

A

Absorption – movement of drug from site of administration into central compartment

Acid – proton donor (H^+ ion) $A^- + H^+ \rightleftharpoons AH$

Acidosis/Alkalosis – excess acid/base (physiological process occurring in patient)

Acidaemia/Alkalaemia – excess acid/base in patient/s blood (normal 7.35-7.45) (H^+ 36-44nmol/L)

Affinity – attraction of a drug to a receptor

Afterload – impedance to ventricular ejection/ventricular wall tension/stress to eject stroke volume (as per Laplace's law)

Agonist – substance which binds to receptor to produce a response (excitatory or inhibitory)

Alveolar gas – Ideal alveolar gas: gas from alveoli with a $V/Q = 1$ (PaO₂ 40mmHg)

End expired gas: end tidal from ideal alveoli + alveoli dead space (PetCO₂ 35-38mmHg)

Mixed expired gas: ideal alveoli gas + physiological dead space (30mmHg)

Anaemia – reduced O₂ carrying capacity due to decreased quantity and quality of Hb

Anaesthesia – without sensation

General – altered level of reversible unconsciousness (not easily rousable)

Sedation – a spectrum of state of reduced consciousness

Hypnosis – induced sleep like state through REM sleep is suppressed

Sleep – normal physiological state of reduced consciousness and readily rousable

Dissociative – trance state where eyes remained open with slow nystagmus gaze/non communicative/intense analgesia/amnesia

Anaphylaxis – severe and potentially life-threatening clinical syndrome produced by IgE hypersensitivity reaction (antigen/antibody reaction on mast cells). Manifest as red flush, bronchospasm, vasodilatation, cardiovascular collapse, bronchospasm (requires prior exposure)

Anaphylactoid – clinical indistinguishable from anaphylaxis, cause by complement/indirect histamine release from mast cell. Dose dependent

Anion – negatively charged ion

Anode – negative electrode (donates electrons)

Antagonist – drugs with affinity to receptor but no intrinsic activity (nil efficacy)

Antibiotic – agent used systemically to treat infection (antibacterial/antifungal/antiparasitic)

Anticoagulant – agent to reduce or prevent coagulation by interfering with fibrin plug formation

Automaticity – ability to self-depolarise and initiate own heart beat

ANS – provides efferent pathway of involuntary control of most organs. Divided to SNS & PNS)

Autoregulation – local mechanism, ability of an organ to maintain adequate perfusion in the presence of altering physiological conditions (pressure autoregulation/metabolic autoregulation)

Avogadro's Hypothesis – equal volume of gases at same temp and pressure contains equal number of molecules. (One mole of gas = 6×10^{23} molecules occupies 22.4L at STP)

B

Bainbridge Reflex – increased intravascular volume in normovolemic pts causes reflex tachycardia independent of increased blood pressure

Baricity – density of liquid in relation with CSF

Basal Metabolic Rate – minimal metabolic rate, amount of energy liberated per unit time to maintain basal cellular function (J/s or W) at defined conditions (rest, room temperature, 12hr post-meal)

Base – proton acceptor (H^+ ion) $B + H^+ \rightleftharpoons BH^+$

Base Excess – blood sample equilibrated to PaCO₂ 40mmHg (titrated with acid/base until pH is normal)

Beer-Lambert law – intensity of light passing through a solution decreases exponentially with concentration (Beers) and distance (Lambert)

$I_{Trans} = I_{Incident} \cdot e^{-A}$ A=absorption (A= distance x extinction coefficient x concentration)

Bernoulli Effect – decreased pressure in tube as velocity of flow increases

Bimetallic Strip – two metal with different expansion coefficient

Bioavailability – proportion of drug which reaches systemic circulation $FB = FA \times (1 - HER)$

Biotransformation – enzymatic conversion of a drug to a more polar molecule

Blood Brain Barrier – physiologically highly selective permeable barrier that separates blood from brain

Blood Pressure – pulsatile ejection of stroke volume into arterial vasculature

	Systolic Pressure	Diastolic Pressure	Mean
Right Atrium	5	0	2
Left Atrium	10	0	5
Right Ventricle	25	0	8
Left Ventricle	120	0	
Aorta	120	80	90
Pulmonary Artery	25	8	15

Blood Volume

Adult: 70ml/kg

Infant (28days to 1year): 80ml/kg

Neonate (0-28days): 90ml/kg

	Blood Volume Distribution	Roles
Veins	65% (55% supine)	Return blood to heart Preload
Arteries	13%	Windkessel effect Distribution of O ₂ blood
Arterioles	2%	Resistance vessels
Capillaries	5%	Exchange vessels
Central Blood Volume (heart & lungs)	15% (25% supine)	Pump Gas Exchange

Blood Gas Partition Coefficient – ratio of anaesthetic agent in equilibrium at 37°C contain same partial pressure between the 2 phases

Bohr Effect – the variable affinity of Hb to O₂ in the variable concentration of H⁺ and PCO₂

Bohr Equation – amount of physiological dead space in lung $V_d/V_t = PaCO_2 - PeCO_2 / PaCO_2$

Boiling Point – temperature which SVP = Patm (all substance enter vapour phase)

Bourdon Gauge – coiled metal where a rise in temperature cause the tube to uncoil

Buffer – substance which to receive or donate H⁺ in solution preventing the change in pH

Bulk Flow – net solvent movement in one direction

Bunsen Solubility Coefficient – volume of gas dissolved in a unit volume of solvent at a stated temperature and 1 atm pressure

C

Calorie – heat energy necessary to raise the temp of 1g of H₂O by 1°C

Cardiac Output – volume of blood ejected from heart per unit time (CO=HR x SV)

	Weight	Flow (% CO)	VO ₂ (% CO)	Autoregulation
Whole body		5L	250ml/min	
Heart	300g	5% (70% LCA; 30% RCA)	10%	Myogenic Metabolic (main)
Kidneys	300g	25% (90% Cortex; 5% Medulla)	7%	Myogenic Tubuloglomerular F
Brain	1.5kg	15% (65% Grey; 33% White)	20%	Myogenic (main) Metabolic (regional)
Liver	2.5kg	30% (30% Hep Art; 70% Portal Vein)	25%	Metabolic (Hepatic Art)
Skin	3kg	5%	5%	
Skeletal Muscle	30kg	20%	20%	Metabolic

Cardiac Properties

Automaticity: ability to initiate own beat

Dromotropy: speed of conduction via AV node

Inotropy: contractility

Lusitropy: active relaxation

Bathmotropy: excitability, ease of myocyte depolarise by stimulus (slope phase 0)

Irritability: size of stimulus required to depolarise cell in context to resting phase (difference between threshold and RMP)

Cathode – positive electrode which receives electron

Cardiovascular Collapse: Convulsion Dose (CC: CD) – ratio of blood levels of local anaesthetics causing toxicity

Ceiling Effect – phenomenon where a drug reaches its maximal effect and effectiveness does not increase with further increase in dose

Cell – smallest structure, functional and biological unit of all organism

Chelate – to incorporate a metal into an organic complex

Chiral – asymmetric in which the structure and its mirror image is not superimposable

Clearance – volume of plasma clear of a drug per unit time

Closing Capacity – the lung volume at which dependant airways begin to close (CV+RV)

Closing Volume – lung volume at which dependant airway begin to close to the start of RV

Colligative Properties – properties of a solution that depends only on the number of freely moving particles and not on the nature of those particles

i.e. – Osmotic pressure, Boiling point elevation, Freezing point depression, Vapour pressure depression

Colloid – substances unable to pass semipermeable membrane (suspension of solutes)

Compliance – change in volume over change in pressure. (Normal 200ml/cmH₂O) affected by lung elastic recoil/lung volume/disease/pulmonary blood volume

Static Compliance: patient inspiring sequentially to different known volume, relaxing against a closed glottis (time for equilibrium to occur) = $V_T / (P_{\text{plateau}} - \text{PEEP})$

Dynamic Compliance: against normal breathing, volume and pressure at point of no flow = $V_T / (P_{\text{peak}} - \text{PEEP})$

Specific Compliance: compliance divided by FRC (Normal: 0.05/cmH₂O)

Concentration – amount per volume

Concentration effect – the higher inspired concentration of a gas, the more rapid rise in alveolar concentration

Conduction – mode of heat transfer between 2 objects that are in contact

Context sensitive half time – time for plasma concentration of a drug to decrease by 50% after stopping the infusion designed to maintain steady state

Dependant on: Duration of infusion/Distribution/Clearance

Contractility – myocardial performance factor that is independent of heart rate and loading factors

Convection – mode of heat transfer via bulk movement of liquid or gas in contact

Coronary Perfusion Pressure – Diastolic BP-LVEDP

Counter Current Exchange – provides circulatory perfusion to LOH and CD while maintaining hypertonic interstitial medullary gradient

Counter Current Multiplier – concentrating effect of the medullary interstitium multiplied by the counter current flow of tubular fluid within LOH

Critical Pressure – pressure required to liquefy a vapour at its critical temperature

Critical Temperature – temperature above which substance cannot be liquefied however much pressure applied

Critical Velocity – velocity above which laminar flow become turbulent

Crossmatch – part of blood compatibility testing (to prevent haemolysis post transfusion)

Major – patient serum + donors' RBC

Saline agglutination: reconfirms ABO grouping

Indirect Coombs: reconfirms presence of minor antibodies

Minor – patient RBC + donors' serum

Crystalloid – substances able to pass semipermeable membrane

D

Dalton's Law – the pressure exerted by a mixture of gas = the sum of pressures of each individual gasses

Damping – resistance to free oscillation

Under damping: overshoot common, system oscillates

Over damping: slow signal response with inability to respond to rapid change

Critical damping: point of overshoot is just avoided

Optimal damping: 64% critical damping, minimal overshoot and minimal response reduction

Dead space – tidal volume that does not take part in ventilation

Physiological – alveolar + anatomical (Bohr's equation)

Anatomical – volume of conducting airways (Fowler's method)

Alveolar – volume beyond conducting airways that do not take part in ventilation (V/Q mismatch)

Decontamination – process which removes/destroys contaminants

Cleaning: physical removal of foreign material

Disinfection: process of eliminating most pathogenic organism except spores

Disinfectant: chemical used to disinfect non-living surfaces

Antiseptic: chemical used to disinfect living surfaces

Sterilisation: process of killing all microbes

Density – mass per unit volume

Dependence – psychophysical requirement of continued supply of substance

Physical dependence: characterised by withdrawal symptoms after discontinuation of a drug or after administration of an antagonist

Psychological dependence: a chronic state, characterised by the compulsive use of a substance resulting in harm (physical, psychological or social) and continued use despite harm

Desensitisation

Tachyphylaxis: acute decrease in response to repeated dose of a drug

Tolerance: chronic decrease in response to repeated dose of a drug

Dibucaine Number - % inhibition of plasma cholinesterase activity after addition of dibucaine (quality of plasma cholinesterase)

Diffusion – movement of substances down its concentration gradient (obeys Fick's law of diffusion)

Diffusional Hypoxia – reduced alveolar O₂ concentration from dilution by N₂O leaving the blood stream and entering the alveoli

Doppler Effect – frequency shift effect where the frequency and wavelength of a signal changes in relation to changes in soundwaves when source moves in relation to stationary observer

Double Burst Stimulation – 2 short burst of tetanus (50Hz) separated by 0.75sec

Down-regulation – decrease responsiveness of target tissue due to decrease active receptor numbers (decrease effect) (due to decrease production/inactivation of receptor)

E

ECG – graphical presentation of surface recording of electrical activity of heart

EEG – graphical presentation of surface recording of electrical activity of neural cells (specifically the post-synaptic potentials of subcortical neurons perpendicular to electrode)

PR interval: 0.12-0.2s

QRS complex: 0.06-0.12s

QT interval: 0.36-0.44s

Efficacy – maximal effect attainable by drug

Elimination – amount of drug excreted by the body

Emulsion – pair of immiscible fluid (droplet disperse throughout another) inherently unstable and tend to coalesce so need emulsifier to improve solubility

Enzyme – biological catalyst

Ergot – fungal derivative

Eutectic – mixture in which the physicochemical properties are different to that of its individual component

Evaporation – mode of heat transfer via vaporisation of H₂O from surface

Exercise – hypermetabolic state produces changes (increase O₂ flux and removal of waste products)

Exponential Function – rate of change of a quantity is proportional to the quantity at that time

Excitability – slope of phase 0, the ease which a myocardial cell respond to a stimuli to depolarise

F

Fasting – abstinence from food +/- water

Fick Principle – blood flow to an organ equals rate of substrate uptake/removal divided by A-V concentration difference for that substance

Filling Ratio – weight of fluid/weight of H₂O required to fill the cylinder (N₂O)

First Pass Metabolism – metabolism of substance once absorbed, before reaching the systemic circulation

Flow – quantity of fluid (gas/liquid) passing a point per unit time

Laminar: organised, parabolic, flow proportional to pressure

Turbulent: disorganised, eddies, flow² proportional to pressure

Force – mass x acceleration (unit: Newton)

Fourier's Analysis – construction of complex waveform from multiple basic sine waves of different frequency

Slowest component: fundamental frequency

Faster component: harmonics

Functional Residual Capacity – lung volume at the end of normal tidal expiration, equilibrium point where the chest wall expand outwards and the lung collapsing

G

Gas – substance in gaseous phase above its critical temperature

Gas Laws

Avogadro's Law (PV~n) at STP 1 mole=22.4L

Boyle's Law (1st gas law): at a constant temperature, volume of gas is inversely proportional with absolute pressure (PV=k, T constant)

Charles' Law (2nd gas law): at a constant pressure, volume of gas is directly proportional to absolute temperature (V~T, P constant)

Amonton's Law (3rd gas law): at a constant volume, pressure is directly proportional to temperature (P~T, V constant)

Dalton's Law: the pressure exerted by a mixture of gas = the sum of pressures of each individual gasses

Henry's Law: at given temperature, amount of a given gas dissolved in a given liquid is directly proportional to the partial pressure of the gas in equilibrium with the liquid

Poynting effect: formation of a gaseous mixture of O₂ and N₂O when O₂ is bubbled through liquid N₂O

Gibbs-Donnan Effect – distribution of charged diffusible ions in the presence of non-diffusible ions across a semi-permeable membrane

Responsible for: Oncotic pressure

Cell volume stability (double Donnan)
RMP

G-Proteins – cell membrane associated proteins which are important in signal transduction mechanisms

H

Haldane Effect – Deoxygenated Hb has increased ability to carry CO₂

Half-Life – the time necessary for drug concentration to decrease by 50%

Haemostasis – physiological process of maintaining blood in a fluid clot free-state in normal vessel or producing rapid localised coagulation at site of injured vessel

Heart Failure – impaired cardiac performance to produce sufficient cardiac output to maintain adequate tissue perfusion and meet metabolic demand (contractility primary problem)

Heat – form of kinetic energy transferred from hotter to colder substance (Joules)

- Conduction – via contact/collision of molecules
- Convection – via bulk flow of fluid
- Radiation – via emission of electromagnetic radiation
- Evaporation – via vaporisation of water (0.56kcal energy for 1g H₂O)

Heat Capacity – amount of heat required to raise the temperature of a given object by 1 Kelvin

Henderson-Hasselbalch Equation – $\text{pH} = \text{pK}_a + \log(\text{base})/(\text{acid})$

Henry's Law – mass of dissolved gas in a given volume of liquid is directly proportional to the pressure of the gas at a constant temperature

Hormone – chemical messenger produced by ductless glands and transported to act on distant target sites via circulation in trace amount

Types: **Peptides** – glucagon, insulin, PTH, ACTH, LH, FSH

Amines – derived from tyramine (T3/T4, NAdr, Adr) or tryptophan (5HT, Melatonin)

Steroids – synthesised from cholesterol (androgens, sex hormones, vit D)

Hufner's Number – 1.34 is amount of oxygen which can combine with 1g of Hb when fully saturated

Humidity – **Absolute**: mass of H₂O in a given volume of air (mg/L)

Relative: ratio of mass of H₂O vapour in a given volume of air to the mass required to saturate the volume at the same temperature

Hyperalgesia – increase in response to noxious stimulus

Hypersensitivity – abnormal response to drugs that are dependent on immunological mechanism

Type 1: IgE mediated

Type 2: IgM & IgG mediated

Type 3: IgM & IgG mediated

Type 4: Cell mediated

Hypothalamus – Portion of the diencephalon (posterior forebrain) beneath the thalamus forming the floor of the 3rd ventricle. Function: neuroendocrine, control of pituitary secretion, ANS, thermoregulation, control of motion, thirst, hunger & sexual activity

Hysteresis – dependence of the output of a system on its current input & past history

Hypoxaemia – presence of low O₂ tension in arterial blood

Hypoxia – presence of low O₂ tension in tissue for effective oxidative phosphorylation to occur

I

Idiosyncrasy – genetically determined abnormal reactions to a drug

Inhalational Agents

	Halo	Iso	Enf	Sevo	Des	N2O	Xenon	Methoxy
MAC	0.75	102	1.7	2.0	6.8	105	70	0.2
SVP	240	240	170	160	680	-	-	23
BP	50	~50	~50	~05	23	-	-	105
BGPC	2.3	1.4	1.8	0.69	0.42	0.47	0.14	13
OGPC	220	~100	~100	~50	~20	1.4	1.9	950
Metabolism	20%	0.2%	2%	2%	0.02%	0.01%	-	50%

Immunity – bodily defence system against antigens

Innate immunity: Humoral – complement system

Cellular – macrophages, neutrophils, barrier

Acquired immunity: Humoral – B-cell, immunoglobulins

Cellular – T-cell mediated

Inotrope – drugs which enhances contractility

Interthreshold Range – range of body temperature where ANS is not triggered

Intraocular pressure – pressure of aqueous humour (10-20mmHg) affected by aqueous humour, extraocular muscles and choroidal blood flow

Intravenous Agents

	Thiopental	Propofol	Ketamine	Etomidate
Dose	3-7mg/kg	2.5mg/kg 4-8mcg/ml infusion	1-2mg/kg IV 5-10mg/kg IM	0.3mg/kg
pH	11	8	3-5	8
pKa	7.5	11	7.5	4
Vd	2L/kg	4L/kg	3L/kg	4L/kg
PPB	High (80%)	High (98%)	Low (25%)	Intermediate (50%)
Clearance	5ml/kg/min	30-60ml/kg/min	15ml/kg/min	15ml/kg/min
Additives	Na ₂ HCO ₃ , N ₂	10% soybean oil 2.5% glycerol 1.25% egg phosphatide NaOH EDTA	HCl Na Benzothonium	H ₂ O & Propylene glycol Lipid emulsion

Intravenous Fluids

	Na	Cl	K	Ca	Osm	pH	Others
Normal	135-145	95-105	3.5-5	2		7.35-7.45	
0.9% NaCl	154	154			308	5-7	
Hartmanns	131	111	5	2	278	5-7	Lactate 29
Plasmalyte	140	98	5		295	4-6	Gluconate 23 Acetate 27 Mg 1.5
5% Dextrose					275	4	Glucose 50g/L
Mannitol					1100		Mannitol 200g

Isobestic Point – unchanged absorbance of light regardless of change during chemical/physical change of a sample

Isomer – compounds with the same molecular weight but different structural or spatial arrangement

Structural isomers: positional/tautomers

Stereoisomers: enantiomers/diastereomers/geometric isomers

Irritability – phase 4, indicating the size of the stimulus needed to depolarise the cell (difference between RMP and threshold potential)

J

Joule – work done when a force of 1N moves its point of application 1m in the direction of the force (Nm)

K

K_a = acid dissociation constant

$$= \frac{(\text{CH}^+)(\text{A}^-)}{(\text{HA})}$$

Kidney Function – Filtration/Absorption/Secretion (H₂O, electrolyte)

- Acid-base balance
- Removal waste and foreign chemicals
- BP regulation
- Metabolism (gluconeogenesis)
- Endocrine (Vitamin D activation/Erythropoietin)

L

Laminar Flow – streamline flow with no eddies or turbulence

Laplace's Law – $P = 2T/R$

Latent Heat – heat required to convert 1kg of a substance from one phase to another at a given temperature

Liver Function

- Metabolism (lipid/protein/carbohydrate)
- Endocrine (erythropoietin/somatostatin)
- Detoxification drugs
- Immunity (innate: macrophages/Kupffer cells)
- Coagulation (factors, fibrinogen, protein C & S)
- Acid-base (fixed acids elimination, endogenous & exogenous acids)
- Bilirubin production (breakdown of RBC reticuloendothelial system)
- Reservoir (500mls blood)
- Urea production (ammonium to urea)
- Storage (glycogen)
- Haematopoiesis (fetus)

Local Anaesthetics

	Potency	pKa	PPB %	Vd	CI	CC:CD	Max Dose
<i>Fast acting</i>							
Mepivacaine	2	7.6					5
Prilocaine	2	7.9	50				7
Etidocaine	6	7.7					2
Lignocaine	2	7.9	70	1	10	7:1 CNS 5mcg/ml CVS 10mcg/ml	3/7 Adr
<i>Med acting</i>							
Ropivacaine	6	8.1	94		10	5:1 CNS 4mcg/ml	3
Bupivacaine	8	8.1	95	1	3	4:1 CNS 3mcg/ml CVS 5mcg/ml	2
<i>Slow acting</i>							
Amethocaine	8	8.5					1.5
Procaine	1	8.9	6				12

Nerve sensitivity to LA blockade: $B > A\delta > C > A\gamma > A\beta > A\alpha$

Lung Function Facilitate gas exchange
 Filtration (dust, inhalation)
 Immunological (mucociliary mechanism)
 Reservoir (500mls blood)
 Metabolic (angiotensin, bradykinin)
 Thermoregulation
 Inhalational agents
 Taking up drugs (lidocaine, fentanyl)
 Surfactant production (type 2 pneumocytes)

Lymph – interstitial fluid which enters lymphatics vessels (high lipid content)

Lymphatic Capillaries – blinding ending with flap valve vessels. Present in almost all tissues

M

MAC – minimal alveolar concentration of inhalational agent at 1atm required to prevent purposeful movement to a standard surgical stimuli (skin incision) in 50% of the population

MAC Awake: (0.3-0.5) 50% of patients will be awoken from anaesthesia during emergence or loss of appropriate response on induction

MAC Super: (1.3) at which no movement to noxious stimuli in 95% of patients

MAC Bar: (1.5) at which ANS is blunted to noxious stimuli in 50% of patients

MAC Hour: time in hours of delivery of inhalational agent at 1MAC (quantify exposure to toxic effect)

Margin of Safety - % post synaptic nAChR blocked to prevent NMJ transmission (80% NDMB, 20% DMB), more conservative approach compared to therapeutic index (LD1/ED99)

Manometer – decide to measure pressure of gas

Mean Arterial Pressure (MAP) – the product of CO x SVR
 $=DBP + 1/3(SBP - DBP)$

Metabolism – literally means change, referring to all types of chemical and energy transformation that occurs in the body

Metabolic Rate – amount of heat energy liberated over time

Mixed Venous Blood – mixture of blood from all systemic venous capillaries of the body

O₂: PvO₂ 40mmHg, SvO₂ 75%, CvO₂ 15mlO₂/dL

CO₂: PvCO₂ 46mmHg, CvCO₂ 52mlCO₂/dL

Mole – amount of a chemical substance that contains as many elementary entities as there are in 12g of Carbon-12 (containing 6×10^{23} molecules)

Molecular Weight – mass of 1 molecule/ (1/12th) mass of 1 Carbon-12 atom (ratio)

Monro-Kellie Doctrine – the cranium is a rigid closed vault. Total volume is fixed, any increase in intracranial content will result in large increase in pressure (blood/brain/CSF)

Motor Unit – consist of anterior horn cell, motor axon and muscle fibre

Muller's Manoeuvre – forced inspiration against a closed glottis

Muscle Spindle – intrafusal muscle fibre (10 in a capsule) which are concerned with proprioception

Muscle Relaxant

	Dose	Speed Onset	Duration	Vd	Metabolism	Excretion
Suxamethonium	1 IV/5-10 IM	0.5-1	3-5	0.2	PChEsterase	
Pancuronium	0.1	3-5	60	0.2	Hepatic 10%	Unchanged Renal 80%

						Bile 10%
Rocuronium	0.6	1-2	30	0.2	Hepatic 15%	Unchanged Renal 10% Bile 40%
Vecuronium	0.1	3-5	30	0.2	Hepatic 60%	Unchanged Renal 20% Bile 20%
Atracurium	0.6	3-5	30	0.2	Hoffman/ P. Esterase	
Cis-Atracurium	0.1	3-5	30	0.2	Hoffman	
Mivacurium	0.1	3-5	15	0.2	PChEsterase	

Myogenic Theory – autoregulation, contraction/dilatation of blood vessels in response to change in transmural pressure

N

Nausea – unpleasant subjective sensation referred to the pharynx and upper abdomen, associated with vomiting

Neuromuscular Blockade

Depolarising/Phase 1 block – fasciculation, T4/T1 >0.7 no fade, no post tetanic facilitation

Non-depolarising/Phase 2 block – no fasciculation, fade (T4/T1 <0.4) in TOF, post tetanic facilitation, antagonism by neostigmine and DMB

Nociception – encoding and processing of harmful stimuli in nervous system

O

Ohm's Law – $V=IR$

Opiate – substances derived from opium (naturally occurring)

Opioids – agonist at opioid receptors (naturally occurring and synthetic) (endogenous: enkephalin, endorphins, and dynorphins)

	Potency	pKa	% unionised	PPB %	Vd	Cl	T1/2
Pethidine	0.1	~8			3	15	3hr
Tramadol	0.1	~8			3	15	3hr
Morphine	1	~8	25	30	3	15	3hr
Oxycodone	1	~8				15	3hr
Methadone	2-4				0.5		5-150hr
Alfentanil	10	6.5	90	>90	3	5	1.5hr
Buprenorphine	30			>90	3	1	5hr
Fentanyl	100	8.5	10	80	0.3	15	3hr
Remifentanyl	100	7			3	40	5min
Sufentanyl	1000				3		
Naloxone					3	30	1.5hr

Osmoles – concentration of osmotically active particles

Osmolarity – number of osmole per litre of solvent dependant on temperature

Osmolality – number of osmole per kg of solute non dependant on temperature

Osmosis – diffusion of solvent (H₂O) down its concentration gradient

Osmotic Pressure – minimum pressure necessary to prevent the movement of solvent

Overton-Meyer Theory – volatile anaesthetics with the highest solubility are higher potency

Oxygen Cascade – series of steps of PO₂ from atmospheric air to mitochondrial in cells

P

P50 – PO₂ at which Hb is 50% saturated. Relates to Hb affinity

pH – negative log of H⁺ concentration

pKa – negative log of acid dissociation constant (K_a), where $K_a = (H^+)(A^-)/(HA)$, buffering capacity of the buff (pKa +/- 1 for closed system) or degree of ionisation (50% @pH=pKa)

Pain – unpleasant sensory and emotional experience associated with potential or actual tissue damage or described in such terms

Comprises of ascending and descending pathway

Hyperalgesia – more pain than expected

Primary hyperalgesia – peripheral sensitisation, stimulus at site produces more pain

Secondary hyperalgesia – central sensitisation, increased responsiveness in surrounding site

Allodynia – previously non-painful stimulus now painful

Wind-up – central sensitisation to pain which impulse strengthens with repetitive stimulation (includes long term potentiation)

Gate Control Theory (of Melzack) – modulation of ascending pathway via activity of transmission cells in substantia gelatinosa (lamina II)

Partition Coefficient – ratio of concentration of substance in 2 phases in equilibrium (equal volume and pressure) at stated temperature (normally 37°C), related to solubility of substances in different phases

BGPC (blood: gas) inversely proportional to speed of onset/offset

OGPC (oil: gas) proportional to potency and metabolism

TGPC (tissue: gas) proportional to tissue uptake/offset

Piezoelectricity – ability to interconvert between mechanical energy and electrical energy

Pharmaceutics – branch of pharmacology that looks at the formulation, packaging and physicochemical properties of a drug

Pharmacodynamics – branch of pharmacology that looks at biochemical and physiological effects of the drug on the body

Pharmacokinetics – branch of pharmacology that look at the fate of the drug administered into the body

Pharmacogenetics – branch of pharmacology that looks at how genetics can influence PK & PD of drug

E.g.: PK – suxamethonium apnoea, acetylators (fast/slow: codeine)

PD – malignant hyperthermia, porphyria (thiopental)

Post Tetanic Count – number of responses to 1Hz stimulation for 3 seconds after 5sec of 50Hz tetanus

PTC 8-10: first TOF

PTC 0: no buck or cough

Potency – drug dose required to achieve certain response, related to receptor affinity (PD) and PK

Poiseuille's Law – Flow = $(P_1 - P_2) \pi r^4 / 8 \eta L$ for laminar flow of fluid

Preload

Isolated: initial fibre length prior to contraction = amount of stretch of ventricular muscle fibre at the end of ventricular filling

Intact: compliance x transmural pressure (filling pressure – extrinsic pressure)

Pressure – force per unit area (Pascal or N/m²)

Gauge Pressure – pressure above/below atmospheric pressure

Absolute Pressure – gauge + atmospheric pressure

Prodrug – inactive substance metabolised to active drug within the body (clopidogrel, dabigatran, enalapril, codeine, heroin, parecoxib, and prednisone)

Pseudo-Critical Temperature – temperature which a gas mixture will separate into its constituents

Q

Quantal Response Curve – x-axis drug dose/y-axis number of patient responding (all or nothing response)

R

Racemic Mixture – mixture of equal amount of enantiomers

Receptor – molecule usually protein on the surface or within the cell that recognises and binds with specific molecules producing some effect in the cells

Reduction – removal of O₂ or gaining e⁻

Residual Volume – volume of gas in the lungs at end of maximal expiration

Resistance – opposing to electrical or non-electrical flow

Respiration – exchange of O₂ and CO₂ between atmosphere and body cells

Respiratory

	O ₂	CO ₂
Stores	1.5L (Hb 1L, FRC 250ml, dissolved 50ml, myoglobin 200ml)	>100L (blood 2.5L, rest in bone/fat)
Consumption	250ml/min (3.5ml/kg/min) (max 40ml/kg/min)	200ml/min (3ml/kg/min)
Arterial		
• Pressure	100mmHg	40mmHg
• Content	20mlO ₂ /dL (SpO ₂ 98-100%)	48mlCO ₂ /dL
Venous		
• Pressure	40mmHg	46mmHg
• Content	15mlO ₂ /dL (SpO ₂ 75%)	52mlCO ₂ /dL

Respiratory Quotient – the ratio in steady state of volume of CO₂ produced per volume of O₂ consumed per unit time (Carbohydrate: 1, Protein: 0.8, Fat: 0.7)

Resting Membrane Potential – electrical potential across semipermeable membrane at cell's resting state

Resonance – tendency at which system oscillates at greater amplitude at certain frequency

Reynold's Number – $Re = \rho v D / \eta$ turbulent if $Re > 2000$

S

Sarcomere – contractile unit of a myofibril separated on each ends by Z lines

Saturated Vapour Pressure – the pressure of a vapour which is in equilibrium with its liquid phase, indicator of volatility

Saturation

SpO₂ = oxygen saturation as measured by pulse oximeter

SaO₂ = oxygen saturation as measured by blood analysis (e.g. a blood gas)

Functional SaO₂ – $\text{HbO}_2 \times 100 / \text{HbO}_2 + \text{Hb}$

Fractional SaO₂ – $\text{HbO}_2 \times 100 / (\text{HbO}_2 + \text{Hb} + \text{MetHbO}_2 + \text{COHb})$

PaO₂ = partial pressure of oxygen in the blood, as measured by blood analysis

Second Gas Effect – uptake of large volume of primary gas accelerates the rate of rise of second gas given concurrently

Shelf Life – period which minimum of 90% of drugs remain intact and available for delivery

Shunt – blood entering the arterial system without passing through ventilated lung

Physiological Shunt:

True Shunt: Thebesian veins & bronchial arteries

Others: V/Q mismatch (V/Q ratio <1)

Pathological Shunt: patent foramen ovale, atelectasis, pneumonia

Shock (electrical) Macroshock: current >10mA or current passes through the trunk/heart in electrocution

Microshock: low current passes through cardiac muscles sufficient to cause cardiac arrhythmias

Shock (physiological) – inadequate circulation to deliver oxygen to tissues/organs

Hypovolemic: haemorrhage, burns

Cardiogenic: post myocardial infarct, acute myocarditis

Obstructive: tension pneumothorax, cardiac tamponade, pulmonary embolism

Distributive: sepsis shock, anaphylaxis

Side Effect – undesirable effect of a drug

SIMV (Synchronised Intermittent Mandatory Ventilation) – patient is allowed to breath spontaneously between present mechanical breaths delivered by ventilator

Sleep – physiological decrease level of consciousness and awareness but easily rousable

Specific Heat Capacity – amount of heat required to raise the temperature of 1kg of a substance by 1 Kelvin

Starling's Forces – sum of hydrostatic and oncotic pressures in determining movement of fluid across semipermeable membrane

Starling's Law of the Heart – the force of contraction is dependent on the end-diastolic muscle fibre length

Starling's Mechanism – stroke volume of the heart increases in response to an increase in end-diastolic volume when all other factors remain constant (contractility and afterload)

Starling's Resistor – a 3rd extrinsic pressure having an influence on the intrinsic pressure gradient

Stats*Contingency table*

	Gold Standard +ve	Gold Standard -ve
Test +ve	TP	FP
Test -ve	FN	TN

Sensitivity: proportion of true positive correctly identified (ability to exclude FN) $\text{FN} = \text{TP} / (\text{TP} + \text{FN})$

Specificity: proportion of true negative correctly identified (ability to exclude FP) $\text{FP} = \text{TN} / (\text{TN} + \text{FP})$

Positive Predictive Value: proportion of TP given a positive test result $\text{PPV} = \text{TP} / (\text{TP} + \text{FP})$

Negative Predictive Value: proportion of TN given a negative test result $\text{NPV} = \text{TN} / (\text{TN} + \text{FN})$

Surfactant – surface active mixture of phospholipids [80% dipalmitoylphosphatidylcholine (DPPC)]

Synergism – implies 2 drugs interact to produce effect greater than additional effect

T

Temperature – thermal state of a substance which determines whether it will give heat to another substance or receive heat (unit SI – Kelvin)

Therapeutic Index – ratio of drug dose causing adverse effect over dose causing desirable effect (LD50/ED50)

Thermoneutral Zone – range of ambient temperature at which VO₂ (metabolic rate) is at minimum (thermoregulation can occur via changes to skin blood flow alone)

Adult: 25-30°C

Term: 32-34°C

Prem: 34-36°C

Time Constant (τ) – the time it would take for an exponential process to be completed should the initial rate of change remains the same 1τ : 63% completed

2 τ : 86.5% completed

3 τ : 95% completed

Tonicity – effective osmolality of a solution

Total Lung Capacity – maximum volume that the lung can contain

Toxicity – excess plasma concentration of drug causing deleterious effects

Train of Four – 4 pulses of supramaximal stimulus at 2Hz

Transducer – a device which changes one form of energy to another

Tubulo-Glomerular Feedback – renal autoregulation to ensure constant GFR (via detection of Na/Cl by macula densa)

U

Ultrafiltration – process which water is removed from blood during various forms of dialysis. Water passing through a semi-permeable membrane as a result of positive pressure on the blood side of membrane

Up-regulation – increase responsiveness of target tissue due to increase active receptor numbers (increase effect) (due to increase synthesis/activation of receptor)

Universal Gas Law – $PV = nRT$

V

V/Q – whole body=0.8 (Vent 4L/min; Perf 5L/min)

V/Q scattering (erect lung due to gravity) Vent apex:base = 1:4
 Perf apex:base = 1:18
 V/Q apex:base = 3.3:0.63

Due to V/Q difference P_AO₂ apex:base 130:90mmHg
 P_ACO₂ apex:base 28:42mmHg
 P_AN₂ apex:base 550:580mmHg

Valsalva Manoeuvre – forced expiration against a closed glottis (standardised, forced expiration against a closed glottis for 10-15secs at 40mmHg)

Vapour – substance in gaseous phase below its critical temperature

Vapour pressure – pressure exerted by molecules in vapour phase

Venous Admixture – the theoretical amount of mixed venous blood added into pulmonary capillary for an observed drop in PaO₂

Ventilation – process of exchange of air between lung and ambient air

Total Ventilation: total volume leaving lung each minute

Alveolar Ventilation: effective ventilation of the alveoli, where gas exchange with blood takes place

Mechanical Ventilation: change in volume/resting volume

Viscosity – property of liquid which creates resistance/impedence to free flow, given by shear stress/shear rate

Vital Capacity – maximum volume of gas that can be exhaled following maximum inspiration

Vitamin – organic substance, not produced in the body, small amount essential for life, for biochemical reactions (non-energy substrate)

Volatiles – liquid substances that are easily evaporated at normal temperature

Volume of Distribution – apparent volume in which a given amount of substance must be dispersed to give the resultant plasma concentration

Vomiting – forceful expulsion of gastric contents via mouth

W

West Zones – regional difference in perfusion in an upright lung due to gravity and Starling resistor effect

Wheatstone Bridge – often incorporated as part of a transducer circuit to amplify signals, composed of a set of four resistors in series, an electrical source and a galvanometer, with one of the resistors often part of a strain gauge or resistance thermometer

Work – force x distance; pressure x volume (Joule)

Work of Breathing – Force (N) x Distance (m) = Pressure x Volume

Elastic Resistance 60% (Surface Tension 70%; Elastic Tissue 30%)

Non Elastic Resistance 40%

Windkessel Effect – hydraulic effect of large elastic arteries which converts the intermittent output of heart to a steady flow through capillaries (maintain perfusion of organ during diastole when cardiac ejection ceases)