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Influence of multiple daily injections of oxytocin on reproductive and milk characteristics of postpartum dairy cows

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Abstract

Release of oxytocin at the time of suckling or milking may delay onset of estrous cycles in postpartum cows. Twenty lactating Holsteins were used in this study to determine if multiple daily injections of oxytocin would prolong postpartum anestrus. Cows received either oxytocin or saline (controls) intravenously through indwelling jugular catheters four times daily for 28 days following calving. Treatment with oxytocin did not lengthen intervals to ovulation or estrus or alter secretion patterns of luteinizing hormone, cortisol, progesterone, or 13,14-dihydro-15-keto prostaglandin F2αin serum. Although milk production, percentage protein, and somatic cell counts were similar between treatment groups, oxytocin appeared to increase (P<.10) percentage of fat 0.99 vs 3.68%) in milk. Involution of the reproductive tract (uterus and cervix) was also similar between oxytocin-treated and control cows. We concluded that oxytocin alone does not prevent the occurrence of estrus and ovulation in dairy cows or hasten the rate of cervical and uterine involution.; Dairy Day, 1986, Kansas State University, Manhattan, KS, 1986;

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INFLUENCE OF MULTIPLE DAILY INJECTIONS OF OXYTOCIN ON REPRODUCTIVE AND MILK CHARACTERISTICS OF POSTPARTUM DAIRY COWS

R. E. Stewart and J. S. Stevenson

Summary

Release of oxytocin at the time of suckling or milking may delay onset of estrous cycles in postpartum cows. Twenty lactating Holsteins were used in this study to determine if multiple daily injections of oxytocin would prolong postpartum anestrus. Cows received either oxytocin or saline (controls) intravenously through indwelling jugular catheters four times daily for 28 days following calving. Treatment with oxytocin did not lengthen intervals to ovulation or estrus or alter secretion patterns of luteinizing hormone, cortisol, progesterone, or 13,14-dihydro-15-keto prostaglandin $F_{2\alpha}$ in serum. Although milk production, percentage protein, and somatic cell counts were similar between treatment groups, oxytocin appeared to increase ($P<.10$) percentage of fat (3.99 vs 3.68%) in milk. Involution of the reproductive tract (uterus and cervix) was also similar between oxytocin-treated and control cows. We concluded that oxytocin alone does not prevent the occurrence of estrus and ovulation in dairy cows or hasten the rate of cervical and uterine involution.

Introduction

Initiation of normal estrous cycles in postpartum cows is a major factor in maintaining yearly calving intervals that are associated with higher and more efficient milk production. Lactating cows require more time after calving to begin estrous cycles than nonlactating cows, and suckling has a stronger inhibitory effect than milking on the re-establishment of estrous cycles. In additon, four times daily milking prevents estrous cycles longer than twice-daily milking. Hormones released at milking or suckling, such as cortisol, prolactin, and oxytocin, could be involved in this inhibitory process. Studies examining the roles of prolactin and cortisol have shown slight effects on postpartum hormonal secretion but no effects on re-establishment of estrous cycles. However, there is little information on how oxytocin, the milk let-down hormone, affects postpartum reproductive function. Uterine involution is completed earlier in milked cows than in nonlactating cows, probably because of the smooth muscle stimulation by oxytocin. The objectives of our study were to determine the effects of multiple daily injections of oxytocin on 1) postpartum intervals to ovulation and estrus, 2) postpartum hormonal secretion, and 3) involution of the reproductive tract.

Procedures

This study utilized 20 cows of mixed parity that calved during January and February, 1985. Cows were balanced for previous milk production and assigned randomly at calving to receive either oxytocin (100 mU) or saline four times daily (0530, 1030, 1730, and 2230 h) via jugular catheters for 28 days. Cows were milked twice daily (0130 and 1330 h). Involution of the reproductive tract was determined

by twice weekly palpation until gross involution was completed. Cows were weighed once weekly for 8 wk. Daily milk production and weekly protein and fat percentages and somatic cell counts were recorded for each cow.

Blood was collected thrice weekly and analyzed for concentrations of progesterone in serum. This enabled us to determine intervals to first and second ovulations. Blood also was collected on day 12 postpartum every 15 min for 6 h to monitor changes in luteinizing hormone, cortisol, and 13,14-dihydro-15-keto-prostaglandin $F_{2\alpha}$ (a serum-stable metabolite of prostaglandin F_2). Intervals to first estrus were determined by checking for estrus throughout the day, as well as early morning and evening heat checks.

Results and Discussion

Intervals to ovulation and estrus were similar for oxytocin-treated and control cows (Table 1). One cow from each treatment remained anovulatory during the experiment. In addition, no cows were observed in heat before the first ovulation (estrous cycle). As shown in Table 1, most cows had two estrous cycles before 60 days postpartum.

Table 1. Postpartum intervals (days) to ovulation and estrus[a]

Treatment Group	No. Cows	First Ovulation	No. Cows	Second Ovulation	No. Cows	First Estrus
Control	9	26 ± 6	9	52 ± 8	9	53 ± 9
Oxytocin	9	27 ± 6	8	51 ± 8	5	48 ± 9

[a]Mean $\pm$ SE.

Rate of involution of the reproductive tract was not increased by adminstration of oxytocin. However, younger cows had smaller cervices and shorter intervals to completion of cervical involution than older cows. These differences tended to become less as gross involution approached completion.

Changes in body weight were not influenced by treatment, but older cows lost more weight early postpartum, whereas younger cows maintained their body weight.

Daily milk yield, percentage fat and protein, and somatic cell counts are shown in Table 2. Percentage fat in milk tended to be higher ($P<.10$) in oxytocin-treated cows than in controls. Older cows produced more milk (70.8 vs 44.8 lb/day) and had higher butterfat (4.18 vs 3.65%) than younger cows. Oxytocin did not affect milk yield, percentage protein, or somatic cell count.

Table 2. Daily milk yield and milk constituents

Milk traits	Treatment Group	
	Control	Oxytocin
Daily milk yield, lb	56.7 ± 1.8	51.1 ± 1.8
Milk fat, %	3.68 ± .21	3.99 ± .22[a]
Milk protein, %	3.02 ± .08	3.00 ± .09
Somatic cell count, 10^3	294 ± 219	369 ± 233

[a]Different from control ($P<.10$).

Since calves generally nurse five to six times daily, the four daily injections of oxytocin were equally spaced around the twice-daily milkings to simulate the release of oxytocin caused by suckling or milking. The dosage of oxytocin administered was sufficient to cause milk let-down because milk leaking from teat ends of treated cows was observed after injections of oxytocin. The results of this study indicate that oxytocin alone does not appear to inhibit reestablishment of postpartum ovarian cyclicity, but it is possible that oxytocin is part of an inhibitory complex of hormones originating in the brain or pituitary that delays the onset of estrous cycles after calving.