Research Article

Dogs' Hormonal Levels Drop after Surgical Gonadectomy in Iraq

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Abstract | This study was conducted to measure the level of hormonal dropping after surgical gonadectomy in male and female dogs, six male and six female dogs were used, the orchidectomy and ovariectomy were done to these animals after one month of quarantine in cages in at the College of Veterinary Medicine-University of Baghdad in April 2016. Serum was collected before the operation and weekly for one month afterwards. Canine ELISA kits were used for hormonal assays. The male testosterone (T), interstitial stimulating hormone (ICSH) and the spermatogenesis stimulating hormone (SSH) showed a significant (P<0.01) decrease after the operation with high correlation to time. The female oestrogen (E2), progesterone (P4), prolactin (PRL) and follicular stimulating hormone (FSH) also had a significant (P<0.01) level decrease with high correlation to time post-operation unlike the luteinizing hormone (LH). Results revealed that the surgical gonadectomy was safe and preferable for dogs' contraceptive and the male and female hormones dropped quickly after the gonadectomy.

Keywords | Gonadectomy, Hormones, Dropping, Dogs, Iraq

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INTRODUCTION

Gonadectomy is removing the source of circulating steroids by removing the gonads (testes or ovaries) (Kim et al., 2005). The reasons for neutralising were related to social, controlling populations or animal's health benefit purposes (Root-Kustritz, 2012). Trevejo et al. (2011) reported that 64% of United State's dogs submit to gonadectomy. In the same direction, Perrin (2009) said that 52% of people who had a dog want castrated animals. The favourable side of the gonadectomy was the low rate of deaths which did not exceeds 0.1% (Pollari et al., 1996). The reproductive events, in both male and female dogs, are controlled by the hypothalamus which releases the gonadotrophin-releasing hormone (GnRH). This hormone (GnRH) stimulates the pituitary gland to secrete (SSH or FSH) and (ICSH or LH) (Linde-Forsberg, 2001). These gonadotrophic hormones induce ovarian follicular development in females and spermatogenesis in males (Linde-Forsberg, 2001). The hypothalamic-pituitary-gonadal axis is regulated by the gonadal hormones when reached a certain concentration via negative feedback mechanism to control the further release of GnRH, and thus SSH or FSH and ICSH or LH (De-Gier, 2012). This study was conducted to follow up the drop-off of the steroid hormones after surgical castration/spaying in the dogs.

MATERIALS AND METHODS

Twelve adult dogs (six of each sex) aged between 2-3 years and mean weight of 20 kg were kept inside dog's cages during April 2016 in the Department of Surgery and Obstetrics of the College of Veterinary Medicine University of Baghdad for one month prior to the surgical operation. The orchidectomy of both testes and ovariectomy of both ovaries were done to all animals within one week (2 operations per day). The procedures of aseptic surgical techniques and post-operative care were done to all animals after castration. Blood samples were collected before the surgery and weekly for one month after the operation. Serum

Table 2: Mean ± SE of the E2, P4, PRL, FSH and LH (ng/ml) hormones levels before and after gonadectomy in female dogs.

Periods	Hormones				
	E2	P4	PRL	LH	FSH
Pre-operation	21.61±2.42 a	0.35±0.021 a	0.23±0.011 a	0.09±0.006 a	1.29±0.082 a
One week post-operation	20.46±2.51 b	0.23±0.020 b	0.12±0.010 b	0.06±0.007 a	0.95±0.093 b
Two weeks post-operation	19.02±2.61 c	0.17±0.022 c	0.09±0.011 bc	0.06±0.006 a	0.58±0.091 c
Three weeks post-operation	17.29±2.85 d	0.12±0.021 d	0.06±0.011 bc	0.03±0.008 a	0.52±0.081 d
Four weeks post-operation	15.27±2.74 e	0.09±0.011 e	0.03±0.010 c	0.03±0.008 a	0.35±0.080 e
LSD	0.760**	0.008**	0.067**	-	0.082**
Correlation coefficient	-0.987**	-0.972**	-0.936**	-	-0.965**
Regression coefficient	-5.6	-0.22	-0.16	-1.13	-0.81

Similar small letters represent no significant differences in the same raw; Different small letters represent significant differences at the level of **(P<0.01) in the same column

was separated and kept in -20°C for hormonal assays. T, SSH, ICSH hormones for males dogs and P4, E2, FSH, LH, PRL hormones for female dogs were measured by using canine ELISA kits (Biocompare).

Statistical Analysis

Means were statistically analysed by using ANOVA and LSD to determine the significance. The correlation and regression coefficient was used to know the hormonal dropping. The statistical analysis was done according to Al-Mohammed et al. (1986).

RESULTS AND DISCUSSIONS

All dogs subjected to gonadectomy did not show any sign of illness or inflammation during the post-operative care. The study also revealed that the T hormone levels significantly decreased (P<0.01) from 16.02±0.72 ng/ml before the operation into 2.85±0.51, 2.50±0.52, 1.52±0.41 and 0.81±0.43 ng/ml after one, two, three and four weeks respectively post the operation. There was a negative significant (P<0.01) correlation -0.676 with regression coefficient -11.02 in T hormone levels dropping after one month of operation (Table 1).

ICSH hormone levels also showed significant decrease (P<0.01) from 0.32±0.011 ng/ml before operation into 0.09±0.011, 0.06±0.012, 0.03±0.011 and 0.03±0.011 ng/ml each week post the operation. The results indicated that the dropping correlation was significantly (P<0.01) -0.789 and the regression coefficient was -0.22 one month after operation (Table 1).

The SSH hormone had a significant decrease (P<0.01) from 29.01±2.51 ng/ml before the operation to 23.05±2.30, 20.17±2.31, 17.29±2.10 and 16.13±2.01 ng/ml after one, two, three and four weeks respectively, with a negative

Table 1: Mean ± SE of the T, ICSH and SSH (ng/ml) hormones levels before and after gonadectomy in male dogs.

Periods	Hormones		
	T	ICSH	SSH
Pre-operation	16.02±0.72 a	0.32±0.011 a	29.01±2.51 a
One week post-operation	2.85±0.51 B	0.09±0.011 b	23.05±2.30 b
Two weeks post-operation	2.50±0.52 c	0.06±0.012 bc	20.17±2.31 c
Three weeks post-operation	1.52±0.41 d	0.03±0.011 c	17.29±2.10 d
Four weeks post-operation	0.81±0.43 e	0.03±0.011 c	16.13±2.01 e
LSD	0.072**	0.057**	0.860**
Correlation coefficient	-0.676**	-0.789**	-0.965**
Regression coefficient	-11.02	-0.22	-11

Similar small letters represent no significant differences in the same raw; Different small letters represent significant differences at the level of **(P<0.01) within the same column.

significant (P<0.01) correlation -0.965 and regression coefficient -11 in hormonal dropping (Table 1).

In the female dogs, the E2 hormone level was decreased significantly (P<0.01) from 21.61±2.42 ng/ml before the operation to become 20.46±2.51, 19.02±2.61, 17.29±2.85 and 15.27±2.74 ng/ml after one, two, three and four weeks respectively. Highly significant negative correlation (P<0.01) -0.987 with regression coefficient -5.6 in hormonal dropping after the operation was noticed (Table 2).

P4 hormone level clearly indicated that there was significant (P<0.01) dropping from 0.35±0.021 ng/ml before the operation to 0.23±0.020, 0.17±0.022, 0.12±0.021 and 0.09±0.011 ng/ml one, two, three and four weeks after the operation respectively. This hormone also showed a significant (P<0.01) correlation reached -0.972 and regression coefficient -0.22 in hormonal dropping after spaying (Table 2).

The PRL hormone also showed a significant (P<0.01) dropping in serum from 0.23±0.011 ng/ml before the operation to 0.12±0.010, 0.09±0.011, 0.06±0.011, 0.03±0.010 ng/ml one, two, three and four weeks after the operation respectively. The correlation coefficient was significantly negative (P<0.01) -0.936 with regression -0.16 in hormonal level dropping after operation (Table 2).

Despite dropping the dropping of LH hormone level, it was non-significant when comparing post and after operation levels. It was 0.09±0.006 before the operation and 0.06±0.007, 0.06±0.006, 0.03±0.008 and 0.03±0.008 ng/ml after one, two, three and four weeks respectively with regression coefficient -1.13 (Table 2).

Significant dropping (P<0.01) in FSH hormone was noticed from 1.29±0.082 ng/ml before the operation 0.95±0.093, 0.58±0.091, 0.52±0.081 and 0.35±0.080 ng/ml after one, two, three and four weeks. There was a -0.965 negative significant (P<0.01) correlation with regression coefficient -0.81 in hormonal levels dropping after operation (Table 2).

Reproductive hormones often have multiple roles through positive and negative feedback mechanisms (Abdel-Sater, 2011). The recent results showed that the gonadectomy of male and female dogs was safe and trusty method in contraceptive techniques. The current results indicated that the T hormone shows significant differences (P<0.01) between the periods before and the weeks after the operation, with -0.676 significant (P<0.01) correlation and -11.02 regression coefficient, because it is produced in the Leydig cells within the testes which are the main source of this hormone. High concentration of T hormone is maintained within the testicular tissue, and it is circulated in the body by diffusion from the spermatic cord into the testicular veins and arteries (Mendis-Handagama and Siril-Ariyaratne, 2005). Our recent study agrees with (Fukuda and Iida, 2000; Frank et al., 2003 and Vanderstichel et al., 2015) who stated that the surgically castrated dogs have T hormone concentration below 1.0 ng/ml with falling in sex hormones levels following orchidectomy. Ortega-Pacheco et al. (2006) found that there is a decrease in peripheral serum T hormone after surgically castrated dogs group even after challenge with a GnRH analogue, this might be referred to the reduction of T hormone blood flow and loss of testicular interstitial tissue. Basal plasma E2 concentrations are significantly higher in intact males than castrated ones and their range does not overlap (De-Gier et al., 2012). The basal plasma T hormone concentration appears to be reliable for verification of neuter status in male dogs.

This study showed that there is a significant decrease (P<0.01) in ICSH and SSH between the periods before and after the operation with a significant (P<0.01) -0.789, -0.965 correlation coefficient respectively, and -0.22 and -11 regression coefficient respectively with hormonal dropping. Meanwhile, ICSH stimulates the production and secretion of T hormone from the testes via Leydig cells (Mendis-Handagama and Siril-Ariyaratne, 2005). The secretion of this hormone is pulsatile, with recurrent episodes of secretion occurring every 2–4 hours; it promotes steroidogenesis by regulating the rate-limiting step of conversion of cholesterol into the T hormone precursor and pregnenolone (Concannon et al., 2009). The same pattern of pulsatile secretion with SSH and its secretion regulated by both gonadal steroids and inhibin (De-Gier et al., 2012). Peak T hormone concentrations follow those of ICSH by about 40 minutes and decline back to prestimulation values over a further 40–80 minutes (Shulman and Spritzer, 2014). T hormone is responsible for negative feedback mechanism of ICSH and male behavior after aromatization into E2 within the brain (Phelps et al., 1998).

E2 hormone in the female dogs demonstrated a significant decline (P<0.01) with time after the operation -0.987 and -5.6 correlation and regression coefficient respectively. Also, the P4 hormone showed a significant dropping (P<0.01) with significant (P<0.01) -0.972 correlation and regression about -0.22. High concentrations of T hormone or P4 hormone will reduce the secretion of GnRH and also the secretion of ICSH or LH and SSH or FSH as a result (Turner et al., 2001). The results of (Kellom and O'Conner, 1991) confirm that P4 in combination with E2 is capable of exerting both inhibitory and stimulatory effects on gonadotropin secretion, the LHRH regimen and the gonadal steroid milieu which are capable of interaction to influence the relative secretion of LH and FSH significantly. So, the suggestion that is the gonadotropin secretion seen in various physiological cases is due to a combination of E2 hormone and P4 hormone in conjunction with the hypothalamic LHRH secretory pattern. The E2 increases pituitary sensitivity to GnRH (Nett et al., 2002). The plasma E2 hormone concentration at 120 minute after GnRH administration can be used to differentiate between functional and non functional ovarian tissue in bitches (De-Gier et al., 2012). It shows up that the preovulatory pituitary enhanced sensitivity may occur as a result of a decrease in concentration of P4 rather than to an increase in the concentration of E2. E2 is also capable of altering secretion of FSH and LH in the absence of GnRH. The E2 induced a dose-dependent increase in secretion of LH, with a dose-dependent decrease in secretion of FSH. It hypothesised that the conflict effects on the secretion of LH and FSH might arise from E2 improving the production of some intra-pituitary factors involved in synthesis and secretion of FSH (Nett et al., 2002).

PRL appears to have a negative correlation with P4; thus, as P4 levels fall towards the end of metoestrus or pregnancy, PRL increases; it is the major luteotrophic hormone in this species (Razzaque et al., 2008). This hormone falls significantly (P<0.01) after the operation with significant (P<0.01) -0.936 correlation and regression -0.16 in our study. PRL have a gonadal function in domestic dog and rodents (Verstegen et al., 2008). E2 can also have an effect on the PRL producing cells within the anterior pituitary, and it is responsible for the increased concentrations of PRL in pubertal females and may also involve in late pregnancy increasing (Wiebe and Howard, 2009).

The LH hormone has no significant changes (P>0.01) with the spaying with -1.13 regression. The last hormone (FSH) showed a significant decrease (P<0.01) by time after the operation with -0.965 correlation and -0.81 regression. The GnRH regulates both LH glycosylation and LH polypeptide synthesis, and the E2 lowers the physiological concentration of GnRH that is necessary to stimulate this biosynthetic response. Moreover, E2 enhancement of GnRH-stimulated LH release appears to be due to its action on mechanisms regulating the release of the previously synthesised stored hormone as well as the release of newly synthesised LH (Ramey et al., 1987). The study partly agrees with the result of (De-Gier et al., 2012) who stated that FSH concentration is higher in bitches than in male dogs after gonadectomy. These basal values do not differ significantly. The same authors added that basal plasma FSH concentration appears to be more reliable than basal plasma LH concentrations for verification of neuter status in both male and female dogs.

CONCLUSION

Authors conclude that all these functions will be affected after gonadectomy operation due to the dropping of hormones with highly safe and peculiar methods of contraceptive.

CONFLICT OF INTEREST

None of the authors have any conflict of interest to declare.

AUTHORS CONTRIBUTION

All authors contirbuted equally.

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