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Usefulness of an injectable anaesthetic protocol for semen collection through urethral catheterisation in domestic cats

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Abstract

Objectives Although less often requested in comparison with dogs, the collection of semen in cats can be necessary for artificial insemination, for semen evaluation in tom cats used for breeding and for semen storage. Urethral catheterisation after pharmacological induction with medetomidine has proved to be useful for the collection of semen in domestic cats. However, most of the previously used protocols require the administration of high doses of medetomidine that can increase the risk of side effects, especially on the cardiovascular system. In routine clinical practice, one safe and useful injectable anaesthetic protocol for short-term clinical investigations or surgery in cats involves premedication with low intramuscular doses of dexmedetomidine with methadone, followed by intravenous propofol bolus injection. We aimed to assess the usefulness of this injectable anaesthetic protocol for semen collection, via urethral catheterisation, in domestic cats.

Methods The study was performed on 38 purebred, adult cats, during the breeding season, and semen was collected via urethral catheterisation using an injectable anaesthesia protocol with methadone (0.2 mg/kg) and dexmedetomidine (5 µg/kg) premedication, followed by induction with propofol.

Results The anaesthetic protocol used in the present study allowed the collection of large-volume semen samples, characterised by good parameters and without side effects.

Conclusions and relevance The results from the present study suggest that the injectable anaesthetic protocol using methadone and dexmedetomidine premedication, followed by induction with propofol, could be suitable and safe for the collection of a good-quality semen sample, via urethral catheterisation, in domestic cats. It can therefore be used as an alternative to previous medetomidine-based sedation protocols.

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Introduction

In cats, the collection of semen, although less often requested compared with dogs, can be necessary for artificial insemination, for semen evaluation in tom cats used for breeding and for semen storage. The collection of semen in cats has only recently attracted substantial interest, thanks to new, alternative methods of collection compared with the less useful procedures using artificial vaginas or electroejaculation. In 2007, Zambelli et al[1] reported the suitability of semen collection in cats by the urethral catheterisation after pharmacological induction of anaesthesia with medetomidine, a potent sedative/analgesic, α_2-agonist able to induce vas deferens contractions and spermatic cell release into the urethra.[1,2] Urethral catheterisation after pharmacological induction with medetomidine allows the collection of semen characterised by low volume and a high concentration of spermatozoa; moreover, the sperm cells are suitable for

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cryopreservation or in vitro fertilisation.[3] For the purpose of semen collection, medetomidine was formerly used at a dose of 130–140 µg/kg, but because of the possible side effects on the cardiovascular system, the pharmacological induction of sedation/anaesthesia with medetomidine still represents a limitation because of the risks for the patient. In fact, as reported by Romagnoli et al,[4] a dose of 130 µg/kg medetomidine is responsible for significant haemodynamic effects on the feline heart, such as the reduction in heart rate, and increased cardiac preload and impaired systolic function.

For these reasons, recent studies have reported other pharmacological protocols, mainly aimed at reducing the medetomidine dose. Cunto et al[5] compared the characteristics of semen collected by urethral catheterisation, using doses of 130 and 50 µg/kg medetomidine, and found a significant impairment of semen volume, motility and sperm concentrations when the lower dose of 50 µg/kg medetomidine was used. Prochowska et al[6] used a dose of 100 µg/kg medetomidine for semen collection in cats and obtained semen samples characterised by mean low volume but high sperm concentrations.

As all the pharmacological actions of medetomidine are due to the dextrorotatory isomer isolated in dexmedetomidine,[7] in recent years dexmedetomidine has largely replaced the use of medetomidine in cats for use in restraint or surgery. Sedation and analgesia induced by dexmedetomidine are similar to those induced by medetomidine, but dexmedetomidine appears to be approximately twice as potent as medetomidine.[7]

Therefore, at present, new, alternative, safer, protocols for good-quality semen collection in domestic cats via urethral catheterisation would be appreciated.

In clinical practice, one of the recognised, injectable, anaesthetic protocols in domestic cats[8] is the use of premedication with methadone at a dose of 0.5 mg/kg intramuscularly, together with dexmedetomidine at a dose of 5 µg/kg, followed by the induction of short-term anaesthesia by propofol administration. The association of methadone with dexmedetomidine has been reported to show a good sparing effect on the dose of propofol necessary for induction (reduced from 4–10 mg/kg to about 2 mg/kg).[8] In cats, this anaesthetic protocol allows for brief clinical investigations and fast-track surgeries, and could therefore also be used for safe and non-painful urethral catheterisation for semen collection.[8]

For these reasons, the present study was aimed at assessing the usefulness of the same, routinely used, injectable, anaesthetic protocol for the collection of semen via urethral catheterisation in domestic cats.

Material and methods

Animals

The study was performed in Italy, on 38 client-owned domestic purebred (Maine Coon, Norwegian Forest Cats, Exotic, Persian, Chartreux, Sphynx, Russian Blue), adult cats, aged 1–3 years, from March to September 2015, corresponding to the full breeding season. For all cats, semen evaluation was specifically requested by the owners/breeders, and in all cases the owners provided signed informed consent for the procedure of urethral catheterisation under pharmacological anaesthesia, and semen analysis, and also for the use of the data for research purposes.

All cats underwent clinical examinations, and were enrolled in the study only if healthy, with normal testicular descent and penile/preputial gross morphology, and with visible penile spines, as evidence of pubertal condition.

Pharmacological protocol for semen collection and semen analysis

All cats, fasted for 12 h by the owners, were injected with 5 µg/kg dexmedetomidine (Dexdomitor; Pfizer Italia) in association to 0.2 mg/kg methadone (Semfortan; Dechra) intramuscularly. After 15 mins, when the palpebral reflex disappeared and the cat was in lateral recumbency and unresponsive (level 5 sedation, as described by Carter et al[9]), a sterile eye lubricating ointment was applied and anaesthesia was induced by an intravenous bolus injection of propofol to effect, until the surgical plane of anaesthesia was reached. At this time, a 3.5 French gauge urinary tom cat catheter (Buster; Kruuse), with the tip cut as described by Zambelli et al,[10] with a final length of 90 mm, was inserted into the urethra, lubricated by preheated 0.9% saline solution (SALF; Laboratorio Farmacologico)[11] and left in situ for 40 s, to allow for semen collection inside the catheter. At catheter withdrawal, semen was placed in preheated 1.5 ml plastic Eppendorf tubes, and submitted for macroscopic and microscopic evaluation.

After the withdrawal of the urethral catheter, atipamezole was administered intramuscularly at a dose of 15 µg/kg to each cat,[12] and recovery evaluated by recording the time to standing and also the recovery scale previously used by Tayari et al.[8] Until full recovery from anaesthesia, all cats were left undisturbed and placed in a single awakening cat cage, equipped with heating blankets.

Semen volume was recorded by a variable volume pipette before the 1:10 dilution with saline solution. Total motility (0–100%) was evaluated subjectively immediately by using an optical microscope (100×) equipped with a warming plate, using 1 µl sample on a warmed slip and covered by a 18 × 18 warmed cover slip. Sperm concentration (expressed as sperm cells $\times 10^6$/ml) was assessed by using a preheated Burker's chamber, and the total number of sperm cells/ejaculate was also calculated (expressed as sperm cells $\times 10^6$). Because cat semen is often characterised by teratozoospermia, which does not necessarily affect fertility,[13] sperm cell morphology was not evaluated.

Table 1 Characteristics of semen collected from 38 tom cats via urethral catheterisation using an injectable anaesthetic protocol

Semen parameter	Range	Mean ± SD
Volume (µl)	200–400	280 ± 80.00
Total motility (%)	55–70	61 ± 5.71
Sperm concentration (sperm cells $\times 10^6$/ml)	1100–2870	1823 ± 539.53
Total sperm cells/ ejaculate ($\times 10^6$)	238–1032	540 ± 245.58

Results

In all the 38 tom cats an adequate sample of semen was obtained, without contamination by blood or urine.

The characteristics (range and mean ± SD) of the semen collected from the 38 tom cats via urethral catheterisation using the injectable anaesthetic protocol are reported in Table 1.

Discussion

The present study showed that, in domestic cats, semen collection via urethral catheterisation under an injectable, routinely used, anaesthetic protocol is suitable, safe and allows the collection of good-quality semen.

In all cats no side effects related to the drugs used were seen, and recovery was always fast and excellent, as previously reported;[8,12] moreover, as reported by Ko et al,[7] none of the cats vomited. All the cats were standing within 20 mins of atipamezole administration, as previously reported by Ko et al,[7] and discharged from the clinic within 1 h of atipamezole administration.

With respect to semen quality, all studied parameters were satisfactory. In fact, the mean semen volume (280 µl) was greater than the volume (16 µl) reported by Prochowska et al,[6] who used medetomidine at a dose of 100 µg/kg, greater than the volume (about 11 µl) reported by Zambelli et al,[3] obtained using a dose of 130 µg/kg, and even higher than the semen volume (about 6 µl) obtained by Cunto et al,[5] who used a dose of 50 µg/kg medetomidine. Although this finding is difficult to explain, it could be supposed that the combined effects of the drugs used in the present study may have influenced semen volume collection, as well as the other semen characteristics. Mean sperm motility (60%) was very similar to that reported by Zambelli et al,[3] who used a dose of 130 µg medetomidine (63%), but higher than that reported using 50 µg medetomidine (about 50%).[5] Mean sperm concentration (1823 sperm cells $\times 10^6$/ml) was also higher than that obtained using high (130 µg/kg)[3] and low (50 µg/kg)[5] doses of medetomidine (1753 and 215 sperm cells $\times 10^6$/ml, respectively), but lower than the mean sperm concentration (3858 sperm cells $\times 10^6$/ml) obtained using 100 µg/kg medetomidine.[6] Mean total number of sperm cells/ejaculate (540 cells $\times 10^6$) was also greater than the values obtained with the use of 130 µg medetomidine (20–30 cells $\times 10^6$),[3,5,14] 100 µg medetomidine (48 cells $\times 10^6$)[6] and 50 µg medetomidine (0.9 cells $\times 10^6$).[5]

Conclusions

The semen collected in domestic cats via urethral catheterisation under a routine injectable anaesthesia protocol, was characterised by parameters very similar to those previously obtained by using 130 µg/kg medetomidine,[3,14] but of a greater volume, and better than semen obtained by using a safer dose of 50 µg/kg medetomidine.[5] However, in comparison with data reported by Prochowska et al,[6] using 100 µg/kg medetomidine, sperm concentration was lower, probably because of the difference in collected volume.

Moreover, because of the absence of side effects, this protocol could be proposed as an alternative to those requiring the administration of medetomidine, especially at high doses, in order to reduce the risk of unwanted side effects, particularly on the cardiovascular system.[4]

Taken together, the results of the present study suggest that the injectable anaesthetic protocol using methadone and dexmedetomidine as premedication, followed by induction with propofol, could be suitable and safely used for the collection of good-quality semen, via urethral catheterisation, in domestic cats, as an alternative to the 130, 100 or 50 µg/kg medetomidine sedation protocols.

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