

Crash Carts: Preparation and Maintenance

Many different types of emergencies can present at veterinary practices at any time of day. Having a centrally located station for emergencies with a crash cart that is stocked and ready to use is essential for saving time, which is crucial in emergencies and should not be wasted by scrambling to gather supplies. A crash cart can be designed to fit the needs of any hospital and can help stabilize critically ill or injured patients.



FIGURE 1. A commercially available crash cart.

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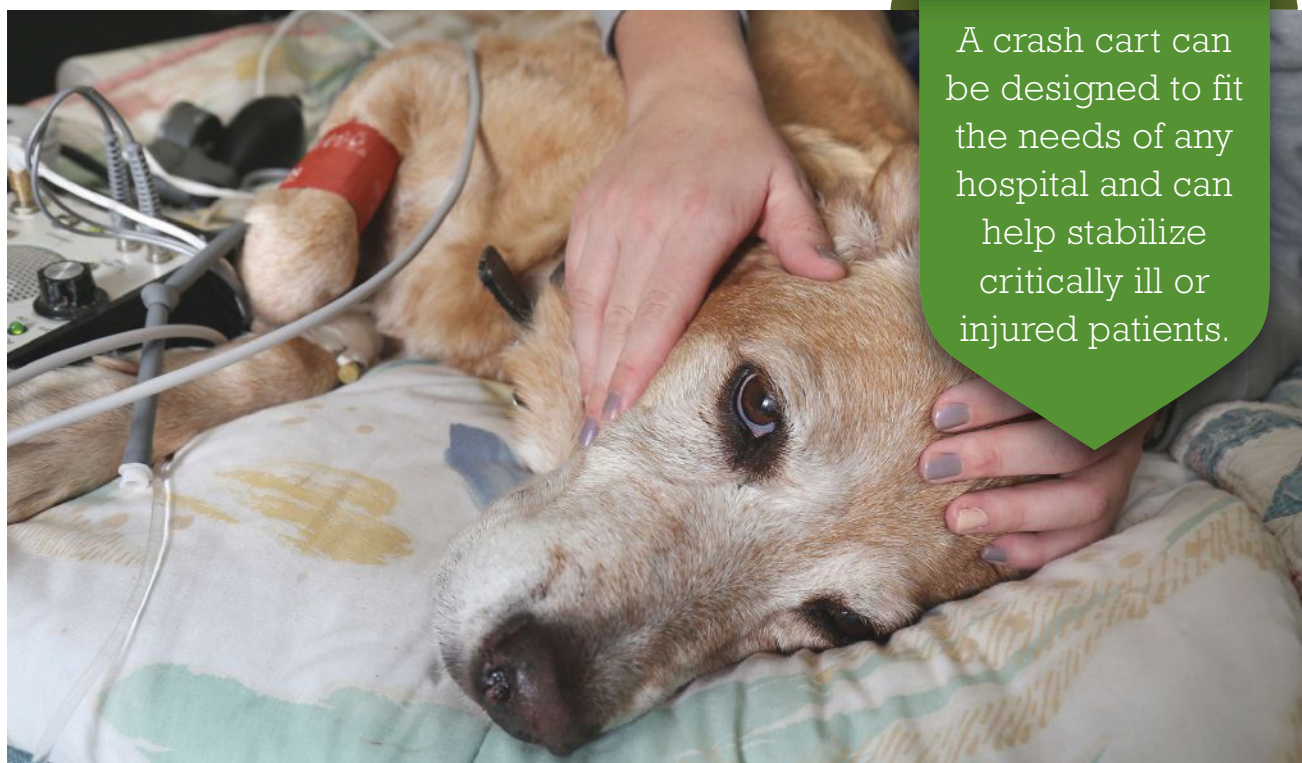
A crash cart can be as simple as a mobile, compact cart equipped with medical equipment and supplies for various emergencies. The size of the cart depends on the number and types of emergencies a hospital manages. Multiple-doctor, high-volume hospitals typically have larger, more complete crash carts than smaller, low-volume hospitals.



FIGURE 2. A toolbox that serves as a crash cart.



FIGURE 3. A look inside the toolbox.



Brian Walski/Colorado Visions

A crash cart can be designed to fit the needs of any hospital and can help stabilize critically ill or injured patients.

Crash carts are commercially available (**FIGURE 1**), but hospitals can prepare their own using a large or a small toolbox (**FIGURES 2 and 3**) or even a cabinet drawer.

The same equipment can be used for canine and feline emergencies, so the same crash cart can be used for both species. Lidocaine is the only emergency drug with different doses for feline and canine patients. The different doses are noted in **TABLE 1**, which is an example of an emergency drug chart.

A hospital's crash cart should be located in the central treatment area and in areas where patients are anesthetized. The station should be near oxygen and suction sources to increase cardiopulmonary resuscitation (CPR) success rates. Hospitals that have separate wards or treatment areas should consider maintaining multiple crash carts to cover all areas.

Studies have shown that environmental factors (e.g., location of the crash station); availability of up-to-date checklists, flow charts, and easy-to-follow aids; and maintenance of a well-stocked, organized cart can help improve the success rate of CPR. In human medicine, it has been proven that a pre-stocked station that includes the proper crash cart and CPR aids such as flow charts and algorithms improves the outcome of cardiopulmonary arrest.

Crash carts should include emergency medications, intravenous catheters and fluids, and a defibrillator. Carts should be fully stocked and in date at all times, and each

drawer should be labeled. All staff members should know what is in the cart and where to find each item. **BOX 1** lists common supplies in a crash cart.

BOX 1 Common Equipment and Supplies in a Crash Cart

- Laryngoscope
- Endotracheal tubes (various sizes)
- Syringes (various sizes)
- Needles (various sizes)
- Ambu bag
- Monitoring equipment (e.g., electrocardiograph, pulse oximeter, capnograph, oscillometric or Doppler blood pressure unit)
- Intravenous fluids
- Dextrose 50%
- Intravenous catheters and the supplies for placing them
- Emergency drug table
- Emergency drugs (e.g., epinephrine, atropine, naloxone, calcium gluconate, furosemide, vasopressin)

All personnel should know how to use all the equipment in a crash cart. Staff training can be essential in saving a patient's life. Scenario-based training should be conducted regularly to train new employees and refresh the skills of the established staff. Written emergency protocols and quick-reference guidelines on how to use the crash cart should be posted, and the team leader should ensure that all staff members understand them.

ORGANIZING A CRASH CART

Organizing a crash cart requires understanding of how a life-threatening emergency progresses. In human medicine, most crash carts have 5 to 9 drawers. In veterinary medicine, most crash carts can be organized into 5 drawers. An example system for organizing crash carts follows.

Top of the Cart

The top of the crash cart could include an electrocardiograph, a defibrillator, a capnograph, a pulse oximeter, Ambu bags

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of various sizes, and a blood pressure unit. A multiparameter unit can be used instead of individual monitors. Keep examination gloves on top of the cart or nearby. All patients arriving as emergencies should be handled with gloves. In trauma cases, patients may be covered in their own or the owner's blood or have undiagnosed infectious diseases. Bloodborne pathogens can be transmitted to staff members.

TABLE 1 Sample Emergency Drug Chart*

DRUG	DOSE	DOSE (in milliliters) PER BODY WEIGHT OF PATIENT													
		2.5 kg; 5 lb	5 kg; 10 lb	7.5 kg; 15 lb	9 kg; 20 lb	11 kg; 25 lb	14 kg; 30 lb	16 kg; 35 lb	18 kg; 40 lb	23 kg; 50 lb	27 kg; 60 lb	32 kg; 70 lb	36 kg; 80 lb	41 kg; 90 lb	45 kg; 100 lb
Epinephrine 1:1000 1 mg/mL Low dose	0.01 mg/kg; 0.005 mg/lb	0.02	0.05	0.07	0.09	0.11	0.14	0.16	0.18	0.23	0.27	0.32	0.36	0.41	0.45
Epinephrine 1:1000 1 mg/mL High dose	0.1 mg/kg; 0.05 mg/lb	0.25	0.5	0.75	0.9	1.1	1.4	1.6	1.8	2.3	2.7	3.2	3.6	4.1	4.5
Atropine 0.5 mg/mL	0.05 mg/kg; 0.02 mg/lb	0.25	0.5	0.75	0.9	1.1	1.4	1.6	1.8	2.3	2.7	3.2	3.6	4.1	4.5
Lidocaine (dogs) 20 mg/mL	2 mg/kg; 1 mg/lb	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Lidocaine (cats) 20 mg/mL	0.2 mg/kg; 0.1 mg/lb	0.02	0.05	0.07	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dexamethasone sodium phosphate 4 mg/mL	4 mg/kg; 2 mg/lb	2.5	5.0	7.5	9	11	14	16	18	23	27	32	36	41	45
Calcium gluconate 100 mg/mL	10 mg/kg; 5 mg/lb	0.25	0.5	0.75	0.9	1.1	1.4	1.6	1.8	2.3	2.7	3.2	3.6	4.1	4.5
Vasopressin 0.4 U/mL	0.8 U/kg; 0.4 U/lb	5	10	15	18	22	28	32	36	46	54	64	72	82	90
Defibrillator (external)	2 joules/kg; 1 joule/lb	5	10	15	20	25	30	35	40	50	60	70	80	90	100
Defibrillator (internal)	1 joule/kg; 0.5 joule/lb	2.5	5	7.5	9	11	14	16	18	23	27	32	36	41	45

*All doses are for intravenous and intraosseous administration in dogs and cats; separate lidocaine doses for dogs and cats are noted. For epinephrine and atropine, double the dose for intratracheal administration.

NA = not applicable. This chart appears courtesy of Dorothy Black, DVM, MPVM, DACVECC, who created it.

Top Drawer

The top drawer could contain intubation supplies, including endotracheal tubes (at least one of each size), laryngoscope handles, blades of various sizes, and umbilical tape or something else for tying endotracheal tubes in place.

Second Drawer

The second drawer could contain emergency drugs. Which drugs to include may be a matter of preference. Ideally, only drugs used in emergencies, such as those listed in **BOX 2**, should be included. All doctors in the hospital should agree on the drugs and doses to be used in an emergency. The drawer could also include a small supply of preassembled needles and syringes as well as a chart of drug doses per body weight. **TABLE 1** is an example of a drug chart; alternatively, a chart can be purchased from the Veterinary Emergency and Critical Care Society.

Third Drawer

The third drawer could contain intravenous catheters of various sizes and the supplies for placing them (e.g., T-ports, tape, surgical scrub, needles, syringes, scalpel blades). Every emergency patient requires placement of an intravenous catheter for administering medications and fluids, so it saves time to keep catheters centrally located in a crash cart.

Fourth Drawer

The fourth drawer could contain intravenous fluids and administration sets. One or two bags of each type of intravenous fluid stocked by the hospital could be kept in the crash cart; suggestions include sodium chloride 0.9%, Normosol-R (Hospira, Lake Forest, IL), lactated Ringer's solution, and hetastarch.

Fifth Drawer

The fifth drawer could contain miscellaneous items to help

treat cardiac arrest. All items could be organized in labeled bins to facilitate access. This drawer could also include anything that might be needed in an emergency. To decide what to include, each hospital should determine which types of emergencies it typically sees. Suggested supplies include suction catheters, internal and/or pediatric defibrillator paddles, conducting gel, intravenous pressure administration bags, chest tubes, and sterile thoracocentesis packs consisting of a butterfly catheter, a three-way stopcock, and a 60-mL syringe. Supplies for thoracocentesis can be sterilized and preassembled to save time in an emergency.

MAINTENANCE

Crash carts should be checked daily and monthly against checklists to ensure that they are fully stocked at all times. When an item from the cart is used, it should be replaced immediately after the emergency. A daily check would include ensuring that the cart has all the necessary supplies in the proper place and that all its electronic equipment is fully charged. A monthly check would include checking drug expiration dates as well as sterilization dates for endotracheal tubes if they are reused.

CONCLUSION

A crash cart can be very helpful in saving lives, but staff members must be properly trained to successfully use a crash cart. It is very important for a crash cart to contain the appropriate equipment and supplies and to be centrally located. Being prepared and organized can make a significant difference in an emergency. ■

BOX 2 Common Emergency Drugs to Include in a Crash Cart

- | | |
|---------------------|-------------------|
| → Aminophylline | → Dextrose 50% |
| → Atipamezole | → Diphenhydramine |
| → Atropine | → Epinephrine |
| → Calcium gluconate | → Naloxone |
| → Dexamethasone | → Vasopressin |

Suggested Reading

- Devey J. CPR: how to set up a ready area. *Proc Latin Am Vet Emerg Crit Care Soc* 2010. Available at ivis.org. Accessed November 2012.
- Fletcher D. Advances in CPR: guidelines & simulations for educational and clinical training. *Proc Int Vet Emerg Crit Care Soc* 2011.
- McMichael M, Herring J, Fletcher DJ, et al. RECOVER evidence and knowledge gap analysis on veterinary CPR. Part 2: Preparedness and prevention. *J Vet Emerg Crit Care* 2012;22 (Suppl 1):S13-S25.
- Quintana A. What's new in CPR? *Proc World Small Anim Vet Assoc* 2009. Available at ivis.org. Accessed November 2012.