Rocuronium Use in Anaesthetics Protocol in Canine Patients with Orthopedic Disease

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Abstract

In modern veterinary medicine, like in human medicine all major surgery procedures must be performed under balanced anaesthesia. This protocol contained substances that insure: neurovegetativ protection, analgesia, miorelaxation, hypnosis. Rocuronium represent a nondepolarizing agent, intermediate acting (60-120 seconds), with relative long effects (40-90 minutes), and with the possibility of effect reversal (agents-Sugammadex). The aim of this study was monitorization of clinical, haematological and biochemical parameters perioperative in dogs scheduled for orthopedic procedures. This study was performed on five canine patients (different breed, with age between 4 months to 11 years), scheduled for femoral had resection procedure. In this dogs balanced anaesthesia was performed: induction with propofol to effect, maintained with sevoflurane 2.5%; analgesic component: fentanyl 3µg/kg b.w.-bolus followed by CRI 5 µg/kg b.w./min, the neuromuscular blocking agent was represented by rocuronium 0.4 mg/kg b.w. Haematological analysis were performed with Abacus Junior Vet 3 diff analyzer, biochemical parameters with UV-VIS Screen Master Touch Hospitex Diagnostic spectrophotometer, and electrolytes with GEM Premier 2000 analyzer. The majority of biochemical and mineral parameters suffered only small changes, without statistical importance. After the surgery we determined only a slight reduction of erythrocyte number, haemoglobin and PCV, a mild increase of γ-globulin. Regarding the clinical parameters only internal temperatures was modified. We recommend the use of rocuronium in orthopedic procedures for the advantages offered in the surgical act (profound miorelaxation) without any major biochemical, haematological, electrolytes alteration.

Keywords: *canine, orthopedic, rocuronium, general anaesthesia*

INTRODUCTION

In modern veterinary medicine, like in human medicine all major surgery procedures must be performed under balanced anaesthesia. That is more important in patients with orthopedic problems (Chohan, 2011). This protocol contained substances that insure: neurovegetativ protection, analgesia, miorelaxation and hypnosis.

The muscle relaxants ensure a better muscle relaxation and from this big category of drugs

NMBA is preferred (Chohan, 2010). Rocuronium is a nondepolarizing blocking agent (NMBA), intermediate acting (60-120 seconds), with relative long effects (40-90 minutes), and with the possibility of effect reversal (agents-Sugammadex) (Raghavendra, 2002). For this moment there are limited studies in veterinary medicine regarding the use of this agent in balanced anaesthesia (Stevens, 1997; Brauer, 2011; Duke-Navakoski, 2012), but the safety is proven by studies from

Tab. 1. Epidemiological structure of the cases

Patient number	Breed	Age	Sex	Chirurgical diagnosis	Intervention time
1	Caniche	11years	F	Recurrence of coxo-femoral luxation	64 minutes
2	Cocker	2 years	M	Chronic femoral head fracture	60 minutes
3	Bichon bolognez	9 months	M	Leg-Perthes disease	45 minutes
4	Tosa-Inu	14 months	M	Chronic Salter-Harris type 2 fracture	31 mnutes
5	Yorkshire Terrier	4 months	F	Leg-Perthes disease	52 minutes

human medicine (Khalil, 1994; Mirakhur, 1994; Robertson, 2005; Craig, 2009)

MATERIALS AND METHODS

This study was performed on five canine patients (different breed, with ages between 4 months to 11 years), scheduled for femoral had resection procedure (the structure of this group is present in Tab. 1). In all cases we used a balanced anaesthesia protocol: **induction** – propofol (Propofol 1%, 20 ml, “Fresenius”, Kabi Deutschland GmbH, Germany) to effect, **maintenance** – sevoflurane 2, 5% (Sevofluran 250 ml, Abbott Laboratories Ltd, U. K.); - **analgesia** fentanyl 3µg/kg b.w.- bolus (Fentanyl-Richter 5ml, 50 µg/ml) followed by CRI 5 µg/kg b.w./min (Braun Perfusor FM- infusion pump), **miorelaxation** - rocuronium 0,4 mg/kg b.w. (Rocuronium Kabi 10 mg/ml 10ml, S.C.Fresenius Kabi Romania) bolus.

The patients were endotracheal intubated and mechanical ventilation was started (IPPV) - 15 mbar, 15 ml/kg b.w., 15 breaths/min (Dräger Cato VT 20 anaesthesia machine). Ventilator parameters were adjusted in conformity with ETCO_2 values during the duration of surgical procedures.

The blood sample was collected in to different time : 1-before the beginning of general anaesthesia and 2- at 120 minute.

Blood hematology was investigated with Abacus Junior Vet, automatic analyzer Diatron Messtechnik, Budapest, Hungary.

Biochemical parameters were investigated with Spectrophotometer Screen Master Touch (Hospitex Diagnosis Italy) using following biochemical methods:

- kinetic-enzymatic assay in u.v. light's at λ 340nm ALAT, ASAT, GGT, PAL, LDH and Urea;
- kinetic-colorimetric method, fixed time, in visible spectrum (v.i.s) at λ 405nm Creatinine;
- end-point method, colorimetric in v.i.s. at: $\lambda=480$ Glucoses, $\lambda=548$ Total protein=600 Albumin, $\lambda=540$ nm Calcium;
- turbidimetric in v.i.s. at $\lambda=405$ γ -globulins;
- enzymatic fixed time method in u.v. at $\lambda=340$ nm Phosphorus.

Materials: intravenous catheter Vasofix® Safety 22 G (0,9X25) (producer Braun); blood collectors Microvette® MicroTube 1,3 ml EDTA; “Blood sample for Blood Gas with cone cap” heparinate syringe 2 ml (producer Instrumentation Laboratory); Urea; Creatinine; ALAT; ASAT; GGT; PAL; LDH; Calcium; Total Protein; Albumin; Globulin diagnosis kits (producer Hospitex Diagnostic, Firenze, Italia); Phosphorus diagnosis kits (producer by Ameda Labordiagnostik, Granz, Austria)

Statistics - the data were expressed as the mean and standard error of the mean (SEM). Pared sample T Student test was used to assess the differences between the two moments investigated. Statistical significance was at $p<0.05$ (95% confidence interval). Statistical values

were obtained using GraphPad Prism version 5.0 for Windows, GraphPad Software, San Diego California USA.

RESULTS AND DISCUSSION

The results are presented in the following tables, because of the individuals variations and the multitudes of the parameters we chose to show only the mean values and standard error of the mean (S.E.M.) so the results to be more easy to follow.

In veterinary medicine there are no study, from our knowledge, to assess the degree of post operative anemia, but in human medicine, two

major studies conclude that in 90% of orthopedic surgery anemia is present postoperative (Kulier, 2001; Dunne, 2002). After the surgery in our cases we noticed a mild anemia.

The others red blood cell parameters remained in normal limits.

The plates count was and remained in normal limits after the general anaesthesia and surgery.

We detected a reduction of white blood cell at 120 minute after the surgery, that remained in normal limit, most probably caused by migration of this cells from blood stream to surgery site.

The glucose level is much higher before the surgery, probably caused by the pain, this finding

Tab. 2. The influence of anesthesia on the values of the red blood cells (RBCs), hemoglobin (HGB) and hematocrit (HCT) (mean $\pm$ S.E.M).

	RBC $10^{12}/l$	HGB g/l	HCT %
Time 1	6.84 $\pm$ 0.22	158.00 $\pm$ 2.31	46.90 $\pm$ 0.55
Time 2	5.23 $\pm$ 0.18*	116.00 $\pm$ 0.95*	35.30 $\pm$ 0.49*

Note: Normal values: RBC 5.5-8.5 $10^6/\mu l$, Hb 120-180 g/l, Ht 37-55 % (Merk Veterinary Manual)

*= p<0.05 as compared to Group 1

Tab. 3. The influence of anesthesia on the values of mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and red blood cells distribution width (RDW) (mean $\pm$ S.E.M)

	MCV fl	MCH pg	MCHC g/l	RDWs fl
Time 1	69.00 $\pm$ 0.39	23.00 $\pm$ 0.20	336.80 $\pm$ 0.66	43.46 $\pm$ 0.31
Time 2	67.20 $\pm$ 0.33	22.00 $\pm$ 0.20	326.60 $\pm$ 0.68	43.58 $\pm$ 0.31

Note: Normal values: MCV 60-72 fl MCH 19.5-24.5 pg MCHC 310-340 g/dl (Merk Veterinary Manual)

Tab. 4. The influence of anesthesia on the values of total platelet count (PLT), platelet hematocrit (PCT), mean platelet volume (MPV), platelet distribution width (PDW) (mean $\pm$ S.E.M.)

	PLT 10^3 cells/ μl	PCT %	MPV fl	PDWs fl
Time 1	241.00 $\pm$ 1.59	0.25 $\pm$ 0.05	10.00 $\pm$ 0.10	15.36 $\pm$ 0.23
Time 2	266.00 $\pm$ 1.98	0.27 $\pm$ 0.06	10.00 $\pm$ 0.20	15.46 $\pm$ 0.27

Note: Normal values: PLT 200-500 10^3 cells/ μl (Merk Veterinary Manual)

Tab. 5. The influence of anesthesia on the WBC count and differential count (mean $\pm$ S.E.M.)

	WBC $10^9/l$	LYM $10^9/l$	MID $10^9/l$	GRA $10^9/l$
Time 1	13.26 $\pm$ 0.46	2.00 $\pm$ 0.40	0.83 $\pm$ 0.13	10.50 $\pm$ 0.31
Time 2	7.02 $\pm$ 0.41	0.90 $\pm$ 0.10	0.38 $\pm$ 0.10	5.71 $\pm$ 0.40

Note: Normal values: WBC 6-17 10^3 cells/ μl , LYM 1-4.8 10^3 cells/ μl , MID 0.2-1.5 10^3 cells/ μl , GRA 3-12 10^3 cells/ μl (Merk Veterinary Manual)

Tab. 6. The influence of anesthesia on the glucoses, urea and creatinine (mean $\pm$ S.E.M.)

	Glucosis mg/dl	uree	creatinine
Time 1	235.58 $\pm$ 1.96	29.8 $\pm$ 0.53	0.77 $\pm$ 0.08
Time 2	160.26 $\pm$ 1.59	35.1 $\pm$ 0.4	0.79 $\pm$ 0.08

Note: Normal values: 63-100 mg/dl, urea 24-54 mg/dl, creatinine 0.48-1.54 mg/dl (Internal Medicine Pathology Laboratory FMV Cluj-Napoca reference values)

Tab. 7. The influence of anesthesia on the calcium, inorganic phosphorus, sodium and potassium (mean $\pm$ S.E.M.)

	Calcium mg/dl	Phosphorus mg/dl	Sodium mEq/L	Potassium mEq/L
Time 1	10.98 $\pm$ 0.20	5.39 $\pm$ 0.13	141.4 $\pm$ 5.41	4.08 $\pm$ 0.65
Time 2	11.61 $\pm$ 0.36	5.55 $\pm$ 0.13	141 $\pm$ 4.3	3.96 $\pm$ 0.35

Note: Normal values: calcium 10.48-11.52 mg/dl, phosphorus 2.47-5.57 mg/dl, sodium 135-155mEq/L, potassium 3.5-5.5 mEq/L (Internal Medicine Pathology Laboratory FMV Cluj-Napoca reference values).

Tab. 8. The influence of anesthesia on the ALAT, ASAT, LDH, GGT, PAL(mean $\pm$ S.E.M.)

	ALAT U/L	ASAT U/L	LDH U/L	GGT U/L	PAL U/L
Time1	85.58 $\pm$ 1.85	113.7 $\pm$ 2.79	163.8 $\pm$ 2.42	11.54 $\pm$ 0.95	275.8 $\pm$ 2.34
Time2	51.92 $\pm$ 1.07	28.63 $\pm$ 0.37	153.6 $\pm$ 1.39	8.06 $\pm$ 0.32	232.2 $\pm$ 1.98

Note: Normal values: ALAT under 40U/L, ASAT under 30 U/L, LDH under 200 U/L, GGT under 10 U/L, PAL 30-140 U/L (Internal Medicine Pathology Laboratory FMV Cluj-Napoca reference values)

Tab. 9. The influence of anesthesia on the Total Protein, Albumin and γ -Globulins (mean $\pm$ S.E.M.)

	Total protein g/dl	Albumin g/dl	γ -globulin g/dl
Time1	5.42 $\pm$ 0.21	2.27 $\pm$ 0.08	0.86 $\pm$ 0.08
Time2	5.92 $\pm$ 0.28	2.4 $\pm$ 0.12	1.13 $\pm$ 0.08*

Normal values : Total Protein : 4-6,4 g/dl, Albumin :1,7-3,14 g/dl, γ -Globulin 0,3-1,34 g/dl (Internal Medicine Pathology Laboratory FMV Cluj-Napoca reference values)

*= p<0.05 as compared to time 1

is different from findings of Selmi 2009 (in that study the glucose level and cortisol concentration were significantly higher within 1 hour after the surgery). Normal level of urea and creatinine show that the renal filtration remains normal and the anesthetic protocol will have a minimal impact on renal perfusion.

After the surgery the calcium and phosphorus level are increased, fact that is in conformity with the study made by Speed 1931 in human medicine (cited by Hardy 1993) after orthopedic procedures. To our knowledge no such studies exist in veterinary medicine.

Only one mild decrease is observed in potassium level, but remains in normal limit.

Alanin aminotransferases is located in hepatocytes cytosol (for diagnosis of hepatocellular disease the values of this enzyme must be higher than four times the upper limit), but also is erythrocytes and striated muscle cell. Also aspartate aminotransferases is located in hepatocytes (more exactly in mitochondria), but can be found in muscle cells and in red blood cells (Alvarez a, 2009). Due to increased values found before the anesthesia and operation we concluded that these modifications are determined by the

muscular trauma. The Cholestatic liver enzyme is increased, but the higher level of alkaline Phosphatase then γ -Glutamyl transpeptidase reflect the bone isoenzyme (that can be elevated in younger or older dogs) (Alvarez *et al*, 2009).

After the surgery due to local inflammation this values can be increased because of catabolic state seen after the injury (Hardy, 1993).

CONCLUSIONS

After surgery, with balanced anesthesia we found only slight changes in RBC, Hct, Hgb considered normal. The white blood cell count remained in normal limits.

After the surgery glucose level is lower than before surgery (a major difference from another protocols)

Total protein, albumin, γ -globulin increase reflects catabolic state after the surgery, but the normal values of urea and creatinine reflect that the level of renal perfusion remains optimal.

The increase in ALAT, ASAT level is determined by muscle injury and the increase of PAL is determined by bone injury, the anesthetic protocol doesn't affect the values of these enzymes.

Sodium and Potassium levels remain in normal limits.

RECOMMENDATION

We recommend the use of Rocuronium in orthopedic procedures for the advantages offered in the surgical act (profound myorelaxation) without any major biochemical, hematological, electrolyte alteration.

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