Evidence of Ovarian Cyclicity Derived from Urinary Progesterone in Asiatic Elephants

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Introduction

For the past 20 months we have been collecting urine samples from the three female captive Asiatic elephants at the Buffalo Zoo. This project has two goals. First, we are attempting to see if variations in urinary progesterone reveals evidence of ovarian cyclicity. Second, we are attempting to see if urinary cortisol levels vary systematically with variations in husbandry practices. This report concerns progesterone; our findings concerning cortisol will be presented elsewhere.

Methods

Urine is collected in 50 ml centrifuge tubes fixed in a clasp at the end of a 2 meter pole (a modified broom handle). Once urination begins, the volume and duration excreted typically allows the keepers sufficient time to retrieve the pole, uncap a tube, and position it behind the elephant to capture fluid in midstream. The keepers make every effort to collect the first urine of the day for each of our three elephants. Most samples are collected between 8 am and 10 am.

The 50 mls of urine collected in this way is then divided into two identical tubes and sealed. The outside of both tubes are then washed, labeled, and immediately placed into a freezer at -20 deg C. The two identical 25 ml aliquots thus preserved allow us (a) redundant storage and (b) periodic checks on the reliability of our assay procedures.

Before analysis, samples are coded with randomized ID numbers so that the assay procedures are conducted in a blind fashion relative to elephant ID and date. Selected urine samples are shipped frozen to Cornell Diagnostic Laboratories in Ithaca, NY where radioimunoassays are performed to assess the concentrations of progesterone and cortisol. Additionally, the concentration of creatinine is assessed. Since the metabolism of creatinine is thought to occur at a steady rate, its level is widely used as a general index of the overall concentration of the urine (i.e., its degree of wateriness). Accordingly, to correct for day-to-day variations in the amount of water contained in the urine, we use a progesterone/creatinine ratio as the measure of interest (rather than absolute values of progesterone concentration in the urine).

All data points sampled are included in the enclosed figures.

Results & Interpretations

Our findings to date are summarized in Fig. 1.

Our oldest elephant, Sheba, is 41 years old and shows a consistently low progesterone/creatinine ratio. She appears not to be cycling and we attribute this to her advanced age.

Our other two elephants, Jothi and Surapa, aged 17 and 16 respectively, show periodic fluctuations in their progesterone/creatinine ratios with inter-peak intervals of about 16.5 weeks—a period consistent with what one would expect for elephant ovarian cyclicity.

In working with these elephants, it has only been during the past 5 months that our staff has been able to reliably collect blood samples. It is therefore only during this most recent time period that we have been able to simultaneously collect urine and blood samples. Fig. 2 presents the data for both urinary and blood progesterone levels obtained over that recent 14 week time period. For each animal, the figure shows progesterone levels in the blood and urine rising and falling together. The Pearson-r correlation relating urinary progesterone with serum progesterone was .869 for Jothi and .852 for Surapa, and both of values are significant at $p < .001$.

Closing

The very high correlation values we have recently obtained between urinary and serum progesterone levels confirm and validate our urinary assays. We have growing confidence that the cyclic variations (over five cycles) that we have been observing in urinary progesterone for both of our elephants are reflective of a normal ovarian cyclicity.

The nominal ovarian cycle of the Asiatic elephant is 15-16 weeks. For each of the Buffalo Zoo's two young female elephants, the "line of best fit" for their urinary progesterone levels is a cyclic wave with a period of 16.5 weeks. Although the findings presented here should be considered preliminary, we feel that it is reasonable to conclude from them that both elephants have been cycling normally for the past 20 months.

We welcome any comments, suggestions, or criticisms regarding our methods, findings or interpretations.

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