

## VIII. THE EFFECT OF HOT AND COLD APPLICATIONS ON NORMAL UTERINE CONTRACTIONS

Alma J. Neill and Harold M. Hefley, Jr.

From the Department of Physiology, University of Oklahoma

### Technique, Material, and Methods

Female rabbits were used as material for the experiments, as they were easily procured. All had borne young, as the uteri of virgin females were too small to yield good results. The subjects were placed on their backs, and strapped down in that position to a medium sized, heavily padded animal board. They soon became accustomed to the position. Upon being placed in position, a small tissue rubber balloon twelve to fifteen centimeters in length, and one half centimeter in diameter, was carefully inserted into the vagina, and extended into one of the arms of the bicornate uterus.

The method of insertion was simple; a small glass tube was heavily vaselined and inserted into the balloon. The tube and balloon were then introduced together into the uterus of the animal. The other end of the glass tubing was cemented to a small length of rubber tubing. After the balloon had remained for a minute or two in the body of the animal the body heat melted the vaseline and upon applying air pressure to the rubber tube, the back pressure forced the glass tube out of the balloon, leaving it in place in the uterus. The balloon was then connected to a recording tambour by means of a large arterial canula, a Y-tube and rubber tubing; the apparatus was inflated, and the contractions recorded upon the smoked drum of a kymograph. Many difficulties were encountered, however. As rabbits are naturally of a nervous disposition, the slightest jar would cause the animal to jump, the result being a spasmodic contraction of the uterus. Any outside noise produced the same effect. If someone called loudly in a hall, if a distant door slammed, the effect was always recorded on the kymograph drum. The animals were even disturbed by the ticking of the timer, and it was found expedient to run off time records previous to the time of taking the contractions. Draughts and puffs of cold air also threw the animal into a hypersensitivity to jars and noises. If the temperature of the room was below 20 degrees Centigrade, the uterus became contracted with a great increase in tonicity.

### Observations and Results

As would be expected, the normal uterine contractions were not larger. With the writing lever fifteen centimeters in length, and the tambour resting five tenths centimeter from the fulcrum, the normal contraction record was only two and a half to three centimeters in height. During anoestrus, the contractions occur in pairs, are of ten to twelve seconds in duration, the pause between individual contractions being four to six seconds, and the interval between pairs of contractions, thirty to forty-five seconds. During pro-oestrus the occurrence in pairs was disturbed, and though the amplitude and duration of the individual contractions remained the same, there was no pause between pairs of contractions, and a uniform rhythm was demonstrated; the individual contractions being ten seconds in duration, and the pause between contractions, four to six seconds.

There was room for doubt in the minds of the authors, because of the suspicion that the contractions demonstrated were not uterine contractions, but modified peristaltic contractions, passed from the lower intestines of the animal to the uterus. As an attempt to validate the foregoing experiments, the following experiment was performed. The animal was placed in the usual position on the animal board. The tambour was connected to a small funnel, which was applied to the shaved, and heavily vaselined posterior portion of the animal's abdomen. Respiratory movements were taken simultaneously, by means of a light writing point attached to a silken thread which was in turn passed over a pulley, and fastened to the thorax of the animal. As the abdominal wall of a rabbit is very thin the peristaltic contractions of the intestine were easily taken. Peristaltic contractions occurred every four or five seconds as contrasted with the minimum of ten seconds for uterine contractions, thus conclusively showing that the contractions demonstrated were specific properties of the uterine muscle.

### Responses To Hot Applications

After a normal contraction had been recorded, a hot application at 45-47 degrees Centigrade was applied to the abdomen of the animal. There was a lag of from forty five seconds to a minute, before any effect was noted.

The effect on the contractions during anoestrus was not nearly so pronounced as during prooestrus. The effect during anoestrus was to cause a small decrease in the tonicity of the

uterine muscle, and a small increase in the amplitude of the individual contraction. The individual contraction, in some cases, was not altered.

During prooestrus, however, a decided change was effected by hot applications. The period of lag was much decreased, being in some cases, only twenty seconds. The amplitude of the individual contractions was increased by a factor of two, while the tonicity of the uterine muscle was only slightly decreased.

#### **Responses To Cold Applications**

As would be expected, the responses to cold applications were nearly the opposite of those effected by hot applications. There was not however, the marked effect on individual contractions, as was demonstrated by hot pack applications.

The amplitude of the individual contractions was decreased by the factor two thirds, although slight deviations in both directions occurred. There was also a tendency to increase the time between pairs of contractions during anoestrus.

When the ice pack was removed, the contractions soon regained their normal proportions, and in some cases, the time between pairs of contractions actually decreased.

One thing which stood out as paramount during the application of cold packs, was the great change in tonicity that almost immediately took place. In no case was the increase in tonicity less than a third greater than the normal tonus, while the maximum increase in amplitude was one and two thirds that of the original contraction.

Associated directly with the great increase in tonicity, was the semi-tetanic condition into which the uterine muscle was thrown. Indeed, the tonicity was so increased, that the contractions were smoothed out, so to speak; the uterus being in such a drawn down condition, that it was impossible for the organ to manifest further contractions.

#### **Conclusions and Summary**

In closing, then there were six definite responses of the uterine muscle demonstrated, four for hot applications, and two for cold packs.

1. Hot applications decreased the tonicity of the uterine muscle.
2. Hot applications increased the individual contraction.
3. The increase in the individual contraction was much

more pronounced during prooestrus than during anoestrus.

4. The decrease in the tonicity of the uterine muscle was nearly the same during both prooestrus and anoestrus, there being a somewhat greater relaxation during anoestrus.

5. Cold applications decreased the individual contractions and somewhat increased the time between contractions, as well as pairs of contractions.

6. Cold applications caused a great rise in the tonicity of the uterine muscle, so much so, that it approached a semi-tetania.

#### BIBLIOGRAPHY

Chesney, V. E. 1924. Gangrene Puerperal Infections Surg. Gynec. Obst., 38: 72-74.

Hobbs, R. 1924. Causes of Acute Infectious Puerpera. Sepsis, Miscarriage: Treatment by Drainage. Proc. R. S. M., Sec. Obst. Gynec. 17: 73-86.

Young, H. H. and Hill, J. H. 1924. Treatment of Septicemia and Local Infections, by the Intravenous Injection of Mercurchrome 220 Soluble, and Gentian Violet J. A. M. A., 82; 669-675.