



Dexmedetomidine and its Injectable Anesthetic-Pain Management Combinations

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OBJECTIVES OF THE PRESENTATION

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To provide detailed information regarding the use of dexmedetomidine as a premedication or as a total injectable anesthetic combination in healthy or diseased dogs and cats. This includes the use of dexmedetomidine as a sole agent and in combination with butorphanol, hydromorphone, buprenorphine, dissociatives (e.g., ketamine or Telazol [tiletamine-zolazepam]) and NSAIDs (e.g., carprofen)

GENERAL KEY POINTS

Building on the recent review (1) of the transition from medetomidine and its combinations to dexmedetomidine in dogs and cats, we continue to seek safe, effective and clinically appropriate ways of using dexmedetomidine in combination with other anesthetics, sedatives and analgesics for premedication, total intravenous or intramuscular anesthesia. Dexmedetomidine and its various combinations are versatile and effective for inducing sedation, reducing stress, and providing muscle relaxation and analgesia in healthy dogs and cats. In geriatric or diseased dogs and cats, dexmedetomidine and its combinations can provide more reliable sedation than many other drug combinations used for intravenous induction and subsequent maintenance with isoflurane or sevoflurane.

Short term immobilization in generally healthy and diseased dogs and cats is frequently a challenge. This presentation describes a versatile and streamlined way of using body surface area (BSA) to calculate appropriate doses for various dexmedetomidine combinations in dogs and cats.

KEY CLINICAL DIAGNOSTIC POINTS

The combination of medetomidine (Domitor) with butorphanol and ketamine in cats has been referred to as "kitty magic" or "triple combination" or "DKT". Following the transition from medetomidine to dexmedetomidine, this combination continues to be called "**kitty magic**". Similarly, the combination of dexmedetomidine with butorphanol and ketamine in dogs has been named "**doggie magic**". In order to provide greater flexibility and versatility to the kitty and doggie magic combinations so as to enable their use in a variety of patients (healthy patients, ill or depressed) for total injectable anesthesia, short term immobilization to facilitate diagnostic procedures, and as premedication I have added different opioids (hydromorphone, morphine or buprenorphine) and used a wide different range of dexmedetomidine doses (62.5, 125, 250, 375 and 500 mcg/m²).

KEY THERAPEUTIC POINTS

The three drug classes (alpha-2 antagonist, dissociative and opioid) that make up the kitty and doggie magic combinations all have specific functions. The dexmedetomidine (alpha-2 antagonist) induces sedation, muscle relaxation and both somatic and viscera analgesia. Ketamine (dissociative) is an immobilizing agent that enhances anesthesia, provides somatic analgesia, and counteracts the dexmedetomidine-induced bradycardia. Opioids included in the combination (e.g., butorphanol, buprenorphine, morphine, hydromorphone) provide additional analgesia as well facilitate the sedative properties of dexmedetomidine and ketamine. These three drug classes (alpha-2, dissociatives and opioids) work synergistically allowing for smaller doses of each individual drug to be used in combination

when compared to the use of each drug on its own.

OVERVIEW OF THE ISSUE

The following dosage tables reflect a dexmedetomidine dose based on BSA (as per the package insert). Dexmedetomidine 125 mcg/m² IM/IV for mild sedation, 375 mcg/m² IM/IV for moderate sedation and 500 mcg/m² for profound sedation. Two additional BSA doses are provided for convenience (62.5 mcg/m² and 250mcg/m²) and are discussed below. Dexmedetomidine can be used alone or in combination with an opioid, ketamine or an opioid and ketamine. Dexmedetomidine is formulated as a 0.5mg/mL solution, ketamine (100 mg/mL) and the opioids as follows: (butorphanol 10 mg/mL, hydromorphone 2 mg/mL, morphine 15 mg/mL, or buprenorphine 0.3 mg/mL).

The 62.5 mcg/m² dexmedetomidine dose table is intended for use in geriatric dogs and dogs with renal, liver or kidney dysfunctions as a premedication prior to propofol or face mask induction with inhalant, followed by maintenance on isoflurane and sevoflurane. The dexmedetomidine/dexmedetomidine-opioid combination can be given either IM or IV. At Purdue University, this dosage table is frequently used in patients requiring sedation for daily radiation therapy and in geriatric patients requiring sedation for other diagnostic procedures (e.g., ultrasound).

The 125 mcg/m² dose table is used for slightly heavier sedation of ASA class II and III dogs requiring sedation for radiographic procedures.

The "doggie magic" combination (dexmedetomidine/butorphanol/ketamine) can be used IM or IV for sedation-premedication of geriatric or sick animals.

The 250 mcg/m² dose table is used for dogs undergoing minor surgery, Penn hip or other OFA types of radiographic procedures which require significant muscle relaxation. It can also be used for moderately painful procedures such as wound debridement or bandage changes etc.

The 375 mcg/m² dose table is used to induce a surgical plane of anesthesia for OHE, castration or other abdominal surgery. This dose provides rapid immobilization, producing lateral recumbency in 5-8 minutes. Dogs can be intubated and maintained on oxygen. If anesthesia requires for extension then a low doses of isoflurane (0.5%) or sevoflurane (1%) may be supplemented.

The 500 mcg/m² dose table is rarely required but has proved useful for immobilizing extremely fractious and wolf-hybrid dogs for surgery.

Atipamezole (Antisedan), administered IM at the same volume as the dexmedetomidine, can be used for reversal in dogs. If ketamine is included in the protocol, the dexmedetomidine should not be reversed earlier than 30 minutes after administration of the ketamine to minimize the likelihood of a dissociative recovery.

ADDITIONAL DETAIL

These dosage charts are flexible in that the dexmedetomidine dose can be combined with ketamine, an opioid, or with an opioid and ketamine. The dexmedetomidine BSA dose ranges are from 62.5 up to 500 mcg/m² as discussed above.

Case Example of Using the Chart in Table 1-3

Dogs weighing 2-3 kg for castration/OHE should receive 0.12 mL of Dexdomitor, 0.12 mL of an opioid (your choice of butorphanol, hydromorphone, morphine or buprenorphine), and 0.12 mL of ketamine from the chart listed in Table 1 (375 mcg/m², IV) or Table 2, (375 mcg/m², IM).

So if we calculate this 0.12 mL with each drug dose rate for 2-3 kg dogs:

- Dexmedetomidine 28.1 mcg/kg (dosed at 375 mcg/m² either IV or IM route).

Opioids (Select ONE)

- Butorphanol 0.6-0.4 mg/kg,
- Hydromorphone is 0.12-0.08 mg/kg,
- Morphine is 0.9-0.6 mg/kg,
- Buprenorphine is 18-12 mcg/kg

Ketamine is 6-4 mg/kg.

The heavier the dog, the smaller the mg/kg dose of each drug.

- Dogs weighing 15-20 kg should receive 0.51 mL of Dexdomitor, 0.51 mL of an opioid of your choice, 0.51 mL of ketamine.

So if we calculate this 0.51 mL with each drug dose rate for 15-20 kg dogs:

- Dexmedetomidine 14.6 mcg/kg (dosed at 375 mcg/m² either IV or IM route).

Opioids (Select ONE)

- Butorphanol 0.34-0.25 mg/kg,
- Hydromorphone is 0.07-0.05 mg/kg,
- Morphine is 0.51-0.38 mg/kg,
- Buprenorphine is 10.2-7.65 mcg/kg

Ketamine is 3.4-2.5 mg/kg.

For the "kitty magic" table, mild doses are useful for sedation or as premedication prior to face mask or propofol induction. Moderate doses are used for castration or minor surgical procedures, and profound doses are used for invasive surgical procedure including OHE and declaws. Cats can be reversed immediately after completion surgical procedure. Using identical dexmedetomidine volume of atipamezole for reversal of the kitty magic combination.

Case Example of Using the Chart in Table 4

Cats weighing 2-3 kg for OHE should receive 0.15 mL of Dexdomitor, 0.15 mL of an opioid (your choice of butorphanol, hydromorphone, morphine or buprenorphine), and 0.15 mL of ketamine from the chart listed in Table 4 (Surgery).

So if we calculate this 0.15 mL with each drug dose rate for 2-3 kg cats:

- Dexmedetomidine 37.5-25 mcg/kg (for 2-3 kg animals).

Opioids (Select ONE)

- Butorphanol 0.6-0.4 mg/kg,
- Hydromorphone 0.15-0.1 mg/kg,
- Morphine is 1.12-0.75 mg/kg,
- Buprenorphine is 22.5-15 mcg/kg

Ketamine is 7.5-5 mg/kg.

The details of how to use these doggie and kitty magic protocols will be covered during the presentation.

KEY DRUGS, DOSAGES AND INDICATIONS

Table 1. Dexdomitor-opioid-sedation/analgesia in dogs.

Dog weight		Profound sedation		Invasive procedures	
		Dexdomitor 375 mcg/m ² IV		Dexdomitor 500 mcg/m ² IM	
lbs	kg	mcg/kg	Dexdomitor ml	mcg/kg	Dexdomitor ml
4-7	2-3	28.1	0.12	40.0	0.15
7-9	3-4	25.0	0.15	35.0	0.20
9-11	4-5	23.0	0.20	30.0	0.30
11-22	5-10	19.6	0.29	25.0	0.40
22-29	10-13	16.8	0.38	23.0	0.50
29-33	13-15	15.7	0.44	21.0	0.60
33-44	15-20	14.6	0.51	20.0	0.70
44-55	20-25	13.4	0.60	18.0	0.80
55-66	25-30	12.6	0.69	17.0	0.90
66-73	30-33	12.0	0.75	16.0	1.00
73-81	33-37	11.6	0.81	15.0	1.10
81-99	37-45	11.0	0.90	14.5	1.20
99-110	45-50	10.5	0.99	14.0	1.30
110-121	50-55	10.1	1.06	13.5	1.40
121-132	55-60	9.8	1.13	13.0	1.50
132-143	60-65	9.5	1.19	12.8	1.60

143-154	65-70	9.3	1.26	12.5	1.70
154-176	70-80	9.0	1.35	12.3	1.80
>176	>80	8.7	1.42	12.0	1.90

Table 2. Dexdomitor-opioid-sedation/analgesia in dogs.

Dog weight		Moderate Sedation		Profound sedation	
		Dexdomitor ~250 mcg/m ² IM		Dexdomitor 375 mcg/m ² IM	
Lbs	kg	mcg/kg	Dexdomitor ml	mcg/kg	Dexdomitor ml
4-7	2-3	20	0.08	28.1	0.12
7-9	3-4	16.6	0.10	25.0	0.15
9-11	4-5	15.5	0.14	23.0	0.20
11-22	5-10	13.3	0.20	19.6	0.29
22-29	10-13	10.8	0.26	16.8	0.38
29-33	13-15	10.7	0.30	15.7	0.44
33-44	15-20	9.7	0.34	14.6	0.51
44-55	20-25	8.9	0.40	13.4	0.60
55-66	25-30	8.4	0.46	12.6	0.69
66-73	30-33	7.9	0.50	12.0	0.75
73-81	33-37	7.7	0.54	11.6	0.81
81-99	36-45	7.5	0.60	11.0	0.90
99-110	45-50	6.9	0.66	10.5	0.99
110-121	50-55	6.6	0.70	10.1	1.06
121-132	55-60	6.6	0.76	9.8	1.13

132-143	60-65	6.4	0.80	9.5	1.19
143-154	65-70	6.2	0.84	9.3	1.26
154-176	70-80	6.0	0.90	9.0	1.35
>176	>80	5.8	0.94	8.7	1.42

Table 3. Dexdomitor-opioid-sedation/analgesia in dogs.

Dog weight		Light sedation		Mild sedation	
		Dexdomitor ~62.5 mcg/m ² IM		Dexdomitor ~125 mcg/m ² IM	
Lbs	Kg	mcg/kg	Dexdomitor ml	mcg/kg	Dexdomitor ml
4-7	2-3	4.7	0.02	9.4	0.04
7-9	3-4	4.15	0.025	8.3	0.05
9-11	4-5	3.85	0.035	7.7	0.07
11-22	5-10	3.25	0.05	6.5	0.10
22-29	10-13	2.8	0.065	5.6	0.13
29-33	13-15	2.6	0.075	5.2	0.15
33-44	15-20	2.45	0.085	4.9	0.17
44-55	20-25	2.25	0.10	4.5	0.20
55-66	25-30	2.1	0.115	4.2	0.23
66-73	30-33	2.0	0.125	4.0	0.25
73-81	33-37	1.95	0.135	3.9	0.27
81-99	37-45	1.5	0.15	3.7	0.30
99-110	45-50	1.75	0.165	3.5	0.33
110-121	50-55	1.7	0.175	3.4	0.35

121-132	55-60	1.65	0.19	3.3	0.38
132-143	60-65	1.45	0.20	3.2	0.40
143-154	65-70	1.41	0.21	3.1	0.42
154-176	70-80	1.5	0.225	3.0	0.45
>176	>80	1.31	0.235	2.9	0.47

Table 4. Dexdomitor-opioid-ketamine sedation/analgesia in cats.

Cat Weight		Volume of Dexdomitor Butorphanol- Ketamine		IM route
Lbs	Kg	Mild	Moderate	Profound /Surgery
4-7	2-3	0.025 mL	0.05 mL	0.1-0.15 mL
7-9	3-4	0.05 mL	0.1 mL	0.2-0.25 mL
9-13	4-6	0.1 mL	0.2 mL	0.3-0.35 mL
13-15	6-7	0.2 mL	0.3 mL	0.4-0.45 mL
15-18	7-8	0.3 mL	0.4 mL	0.5-0.55 mL
18-22	8-10	0.4 mL	0.5 mL	0.6-0.65 mL

References

1. Ko JC, Knesl O, Weil AB, *et al.* Frequently asked questions: analgesia, sedation and anesthesia-making the switch from medetomidine to Dexmedetomidine. *Compend Continue Educ Vet* 2009; 31 (suppl 1A):1-24.

SPEAKER INFORMATION

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