broth cultures similar filamentous structures are present. The capsule is frequently seen to consist of a thick agglomeration of these filaments around the bacteria. In certain subtilis cultures the mucoid substance which consists largely of these filaments shows phenomena suggesting that it is capable of growth independently from the bacteria.

Notes on the staining methods: The filaments could be stained with all flagellar staining methods tried. The following technique gave most constantly satisfactory results. The agar or broth cultures are spread on a cover slip with the help of a small drop of water without being previously suspended or diluted and quickly dried. It is sometimes helpful to extract the preparation after drying with distilled water. For a mordant, Loeffler's solution is used (prepared a few weeks previously) and is applied for 2 to 3 minutes without heating. The preparation is then silvered with aethylamin silver solution. Not all samples of the mordant give satisfactory results.

## 7143 C

### Kidney Function in Pregnancy. II. Effect of Posture on Diuresis.

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(Introduced by A. W. Rowe.)

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In line with observations on normal non-pregnant individuals as to the influence of posture on urine volume,[1] an opportunity has presented itself to carry out similar studies during pregnancy. One private patient volunteered to carry out a series of tests throughout her pregnancy. Commencing about 20 weeks before term, she did 4 tests per month until the time of delivery, and 2 series postpartum.

The tests were done in 4 positions, the horizontal back position, sitting up, the Trendelenberg position, and horizontal on the side. In the latter position the patient was allowed to turn on either side at will. Each monthly series included these 4 tests, and, so far as possible, the tests were arranged for every other day.

Physically Mrs. J. H. was a primapara in excellent health until the very end of her pregnancy. She was not subjected to any ex-

[1] Janney, J. C., Riley, G., and Walker, E. W., PROC. SOC. EXP. BIOL. AND MED., 1933, **31**, 398.

tensive kidney study. She had the usual prenatal care, with checking of the blood pressure, and urine, and all toxic symptoms, but it was felt to be hardly necessary to study her further as the chief question was not of her conformance to an average standard but of the comparison in a single patient of water diuresis under 4 different conditions. The arrangement of the tests (every other day in each series of four) was such that much change during the course of a series was, so far as possible, minimized. Consequently we feel that the conditions are nearly enough uniform to justify comparison. The patient's health continued good until the week before her delivery when her pressure began to creep up and she showed a very slight trace to a slight trace of albumen in the urine. Between the time of the next to the last test, on 4/18, and the last, on 4/20, her systolic pressure had jumped 16 points to 148. She was then 10 days before her calculated full term, and the day after the last test to avoid further risk labor was induced by rupture of the membranes. It will therefore be noted that in Table I and Fig. 1, which show the data on this patient, the weeks antepartum and postpartum are calculated from the time of actual delivery which is about 10 days ahead of the date figured from the last catamenia.

TABLE I.
Showing Urine Volumes of Mrs. J. H. at Various Stages of Pregnancy and Puerperum in the Several Postures of the Test.

| | Weeks Antepartum | | | | | Postpartum | |
|---|---|---|---|---|---|---|---|
| | 18 | 14 | 9 | 5 | 2 | 3 | 9 |
| Recumb. back | 1305 | 1342 | 767 | 828 | 738 | 1113 | 1135 |
| Sitting | 1059 | 898 | 1252 | 699 | 438 | 879 | 537 |
| Trendelenberg | 990 | 1313 | 994 | 1180 | 888 | —— | 1039 |
| Recumb. side | 871 | 1355 | 1317 | 1148 | 1215 | 1000 | 1164 |
| | | | | | | Nursing | |

Comparison of her horizontal back elimination curves with the experience reported for normal pregnant women[2] shows that she conforms to the average trend of these other patients, but runs below the average amount from the 10th week antepartum on. As pregnancy advances the response to the test in the sitting position becomes progressively worse, both actually and compared with the horizontal back tests, and that, in the last sitting test, 2 weeks before the induction of labor, the volume has dropped to 32% of her normal response, whereas the last antepartum test in the horizontal back position, done within 2 days of the one last mentioned, has declined only to 55% of the normal. The tests in the Trendelenberg

[2] Janney, J. C., and Walker, E. W., *J. Am. Med. Assn.*, 1932, **99**, 2078.

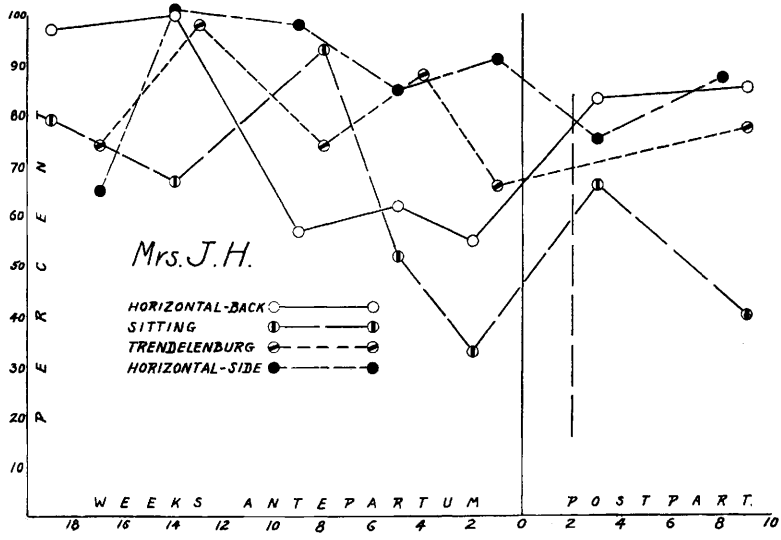


FIG. 1.
The output curves of Mrs. J. H. from the 18th week antepartum on in the several positions of the test. The calculation of the curves is explained in the text.

position show less drop as pregnancy progresses than those in either the horizontal back or the sitting postures. The last test in Trendelenberg, antepartum, showed a volume of 66% compared to the horizontal of 55%. The most interesting curve of the 4 is that in the horizontal side position, which held up to nearer a normal non-pregnant level than any of the others, and on the last test antepartum showed an output of 91%.

The tests done approximately 2 weeks postpartum are somewhat contradictory. The horizontal back test (84%) and the sitting test (66%) showed marked recovery from their antepartum levels, suggesting that the loss of function antepartum was largely due to mechanical obstruction, and was influenced by posture, and that it disappears rapidly when delivery relieves this obstruction. The horizontal side response (75%) was lower than the 91% which was the last antepartum figure, suggesting that beside the mechanical obstruction, which is largely relieved in this position, even during the antepartum tests, there is some other factor involved. It seems not unreasonable to suppose that antepartum there is a certain amount of tissue stored water, occult edema, and that once back pressure on the kidneys is released by the lateral horizontal position this fluid begins to augment the fluid ingested. At 8 weeks postpartum the results of all tests, except in the sitting position, range

between 77 and 87%. The sitting test shows a decided drop, almost back to the lowest antepartum figure, which is entirely unexplained.

The computation of these figures assumes the highest test in the horizontal back series as 100%. This figure is 1342 cc., thoroughly normal when compared to the averages of the normal non-pregnant patients studied in the past. The horizontal back position was the one used in previous tests, with both pregnant and non-pregnant subjects, and the other postures used in this and a former paper are essentially comparisons of water diuresis in different positions with the standard horizontal back position. All other tests, therefore, are related by percentage to this 100% figure.

On theoretical considerations these curves are just what we should expect. The mechanical interference with urine output is increased when the patient sits up and, in addition to the pressure caused by its volume, the weight of the uterus and its contents rests on the ureters at the brim of the pelvis. These effects do not make their appearance, however, until the latter half of pregnancy either in the X-ray or in the functional disturbance. This corresponds to anatomical fact, for until this time the uterus is hardly large enough to cause pressure at the brim of the pelvis. When the test is performed in the Trendelenberg position there is a tendency for gravity to take the weight off the pelvic brim and the ureters, but, mechanically, as the results show, this is not as efficient in relieving the pressure as lying in the side. With the patient in Trendelenberg there is some pressure on both ureters though not so much as in the horizontal position. With the patient on her side the tendency is to relieve the pressure on both ureters. It might be supposed that the upper ureter was the only one relieved, but as pregnancy advances and the uterus becomes larger its center of gravity moves further forward until in the side position the tendency is for it to roll out of the abdomen altogether and not just rest on the lower side. It is this mechanical relation which relieves the lower as well as the upper ureter. If it were possible to accomplish we should expect better diuresis in the knee chest position or with the patient on all fours than in any other posture, but these positions cannot be tolerated long enough for the accomplishment of this test, much less for any therapeutic results. It is an attractive supposition that this 4-footed posture may be an important factor in the absence of eclampsia in animals.

Despairing of finding another patient who would cooperate so intelligently as the one here reported we turned to the next best method of substantiating these figures, namely, the testing of a

number of patients with one series of tests during the last month of their pregnancy. In this series 3 tests were done, in the horizontal back, the sitting, and the horizontal side positions respectively. The subjects of these tests were patients at the Florence Crittenton Home in Boston. The tests were arranged so that they were done on consecutive days with each subject. There were 12 subjects tested and of these 11 were clinically normal at all times. One patient a few days subsequent to her tests showed a blood pressure of 154/100 and headache of 2 days' duration. The urine was negative. She had none of these symptoms, however, during the time of her tests. All of the subjects were tested during the last month of pregnancy. The longest time before delivery that any series was finished was 26 days and the shortest 4 days. In all the subjects average of the tests was 17 days antepartum. No tests were done postpartum. The results of these tests are given in Table II and Fig. 2.

TABLE II.
Showing Urine Volumes of Florence Crittenton Patients in the Several Positions of the Test.

| Name | Horizontal Back | Sitting | Horizontal Side | Dates of Tests | Delivery |
|---|---|---|---|---|---|
| Eleanor C. | 422 | 343 | 508 | 15, 16, 17 Sept. | Sept. 24 |
| Queenie S. | 370 | 451 | 638 | 15, 16, 17 " | " 26 |
| Helen W. | 302 | 807 | 802 | 15, 16, 17 " | Oct. 5 |
| Alberta C. | 519 | 509 | 593 | 15, 16, 17 " | " 5 |
| Marie C. | 663 | 691 | 940 | 21, 22, 23 " | " 14 |
| Sylvia D. | 584 | 902 | 1070 | 21, 22, 23 " | " 11 |
| Lila E. | 895 | 612 | 1095 | 21, 22, 23 " | " 21 |
| Evelyn T. | 1135 | 587 | 1385 | 28, 29, 30 " | " 22 |
| Gertrude J. | 225 | 289 | 408 | 28, 29, 30 " | " 18 |
| Mary S. | 848 | 803 | 1109 | 26, 27, 28 Oct. | Nov. 23 |
| Lillian S. | 725 | 637 | 645 | 26, 27, 28 " | " 5 |
| Average | 608 | 603 | 836 | | |
| Evelyn W. | 571 | 484 | 568 | 28, 29, 30 Sept. | Oct. 15 |

Comparing first the horizontal dorsal and the sitting positions, we find that the responses are very close in the 2 groups, the average being 608 cc. and 603 cc. respectively. Taking the dorsal position as a standard of 100%, the sitting position gives a 98% response. When we compare the results of the 2 recumbent postures we find that the average response in the lateral position is 836 cc. or 136%. The spread of individuals runs from 89% to 266%. Calculated on the same basis the results of the same 2 positions in Mrs. J. H. would show 100% and 164%.

No effort was made to follow through pregnancy, or any considerable part of it, the subjects who were observed at the Crittenton Home. There has been reported such a series followed through the latter months of pregnancy among whom were estab-

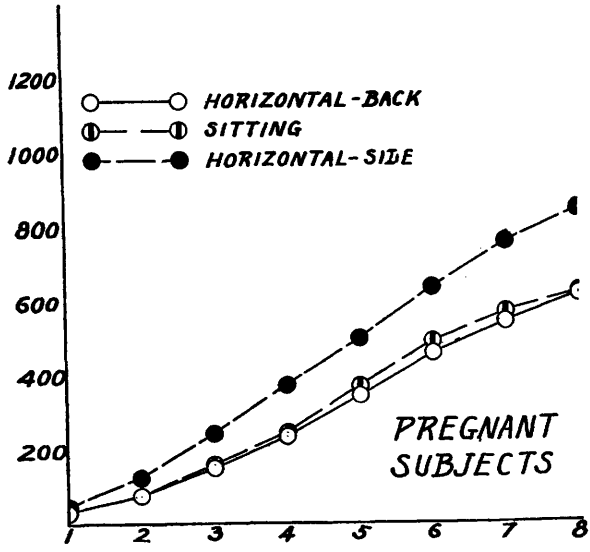


FIG. 2.

Showing summation curves of the Florence Crittenton patients in the various positions of the test.

lished the curve of water diuresis under the conditions of this test. As soon as the results of Mrs. J. H.'s tests were worked out it became evident that the interesting difference in the results of tests in the horizontal lateral position and the others could be checked up by testing a group of patients, as far advanced as possible in pregnancy, with a single series of tests. In this series the Trendelenberg position was omitted because the difference in results was too small to warrant the patient's discomfort.

*Summary.* A series of water diuresis tests have been done on one normal subject throughout pregnancy in various positions. The output was found to be consistently better with the patient in the horizontal lateral position than in any of the others tried. These findings were checked by a single series of tests in 12 normal subjects who were in the last month of pregnancy. In this series the results were similar to the performance of the patient who was followed throughout pregnancy.