The Influence of Hypophysectomy on the Time of Oviposition in Hens

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Frapes (1942) has first suggested, from the occurrence of premature ovulation resulting in the occurrence of premature oviposition, that there is a close relationship between oviposition and ovulation. The contraction of the uterine muscle which plays a main role in the expulsion of an egg from the uterus is observed whenever ovulation occurs regardless of the presence or the absence of an egg in the uterus (Shimada and Asai, 1978). The retained egg in the uterus by the short term vaginal ligation is expelled from the uterus in association with ovulation (Nakada and Tanaka, 1990). These results adduce some additional evidence suggesting that the ovulation process participates in the regulation of oviposition. A presumption evolves that the time of midsequence oviposition which is commonly accompanied by the next ovulation may be delayed by preventing ovulation in hens. This study was made to examine the influence of removal of the anterior pituitary gland on the time of mid-sequence oviposition in the domestic fowl.


Key words: hens, hypophysectomy, oviposition, ovulation

Materials and Methods

Single Comb White Leghorn hens (10-12 month-old, 1.8-2.0 kg BW) were individually caged and maintained in a light cycle of 14 hrs light (05:00-19:00 hr) and 10 hrs dark, and were fed and watered ad libitum. All hens selected for the present study were producing clutches of more than 5 eggs with a pause of a single day between clutches. Daily oviposition times were recorded automatically for at least 2 weeks prior to experiments. The time of ovulation was predicted based on the time of oviposition of the preceding egg, which usually occurred 15 to 30 min prior to a mid-sequential ovulation. To confirm the expected time of ovulation, the arrival time of an ovulated egg at the uterus was checked by palpation of the uterus.

In order to investigate the influence of ovulation on the time of oviposition, hens were hypophysectomized under deep anesthesia. Anesthesia was made by an intravenous injection of pentobarbital Na (Nembutal, Abbot Lab., North Chicago, IL; 40 mg/hen) at 5-10 hrs after ovulation of the first ovum (C1) of a clutch. Hypophysectomy

Received Dec. 7, 1992
was performed with the aid of a stereotaxic instrument using the transbuccal approach (TANAKA and NOBUKUNI, 1977). In hens on which a sham operation was performed, the sphenoid bone was drilled, the dura was cut after anesthesia, but the pituitary was not removed. Completeness of hypophysectomy was checked by visual inspection at the time of autopsy.

In preliminary tests, the minimum dose of Pregnant mare’s serum gonadotrophin (PMSG) for maintaining ovarian follicles was determined in hypophysectomized hens. PMSG (Serotonin; Teikoku Zouki, Ltd; 50 i.u./hen) was dissolved in 0.9% NaCl and injected intramuscularly just after hypophysectomy. To induce ovulation in these hens, LH (NIH–LH–B8, 0.5 mg/hen dissolved in 0.9% NaCl) was intravenously injected at 20:00–21:00 hr on the day of operation.

**Results and Discussion**

At autopsy, the complete removal of the anterior pituitary was verified in all hens that had been operated upon. When hypophysectomy was made 5–10 hrs after ovulation of C1 ovum, subsequent ovulations did not occur in the operated hens both injected and non–injected with PMSG. However, ovulation was induced by LH injection in these operated hens.

The influence of hypophysectomy on the time of oviposition is shown in Table 1. Of a total of 15 hens injected with PMSG following hypophysectomy, in 3 hens the mean lag value from the expected time of oviposition was 1.10 hrs, while in the remaining 12 hens it was 4.70 hrs. When ovulation of the second ovum (C2) in a clutch was induced by LH injection in 8 hens pretreated with PMSG (Table 1), oviposition of a uterine egg, resulting from C1 that had ovulated at the time of hypophysectomy, occurred prematurely 6.30 hrs earlier in 6 hens and at the normal time in the remaining 2 hens. The next ovulation (C2) in the hens that prematurely oviposited took place simultaneously, from 01:00 to 03:00, at the time of the premature oviposition. On the other hand, C1 oviposition was delayed for 4.20 hrs in a hen that did not receive any hormone treatments. In six sham operated hens with the intact pituitary gland, oviposition occurred at the normal time.

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<th>Table 1. Influence of hypophysectomy on the time of oviposition</th>
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<td><strong>Treatment after hypox</strong></td>
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<tr>
<td>Administration of PMSG</td>
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<td>Induction of ovulation in hens treated with PMSG and LH</td>
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<td>No hormonal treatment</td>
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<td>Sham operation</td>
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* Hypophysectomy.
Values in parentheses indicate the numbers of hens laying eggs.
A mid-sequence egg is laid in association with a subsequent ovulation, while oviposition of a terminal egg occurs in the absence of associated ovulation. The time interval from ovulation to oviposition is generally shorter in the mid-sequence egg than that in the terminal egg without associated ovulation (FRAPS, 1955).

In this experiment, associated ovulation was beforehand eliminated by hypophysectomy, thus the mid-sequence egg was equivalent to the terminal egg. In this case, the time interval from ovulation to oviposition was almost the same as that in the case of the normal terminal egg (Table 1). It was also demonstrated that, in the hypophysectomized hen with a uterine egg, the induction of premature ovulation causes premature oviposition (Table 1). Hence, the longer interval from ovulation to oviposition in the normally terminal egg may be due to the lack of associated ovulation, while the shorter interval for the mid-sequence egg may be attributed to acceleration of oviposition by associated ovulation. Our result agreed with that of FRAPS (1942) who first reported the involvement of ovulation in the hastening of oviposition. FRAPS’ conception has been also confirmed by the facts that ovulation induced by progesterone causes premature oviposition (WILSON and SHARP, 1986) and that uterine contraction coincides with the time of ovulation (SHIMADA, 1979).

On the other hand, ROTHCHILD and FRAPS (1944) have reported involvement of the largest postovulatory follicle in the time when oviposition is controlled in the hen. TANAKA and NAKADA (1974) have demonstrated that injection of extracts of either the preovulatory or the postovulatory follicular wall induces premature oviposition, suggesting that the ruptured follicle might be normally concerned in the mechanism of oviposition.

Judging from the above reports and our result, oviposition of a mid-sequence egg seems to be hastened by associated ovulation.

References

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