MEDWELL PUBLISHING
Journal of Animal and Veterinary Advances 8 (5): 946-948, 2009
ISSN: 1680-5593

The Effects of Carbon Dioxide Pneumoperitoneum on Certain Enzyme Levels in Dogs

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Abstract: The aim of the present study was found any changes in the Alanine Amino Transferase (ALT), Aspartate Aminotransferase (AST) and Ceratine Kinase (CK) of carbon dioxide insufflation. Seven adult dogs were used in the experiment. All animals were given ketamine-xylazine as general anesthesia Pneumoperitonuim was done with CO_2, gas insufflation was kept at a constant of 8 L min^{-1} and 12 mmHg throughout the experiment. ALT, AST and CK were measured at the beginning before given general anesthesia, before insufflation and 60 min, 24 h and 1 week after insufflation. The study show significant increase in ALT, AST and CK, 60 min after insufflation with CO_2 while, it retrained to normal value after 7 days. All changes not pass the normal range that's present in dogs and this put our to believe that pneumoperitoneum with CO_2 is suitable and safe method in dogs.

Key words: Pneumoperitoneum, carbon dioxide, ALT, AST, CK, dogs

INTRODUCTION

The direction of surgical growth during the last 10 years has been toward minimally invasive surgery. Gaseous insufflations of the abdomen (i.e., pneumoperitoneum) is used routinely during laparoscopic surgery to allow the surgical team members to view the patient's viscera and to perform indicated procedures (Safran and Orlando, 1994). Pneumoperitoneum is a complex process that affects many of the body's organ systems and in turn, is influenced by patient position and the insufflating agent (Schirmer, 1995; Osamu *et al*., 1998). Advanced laparoscopic procedures may take several hours and the effects of pneumoperitoneum are cumulative. Pneumoperitoneum has varying effects on the patient. The initiation and maintenance of pneumoperitoneum causes most of the complications seen with laparoscopic surgery. The most important complications expected with pnumoperitoneum are hypercarbia, acidosis, bradycardia, subcutaneous emphysema, pneumothorax. As intra abdominal pressure rises, systemic vascular resistance increases and cardiac output decreases. As cardiac output decreases, less of the lung is perfused and alveolar dead space results. Carbon dioxide (CO_2) is a commonly used gas for pneumoperitoneum insufflation during laparoscopic surgery for 3 main reasons: lack of toxicity, high solubility in blood and no support of combustion. Systemic absorption and subsequent elimination of CO_2 by the lungs have been well studied. Clinical trails have been found that pneumoperitoneum has potentially hazardous side effects, the biochemical bases of tissue injury induced by pneumoperitoneum is not well defined (Pross *et al*., 2000), Serum metabolites and hormones increase during to operative stress, glucose, cortisol, prolactin, β-endorphin, epinephrine and Interleukin-6 (IL-6), that is mean laparoscopy increase the release of stress factors and with prolonged insufflations, the development of hypercapnia and subsequent acidosis has been documented (Macfadyen and Ponsky, 1996). Since, it is undoubtful that pneumoperitoneum is an important damaged part in laparoscopy and because of its recent use in our practice, we perform this study to evaluate a damage effects of pneumoperitoneum on liver function tests (ALT and AST) and the enzyme activity creatinekinase in dogs.

MATERIALS AND METHODS

Laparoscopy were performed in 7 adult dogs from both sex, local breed weighing between 6-8 kg. Animals were housed in animal house at the College of Veterinary Medicine. The anesthesia was induced with i.m. Ketamine (15 mg kg^{-1}, Rotexmedica, Tritau, Germany) and xylazine

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(5 mg kg^{-1}, Pantex, The Netherlands). The surgery was performed with strict aseptic condition and antibiotic were administrated. The dogs were placed in supine position and the abdomen was sheaved and disinfected woth poltvidone iodine (iso-betadine; Astra Medica, Brussels, Belgium). A 10 mm trocar (Karlstorz, Tuttlingen, Germany) was induced by open laparoscopy through a 1 cm incision at umbilical region. The pnumoperitoneum created using 100% CO_2. This was achieved using insufflators (Thermoflator; Karl Storz, Tuttlingen, Germany). The intra abdominal pressure were fixed at 12 mm Hg and flow rate 8 L min^{-1}. A 10 mm 30 endoscope (Karl Storz), connected to a single chip video camera (Karl Storz) and light source (Karl Storz) was used, a continuous flow rate through the abdomenal cavity 8 L min^{-1}. The pnumoperitoneum was maintained subsequently up to 60 min. At the end of the surgery deflation of pneumoperitoneum were done to reduce postoperative pain and skin were suture with Silk No. 0 (Ethicon; England) one stitch simple interrupted technique.

Blood were collect from all animals at time 0 (prior to give general anesthesia and considered as negative control (Group I), immediately after given general anesthesia (Group II) and considered as positive control, than 60 min (Group III). after establishing pneumpritoneum, 24 h (Group IV) and 1 week after the surgery (Group V), blood CK metatrsal vein under aseptic condition using 18 G needle and 3 mL syringe. Serum was obtained and stored at -4 until the laboratory test were carried, which done at the same laboratory. Aspirate Aminotransferase level (AST), Alanine Aminotransferase (ALT), using colorimetric method (Zilva *et al*., 1994) and AST, ALT kit, (biomerieux company, France) using spectrophotometer at 505 nm and enzyme concentration expressed in U L^{-1}. Creatine Kinase activity (CK), were measured using same method (Zilva *et al*., 1999) with specific kit, (biolabo reagents company, France) using spectrophotometer at 340 nm and enzyme activity expressed in U L^{-1}.

Data are presented as mean±SE. Statistical analysis was performed with SPSS using 2-way analysis of variance followed with Duncan test to determine the difference between groups.

RESULTS AND DISCUSSION

Mortality was nil, all dogs were stable during the postoperative period. As it is shown in Table 1 there is no significant difference in ALT value after anesthesia, but after (1 h) pneumoperitoneum. there is significant elevation ($p \leq 0.05$) in ALT level in comparing with both –ve and +ve control group and this may be due to the effect of pneumoperitoneum on body organ as general

Table 1: Show the effect of pneumoperitoneum on serum ALT, AST, CK

	Parameters		
Groups	ALT (U L^{-1})	AST (U L^{-1})	CK (U L^{-1})
Group (Before anesthesia) (-ve control)	25.41±2.90^{b}	21.20±3.12^{b}	17.5±2.11^{b}
Group II (After anesthesia) (+ve control)	26.81±3.84^{b}	26.73±2.57^{a}	26.3±1.09^{a}
Group III (60 min. after pneumo.)	30.15±3.17^{a}	28.07±1.73^{a}	30.7±2.91^{a}
Group IV (24 h. after pneumo.)	24.35±1.98^{b}	20.99±2.82^{b}	21.5±1.27^{b}
Group V (1week after pneumo.)	23.98±3.08^{b}	21.69±2.84^{b}	19.25±2.15^{b}

Data mean±SE, Different letters means significant different at $p<0.05$

(and to liver and muscles in especial) and this is agree with (Pierre, 2002; Sakorafas *et al*., 2005) and it may be due to that CO_2 has high hematic solubility and can cause hypercapnia and respiratory acidosis, additionally, an intra-abdominal pressure 12-14 mmHg of CO_2 is higher than the normal portal blood pressure 7-10 mmHg and is thereforcapable to reducing portal blood flow and of causing alterations of the hepatic function (Takagi, 1998) also the effects of CO_2 could be due to the metabolic complication from the transperitoneal absorption of CO_2 and/or the elevated abdominal pressure (Hoolgson *et al*., 1970).

In group IV and V serum ALT level return to back near a control group level. While, in the state of AST levels, there is significant increase ($p \leq 0.05$) in group II (due to anesthetic drugs effect) and group III (due to pneumoperitoneum effect) in comparing with group I and cause may be due to the same reasons mentioned above in state of ALT (Takagi, 1998; Sakorafas *et al*., 2005) after that the level of AST return to near group I, in group IV and V and this may be due to loss of pneumoperitoneum effects after 24 h and 7 days.

In state of CK activity, the condition is differ, which there is increase of CK enzyme activity in group II comparing with control group I and more elevation in enzyme activity in group III (Table 1) and this result agree with (Rank, 1999) and it may be due to in general the stress effects of CO_2 pneumoperitoneum (Pross *et al*., 2000). After that CK enzyme activity in group IV and V return to near the level of group I due to loss of effect of CO_2 by the spend of the time.

Finally, it should be noted that all changes in ALT and AST levels and CK activity are within the normal range in dog as follows: normal range of studied parameters (Kahn, 2005).

In the study, we maintain 12 mm Hg insufflation pressure and this is agree with (Aksoy *et al*., 2001; Al-Badrany, 2006), this pressure did not yet dissect the neighboring tissue in dog (Aksoy *et al*., 2001).

CONCLUSION

Carbon dioxide is the current gas of preference for pneumoperitoneum, changes in ALT, AST and CK not

pass the normal range that's present in dogs and this put our to believe that pneumoperitoneum with CO_2 is suitable and safe method in dogs.

ACKNOWLEDGEMENT

This study was supported by the College of Veterinary Medicine, University of Mosul, Iraq.

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