2006 Paramedic Interfacility Transport Program

Participant Pre-Course Review Packet

MAINE EMS

2006 PIFT Program
Maine EMS
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Foreword

Welcome to the 2006 Paramedic Interfacility Transport Program or PIFT. This program represents a substantial update of the prior PIFT course and signals a change in direction for EMS provider education in Maine. The Medical Directions and Practice Board charged the Maine EMS Education Committee in 2005 with the task of revising, developing, and implementing a new PIFT curriculum and then training a core group of instructors capable of delivering this course to paramedic providers statewide. The curriculum that emerged is a document we are proud to bring to you, based on the best evidence-based practices available and the real world experiences of practicing paramedics and critical care transport providers from around the state.

Due to the substantial differences in this course from previous versions, **all** paramedics who wish to complete PIFT transfers must take and pass this course before utilizing these expanded PIFT guidelines. In addition, the MDPB and Maine EMS have instituted a number of service level requirements for those agencies that wish to conduct PIFT transfers. Maine EMS will keep services advised of the implementation of the new PIFT program and a proposed target date for statewide compliance. Neither services nor individuals may operate under these new PIFT guidelines until the requirements have been met and the service approved to operate as a PIFT provider by Maine EMS. Service chiefs or paramedics with specific questions about the new PIFT program should feel free to contact Scott Smith, Maine EMS Education Coordinator, at (207) 626-3862 or via email at scott.a.smith@maine.gov.

This pre-course learning packet is designed to provide a review of some essential concepts before attending your PIFT training program. The statewide PIFT curriculum has been developed to serve as the minimal standard for education statewide- individual services and service medical directors are free to tailor the course to meet their needs. For example, while the course will cover some generic principles related to devices such as IV pumps and chest tubes, it is the individual service's responsibility to ensure that their paramedics are competent in operating and troubleshooting the equipment they are called upon to transport. In the end, **only you**- the paramedic, who is with the patient while on a PIFT transport, will be responsible for the outcome and management of that patient. Maine EMS and the MDPB believe that our providers represent the very best in EMS and that this increased role is appropriate and prudent for our providers at this time. The training provided in this new PIFT curriculum will give you the basics but for many of us will require some additional study and preparation before we are called to do that next transfer. So read, ask questions, study, practice, and learn before you embark on the new PIFT program. This program represents a great step forward for prehospital care in Maine and one in which I am proud to be a part of.

RN, CEN NREMT P I/C

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Education & Training Coordinator

Introduction

The core skills involved in conducting an interfacility transport often differ little from our traditional EMS practice in a 911 setting. After all, patients are patients, right? Well, the simple answer is both yes and no. Paramedics providing interfacility transfers to most patients can expect nothing more than a simple report, change over of equipment, and uneventful transport to the receiving facility. Unfortunately, some patients may experience changes enroute the require interventions under the PIFT curricula. For this reason, the 2006PIFT training program centers on several key factors the paramedic must analyze and consider before transport including the physiological stability of the patient, special needs and trips planning, crew and vehicle configuration considerations, and a host of other issues. At the conclusion of this program, we would expect that the paramedic should be able to:

- Receive a comprehensive report from the sending facility that identifies the major threats to continued patient stability during transport
- Formulate a plan of patient care for use during transport to include reviewing any needed interventions, medications to administered, and procedures to be performed in accordance with the transfer orders
- Conduct a safe and appropriate transport to the receiving facility
- Continue to assess the patient and the associated therapies enroute
- Manage any unanticipated changes in the patient's condition by either the transfer orders or Maine EMS protocol
- Communicate effectively with OLMC as needed
- Provide a transfer report to the receiving facility

- Document the transfer appropriately
- Complete any associated QA/QI activities

The new 2006 PIFT program contains the answers to many but not all of these tasks. Some are specific to your agency and some are specific to you as a paramedic. This precourse packet is designed to review some basic concepts before class in areas that commonly cause difficulty for providers. You should read and complete this packet before the first class session. Your instructor will provide an answer key in class but the material included here will not be specifically covered in depth. Should you have questions, please feel free to consult the resource list in the appendix or bring specific questions with you to class for your PIFT instructor.

Pharmacology Basics

A major change to this version of the PIFT program is a focus on medication classes and categories rather than on individual agents. The MDPB realizes that as new drugs are added to clinical practice, you may be called upon to transport them before an individual drug could be added via update to the PIFT program. Learning about drugs via class or category prompts us as paramedics to gain a much better and more in-depth understanding of pharmacology then we may have had in our original paramedic training. This is empowering for us as paramedics, for it mimics the educational model used in other health professions such as nursing. We certainly cannot accomplish all the goals of a semester long, college level pharmacology course in the PIFT program. Instead, the focus is on resource identification and utilization.

During your PIFT course, you will have the opportunity to complete several small group exercises that simulate common scenarios encountered in the critical care transport environment. Essential to successfully completing these exercises will be the ability to use drug reference books for finding information about the medications you may transporting. In your class session, examples of medication references will be available to you. These can be found in pocket guides, field guides, PDA programs, the Web, nursing drug books, or the *Physicians' Desk Reference®*. While we are not requiring that you buy and bring a reference to class, you may want to check your local bookstore or web-based provider such as amazom.com for prices and types. To familiarize yourself with some common drug terms and the information typically found in these resources, please complete the following two exercises and bring them to class.

Exercise 1

You are called to transport a patient from the local community hospital to a regional referral center 90 minutes away for potential neurosurgical intervention after an acute subarachnoid hemorrhage. The patient's blood pressure in the E.D. has been managed with two bolus doses of labetalol, the last being 40 mg 30 minutes prior to your arrival. Your transfer orders call for you to administer additional bolus doses of this drug every 10-15 minutes for a systolic BP greater than 180 mm Hg. Please answer the following questions.

a. What class of drug is this?

b. What are the generic and trade names for the drug?

c. List three side effects of the drug.

d. What special precautions should you take when administering this drug in transport?

e. What is the rate of administration of this drug?

Exercise 2

You are on a long distance ground transport that will take several hours. The sending facility has provided you with the patient's scheduled medications for 12 pm dosing. For each of the following medications, state the trade name or generic name (the opposite of which ever was given), list a reason the person may be taking this medication, list two side effects and two adverse reactions, and state any special considerations you should be aware of as the provider administering these medications.

a. Lanoxin 0.125 mg tablet

b. Terazosin 5 mg caplets

Medication Math

Many healthcare providers find the task of medication calculations very challenging. Yet, the ability to correctly perform a wide variety of medication calculations is essential to safe patient care. Thousands of medication errors occur each year- many of which can be linked to basic errors in calculations. This section is designed to serve as a brief review of some concepts that are important in the PIFT setting. For further information, consult a paramedic or basic nursing pharmacology textbook.

1. Abbreviations and Units of the Metric System

In healthcare, most units and calculations are based on the metric system. The principle units are the gram, liter, and meter. All other units are expressed in multiples of 10's of the base unit. For example, a kilometer is 1000 meters; a milligram is 1/1000th of a gram; and a milliliter is 1/1000th of a liter. Please review the common metric prefixes listed below.

kilo-	1000
deci-	1/10th
centi-	1/100th
milli-	1/1000th
micro-	1/1,000,000th

Common Units of Measure

Liter- volume; equal to 1000 milliliters (mL)

Gram- mass (weight); equal to 1000 milligrams (mG); also 1,000,000 micrograms (mcg)

Remember: 1 ml equals 1 cc

15 ml = 1 Tablespoon

5 ml = 1 Teaspoon

1 kg = 2.2 pounds

<u>Exercise</u>

Please complete the following five metric system conversion problems.

1. How many grams in a kilogram? ___________________
2. Convert 500 mcg to mg? __________________________
3. How many centimeters in a meter? _________________
4. A patient is to receive 0.5 Gm of a medication. How much is this in mg?

   ____

5. A patient is receiving a drug at 3 mg/min. There are 2 gm of drug in a 500 ml bag. What is the concentration in mg/ml of the medication? ___________

2. Concentrations, Solutions, and IV Medication Infusions

Now that we have reviewed units and common equivalencies, let us review concentration. A concentration is defined as parts per a whole. Knowing the concentration of a medication is crucial in interfacility transports because the concentration may not be the same as what is typically used in the EMS setting. The basic competency here is to be able to **calculate the number of milligrams of drug per 1 milliliter of solution**. For example,

$$\text{2 grams in 1000 ml} = \frac{(2\text{ gm})(1000\text{ mg/gm})}{1000\text{ ml}} = 2\text{ mg/ml}$$

For a further review of these types of calculations, please see the Appendix B in this packet. Before you attend your PIFT class, it is essential that you are comfortable with the calculation of critical care infusions. Please see the example below and then complete these few sample problems to check your understanding.

Example

A paramedic is to transport a patient on the following medications: nitroglycerin drip at 75 mcg/min IV and heparin at 900 Units/hour. The nitroglycerin was prepared as 25 mg in 250 ml of D5W by the pharmacy and the heparin drip is mixed as 25,000 Units in 250 ml D5W. The patient weighs 165 pounds. Calculate the IV rates you will set your pumps to in transport.

1. Find mg/ml

   25 mg ÷250 ml = 0.1 mg/ml

2. Convert mcg to mg

   75 mcg/min ÷1000 mcg/mg = 0.075 mg/min

3. Convert minutes to hours

   60 min = 1 hour

4. Solve for ml/hr

   (0.075 mg/min) ÷ (0.1 mg/ml) = 0.75 mg/min

5. Convert to hours

    0.75 mg/min x 60 min/hr = 45 ml/hr

The nitro pump would be set at 45 ml/hr.

What about the heparin?

1. Find Units/ml

    25,000 Units ÷ 250 ml = 100 Units/ml

2. Calculate Units per hour

    900 Units/hr ÷ 100 Units/ml = 9 ml/hr

Heparin pump would be set to 9 ml/hr.

Exercise- Critical Care Infusions

Please complete the following problems before class.

1. A patient is being transported on dopamine at 10 mcg/kg/min, heparin at 1000 Units/hr, and Aggrastat at 0.1 mcg/kg/min after a cardiac catheterization. The patient weighs 170 pounds. The dopamine has been mixed as 800 mg in 500 ml D5W, the heparin us mixed as 25,000 Units in 250 cc, and the Aggrastat comes premixed as 12.5 mg in 250 ml. What rates would you set each pump at?

    a. dopamine ______________________________

    b. heparin ________________________________

    c. Aggrastat _______________________________

2. A patient is suffering from DKA. You are transferring him to EMMC from an outlying community hospital for PICU care. He has an insulin drip infusing at 4 Units/hr, D5W0.45%NaCl at 125 cc/hr, and a 20 mEq potassium replacement bag in 250 ml to infuse over the next 2 hours. The insulin drip is labeled 100 Units Regular insulin in 100 ml NS. Calculate the rates for each drip if the patient weighs 36 kg.

    a. insulin drip _____________________________

    b. D5W0.45%NaCl _________________________

    c. potassium replacement ____________________

If you are having difficulty with the basic mechanics of solving these types of medication math problems, we recommend that you review a paramedic or basic nursing pharmacology text before class as you will not be reviewing these calculations in class. Additional resources for medication math are listed in the appendix.

Conclusion

We hope that you are looking forward to this 2006 PIFT training program. This totally revised program will give paramedics in Maine the chance to advance the EMS profession a great deal. However, we must ensure that safe, high quality patient care continues to be provided under these new responsibilities. Should you have any questions or suggestions for improving this program, please feel free to contact Scott Smith at Maine EMS at scott.a.smith@maine.gov.

Appendix A- Resources for Further Learning

Websites

1. Dosage Calculations for Nurses retrieved October 13, 2006 from http://home.sc.rr.com/nurdosagecal.

2. Medication Math for the Nursing Student retrieved October 13, 2006 from http://www.alysion.org/dimensional/analysis.htm.

3. Pharmacology Math retrieved October 13, 2006 from http://www.accd.edu/sac/nursing/math/default.html.

Texts

Gounsoulin, S.M., Sanders, M.J., & Raynovich, W. (2002). *Prehospital drug therapy (2nd ed.)*. St. Louis: Mosby.

Mikolaj, A. A. (1997). *Drug dosage calculations for the emergency care provider*. Upper Saddle River, NJ: Brady.

Sanders, M.J. (2007). *Mosby's paramedic textbook: revised third edition*. St. Louis: Elsevier-Mosby.

Appendix B- Medication Math Handout
Special thanks to Kent Spitler, RN, NREMT-P of Gaston College Department of EMS for sharing this resource.

IV and Drug Calculations for Busy Paramedics

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Introduction

Medication calculations can cause frustration for EMS providers. Math and pharmacology can make it difficult to succeed on course exams, in the clinical setting, and in the field. There is a solution to make medication calculations easier. The answer to this problem is simple by showing students how to perform calculations using a simple process.

While there are plenty of good drug and solution textbooks, study guides, and presentations available showing the methods of medication calculations, It seems that it much of it causes mathematical confusion often called "math mental blocks" for many EMS providers.

There are only a few drug calculations necessary in the prehospital setting. These calculations include IV drip rates, IV piggyback infusion, IM and Subcutaneous injection. A good review of the metric system is in order here since medicine is based on this measurement system. It is necessary to ***practice*** drug calculations on a regular basis to gain a comfort level with the methods. The best way to achieve this comfort level is to practice medication calculations 30 minutes a day for six months and it will come natural after while.

Common abbreviations are used in medication administration for all medical fields. Below is a list of some abbreviations that are found in drug calculations used in the prehospital setting:

Gram =	Mass	5 cc =	1 tsp	gtts/ml =	Drops per milliliter
Meter =	Length	15 cc =	1 TBS or 3 tsp	gtts/min =	Drops per minute
Liter =	Volume	30 cc =	1 ounce	Conversion	
Gm =	Grams	30 cc =	2 TBS	Convert grams to milligrams: multiply X 1000	
Gtts =	Drops	60 mg =	1 Grain	Convert liters to milliliters: multiply X 1000	
Hr =	Hour	1 Gram =	15 Grains	Convert milligrams to grams: divide by 1000	
IVPB =	Intravenous Piggyback	X =	Multiply	Convert milliliters to liters: multiply X 1000	
Mcg =	Micrograms	x =	Unknown answer		
Min =	Minute	/ =	Per or Each		
Mg =	Milligrams	— =	Divide		
Ml =	Milliliters	- =	Minus	*Don't forget where to place the decimal*	

Table 1

It is assumed that the reader has an understanding of general mathematics. It also assumed that the reader has a general understanding of the metric system as it relates to medicine and drug calculations.

IV Drip Rate Calculations

IV calculations are easier than they appear. There are four common drip sets in two categories: minidrip set which includes microdrip or pediatric set, and regular drip set which include macrodrip or adult sets. The various drip sets are as follows:

60 gtts/ml minidrip drip set
10 gtts/ml regular drip set
15 gtts/ml regular drip set
20 gtts/ml regular drip set (this set is sometimes used, but it's not as popular)

Next, think about where these numbers came from for use in medicine. Since there are 60 minutes in one hour and 60 seconds in one minute, it appears natural to calculate drip rates based on the clock.

There is one (1) 60 minute period in one hour
There are six (6) 10 minute periods in one hour
There are four (4) 15 minute periods in one hour
There are three (3) 20 minute periods in one hour

It makes sense doesn't it? When calculating IV drip rates all that needs to be done is divide the amount to be infused over one (1) hour by how many time periods the drip set has in one (1) hour based on the clock.

If infusing 60 ml/hr using a **60 gtts/ml set** divide 60 by 1 (1 60 minute period) which is 60 or 60 gtts/min.

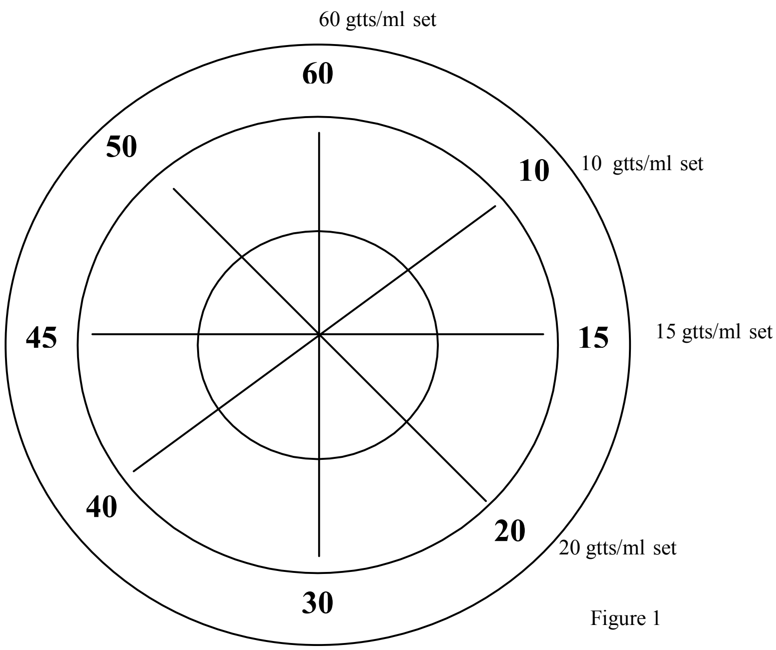


Figure 1

If infusing 60 ml/hr using a **10 gtts/ml set** divide 60 by 6 (6 - 10 minute periods) which is 10 or 10 gtts/min.

If infusing 60 ml/hr using a **15 gtts/ml set** divide 60 by 4 (4 - 15 minute periods) which is 15 or 15 gtts/min.

If infusing 60 ml/hr using a **20 gtts/ml set** divide 60 by 3 (3 - 20 minute periods) which is 20 or 20 gtts/min.

The calculations are based on the following formula:

$$\frac{\textbf{Amount to be infused X drip set}}{\textbf{Time (in minutes)}} = \text{x gtts/min}$$

Minidrip (Pediatric or Microdrip) Set - 60 drops per milliliter

How do we arrive at the correct answer? Let's look at the other methods and see if it makes sense. Think about the 60 drop per milliliter set (60 gtts/ml.) Now think about the answer you want which drops per minute. A protocol or medical control will give you fluid amounts to administer most commonly in ml/hr. You already have the amount and the time to be infused. All you do now is choose the appropriate drip set, using a simple formula you can come up with a quick answer:

$$\frac{\textbf{Amount of Solution (in ml) X drip set}}{\textbf{(gtts/ml)}} = x \textbf{ drops/min (gtts/min)}$$

Looking at an example, your medical control states you need to establish an IV on a cardiac patient complaining of chest pressure at a rate of 80 ml/hr using a 500 ml bag of Normal Saline solution. The drip set you choose is a 60 gtts/ml minidrip set. The formula is as follows:

Divide 60 into 4800

$$\frac{\textbf{80 ml (amount) X 60 gtts/ml (drip set)}}{\textbf{60 (divided my time in minutes – over 1 hour)}} = \frac{\textbf{4800}}{\textbf{60}} = \textbf{80 gtts/min}$$

When calculating IV drip rates remember that you can reduce to the lowest common denominator by dividing the same number into both the numerator and the denominator to make your calculations much easier. All samples shown from now on demonstrate this throughout. Simply remember that the numbers are consistent with the 60 minute clock and you will catch on rather quickly. The sample problems will show you by dividing the same number into the drip set and the time.

As you see the answer is 80 or 80 gtts/min. 60 goes into 60 once (1). Divide 60 into 60 on the top and bottom. Let's look at the problem again and see how simple it really is:

$$\frac{\textbf{80 ml X } \not{60}\ \textbf{1 gtts/ml set}}{\not{60}\ \textbf{1 min}}$$

The only thing necessary is to do is cancel out the 60 on the top line and the bottom line. This leaves you with 1.

$$\frac{\textbf{80 X 1}}{\textbf{1}} = \frac{\textbf{80}}{\textbf{1}} = \textbf{80 or 80 gtts/min}$$

Thinking this way will make it easier for you any time a 60 gtts/ml drip set is used. Just divide the amount of solution per hour by 1 and the number that is left is your answer in drops per minute. All you need to do is plug in the amount to be given over an hour.

REGULAR DRIP SET – 10 DROPS PER MILLILITER

Taking a look at the 10 gtts/ml regular drip set we need to think, how many 10 minute periods are in one hour? The answer is 6. (see page 2.) The objective here is that there are larger drops leading to less drops per minute. In the problem below, 10 goes into 10 once and 10 goes into 60 six times. Using the same formula as we did with the 60 gtts/ml set the problem is as follows:

$$\frac{\textbf{80 ml (amount) X 10 gtts/ml (drip set)}}{\textbf{60 (divided my time in minutes – over 1 hour)}} = \frac{\textbf{80 X } \not{10}\ \textbf{1}}{\not{60}\ \textbf{6}} = \frac{\textbf{80 X 1}}{\textbf{6}} = \frac{\textbf{80}}{\textbf{6}} = \textbf{13.3 or 13 gtts/min}$$

80 divided by 6 is 13.3 or 13 gtts/min. Now to it even simpler, every time you use a 10 gtts/ml regular drip set just divide the amount by 6 since they're six 10 minute time periods in one hour. All you need to do is plug in the amount of fluid per hour.

$$\frac{\textbf{80}}{\textbf{6}} = \textbf{13.3 or 13 gtts/min}$$

The two remaining regular drip sets are the 15 gtts/ml set and the 20 gtts/ml set. Remember, all you need to do is figure out how many time periods the drip set has in one hour (don't forget the clock.)

The 15 gtts/ml drip set is related to four 15 minute time periods in one hour which means we divide the amount per hour by 4. 15 goes into 15 once and 15 goes into 60 four times resulting as 80/4 leaving us with the answer of 20. Observe the example below:

$$\frac{\textbf{80 ml (amount) X 15 gtts/ml (drip set)}}{\textbf{60 (divided my time in minutes – over 1 hour)}} = \frac{\mathbf{80 \times \cancel{15}}\ \mathbf{1}}{\mathbf{\cancel{60}}\ \mathbf{4}} = \frac{\mathbf{80 \times 1}}{\mathbf{4}} = \frac{\mathbf{80}}{\mathbf{4}} = \textbf{20 gtts/min}$$

So any time you use a 15 gtts/ml drip set just divide the amount of solution per hour by 4.

$$\frac{\mathbf{80}}{\mathbf{6}} = \textbf{20 gtts/min}$$

The 20 gtts/ml drip set is calculated the same way except you divide by 3 since there are three 20 minute periods in one hour. 20 goes into 20 once and 20 goes into 60 three times. Observe the example below:

$$\frac{\textbf{80 ml (amount) X 20 gtts/ml (drip set)}}{\textbf{60 (divided my time in minutes – over 1 hour)}} = \frac{\mathbf{80 \times \cancel{20}}\ \mathbf{1}}{\mathbf{\cancel{60}}\ \mathbf{3}} = \frac{\mathbf{80 \times 1}}{\mathbf{3}} = \frac{\mathbf{80}}{\mathbf{3}} = \mathbf{26.6}$$

The answer is 26.6 or rounded off to 27 gtts/minute.

This means all you need to do is divide the amount of solution per hour by 3 to get the gtts/min.

Summary

- Drip sets used in medicine are based on the 60 minute clock for timing and calculations. All you need to do is divide the amount to be infused each hour by how many time periods the drip set has in one hour which is based on the clock.

- The drip sets include the minidrip set, 60 gtts/ml, and three regular drip sets which include the 10 gtts/ml set, 15 gtt/ml set, and the 20 gtts/ml set.

- There is one (1) 60 minute period in one hour, six (6) 10 minute periods in one hour, four (4) 15 minute periods in one hour, and three (3) 20 minute periods in one hour.

- When reducing fractions to allow easier calculations remember to divide the same number into both the numerator and the denominator to arrive at the lowest common denominator. Thinking about the problems presented you must divide the same number into the drops per milliliter and the time (in minutes.)

60 goes into 60 = 1	**10 goes into 10 = 1**	**15 goes into 15 = 1**	**20 goes into 20 = 1**
60 goes into 60 = 1	**10 goes into 60 = 6**	**15 goes into 60 = 4**	**20 goes into 60 = 3**

Looking at these examples you notice that there is a pattern the stays the same. Since there are only four (4) different IV drip sets available, all you have to do is just insert the amount of solution to be delivered over one (1) hour. When setting up each problem remember all you have to do is divide the number of periods each drip set has in the 60 minute clock and divide that number into the amount of solution to delivered in one (1) hour. It's simple as that!

Problems

You have an order to start an IV of NS How many drops per minute do you want to set the IV drip rate for the following?

1. 150 ml/hr using a 10 drop per milliliter set.
2. 75 ml/hr using a 60 drop per milliliter set
3. 100 ml/hr using a 15 drop per milliliter set
4. 200 ml/hr using a 20 drop per milliliter set

IV Infusion/Piggyback Medications

Medication administration in field can become complicated in the field when you need an the drug dose in a hurry. The medications we give are usually limited to IV push medications, SL medications, IM and Subcutaneous medications. It seems like paramedic students struggle with drug calculations, but do not get the opportunity to do many calculations in the clinical setting and the skill is limited in the field.

The amount of medication to give is usually the answer we want. Medication comes in ampules, vials, prefilled syringes, and premixed IV bags. Piggyback infusions are given frequently in the field, but when they are there is no room for error. The goal here is to use a simple method of calculating medication drip rates effectively spending the least amount of time doing so.

There are two basic issues that we need to think about for piggyback infusions. The first is calculating drip rates for medication in milligrams (mg), e.g., lidocaine, Procainamide, and Bretylium, which are common medications used in ACLS and in the field. The second issue is calculating IV infusion rates in micrograms (mcg). Medication dosing may include the patient's weight as well which needs to be figured into the problem to assure the patient receives the correct amount of medication. There are several methods used in calculating medication doses for IV infusion. We will start with lidocaine as an example because it is one of the most common IV infusions drug in the field.

Let's start with the following information:

Lidocaine

Drug ordered:	**2 mg/min IVPB**
Drug on hand:	**2 Grams Lidocaine 20% in 5 ml (the 5 ml is irrelevant in our calculations)**
IV Solution:	**500 ml of Normal Saline**

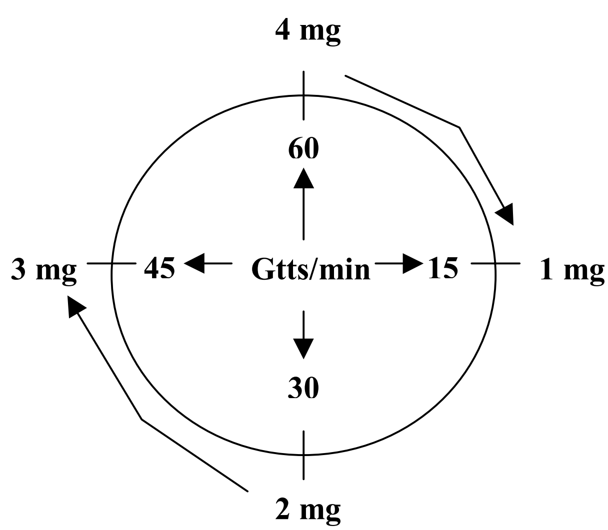
Drug Concentration in the IV Solution:	**4 mg/ml (this is achieved by dividing the amount of IV solution into the drug. But first you must convert grams to milligrams to properly calculate the problem**
IV Drip Set:	**60 drops per milliliter**
Want to Know:	**Gtts/min to be administered to the patient**

Using the "Rule of Fours" Method

Some think the "rule of fours" method is easier than other methods, but this is up to the EMS provider which method is best. This method is sometimes called the Lidocaine clock method. The three simple steps used here are: Compare, Prepare, and Observe.

Using the information above for our problem we can conclude that there is 4 mg of lidocaine for each milliliter of IV solution (That is by putting 2 grams or 2000 mg of lidocaine into 500 ml of NS and dividing 2000 mg by 500 ml = 4 mg/ml) This means that there is 4 mg = 1 ml which means we will have 4mg for every 60 drops of solution because the drip set is a 60 gtts/ml IV set.

The Rule of Fours Method (Lidocaine Clock Method)



Look at the drug order and compare to the clock in the circle. 2 mg = 30 gtts/min is observed and is the answer to the problem.

There is another method that is popular among people with a chemistry and math education, but anyone can use it. Find out the concentration of medication you have. Remember, the drug order is 2 mg of Lidocaine 20% and a bag of 500 ml Normal Saline. First convert the 2 Gms of Lidocaine into mgs which equals 2000 mg. This needs to be done because the order is in milligrams per minute.

We always divide the amount of solution into the amount of drug. Divide 500 ml into 2000 mg Lidocaine 2 Gm = 2000 mg. The answer you get is 4 mg/ml.

The formula is now set up as follows:

$$\frac{\text{IV Bag Amount (ml) X dose ordered (mg/min) X drip set (gtts/ml)}}{\text{Drug on hand (mg)}} = \text{30 drops per minute}$$

Another method found useful is the following:

Reduce fraction

$$\frac{\text{Drug order (2 mg/min) X IV drip set (60 gtts/ml)}}{\text{Drug Concentration 4mg/ml X 1 minute}} = \frac{120}{4} = \text{30 gtts/min}$$

You can use these methods with any drugs in the field when giving drugs in milligrams, such as. Bretyllium and Procainamide..

IV infusion drugs in Micrograms

Now we need to consider drugs given in micrograms. This group of drugs includes dopamine, epinephrine, dobutamine, and Isoproterenol. When calculating a drug, such as dopamine, using the micrograms can be a little tricky, but remember it's just a way to measure medicine in smaller amounts (units.) What this really means is dopamine is potent stuff and we need to keep the math as simple as possible (you know, the KISS method)

Dopamine and other complicated Medications can be challenging to calculate, but there is a simple formula method that will make it easier for you. The first formula will include the patient's weight. Of course, it is assumed you already know how to convert pounds (lbs.) to kilograms (kgs.) But if you are not sure let's review. All you need to know is that 2.2 lbs. = 1 kg. And 1 kg. = 2.2 lbs. This means if you want to convert pounds to kilograms just divide the weight (in lbs.) by 2.2. Now to convert kilograms to pounds just multiply the weight (in kgs) X 2.2. Look at the example below:

> A 50 year old cardiac patient weighs 150 pounds. You need to convert this patients weight to kilograms because medication based on weight is almost always given in kilograms.

150 divided by 2.2: $\frac{150}{2.2}$ or $2.2\overline{)150.}$

it should look like this: $22.\overline{)1500.}$ The answer is: 68.1 or 68 kgs. (rounded off)

Note:

Remember to move the decimal to the right (we don't want to deal with decimals any more than we have to) When you move the decimal to the right you must also move it the same amount of spaces to the right in the for the number you are dividing.

We'll set up a dopamine drip based on the patient's weight (most IV infusion drugs are based on the patient's weight.) This is probably as hard as it's going to get for EMS providers. Take a look and see if you find this fairly easy:

Dopamine

Information

Drug order –	7 mcg/kg/min
Concentration on hand -	800 mg (it may come in a premixed IV bag or in 200 mg vials) We know this has to be converted to mcg because that's the drug order, right?
Drip Set -	60 gtts/ml
Time -	We already know it's per minute
Patient's Weight -	220 lbs.
IV Bag -	500 ml Normal Saline

First convert the patients weight from lbs. to kilograms: Divide 220 by 2.2 = 100 kgs.

Second convert the concentration on hand, 800 mg to micrograms. How do we do that? Multiply 800 X 1000 (review your metric conversions if you don't understand.) The answer is 800,00 mcg. Remember, to convert mg to mcg just multiply X 1000. Anyway we don't want to messing with decimals when we don't have to. 800 mg X 1000 = 800,000 mcg

Third, all you have to know now is how many mcg are in each ml of the IV bag we are using (500 ml.) Divide the solution into the drug to find out:

$$500 \text{ ml} \overline{\big)\, 800{,}000 \text{ mcg}} = 1600 \text{ mcg/ml}$$

This is you concentration on hand

Fourth, set up the formula (this is probably the easiest way to do it without using a drug chart):

$$\frac{\text{Mcg/kg X weight (kg) X drip set}}{\text{Concentration on hand X time}} = \text{Gtts/min}$$

With the numbers now:

$$\frac{\mathbf{7}\ \text{mcg/kg X } \mathbf{100}\ \text{kgs X } \mathbf{60}\ \text{gtts/ml}}{\mathbf{1600}\ \text{mcg/ml X 1 min}} = \frac{7 \text{ X } 100 = 700 \quad 700 \text{ X } 60 = 4200}{1600 \text{ X } 1 = 1600} \quad \frac{4200}{1600} = 26 \text{ gtts/min}$$

concentration on hand

actually the answer is 26.2 but we rounded it off

It may not seem easy at first, but remember all you have to do is plug in the right numbers and the simple math. That's all!

Practice - Practice - Practice

IVP, IM, SQ Parenteral Medication Calculation

The key to finding the answer for the right dose is organizing the right information. Doing well in drug calculations is practice-practice-practice. Earlier, we mentioned to practice 30 minutes each day for six months and you will remember how to do it.

When calculating parenteral medication doses there are only three things to remember, drug order, concentration on hand, and the amount you want to give. Using Lasix, for example:

Drug order:	40 mg
Concentration on hand:	100 mg
Volume of solution	10 ml
Amount you want to give:	X is the answer you want in ml.

Two methods easy to use (you decide which one) for calculating drug doses are ratio and proportion (also known as cross multiplication) method and the formula method. Both methods require setting up the problem and the rest is fairly easy.
Want you want to do is keep it simple (you know , the KISS method) so let's look at the ratio and proportion method first. What needs to be done is put the same form of measurement on the top lines and the bottom lines.

$$\frac{\text{Drug ordered (mg)}}{\text{Amount to give (ml)}} = \frac{\text{Concentration on hand (mg)}}{\text{Volume of solution (ml}}$$

As you can see we put the mg on the top and the ml on the bottom. It is better to do it this way to keep things straight. Once you set up the formula it necessary to cross multiply to arrive at the correct answer. Using our example, Lasix, we will set up the problem now with the information provided above:

Drug ordered **Concentration on hand**

$$\frac{40\text{ mg}}{X\text{ ml}} = \frac{100\text{ mg}}{10\text{ ml}}$$

X = amount to give in ml
This the answer we want

Volume of solution

Next, cross multiply the numbers as shown below:

$$\frac{40\text{ mg}}{X\text{ ml}} = \frac{100\text{ mg}}{10\text{ ml}} \qquad 40 \text{ x } 10 = 400 \qquad 100 \text{ x } X = 100\,X$$

Now it will look like this: 400 = 100 X

Since X is the answer we want, which is the amount of drug to give, X needs to be by itself. The way to do this is move the number with the X underneath the number on the other side. This is how it looks:

$$\frac{400}{100} = 100X \qquad \frac{400}{100} = X$$

To arrive at the correct answer, all we need to do is divide 400 by 100 which equals 4. This means X = 4 or 4 ml. The only left to do is draw up the drug into a syringe and give the Lasix to the patient.

Tips:

- Set the ratio and proportion the same each time.
- Put like measurements on the same line $\frac{mg}{ml} = \frac{mg}{ml}$
- Use X as the symbol for the answer you want
- Always move the number with X underneath the other side leaving X by itself
- Divide leaving you the answer which is the amount to give in ml

The formula method takes a different approach which some practitioners like. It is set up like this:

$$\text{Volume to be given (X ml)} = \frac{\text{Volume of solution X Drug order}}{\text{Concentration on hand}}$$

We will use Lasix again:

Drug order:	40 mg
Concentration on hand:	100 mg
Volume of solution	10 ml
Amount you want to give:	X is the answer you want in ml.

Volume of Solution → 10 ml; Drug Order → 40 mg; Concentration on hand → 100 mg

$$\text{Volume to be given X ml} = \frac{10 \text{ ml} \quad X \quad 40 \text{ mg}}{100 \text{ mg}}$$

As you can see, we need to multiply 10 X 40 and divide the answer by 100.

It will look like this: $\frac{10 \text{ ml X } 40 \text{ mg}}{100 \text{ mg}} = \frac{400}{100} = 4$

X ml is the amount we want to give so just replace **x** with 4 and we have our answer of 4 ml.

Both the ratio and proportion method and the formula method can be used with tablets, IV push, IM, and SQ medication administration. Now isn't that simple? If you are having trouble it is a good idea to read back through the material and work through the practice problems. Remember, practice-practice-practice!