Schweiz. Arch. Tierheilk.
© 2008 by Verlag Hans Huber, Hogrefe AG, Bern
M. P. Larenza et. al., Band 150, Heft 12, Dezember 2008, 599–607
DOI 10.1024/0036-7281.150.12.599

Anaesthesia recovery quality after racemic ketamine or S-ketamine administration to male cats undergoing neutering surgery

M. P. Larenza[1], H. Althaus[2], A. Conrot[2], C. Balmer[3], U. Schatzmann[1], R. Bettschart-Wolfensberger[3]

[1]Anaesthesiology Section, Department of Clinical Veterinary Medicine, University of Bern, Switzerland, [2]Dr. E. Graeub AG, Bern, Switzerland, Equine Department Vetsuisse-Faculty Zürich, [3]Section Anaesthesiology, University of Zürich, Switzerland

Summary

Postoperative anaesthesia recovery and analgesia qualities were compared in cats anaesthetised with racemic ketamine (RS-ket) or S-ketamine (S-ket) undergoing orchiectomy.
Twenty client-owned male cats received medetomidine (0.03 mg/kg) and S-ket (6 mg/kg; n = 10) or RS-ket (10 mg/kg; n = 10), all intramuscularly. After routine orchiectomy, animals received atipamezole (0.15 mg/kg) intramuscularly. Thirty and 60 min after atipamezole administration, one observer unaware of the treatment identity evaluated analgesia using a visual analogue scale (VAS) and, by means of four points scales, sedation, unprovoked behaviour and behavioural reactions to external stimuli. Cats with a VAS ≥ 15 mm were to receive butorphanol. Times to sternal and standing positions were recorded. After 60 min, cats were given carprofen (4 mg/kg) subcutaneously. Anaesthesia with S-ket, at 60% of the RS-ket dose, provided faster recoveries. At 60 min, undisturbed cats in S-ket group had a trend towards fewer behavioural changes. Cats in RS-ket group were more sedate at 30 min and responded with a lower intensity to external stimulation. Immediate postoperative analgesia was considered adequate for both groups and no cat required butorphanol administration.

Postoperative Aufwachphase und Analgesie nach der Kastration von männlichen Katzen unter Anästhesie mit Ketamin Razemat oder S-Ketamin

Die postoperative Aufwachphase sowie die Analgesie nach der Kastration von männlichen Katzen unter Anästhesie mit Ketamin Razemat (RS-ket) oder S-Ketamin (S-ket) wurden verglichen. Zwanzig klinische Patienten bekamen intramuskulär: Medetomidin (0.03 mg/kg) zusammen mit S-ket (6 mg/kg; n = 10) oder RS-ket (10 mg/kg; n = 10). Nach der Kastration bekamen alle Tiere 0.15 mg/kg Atipamezol IM. Dreissig und 60 Minuten nach Atipamezol Verabreichung wertete ein verblindeter Beobachter die Analgesie anhand einer visuellen Skala von 0–100 mm (VAS) sowie den Sedationsgrad und das Verhalten anhand eines numerischen Schemas (1, 2, 3 oder 4) aus. Katzen mit einem VAS > 15 mm wurde Butorphanol verabreicht. Die Zeitdauer bis zum Einnehmen der Sternallage bzw. bis zum Aufstehen wurde gemessen. Nach 60 Minuten zeigten ungestörte Katzen nach S-ket einen Trend zu weniger Verhaltensstörungen. Katzen nach RS-ket waren nach 30 Minuten stärker sediert und reagierten weniger auf externe Stimulation. Die Analgesie in beiden Gruppen war gut und im untersuchten Zeitraum musste kein Butorphanol appliziert werden.

Introduction

Commonly used ketamine hydrochloride is a racemic mixture containing two optical isomers (enantiomers): S-ketamine and R-ketamine. Racemic ketamine has been in clinical use for more than 30 years and is considered to be safe and effective for most anaesthetic procedures in cats. Unfortunately, racemic ketamine has been associated with undesirable psychomimetic effects after anaesthesia, so called 'emergence reactions' (White et al., 1982). Studies of ketamine isomers in several species appeared to demonstrate that the S-isomer of ketamine produced less psychomimetic emergence reactions than either the R-isoform or the racemic mixture (Kohrs and Durieux, 1998). The S-enantiomer has proven to be advantageous over racemic ketamine in cats in which an identical plane of anaesthesia which allowed for endotracheal intubation was obtained with only 60 % of the racemic dose (Wiederstein and Auer, 2003). In addition, S-ketamine administered at half of the racemic ketamine dose was found to

provide similar degree of analgesia to clinically healthy cats (Stelter, 2001) undergoing elective spay. The S-enantiomer of ketamine has also been used in moderate anaesthetic-risk (ASA III; Hosgood and Scholl, 2002) feline patients providing a significantly faster recovery period and better post-operative analgesia and emergence quality than the racemic mixture (Baumgartner et al., 2002). In a previous study we observed similar recovery quality and immediate post-surgical analgesia in female cats undergoing routine ovariectomy wherein anaesthesia was induced intravenously with either S-ketamine or racemic ketamine and maintained with isoflurane in oxygen (Larenza et al., 2004). Nowadays, a formulation of S-ketamine is available commercially in Switzerland to be used in cats. Therefore the aim of the present study was to investigate the postanaesthetic recovery quality and the immediate postoperative analgesia in male cats anaesthetised with intramuscular racemic ketamine or S-ketamine undergoing elective neutering surgery.

Animals, Material and Methods

The experimental trial was designed as a blinded randomised prospective study. A total of 20 client-owned male cats with a low anaesthetic-risk (ASA I-II; Hosgood and Scholl, 2002) entered this study. Food was withheld 12 hours before surgery to avoid the hazards of aspiration after anaesthesia induction. Free access to water was granted until one hour prior to the surgery and after complete recovery from anaesthesia. Medetomidine (Domitor, Orion Corporation, Espoo, Finland) at a dose of 30 µg/kg was administered intramuscularly for pre-anaesthetic sedation. Approximately five minutes later, animals randomly received either S-ketamine (S-ket; 6 mg/kg; n = 10) or racemic ketamine (RS-ket; 10 mg/kg; n = 10) intramuscularly. Randomization was performed by making use of the envelope system and blinding was ensured by using two separated vials containing either S-ketamine 60 mg/mL (Vial "A"; Keta-S ad us.vet., Dr. E. Graeub AG, Bern, Switzerland) or racemic ketamine 100 mg/mL (Vial "B"; Ketasol-100, Dr. E. Graeub AG, Bern, Switzerland) which allowed for equivalent volumes of solution to be administered to each cat (0.1 mL/kg).

Approximately five minutes after ketamine injection, when the cats lost their righting reflex and showed no reaction to pin-prick stimulation of the skin, they were placed in dorsal recumbency. The skin area of the scrotum was clipped and disinfected and cats underwent standard orchiectomy. Surgery time from the first skin incision to the end of surgical procedures was recorded. Throughout anaesthesia, a transparent plastic face mask was used to provide oxygen-enriched air. Haemoglobin oxygen saturation (SpO_2) was determined with a pulse-oximeter infra-red probe placed on the tongue. Hypoxemia was defined as SpO_2 below 90%. A lead II electrocardiogram was displayed and the heart rate (HR) was obtained (beats/min). Bradycardia was defined as HR < 80. Rectal temperature in °C was recorded at the end of the surgery and hypothermia was defined as rectal temperature < 37 °C. A portable anaesthesia monitor (Datex S-5 portable anaesthesia monitor, Datex-Ohmeda, Helsinki, Finland) continuously displayed the aforementioned data during the anaesthetic episode. Respiratory rate (RR) was calculated by counting the breaths/min. Intra-anaesthetically monitored data were recorded every 5 min. At the end of surgery, the effects of medetomidine were antagonised by administering 0.15 mg/kg of atipamezole (Antisedan, Orion Corporation, Espoo, Finland) intramuscularly and the cats were placed into a paediatric incubator (Isolette Model C200, Ing. Nufer AG, Bern, Switzerland) at 25 °C and were video recorded for one hour. The administration of atipamezole was recorded as time-point zero and the times to regain the sternal and the standing position after atipamezole administration were obtained. Heart rate (HR), respiratory rate (RR), pulse rhythm and rectal temperature were evaluated 30 and 60 min after atipamezole administration (t30 and t60, respectively) and the HR and RR differences to baseline values were also calculated at these time-points. One blinded observer evaluated postoperative analgesia at t30 and t60 by means of a visual analogue scale (VAS; 0 mm = no evident signs of pain – 100 mm = worst possible pain). If cats showed VAS values ≥ 15 mm, butorphanol (0.2 mg/kg) was provided intramuscularly as rescue analgesic. The overall behavioural effects of the tested drugs in the undisturbed subjects were evaluated as well at t30 and t60 using a four points scoring system (Fig. 1). The behavioural responses to external stimuli were obtained and scored at the same time points by using a four-point scoring system adapted from Eichenberger (2005) and Larenza et al. (2004). The scoring system includes the responses of the patients after the observer directly interacts with them when performing a clinical evaluation and also while petting them, clapping hands above their heads and by directing a pinpoint light beam to their eyes (0 = normal behavioural responses; 1 = minor exaggeration of responses: sensitive to light, touch and/or noises; 2 = moderately exaggeration of responses: hypersensitive to light, touch and/or noises; 3 = violent exaggeration of responses: becomes aggressive or intend to escape when touched or stimulated with a light beam or noises). The presence (1) or absence (0) of specific behavioural reactions to racemic and S-ketamine anaesthesia that were identified in a previous study (Eichenberger, 2005) such as mydriasis, "licking-the-lips" tongue movements and "disorientation" were also evaluated at t30 and t60. Muscular tone was also evaluated at the same time points and scored as 1 = increased (stiffness), 0 = normal and -1 = decreased (relaxed). In addition, in order to assess the patient's ability to regain the normal motoric function, the degree of sedation (Fig. 2) and the position of their bodies (0 = lateral recumbency, 1 = sternal recumbency, 2 = sitting, 3 = standing) were evaluated and scored from videotapes every 5 min after

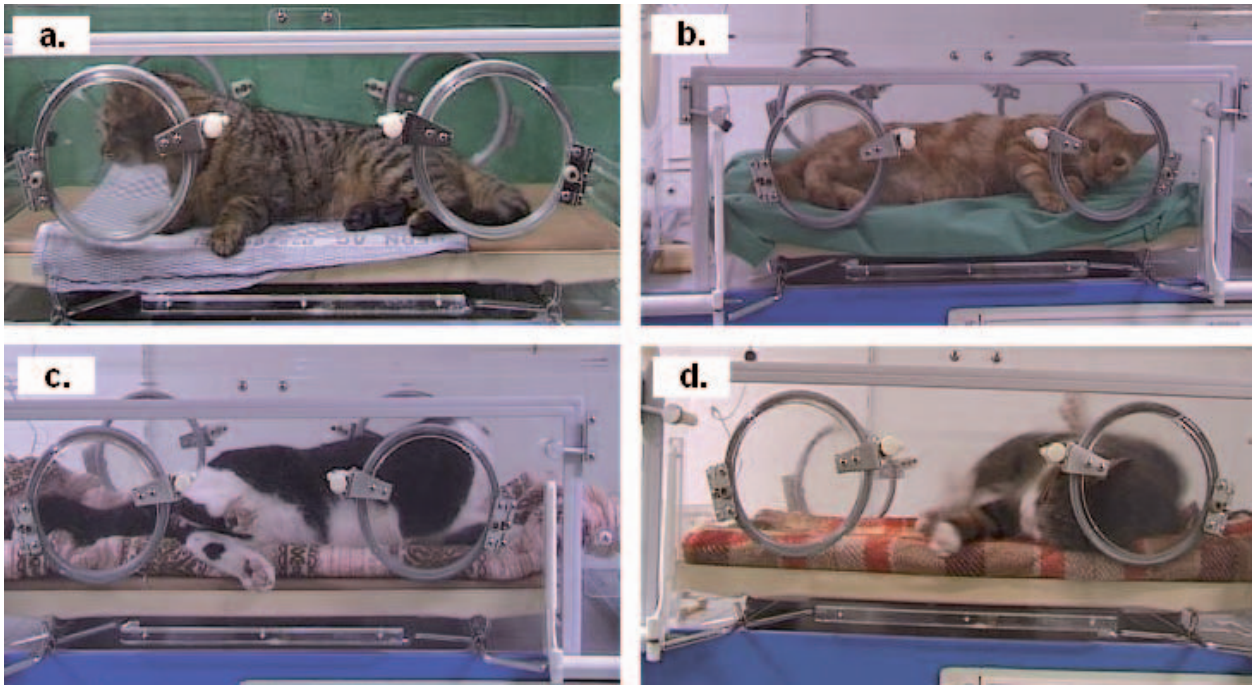

Figure 1: Four-point scoring scale for evaluating behavioural changes in the undisturbed cat during the recovery phase of racemic or S-ketamine anaesthesia. a. 0 = normal behavioural pattern (quiet, grooming, attentive); b. 1 = minor behavioural changes (minor incoordination and excitation); c. 2 = moderate behavioural changes (moderate incoordination and excitation); d. 3 = severe behavioural changes (rolling over, severe incoordination and excitation). Adapted from Eichenberger (2005) and Larenza et al. (2004).

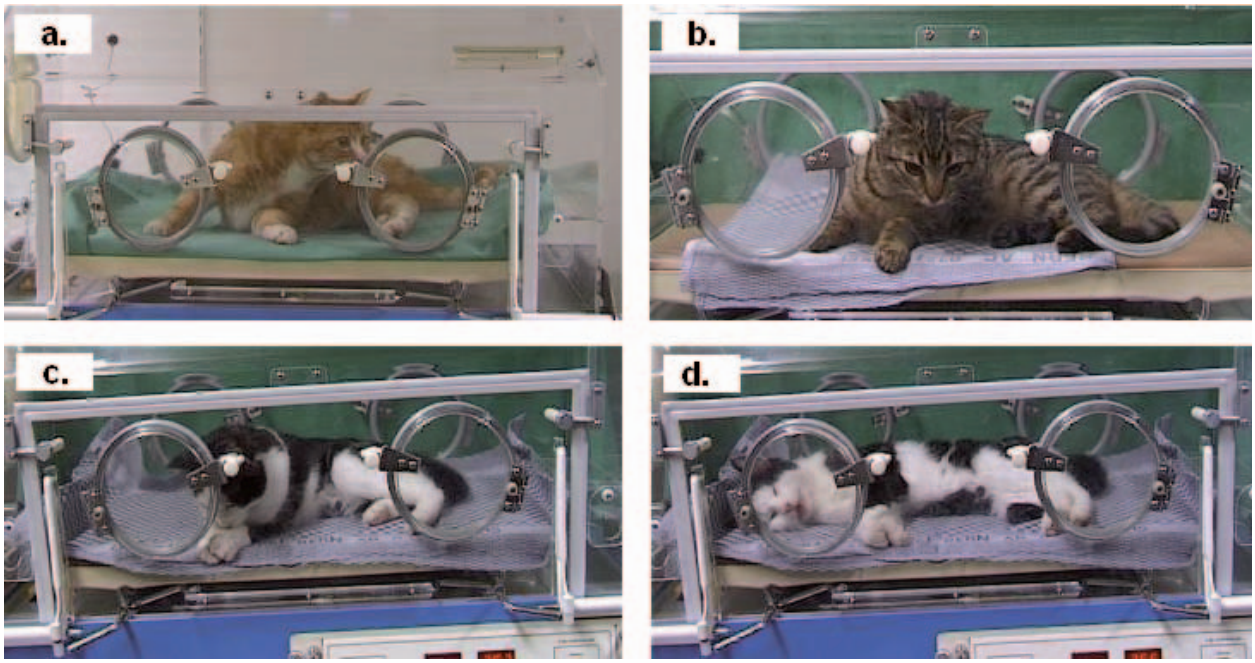

Figure 2: Four-point scoring scale for evaluating the sedation degree during the recovery from racemic or S-ketamine anaesthesia in cats. a. 0 = no sedation (fully alert); b. 1 = poor sedation (alert but with somnolence); c. 2 = moderate sedation (drowsy, but occasionally restless); d. 3 = deep sedation (sleeping comfortable).

atipamezole administration. After the evaluation at t60 the experience was concluded and the antibiotic cefazoline (Kefzol, Teva Pharma AG, Aesch, Switzerland) at a dose of 20 mg/kg and the long term analgesic carprofen (Rimadyl, Pfizer, New York, USA) at a dose of 4 mg/kg were administered subcutaneously. The cats returned to their owners at the same day of the surgery.

The NCSS 2004 (Kaysville, Utah, USA) software package was used to perform the statistical evaluation. All data were analysed for normal distribution with the Shapiro-Wilk W test. The statistical significance of the differences between groups for parametric data was assessed with Student's t-tests or Analysis of Variance tests and for non parametric variables with Mann-Whitney U tests or Kruskal-Wallis One-Way ANOVA on Ranks tests. For comparisons with baseline values the data were paired using every cat as its own match. Chi-square tests for independence in a contingency table were used to compare proportions and if there was any association between two classification variables. For all tests, overall $P < 0.05$ was considered the minimum level of statistical significance. A trend towards a statistical significance was defined as $P \leq 0.1$. Parametric data are presented as mean ± standard deviation and non-parametric data are presented as median [range], interquantile ranges (box plots) or displayed as dot plots. Proportions are presented as percents.

Results

No statistically significant differences between groups were detected regarding the age (1 ± 0.6 years/old for both groups; $P = 0.98$) and weight (S-ket: 3.4 ± 0.5; RS-ket; 3.5 ± 0.5; $P = 0.72$) of the cats. There were no statistically significant differences in HR values (S-ket: 167 ± 29; RS-ket: 157 ± 20; $P = 0.38$) or in RR values between groups, although there was a trend ($P = 0.08$) for lower RR values in S-ket (43 ± 12) compared with RS-ket (53 ± 12). All cats were considered to be healthy on the basis of clinical examination and suitable to receive anaesthesia. All cats in group S-ket (100%) and seven (70%) cats in group RS-ket were ranked as ASA I and three (30%) cats in the group RS-ket were ranked as ASA II.

All anaesthetic and surgical episodes were uneventful. Immediately after surgery rectal temperature remained above 37.5°C for all cats. There were no signs of intra-operative bradycardia, arrhythmias, apnoea, or hypoxaemia. All cats achieved an acceptable anaesthetic depth for the surgical procedures and had a complete recovery from anaesthesia. Mean surgery time was 6.6 ± 2.5 min for S-ket and 7.8 ± 2.7 min for RS-ket ($P = 0.32$). Cats allocated to S-ket reached the sternal recumbency significantly ($P = 0.008$) faster (11.4 ± 3 min) compared with those allocated to RS-ket (29.7 ± 19.3 min; Fig. 3 a). Subsequently, cats allocated to S-ket stood up significantly faster (22.1 ± 6.1 min) than cats in group RS-ket (44.3 ± 21.5 min; $P = 0.005$; Fig. 3 b).

Although there were no significant differences for HR values between groups ($P = 0.4$), both groups showed higher HRs at t30 compared with baseline recordings (S-ket: HR = 215 ± 39 beats/min, $P = 0.003$; RS-ket: HR = 202 ± 23 beats/min, $P = 0.008$). No significant differences were recorded for HR at t60 between groups ($P = 0.11$) and for S-ket (HR = 184 ± 21 beats/min) compared with baseline ($P = 0.13$), although at that time point HR values were significantly higher for RS-ket (HR = 202 ± 23 beats/min, $P = 0.001$) compared with baseline. No ar-

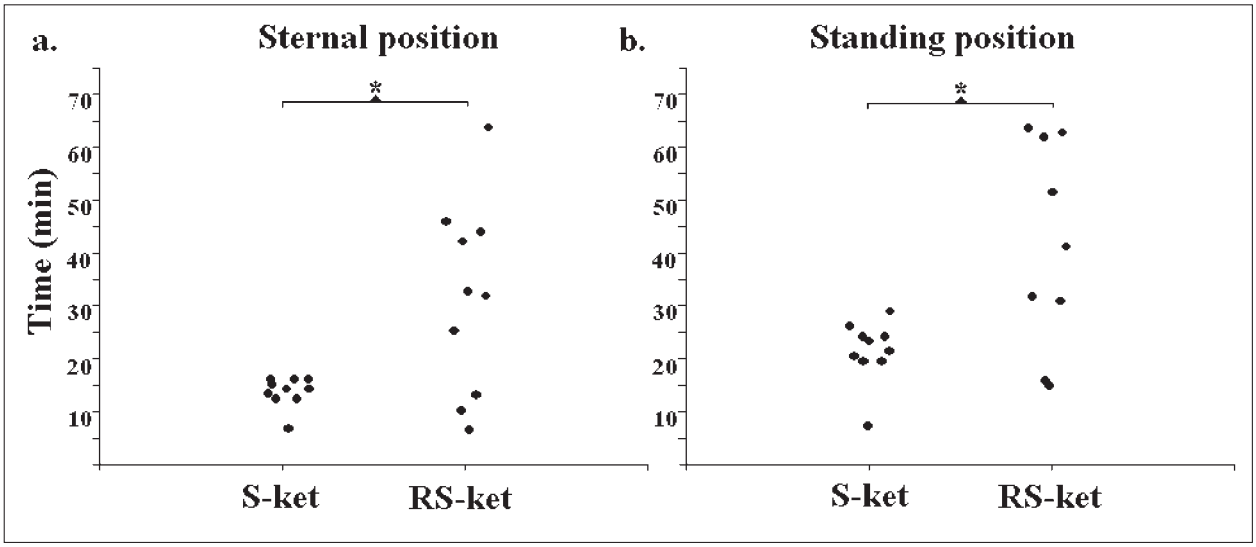

Figure 3: Individual times (dot plots) to achieve the sternal (a) and the standing position (b) after atipamezole administration to cats that were anaesthetized with intramuscular medetomidine and S-ketamine (S-ket; 6 mg/kg; n = 10) or racemic ketamine (RS-ket; 10 mg/kg; n = 10). * $P < 0.05$ for statistical comparisons between groups.

rhythmias were detected at any evaluated time point. For S-ket, values of RRs at t30 (62 ± 10 breaths/min) and at t60 (63 ± 17 breaths/min) were statistically significant different compared with baseline values (P = 0.004 and P = 0.002, respectively). No differences were detected for RRs in RS-ket group at t30 (53 ± 17 breaths/min, P = 0.97) or at t60 (53 ± 11 breaths/min, P = 0.94). However, differences between groups in regards to RR values were not significant at t30 (P = 0.16) nor at t60 (P = 0.17). All cats had rectal temperature values above 38°C at any evaluated time point during the anaesthesia recovery phase. Visual analogue scale values were below levels that would have required rescue analgesia for all cats at any evaluated time point (S-ket: t30 = 5.1 ± 2.1 mm, t60 = 4.3 ± 1.8 mm; RS-ket: t30 = 5.1 ± 3.4 mm, t60 = 4.3 ± 2.6 mm), therefore no cat required the administration of butorphanol during the one-hour examination period. Unprovoked behavioural scores were similar (P = 1) for both groups at t30 (1 [1-2]). Although no significant differences were found between groups at t60, there was a trend (P = 0.09) towards lower scores for S-ket (1 [0-1]) compared with RS-ket (1 [0-2]). Behavioural reactions to external stimuli (Fig. 4 a and b) were adjudged to be significantly higher (P = 0.04) in cats allocated to S-ket at t30 compared with RS-ket, while the differences between groups found at t60 were not significant (P = 0.43). Cats allocated to RS-ket had significantly higher (P = 0.04) sedation scores than cats allocated to S-ket (Fig. 5 a and b). Body posi-

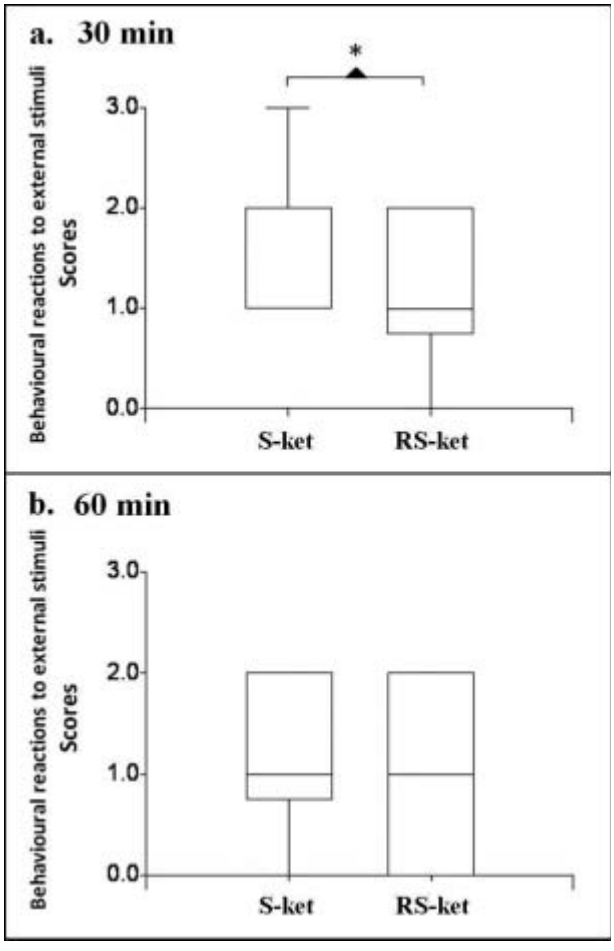

Figure 4: Median and interquantile ranges (box plots) of scores of behavioural responses to external stimuli obtained from cats that were anaesthetized with medetomidine and S-ketamine (S-ket; 6 mg/kg; n = 10) or racemic ketamine (RS-ket; 10 mg/kg; n = 10) when the observer interacted with them at 30 and 60 min after atipamezole administration. The responses were scored using a four-point scale (0 = normal responses – 3 = violent exaggeration) adapted from Eichenberger (2005) and Larenza et al. (2004). * P < 0.05 for statistical comparisons between groups.

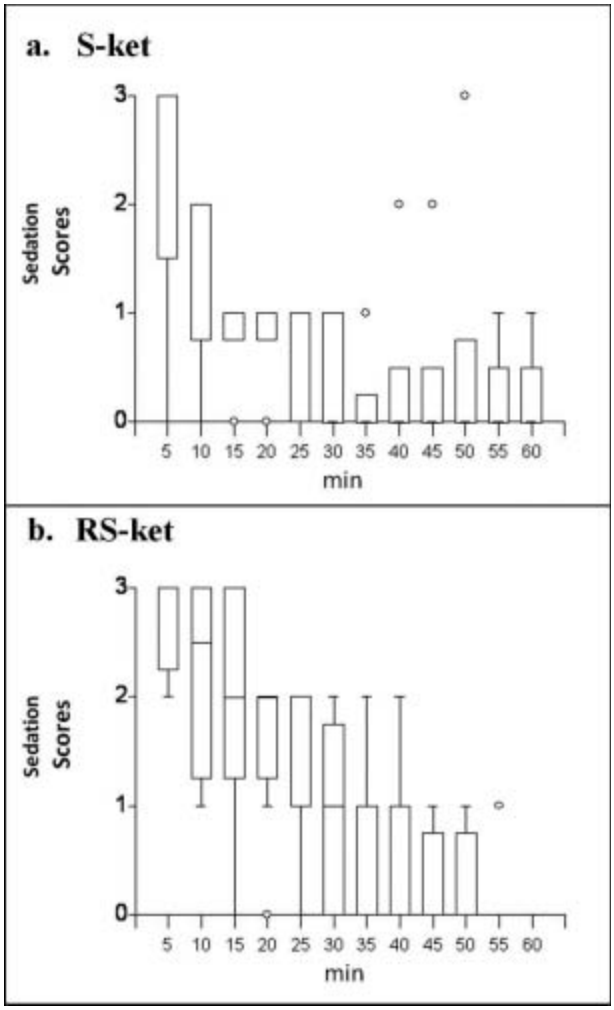

Figure 5: Median and interquantile ranges (box plots) of the degree of sedation obtained from cats that were anaesthetized with medetomidine and S-ketamine (a. S-ket; 6 mg/kg; n = 10) or racemic ketamine (b. RS-ket; 10 mg/kg; n = 10) every 5 min after atipamezole administration. The degree of sedation was scored using a four-point scale (0 = no sedation – 3 = sleeping comfortable).

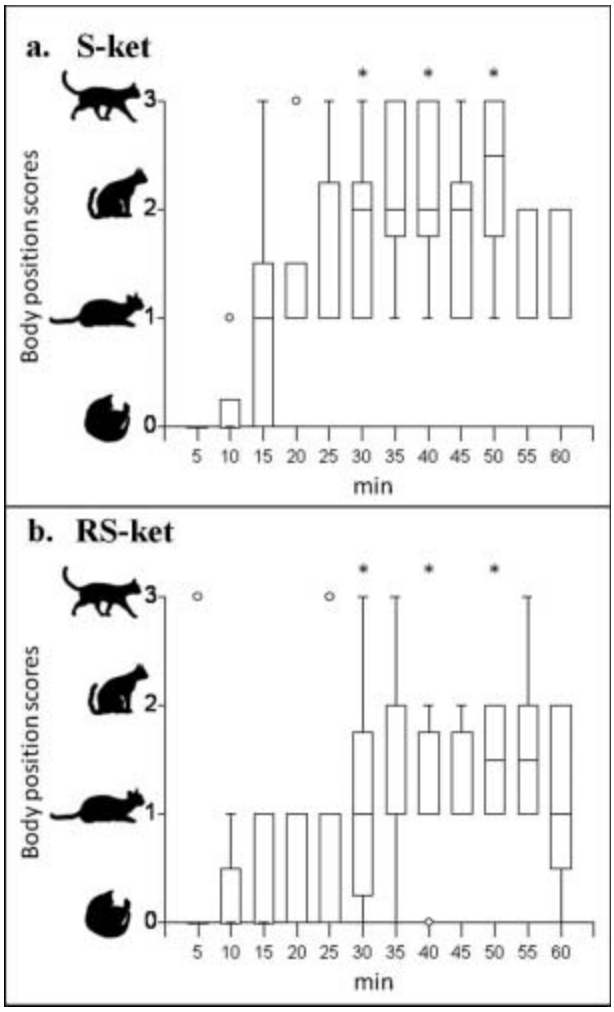

Figure 6: Median and interquantile ranges (box plots) of the body position scores (0 – 3) of cats that were anaesthetized with medetomidine and S-ketamine (a. S-ket; 6 mg/kg; n = 10) or racemic ketamine (b. RS-ket; 10 mg/kg; n = 10) evaluated every 5 min after atipamezole administration. * $P < 0.05$ for statistical comparisons between groups.

tion scores were significantly ($P = 0.001$) higher for S-ket compared with RS-ket (Fig. 6 a and b). Cats allocated to S-ket showed more sitting and standing events than cats allocated to RS-ket. All cats presented mydriasis at t30, and all but one cat in RS-ket presented mydriasis at t60 ($P = 0.3$). Both groups showed comparable episodes ($P = 0.65$) of "disorientation"/falling towards one side (S-ket: 60%; RS-ket: 50%) and although more cats in S-ket showed more "licking the lips" events (70%) than those in RS-ket (60%) these differences were not statistically significant ($P = 0.17$). Comparable scores for the evaluation of muscular tone were obtained at t30 and t60 ($P = 0.5$ at any evaluated time point). At t30, 70% of cats in both groups had an increased muscular tone while at t60 only 20% of cats in S-ket and 30% of cats in RS-ket had an increased muscular tone.

Discussion

The results of the present study show that S-ketamine might be advantageous over racemic ketamine in providing anesthesia for male cats undergoing elective neutering surgery with only 60% of the racemic dose resulting in a more rapid and predictable recovery from anaesthesia. This is in agreement with previous studies performed in cats or in other species (Doenicke et al., 1992; Stelter, 2001; Wohlrab, 2001; Baumgartner et al., 2002; Filzek et al., 2003; Larenza et al., 2007). Similar to previous studies conducted in female cats undergoing elective spay, administration of S-ketamine at 50-60% of the racemic ketamine dose was as effective as the full dose of racemic ketamine in providing immediate postoperative analgesia (Stelter, 2001; Larenza et al., 2004). The equipotent doses of racemic ketamine (10 mg/kg) and S-ketamine (6 mg/kg) chosen for this study were tested in a previous trial in which the necessary doses of either compound to produce similar anaesthetic conditions to place an orotracheal tube in cats were evaluated (Wiederstein and Auer, 2003). Similar doses have been also used in moderate anaesthetic-risk (ASA III) feline patients in which S-ketamine provided a significantly faster recovery period and better post-operative analgesia and emergence quality than the racemic mixture (Baumgartner et al., 2002).

Antagonization of medetomidine by means of antipamezole immediately after surgery caused continuous decrease of sedation scores. At the end of the one-hour observational period, all cats in S-ket and most cats in RS-ket were fully awake. Over time, transitions from middle to slight sedation were significantly faster for cats allocated to S-ket than cats allocated to RS-ket which in turn lead to faster postoperative recoveries of the animals receiving the single enantiomer. Previous studies performed in cats and other species showed similar results (White et al., 1980; Doenicke et al., 1992; Stelter, 2001; Baumgartner et al., 2002; Larenza et al., 2007). These effects could be attributed to the administration of a lower total dose of ketamine to cats in S-ket (6 mg/kg) compared with a total dose of 10 mg/kg administered to cats in RS-ket. However, this hypothesis may be improbable because R-ketamine has only one fourth of the potency of S-ketamine (White et al., 1982) and in the overall evaluation these two doses could be considered equivalent (Wiederstein and Auer, 2003). Interestingly, several authors postulated that the faster recoveries observed after S-ketamine were rather linked to a faster elimination of this isomer when given separately from the racemic mixture because the R-isomer present in the racemate might inhibit S-ketamine elimination leading to a prolonged action of the strongest isomer (Ihmsen et al., 2001; Larenza et al., 2007).

The hallucinatory behaviours after racemic ketamine administration which may progress to delirium are well known in human medicine and have been the reason for the reluctance of many physicians to administer such a drug to their patients (Kohrs and Durieux, 1998). Ataxia,

increased motor activity, hyperreflexia, touch sensitivity, delirium and aggressiveness were some of the emergence reactions observed in cats recovering from racemic ketamine anaesthesia (Beck, 1976; Velisek and Mares, 1990). In this study, a modified version of a table designed to evaluate specific post-ketamine behavioural reactions was used (Larenza et al., 2004; Eichenberger, 2005). Overall, during the one-hour observational period, both groups showed minor to moderate behavioural changes. All twenty cats showed head movements from side to side, exhibited tongue movements described as 'licking the lips" and were disoriented. When the observer interacted with the cats of the S-ket group at t30, they showed stronger reactions than cats allocated to RS-ket. However, when the cats were left undisturbed those allocated to S-ket showed a trend towards more normal behavioural patterns at the end of the examination period. This might be probably related to the prolonged sedation observed in cats receiving the racemate. While cats in S-ket were more attentive of the environment and were able to react in a stronger manner to the interaction with the observer half an hour after atipamezole administration, several cats in RS-ket were still regaining consciousness and motoric function even at t60. In accordance with the findings of the present study, human volunteers showed less frequent excitations and disorientations after S-ketamine administration than after the racemate (White et al., 1980). An influence of the alpha-2 antagonist atipamezole of over the behavioural characteristics cannot be excluded. However, since both groups received similar doses of atipamezole, the differences observed between groups should not be related to this compound.

Evaluation of pain in animals is difficult and often challenging. Although multimodal pain scales might reflect painful events more accurately in other settings, in this case a subjective method (VAS), which is a common and simple system to quantify pain in paediatric patients, was chosen. This selection was made in order to diminish the bias on the overall pain evaluation that could be caused by behavioural events often included in multimodal scales such as vocalization and aggression and/or physiologic parameters such as increases in HR that could simply be provoked by the administration of ketamine to painless subjects. In order to minimize the impact of the subjective component of this method, the same observer assessed all patients. In agreement with a previous study in which pain evaluation included direct wound palpation (Larenza et al., 2004), both groups showed very low VAS values and no cat required butorphanol, suggesting that racemic ketamine and S-ketamine provided good immediate postoperative analgesia. However, since the duration of action of ketamine as analgesic may vary, all cats received carprofen at the end of the experiment to ensure long lasting analgesia.

Ketamine often produces significant increases in HR as a result of sympathetic stimulation (Kohrs and Durieux, 1998). Cats allocated to RS-ket had higher HRs postoperatively at t30 and t60, while those allocated to S-ket had higher HRs only at t30. Likewise, cats with increased anaesthetic risk evidenced lower HRs after S-ket compared with RS-ket administration and the authors postulated that these results suggested a better analgesia for cats receiving S-ketamine (Baumgartner et al., 2002). Contrarily, female cats undergoing spay surgery anaesthetized with similar doses of RS-ket and S-ket to this study and isoflurane in oxygen showed lower HRs after RS-ket compared to S-ket (Larenza et al., 2004). The different surgery times and postoperative recovery times could have been the reason for these observed discrepancies. Ketamine effects on the respiratory system are generally beneficial, it causes minimal respiratory depression with only mild hypercapnia at clinically relevant doses (Kohrs and Durieux, 1998). The reasons for the observed differences in the RR values of cats allocated to S-ket remain unknown. Further trials should be conducted in order to study in more detail the effects of S-ketamine on the respiratory function in cats.

In conclusion, the results of the present study show that S-ketamine at a dose of 60 % of racemic ketamine produces faster recoveries form anaesthesia in cats undergoing orchiectomy. Emergence from anaesthesia with either ketamine solution similarly produced mild to moderate behavioural reactions. However, cats treated with S-ketamine showed shorter lasting episodes of abnormal behaviour reactions and sedation.

Acknowledgment

The authors are grateful to Dr. E. Graeub AG for providing financial support to carry out this study.

Phase de réveil et analgésie après la castration de chats mâle sous anesthésie à la kétamine racémique ou à l'énantiomère S de la kétamine

La phase de réveil ainsi que l'analgésie après la castration de chats mâles sous anesthésie à la kétamine racémique (RS-ket) ou à l'énantiomère S de la kétamine (S-ket) ont été comparées. 20 patients ont reçu par voie intramusculaire de la médétomidine (0,03 mg/kg) associée avec de la S-ket (6 mg/kg, n = 10) ou de la RSket (10mg/kg, n = 10). Après la castration, tous les animaux ont reçu 0,15 mg/kg d'atipamézole, en intramusculaire. 30 et 60 minutes après l'application d'atipamézole, un observateur a estimé à l'aveugle l'analgésie sur la base d'une échelle visuelle de 0 à 100 mm (VAS) ainsi que le degré de sédation et le comportement sur la base de schémas numériques (1, 2, 3 ou 4). Les chats présentant une VAS de plus de 15 mm ont reçu du butorphanol. Le temps jusqu'à la prise d'une position sternale respectivement jusqu'au lever a été mesuré. Après 60 minutes, les chats ayant reçu de la S-ket montraient une tendance à moins de troubles du comportement. Les chats ayant reçu de la RS-ket présentaient une sédation plus forte après 30 minutes et réagissaient moins au stimuli externes. Dans les deux groupes, l'analgésie était bonne et, durant l'étude, il n'a pas été nécessaire d'appliquer de butorphanol.

Fase di risveglio post operativa e analgesia dopo la castrazione di gatti maschi sotto anestesia con ketamina racemato o S-ketamina

Sono state paragonate la fase di risveglio post operativa e l'analgesia dopo la castrazione di gatti maschi effettuata sotto anestesia con ketamina racemato (RS-ket) o S-ketamina (S-ket). Venti pazienti hanno ricevuto per via intramuscolare: medetomidina (0.03 mg/kg) con S-ket (6 mg/kg; n = 10) oppure RS-ket (10 mg/kg; n = 10). Dopo la castrazione a tutti gli animali è stato somministrato 0.15 mg/kg di atipamezolo IM. Dopo un periodo di 30 e 60 minuti, posposto alla somministrazione di atipamezolo, un osservatore in cieco ha valutato l'analgesia coll'aiuto di una scala visiva da 0 a 100 mm (VAS), il grado di sedazione e il comportamento coll'aiuto di uno schema numerico (1, 2, 3 o 4). I gatti con un VAS > 15 mm dovevano ricevere butorfanolo. E stato misurato il tempo necessario al raggiungimento della posizione sternale e sulle zampe. Dopo 60 minuti si è osservato che i gatti indisturbati dopo lo S-ket mostravano minori disturbi di comportamento. I gatti, dopo RS-ket, erano dopo 30 minuti ancora molto sedati e reagivano poco agli stimoli esterni. L'analgesia in entrambi i gruppi è stata buona e nel periodo di tempo dell'esame non si è dovuto applicare butorfanolo.

References

Baumgartner B., Auer U., Mosing M.: Comparison of the recovery period after S(+) ketamine and the racemic mixture in high risk feline patients. Association of Veterinary Anaesthetists, Autumn Meeting, Dublin, Ireland 2002, 67.

Beck C.: Answers to questions about Vetalar (ketamin HCl). Vet. Med., Small Anim- Clin. 1976, 905–908.

Doenicke A., Kugler J., Mayer M., Angster R., Hoffmann P.: Ketamine racemate or S-(+)-ketamine and midazolam. The effect on vigilance, efficacy and subjective findings. Anaesthesist 1992, 41: 610–618.

Eichenberger U.: Evaluation der Aufwachphase von Katzen nach einer routinemässigen Ovariektomie: Vergleich S(+) – Ketamin versus Ketaminrazemat. Dissertation, University of Bern, 2005.

Filzek U., Fischer U., Ferguson J.: Intravenous anaesthesia in horses: racemic ketamine versus S-(+)-ketamine. Pferdeheilkunde 2003, 19: 501–506.

Hosgood G., Scholl D. T.: Evaluation of age and American Society of Anesthesiologists (ASA) physical status as risk factors for perianesthetic morbidity and mortality in the cat. J. Vet. Em. and Criti. Care 2002, 12: 9–15.

Ihmsen H., Geisslinger G., Schuttler J.: Stereoselective pharmacokinetics of ketamine: R(-)-ketamine inhibits the elimination of S(+)-ketamine. Clin. Pharmacol Therap. 2001, 70: 431–438.

Kohrs R., Durieux M. E.: Ketamine: teaching an old drug new tricks. Anesthesia & Analgesia 1998, 87: 1186–1193.

Larenza M. P., Moens Y., Kronen P., Schatzmann U.: Comparison of post-operative analgesia and recovery quality after racemic ketamine or S-ketamine in female cats undergoing ovariectomy: preliminary results. 35th Conference of the Small Animal Veterinary Swiss Association, Interlaken, Switzerland 2004, 207.

Larenza M. P., Knobloch M., Landoni M. F., Levionnois O. L., Kronen P. W., Theurillat R., Schatzmann U., Thormann W.: Stereoselective pharmacokinetics of ketamine and norketamine after racemic ketamine or S-ketamine administration in Shetland ponies sedated with xylazine. Vet. J, in press.

Stelter A.: Die Anästhesie bei der Katze mit Medetomidin und Ketamin-Razemat bzw. S(+)– Ketamine – eine klinische Studie. Dissertation, Ludwig-Maximilians Universität München, 2001.

Velisek L., Mares P.: Anticonvulsant action of ketamine in laboratory animals. In: Status of Ketamine in Anesthesiology. Ed. E. F. Domino, NPP Books, Ann Arbor, Michigan, USA, 1990, 541.

White P. F., Ham J., Way W. L., Trevor A. J.: Pharmacology of ketamine isomers in surgical patients. Anesthesiology 1980, 52: 231–239.

White P. F., Way W. L., Trevor A. J.: Ketamine - its pharmacology and therapeutic uses. Anesthesiology 1982, 56: 119–136.

Wiederstein I., Auer U.: Comparison of clinical efficacy and tolerance of S (+) ketamine for induction of anaesthesia in healthy cats. AVA Spring Meeting, Utrecht, The Netherlands 2003.

Wohlrab S.: Vergleichsuntersuchungen der Anästhetika-Kombinationen Ketamin-Razemat/Medetomidine und S-(+) Ketamin/Medetomidin und deren Teilantagonisierung mit Atipamezol beim Syrischen Goldhamster (Mesocricetus auratus). Dissertation, Ludwig-Maximilians Universität München, 2001.

Corresponding address

Dr. M. P. Larenza
Department of Clinical Studies, Anesthesia Section,
Matthew J. Ryan Veterinary Hospital
University of Pennsylvania
3900 Delancey Street, Philadelphia, PA 19104, USA
Phone: (1) 215.573.7213
Fax: (1) 215.5736050
E-Mail: larenza@vet.upenn.edu

Received: 15 march 2008
Accepted: 2 june 2008