

INTRODUCTION

Dear Reader,

Welcome to the 2010 edition of Dr. Karrenberg's NCLEX-RN® Review Manual. We are continuing our success proven concept of our previous manuals and of our live tutorial and review classes by presenting the entire exam relevant content in a comprehensive but compact format. Based on the latest NCLEX-RN® Test Plan from April 1, 2010 our new manual meets the requirements of the latest passing standards. In comparison to previous versions the new exam curriculum is emphasizing clinical priorities, organizational skills, management of care as well as laws and regulations. A comparably lesser number of questions is now distributed for the category reduction of risk potential. This manual allows you to prepare for your nursing board exam with a detailed review of all exam relevant facts in just one book. Including baseline knowledge requirements as well as high scoring exam relevant content. It meets the requirements of U.S. as well as International nursing students for a successful, time and cost efficient exam preparation.

Based on a review of content, NCLEX-RN® relevant keywords and practice questions this program enables you to acquire the necessary exam relevant knowledge, skills and confidence to pass your board exam and to start your career as a RN soon! No question remains unanswered whether you are sitting for the NCLEX-RN® for the first time or if you are about to prepare for a repeated attempt.

In comparison to other review systems this program is based on the following three steps to assist you in acquiring the entire exam relevant knowledge as well as important test taking strategies.

1. Content Review

The detailed but compact content review allows you to acquire the entire exam relevant knowledge under special consideration the most high scoring content of pathophysiology, pharmacology, nursing mathematics and other difficult subject materials that usually are the greatest challenges for the NCLEX-RN® candidates.

2. Keyword Review

The keyword review outlines the requirements of the minimum knowledge requirements of the most current official NCLEX-RN® Test plan as issued by the National Council of State Boards of Nursing (NCSBN).

3. Question Review

The question review of 355 well composed practice questions allows you to repeat and practice the previously acquired knowledge of the first two steps in the computer adaptive testing question style that you will encounter in the actual testing situation.

I hope that this unique manual will assist you in a successful preparation for your NCLEX-RN® exam as it has supported many U.S. Nursing school graduates and International nurses before. We appreciate your feedback and comments about this book under feedback-manual@nclex-tutorial.com.

Good Luck!

Sincerely,

Dr. H. A. Karrenberg
January 2010

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Administration of the NCLEX-RN® examination

The NCLEX-RN® nursing licensing examination is offered in a computer adaptive testing mode only. The duration of the exam is of variable length and depends on the average performance of the candidate during this exam. Due to its unique setting as a computer adaptive testing the NCLEX-RN®-Examination regularly starts with a question that targets knowledge which is slightly below average of the required overall exam base line knowledge. If the candidate answers this first question correctly then the computer will automatically pick another, more difficult question. If the candidate answers a question wrong then the computer automatically chooses a less difficult question and so on. The minimum amount of questions to be answered by every candidate is 75 within an allotted time of 6 hours. The allotted time includes any breaks as well as the time for the pretest tutorial. Depending on the individual test performance the candidate will be offered more questions but not additional testing time to reach the passing score. The maximum amount of questions will not exceed 265. Fifteen of the overall amount of questions asked will not be used for the assessment of the exam candidate since these questions are included for testing purposes for future exams. The exam stops automatically either after the minimum 75 questions or once the allotted time is over or whenever the candidate has proven a consistent satisfying or a non satisfying level of competence. It typically causes a lot of discomfort for the candidates during the test if the system keeps asking more than the 75 mandatory questions since this may be a sign of a low performance level. Although, this does not necessarily mean that the candidate is failing the overall examination. The most current 2007 NCLEX-RN® test plan includes four main and six subcategories of client needs in which exam candidates need to prove minimum competency. Results of the NCLEX-RN examination are scored as passed or failed only. Exam candidates receive a computerized assessment of their individual testing performance as well.

Categories of the NCLEX-RN® curriculum

I. Safe, Effective Care Environment

- *Management of Care (16-22 %)*
- *Safety and Infection Control (8-14%)*

II. Health Promotion and Maintenance (6-12%)

III. Psychosocial Integrity (6-12%)

IV. Physiological Integrity

- *Basic Care and Comfort(6-12%)*
- *Pharmacological and Parenteral Therapies (13-19%)*
- *Reduction of Risk Potential (10-16%)*
- *Physiological Adaptation (11-17%)*

Test Taking Strategies

General requirements of the NCLEX-RN®:

The NCLEX-RN® is considered to be an *assessment test*. It is specifically designed to assess the ability of a graduate nursing student to start employment as a junior RN in a

hospital or other common type of healthcare setting. All question in this exam are comprised to expose the exam candidate theoretically with a variety of common situations and regulations as they occur and apply in daily nursing practice. It is now necessary to view the question items under consideration of two or more conditioning factors. The appropriate problem solving approach is defined as “critical thinking” in the NCLEX-RN® Test plan.

Specific strategies for successful participation in the NCLEX-RN®:

- Thorough understanding and practice of all six different types of question items currently used in the NCLEX-RN®.
- Complete and careful reading before answering any question items. A question item may not always ask for a variety of possible outcomes. (least, most, wrong, usual, typical outcome, result).
- Use of a problem solving approach that considers all aspects as they are provided in the question items.
- Time measurement - every 10/20 questions during exam following the “one question per minute rule”.
- Use of common sense! All answers must also be rationally explainable!
- Focus on recognition of priorities for a client in a particular situation, (because other answer choices may be correct but not logical in a particular situation).

Priorities examples:

Maslows Hierarchy of Needs, ABC (Airway, Breathing, Circulation), Identifying and recognizing least stable /most riskful situation, time as a priority factor, priority among other clients in need (e.g. patient to be prepared for scheduled surgery).

CAT Question item types:

It is rather important to become familiar with the different types of questions that are used for the different items in the Nclex-RN examination before the actual exam date. This allows a faster pace by answering items and reduces insecurity. There are six alternate item format practice questions to become familiar with:

1. Single response questions (One right answer only)

A single answer question typically starts with a brief description of a common situation in daily nursing practice. The candidate is then asked to make a decision based on principles of nursing practice and/or clinical knowledge by choosing one out of four answers.

Example:

A 40 year old male client is admitted to the hospital for acute abdominal pain. During the interview he points out to the ER Nurse on duty, that he had severe alcohol problems for many years but he has been abstinent for 5 years now. Considering this history which of the following conditions is the most likely cause for this clients chief complaints? Please select the best response.

- A) Ureter stones
- B) Pancreatitis
- C) Gallbladder stones
- D) Gastritis
- E) Gastroenteritis

2. Multiple response questions

Compared to a single response question, test items of this type will provide more than one correct answer to choose from but it may not tell how many correct answers are there at all. Therefore, between two to four of the multiple choice answers may be correct.

Example:

A client who was just admitted to the Emergency Room for acute respiratory distress has a long standing history of an obstructive pulmonary disorder.

Which of the following conclusions are correct in regards to this clients condition ?
Please select all answers that apply.

1. This client may be suffering from Asthma.
2. The hypoxemia of this client may require respirator treatment.
3. The blood gas analysis may show a respiratory acidosis.
4. The blood gas analysis may show a significantly increased pCO₂.

- A) 1 and 3 are correct
- B) 2, 3, and 4 are correct
- C) 3 and 4 are correct
- D) None of the above statements are correct
- E) All of the above statements are correct

3. Fill in the blank questions. (i.e. solution of a math operation)

This type of question is mainly used for subjects dealing with nursing mathematics, (e. g. dosage calculation). In this case the testing computer system provides a calculator for on screen use. There are no answers to choose from and the appropriate answer has to be written in a defined answer field.

Example:

A liquid medication has a concentration of 2mg/ml and is supposed to be applied intravenously.

The written physicians order states the following dosage advice.

0,5 ml / kg bodyweight / hour.

How much dosage in ml will this particular client receive in 24 hours, if his weight is 78 kg?

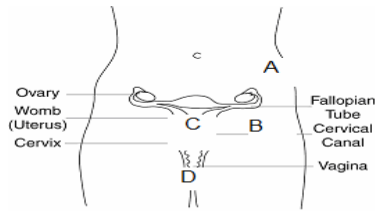
Answer: This client will receive ml of the prescribed substance.

4. "Hot spot" question

A hotspot question allows you to answer a question by clicking on a correct area within an image

Example:

Please use the diagram of the female reproductive tract below to indicate the anatomical area where the fertilization takes place.



- A) Cervical Canal
- B) Fallopian tube
- C) Uterus
- D) Vagina
- E) None of the above

5. Chart exhibit question

An exhibit question will provide a specific clinical information, (e.g. a printout of a complete blood count) followed by a question regarding its interpretation.

Example:

A client on a ward suddenly develops a severe, acute respiratory distress. One of the first diagnostic steps is to obtain capillary blood for a blood gas analysis. Which is the most correct interpretation of the BGA results displayed below?

$pH = 7,04$
 $pCO_2 = 106 \text{ mmHg}$
 $pO_2 = 55 \text{ mmHg}$
 $BE + 8$
Potassium 4.2 mmol/liter

- A) Respiratory alkalosis
- B) Respiratory acidosis
- C) Metabolic alkalosis
- D) Metabolic acidosis
- E) None of the above

6. Drag and Drop Question/ Ordered Response Item

Drag and drop questions are mainly used to assess knowledge concerning practical procedures. Two boxes are provided in this question item. The left hand box contains statements options for a specific question but in a non orderly manner. The right hand box is supposed to be filled with these statement options but in an orderly manner.

Since all statement options have to be used to answer this type of question, there should be no statement option left in the left hand box once this question is answered.

Example:

To perform a cardiovascular resuscitation it is important to follow an algorithm of maneuvers. Please put the assessments and procedures described in the left hand box below in a logical sequence by putting the most basic action on top.

Unordered options

Airway assessment

Circulation assessment

Breathing

Defibrillation

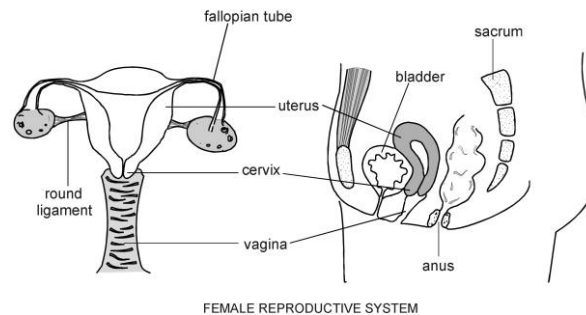
↔

Ordered options

NCLEX-RN® Category II:

HEALTH PROMOTION AND MAINTENANCE

-The Female Reproductive System -



Anatomy of female internal structures

Vagina (birth canal)

Muscular, membranous tube. Side walls covered with rugae. Connects external genitalia and cervix.

Cervix

Neck of Uterus. Consists of fiber tissue. Distending during labor.

Uterus (womb)

Hollow muscular organ. Sheds endometrium periodically. Holds fetus. Superior part: fundus, lower part: cervix.

Fallopian tubes

Connects either ovary with uterus. Ciliated to transport ovum (zygote). Isthmus = part towards to the uterus. Ampulla = middle section. Indundibulum = ending

Ovaries

Almond sized endocrine functioning glands. Producing and secreting estrogene and progesterone. Release one mature follicle per menstrual cycle.

Function of female genital structures.

Oogenesis

Oocytes present at birth.

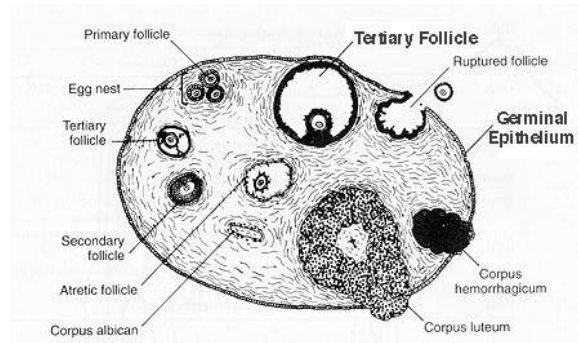
FSH (follicle stimulating hormone) stimulates *meiosis* to develop an individual ovum → **LH (luteinizing hormone)** transforms follicle into corpus luteum → **Corpus luteum** produces **progesterone** and maintains a pregnancy → **Estrogene** and Progesterone are produced by ovaries with or without pregnancy.

Ovulation

FSH stimulates maturation of a follicle during follicular phase into **Graaf Follicle** which ruptures on the surface and becomes corpus luteum under influence of LH and FSH.

*Minimum **body fat percentage** of 14% is needed to have an ovulation!*

Corpus Luteum either degenerates if no fertilization occurs or produces progesterone in case of fertilization.



Conception

Requires a 23 Chromosom containing **Spermatozoon** to meet a 23 Chromosom containing **Ovum** to produce a 23 Chromosom containing diploid zygote. Conception takes place in the ampulla of the fallopian tube.

Development of a Pregnancy

Cleavage (rapid mitotic division of zygote) leads to blastocyst which develops into the 16 cell Morula → Morula divides into trophoblast to be implanted into endometrium.

Cervical secretions become stratified during ovulation to facilitate sperm transport

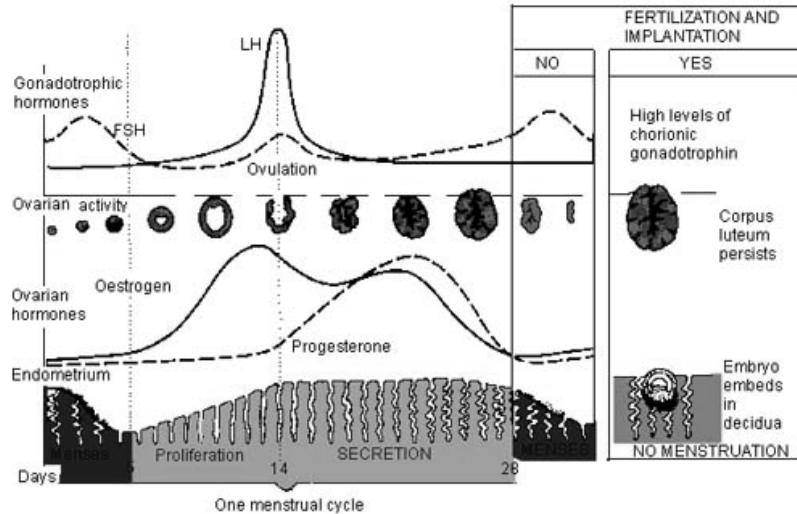
Endometrial Secretions are rich in glycogen to nourish developing embryo until Placenta has developed/

Menses

Begins during puberty and is stimulated by alternating estrogene and progesterone secretion.

Menstrual cycle

A menstruation occurs if the ovum is not fertilized and the corpus luteum disintegrates. Estrogen and progesterone levels drop in last week of menstrual cycle. Leading to sloughing of endometrium.



Menstrual cycle:

Follicular Phase: Day 1 – 14 of cycle

Consists of **menstrual** phase and **proliferative** phase
Length of follicular phase varies and can change length of the entire cycle!

Luteal Phase: Day 15 – 28 of cycle

(Always 12 – 14 days in length)!

Consisting of **secretory Phase** (Endometrium secretes glycogen) and **ischemic phase** (Endometrium breakdown)

Cervical mucus as a fertility indicator

- During ovulation more plentiful, thinner and of stretchy consistency
- Forms columns to facilitate sperm transport
- Production can be impaired by surgical treatment for abnormal Pap smears

Female sexual and reproductive hormones

Estrogene characteristics

- Produced by ovaries and ovarian follicles during ovulation.
- Expresses secondary sex characteristics at puberty.
- Peaks in follicular phase of menstrual cycle
- Inhibits FSH and LH secretion.

Progesterone characteristics “ The Pregnancy Hormone”

- Produced by Corpus luteum.
- Peaks in luteal phase.
- Stimulates LH and FSH.
- Thickens endometrium.

FSH

Anterior pituitary hormone, matures one ovarian cycle each cycle.

LH

Anterior pituitary hormone, completes maturation of ovarian follicles and stimulates ovulation which occurs 10 – 12 hrs after LH Peaks.

Menopause

Defined by 1 year of amenorrhea, occurs on average around 50, leading to thinning and atrophy of internal and external genital structures.

Local anaesthesia to lateral aspect of cervix during active or transition phases

Relatively easy administration, quick onset, rapid onset, no neonatal effects

May lead to decreased or absent urge to push

Systemic effect by infection through vascularized cervix = FHR ↓!!!!

Decreased sensation in lower extremities

Pudendal Block

Local anaesthetic injected into lateral walls of vagina to anaesthetize pudendus nerve.

Administered in 2nd stage during preparation for episiotomy.

Eliminates urge to push.

Decreases sensation in lower extremities or ability to urinate.

Monitoring of Morphine side effects

→ **respiratory depression** may occur up to after 8 hours,
nausea and vomiting after 4 hours,
itching within 3 hours,
urinary retention, constipation, somnolence at any time.

- Complicated delivery and care -

Significant risk factors for intrapartal complications are high catecholamine levels due to stress, fear and labor!

Factors contributing to difficult labor or dystocia

Hypertonic and hypotonic uterine dysfunction

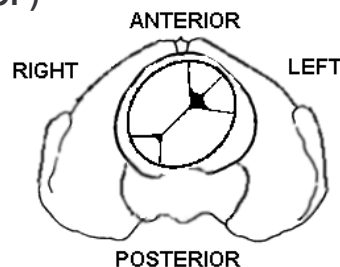
Assessment with labor graph (*Friedman curve*)

(comparing descensus and dilation of cervix over time)

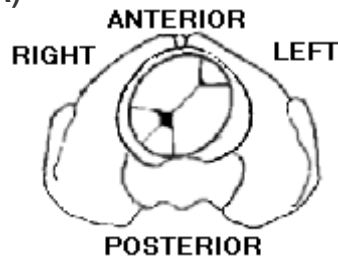
Malpositions and Malpresentations

Fetal malpositioning (*Correct position is Occiput anterior position*)

Occiput posterior position (OP)



Occiput anterior position (OA)



Fetal malpresentations

- **Vertex** presentation
- **Brow** presentation
- **Face** presentation
- **Sincipital** presentation
- **Breech** presentation (*require caesarean section!*) three types:
 1. **Frank breech** (presenting sacrum)
 2. **Incomplete** (footing) breech
 3. **Complete breech** (presenting anus and buttocks)

Shoulder presentation (transverse lie) requires caesarean section.

FHR monitoring electrodes must not be placed on presenting part !

Extraction methods

Vaccum delivery

(→ may cause cephalohematoma, retinal hemorrhage, intracranial hemaorrhage)

Forceps delivery

(→ may cause fetal ecchymosis, edema of face)

Gestational age assessment “Ballard Tool”

Based on six physical and six neuromuscular signs:

→ Outcomes:

Small, appropriate, large for gestational age SGA, AGA, LGA

Neuromuscular assessments may need to be repeated after 24 hours since neuromuscular system may be unstable due to labor and birth.

Physical maturity is always stable from birth.

Lanugo is less the higher gestational age is, minimal at term birth.

Plantar surface covered by 2/3 in crease in first 12 hours.

Breast tissue 5 – 10 mm between forefinger and middle finger.

Nipples aised above skin level?

Testes descended ? Scrotum pendulous, covered w. rugae?

Labia majora cover labia minora and clitoris between 36 – 40 weeks of gestational age.

-Wound Care-

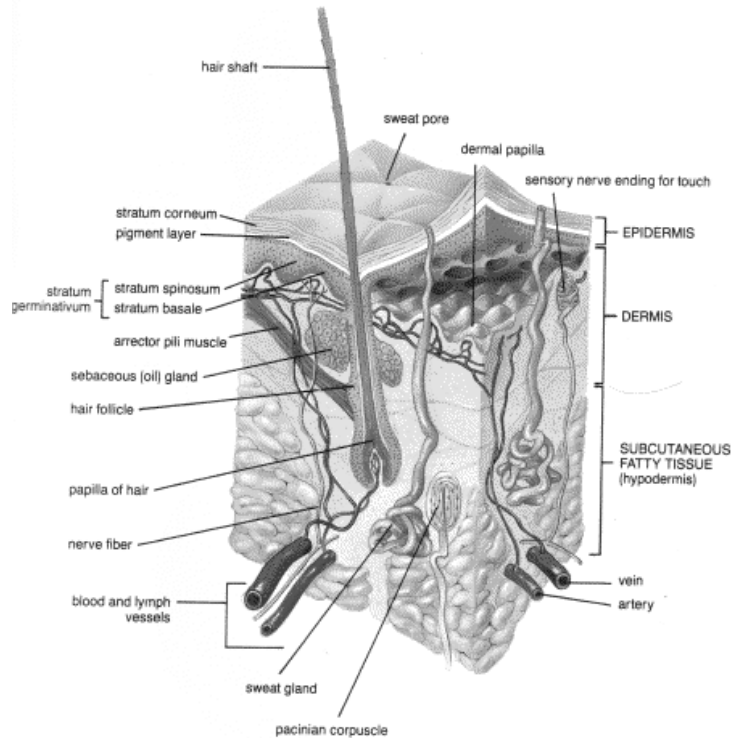
Layers of Epidermis

Epidermis: Five layers of squamous epithelial cells deriving from basal cell layers.

Dermis: Elastic cells with nerves and blood vessels, glands and hair follicles

Subcutaneous tissue: Adipose tissue that provides support and blood flow to epidermis.

Skin glands: sebaceous glands, sudoriferous glands, ceruminous glands and secreting earwax.



Wounds

Break in skin or mucous membranes due to physical means. May be superficial and affecting the skin surface only or deep, involving blood vessels, nerves, fascia, tendons, ligaments and bones.

b

Classifications of wounds

- 1. Open wounds** e. g. cut, lacerations, abrasions
- 2. Closed wounds** e. g. contusion or ecchymosis
- 3. Full thickness** burn or injury that reaches until subcutaneous tissue
- 4. Partial thickness** burn or injury reaches epidermis and dermis
- 5. Noninfected / infected**
- 6. Surgical wounds**

Pressure ulcers

Skin lesion by unrelieved pressure. Caused by immobility, cachexia, moisture, friction, shearing, dry skin.

Norton and Braden Scale for assessment of Pressure ulcer Risk

Stage 1: skin intact, erythema possible, tingling or burning sensations, edema, Induration, hardness as indicators.

Stage 2: superficial partial thickness skin loss, blister, abrasionlike appearance

Stage 3: full thickness skin loss, extending to fascia,

Stage 4: damage beyond fascia, affection muscles, bones, tendons, \. May also build Fistulas.

Phases of wound healing

1. Inflammatory phase

RBC and proteins build fibers of fibrin. Increased blood perfusion of the area to assure adequate nutritional supply. Healing ends with a **scab** from fibrin and other proteins. Skin heals in 3 – 4 days.

2. Proliferative phase

Fibroblasts grow to form granulation tissue with new capillaries and epithelial cells. Connective tissue builds scar tissue. Excessive build up of granulation tissue forms **keloid**.

3. Maturation / remodeling phase

Weeks – years of reorganization of collagen fibers, wound remodeling, tissue maturation.

Factors affecting wound healing

Age, nutrition (Vitamin C!, Proteines), Condition of injured tissue (Grade of destruction, contamination), efficiency of circulation, rest, anxiety, stress, medications. (Immunosuppressant, Cyclooxygenase inhibitors)

Wound closure is either caused by primary intention (surgical repair) or by secondary intention (→ scarring)!

Dehiscence and Evisceration of tissues require urgent surgical repair!

Wound assessment

Signs of infection

Redness, swelling, increased tenderness, temperature, WBC, disruption of wound edges. Treatment with wound cleaning Saline – or diluted antimicrobial solutions. Gauze squares.

Dressing types

Gauze

Sterile, nonsterile, antimicrobial, absorbs drainage

Transparent

Impermeable to bacteria and fluids, supporting autolytic debridement

Composite dressing

Absorbent and adhesive cover. May only require 3 changes weekly. Hydrocolloids – Adhesives made of gelatine. Occlusive to microorganisms. Enhances autolysis of wound bed.

Hydrogel

Water or glycerine is primary component. Maintains moist, oxygenated surface.

Calcium alginates

Made of seaweed fibers to absorb larger amounts of drainage.

Exudate absorbers

Semipermeable polyurethane foam that absorb large amounts of exsudatives while keeping wound moist.

-Monitoring of Tubes and Drains-

Tracheostomy

Surgically created opening in the cricothyroideum ligament between cricothyroideus cartilage and 1st tracheal cartilage. May be temporary or permanent. (Jackson tube) Variations include double or single lumen (with or without inner cannula),cuffed or cuffless, fenestrated and not fenestrated.

Any procedures performed on a tracheostoma require that there is a manual resuscitation bag available at all times. Replacement tracheotomy set has to be in reach in case tracheostoma is accidentally removed and fistula opening collapses!

Tracheostomy care

1. Respiratory assessments 4 hourly.
2. Suctioning prn.
3. Frequent assessment for signs of infection.
4. Tracheostomy care required every 8 hours including assessment of cuff pressure.
5. Change of tracheostomy ties daily, if soiled.

→ Change requires to have tracheostomy held in place by assistant during the procedure since patient may cough and accidentally loose it.

Ensure alternate communication with patient if tracheostomy has a cuff inflation.

Accidental removal of a tracheostomy tube is a medical emergency, especially if trach was inserted within the last 72 hours!

Management of accidental tracheostoma tube removal

- hold stoma open by grasping retention sutures or using curved clamp
- insert obturator, insert tube, remove obturator, if problems occur call rapid response team.

Long Term complications of Tracheostomy

Tracheomalacia

Tracheoesophagel fistula

Tracheal stenosis through scar tissue

Tracheal innominate artery fistula (Life threatening condition)

Endotracheal tube

Required for mechanical ventilation up to 14 days. Orotracheal or nasotracheal insertion.

Assessment of correct placement of an endotracheal tube

Ventilation with manual resuscitation bag and auscultation of epigastric area.

Use of CO₂ analyzer

Portable Chest X-Ray (tip of tube to be placed to 1–2 cm above bifurcation (carina))

Respiratory assessments 4 hourly

Suctioning prn

Oral care 2 hourly

Reposition tube daily

Inflating cuff by minimal leak technique or minimal occluding volume technique

Removal of airway tube

1. Suction trachea,
2. Adjust client to semi–fowlers or fowlers position
3. Deflate cuff
4. Remove tube at peak inspiration
5. Close monitoring for 30 minutes
6. Expect sore throat and hoarseness

Closed Chest Systems

Chest tubes are placed to remove air or fluids from pleural cavity by producing a vacuum. Commonly a 3 Chamber system with water seal (vacuum), suction and collection.

Management of closed chest systems:

1. All tubing connections have to be secured from dislocating with tape.
2. Collector needs to be positioned below chest.
3. Milking of the chest tube can cause organ damage.
4. Clamping of chest tube requires Physicians order.
5. No clamping when patient is mobile. Clamp must be in reach at all times.
6. Monitor drainage 1 – 4 hourly.
7. Maintain – 2cm water level suctioning.
8. Water level must fluctuate.
9. Continuous water bubbles indicate leak in the system.
10. Light permanent bubbling in the suction control chamber is to be expected.
11. Intermittent inspiratory water bubbles in a Pneumothorax indicate normal function.
12. Reposition client twice hourly.
13. Encourage deep breathing, and coughing.
14. Daily Chest X Ray may be necessary.
15. In accidental dislocation or damage of system insert chest tube into sterile water to maintain water seal, then replace system.
16. Accidental removal of chest tube requires immediate cover, closure of insertion wound and surgeon to be contacted. Scheduled Removal under **Valsalva** maneuver.

Dosage calculation medication administration

Metric system

Uses gram for a unit of weight and liter for an unit of liquid volume.

Conversion within the metric system

From a lower to the next larger unit of measure move decimal point three places to the right. → e. g. 1.5 grams → 1500 milligrams

From a larger to the lower unit of measure move three places to the left
→ e. g. 1000 ml → 1.0 Liter

Dosage calculation schemes

Formula 1 “Desired over have”

$$\frac{\text{Dose ordered (desired)}}{\text{Dose on hand (have)}} \times \text{Amount available} = \text{Amount to give}$$

Example: Metoclopramide 15 mg is ordered, Medication is available in 10 mg/2mL

$$\frac{15 \text{ mg}}{10 \text{ mg}} \times 2 \text{ mL} = 3 \text{ mg}$$

Formula 2: Ratio and Proportion

Step 1:

$$\frac{\text{Dose ordered (desired)}}{\text{Dose on hand (have)}} = \frac{\text{Dose required}}{\text{Amount available (have)}}$$

$$\frac{15 \text{ mg}}{10 \text{ mg}} = \frac{X}{2}$$

Step 2:

Result of left Division x Amount available = Amount to have

$$1.5 \text{ mg} \times 2 = 3 \text{ mg} \quad x = 3$$

Formula 3: Dimensional Analysis

Equation:

$$X = \frac{\text{Amount available} \times \text{Dose on hand}}{\text{Dose ordered}}$$

$$X = \frac{20}{15}$$

$$X = 3$$

*Each of these formulas works for all dosage calculation operations.
Use the formula which is best for you !*

Identification of extended length oral medication by additional abbreviations

CR, (controlled release), CRT (controlled release tablet), LA (long acting), SA (sustained action), SR (sustained release), TR (time release) XL, XR (extended length of release)

Do not crush extended length oral medication !

Administration of Blood Products

Checklist:

1. Assessment of vital signs.
2. Obtaining clients consent.
3. Finding and puncturing suitable vein.
4. Insertion of a 18 – 20-gauge needle catheter.
5. Start Saline 0.9 % Solution using a Y – Set.
6. Check blood from blood bank for donor number and expiration date.
7. Compare blood donor number and patient identification with second nurse.
8. Mix cells and plasma gently by inverting back several times.
9. Hang blood unit
10. Start with transfusion rate of 2 mL per minute for first 15 minutes.
11. Check vital signs every 5 – 15 minutes.
12. Increase transfusion rate after 15 minutes.

*Blood must be hung within 30 minutes of receipt from the blood bank !
Unit must be administered within four hours !
Asses vital signs half hourly until 1 hour after transfusion has stopped !*

Transfusion reactions, symptoms and management

Bacterial reactions

Chills, tachycardia, fever. → Obtain blood culture, start antibiotic therapy, fluid resuscitation, vasopressors, corticosteroids.

Hypersensitivity

Urticaria, fever, anaphylactic reaction. → Diphenhydramine, shock treatment, oxygen.

Hemolytic reaction

Nausea, back pain, tachycardia, hypotension, hematuria → Diphenhydramine, shock treatment, oxygen.

Febrile reaction

Nonspecific if not accompanied by additional physical symptoms. Most common transfusion reaction, may require premedication with Acetaminophen or Aspirin.

Circulatory overload

Transfusion speed too fast. Leading to tachycardia, pounding pulse, hypertension, distended neck veins, crackles upon lung auscultation, dyspnea and coughing.

Procedure → slow transfusion rate, maintain an upright position, supply oxygen and notify physician.

Blood – borne infection

Specific risks are CMV, HIV, Hepatitis B + C, Malaria.

Electrolyte imbalances

- *Hyperkalemia*, due to intravascular hemolysis.
- *Hypocalcemia* caused by citrate from blood products.

Iron overload

Delayed complication after multiple transfusions. Treatment with desferoxamine (Desferal) subcutaneously or intravenously which will eliminate iron via kidneys (red urine !)

-Total Parenteral Nutrition (TPN)-

Total parenteral nutrition via an intravenous catheter is indicated in conditions that interfere with a regular function of the gastrointestinal tract. (i. e. intestinal blockage or recent abdominal surgery) This form of treatment may be provided in a hospital as well as in a home care setting. Main goals of a TPN are prevention of weight loss, protein loss and adequate Fluid and Electrolyte supply.

The **TPN** solutions typically consist of a mixture of amino acids and dextrose as well as electrolytes and vitamins in an amount of 2 – 3 liters which are usually administered over 24 hours. Depending on the duration of this treatment it may be necessary to supply additional lipids, vitamins and minerals. Lipids are usually not given on a daily basis unless the primary formula solution with carbohydrates and aminoacids also includes lipids in a small concentration. Such solutions are called **total nutrient admixture TNA**. Single fat emulsions to be added to the TPN are called linoleic, linolenic, oleic, palmitic and stearic acids.

Access sites for TPN

A peripheral vein is used for up to 7 days but no longer than two weeks to administer parenteral nutrition. *Access via a peripheral vein does not allow to administer dextrose solutions of more than 10 % concentration since higher concentrated solutions cause sclerosing and phlebitis of the peripheral veins.* A central vein access allows the administration of dextrose concentration of more than 10 %. TPN via a central vein access requires a catheter with at least 3 lumen where one lumen has to be reserved for administration of the TPN only. A vein catheter inserted directly into a central vein can be used for up to 4 weeks. If a TPN is required for a longer period of time, then a peripherally inserted central catheter (PICC) may be used since it can remain inserted for a longer period of time.

Management of a TPN:

Checklist:

1. Ensure correct function and insertion of peripheral or central vein catheter.
2. Blood glucose monitoring prior to the start of a TPN as well as every 6 hours to detect Hyperglycemia / Hypoglycemia.
3. Daily weight measurement to determine fluid balance as well as accurate 24 h input / output records.
4. (A sudden and significant increase of i.e. 1 kg per day may be rather fluid retention while a slower less significant weight of 1 – 2 pounds weekly is rather caused by weight gain
5. Regular laboratory assessments of liver function, TLC, BUN, creatinine, albumin, prealbumin, total protein and serum electrolytes.
6. Ensure that type, concentration and amount of any ingredients of a TPN solution are complying with physicians order.
7. Assure that TPN solution has a homogenous light color and concentration without any solid particles.
8. Adjust TPN flow rate to individual conditions (usually 50 mL/hr – 125 mL/hr).
9. Lipid concentration flow rates start from 1 mL / min.
10. Maintain Normoglycemia by using Dextrose 10 % Solution if TPN is temporarily not available.

NEUROLOGICAL DISORDERS AND DISEASES

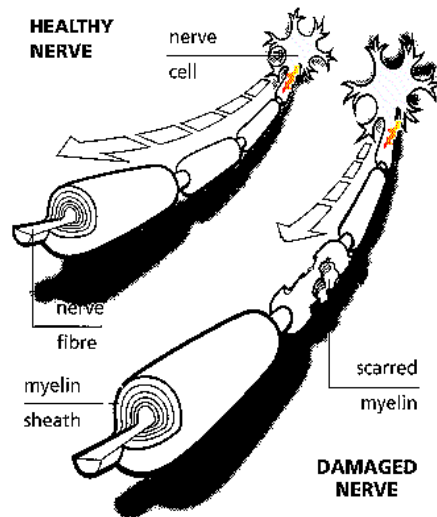
Anatomy and physiology of the nervous system

Microanatomy of the nervous system

The nervous system contains specific structural nerve cells (= **neurons**). These cells are designed to produce and process electrical impulses along the neural fibers (= nerve **axons**). Each neuron communicates with an average of 1000 other neurons via functional connections which are described as **synapses** and **dendrites**. Neurons are the basic information processing units of the entire nervous system. The main cell types of the connective tissue of the central nervous system are **astrocytes** and **oligodendrocytes**.

Myelin sheaths

Central and peripheral nerves can be differentiated in **myelinated and unmyelinated** nerve fibers. Myelin layers of peripheral nerves are built by specific connective tissue "glia" cells, ("**Swann's cells**") and designed to increase the speed at which neural impulses are progressing along the *myelinated* fiber. Along *unmyelinated* fibers, impulses move continuously as waves, but, in myelinated fibers, they hop or "propagate by saltation." Myelin increases electrical resistance across the cell membrane by a factor of 5,000 and decreases capacitance by a factor of 50. Myelination also helps to prevent the electrical current from leaving the axon. When a peripheral fiber is severed, the myelin sheath provides a track along which regrowth can occur.



Oxygen administration methods

Nasal cannula:

Allows 1–6 L/min O₂/min provides 24–44% oxygen concentration of inspiratory volume.

O₂ Administration has to be performed cautiously in clients with COPD to avoid respiratory failure due to the decrease of paCO₂ or under use of Venturi mask which can be adjusted to deliver exact concentrations of O₂.

Methods of mechanical ventilation

Types of ventilators differ by trigger

- Positive pressure time cycled ventilator
- Positive pressure volume cycled ventilator
- Positive pressure pressure cycled ventilator
- Positive pressure jet ventilator
- Negative pressure ventilator (Iron lung)

Modes of ventilation

- Intermittent Mandatory Ventilation IMV
- Assist Control Ventilation ACV
- Controlled mandatory Ventilation CMV
- Synchronized Intermittent Mandatory Ventilation SIMV

Ventilator settings

1. PEEP positive end-expiratory pressure
2. FiO₂ fraction = amount of O₂ inhaled via ventilator
3. Tidal volume VT
4. Breathing rate per minute

Indications for ventilator respiration:

- O₂ Saturation < 80%
- pH < 7,35
- PaCO₂ > 50mmHg
- VT < 5mL/kg Bodyweight
- Minute volume < 10 L/min

Client care after lung surgery

After lobectomy an equal alternating positioning on back and either side is necessary to avoid atelectasis and to optimize the ventilation – perfusion ratio for the remaining lung.

After segmental resection a positioning on side of surgery can cause damage to the surgical wound.

After pneumonectomy client is to be preferably positioned on back and halfway turned to side of resected lung.

Respiratory Medication Therapy

Bronchodilators

Beta-agonist sympathomimetics

Pharmacological effect:

Sympathomimetic bronchodilators connect with beta–2 receptors on bronchial membranes and lead to release of cAMP (cyclic adenosine monophosphate) which will leads to a dilation of bronchi and bronchioles.

Indication:

Acute Asthma attack, acute Dyspnea in a Chronic obstructive lung disease (COPD), Long term Asthma and COPD treatment.

Special considerations and side effects:

- The therapeutic effect of Beta-2 mimetic medication decreases with increase of administered dose and frequency.
- Side-effects increase with increased dosage.
- Once Beta-2 receptors are saturated with Beta-mimetic medication there is no further therapeutic effect until the substance is released from receptor.
- This process can be enhanced by intermittent use of inhalatory corticosteroids.
- Increased dosage may also lead to stimulation of Beta1-sympatomimetic receptors leading to tachycardia, hypertension, palpitations, tremor and anxiety.
- These effects may be increased under caffeine consume which should be avoided during the treatment.
- Sympatomimetics have to be used with caution in patients with cardiovascular disease.
- Sympatomimetics are contraindicated in combination with Monoamine oxidase inhibitors. (MAOI's)
- Administration of inhalatory Sympatomimetics requires adequate patient education.
- There should be between 1–5 minutes of waiting time in between dosages
- If administration of a maximum dosage does not lead to a relief of the bronchospasm within minutes a physician has to be contacted.
- Diabetes patients may respond with hyperglycemia.
- During treatment of an acute dyspnea due to a flare of asthma or COPD it is very important to remain calm and reassure the patient about a positive outcome.

Substances:

Albuterol (Proventil®), Bitolterol mesylate (Tornalate®), Formoterol (Foradi®) Isoprotenerol (Isuprel®), Metaproterenol sulfate (Alupent®) Pirabuterol acetate (Maxair®), Salmeterol (Serevent®), Terbutaline sulfate (Brethine®)

Salmeterol and Formoterol is not indicated for an acute treatment since its effect starts after 20 minutes and lasts for 12 hours!

Albuterol, Bitolterol, Metaproterenol and Terbutaline is not indicated in children under 12 years of age!

“How to ..”

use a metered dose inhaler

1. Insert medication cartridge into inhaler.
2. Remove cap from mouthpiece and hold inhaler upright.
3. Shake inhaler for 3 – 5 seconds.
4. Hold inhaler upright with mouthpiece downwards.
5. Tilt head lightly backwards.
6. Close lips tightly around mouthpiece.
7. Release dosage while taking a deep, slow breath for 3 – 5 seconds.
8. Hold breath for 10 seconds.
9. Exhale.
10. Rinse mouth and blow nose.
11. Clean mouthpiece with mild soap.
12. Store inhaler at room temperature.

Anticholinergic Bronchodilators

Pharmacological effect:

Blocking Acetylcholine receptors of the PNS on bronchial membranes.

Indication:

Acute Asthma attacks

Acute Dyspnea in a Chronic obstructive lung disease (COPD)

Special considerations and side effects:

- Lower potency than sympathomimetics.
- Immediate but short lasting effect.
- Can be used in an acute bronchoconstriction even in combination with sympathomimetics.
- May cause *anticholinergic effects*: dryness of mouth, tachycardia, hypertension, palpitations, tremor, anxiety, urinary retention, diarrhea, nausea and vomiting.

Substances :

Ipratropiumbromide (Atrovent® and Combivent®), Tiotropium (Spriva®)

Xanthines

Pharmacological effect:

Inhibition of the enzyme phosphodiesterase (PDE)

Increase of cAMP in smooth muscle cells to achieve a bronchial dilation.

Increase of catecholamine levels.

Inhibiting synthesis of Prostaglandines.

Inhibiting release of cellular mediators Prostaglandin, Histamine, Thromboxane, from leucocytes and mastcells.

Indication:

Status asthmaticus, mild and moderate Asthma attacks, pulmonary edema.

Special considerations and side effects:

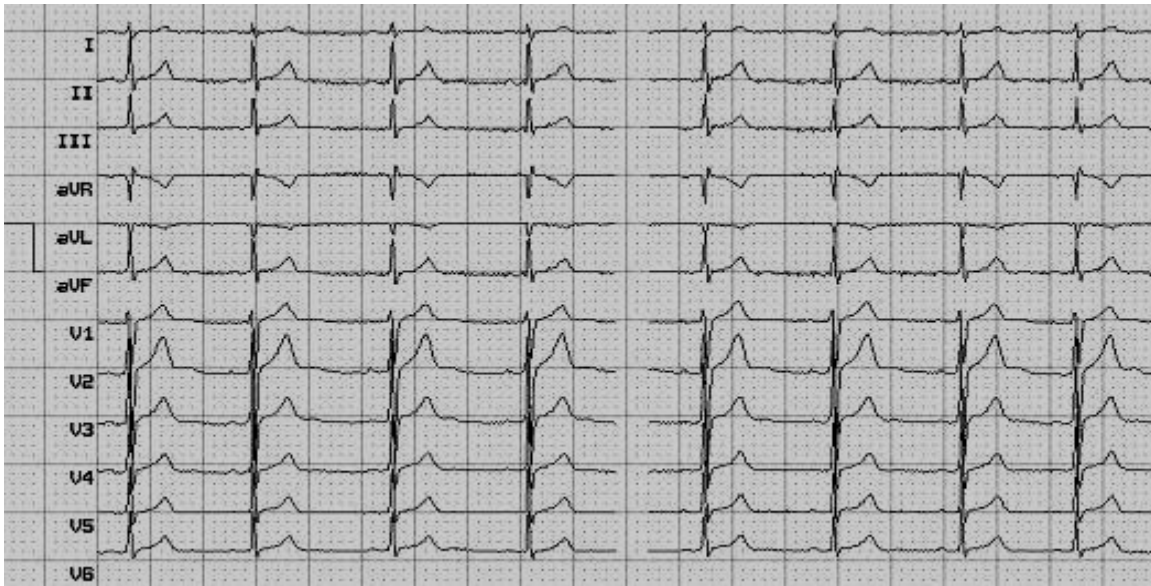
- Long term treatment requires monitoring of blood levels.
- Therapeutic range: 10 – 20 mcg/mL
- Slower onset of effect than inhalers, especially if administered orally.
- Same stimulating effects, side effects to the cardiovascular system and central nervous system as Sympathomimetics.
- Euphoric effect, comparable to and increased by caffeine.
- Overdose may cause irritability, insomnia, restlessness, palpitations, hypertension.
- Not FDA approved for other pulmonary obstructive diseases than asthma.

Substances:

Aminophylline (Truphylline®), Theophylline (Theo – Dur®)

Interpretation of common ECG findings

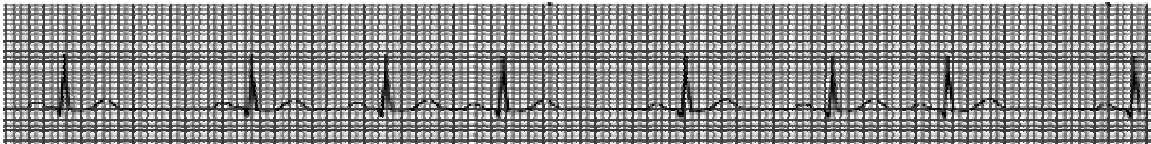
Normal 12 lead ECG



Variations of normal ECG findings

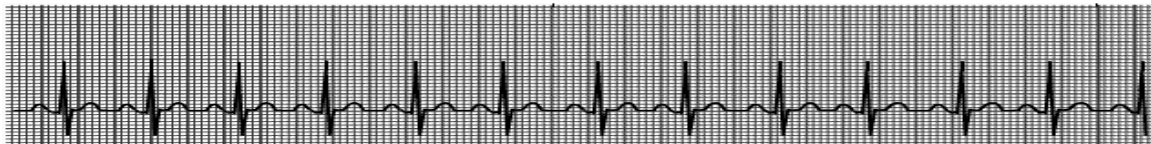
Sinus arrhythmia

R-R Interval changes depending on respirations. Does not require treatment.



Sinus tachycardia

HR > 100 – 150 bpm. May be caused by fever, hypovolemia and pain.
Treatment due to relief of underlying cause.



Pathophysiology of acute renal failure:

- **Oliguria** → **Anuria** = urine output < 400 mL / 24 hours → 0
- **Hypervolemia** due to ECF fluid excess
- blood count: WBC ↑, Platelets ↓, RBC ↓ due to **erythropoietin deficiency**
- muscle weakness
- **hypernatremia**
- **hyperkalemia**
- **hypermagnesemia**
- **hyperphosphatemia**
- **hypocalcemia**
- metabolic acidosis → Vitamin D deficiency → SG ↑ and Proteinuria
- Loss of consciousness → Neurological symptoms

NOT all symptoms are expressed from the beginning of an acute renal failure!

Pathophysiology of liver cirrhosis

Portal vein hypertension

- Caused by an increased pressure within the portal vein due to growing resistance caused by fibrotic liver tissue as the most common cause. Other causes are portal vein thrombosis, liver vein thrombosis (*Budd Chiari Syndrome*), right sided heart failure.

The increased pressure in the portal vein causes large connecting veins to expand, leading to the following characteristic symptoms:

- **Hemorrhoids**
- **Esophageal and gastric varicosis** with potential risk of hematemesis
- **Umbilical vein dilation** "*caput medusa*"
- **Hepatosplenomegaly**

Non – opioid pain management in musculoskeletal disorders Prostaglandin synthesis inhibitors - Nonsteroidal Anti – Inflammatory Agents

Pharmaceutical effect:

Inhibition of cyclooxygenase, the key enzyme for the synthesis of the inflammation and pain mediator prostaglandin.

Physiological effect:

pain relief, anti inflammatory effect, inhibition of platelet aggregation, antipyretic effect

Indications:

Treatment of musculoskeletal pain and dysmenorrhea.

Side effects:

Gastric irritation, prolonged bleeding, tinnitus, hepatotoxicity, allergies, bronchospasms.

Contraindications:

Children, due to danger of **Reye Syndrome**, (Encephalopathy and fatty liver degeneration) asthma, peptic ulcer disease, history of gastrointestinal bleedings, anticoagulant therapy, hepatic diseases, kidney disease.

Treatment should be pursued for up to one month at a time or as required!

Classification of pressure ulcers

Stage 1: Erythematous, warm and tender

Stage 2: Loss of epidermis, excoriation, erythema and swelling.

Stage 3: Subcutaneous ulcer

Stage 4: Ulceration beyond deep fascia → decayed wound

Treatment of accidental paravasations

Vesicant therapy antidotes and treatment

Thiosulfate – Nitrogen mustard

Dactinomycin – Apply ice

Doxorubicin – Cold pack

Vinblastine – Hyaluronidase + Warm pack for 24 hours

Paclitaxel – Hyaluronidas + Ice for 24 hours

Common side effects related to chemotherapeutic agents

Neutropenia

Defined by Neutrophil count $< 1500/\text{mm}^3$.

Nadir most common 7–14 days following administration.

Frequent assessment of Body temperature mandatory.

Fever $> 38.0^\circ\text{C}/100.4^\circ\text{F}$ is most significant symptom.

Limit amount of visitors, avoidance of contact with individuals suffering from infections.

Advice patient on good personal hygiene. Advice visitors to wash hands before touching patient. Avoid exposure to potentially contaminated fresh fruit or homemade food from unknown sources. In case of infection determination of the infectious location involves cultures of urine, blood, tip of intravenous catheter and chest X-ray. Administration of filgrastim (Neupogen) stimulates regrowth of neutrophil colonies. (G-CSF) Substance may induce bone pain and can be self – administered via subcutaneous injection.

Thrombocytopenia

Defined by platelet count $< 50.000\text{ mm}^3$. Lifespan of Thrombocytes is 10 days.

Clients are at risk for hemorrhage, prolonged bleeding time, bruising, petechiae, hypotension, tachycardia and intracranial bleedings. Advice to minimize risk of accidental injury due to falls and cuts etc. Administering stool regulators to ease defecation. Monitoring of pad count in menstruating women. Client to avoid nose blowing. Treatments with non steroidal anti-inflammatory medication or acetylic salicylic acid is contraindicated. Frequent urine and stool test for blood necessary. Hemorrhage may require platelet transfusion.

Nausea and vomiting

Can occur acute or delayed in clients under chemotherapy. Avoid strong aromatic odors.

Encourage small frequent meals and sufficient fluid supply. Antiemetics may be administered parenteral (i. e. Metoclopramide, domperidone and ondansetron).

Anticipatory nausea can be prevented with dexamethasone. Monitoring for dehydration is mandatory. Replenishment of fluids and electrolytes as required.

Diarrhea

Monitor client frequently for dehydration. Replenishment of fluids and electrolytes as required. Administering antidiarrhea medication. Elimination of sweets, processed sugars, caffeine and cold drinks. Avoiding milk and chocolate. Serving low fiber, high protein and high calorie diet. Client may require liquid diet or temporary fasting. Perianal area may require application of moisture barrier

Constipation

May occur due to intestinal polyneuropathy caused by chemotherapy. Requires monitoring of defecation frequency. Encouraging a fiber rich diet and sufficient fluid supply. Preventive treatment with stool regulators may be indicated. Sufficient regular exercise in order to clients overall physical condition. Laxatives may be used reluctantly due to side effects.

Stomatitis

Caused by destruction of epithelial cells of oral cavity during chemotherapy. Condition causes hypersensitivity to hot and cold temperatures, spices and alcohol. Assure thorough oral hygiene to prevent secondary infections. Antifungal/antiviral preventive treatment may be indicated.

Alopecia

Typical onset 2 weeks after administration of chemotherapeutic agents. May continue for up to 5 months. Condition requires careful care of persistent and regrowing hair until full consistency is achieved again. Clients may require emotional support to cope adequately.

Cardiotoxicity

Developing immediately or within 4–5 weeks after drug administration. *Onset of symptoms requires immediate cessation of chemotherapy.* Assessment parameters are the decrease of the cardiac ejection fraction, ECG – changes, dysrhythmias, hypotension, chest pain, pulmonary congestion and peripheric edema. Reversibility depends on amount of administered dosage.

Pulmonary toxicity

More common in clients >70 years of age. Toxic reaction of alveoli and capillary endothelium. *High oxygen supply increases toxicity of Bleomycin.* Regular assessment of pulmonary function studies and oxygene saturation in peripheric blood required. Onset of dyspnea is the primary symptom. Management with low dose opioid medication, oxygen supply and instruction on appropriate breathing techniques.

Hemorrhagic cystitis

Due to damage of urothelial lining and induction of inflammation of bladder wall. Caused by acrolein, metabolit from cyclophosphamide and ifosfamide. Symptoms comparable to an urinary tract infection. Treatment with a chelatbinding agent (mesna) may lead to excretion of acrolein from bladder. Client is required to maintain adequate hydration.

Hepatotoxicity

Caused by metabolism of toxic chemotherapeutic agents in liver. Manifestation includes jaundice, pruritus, abdominal pain in upper right quadrant, hepatomegaly, hyperpigmentation, acholic stool and beerbrown urine. Assessment via regular liver function test. Management involves avoidance of other potentially hepatotoxic substances.

Nephrotoxicity

Caused by damage of nephrons leading to an obstructive nephropathy. Symptoms include elevated levels of creatinine and urea in serum and urine as well as decreased albumin levels and glomerular filtration rate. Urine specific findings are proteinuria, hematuria and hypomagnesemia. Medication may need to be ceased if BUN is > 22mg/dL and/or creatinine > 2 mg/dL. Prevention of nephrotoxicity requires hydration with minimum 3000mL fluids daily and prescription of Allopurinol to control uric acid levels. Also alkalization of urine with bicarbonate and strict avoidance of NSAID required to prevent further kidney damage.

Neurotoxicity

Mainly caused by cumulative dosage of vinca alkaloids passing through the blood/brain barrier to cause direct damage on cells of the central nervous system. Requires frequent neurological assessments. Neurological deficiencies allow conclusion on the affected CNS areas as follow: Confusion or impaired level of consciousness → Cerebrum
Tinnitus, hearing loss → Auditory cortex. Digestive and urogenital dysfunction → Autonomous nervous system. Paresthesias and impaired deep tendon reflexes → Sensoric cortex.

SAFETY REQUIREMENTS FOR HANDLING CHEMOTHERAPEUTIC MEDICATION

- Personnel should be specially trained for this task.
- Dosages have to be calculated in relation to body weight or body surface.
- Treatment courses are mainly intermittent and sometimes combine two or more chemotherapeutic agents.
- Preparation of dosages has to occur in a well air vented area with restricted access.
- Personal safety requires wearing of leak proof gown, disposable gloves and eye protection.

Antipsychotics

Are divided in two subgroups: Phenothiazines and atypical antipsychotic drugs.

Phenothiazines: (= "typical" antipsychotic agents)

Effect and therapeutic use:

Phenothiazines are also called neuroleptic medication and were the first drugs used for treatment of different types of schizophrenia. These very complex drugs are used for treatment of other psychotic disorders as well. Some Phenothiazine types also have an antihistaminic and antiemetic effect. In general Phenothiazines rarely induce a tolerance and treatments can be pursued for many years if necessary and if no side effects occur. Neuroleptic medication has to be administered in defined dosages and punctual over a circadian rhythm to establish a significant blood level of the particular substance. Phenothiazines are Dopamine antagonists as well as anticholinergic drugs. The different types of antipsychotic drugs differ in their antipsychotic and sedating effect. The weaker the antipsychotic effect is, the stronger is the sedating effect.

Side effects:

Extrapyramidal side effects "ESPE's"

Akathisia → Disability to sit still.

Dystonias → Torticollis, tongue and pharyngeal cramps, oculogyric crisis.

Parkinsonism → Picture of symptoms equivalent to Parkinson's disease (Tremor, rigor and akinesia)

Tardive dyskinesia → abnormal involuntary movements

Anticholinergic effects

- Dry mouth
- Urine retention
- Photophobia
- Constipation
- Tachycardia
- Hypertension
- Blurred vision

Questions and Answers

297. An unconscious client is admitted to the Emergency room. He carries the following prescription drugs.

1. Amitriptyline
2. Ramipril
3. Hydrochlorothiazide
4. Glimepirid
5. Pantozole

Which of the following assumptions can be made regarding the medical history of this client ?

- A) This patient may suffer from schizophrenia
- B) This patient may suffer from cancer
- C) This patient may suffer from hypothyroidism
- D) This patient may suffer from diabetes
- E) This patient may suffer from COPD → **p. 145**

298. Which of the following rules apply to a priority based clinical decision making process of a team leader RN ?

- 1) Acute care first
 - 2) Rules of delegation
 - 3) Oral medication first
 - 4) Consideration of ethnical and religious needs
 - 5) Institutional rules
- A) 1,2, and 4 are correct.
 - B) 1,2, and 3 are correct
 - C) Only 4 and 5 are correct
 - D) None of the statements are correct
 - E) All statements are correct → **p. 12/13**

299. Which of the following infection is transmitted via an enteral pathway?

- A) Influenza
- B) Hepatitis B
- C) Hepatitis C
- D) HIV
- E) Polio → **p. 157**