IV Fluid Therapy Calculations

Disclaimer

A series of booklets has been developed by the Clinical Skills Lab team (staff, recent graduates and students) from the School of Veterinary Sciences, University of Bristol, UK.
Please note:

- Each booklet illustrates one way to perform a skill and it is acknowledged that there are often other approaches. Before using the booklets students should check with their university or college whether the approach illustrated is acceptable in their context or whether an alternative method should be used.
- The booklets are made available in good faith and may be subject to changes.
- In using these booklets you must adopt safe working procedures and take your own risk assessments, checked by your university, college etc. The University of Bristol will not be liable for any loss or damage resulting from failure to adhere to such practices.

This work is under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

© The University of Bristol, 2017

University of BRISTOL

Year Group: BVSc3 +

University of BRISTOL

Equipment list:
IV Fluid Therapy Calculations

Equipment for this station:

- Calculator
- Pen
- Paper

Considerations for this station:

- Every patient should be assessed as an individual and the plan for fluid therapy adjusted accordingly.

Anyone working in the Clinical Skills Lab must read the 'CSL_I01 Induction' and agree to abide by the 'CSL_I00 House Rules' & 'CSL_I02 Lab Area Rules'

Please inform a member of staff if equipment is damaged or about to run out.

University of BRISTOL

Useful Information

IV Fluid Therapy Calculations

The basics:

- Maintenance fluid rate for an adult dog or cat is estimated as 2mL/kg/hr OR 50mL/kg/24 hours
    - *e.g. 35kg dog: Maintenance = 35kg x 2 = 70mL/hour*

      or 50mL x 35kg = 1750mL/24 hours
- Maintenance fluid rate for puppy or kitten may be estimated as 3-4mL/kg/hr
- More detailed guidelines are available in the *'2013 AAHA/AAFP Fluid Therapy Guidelines for Dogs and Cats'*

Fluid deficit:

- If present, the fluid deficit needs to be calculated and this can be done by estimating the percentage dehydration:
    - *e.g. A 35kg dog that is estimated to be 8% dehydrated*
- Percentage dehydration is estimated to be 8% of the body weight and then this is converted into fluid units:
    - *e.g. 35kg x 0.08 = 2.8kg*
    - *1kg = 1L, therefore the dog has a 2800mL fluid deficit*
- If the fluid lost is to be replaced over 24 hours, the maintenance requirement is added to the fluid deficit to work out the total amount to be given over a 24 hour period:
    - *e.g. 1750mL + 2800mL = 4550mL over 24 hours*
- In a severely dehydrated animal the deficit may be replaced over 24 hours, but at times it may be appropriate to 'front-load' e.g. 30% in the first 3 hours, though more of less may be appropriate depending on the case and response to treatment.
- If a patient is in shock, generally a bolus of fluids will be given over a short period of time rather than increasing the fluid rate so that the fluid deficit is replaced more quickly.

Ongoing losses:

- Fluid rates must be adjusted according to the ongoing losses such as vomiting, diarrhoea, haemorrhage.
- The volume of fluid that is being lost should be estimated in each case and then adjusted depending on disease progression and clinical assessment.

University of BRISTOL

Useful Information

IV Fluid Therapy Calculations

- Once the overall fluid rate per hour has been calculated, taking into consideration maintenance, deficit and on-going loss, this information can be entered into an infusion pump if this is available. If not a drip rate needs to be calculated in mL/minute:
  - e.g. *A dog needs 116mL/hour*
  - *116mL/hour/60 = 1.93mL/minute*

- The amount needed per minute then has to be multiplied by the drops/mL that the giving set delivers. This can be found on the giving set. Use this to convert the amount needed in mL per minute to the number of drops per minute.
  - *e.g. A 20drops/mL giving set*
  - *1.93mL/min x 20 = 38 drops per minute*

- Set up the giving set to deliver 38 drops per minute
  - To check, the drip rate can be measured over a shorter period of time
  - *e.g. 19 drops over 30 seconds, ~10 drops over 15 seconds*

- Note: Fluid administration rates can be controlled more accurately using an infusion pump.

- Current practice for fluid administration during anaesthesia:
  - 2-4mL/kg/hr (healthy animal, minimal fluid losses e.g. blood loss or evaporation)
  - Faster rates may be required for individual animals i.e. for different cases and situations

University of BRISTOL

Questions

IV Fluid Therapy Calculations

Work through the following scenarios, the answers are on the next 2 pages.

1. Calculate the drip rate required for a 6 year old female DSH undergoing a routine dental. She weighs 3.4kg and otherwise healthy. The giving set delivers 60 drops/mL.

2. A 15 week old, 6.8kg puppy has been admitted with vomiting and diarrhoea that have been present for 2 days. The puppy is 6% dehydrated which needs to be corrected over 24 hours. What fluids will be used initially for the puppy and what drip rate would be used? The giving set delivers 20 drops/mL.

3. A dog is admitted following an road traffic accident (RTA) and is in hypovolaemic shock. The dog weighs 35kg and you decide that it needs a bolus of fluids. You decide to give it a 30mL/kg bolus over 20 minutes. The giving set delivers 20 drops/mL. What would the drip rate be? What could be done to try to ensure the animal received this volume in the time required?

4. A 4.7kg, 9 year old MN DSH cat has been admitted with a severely distended and painful bladder due to a urethral obstruction. You successfully catheterise the urethra but the cat is 10% dehydrated. He has a high (raised) potassium and is depressed. What would be the setting of an infusion pump to deliver a bolus of 25mL/kg over 30 minutes? What fluid type would be most appropriate in this case?

University of BRISTOL

Answers

IV Fluid Therapy Calculations

1. Calculate the drip rate required for a 6 year old female DSH undergoing a routine dental. She weighs 3.4kg and otherwise healthy. The giving set delivers 60 drops/mL.

   - *3.4kg x 4mL/hour = 13.6 mL/hr*
   - *13.6mL/hour / 60 = 0.226mL/minute*
   - *0.226mL/minute x 60drops/mL = 13.5 drops/minute*
     = 0.225 drops/second
     = approx. 1 drop every 5 seconds

2. A 15 week old, 6.8kg puppy has been admitted with vomiting and diarrhoea that have been present for 2 days. The puppy is 6% dehydrated which needs to be corrected over 24 hours. What fluids will be used initially for the puppy and what drip rate would be used? The giving set delivers 20 drops/mL.

   - *Maintenance = 3mL/kg/hr x 24 hrs = 72mL/kg/24hrs = 489.6mL*
   - *Deficit = 6.8kg x 0.06 (% dehydration) = 408mL*
   - *Total over 24 hours = 489.6mL + 408mL = 897.6mL*
   - *897.6mL /24 hrs = 37.4mL/hr*
   - *37.4mL /60min = 0.623mL/min*
   - *0.623mL/min x 20drops/mL = 12.5 drops/min*
   - *0r if you had used 4mL/kg/hr. Answer: 15 drops/min*
     = 0.25 drops/second
     = approx. 1 drop every 4 seconds

   If the puppy continues to vomit and have diarrhoea, these ongoing losses with need to be factored in to the fluid therapy plan.

- N.B. It is important to monitor the response to treatment and alter the fluid rate accordingly; the initial calculations are only the starting point.

University of BRISTOL

Answers

IV Fluid Therapy Calculations

3. A dog is admitted following an road traffic accident (RTA) and is in hypovolaemic shock. The dog weighs 35kg and you decide that it needs a bolus of fluids. You decide to give it a 10mL/kg bolus over 10 minutes. The giving set delivers 20 drops/mL. What would the drip rate be? What could be done to try to ensure the animal received this volume in the time required?

   - *35Kg x 10mL/kg = 350mL over 10 minutes*
   - *350mL x 6 = 2100mL over 1 hour*
   - *2100 /60 = 535mL/minute*
   - *35mL/minute x 20 drops/mL = 700 drops/minute*
     = 11.6 drops every second
   - *It would be difficult to accurately set a giving set to this speed and most infusion pumps would not work at this speed – so if this is what is required the bag would need to be squeezed. Another options would be to place another i.v. catheter and run 2 bags of fluid in at once.*

4. A 4.7kg, 9 year old MN DSH cat has been admitted with a severely distended and painful bladder due to a urethral obstruction. You successfully catheterise the urethra but the cat is 10% dehydrated. He has a high (raised) potassium and is depressed. What would be the setting of an infusion pump to deliver a bolus of 25mL/kg over 30 minutes? What fluid type would be most appropriate in this case?

   - *Either 0.9% NaCl or Hartmans would be suitable in this case.*
   - *4.7kg x 25mL/kg = 117.5mL over 30 minutes*
   - *117.5mL x 2 = 235mL/hr*
   - *Enter 117.5mL under VTBI (volume to be infused) on the infusion pump*

   N.B. Normally the value would be rounded up or down i.e. 117.5 set as 120mL

University of BRISTOL

Additional Information

IV Fluid Therapy Calculations

- In cases of lower urinary tract obstruction and hypoadrenocorticoid (Addisonian) crisis where there is hyperkalaemia, crystalloids that contain potassium can be given e.g. Hartmann's solution. This is because the concentration of potassium in the fluids is still lower than the concentration in the blood, which will therefore be lowering the potassium concentration in the blood. These fluids are also more balanced and lead to a more rapid resolution of the acidosis that is present.

  Drobatz et. al. (2008). The influence of crystalloid type on acid-base and electrolyte status of cats with urethral obstruction. *Journal of Emergency and Veterinary Clinical Care.* 18, 4, 355-361.

- When administering fluids to an animal of small body size e.g. a cat or small dog, it may be advisable to empty (remove) some of the fluid from the bag to prevent the inadvertent administration of an excessive volume of fluid. Do not replace an empty bag without considering the current fluid status and requirements and the risk of fluid overdose to the animal.

- Common infusion pump abbreviations:
  - VTBI = volume to be infused

    If administering a bolus enter the total amount. Once the infusion pump has infused this set amount it will stop and the animal will no longer receive fluids (and most pumps then beep loudly).
  - RATE = rate e.g. 2mL/kg/hr
  - VI = volume infused. This is the total amount of fluid the patient has received (as long as this was reset when the patient was first put on the drip).