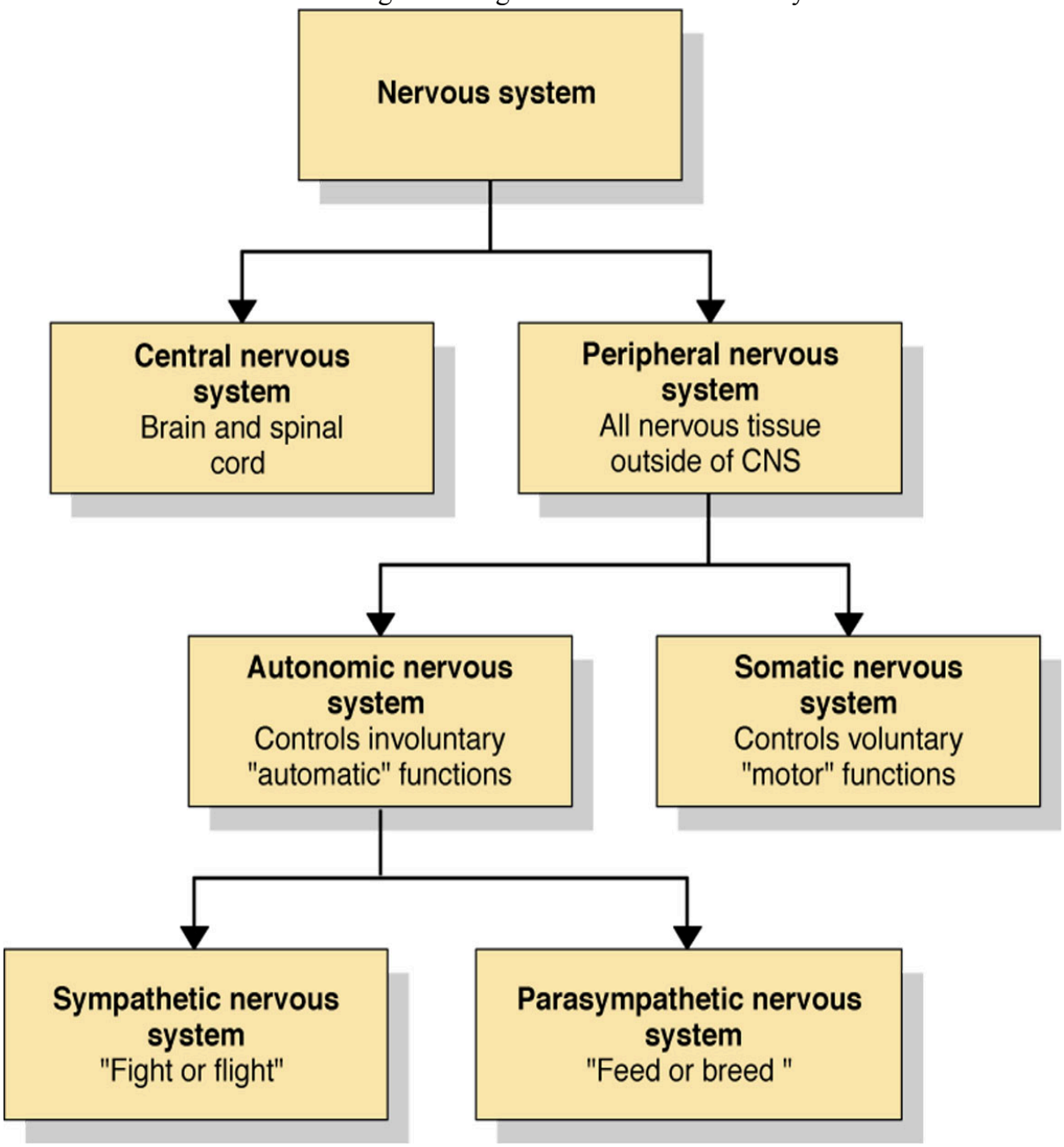
Drugs affecting the autonomic nervous system And Cardiovascular System



Overview of the ANS

1 Consists of the sympathetic and parasympathetic nervous system.

49145888 Drugs that stimulate the sympathetic nervous system are called adrenergics.

49145944 Adrenergics are also called adrenergic agonists or sympathomimetics because they mimic (تقليد)) the effects of the SNS neurotransmitters norepinephrine and epinephrine (catecholamines).

49145945 Inotropes: agents that improve myocardial contractility and enhance stroke volume

49145946 Pressors: agents that increase systemic vascular resistance and increase blood pressure

49145947 Chronotropic: Increase heart rate

49145948 Dromotropic : increase conduction

Adrenergic Receptors

1. Adrenergic receptors are the sites where adrenergic drugs bind and produce their effects.
2. Adrenergic receptors are divided into alpha-adrenergic and beta-adrenergic receptors depending on whether they respond to norepinephrine or epinephrine.
3. Both alpha- and beta-adrenergic receptors have subtypes designated 1 and 2.

4. Beta1-adrenergic receptors are primarily located in the heart.
5. Beta2-adrenergic receptors are primarily located in the smooth muscle of bronchioles, arterioles, and visceral organs.
6. Adrenergic blockers, also called adrenergic antagonists or sympatholytics, have the opposite effect of adrenergics.
7. Alpha-blockers and beta-blockers bind to the receptor sites for norepinephrine and epinephrine blocking the stimulation of the SNS.

** Dopaminergic receptors are only stimulated by dopamine which causes the vessels of renal, mesenteric, coronary, and cerebral arteries to dilate and the flow of blood to increase.

Function of adrenergic receptor subtype

Alpha1 receptors :-its activation cause
-mydriasis(dilation of the pupil)
-vasoconstriction

Alpha 2 receptors:- its activation cause
-inhibition of norepinephrin release
- inhibition of acetylcholine release
(used in the treatment of hypertension when given systemically as IV or very high oral Dose)
(its activation lead to vasoconstriction only when given locally)

Beta1 receptors :- its activation cause
-increase heart rate ,force of contraction ,velocity of impulse conduction through the atrioventricular(AV) node
-vasoconstrictor.

Beta2 receptors :-its activation cause

-bronchial dilation
-relaxation of uterine smooth muscle
-vasodilation
-promotes glycogenolysis (breakdown of glycogen into glucose) therapy
Increase blood level glucose

Dopamine receptors:-its activation cause
-dilates renal blood vessels, thereby enhancing renal perfusion

Cholinergics

1. Drugs that stimulate the parasympathetic nervous system are called cholinergics.
2. Sometimes called cholinergic agonists or parasympathomimetics, these drugs mimic the effect of acetylcholine, which is the neurotransmitter responsible for the transmission of nerve impulses to effector cells in the PSNS.

3. The receptors that bind the acetylcholine and mediate its actions are called cholinergic receptors.
4. These receptors consist of nicotinic receptors and muscarinic receptors.

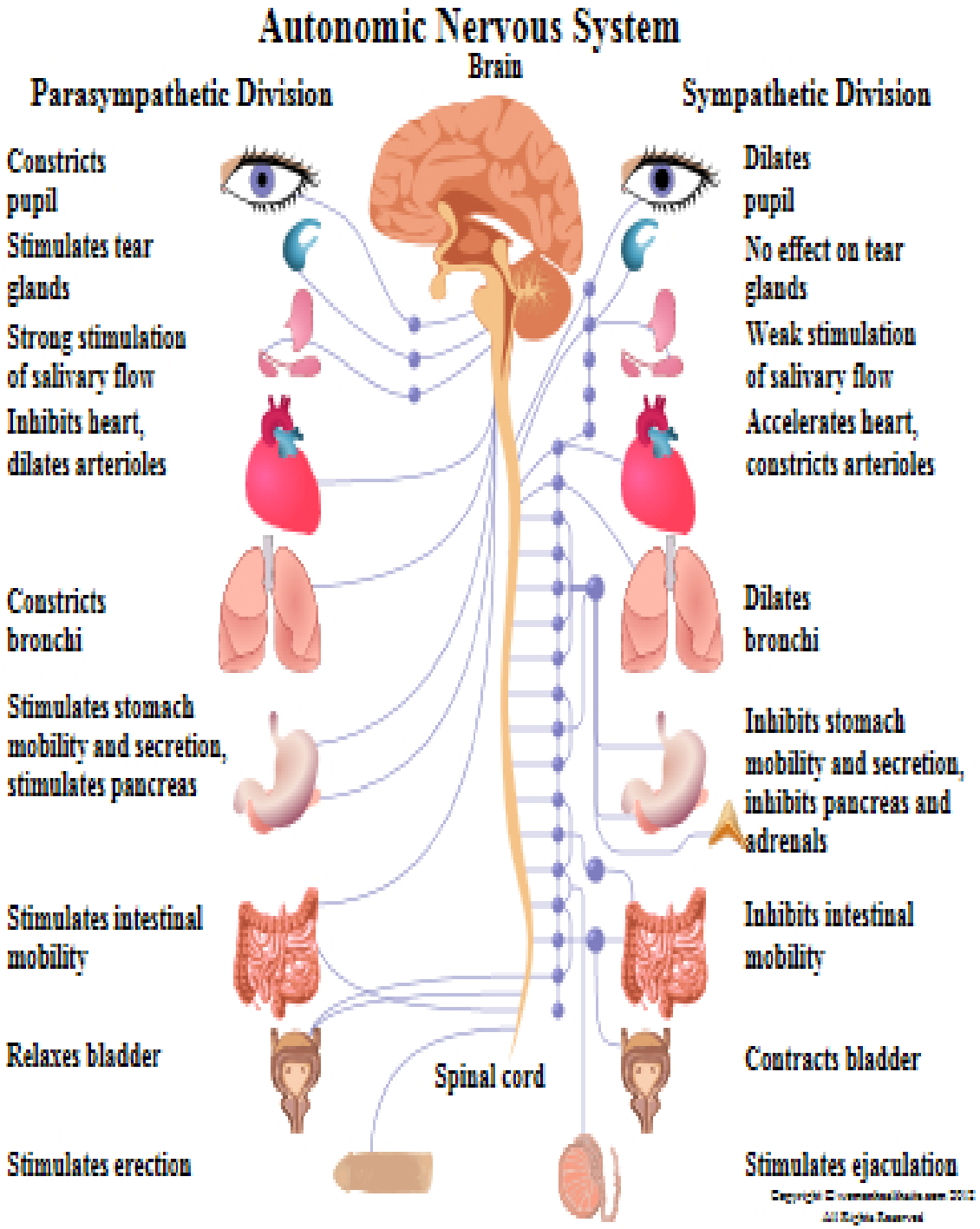
5. Cholinergic drugs can be direct-acting (bind to and activate cholinergic receptors) or indirect-acting (inhibit cholinesterase which is the enzyme responsible for breaking down acetylcholine).

6. Cholinergic blockers, anticholinergics, parasympatholytics, and antimuscarinic agents are all terms for the class of drugs that block the actions of acetylcholine in the PSNS(parasympathetic nervous system.).
7. Cholinergic blockers allow the SNS (sympathetic nervous system) to dominate and, therefore, have many of the same effects as the adrenergics.

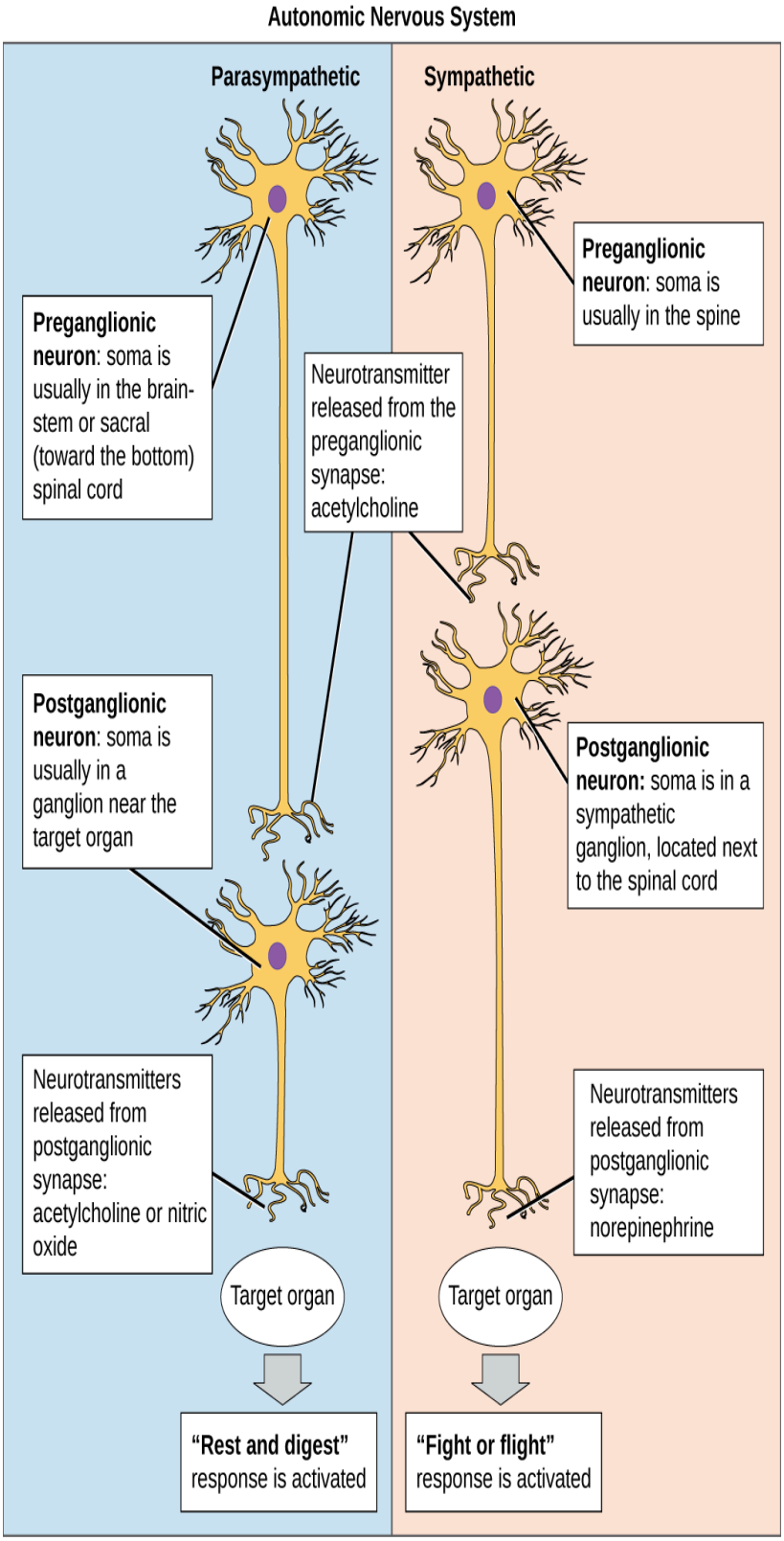
Catecholamines

1 Stimulate the nervous system, constrict peripheral blood vessels, increase heart rate, and dilate the bronchi.

49146616 Can be natural or synthetic and include: dobutamine, dopamine, epinephrine, norepinephrine, .


Autonomic Nervous System
Brain
Parasympathetic Division
Sympathetic Division
Constricts pupil
Stimulates tear glands
Strong stimulation of salivary flow
Inhibits heart, dilates arterioles
Constricts bronchi
Stimulates stomach mobility and secretion, stimulates pancreas
Stimulates intestinal mobility
Relaxes bladder
Stimulates erection
Dilates pupil
No effect on tear glands
Weak stimulation of salivary flow
Accelerates heart, constricts arterioles
Dilates bronchi
Inhibits stomach mobility and secretion, inhibits pancreas and adrenals
Inhibits intestinal mobility
Contracts bladder
Stimulates ejaculation
Spinal cord


Dry Mouth


Autonomic Nervous System
Parasympathetic
Sympathetic
Preganglionic neuron: soma is usually in the brain-stem or sacral (toward the bottom) spinal cord
Neurotransmitter released from the preganglionic synapse: acetylcholine
Preganglionic neuron: soma is usually in the spine
Postganglionic neuron: soma is usually in a ganglion near the target organ
Postganglionic neuron: soma is in a sympathetic ganglion, located next to the spinal cord
Neurotransmitters released from postganglionic synapse: acetylcholine or nitric oxide
Neurotransmitters released from postganglionic synapse: norepinephrine
Target organ
Target organ
"Rest and digest" response is activated
"Fight or flight" response is activated

Scientific name: - epinephrine

Trade name: - adrenaline

Drug classes

Alpha-adrenergic agonist ,Antiasthmatic

Beta1- and beta2-adrenergic agonist

Bronchodilator ,Cardiac stimulant ,Sympathomimetic ,Vasopressor

Therapeutic actions

Effects on alpha receptors include

vasoconstriction, contraction of dilator muscles of iris.

Effects on beta receptors include

positive chronotropic and inotropic effects on the heart (beta1 receptors); bronchodilation, vasodilation, and uterine relaxation (beta2 receptors);

Pharmacokinetics

Route Onset Peak Duration

Subcut. 5–10 min 20 min 20–30 min

IM 5–10 min 20 min 20–30 min

IV Instant 20 min 20–30 min

Inhalation 3–5 min 20 min 1–3 hr

Indications

● IV: treatment and prophylaxis of cardiac arrest; acute hypersensitivity (anaphylactoid) reactions,in acute asthmatic attacks to relieve bronchospasm not controlled by inhalation or subcutaneous injection; additive to local anesthetic solutions for injection to prolong their duration of action and limit systemic absorption

● Aerosols and solutions for nebulization: Temporary relief from acute attacks of bronchial asthma, COPD

****contraindication**

Diabetes mellitus,Hypertension,Hyperthyroidism,Ischaemic heart disease

Epinephrine injection

● *Cardiac arrest:* 0.5–1 mg

Infusion: Administer by direct IV injection

or into the tubing of a running IV, each 1 mg

over 1 min

Adverse effects

Systemic administration

● **CV:** Arrhythmias, hypertension resulting in intracranial hemorrhage, palpitations, tachycardia, precordial pain in patients with ischemic heart disease

● **GU:** *decreased urine formation* (initial parenteral administration),

Local injection

● **Local:** Necrosis at sites of repeat injections (due to intense vasoconstriction)

■ **Nursing considerations**

Assessment

● **History:** Allergy or hypersensitivity to epinephrine or components of drug preparation; tachyarrhythmias; ischemic heart disease; hypertension; diabetes mellitus;

● **Physical:**; P, BP; R, normal urine output;, blood and urine glucose, ECG

Interventions

● Protect drug solutions from light, extreme heat, and freezing; do not use pink or brown solutions. Drug solutions should be clear and colorless

● Rotate subcutaneous injection sites to prevent necrosis; monitor injection sites frequently.

≠***Warning*** Keep a rapidly acting alpha-adrenergic blocker (phentolamine) or a vasodilator (a nitrate) readily available in case of excessive hypertensive reaction.

≠***Warning*** Keep a beta-adrenergic blocker (propranolol; a cardioselective beta-adrenergic blocker, such as atenolol, should be used in patients with respiratory distress) readily available in case cardiac arrhythmias occur.

● Do not exceed recommended dosage of inhalation

Scientific name:- norepinephrine

Trade name:- Levophed

Drug classes

Alpha-adrenergic agonist

Beta1-adrenergic agonist

Cardiac stimulant

Sympathomimetic

Vasopressor

Therapeutic actions

Vasopressor and cardiac stimulant; effects are mediated by alpha1- or beta1-adrenergic receptorsin target organs; potent vasoconstrictor

(alpha effect) acting in arterial and venous beds; potent positive inotropic agent (beta1 effect),increasing the force of myocardial contraction

and increasing coronary blood flow.

Indications

● Restoration of BP in controlling certain acute hypotensive states EX :-(spinal anesthesia, MI, septicemia, blood transfusion, and drug reactions)

● Adjunct in the treatment of cardiac arrest and profound hypotension

Contraindications and cautions

● Contraindicated with hypovolemia (not a substitute(بدل) for restoration of fluids, plasma,electrolytes, and should not be used when there are blood volume deficits except as an emergency measure to maintain coronary and cerebral perfusion until blood volume replacement can be effected; if administered continuously to maintain BP when there is hypovolemia, perfusion of vital organs may be severely compromised and tissue hypoxia may result

Available forms

Injection—1 mg/mL (as base)

Dosages

Individualize infusion rate based on response.

Adults

● *Restoration of BP in acute hypotensive states:* Add 4 mL of the solution (1 mg/mL) to 1,000 mL of 5% dextrose solution for a concentration of 4 mcg base/mL. Initially, give 8–12 mcg base per min. Adjust dose gradually to maintain desired BP (usually 80–100 mm Hg systolic). Continue the infusion until adequate BP and tissue perfusion are maintained without therapy.

Preparation: Dilute drug in 5% dextrose solution in distilled water or 5% dextrose in saline solution; these dextrose solutions protect against oxidation. *Do not administer in saline solution alone.*

Infusion: Infusion rate is determined by response

with constant BP monitoring

Incompatibilities: Do not mix with blood

products, aminophylline, lidocaine,

, phenytoin,sodium bicarbonate

Adverse effects

● **CV:** hypertension ,tachydysrhythmias.

■ **Nursing considerations**

Assessment

● **History:** Hypovolemia,

● **Physical:** Weight; skin color, T, turgor; P, BP; R, urine output; serum electrolytes, ECG

Interventions

● Give whole blood or plasma separately, if indicated.

● Administer IV infusions into a large vein, preferably the antecubital fossa, to prevent extravasation.

● Do not infuse into femoral vein in elderly patients or those suffering from occlusive vascular disease

● Avoid catheter tie-in technique, if possible, because stasis around tubing may lead to high local concentrations of drug.

● Monitor BP every 2 min from the start of infusion until desired BP is achieved, then monitor every 5 min if infusion is continued.

● Monitor infusion site for extravasation.

q ***Black box warning*** Provide phentolamineon standby in case extravasation occurs (5–10 mg phentolamine in 10–15 mL saline should be used to infiltrate the affected area).

≠***Warning*** Do not use drug solutions that are pink or brown; drug solutions should be clear and colorless.

Note:-norepinephrine is similar to epinephrine except that NE does not

activate beta2 receptors so it does not promote hyperglycemia.

-NE administer just IV.

-NE has limited clinical application just hypotensive states and cardiac arrest .

Scientific name :-atropine sulfate

Trade name: Atropine

Drug classes

Anticholinergic ,Antidote ,Antimuscarinic

Diagnostic agent (ophthalmic preparations) ,Parasympatholytic

Therapeutic actions

Competitively(تنافس) blocks the effects of acetylcholine at muscarinic cholinergic receptors that mediate the effects of parasympathetic postganglionic impulses, depressing salivary and bronchial secretions, dilating the bronchi, inhibiting vagal influences on the heart, relaxing the GI and GU tracts, inhibiting gastric acid secretion (high doses), relaxing the pupil of the eye (mydriatic effect)

Indications

Systemic administration

- preanesthetic medication to prevent or reduce respiratory tract secretions
- Restoration of cardiac rate and arterial pressure

during anesthesia when vagal stimulation produced (vagal stimulation cause decrease in pulse rate)

- Relief of bradycardia and syncope due to hyperactive carotid sinus reflex
- Relaxation of the spasm of biliary and ureteral colic and bronchospasm
- Relaxation of uterine hypertonicity
- Management of peptic ulcer
- Antidote (with external cardiac massage)

for CV collapse from overdose of parasympathomimetic (cholinergic) drugs, or cholinesterase inhibitors (eg organophosphorus)المبيدات الفوسفورية العضوية)nerve agent))

- Antidote for poisoning by certain species of mushroom
- Diagnostically to produce mydriasis

Contraindicated

- Contraindicated with adhesions bronchial asthma; COPD (because it drying and thickening of bronchial secretionthat can be harmful); cardiac arrhythmias; tachycardia; myocardial ischemia myasthenia gravis.
- Contraindicated with glaucoma (because it paralysis the iris sphincter)

Dosages

Adults

Bradycardia dose: 0.5mg IVP q3-5 minutes – total 0.04mg/kg.

● *Antidote:* For poisoning due to cholinesterase inhibitor insecticides الحشرية (المبيدات), give large doses of at least 2–3 mg parenterally, and repeat until signs of atropine intoxication(تسميم) appear; for rapid type of mushroom poisoning, give in doses sufficient to control parasympathetic signs before coma and CV collapse intervene.

Auto-injector provides rapid administration.

Pharmacokinetics

Route Onset Peak Duration

IV Immediate 2–4 min 4 hr

Subcut. Varies 1–2 hr 4 hr

▼IV FACTS

Preparation: Give undiluted or dilute in 10 mL sterile water.

Infusion: Give direct IV; administer 1 mg or less over 1 min.

Adverse effects

● **CNS:** Blurred vision, mydriasis, flushing, nervousness,

● **CV:** *Palpitations, bradycardia* (low doses), *tachycardia* (higher doses)

NOTICE: Administration of atropine in doses less than 0.5 mg OR slowly should be avoided because this may result in a paradoxical bradycardia.

● **GI:** *Dry mouth, altered taste perception, nausea,* vomiting, dysphagia, heartburn, constipation, paralytic ileus

● **GU:** *Urinary retention;*

● **Other:** *Decreased sweating (that make pt risk for hyperthermia)*

■ **Nursing considerations**

Assessment

● **History:** Hypersensitivity to anticholinergics; glaucoma; paralytic ileus, bronchial asthma, COPD, cardiac arrhythmias, myocardial ischemia, myasthenia gravis, , hypertension,

● **Physical:** Skin color; P, BP; R, ECG

Interventions

● Ensure adequate hydration

● Have patient void before taking medication if urinary retention is a problem.

Teaching points

● Avoid hot environments; you will be heat intolerant, and dangerous reactions may occur.

● You may experience these side effects: Dizziness, confusion (use caution driving or performing hazardous tasks); constipation (ensure

adequate fluid intake, proper diet); dry mouth (frequent mouth care may help; may be transient); blurred vision, sensitivity to light (reversible; avoid tasks that require acute vision; wear sunglasses in bright light; difficulty in urination (empty the bladder prior to taking drug).

Scientific name:-Dopamine

Trade name: Dopamine

Drug classes

Alpha-adrenergic agonist

Beta1-selective adrenergic agonist

Dopaminergic drug

Sympathomimetic

Therapeutic actions

Drug acts directly and by the release of norepinephrine from sympathetic nerve terminals; dopaminergic receptors mediate dilation of vessels in the renal and splanchnic beds, which maintains renal perfusion and function; alpha receptors, which are activated by higher doses of dopamine, mediate vasoconstriction, which can override the vasodilating effects; beta1 receptors mediate a positive inotropic effect on the heart.

Indications

● Correction of homodynamic imbalances present in the shock syndrome due to MI, trauma, septicemia, open heart surgery, renal failure, and chronic cardiac decompensation in heart failure

● Poor perfusion of vital organs

● Low cardiac output

● Hypotension

Contraindications and cautions

● Contraindicated with tachyarrhythmia, ventricular fibrillation, hypovolemia (dopamine is not a substitute for blood, plasma, fluids, electrolytes, which should be restored promptly when loss has occurred),

Pharmacokinetics

Route Onset Peak Duration

IV 1–2 min 10 min Length of infusion

▼IV FACTS

Preparation: Prepare solution for IV infusion as follows: Add 200–400 mg dopamine to 250–500 mL of one of the following IV solutions: 0.9% sodium chloride solution; 5% dextrose injection; 5% dextrose and 0.45% or 0.9% sodium chloride solution; lactated Ringer’s injection.

Commonly used concentrations are 800 mcg/mL (200 mg in 250 mL) and1,600 mcg/mL (400 mg in 250 mL).

Infusion: Determine infusion rate based on patient response.

Incompatibilities:

Do not mix with other drugs; do not add to 5% sodium bicarbonate or other alkaline IV solutions, or iron salts because drug is inactivated in alkaline solution (solutions become pink to violet).

Adverse effects

● **CV:** *Ectopic beats, tachycardia, anginal, pain, palpitations, vasoconstriction,* hypertension,

● **Other:** gangrene with prolonged use

■ **Nursing considerations**

CLINICAL ALERT!

Name confusion has occurred between dopamine and dobutamine; use caution.

Assessment

● **History:** tachyarrhythmia, hypovolemia,

● **Physical:** Body weight; skin color, T; P, BP, pulse pressure; urine output; serum electrolytes, ECG

Interventions

≠***Warning*** Exercise extreme caution in calculating and preparing doses; dopamine is a very potent drug; small errors in dosage can cause serious adverse effects. Drug should always be diluted before use if not prediluted.

● Administer into large veins of the antecubital fossa in preference to veins in hand or ankle.

q ***Black box warning*** To prevent necrosis after extravasations, infiltrate area with 10–15 mL saline containing 5–10 mg phentolamine. Do so as soon as possible after extravasations occurs.

● Monitor urine flow, cardiac output, and BP closely during infusion.

Teaching points

Instruct patient to report any pain at injection site.

DOBAMIN DOSE AND DILUTION

1-4mcg/kg/min – (low dose); 5-10mcg/kg/min = (cardiac dose)

11-20mcg/kg/min = (vasopressor dose). Useful in the treatment of cardiogenic shock, hypotension, symptomatic bradyarrhythmias.

CAUTION: May increase myocardial oxygen requirements or worsen ischemia.

Drip: 400mg in 250cc = 1600mcg/cc

Reference: American Heart Association 2005/2010 ECC Handbook for Healthcare Providers

Dobamin equation:

Ordered amount of drug ×patient's weight (kg) ×60 =I.V. infusion rate (in ml/hour)

_____

Drug concentration

Note….. •

30 gtt/min =30 cc/hr

Scientific name:-DOBUTamine

Trade name: DOBUTamine

Drug classes

Beta1-selective adrenergic agonist Sympathomimetic

Therapeutic actions

Positive inotropic effects are mediated by beta1- adrenergic receptors in the heart; increases the force of myocardial contraction with relatively minor effects on heart rate, arrhythmogenesis; has minor effects on blood vessels.

Indications

● for inotropic support in the short-term treatment of adults with cardiac decompositions due to depressed contractility,

Contraindications and cautions

● Contraindicated with; hypovolemia (dobutamine is not a substitute for blood, plasma, fluids, electrolytes, which should be restored promptly when loss has occurred and in any case before treatment with dobutamine); acute MI (may increase the size of an infarct by intensifying ischemia

side effects

Myocardial Ischemia, Cardiac arrhythmias, Hypotension, after the acute overdosage of Dobutamine (HCl) produse Hypertension, Peripheral vasoconstriction,

■ Nursing considerations

Dosages

Administer only by IV infusion using an infusion pump or other device to control the rate of flow. Titrate on the basis of the patient's homodynamic and renal response. Close monitoring is necessary.

▼IV FACTS

Preparation: Dilute vials to at least 50 mL with 5% dextrose injection, 0.9% sodium chloride injection, or sodium lactate injection. Stable for 24 hr. Do not freeze.

(Drug solutions may exhibit a pink color that increases with time; this indicates oxidation of the drug, not a loss of potency up to 24 hr.)

Infusion: May be administered through common IV tubing with dopamine, lidocaine, nitroprusside, potassium chloride, Titrate rate based on patient response—P, BP, rhythm; use of an infusion pump is suggested.

Incompatibilities: Do not mix drug with alkaline solutions, such as 5% sodium bicarbonate injection; do not mix with hydrocortisone ; sodium heparin.

.≠***Warning*** Monitor urine flow, cardiac output, , ECG, and BP closely during infusion; adjust dose and rate accordingly.

Scientific name:-nitroglycerin

Trade name: Tridil(IV)

Scientific name:-**isosrbide dinitrate**

Trade name:**isordil(sublingual tablets, oral tablets)**

CLASSIFICATION(S):

Ther. Class: *antianginals*

Pharm. Class: *nitrates*

INDICATIONS

- Acute (**SL**) and long-term prophylatic (**oral, buccal, transdermal**) management of angina pectoris
- **PO:** Adjunct treatment of CHF
- **IV:** Adjunct treatment of acute MI
- Production of controlled hypotension during surgical procedures.
- Treatment of congestive heart failure associated with acute MI

ACTION

- Increases coronary blood flow by dilating coronary arteries and improving collateral flow to ischemic regions
- Produces vasodilation (venous greater than arterial)
- Decreases left ventricular end-diastolic pressure and left ventricular end-diastolic volume (preload)
- Reduces myocardial oxygen consumption.

- **Therapeutic Effects:**
    - Relief or prevention of anginal attacks
    - Increased cardiac output
    - Reduction of blood pressure.

Contraindicated in:

- Hypersensitivity

ADVERSE REACTIONS AND SIDE EFFECTS*

CNS: dizziness, headache,

CV: hypotension, tachycardia

Derm: contact dermatitis (transdermal or ointment).

TIME/ACTION PROFILE (cardiovascular effects)

	ONSET	PEAK	DURATION
SL	1–3 min	unknown	30–60 min
PO-ER	40–60 min	unknown	8–12 hr
IV	immediate	unknown	several min

NURSING IMPLICATIONS

ASSESSMENT

- Assess location, duration, intensity, and precipitating factors of patient's anginal pain.

- Monitor blood pressure and pulse before and after administration. Patients receiving IV nitroglycerin require continuous ECG and blood pressure monitoring. Additional hemodynamic parameters may be monitored.
    - May cause falsely elevated serum cholesterol levels.

IMPLEMENTATION

- **PO:** Administer dose 1 hr before or 2 hr after meals with a full glass of water for faster absorption.
- **SL:** Tablet should be held under tongue until dissolved. Avoid eating, drinking, or smoking until tablet is dissolved.
- **Buccal:** Place tablet under upper lip or between cheek and gum. Onset of action may be increased by touching the tablet with the tongue or by drinking hot liquids.
- **IV:** Doses must be diluted and administered as an infusion. Standard infusion sets made of polyvinyl chloride (PVC) plastic may absorb up to 80% of the nitroglycerin in solution. Use glass bottles only and special tubing provided by manufacturer.
- **Continuous Infusion:** Dilute in D5W or 0.9% NaCl in a concentration of 25–40 mcg/ml, dependent upon patient's fluid tolerance. Solution is stable for 48 hr at room temperature. Solution is not explosive(مفرقعة) either before or after dilution.
- ***Rate:*** Administer via infusion pump to ensure accurate rate. Titrate rate according to patient response.
- **Additive Incompatibility:** Manufacturer recommends that nitroglycerin not be admixed with other medications.
- **Topical:** Sites of topical application should be rotated to prevent skin irritation. Remove patch or ointment from previous site before application.
    - Doses may be increased to the highest dose that does not cause symptomatic hypotension.
    - Apply ointment by using dose-measuring application papers supplied with ointment. Squeeze ointment onto measuring scale printed on paper. Use paper to spread ointment onto non hairy area of skin (chest, abdomen, thighs; avoid distal extremities) in a thin, even layer, covering a 2–3-in. area. Do not allow ointment to come in contact with hands. Do not massage or rub in

ointment; this will increase absorption and interfere with sustained action. Apply occlusive dressing if ordered.

- Transdermal patches may be applied to any hairless site (avoid distal extremities or areas with cuts or calluses). Apply firm pressure over patch to ensure contact with skin, especially around edges. Apply a new dosage unit if the first one becomes loose or falls off. Units are waterproof and not affected by showering or bathing. Do not cut or trim system to adjust dosage.. Remove patches before cardioversion or defibrillation to prevent patient burns. Patch may be worn for 12–14 hr and removed for 10–12 hr at night to prevent development of tolerance.

PATIENT/FAMILY TEACHING

- **General Info:** Instruct patient to take medication exactly as directed, even if feeling better. If a dose is missed, take as soon as remembered unless next dose is scheduled within 2 hr .Do not double doses. Do not discontinue abruptly; gradual dosage reduction may be necessary to prevent rebound angina.
  - Caution patient to change positions slowly to minimize orthostatic hypotension
  - Inform patient that headache is a common side effect that should decrease with continuing therapy. Aspirin or acetaminophen may be ordered to treat headache. Notify health care professional if headache is persistent or severe.
  - Advise patient to notify health care professional if dry mouth or blurred vision occurs.
- **Acute Anginal Attacks:** Advise patient to sit down and use medication at first sign of attack. Relief usually occurs within 5 min. Dose may be repeated if pain is not relieved in 5–10 min. Call health care professional or go to nearest emergency room if anginal pain is not relieved by 3 tablets in 15 min. (call help after first tablet if pain doesn't relieved)
- **SL:** Inform patient that tablets should be kept in original glass container or in specially made metal containers, with cotton removed to prevent absorption. Tablets lose potency in containers made of plastic or cardboard or when mixed with other capsules or tablets. Exposure to air, heat, and moisture also causes loss of potency. Instruct patient not to open bottle frequently, handle tablets, or keep bottle of tablets next to body (i.e., shirt pocket) or in automobile glove compartment. Advise patient that tablets should be replaced 6 mo after opening to maintain potency.
- **Lingual Spray:** Instruct patient to lift tongue and spray dose under tongue.

- Sustained-release preparations,SR (it contain a large dose of nitroglycerin that is slowly absorbed across the GI wall)should be swallowed whole; do not crush, break, or chew.

Scientific name:- DIGOXIN

Trade name: Lanoxin

CLASSIFICATION(S):

Ther. Class: *antiarrhythmics, inotropics*

Pharm. Class: *digitalis glycosides*

INDICATIONS

- Treatment of CHF
- Tachyarrhythmias
    - Atrial fibrillation and atrial flutter (slows ventricular rate)

ACTION

- Increases the force of myocardial contraction
- Prolongs refractory period of the AV node
- Decreases conduction through the SA and AV nodes.
- **Therapeutic Effects:**
    - Increased cardiac output (positive inotropic effect) and slowing of the heart rate (negative chronotropic effect).

Mechanism of inotropic action and its relation with potassium

**digoxin increase myocardial contractility by inhibiting an enzyme known as sodium,potassium-ATPase (NA,K-ATPase) its inhibition promote calcium accumulation within myocyte , the calcium then augment contractile forse.

** potassium ions compete with digoxin for binding to NA.K-ATPase …….when potassium level are low ,binding of digoxin to NA,K-ATPase increase ,this increase can produce excessive inhibition of NA,K-ATPase with resulting toxicity.

Contraindicated in:

- Uncontrolled ventricular arrhythmias
- AV block

Use Cautiously in:

- Electrolyte abnormalities (hypokalemia, hypercalcemia, and hypomagnesemia may predispose to toxicity)

- Renal impairment (dosage reduction required)
- Obese patients (dose should be based on ideal body weight)

ADVERSE REACTIONS AND SIDE EFFECTS*

CNS: fatigue,

EENT: blurred vision, yellow vision.

CV: ARRHYTHMIAS, bradycardia, ECG changes.

GI: anorexia, nausea, vomiting, diarrhea.

INTERACTIONS

Drug-Drug:

- **Thiazide** and**loop diuretics ,piperacillin**, and **corticosteroids**, which cause hypokalemia, may increase the risk of toxicity
- Excessive use of **laxatives** may also cause hypokalemia and increase the risk of digoxin toxcicity
- Additive bradycardia may occur with **beta blockers** .

ROUTE AND DOSAGE

For rapid effect, a larger initial loading/digitalizing dose should be given in several divided doses over 12–24 hr. Maintenance doses are determined for digoxin by renal function. All dosing must be evaluated by individual response

AVAILABILITY

- ***Tablets:*** 0.125 mg^{Rx}, 0.25 mg^{Rx}, 0.5 mg^{Rx}
- ***Capsules:*** 0.05 mg^{Rx}, 0.1 mg^{Rx}, 0.2 mg^{Rx}
- ***Injection:*** 0.25 mg/ml^{Rx}

	ONSET	PEAK	DURATION
Digoxin–PO	30–120 min	2–6 hr	2–4 days†

Digoxin–IM	30 min	4–6 hr	2–4 days†
Digoxin–IV	5–30 min	1–5 hr	2–4 days†

NURSING IMPLICATIONS

ASSESSMENT

- Monitor apical pulse for 1 full min before administering. Withhold dose and notify physician if pulse rate is <60 bpm in an adult, <70 bpm in a child, or <90 bpm in an infant. Also notify physician or health care professional promptly of any significant changes in rate, rhythm, or quality of pulse.
- Monitor blood pressure periodically in patients receiving IV digoxin.
- Monitor ECG throughout IV administration and periodically during therapy. Notify physician or health care professional if bradycardia or new arrhythmias occur.
- Observe IV site for redness or infiltration; extravasation can lead to tissue irritation .
- Monitor intake and output ratios and daily weights. Assess for peripheral edema, and auscultate lungs for rales/crackles throughout therapy.
- ***Lab Test Considerations:*** Serum electrolyte levels (especially potassium, magnesium, and calcium) and renal and hepatic functions should be evaluated periodically during therapy. Notify physician or other health care professional before giving dose if patient is hypokalemic. Hypokalemia, hypomagnesemia, or hypercalcemia may make the patient more susceptible to digitalis toxicity.
- ***Toxicity and Overdose:*** Therapeutic serum digoxin levels range from 0.5–2 ng/ml. Serum levels may be drawn 4–10 hr after a dose is administered, although they are usually drawn immediately before the next dose.
    - Observe patient for signs and symptoms of toxicity. In adults and older children, the first signs of toxicity usually include abdominal pain, anorexia, nausea, vomiting, visual disturbances, bradycardia, and other arrhythmias. In infants and small children, the first

symptoms of overdose are usually cardiac arrhythmias. If these appear, withhold drug and notify physician or health care professional immediately.

- If signs of toxicity occur and are not severe, discontinuation of digitalis glycoside may be all that is required.
- Treatment of life-threatening arrhythmias may include administration of digoxin immune Fab (Digibind), which binds to the digitalis glycoside molecule in the blood and is excreted by the kidneys.

IMPLEMENTATION

- **PO:** Oral preparations can be administered without regard to meals. Tablets can be crushed and administered with food or fluids if patient has difficulty swallowing. Use calibrated measuring device for liquid preparations. Do not alternate between dosage forms
- **Direct IV:** IV doses may be given undiluted or each 1 ml may be diluted in 4 ml of sterile water, 0.9% NaCl, D5W, or LR for injection. Less diluent will cause precipitation. Use diluted solution immediately. Do not use solution that is discolored or contains precipitate.
- ***Rate:*** Administer each dose through Y-site injection over a minimum of 5 min.
- **Additive Incompatibility:** Manufacturer recommends that digoxin not be admixed with other drugs.

PATIENT/FAMILY TEACHING

- Instruct patient to take medication exactly as directed, at the same time each day. Missed doses should be taken within 12 hr of scheduled dose or not taken at all. Do not double doses. Consult health care professional if doses for 2 or more days are missed. Do not discontinue medication without consulting health care professional.
- Teach patient to take pulse and to contact health care professional before taking medication if pulse rate is <60 or >100.
- Review signs and symptoms of digitalis toxicity with patient and family. Advise patient to notify health care professional immediately if these or symptoms of CHF occur. Inform patient that these symptoms may be mistaken for those of colds or flu.
- Instruct patient to keep digoxin tablets in their original container and not to mix in pill boxes with other medications; they may look similar to and may be mistaken for other medications.
- Caution patient to avoid concurrent use of OTC and herbal medications without consulting health care professional. Advise patient to avoid taking antacids or antidiarrheals within 2 hr of digoxin.
- Advise patient to notify health care professional of this medication regimen before treatment.

- Patients taking digoxin should carry identification describing disease process and medication regimen at all times.
- Emphasize the importance of routine follow-up exams to determine effectiveness and to monitor for toxicity.

Toxicity in ECG

- slowing of heart rate .
- A narrower QRS complex.
- prolonged PR interval

* endotracheal (ET) tube. Instilling some resuscitation drugs via an ET tube results in lower circulating blood levels of the medication and lower survival rates compared with I.V. administration. Use this method only if I.V. or IO access can't be established. Only **naloxone, atropine, vasopressin, epinephrine, and lidocaine** can be administered via ET tube. The recommended dosing is two to two and a half times the I.V. dose, although little evidence supports this practice. After diluting the recommended drug dose in 5 to 10 mL of sterile water or 0.9% sodium chloride solution, instill the drug directly into the ET tube, followed by ventilations via a bag-valve-mask device. - See more at: http://www.nursingcenter.com/lnc/journalarticle?Article_ID=757400#sthash.Cd77AB6k.dpuf

Remember the mnemonic NAVEL:or **LEAN(PEDS)**

N-Naloxone

A-Atropine

V-Vasopressin (adults only)

E-Epinephrine

L-Lidocaine

LEAN(PEDS)

L-Lidocaine

E-Epinephrine

A-Atropine

N-Naloxone