

## Effect Halothane-Induced Anesthesia on Plasma Cortisol in Celiotomy in Pigeon

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**Abstract:** Blood biochemical factors are changed by anesthesia in birds. Cortisol is one of these factors which related to inflammation and pain at surgery or post-operation. In present study, we evaluated effect of halothane-induced anesthesia on plasma level of cortisol in pigeon. Ten domestic pigeons were used. The weight of birds was about 300 g. After 3 to 4 h food restriction, anesthesia was induced by halothane for celiotomy within 20 min. Anesthesia was induced by halothane at 2.5% with oxygen gas and it continued by 1.5% halothane. Blood sample was collected before, during and after surgery from pigeons and plasma level of cortisol was measured by commercial kit. Anesthesia induction and maintenance with halothane provided suitable anesthesia during celiotomy in pigeon. Plasma level of cortisol was significantly decreased after anesthesia. The mean of cortisol was 2.02 ng/mL before anesthesia and reached to 1.75 and 1.59 ng/mL in during and after anesthesia respectively. This change significantly differed with comparison to before surgery. But the mean of cortisol was not different significantly between duration of surgery and post operation. Halothane can decrease level of cortisol during anesthesia and so it decreases anti-inflammatory and analgesic effect of cortisol and also side effect of corticosteroids.

**Keywords:** Anesthesia, cortisol, halothane, pigeon

### INTRODUCTION

Halothane is a non-inflammable hydrocarbon that induces anesthesia, with little tendency to excitement (Mandelker, 1988; Thorstad, 1993; Deoki *et al.*, 2006). Halothane is potent coronary vasodilators, able to produce some degree of coronary steal in ischemic regions. Despite this, halothane may preferentially dilate large coronary arteries and/or interfere with platelet aggregation. If these experimental effects are confirmed, halothane may be the anesthetic of choice in the non-failing ischemic heart (Harrison, 1991).

Halothane has a mild depressive effect on cardiac performance (Thorstad, 1993). In human ventricular myocardium, halothane interacted with L-type calcium channels by interfering with the dihydropyridine binding site; this may, at least in part, explain its negative inotropic effect (Wheler, 1993). This drug depressed cardiovascular function significantly more than isoflurane in younger adults, but the falls in systolic and diastolic blood pressures in elderly patients were significantly greater with isoflurane (Bennett, 1993).

Halothane is sometimes used for birds. One of the reasons is that halothane is partly metabolized by the liver and, as many sick avian patients have some degree of hepatic function impairment, this can place the patient at some risk. Recovery is often extended and cardiac arrest often occurs at the same time as respiratory arrest giving little response time in an emergency. It was reported that cardiac arrhythmias

developed in five ducks at end-tidal halothane concentrations as low as 1.15% (Ludders, 1992). Halothane also depresses the responsiveness of the bird's intrapulmonary chemoreceptors to carbon dioxide. This is important as the intrapulmonary chemoreceptors only respond to increasing carbon dioxide levels in the anesthetized bird and not to hypoxia. Hence birds anesthetized with halothane are less able to adjust ventilation in response to changes in carbon dioxide levels.

Blood biochemical factors are changed by anesthesia in birds. Cortisol is one of these factors which related to inflammation and pain at surgery or post-operation. Metabolic and inflammatory aspects of the injury are part of an overall "stress response". These reactions can occur with trauma, burns, severe infections and physical exertion. Metabolic and neuroendocrine response to surgical intervention depends on several factors, such as severity and duration of the surgical trauma, patient's age, type of anesthesia and surgical techniques (Celic-Spuzic, 2011; Wolf, 2012).

In present study, we evaluated effect of halothane-induced anesthesia on plasma level of cortisol in pigeons.

### MATERIALS AND METHODS

Ten domestic pigeons were used. The weight of birds was about 300 g. After 3 to 4 h food restriction, anesthesia was induced by halothane for celiotomy

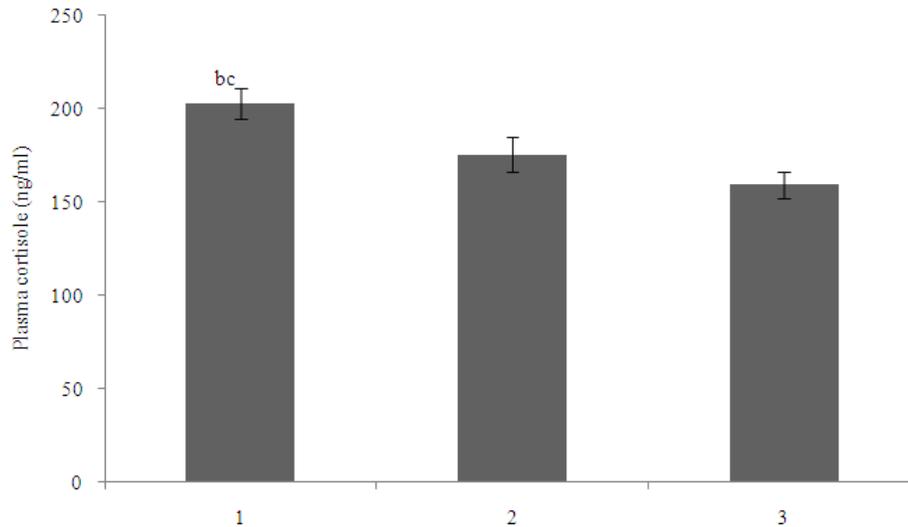


Fig. 1: Mean±SEM of plasma cortisol in pigeons, 1: Plasma cortisol before anesthesia; 2: Plasma cortisol duration of anesthesia; 3: Plasma cortisol after anesthesia; the mean of cortisol significantly decreased during and after anesthesia with comparison to before it ( $p < 0.05$ ,  $n = 10$ )

within 20 min. Anesthesia was induced by halothane at 2.5% with oxygen gas and it continued by 1.5% halothane. Blood sample was collected before, during and after surgery from pigeons. The amount of plasma level of cortisol was measured by commercial ELISA kit (Radim Co. Iran).

Statistical significance between groups was determined using SPSS program (USA, version 16). The minimum level of significance was ( $p < 0.05$ ).

## RESULTS

Anesthesia induction and maintenance with halothane provided suitable anesthesia during celiotomy in pigeon for 20 min. Plasma level of cortisol was significantly decreased after anesthesia (Fig. 1). The mean of cortisol was 2.02 ng/mL before anesthesia and reached to 1.75 and 1.59 ng/mL in during and after anesthesia, respectively. This change significantly differed with comparison to before surgery. But the mean of cortisol was not different significantly between surgery duration and post operation.

## DISCUSSION

Cortisol was the predominant glucocorticosteroid in immune tissues (bursa of Fabricius, thymus, spleen) and decreased with age. Cortisol levels in immune tissues were higher than cortisol levels in plasma (Schmidt and Soma, 2008).

At present study, we demonstrated the plasma level of cortisol decreased by halothane. Some studies reported opposite this effect. This controversy may be related to difference between mammals and birds. For example; cortisol and ACTH did not change significantly during halothane anesthesia in ponies (Taylor, 1998). Halothane anesthesia alone resulted in no change in plasma cortisol concentration in dog (Fox *et al.*, 1998). But result of some studies is similar to our result including (Rains *et al.*, 2009) report. They serum cortisol and salivary cortisol measured before and after anaesthesia and during recovery in children. The mean cortisol level was 303 ( $\pm 117$ ) nmoL/L at induction, 396 ( $\pm 241$ ) nmoL/L at emergence from anaesthesia and 584 ( $\pm 218$ ) nmoL/L during recovery (Rains *et al.*, 2009).

Stress of surgery may be increase cortisol level. Some relaxation manners such as listening to music during surgery under regional anesthesia has effects on cortisol levels (reflecting stress-reducing effects) and reduces sedative requirements to reach light sedation (Koelsch *et al.*, 2011). While cortisol did not change statistical significance by analgesia protocols during abdominal aortic aneurysm endovascular repair. Barbieri *et al.* (2011). Increased levels of ACTH intraoperative in anesthesia techniques applied, with a slightly larger increase in the value of the respondents with technique of general anesthesia. The values of ACTH after 24 h showed a return to preoperative values in case of techniques of anesthesia (Celic-Spuzic, 2011). Using plasma cortisol as a measure,

bupivacaine-based epidural anesthesia significantly reduces the stress response to surgical stimuli when compared with isoflurane-based tracheal general anesthesia (Aggo, 2012).

Cortisol levels in the saddle (regional) block group were significantly lower than in the intratracheal general anesthesia group at 3 h postoperatively (Buyukkocak *et al.*, 2006). Thus if anesthetic agent or surgery protocol could decrease stress and cortisol; it may help to more safe anesthesia and operation. In our study we demonstrated halothane reduces cortisol of plasma in pigeons; although it is needed to more research for a clinical comment.

### CONCLUSION

Halothane can decrease level of cortisol during anesthesia and so it decreases anti-inflammatory and analgesic effect of cortisol and also side effect of corticosteroids.

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