Female rat reproductive anatomy and non-surgical embryo transfer
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Our laboratory has been investigating the reproductive anatomy of the female rat as it relates to non-surgical embryo transfer. Although there are a number of references for the anatomy of the rat reproductive tract, there is disagreement among the various anatomical descriptions. We hypothesized that an accurate assessment of the rat reproductive tract would enable us to begin designing a method for transcervical embryo transfer in the rat. The purpose of this study was to perform dissections on rats of a variety of sizes and two breeds in order to accurately describe and make measurements of the rat reproductive tract (length of the vagina, length of cervix, length of uterine horns, length of the ovary + bursa). In addition, this study would provide useful reference information on female rat reproductive anatomy.

Anatomical measurements were taken of 39 Sprague Dawley and six nude female rats. Rats were obtained from other investigators at Tufts after use in unrelated studies and euthanized on the premises. Additional rats were obtained from other facilities after being euthanized and stored cold for same day dissection. Measurements were made using a digital caliper. For each specimen we recorded the length of the vagina, the length of the cervix, the length of the ovary + ovarian bursa, and the length of the uterine horns. To expose the reproductive tract we opened specimens from the floor of the vagina to the lower abdomen, also cutting through the pelvic girdle. Horns and ovaries were exposed and measured. We recorded weights for each specimen and took photographs of representative animals to illustrate the rat’s unique anatomy.

Mean measurements for length of vagina, length of cervix, length of uterine horns (right and left), length of the ovary plus ovarian bursa (right and left) and mean body weight are shown below.

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th>Length of vagina (mm)</th>
<th>Length of cervix (mm)</th>
<th>Length of uterine horns (R/L) (mm)</th>
<th>Length of ovary + Bursa (R/L) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>255.82</td>
<td>15.77</td>
<td>9.40</td>
<td>43.30/42.73</td>
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</table>

Weight was significantly correlated with vaginal length, cervical length and ovary size (Pearson’s correlation p<0.05). Weight was not correlated with uterine horn length, but this might be explained by the different life history of the rats used in this study, some of which had previously reproduced and some of which had not.

We found that rats have a single cervical os surrounded by four petal-like papilla (top, bottom, and either side). Although externally the rat appears to have one cervix, internally the cervix is immediately divided by a septum into two non-communicating canals. The septum continues to the bifurcation of the uterine horns, preventing the horns from communicating with each other.

Aside from serving as an anatomical guide, the findings presented here have a major implication for the further development of embryo transfer techniques in rats. Knowing that the uterine horns are not in communication necessitates that for both horns to be gravid, embryos must be introduced on both sides of the cervical septum. Taking these anatomical findings into account, further work is being done in our laboratory to develop a non-surgical embryo transfer technique for rats.

Keywords: Rat, embryo transfer, reproductive anatomy, rat cervix