The Importance of Acid-base Analysis in Dogs Under Orthopedic Procedures Under General Anesthesia (P)

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Introduction. Venous blood gases analysis provides information on acid-base status and ventilation (venous partial pressure of CO₂) (Reiss, 2009). General anesthesia reduces the oxygenation degree of blood (Grimm, 2010), and SpO₂ analysis by transcutaneous monitor does not approximate correctly the level of oxygenation from the patient's body (Barter, 2011).

Material and methods. This study was performed on five canine patients (different breed, with ages between 4 months to 11 years, 3 males and 2 females), scheduled for femoral head resection procedures. A balanced anesthesia protocol was performed: **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** with fentanyl 3 µg/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 endotracheally intubated and mechanical ventilation was started (IPPV) - 15 mbar, 15 ml/kg b.w., 15 breaths/min (Dräger Cato VT 20 anesthesia machine). Ventilator parameters were adjusted in conformity with ET-CO₂ values

during the surgical procedures. Blood gases analysis was performed from venous blood (pH, PCO₂, HCO₃⁻, BE_{ecf}) using GEM Premier 2000 blood gas analyzer, in different times (-1- before induction, 0 – following induction and before administration of NMB, 15 – after NMB administration, 60 minutes and 120 minutes after induction). The collection of the blood samples was performed in heparinated syringe (Blood sample for Blood Gas with cone cap" 2 ml, Instrumentation Laboratory) exactly to the signs.

Results and discussions. In all of our cases anesthesia induced respiratory acidosis (pH under 7.35, PvCO₂ higher than 46 mmHg).

Tab. 1. Values of pH in dogs under general anesthesia

Casenumbr/ time	Case 1	Case 2	Case 3	Case 4	Case 5
-1	7.52	7.38	7.4	7.37	7.35
0	7.46	7.31	7.38	7.28	7.27
15	7.24	7.29	7.27	7.22	7.31
60	7.29	7.27	7.26	7.31	7.25
120	7.3	7.31	7.3	7.3	7.34

Note: Normal values in dogs': 7.35-7.45 (Reiss, 2009)

Tab. 2. Values of PvCO₂ in anesthesia dogs (venous blood)

Casenumbr/ time	Case 1	Case 2	Case 3	Case 4	Case 5
-1	27	42	38	40	45
0	26	49	37	45	55
15	56	53	48	51	50
60	48	55	50	42	56
120	45	50	52	50	45

Note: Normal values: PvCO₂:40-46 mmHg (Ress, 2009)

Tab. 3. HCO₃⁻ values under general anesthesia

Casenumbr/ time	Case 1	Case 2	Case 3	Case 4	Case 5
-1	22	24.8	23.5	23.1	24.8
0	18.5	24.7	21.9	21.1	25.3
15	24	25.5	22	20.9	25.2
60	23.1	25.3	21.9	21.1	24.6
120	22.1	25.2	21.6	21.6	24.3

Note: Normal values in dogs: HCO₃⁻:20-24 mmHg (Ress, 2009)

Tab. 4. ETCO₂ values under general anesthesia

Casenumbr/ time	Case 1	Case 2	Case 3	Case 4	Case 5
-1	46	45	32	33	44
0	50	45	38	33	51
15	42	43	42	40	38
60	36	41	47	41	37

Note: Normal values in dogs: ETCO₂ 35-45mmHg (Ress, 2009)

Tab. 5. BEecf values under general anesthesia

Casenumbr/ time	Case 1	Case 2	Case 3	Case 4	Case 5
-1	-0.9	-0.3	-1.3	-2.2	-0.8
0	-5.3	-1.6	-3.2	-5.6	-1.6
15	-3.4	-1.1	-4.9	-6.8	-1.1
60	-3.5	-1.6	-6.8	-5.2	-2.6
120	-4.3	-1.1	-5.2	-3.7	-1.5

Normal values in dogs: BEecf: -4 until 4 mEq/L (Ress 2009)

There is not direct correlation between the values of pCO₂ and ET CO₂ (Tab.2 and 4)

Blood gases analysis performed from venous blood, revealed more accurate the changes in PvCO₂ level, than the data obtained from ETCO₂, what remained under 45 mmHg, in the majority of the cases and can be inaccurate in small body sized patients (Barter, 2011). This aspect is very important in adjusting the settings used in mechanical ventilation for the reduction of respiratory acidosis induced by hypoventilation under general anesthesia.

Conclusion. We recommend the use of blood gases analysis in general anesthesia, for correction of mechanical ventilation settings and prevention of respiratory acidosis.

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