

Tracking Endometrial Cyst Growth Using Magnetic Resonance Imaging

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Introduction: Endometriosis, the presence of a functional endometrium outside the uterine cavity, is an estrogen-dependent condition that affects 5 million American women¹. Traditional methods of measurement in animal models of endometriosis require multiple surgical interventions to monitor the effect of drug treatment on the growth of auto-transplanted uterine tissue². Our laboratory has established a rat model of endometriosis in which the growth of the tissue is monitored non-invasively using MRI. In this study, we evaluate the effect of a gonadotropin releasing hormone antagonist, antide, followed by hormone supplementation.

Methods: *Animal Model:* Sprague Dawley female rats (n=12) were monitored for at least three consecutive 4-day estrous cycles. On a day of estrus, a 5x5 mm patch of uterine tissue was autotransplanted to the peritoneal wall. The implants were allowed to grow for a minimum of 3 weeks. After MRI baseline measurements of cyst volume were taken, rats were subcutaneously dosed with 2 mg/kg of antide, a gonadotropin releasing hormone antagonist, every 3 days at day 0, 3, 6, and 9 to reduce ovarian hormones. On Day 12 the antide effect on cyst volume was measured by MRI. Following antide treatment, the rats were then divided into groups of six each and received hormone pellets containing estradiol (0.5mg) or progesterone (25mg) sub-cutaneously. MRI imaging was performed on day 4 and 8 of pellet hormone release.

MRI: Images were acquired on a Bruker Biospec 4.7T/40 cm horizontal bore magnet using a homemade half birdcage surface coil. A multi-slice coronal spin echo scout image (TR/TE=593/15 ms, FOV= 10X10 cm, matrix=128X128, slice thickness = 1 mm, NEX=1) was initially acquired to locate the cyst. This was followed by a multi-slice transverse high resolution scan acquired through the cyst using a T₁ weighted spin echo sequence (TR/TE=400/15 ms, FOV = 5X5 cm, matrix=256X256, slice thickness = 1 mm, NEX =1). Images were analyzed on a Linux workstation using ParaVision software.

Results: The endometrial cyst on the peritoneal wall was clearly visible in the autotransplant rat model of endometriosis (Fig 1). Figure 2 represents transverse MR images of one animal's cyst at baseline (A) and after 12 days on antide (B). Significant cyst shrinkage ($\downarrow\sim 80\%$) was observed in animals treated with antide (Fig 3). Endometrial cyst volume changes after 12 days on antide and subsequent hormone supplementation are shown in Fig 3. The estradiol group showed significant cyst size increase from its respective antide volume ($\uparrow\sim 100\%$) after only 4 days with pellets ($P<0.05$), whereas the progesterone group showed no significant increase in eight days.

Figure 1



Figure 2

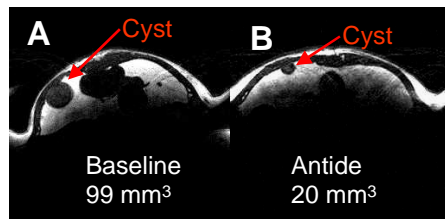
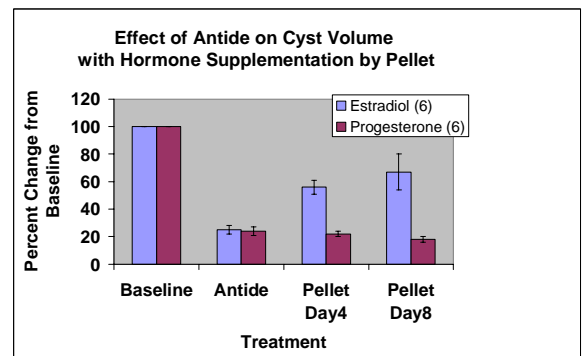


Figure 3



Summary: Through the use of MRI technology, we can examine the effect of pharmacological agents on endometrial cyst volume over multiple time points within the same animal.

References:

1) Hastings et al, *Sem in Rep Med* vol.21:2, 255-62, 2003. 2) Sharpe et al, *Am J Obs Gyn* vol. 164:1,187-194, 1991.