Course Title: General Pharmacology
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Note:

- **Paper is divided into 5 questions**
- **Each question carry equal marks (10) with grand total of 50 marks**
- **Each question is composed of specific parts, pay attention to each part of question or otherwise it will lead to mark deduction**
- **Avoid copy paste from slides, your answer may got canceled if it found a total copy**

Q1. Define drug receptors, enumerate different receptor families and explain the receptor that shows its effect through second messenger system.

Answer No 1

Drug receptors. Receptor is a macromolecule in the membrane or inside the cell that specifically (chemically) bind a ligand (drug). The binding of a drug to receptor depends on types of chemical bounds that can be established between drug and receptor.

Three three major receptor familie

{Mieu} μ receptors

The μ receptor is characterized by its high affinity for morphine. The analgesic properties of the opioids are primarily mediated by the μ receptors.

Subtypes of μ receptor have been proposed

μ1

Has higher affinity for morphine, mediates supraspinal analgesia and is selectively blocked by naloxonazine.

μ2

Has lower affinity for morphine, mediates spinal analgesia, respiratory depression and constipating action.

{kappa} κ receptor

This receptor is defined by its high affinity for ketocyclazocine and dynorphin A

{endogenous ligand}

Subtypes of κ receptor

κ1 and κ3 are functionally important

{delta} δ receptor

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Second messengers are molecules that relay signals received at receptors on the cell surface such as the arrival of protein hormones, growth factors, etc. ... But in addition to their job as relay molecules, second messengers serve to greatly amplify the strength of the signal.Second messengers are intracellular signaling molecules released by the cell in response to exposure to extracellular signaling molecules—the first messengers. (Intracellular signals, a non-local form or cell signaling, encompassing both first messengers and second messengers, are classified as juxtacrine, paracrine, and endocrine depending on the range of the signal.) Second messengers trigger physiological changes at cellular level such as proliferation, differentiation, migration, survival, apoptosis and depolarization.Examples of second messenger molecules include cyclic AMP, cyclic GMP, inositol trisphosphate, diacylglycerol, and calcium.[2] First messengers are extracellular factors, often hormones or neurotransmitters, such as epinephrine, growth hormone, and serotonin. Because peptide hormones and neurotransmitters typically are biochemically hydrophilic molecules, these first messengers may not physically cross the phospholipid bilayer to initiate changes within the cell directly—unlike steroid hormones, which usually do. This functional limitation requires the cell to have signal transduction mechanisms to transduce first messenger into second messengers, so that the extracellular signal may be propagated intracellularly. An important feature of the second messenger signaling system is that second messengers may be coupled downstream to multi-cyclic kinase cascades to greatly amplify the strength of the original first messenger signal. For example, RasGTP signals link with the Mitogen Activated Protein Kinase (MAPK) cascade to amplify the allosteric activation of proliferative transcription factors such as Myc and CREB.Secondary messenger systems can be synthesized and activated by enzymes, for example, the cyclases that synthesize cyclic nucleotides, or by opening of ion channels to allow influx of metal ions, for example Ca2+ signaling. These small molecules bind and activate protein kinases, ion channels, and other proteins, thus continuing the signaling cascade.

Q2. Define drug interactions, enumerate its various types, and explain pharmacokinetic drug interactions and its factors with examples.

Answer No 2 #

A drug is any substance {with the exception of food and water} which, when taken into the body, alters the body's function either physically and/or psychologically. Drugs may be legal {e.g. alcohol, caffeine and tobacco{ or illegal {e.g. cannabis, ecstasy, cocaine and heroin}.

Generally speaking, there are only four different types of medications that you would come across.

These are:

1 General Sales List.
2 Pharmacy Medicines.
3 Prescription Only Medicines.
4 Controlled Drugs.

Pharmacokinetics, sometimes described as what the body does to a drug, refers to the movement of drug into, through, and out of the body—the time course of its absorption, bioavailability, distribution, metabolism, and excretion.Pharmacodynamics, described as what a drug does to the body, involves receptor binding, postreceptor effects, and chemical interactions. Drug pharmacokinetics determines the onset, duration, and intensity of a drug's effect. Formulas relating these processes summarize the pharmacokinetic behavior of most drugs.Three major receptor families (Mieu) μ receptors The μ receptor is characterized by its high affinity for morphine. The analgesic properties of the opioids are primarily mediated by the μ receptors. Subtypes of μ receptor have been proposed:
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Cell-surface receptors are involved in most of the signaling in multicellular organisms. There are three general categories of cell-surface receptors: ion channel-linked receptors, G-protein-linked receptors, and enzyme-linked receptors.
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Pharmacokinetics of a drug depends on patient-related factors as well as on the drug’s chemical properties. Some patient-related factors (eg, renal function, genetic makeup, sex, age) can be used to predict the pharmacokinetic parameters in populations. For example, the half-life of some drugs, especially those that require both metabolism and excretion, may be remarkably long in the elderly. Other factors are related to individual physiology. The effects of some individual factors (eg, renal failure, obesity, hepatic failure, dehydration) can be reasonably predicted, but other factors are idiosyncratic and thus have unpredictable effects. Because of individual differences, drug administration must be based on each patient’s needs—

traditionally, by empirically adjusting dosage until the therapeutic objective is met. This approach is frequently inadequate because it can delay optimal response or result in adverse effects.

Knowledge of pharmacokinetic principles helps prescribers adjust dosage more accurately and rapidly. Application of pharmacokinetic principles to individualize pharmacotherapy is termed therapeutic drug monitoring.

Q3. Differentiate between general and local anesthesia, explain stages of anesthesia in detail

Answer No 3 #

General anesthesia – for surgical procedure to render the patient unaware/unresponsive to the painful stimuli. Drugs producing General Anaesthesia – are called General Anaesthetics. Local anesthesia - reversible inhibition of impulse generation and propagation in nerves.

There are 5 stages

ASC owners and administrators frequently utilize simple heuristics when selecting anesthesia providers, often limiting selection criteria to coverage availability, cost and surgeon relationships.

This approach implies that many surgery center leaders and owners view anesthesia as a commodity, defined by Investopedia as:

"A basic good that is interchangeable with other commodities of the same type. Commodities are most often used as inputs in the production of other goods or services. The quality of a given commodity may differ slightly, but is essentially uniform across producers."That anesthesia serves as an input in producing surgery is unquestionable. However, by viewing anesthesia providers as interchangeable or delivering uniform quality, ASC leaders and owners leave value on the table.Anesthesia can differentiate surgery centers. Below details five strategies for enabling ASC differentiation via anesthesia.

1. Make Anesthesia a Growth Engine

Anesthesia can help surgery centers drive growth by:

• Enabling new service lines and

• Directly contributing cases.

New Service Lines

Total joints represent a salient example of an anesthesia-supported service-line addition. Vizient projects the proportion of primary hip and knee replacement surgeries performed in outpatient settings will double by 2026, and due to the lofty margin potential associated with these cases, virtually all multi-specialty and orthopedic-focused ASCs want to develop joint programs. In doing so, ASC owners and administrators are well-served to acknowledge that not all anesthesia groups are created equal.

Efficaciously caring for outpatient joint-patients requires anesthesia that minimizes post-surgical nausea and vomiting and maximizes ambulation. Furthermore, patient-selection comprises another determinant of outpatient joint programs' success, and anesthesia providers should heavily contribute to, if not lead, pre-surgical testing (PST) and resultant decisions on patients' readiness for ambulatory joint procedures.Partnering with anesthesia groups that have direct experience with

outpatient joints and have codified that experience into PST and care protocols not only drives better patient outcomes, but also gives orthopedic surgeons confidence in transitioning appropriate cases to surgery centers.Case Contributions
Interventional pain management (IPM) represents the archetypal example of an opportunity for anesthesia to contribute cases to ASCs. Again, in this regard, not all anesthesia groups are created equal.Many surgery centers have experienced the frustration of purchasing equipment and dedicating space for an anesthesia-led pain management program, only to see volume projections fail to materialize. Anesthesia groups that have demonstrated clinical and business capabilities to stand-up de novo pain management programs and integrate those programs into centers' overall care continuums mitigate the risk that ASCs' IPM investments fail to generate ROI. Equally important is working with an anesthesia group that understands and complies with regulatory guidelines when adding IPM services to its clients' sites to avoid risking Anti-Kickback violations.
2. Use Anesthesia to Enable Disruption
Anesthesia-supported ASC volume growth opportunities are not limited to total joints and pain. For the first time in the industry's history, healthcare underwriters (employers, health insurers and consumers) care about the lower cost and superior quality offered in outpatient settings. In 2016, health plans responding to a Change Healthcare survey projected an almost 33% reduction in fee-for-service business through 2021, offset by growth in value-based payment models. Exploiting this newfound interest in value requires that ASCs enter into innovative reimbursement arrangements, designed to steer volume to the optimal site of service.
ASCs' success inside bundled, pay-for-performance, shared savings and similar reimbursement models can be easily derailed by an ill-prepared or abstaining anesthesia group. Moreover, most private anesthesia groups are ill-prepared to take risk, as private groups tend to distribute earnings, versus retain and invest earnings to fund transformation.Therefore, the ASCs that are most successful in value-based strategies will have anesthesia groups that enable (instead of encumber) their strategies. This means securing an anesthesia group that offers: direct experience inside alternative reimbursement arrangements, a sophisticated managed care contracting team, data assets and analytical resources required to undertake risk and intellectual capital (e.g., care protocols, technology) that reduces waste and standardizes care to best-practice.
3. Operationally Integrate Anesthesia into the Team
Beyond adding cases, anesthesia can drive increased ASC distributions by identifying and leading efforts to:

• Improve on-time starts, enabling reduced labor spend or increased volume (through capturing latent demand),
• Reduce turnover time, enabling reduced labor spend or increased volume,
• Compress schedules, enabling reduced labor spend and
• Optimize the supply chain, enabling reduced drug costs.

Of course, most anesthesia groups (1) do not view the above performance improvement (PI) initiatives as their responsibility and (2) are not positioned to meaningfully contribute to PI initiatives. ASCs that partner with anesthesia groups

that have readily accessible data-assets and analytical resources to support PI initiatives, as well as cultural and financial incentives for anesthesia team members to contribute to their clients' operational success, create the ability to generate outsized profits and distributions.

4. Leverage Anesthesia to Improve Service

Just as anesthesia can help surgery centers improve operations, it can help surgery centers improve service. The past decade has seen an unprecedented level of healthcare cost-shifting from employers to consumers. According to the CDC, almost 45% of Americans, aged 18-64 with employment-based health insurance coverage, are enrolled in high-deductible health plans, up from about 15% in 2007.

As a result of this cost-shifting, consumers actively "shop" for healthcare with ever-increasing frequency. Like for any good or service, however, cost is not consumers' only consideration when healthcare shopping. Service, often manifesting itself in the form of online reviews, can function as a deciding factor when patients chose between one ASC and another.

Thus, the old joke, "Anesthesiologists and CRNAs don't have to be nice. They just put patients to sleep," no longer applies. Conversely, the anesthesia team should be a key-contributor to delivering on ASCs' ideal patient experiences/brand promises. Centers that want to stand-out and use exceptional service to drive awareness and volume should seek-out an anesthesia partner that has:

• Drafted, tested, defined and implemented service standards for patients and patients' families,
• Built and implemented tools (i.e., surveys) to measure service performance and
• Invested in technology to enhance the patient experience.

5. Create a Strategic Partner

Finally, ASCs that leverage anesthesia to differentiate will expect their groups to provide clinical leadership for their centers, in lieu of simply purveying staffing models. This requires that anesthesia:

• Actively engages in or leads PI initiatives,
• Actively engages in efforts to add or strengthen clinical services,
• Enhances the patient experience, through technology and standardization of service to best-practice,
• Shares performance metrics (quality, cost and service), regularly, and collaboratively develops corrective action plans when warranted,
• Proactively shares and implements cost, quality and service improvement opportunities and
• Dedicates local and regional (if applicable) leadership to the surgery center.

In part, because of the low standard to which most centers have held their anesthesia providers, the above seems utopian, mythical and unrealistic to many ASC partners and administrators. Nevertheless, anesthesia groups that can deliver on the above

exist. Typically, such groups have intentionally invested in creating anesthesia leaders through leadership training; at-risk compensation packages, tied to client (ASC) objectives; and overt, cultural expectations for Chiefs to provide perioperative leadership, instead of solely overseeing staffing.

A Call to Action

Modern healthcare is too complicated for ASC owners and administrators to limit expectations of their anesthesia providers to coverage, cost and likable clinicians. The time has come for ASC principals and leaders to evaluate anesthesia options in-terms of each group's ability to differentiate their center. In the future, the most successful surgery centers are likely to expect more and, therefore, get more from anesthesia.

Q4

(a) What does heart failure means, explain the pathophysiology of heart failure

Answer NO 4 A

Heart failure means that the heart is unable to pump blood around the body properly. It usually occurs because the heart has become too weak or stiff. It's sometimes called congestive heart failure, although this name is not widely used nowadays. Heart failure does not mean your heart has stopped working.Pathophysiology. In heart failure, the heart may not provide tissues with adequate blood for metabolic needs, and cardiac-related elevation of pulmonary or systemic venous pressures may result in organ congestion. This condition can result from abnormalities of systolic or diastolic function or, commonly, both.the physiology of abnormal or diseased organisms or their parts; the functional changes associated with a disease or syndrome.

(b) Classify the drugs used for the treatment of heart failure, explain along with mechanism.

Answer No 4 B

Beta-blockers, ACE inhibitors, glycosides, and diuretics are the key medications used for managing congestive heart failure through regulating renal function and the sympathetic nervous system.

After a patient has been diagnosed with a type, stage, and class, treatment can be determined. First-line drug therapy for all patients with HFrEF should include an angiotensin-converting enzyme (ACE) inhibitor and beta blocker. These medications have been shown to decrease morbidity and mortalityThe following medicines are frequently used to treat heart failure.

Beta blockers (carvedilol, metoprolol, bisoprilol)

ACE inhibitors (lisinopril, captopril)

Angiotensin receptor blockers (losartan)

Combination medicines (Entresto, or sacubitril/valsartan)

Aldosterone antagonist (spironolactone, eplerenone).Angiotensin-Converting Enzyme (ACE) Inhibitors

Commonly prescribed include: Captopril (Capoten) Enalapril (Vasotec) Fosinopril (Monopril).Heart failure patients may need multiple medications. Each one treats a different symptom or contributing factor and comes with its own instructions and rules.You and your caregivers should work with your healthcare team to understand the medications and when, how often and in what dosage to take them.

It's important to discuss all of the drugs you take with your doctor (or other healthcare providers) and understand their desired effects and possible side effects. Your doctor

and your pharmacist are your best sources of information. Don’t hesitate to ask them questions about your medicines. It's critical that people with heart failure take their medications exactly as directed by their healthcare provider, to optimize the benefits. The use of these drugs has saved lives, prolonged life and improved the heart’s function.

Q5

(a) Differentiate between broad spectrum and narrow spectrum antibiotics, classify antibiotic drugs

Answer No 5 A

Narrow-spectrum antibiotics target a few types of bacteria. Broad-spectrum antibiotics target many types of bacteria. Both types work well to treat infections. But using broad-spectrum antibiotics when they're not needed can create antibiotic-resistant bacteria that are hard to treat.Antibiotics can be categorized by their spectrum of activity—namely, whether they are narrow-, broad-, or extended-spectrum agents. Narrow-spectrum agents (e.g., penicillin G) affect primarily gram-positive bacteria.Top 10 List of Antibiotic Classes (Types of Antibiotics)

Penicillins.
Tetracyclines.
Cephalosporins.
Quinolones.
Lincomycins.
Macrolides.
Sulfonamides.
Glycopeptides.

(b) Explain briefly the mechanism of action of antiviral agents

Answer No 5 B

Antiviral drugs are a class of medication used for treating viral infections.[1] Most antivirals target specific viruses, while a broad-spectrum antiviral is effective against a wide range of viruses.[2] Unlike most antibiotics, antiviral drugs do not destroy their target pathogen; instead they inhibit its development.

Antiviral drugs are one class of antimicrobials, a larger group which also includes antibiotic (also termed antibacterial), antifungal and antiparasitic drugs,[3] or antiviral drugs based on monoclonal antibodies.[4] Most antivirals are considered relatively harmless to the host, and therefore can be used to treat infections. They should be distinguished from viricides, which are not medication but deactivate or destroy virus particles, either inside or outside the body. Natural viricides are produced by some plants such as eucalyptus and Australian tea trees.