Monitoring IV Fluid Therapy

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One of a veterinary nurse's core responsibilities is monitoring patients during treatment. Intravenous (IV) fluid therapy administration is used frequently in veterinary medicine, yet team members can be incognizant of the need for careful patient monitoring.

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Fluid therapy exerts a physiologic effect on the patient and should always be monitored closely. Reasons for fluid therapy include:

- Replacing fluid deficits
- Maintaining fluid balance
- Preventing dehydration and hypovolemia when the potential for fluid loss is recognized
- Aiding in the distribution of medications
- Promoting diuresis
- Correcting electrolyte imbalance

Patient Assessment

Assessment should include a complete history, physical examination, and laboratory tests.[1]

History

A thorough clinical history will help establish why the patient needs fluid therapy, which is important for evaluating the patient's possible response to fluid administration and determining the treatment goals. The patient history is also important to ensure the veterinary nurse is aware of possible complications (eg, a patient with a heart murmur requires different monitoring than a young patient that is vomiting but otherwise healthy).

Physical Examination

Never underestimate the importance of a physical examination, which should be performed on patients receiving IV fluids, with an emphasis on degree of dehydration (see **Table 1**) and perfusion parameters.

Physiologic indicators of poor perfusion include:

- Tachycardia
- Peripheral vasoconstriction resulting in poor pulse quality
- Hypotension caused by moderate-to-severe hypovolemia
- Cool extremities and possible core temperature decrease
- Increased (>2 sec) capillary refill time
- Light-pink-to-pale mucous membranes
- Tachypnea
- Altered mentation (depressed or dull)

A veterinary nurse who understands the parameters can establish a patient's positive or negative response to fluid therapy, determine any necessary changes, and effectively communicate information to team members.

Treatment is adjusted by the veterinarian based on patient response. Fluids can typically be discontinued if the patient responds positively with improved perfusion parameters and achieves normal hydration status with no anticipation of continued losses. If the patient has a negative response (eg, signs of fluid overload [ie, serous nasal discharge, tachypnea, chemosis, new heart murmur, polyuria]), fluid therapy should be stopped and the veterinarian should be alerted. Patients should also be monitored for fluid-related complications caused by underlying conditions (eg, edema, congestive heart failure).

TABLE **1** **Signs of Dehydration Pertaining to Percent Dehydration**[2]

Percent Dehydration	Clinical Signs
<5%-6%	Subtle loss of skin elasticity
6%-8%	Dry mucous membranes, decreased skin turgor, slight increase in capillary refill time, eyes slightly sunken into orbits
10%-12%	Dry mucous membranes, loss of skin turgor, eyes sunken into orbits, possible signs of shock
12%-15%	Definite signs of shock

A patient receiving IV fluids should be monitored via regular physical examinations, basing the frequency on the patient's status, therapy phase, and individual patient findings that could increase the potential for complications associated with fluid therapy.

Laboratory Tests

Laboratory findings should be part of the patient assessment when evaluating the fluid therapy plan. Tests used to evaluate and monitor hydration status include:

- Acid-base status
- Electrolyte levels
- Lactate levels
- PCV/TS
- Urine production (normal = 1-2 mL/kg/hr)[3]
- USG (dogs, 1.026; cats, 1.035)[4]

TAKE ACTION

1. Understand the clinical history, and perform a thorough physical examination so the patient's response to fluid therapy can be evaluated.
2. Be comfortable evaluating perfusion parameters and identifying signs of fluid overload to determine response to treatment.
3. Carefully monitor not only the patient but also the equipment, including the actual fluids, fluid administration line, IV catheter, and fluid pump.

Therapy Phases

The frequency of physical examinations depends partly on the phase of the fluid therapy administration.[2]

- **Phase 1: Resuscitation & Emergency Therapy**
  - Requires immediate resuscitation during life-threatening fluid deficits that result from acute changes in fluid balance and cause decreased tissue perfusion, leading to hypoxemia and shock
  - Caused by severe dehydration, hemorrhage, or shock
  - Typically requires large fluid volumes at high rates
  - The goal is to expand and support intravascular volume and increase blood flow and cardiac output to restore tissue perfusion and oxygen delivery to tissues.

- **Phase 2: Replacement Therapy**
  - Previous, ongoing, or anticipated losses (ie, vomiting, diarrhea, diuresis) leading to dehydration must be replaced.
  - Fluid deficits are typically replaced over 4 to 24 hours, depending on the patient's hydration status.[2]
  - The goal of treating dehydration is to restore homeostasis and prevent shock and clinical decompensation.
  - In the author's experience, monitoring may not need to be constant but should occur q1-4h.

- **Phase 3: Maintenance Therapy**
  - Involves maintaining tissue perfusion,

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electrolyte balance, and cellular metabolism and function in an ill patient
  - Indications for maintenance fluid therapy include anesthesia, continued fluid losses after rehydration, and decreased intake.
  - In the author's experience, stable patients receiving maintenance fluids should be evaluated q4h.

Ongoing losses should be monitored during each phase. (See **Table 2**.)

Equipment Evaluation

After patient assessment, evaluate the physical equipment and other components—including the fluids, fluid administration line, IV catheter, fluid pump, and fluid rate—to ensure the patient is receiving the correct treatment.

Fluids

When checking a patient receiving IV fluid therapy, the fluids themselves should be evaluated first. Examining the bag for the following should be common practice.

- Fluids being administered are the exact fluids ordered
- Fluids have no abnormalities
- Any additives are properly labeled
- Quantity of fluids missing from the bag matches the amount received by the patient

Fluid Administration Line

Fluid administration lines should also be examined quickly and efficiently by following the line from the fluid bag to the patient to ensure each connection is snug, there are no leaks or disconnections, and no kinks or twists are obstructing the lines.

IV lines commonly become disconnected because patients move constantly and may even chew lines, leaving small leaking holes that can be hard to find. Small holes and disconnections can be a source of infection, and any fluid line that becomes disconnected should be replaced to prevent contamination.

IV Catheter

Proper placement and care of a peripheral IV catheter is critical for fluid delivery and for

TABLE **2** Monitoring Ongoing Fluid Losses[5]

Method[a]	Collection & Measurement
Bowl/syringe	Collect and measure in mL
Absorbent pad/bedding	Weigh before soiling; subtract bedding weight from the weight after soiling (1 g = 1 mL fluid)
Litter box	Weigh before soiling; subtract box weight from weight after soiling (1 g = 1 mL fluid)
Output replacement	• Measured or predicted volume of loss (mL) per kg per hour (mL/kg/hr; normal = 1-2 mL/kg/hr)[3] • Fluid should be replaced immediately or over the number of hours eliminated, depending on patient status[3] • **Example using urine:** 180 mL collected over 4 hours from a 20-kg dog: 180 ÷ 4 = 45 mL/hr 45 mL/hr ÷ kg BW = 2.25 mL/kg/hr

[a] Methods are applicable to urine, feces, vomitus, effusion, hemorrhage, and blood collection.

prevention of catheter failure and catheter-related infections. Catheters should be evaluated for patency and potential complications (eg, inflammation, infection, phlebitis, subcutaneous extravasation). Factors contributing to infection include inadequate preparation of catheter insertion sites, team members' poor personal hygiene, and lack of cleanliness of the catheter insertion site.

The patient should be examined at least every hour for catheter patency and signs of inflammation and infection and to ensure the fluids are still attached and flowing. Catheter-related issues can easily be mistaken for signs of the patient's primary disease, so frequent evaluations are extremely important.

In the author's experience, IV catheters should not be bandaged unless the patient's condition (eg, vomiting, diarrhea) risks contamination of the insertion site. If bandages are used, they should be changed whenever they are soiled or at least q12h for evaluation of the insertion site.

Fluid Pump

Most veterinary practices administer fluids with fluid pumps, which set a constant rate, calculate the quantity of fluids administered, and send an alert if air or obstructions are detected in the line. However, fluid pumps are not without their faults, including:

- Continuing to administer fluids and appearing normal even if the line becomes disconnected
- Continuing to administer fluids when an IV catheter becomes nonpatent, allowing fluids to build up in the subcutaneous space
- Appearing to administer fluids when nothing is actually leaving the fluid bag; therefore, evaluating the quantity changes in the bag and not relying on the pump to measure fluids is important
- Frustrating and distracting team members with false alarms; nevertheless, a team member must evaluate fluid administration when the pump alarm sounds and not assume there is no reason for concern

If a fluid pump is not available, a drip rate must be calculated to achieve the desired fluid rate, and the fluid bag must be used to quantitate the fluids administered. In such cases, the author recommends constant supervision of the patient, whose slight movements can change the fluid rate administered by a drip technique.

Fluid Rates

The rate of fluid should be constantly monitored and each patient evaluated based on weight, cardiovascular and renal function, treatment goals, and response to fluid therapy. The pump should be checked to ensure the rate of fluid administered is the prescribed rate because mistakes commonly occur when the fluid rate is changed (eg, for a bolus) or discontinued temporarily (eg, for a physical examination, a walk) and the rate is not reset correctly.

Conclusion

IV fluid therapy is a common procedure used to treat patients for many reasons. Because of its physiologic effects, the team must be cognizant

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of the steps required—patient assessment, therapy phases, and equipment evaluation—to carefully and appropriately monitor patients receiving fluid therapy.

References

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FUN FACT: Erica enjoys her children, Sean, 14, and Alexandra, 10, and loves doing anything outdoors.