardiac injection (directly into the heart), which is used in emergencies and administered by a physician.

An injection may be momentarily painful when the needle pierces the skin because pain receptors are located there. Deeper insertion of the needle does not mean greater pain. Injecting the solution fairly slowly distributes it more evenly in the tissues and prevents painful pressure. The needle should be inserted and removed *quickly,* however. Gently massaging the area after the needle is withdrawn speeds absorption and helps relieve discomfort.

The nurse should not be afraid to give an injection, but it is important to realize that possible dangers *do* exist. The injection may enter a blood vessel, in which case the drug could be absorbed too rapidly and cause damage. Paralysis or nerve damage, as well as scar formation, necrosis, and sloughing of the tissues, embolism, and abscess or cyst formation may also result.

Syringes. Measurements are stamped on the barrel of the syringe (*Fig. 29*). Milliliters are subdivided into tenths. A subcutaneous or intramuscular injection is usually given with a 2- to 3-ml syringe. Special syringes are used for tuberculin and other intradermal skin tests and for insulin injections.

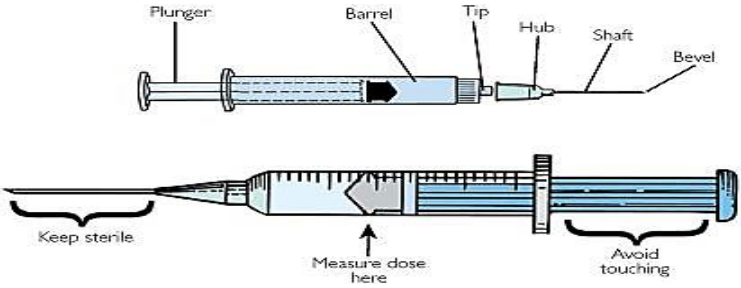


Fig. 29 Parts of needle and syringe

Syringes are disposable. In one type, the entire unit is discarded after one use. In another type, the medication is premeasured in a disposable cartridge-needle unit that is damped in a nondisposable holder. Disposable systems are used to prevent cross-contamination. Do not touch the inside or the tip of the barrel or the shaft of the needle. Touching any of these areas could contaminate the injection setup and could cause an infection in the patient).

The needle. Needles are made of stainless steel and are disposable. The needle is hollow (the **lumen);** the part attached to the syringe is called the **hub** or hilt (*see Fig. 29*). The needle has a sharp point and a beveled (slanted) edge, so that it can be inserted easily and with minimum discomfort to the patient. Always inspect a needle before giving an injection to be sure that the point is perfect; a dull or damaged needle should never be used. Be sure the needle is firmly attached to the syringe.

The length and gauge of the needle chosen depend on the type of medication given, the route, the site of injection, and the patient's weight. Needle lengths vary from $^{1}/_{2}$ inch to 5 inches. The gauge (diameter) of the needle varies from 14 to 28. Smaller gauge numbers indicate larger outer diameters. Inner diameter depends on both gauge and wall thickness. For example, a tuberculin test is given with a short, fine needle about $^{1}/_{2}$ to $^{3}/_{4}$ inches long, 25 gauge. An intramuscular injection is given with a larger needle**,** about 1 $^{1}/_{2}$ to 2 inches long. The gauge depends on the viscosity (thickness) of the medication (20–22 gauge is usual). The length depends on the patient's size. The administration of blood requires a larger gauge needle.

Note*! Always inspect the needle before performing the injection. Do not use the needle if the tip is bent, curved or you can see spurs. This rarely occurs but should always be checked.*

Needleless systems are available for use with an I.V. setup. This syringe has a plastic tip which can be inserted into a special port.

The *safely syringe is* becoming more popular. It has a plastic sheath which is pulled down after a medication is drawn up, to protect the needle. After the injection has been given, this sheath is pulled out, twisted and locked into place. This precludes recapping needles and prevents needle sticks to nurses and other personnel.

An insulin syringe. Insulin, a drug used to control diabetes mellitus, must be given subcutaneously; it cannot be given by mouth because digestive enzymes destroy it. The physician prescribes the dosage, according to the needs of the patient, and adjusts it if necessary. The needle is short and thin and covered with a fine layer of silicone to allow it to pass through the skin easily. A cap covers and protects the needle before it is used. The barrel is the long, thin chamber that holds the insulin. The barrel is marked with lines to measure the number of insulin units. The plunger is a long, thin rod that fits snugly inside the barrel of the syringe. It easily slides up and down to push the insulin out through the needle. The plunger has a rubber seal on the end that is inside the barrel, to prevent leakage. To measure the required amount of insulin, you move the rubber seal until it matches the correct line on the barrel.

Some people inject the insulin with a syringe that delivers insulin just under the skin. Others use insulin pens, jet injectors**,** or insulin pumps.

Insulin pens look like pens with cartridges - but the cartridges are filled with insulin. They can be used instead of needles for giving insulin injections. Some pens use replaceable cartridges of insulin; other models are totally disposable after the pre-filled cartridge is empty. A fine short needle, like the needle on an insulin syringe, is on the tip of the pen. Users turn a dial to select the desired dose of insulin and press a plunger on the end to deliver the insulin just under the skin.

Insulin Jet Injector may be an option for people who do not want to use needles. These devices use high pressure air to send a find spray of insulin through the skin. Jet injectors have no needles (*Fig. 30*).

An insulin pump is an external device that continuously delivers rapid-acting insulin to patient's body through a tiny tube placed under the skin. About the size of a cell phone, it can be hidden under clothing or worn on a waistband. The patient programs the pump to dispense the necessary amount of insulin.

Fig. 30. Jet Injector

The insulin pump is a small electronic device (worn externally) that continuously delivers rapid-acting insulin subcutaneously.

Insulin pumps contain a 3 ml cartridge/syringe attached to a thin, long (60–100 cm) tube with a needle or Teflon catheter on the end (*Fig. 31*). The

needle/catheter is inserted into the subcutaneous tissue usually in the abdomen and changed every 3 days. The pump is about the size of a pager and is designed to closely mimic the functioning of a normal pancreas. It is worn in a pocket or on a belt. A key benefit of an insulin pump is that it can help people with diabetes gain tighter control of blood glucose levels without increasing the risk of hypoglycaemia.

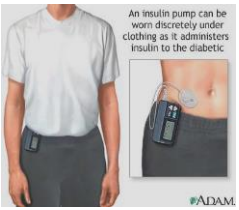


Fig. 31. The insulin pump

Preparing medications for administration by injection. Drugs that are given by injection are packaged in many ways. Some are dispensed as powders because they would deteriorate in a solution. They are diluted, immediately before use, with the solution (sterile water or normal saline) suggested by the manufacturer. If the drug will remain stable in a solution, it is dispensed in an ampule, a vial. There are single dose ampules and single and multidose vials.

An *ampule* is a glass container that holds a single dose of medication. Because there is no way to prevent contamination of an open ampule, any unused medication must be discarded. A vial is a glass container with a self-sealing stopper. Because of this self-sealing stopper, vials can contain more than one dose of a medication.

Drawing up medication from an ampule or vial

Step 1. Wash hands.

Step 2. Gather equipment. Check any inconsistency with physician.

Step 3. Unlock medication card or drawer. Check expiration date on medication.

AMPULE (*Fig. 32*, st 4–7).

Step 4. Hold ampule upright. Use finger to tap on stem of ampule or hold ampule by the stem and rotate hand in a circular motion. All medication in the ampule should be in the lower part prior to snapping off the stem.

Step 5. Grasp the stem with alcohol swab or gauze pad. Pad protects the nurse's finger from glass particles when stem is removed.

Step 6. Snap off neck of ampule away from your hands and face.

Step 7. Remove cap and insert needle into ampule. Certain agencies may recommend use of a filter needle. Withdraw the medication. Avoid touching rim of ampule with needle and injecting any air into ampule. Use one of the following methods:

7a. Keeping ampule *upright* on a flat surface, insert needle into solution and aspirate medication into syringe.

7b. Invert the ampule, insert needle into the solution and aspirate medication into syringe. Keeping the needle in the solution prevents aspiration of air. Touching the sterile needle against the ampule rim contaminates the needle. There is no need to inject air into ampule because contents are not under pressure.

Step 4. Tapping the stem of an ampule

Step 6. Snapping off the neck of an ampule

Step 7a. Keeping an ampule upright when withdrawing medication

Step 7b. Inverting an ampule to withdraw medication

Fig. 32. Steps for drawing up medication from an ampule

Step 8. Remove needle from solution in ampule. Hold needle upright and discard any air that has been with drawn into syringe. Discard any excess medication into plastic cup or sink. Checking amount of medication withdrawn from ampule ensures that correct dose is administered)

Step 9. Change needle if necessary, recap the needle, or pull the safety sheath over the needle. Do not lock the safety sheath. Cap maintains sterility of needle.

Step 10. Discard used ampule in sharps container. Proper disposal prevents accidental injury.

VIAL

Step 11. Remove metal or plastic cover from vial and cleanse the rubber port with alcohol swab. Cap and cleansing with alcohol swab decrease the possibility of introducing contaminants into the vial.

Step 12. Remove needle cap and add amount equal to amount of medication that will be drawn from vial.

Step 13. Insert needle through center of rubber stopper and inject air into vial keeping the needle (Fig 40). Air should be injected into a space, rather than bubbled through solution so accurate dose is withdrawn into syringe.

Step 14. Invert the vial. Steady vial and syringe in nondominant hand at eye level. Brace little finger against plunger. Holding vial and syringe securely prevents contamination of the medication. The plunger is held in case negative pressure already exists in the vial. This could force the plunger out.

Step 15. Move needle into solution. Medication rather than air will be aspirated.

Step 16. Use dominant hand to pull back on plunger of syringe. Withdraw accurate dose into syringe (*Fig. 33*)**.** Remove needle from vial. Positive pressure in vial promotes easy aspiration of fluid into syringe.

Step 13. Adding air to the vial

Step 16. Withdrawing medication from a vial

Fig. 33. Steps for drawing up medication from a vial

Step 17. Hold needle upright and recheck syringe contents for presence of air. Tap barrel of syringe to move air bubbles upward prior to expelling them. Reinsert needle into solution if it is necessary to withdraw any additional medication. Removing air bubbles ensures that accurate amount of medication was withdrawn.

Step 18. Change needle if necessary, recap the needle, or pull safety sheath over needle. Do not lock. Cap maintains sterility of needle.

Step 19. Discard used single dose via or store multidose vial according to agency policy. Proper disposal prevents transmission of organisms.

Step 20. Wash hands. **Step 21**. Always wear gloves when administering injections.

Administering an intradermal injection. An **intradermal** injection is a shallow injection, just beneath the epidermis (*Fig. 34*). These injections are usually performed for diagnostic purposes. A tuberculin syringe with a 25- to 26-gauge needle is used. The inner aspect of the lower arm is a common site for intradermal injections.

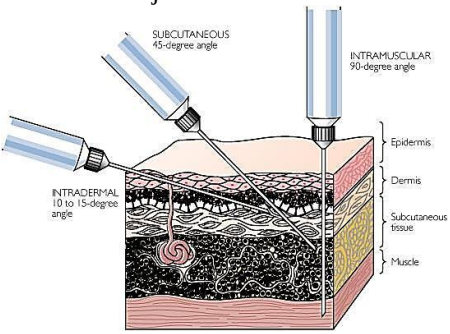


Fig. 34**.** Comparison of the angles of insertion of IM (90°), SubQ (45°), and ID (15°) injections. A SubQ may be given at 90° angle if a short needle is used or if the patient is overweight.

Giving an intradermal injection

Nursing Skill

Step 1. Assemble equipment and check physician's order. The right medication must be given to the right patient.

Step 2. Wash your hands. Wear gloves. Set up medication following safety guidelines. This prevents contamination and decreases the possibility of medication error. Gloves are worn because the patient's skin will be pierced.

Step 3. Explain to the patient what you are going to do and why. This decreases the patient's anxiety and helps increase the patient's cooperation.

Step 4. Choose an injection site on the inner aspect of the forearm that is not heavily pigmented or covered with hair and cleanse the site with an alcohol pad in a circular motion and moving outward from the injection site. Allow skin to dry. Upper chest or upper back beneath the scapulae also are sites for intradermal injections.

Step 5. Uncap the needle (usually 26- or 27-gauge needle) by pulling it straight off and use your nondominant hand to spread skin taut over injection site. Firmer skin makes it easier to access intradermal tissue but not subcutaneous tissue).

Step 6. Place needle almost flat against patient's skin, bevel up, at a 10- to 15° angle and insert it just until the bevel is no longer visible (*Fig. 35*).

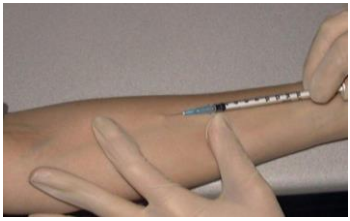


Fig. 35. Giving an intradermal injection

Step 7. Slowly inject the medication (solution quantity for injection is 0.2–0.3 ml or less). Watch for a small blister or wheal to be appear. If none appears, withdraw needle slightly. This indicates that the medication is correctly placed. Intradermal sites can tolerate only small amounts of medication.

Step 8. Withdraw the needle quickly and at the same angle at which it was inserted. This minimizes damage to the tissues. There must be no blood when the needle is removed.

Step 9. Do not massage the site after removing needle. This could displace the medication and give false readings to a test.)

Step 10. Discard the needle and syringe in the appropriate receptacle. Lock the safety sheath in place. Do not recap the needle. (This decreases the possibility of injury from a needle stick or infection.)

Step 11. Remove gloves, properly dispose of them and wash your hands.

Step 12. Record the medication given, the site, and the patient's response. Note when test results should be assessed in the chart. Occasionally, the site is circled with pen. Test results can be false if not read at the appropriate time. Marking the site can allow careful observation of the correct area, especially if controls are used.

If the test is given to determine sensitivity, the injection site is checked at 48 and 72 h. The evaluation of the injection site is based on induration (a hardness) and, to a lesser extent, on erythema. Controls may be given, along with the desired test material (such as tuberculin). This ensures the person is producing antibodies.

Administering a subcutaneous injection

In **subcutaneous** injection. ("SubQ"), a small amount of a drug is injected into the subcutaneous tissue. This method is used to give drugs that are soluble and nonirritating, such as insulin. A subcutaneous injection is given in an area where bones and blood vessels are not near the surface, commonly the upper part of the arms and the thighs.

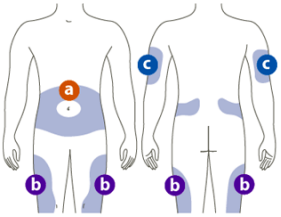


Fig. 36. Recommended sites for subcutaneous injection

For the occasional subcutaneous injection, the arm is the most convenient site. If a patient is having injections regularly, a different location is chosen each time; for example, use the right arm, then the left arm, then the right thigh, then the left thigh. The abdomen is also an area frequently used for injections; the back may also be used (*Fig. 36*). Recommendations as to angle of administration and length of needle vary. The nurse must assess the patient's body mass and use judgment for each patient.

An undernourished or emaciated patient has less subcutaneous tissue than a stouter person; a 1.1 cm needle is used. The solution is usually injected at a 45°, but it may be necessary to increase this angle slightly. In a very heavy person, a 90° is used because a short needle may not reach the subcutaneous tissue. Using a needle that is too long can cause damage by hitting a bone or a nerve; a 25-gauge needle is commonly used. Actions in giving a subcutaneous injection are given bellow.

Giving a subcutaneous injection (*Fig. 37*)

Nursing Skill

Step 1. Assemble equipment and check physician's order. Explain procedure to patient. Check any inconsistency with physician.

Step 2. Wash hands.

Step 3. Prepare medication. If necessary, withdraw from ampule or vial.

Step 4. Add air to syringe according to agency policy. For a heparin injection, 0.1 mL of air is generally recommended to clear the medication from the needle.

Step 6. Identify the patient before giving the medication. Medication may be administered to the wrong patient if identity is not established.

Step 7. Put on gloves.

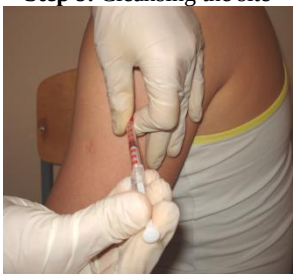
Step 8. Have patient assume a position appropriate for the most commonly used sites. Select appropriate site using anatomic landmarks. Locate site of choice

(outer aspect of upper arm, abdomen, anterior aspect of thigh, upper back, upper ventral or dorsogluteal area). Ensure that area is not tender and is free of lumps or nodules. Correct identification of site decreases the risk of injury.

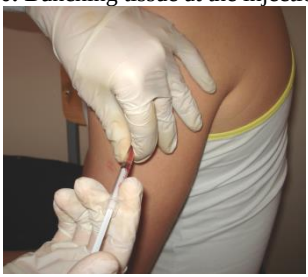
Step 9. Clean area around injection site with an alcohol swab. Use a firm circular motion while moving outward from the injection site. Allow area to dry. Place alcohol swab on a clean, nearby surface. Cleansing injection site with antiseptic prepares the site for the injection.

Step 9. Cleansing the site

Step10. Bunching tissue at the injection site



Step 14. Aspirating for blood



Step15. Injecting the medication

Fig. 37. Steps for giving a subcutaneous injection

Step 10. Remove needle cap or retract sheath. Use nondominant hand to grasp and bunch area surrounding injection site or spread skin at site. Size of patient determines method of preparation of site. Skin that is spread taut facilitates needle entry. Bunching the area, if patient has excess tissue, may be necessary to ensure that needle is placed in subcutaneous tissue.

Step 11. Hold syringe in dominant hand between thumb and forefinger (like a pencil or dart). This position prevents accidental loss of medication while inserting needle.

Step 12. Insert needle quickly at correct angle, depending on amount and turgor of tissue and length of needle. Quick entry of needle is less painful. Correct angle delivers medication to subcutaneous tissue.

Step13. After needle is in place, release tissue. If you have a large skin fold pinched up, ensure that the needle stays in place as the skin is released. Immediately move your nondominant hand to steady the lower end of the

syringe. Slide your dominant hand to the tip of the barrel. This prevents movement of the syringe, which can be painful for the patient.

Step 14. Aspirate, if recommended, by pulling back gently on syringe plunger to determine whether needle is in the blood vessel. If blood appears, the needle should be withdrawn, the medication syringe and needle discarded, and a new syringe with medication prepared. Do not aspirate when giving insulin or heparin. (Heparin is not aspirated because of its anticoagulant activity.

Step 15. If no blood appears, inject the medication at a slow and steady rate. Rapid injection may be painful for the patient.

Step 16. Remove needle quickly at the same angle it was inserted. Slow withdrawal of needle may be uncomfortable for the patient.

Step 17. Massage area gently with alcohol swab unless contraindicated for specific medication. Do not massage a subcutaneous heparin or insulin injection site.

Step 18. Do not recap used needle. Place uncapped needle and syringe in appropriate container. If using safety syringe, pull sheath over the needle, and twist until it locks into place. Most accidental needle sticks occur while recapping needle. Proper disposal prevents injury.

Step19. Assist patient to return to position of comfort. Remove gloves and wash hands.

Step 20. Record medication administration on the appropriate form. Indicate subcutaneous site that was used. Documentation provides coordination of care. Rotation of sites prevents injury to subcutaneous tissue.

Step 21. Check on patient response to medication within appropriate period of time. Drugs administered parenterally have a more rapid response.

Step 22. Remove gloves, properly dispose of them and wash your hands.

Administering an intramuscular injection. In intramuscular (IM) injection, a drug is injected into the muscle beneath the subcutaneos tissue. This method is used when giving irritating drugs or large amounts of a drug because deep muscle tissue has fewer nerve fibers. In addition, larger doses can be given intramuscularly. Absorption of the drug is faster because muscle tissue has a great number of blood vessels. The injection is given in much the same way as a subcutaneous injection, except that a longer needle is used and the drug is injected into muscles, instead of into tissues directly beneath the skin. Most often a $1\ ^{1}/_{2}$ to 2-inch, 20- to 22-gauge needle is used depending on the type of medication. Intramuscular injections are more difficult and dangerous to give than subcutaneous injections for several reasons. The needle must penetrate thick muscles. The possibility of striking bones, large nerves, and blood vessels is greater when a longer, larger needle is used. Paralysis or nerve damage can result from injecting in an incorrect site.

Injection sites. Intramuscular injections are usually given in the thick gluteal muscles of the buttocks, although small injections may be given in the side of the thigh in the vastus lateralis muscle (part of the quadriceps femoris) or in the outer part of the upper arm in the deltoid muscle. Any intramuscular injection must be given into healthy muscle tissue for proper absorption to occur. If a patient requires intramuscular injections frequently, the sites should be rotated, and a notation of the site used each time should be made on the patient's chart. The rotation of injection sites is particularly important in the diabetic patient.

Giving an intramuscular injection (*Fig. 38*)

Nursing Skill

Step 1. Perform hand hygiene.

Step 2. Assemble equipment and check physician's order. Check any inconsistency with physician.

Step 3. Prepare medication. If necessary, withdraw from ampule or vial.

Step 4. Explain procedure to patient.

Step 5. Identify the patient before giving the medication. There are three ways to do this:

a) check the name on the patient's identification badge;

b) ask the patient his or her name;

c) verify the patient's identification with a staff member who knows the patient.

Step 6. Have patient assume a position for the site selected. Locate site of choice and ensure that the area is not tender and is free of lumps or nodules.

– **Ventrogluteal** (side hip) – patient may lie on back or side with hip and knee flexed.

– **Vastus lateralis** (side thigh) – patient may lie on the back or may assume a sitting position.

– **Deltoid** (upper arm) – patient may sit or lie with arm relaxed.

– **Dorsogluteal** (back of hip) – patient may lie prone with toes pointing inward or on side with upper leg flexed and placed in front of lower leg.

PEDIATRIC ALERT. For infants and children, the vastus lateralis muscle of the thigh is used most often because it's usually the best developed and contains no large nerves or blood vessels, minimizing the risk of serious injury. The dorsogluteal site should not be use in infant under 3 years because the gluteal muscles are not well developed yet.

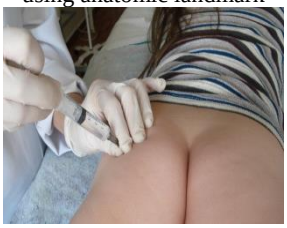
Step 7. Put on gloves.

Step 8. Select appropriate site using anatomic landmarks.

Step 9. Cleanse area thoroughly with an alcohol swab, using friction. Start at site and move outward with a circular motion. Allow area to dry. Place alcohol swab on a clean, nearby surface or hold between fingers of nondominant hand. Cleansing injection site with antiseptic prepares the site for the injection.

Step 8. Selecting the appropriate site using anatomic landmark

Step 12. Inserting the needle



Step 13. Aspirating for blood

Step14. Intramuscular injection of solution

Fig.38. Steps for giving intramuscular injections

Step 10. Remove needle cap by pulling it straight off. Use nondominant hand to spread tissue at injection site. Skin that is spread taut facilitates needle entry.

Step 11. Hold syringe in your dominant hand between thumb and forefinger (like a pencil or dart). This position keeps finger off plunger, preventing accidental loss of medication while inserting needle. As soon as needle is in place, release skin and move your nondominant hand to hold lower end of syringe. Slide your dominant hand to tip of barrel. This prevents movement of the syringe, which can be painful for the patient.

Step 12. Quickly insert needle into the tissue at 90º angel. Insertion is less painful and enters muscle tissue.

Step 13. Aspirate slowly (for at least 5 seconds), pulling back on plunger with dominant hand to determine whether the needle is in a blood vessel. If blood is aspirated, discard needle, syringe and inject in another site. A blood return indicates intravenous placement of needle. Medication becomes contaminated by blood and must be redrawn.

Step 14. If no blood is aspirated, inject solution slowly (10 seconds per ml of medication). Rapid injection may be painful for the patient.

Step 15. Use nondominant hand to spread skin around needle entry site**.** Remove the needle quickly at the same angle it was inserted. Slow withdrawal of needle may be uncomfortable for the patient. Taut skin provides for easier removal of needle. Apply gentle pressure at site with small sponge. Massaging the site promotes absorption of the medication and increases patient comfort.

Step 16. Do not recap used needle. Place uncapped needle and syringe in appropriate container. Most accidental needle sticks occur while recapping needle. Proper disposal prevents injury.

Step 17. Assist patient to return to a position of comfort.

Step 18. Remove gloves and wash hands.

Step 19. Record medication administration on the appropriate form. Indicate intramuscular site that was used.

Step 20. Check on patient response to medication within appropriate period of time.

Intravenous Injection. A drug may be injected *intravenously* (IV), directly into a vein (given intravenously, to obtain the needed effect quickly or when it is impossible to inject the drug into other tissues. A large quantity of solution is given by *infusion,* that is, the solution flows into the patient's vein with the aid of gravity or an infusion pump. The starting of an intravenous injection *(venipuncture)* requires technical skill and usually must be done by a physician or registered nurse. Intravenous infusion is commonly give for dehydration and excessive loss of blood, to dilute poisons in the blood and other body fluids, or to provide electrolytes, drugs, and nutrients. If blood is given, this method is called a **transfusion.** Drugs are not added to a blood transfusion.

Intravenous infusion is widely used. You will not be responsible for starting an infusion, but you should know how to care for a patient who is having this treatment. Usually, a plastic catheter is inserted into a vein. Attached to it is a length of tubing connected to a plastic bag containing the prescribed solution. A clamp on the tubing regulates the flow of fluid. In many hospitals, an electronic infusion pump is used to regulate the drip rate of the intravenous infusion. In some situations when the fluid is being infused into an arm vein, the arm may be immobilized. This is less common with a catheter than with a needle in the vein.

Many drugs, including antibiotics, electrolytes, and vitamins, are commonly added to an intravenous infusion. Most hospital pharmacies add the drugs ordered by the physician to the intravenous solution. Medications may be added to intravenous solutions in a laminar flow hood, which reduces the risk of contamination. Because of the growing number of drugs administered intravenously and the dangers of drug incompatibilities, having the pharmacy personnel prepare the solutions reduces the chances of dangerous drug or electrolyte combinations and of errors in mixing medications.

Giving intravenous injection

Nursing skill

Step 1. Perform hand hygiene.

Step 2. Assemble equipment and check physician’s order. Check any inconsistency with physician.

Step 3. Prepare medication. If necessary, withdraw from ampule or vial.

Step 4. Explain procedure to patient.

Step 5. Select the largest vein suitable for an injection. The larger the vein, the more diluted the drug will become, minimizing vascular irritation.

Step 5. Apply a tourniquet above the injection site to distend the vein.

Step 6. Clean the injection site with an alcohol pad, working outward from the puncture site in a circular motion to prevent recontamination with skin bacteria.

Step 7. If you're using the drug syringe's needle, insert it into the vein at a 30-degree angle with the bevel up. The bevel should reach 0.6 cm into the vein (*Fig. 39*). If you're using a winged-tip needle, insert the needle (bevel up), tape the butterfly wings in place when you see blood return in the tubing, and attach the syringe containing the medication.

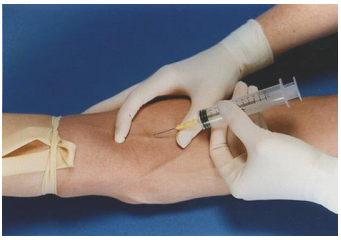


Fig. 39. Inserting a needle

Step 8. Pull back on the syringe plunger, and check for blood backflow, which indicates that the needle is in the vein.

Step 9. Remove the tourniquet and inject the medication at the appropriate rate.

Step 10. Pull back slightly on the syringe plunger and check for blood backflow again. If blood appears, this indicates that the needle remained in place and all the injected medication entered the vein.

Step 11. Flush the line with the normal saline solution from the second syringe to ensure delivery of all the medication.

Step 12. Withdraw the needle and apply pressure to the injection site with a sterile gauze pad for at least 3 min to prevent hematoma formation.

Step 13. Apply the adhesive bandage to the site after bleeding has stopped.

3.3. Drug dosage calculation and administration. Accurate calculating of drugs is vital in Nursing. Nurses must know how to calculate required dosages accurately and efficiently. This requires some basic mathematics: addition, subtraction, multiplication and division. The difficulty of the calculation is what to do and when to do it.

Pediatric calculations. Accurate doses are especially important in giving medications to infants and children because even small errors can be dangerous due to their small body size.

Two methods are used to calculate pediatric dosages:

I. According to the weight in kilograms (kg).

II. According to the child's body surface area (BSA).

I. Calculations based on body weight

The first step is to measure the child's body weight in kg.

The second step is to calculate the medication dose:

a. calculate the daily dose;

b. divide the daily dose by the number of doses to be administered;

c. use either the ratio-proportion or formula method to calculate the number of tablets/ capsules or volume to be administered with each dose.

Example: A child weighing 34.5 kg is ordered to receive 150 mg of Clindamycin q6h. The pediatric drug handbook states the recommended dose is 8–20 mg/kg/day in four divided doses. The Clindamycin is supplied in 100 mg scored tablets.

Step 1. What is the safe total daily dose?

Minimum: 8 mg/kg/day × 34.5 kg = 276 mg/day

Maximum: 20 mg/kg/day × 34.5 kg = 690 mg/day

Step 2. Is this a safe dose?

150 mg/dose × 4 doses/day = 600 mg/day

Yes, this is within the recommended safe range.

Step 3. Calculate the number of tablets to give.

100 mg:1 tablet =150 mg : *x*

100 *x* = 150 *x* = 1.5 tablets

II. Calculations based on body surface area (BSA)

BSA is determined from a nomogram using the child's height and weight.

When you know the child's BSA the dosage is determined by multiplying the BSA by the recommended dose.To determine whether the dose is safe, compare the ordered dose and the calculation based upon the BSA. The formula for calculating child's dosage is

$$\frac{\text{Child's BSA}}{1.7\,\text{m}^2} \times \text{Adult Dosage}$$

3.4. The technique of performing intravenous infusions

Intravenous infusions (an intravenous drip**)** is the continuous infusion of fluids, with or without medications, through an IV access device. This may be to correct dehydration or an electrolyte imbalance, to deliver medications, or for blood transfusion.Intravenous fluids must always be sterile.

Giving intravenous infusion

Step 1. Gather equipment and bring to patient's bedside. Check medication order against physician's order. Check a drug resource to clarify if medication needs to be diluted before administration.

Step 2. Explain procedure to patient.

Step 3. Perform hand hygiene. Put on gloves.

Step 4. Prepare IV solution and tubing:

a. maintain aseptic technique when opening sterile packages and IV solution;

b. clamp tubing, uncap spike, and insert into entry site on bag as manufacturer directs;

c. squeeze drip chamber and allow it to fill at least half way;

d. remove cap at end of tubing , release clamp, and allow fluid to move through tubing. Allow fluid to flow until all air bubbles have disappeared. Closed clamp and recap end of tubing, maintaining sterility of setup;

e. apply label if medication was added to container. (Pharmacy may have added medication and applied label.)

Step 5. Assist patient to a comfortable position. Place protective towel or pad under patient's arm.

Step 6. Select appropriate site and palpate accessible veins.

Step 7. Apply tourniquet to obstruct venous blood flow and distend vein. Direct tourniquet ends away from entry site. Check to be sure radial pulse is still present.

Step 8. Ask patient to open and close his or her fist. Observe and palpate for a suitable vein. Try the following techniques if vein cannot be felt:

a) release tourniquet and have patient lower his or her arm below the level of the heart to fill the veins.

b) reapply tourniquet and gently tap over the intended vein to help distend it.

Step 9. Don clean gloves.

Step 10. Cleanse the entry site with an antiseptic solution (alcohol swab) followed by antimicrobial solution (povidone iodine) according to agency policy. Use a circular motion to move from the center outward for several inches.

Step 11. Use the nondominant hand, placed below entry site, to hold skin taut against vein. Avoid touching prepared site.

Step 12. Enter skin gently with catheter held by the hub in the dominant hand, bevel side up, at a 10- to 30º angle. Catheter may be inserted from either directly over vein or from side of vein. While following the course of the vein, advance needle or catheter into vein. A sensation of "give" can be felt when needle enters vein.

Step 13. When blood returns through lumen of needle or flashback chamber of catheter, advance either device ½ to ¼ inch farther into vein. A catheter needs to be advanced until the hub is at the venipuncture site, but the exact technique depends on the type of device used.

Step 14. Release tourniquet. Quickly remove protective cap from IV tubing and attach tubing to catheter or needle. Stabilize catheter or needle with nondominant hand.

Step 15. Start solution flow promptly by releasing the clamp on the tubing. Examine the tissue around entry site for signs of infiltration.

Step 16. Secure the catheter with narrow nonallergenic tape placed sticky side up under hub and crossed over the top of the hub.

Step 17. Place sterile dressing over venipuncture site. Agency policy may direct nurse to use gauze dressing or transparent dressing. Apply tape to dressing if necessary. Loop tubing near site and anchor to dressing.

Step 18. Mark date, time, site, and size of catheter used for infusion on the tape. Anchor tubing.

Step 19. Anchor arm to an armboard for support, if necessary, or apply site protector or tube-shaped mesh netting over insertion site.

Step 20. Adjust rate of solution flow according to amount prescribed or follow manufacturer's directions for adjusting the flow rate infusion pump.

Step 21. Remove all equipment and dispose of in proper manner. Remove gloves and perform hand hygiene.

Step 22. Chart administration of medication.

Step 23. Return to check flow rate and observe for infiltration 30 minutes after starting infusion.

Step 24. Evaluate patient's response to medication within appropriate time frame.

Possible Complications of intravenous therapy

Adverse reactions in intravenous therapy:

- Infiltration
- Area feels cold and hard to the touch
- Pain and burning sensation at the site
- Blood does not return in the tubing when the bag is lowered below the level of the patient
- Edema
- White, raised area on the arm
- Flow rate may or may not be slow

Fluid overload

- Increased pulse rate
- Dyspnea
- Increased blood pressure
- Engorged neck veins

Inflammation or phlebitis

- Redness and warmth along the vein
- Pain or burning sensation at the site
- Slow flow rate
- Tenderness
- Edema of the vein above the insertion site
- Hardened feel to the vein

Infection

- Fever
- Chills

● Redness, swelling, or discharge at the insertion site

● Malaise

If you see any of these signs, discontinue the intravenous infusion as soon as possible and notify the physician.

3.5. Medical instrument disinfection and sterilization

In a hospital it is necessary that all equipment and materials used for treating patients are absolutely safe for use: the chance for spreading of diseases should be kept as small as possible. Cleaning, decontamination and sterilization are important methods in the battle against this ever present threat. Especially since the fatal disease AIDS became so powerful and spread world wide, the demand for proper procedures for infection control gained momentum enormously. Diseases such as Hepatitis B, known to be transmitted through contaminated surgical instruments, stimulated the need for stricter guidelines for disinfection and sterilization. All sterilization, disinfection and cleaning needs including training staff and monitoring results.

General principles of disinfection and sterilization

1. In general, reusable medical devices or patient-care equipment that enters normally sterile tissue or the vascular system or through which blood flows should be sterilized before each use. **Sterilization** is a process intended to kill all microorganisms and is the highest level of microbial kill that is possible. Sterilizers may be heat only, steam, or liquid chemical. Effectiveness of the sterilizer (often called “an autoclave") is determined in three ways. First - by the mechanical indicators and gauges on the machine itself, second - the heat sensitive indicators or tape on the sterilizing bag turn color, and thirdly - and most importantly is the biological test. With the biological test, a highly heat and chemical resistant microorganism (often the bacterial endospore) is selected as the standard challenge. If the process kills this microorganism, the sterilizer is considered to be effective. It should be noted that in order to be effective, instruments must be cleaned, otherwise the debris may form a protective barrier, shielding the microbes from the lethal process. Similarly care must be taken after sterilization to ensure sterile instruments do not become contaminated prior to use.

2**. Disinfection** refers to the use of liquid chemicals on surfaces and at room temperature to kill disease causing microorganisms There are three levels of disinfection: high, intermediate, and low. High-level disinfectants destroy all microorganisms, with the exception of high numbers of bacterial spores. Intermediate-level disinfectants inactivate even resistant organisms such as *Mycobacterium* tuberculosis, as well as vegetative bacteria, most viruses, and most fungi, but do not necessarily kill bacterial spores. Low-level disinfectants kill most bacteria, some viruses, and some fungi, but cannot be relied on to kill resistant microorganisms such as tubercle bacilli or bacterial spores.

3**.** Heat stable reusable medical devices that enter the blood stream or enter normally sterile tissue should always be reprocessed using heat-based methods of sterilization (e.g., steam autoclave or dry heat oven).

1. Laparoscopic or arthroscopic telescopes (optic portions of the endoscopic set) should be subjected to a sterilization procedure before each use; if this is not feasible, they should receive high-level disinfection. Heat stable accessories to the endoscopic set should be sterilized by heat-based methods.

2. Reusable devices or items that touch mucous membranes should, at a minimum, receive high-level disinfection between patients. These devices include reusable flexible endoscopes, endotracheal tubes, anesthesia breathing circuits, and respiratory therapy equipment.

3. Medical devices that require sterilization or disinfection must be thoroughly cleaned to reduce organic material or disburden before being exposed to the germicide.

4. Except on rare and special instances, items that do not ordinarily touch the patient or touch only intact skin are not involved in disease transmission, and generally do not necessitate disinfection between uses on different patients. These items include crutches, bed boards, blood pressure cuffs, and a variety of other medical accessories. Consequently, depending on the particular piece of equipment or item, washing with a detergent or using a low-level disinfectant may be sufficient when decontamination is needed.

Sterilization of equipment. Many steps are required to ensure that instruments are appropriately sterilized. These include pre-cleaning, cleaning, milking, inspection, packaging, wrapping, autoclaving and maintaining the autoclave.

Pre-cleaning needs to be done at the point of use to prevent the drying of organic material. This can be accomplished by either wiping the instrument with a wet cloth or placing the instrument in an enzymatic cleaner.

Cleaning includes many steps. Staff should wear appropriate personal protection equipment and follow approved procedures to prevent BBP (blood borne pathogen) exposure.

Milking. After cleaning, instruments with moveable parts need to be immersed in a milk solution and removed without rinsing. All instruments should be inspected before wrapping. It is important to ensure that hinged instruments open easily and that the jaws are properly aligned. Sharp instruments should be inspected for sharpness. All instruments should be inspected for cracks, chips or worn spots, with any instruments found with defects removed from service and sent for repair.

After inspection, wrap instruments in a single pouch of an appropriate size. Store all instruments in the open position with any curved tips pointed in the same direction. A steam indicator should be placed in the center of the pack with one end visible when the pack is opened. Secure the packet with steam

indicator tape and labeled with the date of sterilization, the load number and the initials of the person preparing the package.

Autoclaving or other sterilization methods should be done following manufacturer's directions. Keep a log that details each time the equipment is run, every time a biological indicator is sent and every time maintenance is performed. Staff should be able to verbalize the recall/resterilization procedure in case of failure of the biological indicator, visible condensation seen in a package, indicators that do not appropriately change color, and package integrity concerns or compromised storage and handling conditions.

Nurses maintain the immediate health care environment. Because they provide care for a variety of patients, the risk of contamination from pathogenic microorganisms is increased. The practice of medical asepsis and standard precautions provides the nurse with techniques for destroying or containing pathogens and for preventing contamination to other people or to bedside materials and equipment.

Universal precautions dictate that needles not be recapped after use. This helps to prevent a needle stick to the nurse. Diseases such as acquired immunodeficiency syndrome and hepatitis B are spread by contaminated body fluids**,** such as blood.

● Be careful when placing needles in the «sharps» container and when carrying a used syringe/needle.

● Dispose of used syringe /needles immediately. Most hospitals have a sharps disposal container in each room. Otherwise, there are containers on the medication and treatment carts.

● Any finger stick is potentially dangerous to the nurse and must be reported immediately.

● If a needle must be recapped, place the cap on a level surface and "scoop" it up with the needle. Do not touch the cap while this is being done.

● Small styrofoam-filled boxes are also available. Stick the needle into the styrofoam to prevent accidental finger sticks while transporting the equipment back to a sharps disposal container.

There are new devices available for recapping needles that will prevent needle sticks**,** such Gard Recapper. These devices allow the nurse to uncap and recap the needle without danger. After the Recapper removes the needle, the syringe is placed in the attached reusable container, which is lined with a disposable plastic bag. A standard sharps container can hold 500 needles. This reduces the volume of sharps waste and reduces a typical physician's needle/syringe disposal cost by an average of 40 %, depending on the volume.

CHAPTER 4

Providing of medical and diagnostic process in children's hospital

4.1. Stool specimen collection for testing

Feces, also called stools or bowel movements (BM), are an important source of information about the digestive system. Stool is collected to determine the presence of inflammation, or obstruction or blood, ova and parasites, bile, fat, starch, connective tissue or undigested muscle fibers, leucocytes, erythrocytes, epithelium. Because the food mass loses water as it moves along, liquid feces indicate a rapid movement, whereas hard feces indicate that slower passage has occurred or that the feces have been in the rectum for some time. The process of expelling stool or feces is called *defecation.* Feces can also be tested for fecal proteolytic activity, which is a reflection of the pancreas' ability to produce protease enzymes. Macroscopic examination of stool is perfomed for evaluation characteristics, such as color, consistency, odor, mucus, pus, blood.

Collecting specimens promptly and correctly can directly affect a patient's diagnosis, treatment, and recovery. In many cases, the nurse is solely responsible for collecting appropriate specimens. Even for tests that are not a nurse's hands-on responsibility, you may have to schedule the test, prepare the patient, assist the physician or other caregiver in performing the test, and care for the patient afterward. For some tests, for example, you may have to teach the patient how to perform the procedure at home, as with blood glucose tests and fecal occult blood tests.

A thorough working knowledge of diagnostic tests will help you prepare patients for them. If you can explain a test with clarity and compassion, you'll help put the patient at ease, gain his trust and cooperation, and thus ensure more accurate results. Helping him understand a procedure based on the physician's explanations also paves the way for consent that's truly informed.

When preparing a patient, your explanations should be clear, straightforward, and complete. For example, before a difficult or painful procedure, warn the patient about the type of discomfort he'll probably feel. Letting him know exactly what to expect helps him tolerate such a procedure. Preparation should include telling the patient how long the procedure takes and how soon the results will be available.

Record the time of specimen collection and transport to the laboratory. Note stool color, odor, and consistency, and any unusual characteristics; also note whether the patient had difficulty passing the stool.

Collecting a stool for ova and parasites. This test indicates the presence of intestinal parasites and/or their eggs (ova), which can cause gastrointestinal symptoms and disease.

1. The patient should be instructed not to take any antacids, oily laxatives, or anti-diarrheal medications, unless prescribed by the physician.

2. Wash your hands and put on gloves.

3. Explain the procedure to the person and ask the person to tell you when the urge to have a bowel movement is felt.

4. Label the container with the patient's first and last name, date of birth, and the date and time of collection of the sample.

5. Collect stool sample into a clean dry container such as a disposable food container, or onto plastic wrap stretched under the toilet seat.

6. Take a portion of feces from three different areas of the stool specimen.

7. Cover the container. Note any special examination requested.

8. For sanitary reasons, the container must be enclosed in a plastic bag. Properly dispose of gloves and wash your hands thoroughly after collection.

9. Deliver the stool sample to the laboratory as soon as possible. Stool should be examined when fresh. Examinations for parasites, eggs (ova), and organisms must be made when the stool is warm.

Special Considerations in Children. When an infant has diarrhea and the stool specimen is to be examined, place the diaper in a biohazard bag, label it, and take or send the diaper to the laboratory immediately. Otherwise, remove the stool from the diaper.

Enterobiasis (Pinworm infection) is a large intestine infection caused by a small, white worm called a pinworm, seatworm, or threadworm. The medical name for the pinworm is *Enterobius vermicularis*, also called a helminth. The disease is highly contagious and generally is spread by inadequate handwashing from infected persons.

The adult female worm is about the size of a staple (approximately 1 cm long and 0.5 mm wide) and has a pointed tip. The disease is transmitted by ingesting the eggs of the pinworm. These eggs travel to the small intestine where, after approximately one month, they hatch and mature into adult worms. During the night, the female adult worms travel to the area around the anus and deposit eggs in the folds of the anal area.A single female pinworm can lay 10,000 eggs and, after laying eggs, dies. The eggs are capable of causing infection after 6 h at body temperature.

While an infected person is asleep, female pinworms leave the intestines through the anus and deposit eggs on the skin around the anus. Intense itching around the anus and/or vagina comprise the classic symptoms of pinworms. Less common symptoms range from upset stomach to loss of appetite, irritability, restlessness, and insomnia.

School-age children have the highest rates of pinworm infection. They are followed by preschoolers. Pinworm infection often occurs in more than one family member.

To relieve the rectal itching, a shallow warm bath with half a cup of table salt is recommended. Also, application of an ointment containing zinc oxide or regular petroleum jelly can be used to relieve rectal itching.

Enterobiasis tape test. ***Alternative names:*** *Oxyuriasis test; Pinworm test.*

Enterobiasis tape test or *transparent adhesive tape test* (sometimes called a ***Scotch tape test***) refers to a method used for collecting and examining material gathered from regions surrounding the anus. This test is usually used to identify an infection of pinworms by collecting both the worms and eggs.

The best time to perform this test is at night or as soon as the individual wakes up in the morning, before having a bowel movement or taking a bath or shower. The pinworm eggs will stick to the tape, which can then be placed on a specimen slide. When under a microscope in the laboratory, the eggs will be clearly visible.

The sticky slide of the adhesive is patted on the anus and the perianal regions of the person who is thought to be infected with pinworms. The adhesive is then stuck onto the slide and read under a microscope by a professional, who should easily be able to tell if there is an infection or not. One test is not always enough to successfully diagnose enterobiasis and more than one may have to be done. A repeated test done everyday for three days straight will diagnose enterobiasis over 90 % of the time.

At revealing helminthic invasion in the child, all members of family should undergo this medical test. And all of them should be treated irrespectively of the results of tests.

Samples taken from under the fingernails may also contain eggs (since scratching of the anal area is common by affected individuals).

Because the infection is easily spread through contact with contaminated clothing or surfaces, it is recommended that all family members receive the therapeutic dose.

Fecal occult blood test is valuable for determining the presence of occult blood (hidden GI bleeding) and for distinguishing between true melena and melena-like stools. Certain medications, such as iron supplements, activated carbon and bismuth compounds, can darken stools so that they resemble melena(stool is collected in a clean vessel).

Diet Guidelines. Because certain foods can alter the test results, a special diet is often recommended. The following foods should not be eaten 48–72 h before taking the test: beets, broccoli, cantaloupe, carrots, cauliflower, cucumbers, grapefruit, horseradish, mushrooms, radishes, red meat (especially meat that is cooked rare), turnips, vitamin C-enriched foods or beverages.

Two common occult blood screening tests are Hematest (an orthotolidine reagent tablet) and the benzidine test (Gregerson test). Both tests produce a blue reaction in a fecal smear if occult blood loss exceeds 5 ml in 24 h.

Occult blood tests are particularly important for early detection of peptic ulcer (in the stomach and duodenum**),** colorectal cancer. To confirm a positive result, the test must be repeated at least three. Even then, a confirmed positive test doesn't necessarily indicate colorectal cancer. It does indicate the need for further diagnostic studies because GI bleeding can result from many causes other than cancer, such as ulcers and diverticula. These tests are easily performed on collected specimens or smears from a digital rectal examination.

Sometimes appearance of blood in the intestines is of some other reason:

– Eruption and dental treatment.

– Nasal bleeding.

– Injury of mucous membrane of oral cavity.

– Alimentary character – eating of poorly processed meat, liver.

4.2. Collection of urine for Zimnitskiy, Nechiporenko tests, Addis sediment count. Chemical examination of urine. Urine culture. The urinalysis is used as a screening and/or diagnostic tool because it can help detect substances or cellular material in the urine associated with different metabolic and kidney disorders. It is ordered widely and routinely to detect any abnormalities that should be followed up on. Often, substances such as protein or glucose will begin to appear in the urine before patients are aware that they may have a problem. It is used to detect urinary tract infections (UTI) and other disorders of the urinary tract.

Urinalysis is done by collecting a urine sample from a patient. The optimal sample tends to be an early morning urine sample because it is frequently the most concentrated urine produced in the day.

Methods of collection are slightly different for female and male patient.

For females, the patient is asked to clean the area around the urethra with a special cleansing wipe, by spreading the labia of the external genitals and cleaning from front to back (toward the anus).

For men, the tip of the penis may be wiped with a cleansing pad prior to collection. The urine is then collected in a clean urine specimen cup while the patient is urinating. It is best to avoid collecting the initial stream of urine. After the initial part of urine is disposed of in the toilet, then the urine is collected in the urine container provided. Once about 30–50 ml are collected in the container for testing, the remainder of the urine may be voided in the toilet again. This is called the clean catch or the midstream urine collection.

The collected urine sample should be taken to the laboratory for analysis, typically within 1 h of collection. If transportation to the lab could take more than 1 h, then the sample may be refrigerated.

In some patients who are unable to void spontaneously or those who are not able to follow instructions other methods may be used, such as placing a

catheter (a small rubber tube) through the outside opening to the bladder (urethra) to collect the sample directly from the bladder.

Collecting urine in a urine collector (*Fig. 40*). Wash your hands. Gather needed supplies. Explain to parents what you are going to do and why. Position the child on his or her back with legs apart and knees bent (frog-leg position).

Fig. 40. Collecting urine in a urine collector

You may need the assistance of another adult to position the child properly so you can accurately apply the collector. Gently cleanse and dry perineal area. You may use plain water and a wash cloth to cleanse the labia or penis. Remove any powder or lotion. Peel backing off adhesive surface and apply bag to perineum. With females, it is easiest to seal it from the bottom up to the pubis; do the opposite with males. Be sure the skin is smoothed during application, by gently pulling on the skin as needed. With males, place the penis in the bag and apply the bag to the pubis and scrotum.

Be sure the foreskin is in its normal position in an uncircumcised male before applying the bag. Cover the bag with a loose-fitting diaper or underpants. *(This discourages the child from pulling on the bag. Tight-fitting diapers or pants may dislodge the bag or cause the seal to burst after the child has voided).* Offer fluids after the bag is applied. *(This encourages voiding.)*Check the bag every 15 to 30 min to see if the child has voided. After the child has voided, gently remove the bag as soon as possible. Cleanse the perineum. Apply a clean diaper or underpants. Place the urine in a specimen cup through the emptying port provided on the outside of the bag. Discard waste appropriately. Discard gloves. Wash your hands. Send specimen to the lab following your facility's policy. Document that the specimen was obtained.

The drawback of the present pediatric urine collector is that during actual use a diaper is placed over the urine collector bag covering the whole part of the urine collector device.

Taking urine by the method of Nechiporenko. This method helps to determine the amount of cellular elements (WBC, RBC and casts) **in 1 ml of urine.** Midstream urine

Rules of collecting: in a clean vessel not less than 10 ml of urine is taken from the middle portion of the first morning urination (mead stream catch).

The normal values by the method of Nechiporenko are:

WBC	not more than 2,000/ml;
RBC	not more than 1,000/ml;
Casts	not more than 200/ml.

Addis sediment count – quantitative estimation of urinary cellular excretion. Method for counting the sediment (casts and cells) in a 12-h (24 h) urine sample.

Technique of urine collecting:

1. The day before child should take high-protein and low-fluid diet and should not drink at night-time.

2. Collect all the urine into container during 12 hours (from 22 p.m to 8 a.m.).

The normal values are:

WBC not more than 2,000,000 per 24h;
RBC not more than 1,000,000 per 24h;
Casts not more than 20,000 per 24h.

Taking urine by the method of Zimnitskiy. This method helps to determine functional renal capabilities to osmotic concentration and dilution in diurnal diuresis.

Technique of urine collection:

Collect 8 portions of urine per 24 h. Adult persons and elder children perform this by voiding every 3 h (at 9.00, 12.00, 15.00, 18.00, 21.00. 24.00, 3.00 and 6.00). If the child needs to discharge between these hours, he urinates into container marked by the next hour. In infants and young children urine is collected during natural urinations, and the amount of containers is equal the number of voiding. While estimating the results, the following data are taken into account:

- daily volume of urine;
- correlation of daytime and nocturnal urine volume. (Normal correlation of day time and night diuresis is 2:1);
- changes of specific gravity during 24 h. (Normal values of specific gravity of urine depend on age and must be different in different portions (the difference between maximum and minimum values must be more than 0.007). The less this difference the worse the function of kidneys.

Chemical Examination of Urine

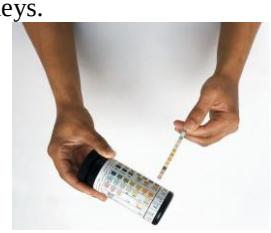


Fig. 41. Chemical Examination of Urine

Urine dipsticks provide a quick and inexpensive method for detecting abnormal substances within the urine. Urine dipstick is a narrow plastic strip which has several squares of different colors attached to it (*Fig. 41*). Each small square represents a component of the test used to interpret urinalysis. The entire strip is dipped in the urine sample and color changes in each square are noted. The color change takes place after several seconds to a few minutes from dipping the strip. If read too early or too long after the strip is dipped, the results may not be accurate. The squares on the dipstick represent the following components in the urine: (1) blood, (2) protein, (3) glucose, (4) ketones, (5) urobilinogen and

bilirubin, (6) white blood cells, (7) specific gravity, (8) pH. Presence or absence of each of these color changes on the strip provides important clues for doctor to make clinical decisions based on the urinalysis results.

The main disadvantage is that the information may not be very accurate as the test is time-sensitive. It also provides limited information about the urine as it is qualitative test and not a quantitative test.

Urine Culture. A urine culture is used to identify urinary tract infections and yeast by obtaining a sample of "clean-catch" (midstream) urine. Because of the potential to contaminate urine with bacteria and cells from the surrounding skin during collection (particularly in girls), it is important to first clean the genitalia. In preparation for this test, males must clean the head of the penis. Females need to wash the area between the lips of the vagina with soapy water and rinse. The patient then gives the container containing the urine sample to their health care provider.

As the patient begins to urinate, they should allow a small amount to fall into the toilet bowel to clear the urethra of any contaminates. Then, in a sterile container, they should catch about 50–150ml and then remove the container from the urine stream.

The urine sample should be sent out to a laboratory for evaluation within 2 h. With a urine culture, a small sample of urine is placed on one or more agar plates (a thin layer of a nutrient gel) and incubated at body temperature. Any microorganisms that are present in the urine sample grow over the next 24 to 48 h as small circular colonies.

Based upon the information obtained, the laboratorian gives the doctor an initial report of the quantities and types of bacteria (or yeast) present in the urine. Pure culture isolates are identified and susceptibilities are performed at counts greater than 10^4 colonies/mL, if appropriate. Examples would be: “no growth in 24 h” (nothing grew on the agar), “less than 10,000 colonies/ml” (a small amount of bacteria is present) or “greater than 50,000 colonies/ml of gram negative rods, ID and susceptibility to follow” (the patient probably has an infection caused by a gram negative bacteria that needs to be further identified).

If there is no or little growth on the agar after 24 to 48 h of incubation, the urine culture is considered negative for pathogens and the culture is complete. If there is one or more pathogen present, further testing is performed.

4.3. Collection of a nose and throat swab. Collection normally involves sampling inflamed tissues and exudates from the throat, nasopharynx, with sterile swabs of cotton or other absorbent material. The type of swab used depends on the part of the body affected. For example, collection of a nasopharyngeal specimen requires a cotton-tipped swab.

After the specimen has been collected, the swab is immediately placed in a sterile tube containing a transport medium. Swab specimens are usually collected to identify pathogens and sometimes to identify asymptomatic carriers of certain easily transmitted disease organisms.

Throat swab. Alternative names – Throat culture and sensitivity; Culture – throat.

Throat swab is a laboratory test done to isolate and identify organisms that may cause infection in the throat. The test is used to establish the diagnosis of bacterial infection with ß-haemolytic streptococci (especially Group A (*Streptococcus pyogenes*), Group C or Group G) and *Arcanobacterium haemolyticum.* A throat swab is required to diagnose suspected Vincent's angina and gonococcal pharyngitis or herpes simplex infection and to confirm a clinical diagnosis of diphtheria. Viral detection culture is seldom indicated to determine other viral causes of pharyngitis, but can be used to establish a diagnosis of influenza. Influenza virus antigen gives a more rapid result.

Note. Patient must not use antiseptic mouthwashes before the test.

Implementation. Explain the procedure to the patient to ease his anxiety and ensure cooperation. Instruct the patient to sit erect at the edge of the bed or in a chair, facing you. Wash your hands and put on gloves. Ask the patient to tilt his head back. Depress his tongue with the tongue blade, and illuminate his throat with the penlight to check for inflamed areas and tell him to breathe deeply. Using the cotton-tipped swab, wipe the tonsillar areas from side to side, including any inflamed or purulent sites. Make sure you don't touch the tongue, cheeks, or teeth with the swab to avoid contaminating it with oral bacteria. **Do not touch oral mucosa or tongue with swab.**

Withdraw the swab and immediately place it in the culture tube. If you're using a commercial kit, crush the ampule of culture medium at the bottom of the tube, and then push the swab into the medium to keep the swab moist. Remove and discard your gloves, and wash your hands. Label the specimen with the patient's name and room number, the physician's name, and the date, time, and site of collection. On the laboratory request form, indicate whether any organism is strongly suspected, especially Corynebacterium diphtheriae (requires two swabs and special growth medium), Bordetella pertussis (requires a nasopharyngeal culture and special growth medium), and Neisseria meningitidis (requires enriched selective media). Place in a laboratory biohazard transport bag and send the specimen to the laboratory immediately to prevent growth or deterioration of microbes.

Nose Swab. Implementation. Explain the procedure to the patient. Have the patient sit erect at the edge of the bed or in a chair, facing you. Then wash your hands and put on gloves. Ask the patient to blow his nose to clear his nasal passages. Then check his nostrils for patency with a penlight. Tell the

patient to occlude one nostril first and then the other as he exhales. Listen for the more patent nostril because you'll insert the swab through it. While it's still in the package, bend the sterile swab in a curve and then open the package without contaminating the swab. Ask the patient to tilt his head back, and gently pass the swab through the more patent nostril keeping the swab near the septum and floor of the nose. Rotate the swab gently and remove it. Remove the cap from the culture tube, insert the swab, and break off the contaminated end. Then close the tube tightly. Remove and discard your gloves and wash your hands.

Label the specimen for culture, complete a laboratory request form, and send the specimen to the laboratory immediately in a laboratory biohazard transport bag. If you're collecting a specimen to isolate a possible virus, check with the laboratory for the recommended collection technique.

4.5. Application of a hot and cold compresses

Heat Application. Heat applied directly to the patient's body raises tissue temperature and enhances the inflammatory process by causing vasodilation and increasing local circulation. Heat also increases tissue metabolism, reduces pain caused by muscle spasm, and decreases congestion in deep visceral organs, makes the chilly patient more comfortable. Direct heat may be dry or moist. Dry heat can be delivered at a higher temperature and for a longer time. Common methods for applying dry heat are an electric pad, warm-water bag, aquathermic pad, heat lamp, or electric.

Moist heat softens crusts and exudates, penetrates deeper than dry heat, doesn't dry the skin, produces less perspiration, and usually is more comfortable for the patient. Devices for applying moist heat include warm compresses for small body areas and warm packs for large areas. Moist, hot applications heat skin more quickly and are more penetrating than applications of dry heat because water is a better heat conductor than air. Both dry and moist heat are usually applied for their local effects.

Direct heat treatment can't be used on a patient at risk for hemorrhage. It also is contraindicated if the patient has a sprained limb in the acute stage (because vasodilation would increase pain and swelling) or if he has a condition associated with acute inflammation, such as appendicitis. Direct heat should be applied cautiously to pediatric and elderly patients and to patients with impaired renal, cardiac, or respiratory function. It should be applied with extreme caution to heat-sensitive areas, such as scar tissue and stomas.

Implementation. Check the physician's order, and assess the patient's condition. Explain the procedure to the patient, and tell him not to lean or lie directly on the heating device because this reduces air space and increases the risk of burns. Warn him against adjusting the temperature of the heating device or adding hot water to a hot-water bottle. Advise him to report pain immediately

and to remove the device if necessary. Provide privacy and make sure the room is warm and free of drafts. Wash your hands. Take the patient's temperature, pulse, and respiration to serve as a baseline. If heat treatment is being applied to raise the patient's body temperature, monitor temperature, pulse, and respirations throughout the application. Position him comfortably in bed. Expose only the treatment area because vasodilation will make the patient feel chilly.

Applying a hot-water bottle, an electric heating pad, an aquathermia pad. Fill the bottle with hot tap water to detect leaks and warm the bottle; then empty it. Run hot tap water into a pitcher and measure the water temperature with the bath thermometer. Adjust the temperature to 40.6 to 45.0 °C – for children under age 2 and to 45.1 to 50.0 °C – for adults. Next, pour hot water into the bottle, filling it one-half to two-thirds full. Partially filling the bottle keeps it lightweight and flexible to mold to the treatment area. Squeeze the bottle until the water reaches the neck to expel any air that would make the bottle inflexible and reduce heat conduction. Fasten the top and cover the bag with an absorbent cloth. Secure the cover with tape or roller gauze.

Before applying the heating device, press it against your inner forearm to test its temperature and heat distribution. If it heats unevenly, obtain a new device. Apply the device to the treatment area and, if necessary, secure it with tape or roller gauze. Begin timing the application.

Assess the patient's skin condition frequently, and remove the device if you observe increased swelling or excessive redness, blistering, maceration, or pallor or if the patient reports discomfort. Refill the hot-water bottle as necessary to maintain the correct temperature. Remove the device after 20 to 30 min, or as ordered.

N.B! *Tissue exposed to heat for more than 30 minutes begins to develop vasoconstriction.*

Dry the patient's skin with a towel and redress the site, if necessary.

Applying a warm compress or pack. Place a linen-saver pad under the site. Remove the warm compress or pack from the bowl or basin. Wring excess solution from the compress or pack (using sterile forceps if needed). Excess moisture increases the risk of burns. Apply the compress gently to the affected site (using forceps, if warranted). After a few seconds, lift the compress and check the skin for excessive redness, maceration, or blistering. When you are sure the compress is not causing a burn, mold it firmly to the skin to keep air out, which reduces the temperature and effectiveness of the compress. Work quickly so the compress retains its heat.

Apply a waterproof covering (sterile, if necessary) to the compress. Secure it with tape or roller gauze to prevent it from slipping. Place a hot-water bottle, or aquathermia pad to maintain the correct temperature. Begin timing the application. Check the patient's skin every 5 min for tissue tolerance. Remove the device if the skin shows excessive redness, maceration, or blistering or if

the patient experiences pain or discomfort. Change the compress as needed to maintain the correct temperature.

After 15 to 20 min or as ordered, remove the compress. Discard the compress into a waterproof trash bag. Dry the patient's skin with a towel (sterile, if necessary). Note the condition of the skin and re-dress the area, if necessary. Take the patient's temperature, pulse, and respiration for comparison with baseline. Then make sure the patient is comfortable.

Complications. Because tissue damage may result from direct heat application, monitor the temperature of the compress carefully. Assess frequently the condition of the patient's skin under the heat application device.

Cold application. The application of cold constricts blood vessels, inhibits local circulation, suppuration, and tissue metabolism; relieves vascular congestion; slows bacterial activity in infections; reduces body temperature; and may act as a temporary anesthetic during brief, painful procedures. Because treatment with cold also relieves inflammation, reduces edema, and slows bleeding, it may provide effective initial treatment after eye injuries, strains, sprains, bruises, muscle spasms, and burns. Cold doesn't reduce existing edema, however, because it inhibits reabsorption of excess fluid.

Cold may be applied in dry or moist forms, but ice shouldn't be placed directly on a patient's skin because it may further damage tissue. Moist application is more penetrating than dry because moisture facilitates conduction.

Devices for applying cold include: an ice bag or collar, aquathermia pad (which can produce cold or heat), chemical cold packs, ice packs.

Devices for applying moist cold include: cold compresses for small body areas; cold packs for large areas. Apply cold treatments cautiously on patients with impaired circulation, on children, and on elderly or arthritic patients because of the risk of ischemic tissue damage. Cold applications are useful right after an injury.

Special considerations. Apply cold immediately after an injury to minimize edema. Although colder temperatures can be tolerated for a longer time when the treatment site is small, don't continue any application for longer than 1 h to avoid reflex vasodilation. The application of temperatures below 15 °C also causes local reflex vasodilation. Use sterile technique when applying cold to an open wound or to a lesion that may open during treatment. Also maintain sterile technique during eye treatment, with separate sterile equipment for each eye to prevent cross-contamination. If the patient is unconscious, anesthetized, neurologically impaired, irrational, or otherwise insensitive to cold, stay with him throughout the treatment, and check the application site frequently for complications. Avoid direct and prolonged ice contact with the skin, to avoid damaging it, by placing a cloth between the cold source and the skin.

Applying an Icecap or Ice Collar, an aquathermia pad, or a chemical cold pack. Wash your hands. Select a device of the correct size, fill it with cold tap water, and check for leaks. Fill an icecap or collar about $^{3}/_{4}$ full with crushed ice. *(Small pieces of ice cool faster because they have more surface area.)* Sometimes cold water is added to increase the cooling effect further. Squeeze the device to expel air that might reduce conduction. (*A flat icecap or ice collar is easier to fit to the body).*Screw in the top or fold over the end, making sure that the top is firmly in place. Dry the icecap or collar and cover with a towel. *(*The protective cover prevents tissue trauma and absorbs condensation). Adjust bag on the part of body to be treated. Leave icecap or ice collar in place for 30 min to 1 h, as directed. Keep icecap or ice collar off for 1 h before reapplying it, unless directed otherwise. (Prolonged applications of cold could dangerously slow circulation and may cause tissue damage. The ice will melt in this length of time as well).Wash your hands after applying the icecap or ice collar and after removing it. Document the treatment on the patient's chart, noting "on" and "off" periods and patient's reactions.

Applying a cold compress or pack

1. Cool a container of tap water by placing it in a basin of ice or by adding ice to the water. Using a bath thermometer for guidance, adjust the water temperature to 15° C or as ordered. Immerse the compress or pack material in the water. Place a linen-saver pad under the site. Remove the compress or pack from the water, and wring it out to prevent dripping. Apply it to the treatment site, and begin timing the application. Cover the compress or pack with a waterproof covering to provide insulation and to keep the surrounding area dry. Secure the covering with tape or roller gauze to prevent it from slipping. Check the application site frequently for signs of tissue intolerance, and note complaints of burning or numbness. If these symptoms develop, discontinue treatment and notify the physician.

2. Change the compress or pack as needed to maintain the correct temperature. Remove it after the prescribed treatment period (usually 20 min).

Complications: 1. Hemoconcentration may cause thrombi. 2. Intense cold may cause pain, burning, or numbness.

4.6. Technique of gastric lavage. Gastric lavage, also commonly called Gastric suction; Stomach pumping; Nasogastric tube suction, is the process of mechanical cleaning out the contents of the stomach.

This test may be performed for several different reasons, including removing poisons, toxic materials, or overdosed medications from the stomach, cleaning the stomach prior to an upper endoscopy in someone who has been vomiting blood, collecting stomach acid for tests, providing relief and decompression in someone with intestinal blockage.

Technique. Gastric lavage involves the passage of a tube via the mouth or nose down into the stomach, followed by sequential administration and removal of small volumes of liquid. On draining the stomach in connection with poisoning of the child it is necessary to put the patient on the left side (on the right side position washing waters will flow into duodenum).

To perform gastric lavage a glass funnel is attached to the end of the rubber tube. Water, Ringer solution or some other lavaging solution (as prescribed by the doctor) is poured into the elevated funnel, and the liquid passes into the stomach. When the funnel is held beneath the level of the child's head (he is placed on his side on a table, buttocks elevated) the stomach contents pour out together with the lavaging liquid. When the stomach has been emptied the funnel is again elevated and a new portion of the liquid poured in. This procedure is repeated several times until the fluid emerging from the stomach becomes clear. At the end of the lavaging procedure 50 to 100 ml of solution are left in the stomach. In *domestic conditions* gastric lavage is performed by giving the child an abundant amount of warm water to drink (1–2 litres), until vomiting is evoked. This procedure may only be employed if the child is conscious. According to the doctor's prescription the waters obtained are sent to the laboratory for the analysis. After lavage, the child is generally kept for 1 or 2 h before being discharged, unless much of the poison was absorbed into the bloodstream.

Complications include: 1. Nasal irritation, sinusitis, epistaxis, rhinorrhea, skin erosion or esophagotracheal fistula secondary to NG placement. 2. Aspiration pneumonia secondary to vomiting and aspiration. 3. Hypoxia, cyanosis, or respiratory arrest due to accidental tracheal intubation. Laryngospasm, bradycardia, hyponatremia, water intoxication, or mechanical injury to the stomach.

Documentation. Record the date and time of lavage, the size and type of NG tube used, the volume and type of irrigant, and the amount of drained gastric contents. Document this information on the intake and output record sheet, and include your observations, including the color and consistency of drainage. Also keep precise records of the patient's vital signs and LOC, any drugs instilled through the tube, the time the tube was removed, and how well the patient tolerated the procedure.

4.7. Inserting the flatus tube. The flatus tube is reusable rubber tube used for the expelling of flatus (gas) from the intestine. It is also used for the treatment of sigmoid volvulus and intussusceptions. It is used also for barium enema. Inserted in the rectum, the device provides an outlet for accumulated gas and relieves the discomfort of intestinal distention.

Equipment: rectal tube, lubricant, disposable gloves.

Procedure. Ask the patient to lie on his or her side (preferably the left). Wash hands and put on gloves. Lubricate the tube. Insert the tube 7.5–10 cm

into the rectum. The tube is inserted far enough to pass any stool in the lower rectum and reach the gas above the stool. Determine the patency of the tube. If the tube is patent, gas or feces will return. The tube can become plugged with stool; it must be kept open. Leave the tube in the rectum from 20 to 30 min. After that time the sphincter muscles become numbed and the tube ceases to stimulate peristalsis. After use, rinse a tube with running water and wash with soap and water. It can be sterilized by boiling or autoclaving. Properly dispose of your gloves and wash your hands. Document the result on the patient's chart; the duration of the insertion, the amount of gas and feces expelled, if any, and whether the patient felt relief.

4.8. Oxygen therapy benefits the patient by increasing the supply of oxygen to the lungs and thereby increasing the availability of oxygen to the body tissues.

Appropriate levels of oxygen are vital to support cell respiration. High blood and tissue levels of oxygen can be helpful or damaging, depending on circumstances. High levels of oxygen given to infants causes blindness by promoting overgrowth of new blood vessels in the eye obstructing sight. This is Retinopathy of prematurity (ROP). Administration of high levels of oxygen in patients with severe emphysema and high blood carbon dioxide reduces respiratory drive, which can precipitate respiratory failure and death.

Types of Oxygen delivery devices

Nasal CPAP is also known as Continuous Positive Airway Pressure. CPAP stands for "continuous positive airway pressure." CPAP is a treatment that delivers slightly pressurized air during the breathing cycle. This makes breathing easier for persons with obstructive sleep apnea and other respiratory problems. Nasal CPAP is given through a mask that is placed and secured over the person's nose or nose and mouth (*Fig. 42*).

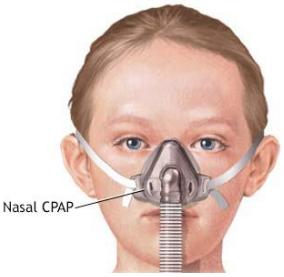


Fig.42. Nasal Continuous Positive Airway Pressure

Slight positive pressure is used to increase the amount of air breathed in without increasing the work of breathing. Nasal CPAP is useful for children with collapsible airways, small lung volumes, or muscle weakness that make it difficult to breathe.

Fig.43. The oxygen bag

The oxygen bag is mainly used for emergency use in hospital and as health care product at home (*Fig. 43*). It should be prepared beforehand (two

hours) and kept in a warm room. A clean pillow-case is put on the bag, and the respirating funnel is washed in warm water. The funnel is placed 1–3 cm from the mouth of the infant, the stopcock is opened cautiously, and the bag is pressed gently with the hand, so that a small stream of oxygen slowly emerges. Oxygen is given over one-hour intervals for 2–3 min. From one to four bagfuls may be given in 24 hours. However, one must never forget that thorough airing of the room and taking the child outside may often be an adequate substitute for the inhalation of oxygen.

Low-Flow Devices

Low-flow systems deliver oxygen at flows that are less than the patient's inspiratory flow rate (i.e, the delivered oxygen is diluted with room air) and, thus, the oxygen concentration inhaled may be low or high, depending on the specific device and the patient's inspiratory flowrate.

1. The nasal cannula (NC) is a thin tube with two small nozzles that protrude into the patients nostrils. The rest of the tubing wraps around the head. It can only comfortably provide oxygen at low flow rates, 0.25–6 l per min (LPM), delivering a concentration of 24–40 %. Flow rates greater than 4 l per mi can cause discomfort and dry out the nasal passages and should also be used with a humidifcation system. Patients prefer cannulas over masks because they are less confining and do not interfere with eating or talking. Cannulas should be used with caution on patients with irregular breathing patterns because the percentage of oxygen reaching the lungs varies with the rate and depth of respirations.

2. The simple face mask (SFM) is a basic mask used for non-life-threatening conditions but which may progress in time, such as chest pain (possible heart attacks), dizziness, and minor hemorrhages. It is often set to deliver oxygen between 5–15 LPM.

The final oxygen concentration delivered by this device is dependent upon the amount of room air that mixes with the oxygen the patient breathes. The general oxygen concentration is between 35 % and 50 %. The simple face mask is a transparent mask with a simple nipple adapter. It is fitted over the nose, mouth, and chin (*Fig. 44*).

Fig. 44. A patient wearing a simple face mask

Навчальне видання

ОСНОВНІ ОБОВ'ЯЗКИ ТА ПРОФЕСІЙНІ ДІЇ МЕДИЧНОЇ СЕСТРИ ПЕДІАТРИЧНОГО ВІДДІЛЕННЯ

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