Oestrous and ovarian activity in a female jaguar (*Panthera onca*)

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Summary. The mean $\pm$ s.e.m. duration of oestrus was 12.0 ± 1.0 days ($n = 7$) and the oestrous cycle length was 47.2 ± 5.4 days ($n = 6$) for a captive jaguar. Ovulation did not occur spontaneously, but was induced by treatment with hCG or LH-RH.

Introduction

Little specific information exists on reproductive events in most wild felids. Such knowledge is important for studies concerned with the artificial breeding of endangered feline species and as a data base now that more information is available on behavioural–ovarian–hormonal relationships and the successful artificial breeding of the domestic cat (Wildt & Seager, 1978; Wildt, Kinney & Seager, 1978c; Platz, Wildt & Seager, 1978; Wildt, Guthrie & Seager, 1978b; Chakraborty, Wildt & Seager, 1979). In the present study, observations were made of an adult jaguar (*Panthera onca*).

Materials and Methods

Bianca, a 28-month-old prepubertal female jaguar, was housed in an outdoor, covered cage enclosure and fed a commercial zoo diet. Water was always available. This animal had been raised from birth at the Gladys Porter Zoo, Brownsville, Texas, and no behavioural signs of oestrus had been observed by her caretakers up to this time. Daily visual observations of behaviour and monthly laparoscopic examination were undertaken to determine the onset of reproductive cyclicity. During the study, Bianca was not in visual or aural proximity to male or female jaguars. Daily records of oestrous behaviour were generally made by one of two technicians on a rotating basis. The first evidence of oestrous behaviour was defined as puberty. Laparoscopy was continued periodically during succeeding oestrous cycles, and blood samples were also collected.

Oestrus was defined as the period when specific behavioural activity, as described previously for this species (Stehlik, 1971), was exhibited. These behavioural signs included increased restlessness and pacing, rolling and distinct and prolonged vocalization. The oestrous cycle was considered to be the period from Day 1 of oestrus to Day 1 of the subsequent oestrus.

Anaesthesia, laparoscopy and laparoscopic photography were performed according to methods previously described for this species (Wildt, Bush, Whitlock & Seager, 1978a). Blood samples (20 ml) were collected by jugular venepuncture when the animal was anaesthetized for laparoscopy. The serum was collected and stored at -60°C until assayed. A heterologous double antibody radioimmunoassay validated for the domestic cat (Chakraborty *et al.*, 1979) was used to determine serum LH concentrations. This assay employed a bovine LH antibody (NIH-LH-B5), radioiodinated ovine LH (LER-1056-C2) and a canine pituitary standard (LER-1685-1). The minimum detectable LH level in this assay was 0.3 ng/ml and the inter- and intra-assay

coefficients of variation were 12.6 and 8.4%, respectively. The progesterone assay was performed using a progesterone double-antibody RIA kit purchased from Micromedex Systems (Horsham, Pennsylvania). The specificity of the rabbit progesterone antibody has been described by Niswender (1973). The intra-assay coefficient of variation was 8.4% and the minimum assay sensitivity was 0.1 ng/ml.

The induction of ovulation of laparoscopically detected follicles was attempted twice during oestrus (Table 1) by i.m. injections of 500 i.u. hCG (Pregnyl: Organon, Inc., West Orange, New Jersey) or 100 µg LH-RH (Abbott Laboratory, North Chicago, Illinois). On the first day that LH-RH was administered blood samples were obtained at 0 min (just before LH-RH injection) and at 15 and 30 min after injection. These samples were then assayed for LH and progesterone.

Results

Plate 1 illustrates various stages of ovarian morphology of the jaguar as documented by laparoscopy. The uterus was bicornuate with the ovary normally covered by a translucent ovarian fimbria attached laterally to the dorsal suspensory ligament. Using the measuring probe, the fimbria was removed exposing a smooth ovoid shaped ovary approximately 3.5 cm long (Pl. 1, Fig. 1). At oestrus, the ovaries contained distinct translucent follicles, spherical and generally not protruding above the ovarian surface (Pl. 1, Fig. 2). Follicle number and size varied according to the stage of the cycle (Table 1); there were usually no more than 3 or 4 vesicular follicles (3–6 mm in diameter) visible at the surface of the 2 ovaries.

Corpora lutea (CL), when present, were prominent, contained slightly cratered domes (Pl. 2, Figs 4 and 5) and were larger in diameter (8–10 mm) than the corresponding vesicular follicle. Luteal tissue varied from dark orange to pale yellow in colour and was often traversed by distinct vascular patterns (Pl. 2, Fig. 5). The CL regressed to become a corpus albicans and remained visible as yellowish scars (< 1 mm in diameter, Pl. 1, Fig. 3) for as long as 6 months.

Bianca exhibited her first behavioural oestrus at 29.5 months of age and subsequently experienced 7 distinct periods of oestrus. The mean $\pm$ s.e.m. duration of oestrus was 12.0 ± 1.0 days and the average cycle duration 47.2 ± 5.4 (range 31–63) days.

There was no evidence of spontaneous ovulation. In cycles in which no hormone was administered, vesicular follicles gradually regressed during the second half of oestrus, and there were no apparent elevations in LH or progesterone. Ovulation did occur after treatment with hCG (4th oestrus) or LH-RH (7th oestrus) as shown by the presence of CL and elevations in serum progesterone (Table 1).

Discussion

The mean lengths of oestrus and the oestrous cycle for the jaguar in this study were similar to those (12.9 and 42.6 days, respectively) reported by Sadleir (1966) for a single jaguar, and are much longer than the values for the domestic cat of 5.8 and 14–19 days (Wildt *et al.*, 1978b).

PLATE 1

Fig. 1. A measuring probe is being used to lift the fimbria from the surface of a quiescent ovary.

Fig. 2. Ovary containing 3 vesicular follicles (arrows) on Day 6 of oestrus (4th oestrus).

Fig. 3. Ovary containing 2 corpora albicantia (arrows) approximately 6 months after ovulation.

PLATE I

(Facing p. 556)

Fig. 4. Ovary containing 3 corpora lutea (arrows) 4 days after hCG administration (4th oestrus).

Fig. 5. Ovary containing 2 corpora lutea 13 days after administration of LH-RH (7th oestrus). One CL (white arrow) has a cratered dome and the other CL (black arrow) shows distinct vascular patterns.

Table 1. Chronology of oestrous behaviour (+), ovarian activity and serum LH and progesterone concentrations in a jaguar

Oestrus (duration)	Dates	Oestrous behaviour	Comments/ovarian activity	LH (ng/ml)	Progesterone (ng/ml)
	3 Sept. 1976	—	No follicles	3.9	3.9
	12 Oct. 1976	—	1 follicle (1 mm)	3.6	0.7
1 (15 days)	4 Nov. 1976	+	Day 1 of oestrus, NL	—	—
	9 Nov. 1976	+	3 follicles (5, 4.5, 3 mm)	4.8	0.6
	10 Nov. 1976	+	NL	4.7	0.5
	12 Nov. 1976	+	2 follicles (5, 4.5 mm)	3.9	0.2
	18 Nov. 1976	+	Last day of oestrus, 1 follicle (2 mm)	4.1	0.8
	24 Nov. 1976	—	NL	4.1	1.0
2 (15 days)	20 Dec. 1976	+	Day 1 of oestrus, 4 follicles (5, 5, 4, 4 mm)	3.4	0.2
	3 Jan. 1977	+	Last day of oestrus, 2 follicles (3, 3 mm)	5.9	0.1
3 (12 days)	19 Jan. 1977	+	Day 1 of oestrus, NL	—	—
	30 Jan. 1977	+	Last day of oestrus, NL	—	—
4 (7 days)	26 Feb. 1977	+	Day 1 of oestrus, NL	—	—
	3 Mar. 1977	+	3 follicles (6, 5.5, 5.5 mm), hCG	2.5	0.4
	4 Mar. 1977	+	Last day of oestrus, NL, hCG	—	—
	7 Mar. 1977	—	3 CL (8, 8, 8 mm)	3.4	12.0
5 (11 days)	29 Apr. 1977	+	Day 1 of oestrus, NL	—	—
	9 May 1977	+	Last day of oestrus, NL	—	—
	20 May 1977	—	3 CL (2.5, 2.5, 2 mm) from Oestrus 4	5.4	11.6
6 (13 days)	30 June 1977	+	Day 1 of oestrus, NL	—	—
	12 July 1977	+	Last day of oestrus, NL	—	—
	13 July 1977	—	1 follicle (2 mm) 3 CA from Oestrus 4	5.0	3.6
7 (11 days)	8 Aug. 1977	+	Day 1 of oestrus, NL	—	—
	12 Aug. 1977	+	4 follicles (4.5, 4, 3.5, 3.5 mm), LH-RH	4.4 (0 min) 61.5 (15 min) 56.1 (30 min)	0.6 2.2 6.6
	15 Aug. 1977	+	NL, LH-RH	3.7	22.1
	18 Aug. 1977	+	Last day of oestrus, NL	—	—
	25 Aug. 1977	—	3 CL (10, 9.5, 8 mm), 3 CA from Oestrus 4	4.3	67.7

CA, corpus albicans; CL, corpus luteum; NL, not examined by laparoscopy; —, no sample.

The jaguar resembled the domestic cat with respect to reproductive tract anatomy, ovulatory mechanism and hormonal response to LH-RH. Although larger, the reproductive organs of the jaguar, including ovarian follicle and CL morphology, were similar in appearance to those of the domestic queen (Wildt & Seager, 1979). The results suggest that, as in the domestic queen (Greulich, 1934; Hamner, Jennings & Sojka, 1970; Wildt & Seager, 1978) and lion (Rowlands & Sadleir, 1968), ovulation in the jaguar is not spontaneous but can be artificially induced by hormonal treatment. In addition, the immediate rise in serum LH and subsequent ovulation resulting from LH-RH administration in the present study was similar to that recently reported in the domestic queen exhibiting oestrus (Chakraborty *et al.*, 1979).

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