Reproductive/Nursing Safety

Meclizine is considered teratogenic at high dosages in laboratory animals and cleft palates have been noted in rats at 25–50 times higher than labeled dosages. However, in humans, it has been suggested that meclizine possesses the lowest risk for teratogenicity for antiemetic drugs and that it is the drug of first choice to treat nausea/vomiting associated with pregnancy. In humans, the FDA categorizes this drug as category ***B*** for use during pregnancy (*Animal studies have not yet demonstrated risk to the fetus, but there are no adequate studies in pregnant women; or animal studies have shown an adverse effect, but adequate studies in pregnant women have not demonstrated a risk to the fetus in the first trimester of pregnancy, and there is no evidence of risk in later trimesters.*)

It is unknown if meclizine enters milk; its anticholinergic activity may, potentially, inhibit lactation.

Overdosage/Acute Toxicity

Moderate overdosage may result in drowsiness alternating with hyperexcitability. Massive overdosages may result in profound CNS depression, hallucinations, seizures and other anticholinergic effects (tachycardia, urinary retention, etc.). Treatment is considered symptomatic and supportive. Consider gut emptying when patients present soon after ingestion. Avoid respiratory depressant medications.

Drug Interactions

The following drug interactions have either been reported or are theoretical in humans or animals receiving meclizine and may be of significance in veterinary patients:

- **CNS DEPRESSANTS:** Use with other CNS depressants may cause additive sedation
- **ANTICHOLINERGIC DRUGS:** Other anticholinergic drugs may cause additive anticholinergic effects

Laboratory Considerations

- Because these drugs are antihistamines, they may affect the results of **skin tests** using allergen extracts. Do not use within 3–7 days before testing.

Doses

- **DOGS:**
  a) For supportive treatment of peripheral vestibular disease: 25 mg per dog PO once daily. Treatment is usually unnecessary after 72–96 hours. (Hoskins 2005c)
  b) 25 mg per dog PO once daily. For motion sickness, give one hour before traveling (Papich 1992)
  c) As an antihistamine: 25 mg PO once daily (Bevier 1990)
  d) As anti-emetic: 4 mg/kg PO once a day (Dowling 2003a)
  e) For palliative treatment of vertigo: 25 mg per dog PO once daily. (Schubert 2007)
- **CATS:**
  a) 12.5 mg per cat PO once daily (Pearce 2006a)
  b) 6.25 mg/5 kg of body weight PO (Day 1993)
  c) As anti-emetic: 4 mg/kg PO once a day (Dowling 2003a)
  d) For palliative treatment of vertigo: 12.5 mg per cat PO once daily. (Schubert 2007)
- **RABBITS, RODENTS, SMALL MAMMALS:**
  a) Rabbits: For Rolling, torticollis, motion sickness: 2–12 mg/kg PO once daily (Ivey and Morrisey 2000)
  b) Rabbits: For adjunctive treatment of torticollis, head tilt ("wry neck"): 12.5 mg (total dose) PO q12–24h. (Johnson 2006e)

Monitoring

- Efficacy
- Adverse effects

Client Information

- When using for motion sickness prevention, instruct client to give medication 30–60 minutes before travel.

Chemistry/Synonyms

Meclizine HCl is a piperazine derivative antiemetic antihistamine.

Meclizine may also be known as: meclozine hydrochloride, meclizine hydrochloride; meclizinium chloride; meclozini hydrochloridum; parachloramine hydrochloride, *Agyrax®*, *Ancolan®*, *Antivert®*, *Antrizine®*, *Bonamine®*, *Bonine®*, *Calmonal®*, *Chiclida®*, *D-Vert 30®*, *Dizmiss®*, *Dramamine II®*, *Dramine®*, *Duremesan®*, *Emetostop®*, *Marevit®*, *Meni-D®*, *Navicalm®*, *Neo-Istafene®*, *Nico-Vert®*, *Peremesin®*, *Peremesin N®*, *Peremesine®*, *Postadoxin N®*, *Postafen®*, *Postafene®*, *Ru-Vert-M®*, *Sea-Legs®*, *Suprimal®*, *Vergon®*, and *Vertin®*.

Storage/Stability/Compatibility

Meclizine products should be stored at room temperature in well-closed containers.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS: None

The ARCI (Racing Commissioners International) has designated this drug as a class 4 substance. See the appendix for more information.

HUMAN-LABELED PRODUCTS:

Meclizine HCl Tablets: 12.5 mg, 25 mg (plain and chewable), 50 mg; *Antivert®* (Pfizer); (Rx); *Antrizine®* (Major); (Rx); *Antivert/25®* (Pfizer US); (Rx); *Dramamine® Less Drowsy Formula* (Pfizer); (OTC); *Bonine®* (Pfizer Consumer); (OTC); *Antivert/50®* (Pfizer); (Rx); generic; (Rx and OTC).

Meclizine Oral Caps: 25 mg; *Meni-D®* (Seatrace); (Rx)

MEDETOMIDINE HCL

(mee-de-*toe*-mi-deen) Domitor®

ALPHA-2 ADRENERGIC AGONIST

Prescriber Highlights

- **Alpha2-adrenergic sedative analgesic used primarily in dogs & cats, but also may be useful in small mammals, exotics, etc.**
- **Contraindications: Cardiac disease, respiratory disorders, liver or kidney diseases, shock, severe debilitation, or animals stressed due to heat, cold or fatigue. Caution in very old or young animals**
- **NOT recommended for use during pregnancy**
- **Adverse Effects: Bradycardia, occasional AV blocks, decreased respiration, hypothermia, urination, vomiting, hyperglycemia, & pain on injection (IM). Rarely: prolonged sedation, paradoxical excitation, hypersensitivity, apnea & death from circulatory failure**
- **Drug interactions**

Uses/Indications

Medetomidine is labeled for use as a sedative and analgesic in dogs over 12 weeks of age to facilitate clinical examinations and procedures, minor surgical procedures not requiring muscle relaxation, and minor dental procedures not requiring intubation. The manufacturer recommends the IV route of administration for dental procedures.

Medetomidine has also been used in cats, primarily in Europe. But there is apparently much less data available to evaluate its use; caution is advised.

Pharmacology/Actions

An alpha adrenergic receptor, medetomidine has an alpha$_2$:alpha$_1$ selectivity factor of 1620, and when compared to xylazine is reportedly 10X more specific for alpha$_2$ receptors versus alpha$_1$ receptors. The pharmacologic effects of medetomidine include: depression of CNS (sedation, anxiolysis), GI (decreased secretions, varying affects on intestinal muscle tone) and endocrine functions, peripheral and cardiac vasoconstriction, bradycardia, respiratory depression, diuresis, hypothermia, analgesia (somatic and visceral), muscle relaxation (but not enough for intubation), and blanched or cyanotic mucous membranes. Effects on blood pressure are variable, but medetomidine can cause hypertension longer than does xylazine. Medetomidine also induces sedation for a longer period than does xylazine.

Pharmacokinetics

After IV or IM injection, onset of effect is rapid (5 min. for IV; 10–15 min. for IM). After SC injection, responses are unreliable and this method of administration cannot be recommended. The drug is absorbed via the oral mucosa when administered sublingually in dogs, but efficacy at a given dose may be less than IM dosing.

Contraindications/Precautions/Warnings

The label states that medetomidine is contraindicated in dogs having the following conditions: cardiac disease, respiratory disorders, liver or kidney diseases, shock, severe debilitation, or dogs stressed due to heat, cold, or fatigue.

Dogs that are extremely agitated or excited may have a decreased response to medetomidine; the manufacturer suggests allowing these dogs to rest quietly before administration of the drug. Dogs not responding to medetomidine should not be re-dosed. Use in very young or older dogs should be done with caution.

Adverse Effects

The adverse effects reported with medetomidine are essentially extensions of its pharmacologic effects including bradycardia, occasional AV blocks, decreased respiration, hypothermia, urination, vomiting, hyperglycemia, and pain on injection (IM). Rare effects have also been reported, including prolonged sedation, paradoxical excitation, hypersensitivity, apnea, and death from circulatory failure.

Reproductive/Nursing Safety

The drug is not recommended for use in pregnant dogs or those used for breeding purposes because safety data for use during pregnancy is insufficient; therefore, use only when the benefits clearly outweigh the drug's risks.

Overdosage/Acute Toxicity

Single doses of up to 5X (IV) and 10X (IM) were tolerated in dogs, but adverse effects can occur (see above). Death has occurred rarely in dogs (1 in 40,000) receiving 2X doses.

Because of the potential of additional adverse effects occurring (heart block, PVC's, or tachycardia), treatment of medetomidine-induced bradycardia with anticholinergic agents (atropine or glycopyrrolate) is usually not recommended. Atipamezole is probably a safer choice to treat any medetomidine-induced effect.

Drug Interactions

The following drug interactions have either been reported or are theoretical in humans or animals receiving medetomidine and may be of significance in veterinary patients:

Note: Before attempting combination therapy with medetomidine, it is strongly advised to access references from veterinary anesthesiologists familiar with the use of this product.

- **ATROPINE, GLYCOPYRROLATE:** The use of atropine or glycopyrrolate to prevent or treat medetomidine-caused bradycardia is controversial as tachycardia and hypertension may result. This is more important when using higher doses of medetomidine (>20 mcg/kg) and concomitant use is discouraged.
- **OPIATES:** Enhancement of sedation and analgesia may occur when medetomidine is used concurrently with fentanyl, butorphanol, or meperidine, but adverse effects may be pronounced as well. Reduced dosages and monitoring is advised if contemplating combination therapy.
- **PROPOFOL:** When propofol is used after medetomidine, hypoxemia may occur. Dosage adjustments may be required along with adequate monitoring.
- **YOHIMBINE:** May reverse the effects of medetomidine; but atipamezole is preferred for clinical use to reverse the drug's effects

Laboratory Considerations

- Medetomidine can inhibit ADP-induced **platelet aggregation** in cats.

Doses

- **DOGS:**

For sedation/analgesia:

a) 750 mcg (0.75 mg)/m2 body surface area IV or 1000 mcg (1 mg)/m2 body surface area IM. Allow to rest quietly for 15 minutes after injection. Practically, the following dosing table may used:

IV DOSING WEIGHT IN LBS.	INJECTION VOLUME IN ML	IM DOSING WEIGHT IN LBS.
3–4	0.1	-
5–7	0.15	4–5
8–11	0.2	6–7
12–15	0.25	8–9
16–21	0.3	10–14
22–31	0.4	51–20
32–43	0.5	21–27
44–55	0.6	28–35
56–68	0.7	36–44
69–82	0.8	45–53
83–97	0.9	54–63
98–121	1	64–78
122–156	1.2	79–101
157–194	1.4	102–126
195+	1.6	127–165
-	2	166+

(Package Insert; *Domitor*®—Pfizer)

b) 10–40 mcg/kg IM; higher doses do not cause greater sedation, but increase the duration of effect (McGrath and Ko 1997)
c) For use with an IM opioid: 5–10 mcg/kg (Hardie 2000)
d) 0.001–0.01 mg/kg (1–10 mcg/kg) IV, IM or SC (Carroll 1999)

■ **CATS:**

For sedation/analgesia:
a) 40–80 mcg/kg IM; higher doses do not cause greater sedation, but increase the duration of effect (McGrath and Ko 1997)
b) For use with an IM opioid: 5–10 mcg/kg (Hardie 2000)
c) 0.001–0.01 mg/kg (1–10 mcg/kg) IV, IM or SC (Carroll 1999)
d) For large, exotic cat (tigers, etc.) immobilization: Midazolam (0.1 mg/kg) plus medetomidine (0.05–0.07 mg/kg) IM followed by ketamine (4–10 mg/kg) IM, if needed. May antagonize with atipamezole (0.25–0.35 mg/kg) IV, SC. (Curro 2002)

■ **SMALL MAMMALS/RODENTS:**

For chemical restraint:
a) Rats: 0.25–0.5 mg/kg IM;
Guinea pig: 0.5 mg/kg IM;
Rabbits: 0.25–0.5 mg/kg IM (Burke 1999)

■ **FERRETS:**

As a sedative/analgesic:
a) 15 minutes prior to medetomidine, give atropine (0.05 mg/kg or glycopyrrolate (0.01 mg/kg) then give medetomidine at 60–80 mcg/kg IM or SC. Sedation lasts for up to 3 hours. May be reversed with atipamezole (400 mcg/kg IM);
For injectable anesthesia: Butorphanol 0.1 mg/kg, Ketamine 5 mg/kg, Medetomidine 80 mcg/kg. Combine in one syringe and give IM. May need to supplement with isoflurane (0.5–1.5%) for abdominal surgery. (Finkler 1999)

■ **BIRDS:**

For sedation/analgesia:
a) 0.1 mg/kg IM; limited data available on duration of effect, adverse effects, etc. (Clyde and Paul-Murphy 2000)

■ **REPTILES:**

a) Medium to small land Tortoises: Medetomidine 100–150 mcg/kg with ketamine 5–10 mg/kg IV or IM;
Freshwater Turtles: Medetomidine 150–300 mcg/kg with ketamine 10–20 mg/kg IV or IM;
Giant Land Tortoises: 200 kg Aldabra tortoise: Medetomidine 40 mcg/kg with ketamine 4 mg/kg IV or IM;
Smaller Aldabra tortoises: Medetomidine 40–80 mcg/kg with ketamine 4–8 mg/kg IV or IM. Wait 30–40 minutes for peak effect.
Iguanas: Medetomidine 100–150 mcg/kg with ketamine 5–10 mg/kg IV or IM;
Reversal of all dosages with atipamezole is 4–5 times the medetomidine dose. (Heard 1999)

Monitoring

■ Level of sedation and analgesia; heart rate; body temperature
■ Heart rhythm, blood pressure, respiration rate, and pulse oximetry should be considered, particularly in higher risk patients if the drug is to be used

Client Information

■ This drug should be administered and monitored by veterinary professionals only
■ Clients should be made aware of the potential adverse effects associated with its use, particularly in dogs at risk (older, preexisting conditions)

Chemistry/Synonyms

An alpha2-adrenergic agonist, medetomidine occurs as a white or almost white crystalline substance. It is soluble in water. While the compound exists as two stereoisomers, only the D-isomer is active.

Medetomidine HCl may also be known as MPV-785 and *Domitor®*.

Storage/Stability/Compatibility

The commercially available injection should be stored at room temperature (15–30°C) and protected from freezing.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

Medetomidine HCl for Injection: 1 mg/mL in 10 mL multidose vials; *Domitor®* (Pfizer); (Rx). Approved for use in dogs over 12 weeks of age.

The ARCI (Racing Commissioners International) has designated this drug as a class 3 substance. See the appendix for more information.

HUMAN-LABELED PRODUCTS: None

MEDIUM CHAIN TRIGLYCERIDES (MCT OIL)

NUTRITIONAL

Prescriber Highlights

- **Lipid used to provide calories & fatty acids to animals with restricted fat intake due to chronic infiltrative disease of small intestine or fat malabsorption syndromes present**
- **Cautions: Significant hepatic disease (*e.g.*, portacaval shunts, cirrhosis, etc.)**
- **Adverse Effects: Unpalatability, bloating, flatulence, & diarrhea**
- **Unpalatable if given alone, mix with food**

Uses/Indications

MCT oil is sometimes used to offset the caloric reduction when long-chain triglycerides found in dietary fat are restricted, usually in chronic infiltrative diseases of the small intestine or when there is fat malabsorption of any cause. Because of expense and unpalatability, many clinicians are bypassing MCT oil and having their clients prepare homemade, highly digestible, ultra-low fat diets (*e.g.*, white turkey meat plus rice/potato) or using very low fat prescription diets.

Pharmacology/Actions

Medium chain triglycerides (MCT) are more readily hydrolyzed than conventional food fat. They also require less bile acids for digestion, are not dependent for chylomicron formation or lymphatic transport, and are transported by the portal vein. Medium chain triglycerides are not a source for essential fatty acids.