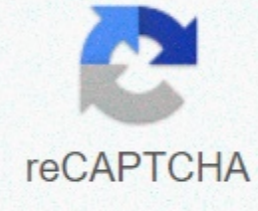I'm not robot

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Paramedic dosage calculations practice pdf

24/10/2015 Update: 06/05/2020 Med Math 101: The basics everyone should know how to trust us, you need to know this stuff... Measurement units As part of the EMS, we are concerned about three metric units of measurement... Grams (g) - weight Meters (m) - liters of distance (L or l) - volume Attached to these units of measurement will be one of the... Kilo - thousand (1000) Centi - one hundredth (.01) Milli - one thousandth (.001) Micro - one millionth (.000001) Now let's combine the two... Kilogram (kg) Gram (g) Milligram (mg) Microgram (mcg) Centimeter (cm) Litre (L) Milliliter (ml) Metric System Practice Problems Tip: If you switch from a smaller unit to a larger unit, move the decimal point to the left. Milligrams to grams (move the decimal point 3 points to the left) 740mg - 0.740g 2mg - 0.002g 100mg - 0.1 g Grams to kilograms (move the decimal 3 points to the left) 4000g - 4kg 750g - 0.75kg 933 5 00g - 93.5kg Micrograms to Milligrams (move the decimal point 3 points to the left) 250mcg - 0.25mg 500mcg - 0.5mg 1000mcg - 1mg Tip: If you go from a larger unit to a smaller unit, move the decimal point to the right. 1) Grams to Milligrams (move the decimal point 3 points to the right) 50g - 50000mg 7500 - 750000mg 3g - 3000mg 2) Kilograms to Grams (move the decimal point 3 points to the right) 35kg - 35000g 250kg - 25,000 7000kg 7000kg 1kg ———- 1,000g ———- 1,000,000mg ———- 1,000,000 mcg Converting kilos into kilograms As a paramedic, you will be required to quickly convert a patient's weight into pounds into kilograms. As you well know now, this is done for any drug that has a weight-based dosage. When the pressure is on, you'll need a quick and easy way to make your conversions. You have a 200-pound patient. You need to convert their weight into kilograms so that you can administer a Lidocaine bolus at 1.5 mg/kg Reducing the patient's weight in half... 300lb / 2 - 150 Take 10% of this number and subtract it from itself ... 150 / 10 - 15. 150 - 15 - 135kg You have a 40 lb paediatric patient. You need to convert their weight into kilograms so that you can administer succinylcholine to 2mg/kg. Cut the patient's weight in half... 40lb / 2 - 20. Take 10% of that number and subtract it from itself... 20/10 - 2. 20 - 2 - 18kg Convert kilograms into pounds From time to time, you may need to convert kilograms into pounds. Here's a quick and easy way to do it: Multiple patient weight in kilograms by 2... 60kg x 2 - 120 Take 10% of this new number and add it to itself... 120/10 - 12. 120 - 12 - 132 lb Drug concentrations and doses of bolus The glossary of the terms of the words of the ambulance While most of these terms are explicit, let us define them so that there is no confusion. Desired dose: the dose we want to administer to the patient Total amount of medication: the total amount of a drug in its container Total volume of drugs: drugs: amount of fluid in the container of a drug Volume administered: the amount of fluid (mL) that we will administer to a patient Drug Concentrations Fortunately for EMS professionals, most of our drug concentrations are expressed as a unit of weight by volume. Usually you will see this expressed on a drug like g/ml, mg/ml or mcg/ml. You can find this number on the medicine box or the vial. So let's put it all together... Let's set up this calculation for the most typical concentration we see in the field: mg/ml. Concentration (mg/ml) - Total drug / Total volume Fill the numbers we see on furosemide (Lasix) Furosemide concentration - 40mg / 10 ml - 4mg/ml Sometimes the concentrations are expressed as a percentage (Dextrose 50%, Lidocaine 2%). There is a very simple way to solve this problem so don't make it too complicated! Let's look at Lidocaine 2%. Take the percentage (2%) and make grams of it... 2% - 2 grams Take the number of grams and place it on 100mL: 2g / 100mL - 2000mg / 100mL - 20mg/mL (This is the concentration observed on a prehospital bottle Lidocaine) Want to try Dextrose 50%? Okay, let's do it. Take the percentage (50%) and make grams of it... 50% - 50 grams Take the number of grams and place it on 100mL: 50g / 100mL - 50000mg / 100mL - 500mg / 1mL - 0.5g/mL (This is the concentration seen on a box of D50%) Bolus Drugs When you administer a bolus of a drug, you give a specific amount at a time. This is different from a drip, where a certain amount of medication is administered slowly over a period of time. Paramedics usually administer medications by bolus instead of

drip. Each drug has a solute and a solution, leading to a concentration. It is up to you, as a paramedic, to determine how much you need to administer to provide the right amount of medication to your patient. Depending on the information you need, you can use one of the two equations to calculate the number of mL of a drug you will need to administer: X (mL to give) - (Total volume x Desired Dose) / Total amount of drug X (mL to administer) - Desired dose / Let's try a calculation of drug bolus ... You must administer 15mg of Diltiazem to a patient. Diltiazem is provided in a bottle that contains 25mg in 5mL. How much mL will you need to elaborate? Volume (mL to give): X Total amount of medication: 25mg Total volume: 5mL Desired dose: 15mg X (mL to give) - (Total volume x Desired Dose) / Total amount of medication Fill the known information to the equation: X (mL to give) - (5mL x 15mg) / 25mg X (mL to give) - 75mL / 25 mg (25 mg X (mL to give) - 3mL Your patient in cardiac arrest requires 300mg of Amiodarone by 2010 ACLS guidelines. Amiodarone is provided in a pre-filled syringe that contains 450mg in 3mL. How much mL will you need to elaborate? Volume (mL to give): Concentration X: / 3mL - 150mg/mL Desired dose: 15mg X (mL to give) - Desired dose / Concentration Fill known information to the equation: X (mL to give) - 300mg / (150 mg/mL) (mg cancels) X (mL to give) - 2mL drug administration: Drip sets IV Drip functions Maintenance drip: A maintenance drip allows you to maintain the therapeutic levels of a drug after giving a bolus medication. Maintenance drops are usually soaked at a specified rate (15mL/h) instead of a specified dose (300mg in total). Bolus Over time: Some treatments must be given over a certain period of time. Take, for example, amiodarone given for stable ventricular tachycardia with pulses. According to current ACLS guidelines, 150 mg of Amiodarone should be given more than 10 minutes. Amiodarone often comes in vials that contain 150mg of Amiodarone in 3mL. How are you supposed to give 3mL over 10 minutes? Mixing it in a 100mL IV bag of natural saline solution and starting an IV drip! Drip to decrease power effects: Some of the medications we give are very potent and can cause adverse reactions and side effects that should be avoided in certain circumstances. For example, nitroglycerin acts to relieve chest pain, but can cause a dangerous drop in a patient's blood pressure. The sublingual dose is 0.4 mg (400 mcg) and is administered in one go. A drop-off of nitroglycerin is started at 10mcg, which means that 1/40 of a sublingual dose is given more than a minute! By drip nitroglycerin, you can title the drug to relieve pain and reduce the negative effects it has on blood pressure. IV Drip components: Bag IV (solution to be administered): an IV bag is a bag of solution to be administered to the patient. The bag may be regular liquid (normal saline solution) or it may have a medication mixed with it. Some IV drugs are used in pre-mixed IV bags (Lidocaine, Dopamine) while others require premeasion before administration (Amiodarone, Epinephrine). Drip set: An IV drip set connects the IV bag to the actual IV catheter, allowing the solution to be administered to the patient. A drip set is categorized by the number of drops it takes to administer a mL of solution. There are two types of IV drip sets - macro and micro. Macro drop sets produce larger drops, requiring 10-15 drops/mL (depending on the manufacturer). Micro drop sets produce smaller drops, requiring 60 drops/mL. A Drip Set: Macro drip sets (10-15 gtt/mL) are usually used for fluid administration because they allow rapid administration of large amounts of volume. Micro drip sets (60 gtt/mL) are generally used for the administration of drugs because a drip of medication usually requires small amounts of medication to administer over time. Note: The abbreviation for drip rate is drip/minute, or drip formulas gtt/min. IV There are two formulas that can be used to calculate drip rates. One of the formulas is the general general formula drip rates and the other is used to calculate specific amounts of fluid administration over time. General formula: a certain amount of medication (with a specified concentration) to be administered at a desired dose X -(Dose desired x Drip Set) / Concentration of drugs X: rate calculated by drip, expressed drip/minute (gtt/min) Desired dose: total amount of medication to be administered, generally defined as a rate (e.g. 450mcg/min) Drip Set: number of drops needed to produce a solution mL (e.g. 60gtt/mL) Drug concentration: quantity of medication in the vial/bag (e.g. 400mcg/250mL) Fluid delivery formula: administration of a given volume of solution over time X (Total Volume x Drip Set) / Total Time X: calculated drip rate, expressed drip/minute (gtt/min) Total volume: total volume to be administered (e.g. 10 Litres of NS) Drip Set : number of drops needed to produce a solution mL (e.g. 15gtt/mL) Total time: total time during which the liquid must be administered for (e.g. 8 hours) So how to calculate a drip rate using all this information... You are preparing to drip nitroglycerin for your patient. You must administer 40mcg/min of Nitroglycerin. If you use a 60 drop/min set, what should be your flow (gtt/min)? Desired dose: 40mcg/minute Drip Set: 60-drop/mL Drug concentration: 200mcg/mL Calculated rate drip: X X - (Dose desired x Drip Set) / Concentration of drugs X: (calculated rate drip) - (40mcg/minute x 60-drop/mL) / 200mcg/mL X - 2400 (mcg and mL cancel) / 200 X - 2400 / 200 - 12 gtt/minute You are preparing to administer a drop of epinephrine for your patient. You must administer 2mcg/min of epinephrine. If you use a 60 drop IV drip set, what should be your flow (gtt/min)? Desired dose: 2mcg/minute Drip Set: 60-drop/mL Drug concentration: 1mg/250mL (1000mcg/250mL - 4mcg/mL) Rate calculated by drip: X X Desired Dose X Drip Set) / Concentration of Drugs Fill information known to the equation: X (drip-calculated rate) - (2mcg/minute x 60-drop/mL) / 4mcg/mL X - 120 (mcg mL cancel) / 4 X - 120 / 4 - 30 gtt/minute Let's calculate drip rates for some fluid administration ... You have been ordered to administer 1L of Normal Saline during your one-hour transfer. If you use a 15-drop/mL drip set, what should be your flow (gtt/min)? Total volume (mL to give): 1000mL Drip Set: 15-drop/mL Total Time: 60 Drip-calculated rate: X X - (Total Volume x Drip Set) / Total Time Fill in known information to equation: X (calculated drip rate) - (1000mL x 15 drop/mL) / 60 minutes X - 15000 drops (mL cancels) / 60 min X - 15,000 drops / 60 minutes - 250 drip/minute You calculated that you must give 10L of normal saline to your patient over 8 hours. If you use a 15-drop/mL drip, drops/mL, should your flow be (gtt/min)? Total Volume (mL to give): 10000mL Drip Set: 15-drop/mL Total Time: 8 hours Rate calculated by drip: X X - (Total Volume x Drip Set) / Total Time Fill in known information to equation: X (calculated drip rate) - (10000 mL x 15 drop/m L) / 8 hours X - 150,000 drops (mL cancels) / 480 minutes X - 150,000 drops / 480 minutes - 312.5 gtt/minute Dopamine: Dopamine is administered as a drip because it is a very powerful drug that is only given to extremely sick patients. The effects of dopamine on the body depend on the dose given. A dose of 5mcg/kg/min has different actions on the body than a dose of 20mcg/kg/min. An IV drip of dopamine allows you to control the drug's actions in the body as needed. When calculating dopamine drip levels, your calculations should be based on a concentration of 1600mcg/mL. Pre-mixed dopamine bags should come in this concentration. If you need to mix your own IV bag with dopamine, it is important to achieve this concentration as well. Dopamine - 1600mcg/mL Your medical kit has only a 250 mL bag of natural saline solution in it. How much dopamine do you need to inject into the bag to reach the desired concentration of 1600mcg/mL? Total volume (mL of solution to mix with): 250mL Desired dose: 1600mcg/mL X: amount of dopamine to be injected (mg) (1600mcg/1mL) - (X/Total volume) Fill in the known information to the equation and multiply. Then solve for X: 1600mcg / 1mL X / 250 mL - 1600 x 250 (mL cancels) X - 400000mcg - 400mg You should inject 400mg of dopamine into the 250mL bag of normal Saline to reach the desired concentration of 1600mcg/mL. There are two ways to calculate a dopamine drip rate: 1. Use the drip formula and perform mathematical operations to find the exact drip rate. 2. Use the Dopamine clock to quickly get a relatively accurate drip rate. Calculating a dopamine drip... Using the drip formula Your protocols indicate that you should administer 10mcg/kg/min of dopamine to your hypotensive patient. Your patient weighs 100 kg. You have 400mg of dopamine in 250mL of normal saline and use a set of 60 drops. What should your flow (gtt/min)? Desired dose: 10mcg/kg/minute Drip Set: 60-drop/mL Drug concentration: 400mg/250mL (1600mcg/mL) Rate calculated at drip-to-Drop: X X - (Desired Dose x Drip Set) / Concentration of Drugs Fill information known to the equation: Desired dose - 10mcg/kg/minute X 100kg - 1000mcg/min X drip-drip calculated) - (1000mcg/minute X 60-drop/mL) / 1600mcg/mL X - 60000 (mcg and mL cancel) / 1600 X - 60000 / 1600 - 37.5 gtt/minute calculation of a dopamine drip... Using the dopaminer clock using the same problem and the same numbers, we will calculate this dopamine drop using the dopamine clock. For mathematics to work properly, you need to make sure that your calculations to account for a different concentration) and you should use a 60 drop/mL drip set. Here's what we know: Desired dose: 10mcg/kg/minute Patient weight (in kg): 100 kg The dopamine clock is dosed like mcg/min so we need to get our math to show mcg/min. We can do this by multiplying the mcg/kg/minute dose by the patient's weight (in kg): 10mcg/kg/minute x 100kg -1000mcg/minute (kg cancels) Now, locate on the clock approximately where 1000mcg/min would be. Then, approximately how many drops per minute are needed to reach this dose. For example, a dose of 1000mcg/min would require about 38 gtt/minute. Lidocaine: Lidocaine is administered as a maintenance drip, after an initial bolus, in order to maintain the therapeutic dose in the patient's blood. When calculating lidocaine drip rates, your calculations should be based on a concentration of 4mg/mL. Pre-concentrated lidocaine bags should enter this concentration. If you need to mix your own IV bag with Lidocaine, it is important to achieve this concentration as well. Lidocaine - 4mg/mL Your medical kit has only a 1000 mL bag of natural saline solution in it. How much lidocaine do you need to inject into the bag to reach the desired concentration of 4mg/mL? Total volume (mL solution to mix with): 1000mL Desired dose: 4mg/mL X: amount of Lidocaine to be injected (mg) (4mg/1mL) - (X/Total Volume) Fill in the information known to equation and multiply. Then solve for X: 4mg / 1mL X / 1000mL X - 4 x 1000 (mL cancels) X - 4000mg You should inject 400mg of Lidocaine into the 1000mL bag of Normal Saline to reach the desired concentration of 4mg/mL. There are two ways to calculate a lidocaine drip rate: 1. Use the drip rate formula and perform mathematical operations to find the exact drip rate. X - (Desired Dose x Drip Set) / Concentration of drugs 2. Use the Lidocaine clock to quickly get a relatively accurate drip rate. Calculating a Lidocaine drip... Using the drip formula Your patient in cardiac arrest has experienced a return to spontaneous circulation. Protocol says you should start a Lidocaine drip at 2mg/minute. You have 2000mg of Lidocaine in 500mL of normal Saline and use a set of 60 drops. What should your flow (gtt/min)? Desired dose: 1.5mg/minute Drip Set: 60-drop/mL Drug concentration: 2000mg/500mL (4mg/mL) Drip-calculated rate: X X -(Desired dose x Drip Set) / Drugs Fill in known information to the equation: X (calculated drip rate) - (1.5 mg/minute x 60-drop/mL) / 4mg/mL X - 90 (mg and mL cancel) / 4 X - 90 / 4 - 22.5 gtt/minute Lidocaine Drip Calculation ... Using the Lidocaine clock using the same problem and the same numbers, let's calculate this Lidocaine drip using the Lidocaine clock. For mathematics to work properly, you need to make sure that the Lidocaine you use is 4 mg/mL (or you have adjusted your math to account for a different concentration) and you need to use a 60 drop/mL drip set. Here's what we know: Desired dose: 1.5 mg/minute Now locate on the clock about where 1.5 mg/minute would be. Then, approximately how many drops per minute are needed to reach this dose. For example, a dose of 2 mg/min would require about 23 gtt/minute. Med Math 101: Practice problems Below are a series of practice problems designed to increase your skills and test your understanding of what you have just learned. Convert 8.4L in mL metric system - Convert 1274 g into kg - Convert 111.4 g to mg - Convert 1,350 mcg into g - Convert 125 mL to L - Pounds in 40 lb kilograms - 40 lbs1 80 lbs - 220 lbs - 260 lbs - 350 lbs - kilograms at 4 kg - 50 kg - 70 kg - 120 kg - 135 kg - 4mg/2mL drug concentrations 1mg/10mL - 250mcg/5mL - 50g/500mL - 150mg/250mL - 30mg/30mL - 200mg/10 L - 1g/10mL - 50mEq/50mL - 100mg/25mL - Bolus Medications Administer 75mcg Fentanyl citrate (concentration of 250mcg/5mL). Administer 15 g Of Dextrose 10% (concentration of 50 g/500 mL). Administer 0.16 mg of atropine (concentration 1 mg/10 mL). Administer 12.5 mg of Promethazine (concentration of 25 mg/mL). Administer 4 g magnesium sulphate (concentration of 1 g/2 mL). Administer 0.4 mg nitroglycerin (400mcg/tab concentration). Administer 18 mg of morphine sulphate (concentration of 5 mg/mL). Administer 25 mg of diphenhydramine (50mg/2mL concentration). Administer 100 mg of Suxamethonium chloride (200mg/20mL concentration). Administer 24mg of Etomidate (20mg/10mL concentration). IV Drops (response in gtt/minute) Administer 70mcg/min Nitroglycerin (concentration of 200mcg/mL) using a drop/mL set of 60 drops/mL. Administer 200 mg/hour lidocaine (concentration of 4 mg/mL) using a 60 drops/mL drops/mL. Administer 50 mg/hour of lidocaine (concentration of 4 mg/mL) using a 60 drop/mL set. Administer 1.5 mg/min Amiodarone (concentration of 3 mg/mL) using a 60 drop/mL/mL set. Administer 4 g of magnesium sulphate for 5 minutes (400 mg/mL concentration) using a 60 drop/mL drip. Administer 5mcg/minute of epinephrine (concentration of 4mcg/mL) using a 60 drop/drip set. Administer 25mg/hour Versed (500mcg/mL concentration) using a 60 drop/mL set of 60 drops/mL. Administer 1 g/hour of cefazolin sodium (concentration of 1,000 mg/500 mL) using a 60 drop/drip set. Is this drip level possible? Administer 0.5 diazepam (concentration of 30 mg/L) using a 10-drop/mL drip set. Is this drip level possible? Administer 300 mg/hour of Labetalol (2.5 g/500 mL) with a drop/mL set of 60 drops/mL. Fluid administration (response in gtt/minute) Administer 125mL/hour using a 15 drop/mL set of 15 drops/mL. Administer 350 mL/hour using a 15 drop/mL drip. Administer 500 mL/hour using a 10 drop/mL set of 10 drops/mL. Administer 50mL/hour using one of a Drip game. Administer 1000mL/hour using a 10 drop/mL drip set. Administer 80mL/hour using a 60 drop/mL set of 60 drops/mL. Administer 1.875 L/hour using a 10 drop/mL drip set. Administer 940mL/hour using a 15 drop/mL drip set. Administer 43mL/hour using a 10 drop/mL drip set. Administer 17mL/hour using a 60 drop/mL set of 60 drops/mL. Dopamine drops (response in gtt/minute) Administer 5mcg/kg/minute dopamine (concentration of 400mg/250mL) using a 60 drop/mL set of 60 drops/mL. Your patient weighs 75 kg. Administer 17mcg/kg/minute dopamine (concentration of 1600mcg/mL) using a 60 drop/mL drip set. Your patient weighs 55 kg. Administer dopamine of 10mcg/kg/minute (concentration of 0.8 g/500 mL) using a drop/mL set of 60 drops/mL. Your patient weighs 125 kg. Lidocaine drops (response in gtt/minute) administer 3.5 mg/minute of Lidocaine (concentration of 4 mg/mL) using a drop/mL set of 60 drops/mL. Administer 1.2 mg/minute of lidocaine (concentration of 4 mg/mL) using a set of 60 drops/mL. Administer 5 mg /minute lidocaine (concentration of 4 mg/mL) using a 60 drop/mL set. Dopaminerist clock (response in gtt/minute - drawing line on the clock) Administer 7.5mcg/kg/minute dopamine (concentration of 400mg/250mL) using a 60 drop/mL drip set. Your patient weighs 80 kg. 2. Administer 12mcg/kg/minute dopamine (1600mcg/mL concentration) using a 60 drop/mL set of 60 drops/mL. Your patient weighs 150 kg. 3. Administer 20mcg/kg/minute dopamine (concentration of 0.8 g/500 mL) using a 60 drop/mL set of 60 drops/mL. Your patient weighs 68 kg. Lidocaine Clock (response in gtt/minute - drawing line on the clock) Administer 5 mg/minute Lidocaine (concentration of 4 mg/mL) using a 60 drop/mL drip. 3. Administer 4.5 mg/minute of lidocaine (concentration of 4 mg/mL) using a 60 drop/mL drip. Med Math 101: Practice Problems ANSWERS Metric System 8400 mL 1.274 kg 111400 mg 0.00135 g 0.125 L Pounds To Pounds Kilograms 18 kg 81 kg 99 kg 117 kg 157.5 kg Kilograms 5 8.8 lbs 110 lbs 154 lbs 264 lbs 297 lbs Medication Concentrations 2mg/mL 0.1mg/mL (100mcg/mL) Lidocaine (concentration of 4mg/mL) using a 60 drop/mL drip. 2. Administer 1.75 mg/minute of lidocaine (concentration of 4 mg/mL) using a 60 drop/mL drip. 3. Administer 4.5 mg/minute of lidocaine (concentration of 4 mg/mL) using a 60 drop/mL drip. 0.1mg/mL (100mcg/mL) 0.6mg/mL (600mcg/mL) 1mg/mL 20mg/mL 0.1g/mL (100mcg/mL) 1mEq/mL 4mg/mL Bolus Medications 1.5mL 150mL 1.6mL 0.5mL 8mL 3mL 3.6mL 1mL 10mL 12mL IV Drips 21 gtt/min 40 gtt/min 12.5 gtt/min 30 gtt/min 120 gtt/min 75 gtt/min 50 83 gtt/min; Yes 1000 gtt/min; no 60 gtt/min Fluid Administration 31 gtt/min 88 gtt/min 83 gtt/min 50 gtt/min 167 gtt/min 80 gtt/min 313 gtt/min 235 gtt/min 7 gtt/min 17 gtt/min Dopamine Drips 14 gt 35 gtt /minute 47 gtt/minute Lidocaine Drips 53 gtt/minute 18 gtt/minute 75 gtt/minute Dopamine Clock 1) 2) 3) Lidocaine clock 10mg/minute (2.5 times more than concentration so 2.5 times 2.5 times 24 hours a day) 2. 75mg/minute (just under half the concentration so just under half the clock) 3. 4.5 mg/minute (slightly more than so just a little more than a whole time around the clock) clock)