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AVOID ERRORS IN THE ER: 10 COMMON MISTAKES YOU CAN EASILY STEER CLEAR OF
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Don't see emergency cases every day? Have a dog presenting to you with pale mucous membranes, a weak pulse, a heart rate of 190 bpm, and you're not sure what to do next? Have a dyspneic cat fish-mouth breathing in front of you? This article discusses how to avoid 10 common errors in emergency patients that will save your patient's life, including when to tap that dyspneic cat's chest, when to reach for that "FAST" ultrasound, or the best time to do chest radiographs. Having practiced in the trenches of a busy inner-city emergency room to the ivory tower of academia, I've seen these mistakes made, and I've made them myself. Here, some common mistakes to avoid in the emergency room.

KEY CONCEPTS

- Geriatric patients should have chest radiographs performed before any other advanced diagnostics are done to rule out underlying metastatic disease.

- The shock dose of fluids (60–90 ml/kg) is no longer recommended—instead, smaller aliquots are preferred. Frequent evaluation and assessment of the patient (e.g., based on improvements in mucous membrane color, heart rate, pulse quality, and mentation) should be used to titrate fluid dosing for resuscitation efforts.

- The use of steroids in trauma patients is no longer recommended as the mainstay of therapy; indeed, with head trauma their use is contraindicated.

- Patients should be appropriately stabilized before anesthesia and surgery, as anesthetic agents and analgesics may mask signs of shock (resulting in bradycardia) and blunt the body's ability to respond appropriately (reducing cardiac output).

- To avoid negative abdominal exploratory surgery, advanced diagnostics (e.g., barium series, fluoroscopy, abdominal ultrasonography, venous blood gases) should be considered for adequate evaluation and diagnosis of surgical emergencies.

- Simple physical examination findings and basic blood work (including temperature, heart rate, respiratory rate, thirst reflex, urine output [UOP], packed cell volume [PCV], total solids [TS], urine specific gravity, [USG]) can be used as inexpensive, easily repeatable tests to assess emergency patients.

- FAST (focused assessment with sonography for trauma) ultrasound should be used to aid in rapid, accurate diagnosis of pleural or peritoneal effusion.

- Veterinarians should be comfortable performing such techniques as thoracocentesis and abdominocentesis, as they may be life-saving in emergency patients and aid in diagnostic evaluation.

NOT DOING CHEST RADIOGRAPHS

One of the most common mistakes in the emergency room is not performing chest radiographs (a "met check") as part of routine geriatric diagnostics. Geriatric patients (defined as a dog > 6–7 years of age [size-dependent] or a cat > 12 years of age) with, for example, hepatosplenomegaly, icterus, hemoabdomen, immune-mediated disease, or fever of unknown origin should have chest radiographs done at the same time as abdominal radiographs. Typically, a three-view chest set is the method of choice; however, this may be difficult in emergency patients with dyspnea. That said, a right- and left-lateral chest radiograph is also an effective way to screen for metastasis. While a met check is often a "low-yield test" (i.e., the likelihood of identifying chest metastasis is relatively low), it is an important screening tool that can help veterinarians counsel pet owners on end-of-life decision-making and overall prognosis.

Clinical application
- Although it's a low-yield test, consider doing chest radiographs on any geriatric patient before advanced diagnostics.
- Trauma patients should always have chest radiographs done to rule out lung disease or pathology.

USING THE SHOCK DOSE OF FLUIDS

The "shock dose" of fluids is extrapolated from the blood volume (60–90 ml/kg for dogs; 60 ml/kg for cats). More recently, emergency critical care specialists have moved away from using the entire shock dose when trying to stabilize hypovolemic patients—smaller aliquots (e.g., one-quarter to one-third of a shock dose) of intravenous (IV) crystalloids are preferred. A patient rarely requires replacement of the whole blood volume with crystalloid fluids.

Clinical application
- Smaller, repeated aliquots of fluid therapy given according to the patient's status (e.g., improvements in heart rate, blood pressure, mentation, capillary refill time, pulse quality) are preferred to prevent volume overload or edema.

USING THE WRONG DOSE OF STEROIDS

Traditionally, "shock doses" of steroids have been listed in emergency books (e.g., dexamethasone sodium phosphate [DexSP] 4–6 mg/kg). However, criticalists have moved away from giving steroids with trauma because of potential deleterious effects (including gastric ulceration in a poorly perfused "shock gut" in the dog, exacerbation of hyperglycemia, and delayed wound healing). More recently, we have moved to different *doses* of DexSP. Antiinflammatory doses of DexSP are generally considered 0.1 mg/kg, whereas immunosuppressive doses are as low as 0.25 mg/kg IV q 12 to 24 hours. For that reason, the 4-6 mg/kg dose for shock is no longer indicated. Remember that DexSP is approximately 8 to 15 times stronger than prednisone, and one is unlikely to need 40 mg/kg of prednisone in trauma cases.

Clinical application
- For cases warranting immunosuppression (e.g., immune-mediated hemolytic anemia), consider using lower doses of DexSP (0.25 mg/kg IV q 12–24 hours).
- Avoid the "shock doses" of steroids—if you are giving more than a few milliliters, it's probably too much.
- Concurrent use of nonsteroidal antiinflammatory drugs and steroids should still be avoided to minimize GI effects.

GIVING STEROIDS TO HEAD TRAUMA PATIENTS

Recently, the use of steroids in both human and veterinary head trauma has been widely debated. Although research in this topic is voluminous, there are no experimental or clinical studies demonstrating a *clear* benefit of steroids in head trauma. In one human study, a meta-analysis of randomized, controlled trials did not show a beneficial response from steroid therapy (1). Unfortunately, steroids have been associated with the following deleterious side effects: gastrointestinal (GI) bleeding, hyperglycemia, immunosuppression, delayed wound healing, and perpetuation of a catabolic state. Currently, the brain trauma foundation guidelines state that glucocorticoids are "not recommended for improving outcome or reducing intracranial pressure in head-injured patients" (2). The "CRASH" (Corticosteroid Randomisation After Significant Head injury) study demonstrated that overall mortality was statistically higher in patients who were treated with steroids (3).

Recent studies have shown that human patients with head trauma and hyperglycemia have a *poorer* return to cognitive function than do euglycemic patients. Why is hyperglycemia dangerous in head trauma, or in any case of brain ischemia? Unfortunately, elevated glucose concentrations provide a substrate for anaerobic metabolism and glycolysis in the brain, worsening brain perfusion via the accumulation of the by-product, lactic acid. Hyperglycemia is also associated with proconvulsant effects, which are due to increased neuronal excitability. In a veterinary study by Syring and coworkers, 52 dogs and 70 cats with head trauma were compared with 122 age- and species-matched control dogs and cats (4)**.** Severity of head trauma was classified

as mild, moderate, or severe, and blood glucose concentrations were recorded within 1 hour after admission (4). The study found that the blood glucose concentrations were significantly associated with *severity* of head trauma in dogs and cats and were significantly higher in dogs and cats with head trauma than in the control animals.[4] However, blood glucose concentration was not associated with outcome, which is divergent from human studies. This veterinary study may also differ from human medicine in that overall cognitive function varies between humans and dogs/cats. These studies reiterate that iatrogenic hyperglycemia must be avoided in patients with head trauma or cerebral ischemia and that severe hyperglycemia in head trauma should potentially be treated with regular insulin therapy if warranted and persistent. When in doubt, withhold steroid therapy in head trauma patients to prevent hyperglycemia and other detrimental effects. Instead, osmotic agents such as mannitol have been found to be helpful in decreasing intracranial pressure (ICP).

If IV fluid resuscitation alone does not reduce glucose levels in hyperglycemic patients with head trauma, a low dose of regular insulin (0.2 U/kg, intramuscular) may be given every 3 to 4 hours for the first few hours to help lower blood glucose. Blood glucose levels should be monitored frequently to ensure improvement and to preclude hypoglycemia, which would further complicate neurologic monitoring.

Therapies other than steroids to consider in head trauma patients include:
- Aggressive fluid resuscitation to help normalize or maintain blood pressure and maximize perfusion
- Oxygen therapy
- 15- to 30-degree head elevation (to lower ICP)
- Minimal jugular restraint or pressure (to prevent increased ICP)
- Tight glycemic control

Clinical application
- Consider using mannitol at 0.5 to 2 g/kg IV over 20 to 30 minutes as needed. This is particularly important if the patient develops "Cushings" reflex (e.g., bradycardia with concurrent hypertension), which is suggestive of severe cerebral edema and imminent herniation.
- Avoid steroids in head trauma until further veterinary studies determine the safety of this protocol. Instead, use supportive care to increase perfusion to brain tissue (e.g., IV fluids, oxygen) while decreasing ICP (e.g., mannitol, head elevation).

NOT STABILIZING A PATIENT MORE AGGRESSIVELY BEFORE SURGERY

Rivers and colleagues (5) found that early goal-directed therapy was imperative in the initial treatment and stabilization of severe sepsis and septic shock. With aggressive IV fluid therapy, blood transfusion, vasopressors, and normalization of perfusion parameters (e.g., UOP, base excess, lactate, central venous oxygen saturation, central venous pressure), mortality was reduced from 46% to 30% (5). Likewise, when we are presented with a patient in shock (e.g., hemoabdomen, septic peritonitis, uroabdomen),

it is imperative to aggressively stabilize the patient before anesthesia and surgery. By adequately perfusing the patient before anesthesia (e.g., with IV crystalloids, colloids, blood products), we are able to maximize cardiac output, improve heart rate, and increase overall mean arterial pressure and, indirectly, cellular perfusion. Inhalant agents, propofol, preanesthetic medications, and analgesics can result in bradycardia and hypotension; these agents also blunt the body's response to poor cardiac output and mask the underlying "shocky" state of the patient.

Clinical application
- Cure before you cut!

HAVING A NEGATIVE LAPAROTOMY

Nobody likes a negative laparotomy—not the veterinarian, the patient, or the pet owner. Aggressive diagnostics should be done to evaluate the necessity of surgery. The use of serial radiographs; advanced diagnostics (such as barium series, fluoroscopy, and abdominal ultrasonography); repeat physical examination; and venous blood gas evaluation are all necessary to prevent a negative exploratory procedure. Serial radiographs (e.g., 2 hours postinitial presentation) are often beneficial after aggressive IV fluid therapy has been initiated to evaluate changes in gas patterns. When performing a barium series, keep in mind that the no. 1 mistake is not using enough barium, resulting in poor imaging and interpretation. Delivery of barium through a stomach tube is an effective method to ensure adequate delivery of volume (barium dose: 3–6 ml/lb for a cat or dog).

Venous Blood Gas Analysis
Venous blood gas measurement is a helpful way to rule out a pyloric outflow obstruction. Metabolic alkalosis in veterinary medicine primarily has two differential diagnoses: pyloric outflow obstruction and loop diuretic administration, and it is primarily due to hypochloremia, either by gastric acid vomition or by use of a Na-K-2Cl loop diuretic and chloride loss through the kidney. Because chloride is an anion, it must be paired with a cation (Na^+) to maintain electroneutrality. When the body is depleted of chloride, sodium absorbs bicarbonate (HCO_3^-) instead to maintain electroneutrality, resulting in metabolic alkalosis. The absence of metabolic alkalosis does not exclude a foreign body obstruction further distal to the pylorus, but the presence of metabolic alkalosis should make the clinician highly suspicious of an upper GI outflow obstruction.

If in the event of a negative exploratory, it is imperative to obtain appropriate biopsies from relevant or diseased organs (e.g., liver, stomach, small intestine, pancreas) as deemed by medical necessity. In cases of acute pancreatitis, aggressive lavage of the abdominal cavity is beneficial to dilute activated pancreatic zymogens and to reduce the severity of inflammation. Lastly, feeding-tube placement (e.g., duodenal) may be beneficial at the time of surgery (particularly for pancreatitis cases), bypassing the stomach and allowing for enteral support.

Clinical application
- Advanced diagnostics (e.g., barium series, fluoroscopy, abdominal ultrasonography, venous blood gas analysis) should be considered to adequately evaluate and diagnose surgical emergencies.

NOT ASSESSING YOUR PATIENT MORE FREQUENTLY WITH SIMPLE TESTS
In veterinary medicine, the temperature, pulse rate, respiratory rate, and weight are typically evaluated during the initial presentation. These simple, inexpensive physical examination parameters are an important part of serial assessment and often provide clues on hydration status, disease process, and response to treatment.

Temperature
When examining a hyper- or hypothermic patient, differentiate between exogenous and endogenous sources. Hyperthermia is typically caused by an exogenous heat source (e.g., sun exposure, humidity, locked inside a car, upper airway obstruction resulting in lack of ability to thermoregulate). This is semantically different from fever, which is caused by an endogenous heat source (e.g., neoplasia, inflammatory cytokines). With hyperthermia, patients should be cooled by using cold water baths, cold IV fluids, fans, and relieving the upper airway obstruction. Patients should only be cooled to 103.5°F (39.7°C) to prevent severe rebound hypothermia. The use of "fever-breaking" medications (e.g., dipyrone) is not indicated, as resetting of the hypothalamus may have already occurred.

Patients with fever should not undergo cooling methods, as the fever is a physiologic response to an underlying pathology (e.g., viruses, bacteria). Three key differential diagnostics should be considered with fever:

- Infection
- Inflammation
- Neoplasia

For hypothermia, it is important to determine whether it is due to an exogenous source (e.g., living in a cold environment with inadequate shelter, hair coat, or underlying hypothyroidism) or an endogenous one. Hypothermic patients should be warmed passively (e.g., blankets, concurrent warm IV fluids) and *slowly*. With hypothermic patients, it is important not to rapidly warm patients via surface warming alone (e.g., BAIR hugger), particularly if they are hypotensive, as rewarming can result in peripheral vasodilation. During states of poor perfusion or hypotension, patients should physiologically vasoconstrict peripheral blood flow to direct blood to more important organs—the heart and lungs. Rapid surface rewarming of hypothermic patients without adequate IV fluid replacement can result in inappropriate shunting of blood.

Weight
Weight is often underutilized as a means of assessing hydration. Because we can calculate dehydration (kg weight X % dehydration), we can also estimate appropriate

weight gain, as 1 liter = 1 kg. Patients should be weighed daily while hospitalized, ideally on the same scale. This is important because it is an easy way to evaluate hydration and appropriate (or inappropriate) weight gain. For patients in which volume–fluid balance is tenuous (e.g., acute renal failure with anuria, congestive heart failure, volume overload), weight should be evaluated every 6 to 8 hours.

For example, if you determine that a 30 kg dog is 10% dehydrated, the amount of fluid required to hydrate him is:

Calculated dehydration: 30 kg X 0.1 (percent dehydration) X 1000 mls = 3000 ml = 3 L

In other words, a 30 kg dog needs 3L of IV crystalloids for rehydration alone and thus should weigh 33 kg after hydration (in 8–12 hours, depending on patient stability). If that same dog weighs 32 kg by the next day, he may still be inadequately hydrated. Likewise, if the patient weighs 34.8 kg the next day, he may be overhydrated, volume overloaded, and retaining water inappropriately (e.g., acute renal failure).

Pulse Quality
Assessing pulse quality frequently is imperative in unstable, shocky emergency patients. Palpating the femoral pulse enables assessment of pulse quality, which is the difference between the systolic and diastolic pressures. Pulse palpation, quality, and duration are a gross estimate of blood pressure and, indirectly, stroke volume. In a normal healthy animal, the pulses should be strong and synchronous, with a palpable pulse for each heart beat (therefore, make sure that you are simultaneously ausculting your patient and palpating for femoral pulses). A palpable femoral pulse is consistent with systolic blood pressure of at least 60 mm Hg. Poor femoral pulses typically indicate profound hypotension and should be treated aggressively and appropriately. A palpable dorsal metatarsal pulse is consistent with a systolic blood pressure of at least 90 mm Hg, and can be used as a basic "poor man's Dinamap," particularly during volume resuscitation.

Figure 1. Pulse pressure. Image courtesy of Klabunde RE, www.cvphysiology.com, 2010.

When palpating the femoral pulse of a patient, one can determine pulse quality based on the duration, width, and strength. A patient's pulse is normal if it has a normal waveform duration (Figure 2)). A thready pulse indicates a narrow waveform, whereas a weak pulse refers to a small-amplitude pulse-pressure difference (Figure 3). Either of these may be indicative of decreased stroke volume. Thready pulses are often associated with peripheral vasoconstriction and may indicate low diastolic pressure. Thready pulses are consistent with volume depletion. Bounding pulses have a large pulse-pressure difference and a wide waveform, usually associated with increased cardiac output and vasodilatation (Figure 4). However, bounding pulses may also result from a larger difference between systolic and diastolic blood pressures. This is classically seen in cases of chronic anemia (e.g., immune-mediated hemolytic anemia).

These patients adapt to the anemia and thus are able to maintain normal systolic function, but their blood vessels may be "empty"; hence, diastolic pressure is often low. This large net difference usually results in bounding pulses.

Figure 2. Normal pulse. Image courtesy of Klabunde RE, www.cvphysiology.com, 2010.

Figure 3. Weak pulse. Image courtesy of Klabunde RE, www.cvphysiology.com, 2010.

Figure 4. Bounding pulse. Image courtesy of Klabunde RE, www.cvphysiology.com, 2010.

Patients with systolic blood pressure < 90 mm Hg should be treated with IV fluids (if hypovolemic) and vasopressors (once adequately volume resuscitated) if evidence of shock (e.g., hypovolemic, septic, hyperdynamic, hemorrhagic) is present (provided cardiovascular shock has been ruled out as a differential). Patients with systolic blood pressure > 180 mm Hg (normal, 120 mm Hg) should be treated with antihypertensives, such as hydralazine, nitroprusside, amlodipine or enalapril, to minimize secondary complications from hypertension, such as detached retinas, cardiovascular and renal effects, and ischemic events. Frequent monitoring of blood pressure is imperative to ensure adequate care.

Serial physical examination is imperative to adequately evaluate a patient's hydration status—checking for return of skin turgor, appropriate weight gain, and moisture of mucous membranes. However, physical examination findings are subjective, and <5% dehydration is subjective and difficult to assess on physical examination. The concurrent use of evaluation of PCV/TS, blood glucose, blood urea nitrogen (BUN or AZO) weight, UOP, and urine specific gravity (USG), and thirst can be used in conjunction with physical examination findings to better assess hydration status.

Packed Cell Volume/Total Solids, Blood Glucose, and Blood, Urea, Nitrogen (BUN or AZO) ("The Big 4")
Patients on IV fluids should have a minimum database (including PCV/TS and blood glucose) measured daily, along with basic electrolytes to make sure Na^+ and K^+ are normal. Because patients often experience hemoconcentration when they are dehydrated (e.g., PCV/TS 55%/7.8 g/dl [78 g/L]), the goal of fluid therapy is to ensure that these numbers improve with appropriate therapy (consistent with hemodilution). Ideally, the PCV/TS in a normal, systemically healthy patient on IV fluids at sea level should be 35%/5.0 g/dl (50 g/L). In fact, oxygen delivery is maximal at such a "hemodilute" PCV/TS, as there is less viscosity of red blood cells and "sludginess." We

can still evaluate the PCV/TS in abnormal, metabolically inappropriate patients. Classically, a 10% to 12% dehydrated, cachectic, geriatric cat with chronic renal failure may present to you with a PCV/TS of 28%/11 g/dl (110 g/L). Once that patient is adequately hydrated, the PCV/TS may decrease to 20%/7 g/dl (70 g/L), unmasking the anemia from lack of erythropoietin.

Urine Specific Gravity (USG)
USG can be evaluated in patients on IV fluids to help assess hydration status. Ideally, USG should be measured before fluid administration to allow for evaluation of renal function. Dehydrated patients with concentrated urine demonstrate adequate renal function (cat > 1.040, dog > 1.025)—in other words, the kidneys are working and trying to absorb as much water from the urine as possible. Once started on IV fluids, normal, systemically healthy patients should have isosthenuric urine. Patients on IV fluids for > 6 to 12 hours should have adequate dilution of USG, and the ultimate goal of fluid therapy and adequate hydration should be USG of 1.015 to 1.018 on IV fluids. Patients on IV fluids with USG > 1.020 are still likely dehydrated and should be treated more aggressively with IV fluids if other parameters of dehydration persist (e.g., hemoconcentration). Hydration can be determined by assessing the color, volume, and USG of urine. A patient that is still dehydrated while hospitalized on IV fluids may have decreased UOP and dark-yellow urine (provided, for example, that no pigmentation, myoglobinuria, or bilirubinuria are present). This is a result of antidiuretic hormone release and renin-angiotensin stimulation, resulting in maximum absorption of free water and sodium.

Urine Output (UOP)
UOP should be monitored carefully, particularly in azotemic patients. Fluid therapy should be directed toward achieving normal UOP (i.e., 1–2 ml/kg/hour). Again, one can assess the hydration status of the patient by evaluating the volume and USG of urine. Excessive urination with dilute, clear urine may indicate copious or excessive IV fluid therapy, whereas hypersenthuria may suggest ongoing dehydration, and aggressive fluid resuscitation may be further warranted. If UOP is decreased (particularly in azotemic patients), fluid therapy and vasopressor support (to increase renal blood flow) should be initiated to prevent anuria (< 0.5 ml/kg/hour) or oliguria (< 1 ml/kg/hour). If UOP is decreasing and renal function is normal (based on creatinine, BUN, and pre–fluid therapy USG), the patient should be reassessed for hydration status, and fluid therapy adjusted as indicated. Classically, a cat with urethral obstruction may have a profound postobstructive diuresis. A sudden decrease in UOP should elicit assessment for reobstruction. If no obstruction is found, USG should be remeasured. If hypersenthuria is found (>1.025 on IV fluids), decreased UOP is likely due to continued dehydration from a postobstructive diuresis—the patient is attempting to absorb as much free water as possible from the kidneys, resulting in decreased UOP. In this example, the IV fluid rate should be increased.

- Normal UOP: 1–2 ml/kg/hour
- Oliguria: 0.5–1 ml/kg/hour
- Anuria: < 0.5 ml/kg/hour

Note that underlying diseases such as postobstructive diuresis (posturethral obstruction); diabetes mellitus (with secondary osmotic diuresis due to glucosuria); hyperthyroidism (increased glomerular filtration rate due to increased metabolic rate); and chronic renal failure (inability to adequately concentrate and absorb water) may result in dramatic water losses through the kidneys, and these patients may need a higher rate of fluids to compensate for ongoing losses. Likewise, these disease processes prevent us from differentiating renal versus prerenal disease on the basis of USG alone, as these patients have isosthenuria due to metabolic disease. Regardless, appropriate fluid therapy and urine monitoring (e.g., "measuring ins and outs") may be necessary, particularly in azotemic, oliguric renal failure.

A Water Bowl
Any hospitalized animal should always have access to fresh, clean water unless it is contraindicated due to vomiting, pancreatitis, fasting for anesthesia or sedation, or to maximize mannitol or furosemide effects (fasted for 20 minutes only). If a hospitalized patient on IV fluids continues to drink water in front of you, you should be concerned that the patient is still dehydrated. Due to the timidity of cats, they often will not drink water when stressed and hospitalized. If a dog or cat drinks in your presence, that patient is probably still dehydrated, and their thirst mechanism continues to be stimulated in an attempt to hydrate. Take that as a hint that your patient is trying to tell you to increase the fluid rate! Rare situations when hydration status cannot be based on the thirst mechanism include diabetes insipidus and psychogenic polydypsia.

NOT USING ENOUGH SQ FLUIDS
We often use SQ fluids in veterinary outpatient medicine to help hydrate a patient. Because fluids are so slowly absorbed when given in this manner, SQ administration is not appropriate for hypovolemic or severely dehydrated patients. SQ fluids are ideally utilized for outpatient medicine (e.g., the vomiting patient that needs to be fasted overnight but still needs to maintain hydration). But just how much fluid can you give SQ? The calculation for how many ml/kg to give SQ is typically *maintenance fluids*. We do not adjust for dehydration or ongoing losses with SQ fluids.

Example:
5-kg, male castrated cat presents for 4 episodes of vomiting
Physical examination: no string on oral examination, nonpainful abdomen
Amount of SQ fluids to potentially give: 5 kg x 60 ml/kg/day = 300 ml SQ

40 kg, female spayed Labrador presents for 3 vomiting episodes in 12 hours after ingesting garbage
Physical examination: nonpainful abdomen; abdominal radiographs: no significant findings, no obstruction, but some fluid-filled loops of intestine
Amount to give: 40 kg x 50 ml/kg/day = 2000 ml SQ

Giving too small of an amount of SQ fluids often does not benefit the patient. Having owners give < 50 ml/adult cat for SQ fluids is often not aggressive enough (not worth

the needle poke!). That said, if a patient has a heart murmur (particularly in cats), this maintenance amount should be *reduced* to prevent volume overload.

Clinical application
- If you're giving SQ fluids, take the time to calculate maintenance, so you know the exact amount to give.
- The most common error with SQ fluid administration in dogs is giving too little.
- Caution must be used in cats—even SQ fluid administration can result in volume overload.

NOT DOING ENOUGH FAST (FOCUSED ASSESSMENT WITH SONOGRAPHY FOR TRAUMA) ULTRASOUNDS

The focused assessment with sonography for trauma (FAST) ultrasound is a 2-minute procedure that detects the presence of fluid in the abdominal cavity to allow for rapid therapeutic intervention (e.g., fluid resuscitation, abdominocentesis, cytology, clinicopathologic testing) (6). This has also been modified for the pleural (T-FAST) and pericardial space. This rapid method of ultrasound is designed to be used by health care professionals with limited ultrasonographic training and is not designed for extensive examination of the abdomen. The added benefit of the FAST examination is the ability to detect very small amounts of fluid. Typically, 5 to 25 ml/kg of fluid needs to be present to be removed by blind abdominocentesis; > 10 to 20 ml/kg of fluid has to be present before it can be detected by fluid-wave assessment on physical examination; and approximately 8.8 ml/kg of fluid needs to be present before it can be detected radiographically. On the contrary, as little as 2 ml/kg of fluid can be detected on a FAST examination, allowing for rapid diagnosis and identification of underlying pathology.

The FAST examination typically involves assessment of 4 sites of the abdomen: caudal to the xiphoid, cranial to the bladder, and the right and left dependent flank (6). The presence of fluid at any of the sites is considered positive. Evaluation of the xiphoid region allows you to check for fluid between the liver and diaphragm and the liver lobes, as well as for pericardial or pleural effusion (6). Evaluation of the bladder view evaluates for fluid cranial to the bladder and for the presence of a bladder (6). The right dependent flank allows for fluid detection between the intestines and the body wall, whereas the left dependent flank view allows for identification of the spleen, abdominal effusion near the spleen and body wall, the kidney and spleen, and the liver and spleen (6).
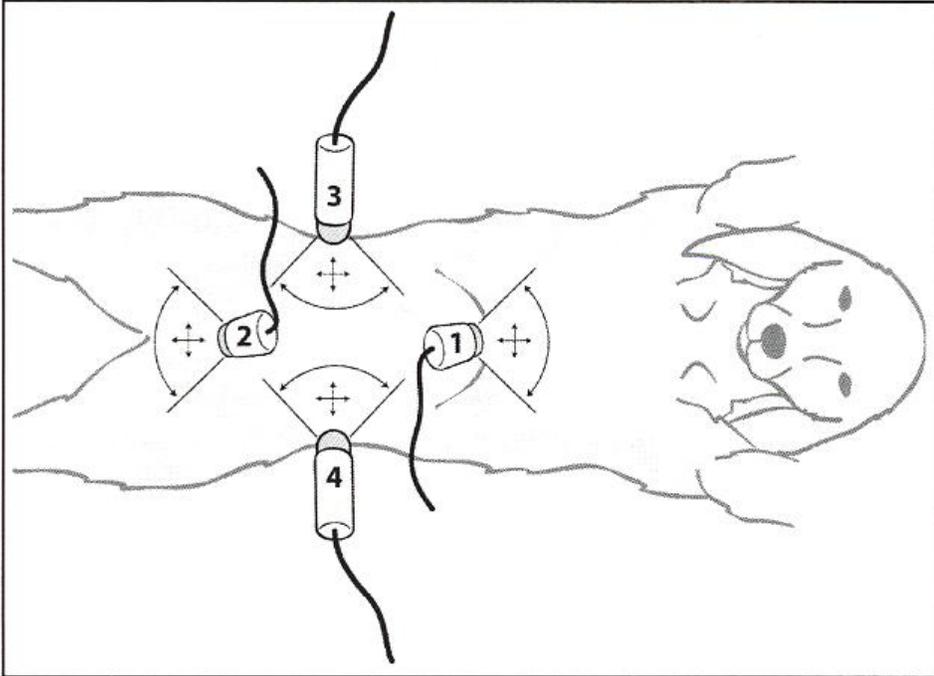
Figure 5. Illustration of the probe placements and movements used to obtain ultrasonographic views of the abdomen via FAST in a dog. Figure courtesy of Boysen SR from IVECCS proceedings 2006.

Clinical application
- The use of the FAST ultrasound is particularly beneficial for dyspneic cats and is less invasive and stressful than chest radiographs in diagnosing pleural effusion.
- The FAST examination allows for ultrasound-guided thoracocentesis or abdominocentesis, particularly when scant fluid is present.

RELUCTANCE TO PENETRATE BODY CAVITIES

The use of abdominocentesis or thoracocentesis is a benign procedure that is both diagnostic and therapeutic. Referring a stressed, hypoxemic, frantic, dyspneic cat with 300 ml of pleural effusion for a 1-hour car ride to a specialist can easily result in the cat's demise. Shaving and surgically preparing a wide area near the umbilicus (abdominocentesis) or thorax (thoracocentesis) should be done quickly but aseptically. For the thorax, thoracocentesis should be performed either dorsally (for air) or ventrally (for effusion) at the 7th to 9th intercostal space (ICS). Likewise, an imaginary line can be drawn from the end of the xiphoid to the lateral body wall, which is approximately the 8th ICS. This will allow for rapid identification of where to perform an emergency thoracocentesis. Pericardiocentesis should be performed on the right side at the region of the 3rd to 5th ICS at the point of the flexed elbow. Abominocentesis should be aseptically performed via a four-quadrant tap in the periumbilical region. The use of a 3-way stopcock, 20- to 60-ml syringe, extension tubing, and appropriately sized needles

dependent on patient size and volume of effusate (usually 20–22 gauge for cats and 16–22 gauge for dogs) is indicated.

Clinical application
- Having a sterile, preset thoracocentesis set up in the crash cart is beneficial for dyspneic patients who require life-saving care.

CONCLUSION

Veterinarians should avoid these key, common mistakes in emergency medicine. By avoiding these errors, the overall quality of care and survival of the emergency patient may improve. Simple, easy monitoring tools (e.g., Big 4, pulse quality, weight) can be used to more carefully monitor our critically ill patients in a cost-effective, simple, repeatable manner.

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