11023

Recovery of Vitamin C from the Human Bladder.*

SOL SHERRY AND GERALD J. FRIEDMAN. (Introduced by Elaine P. Ralli.)

From the Third (New York University) Medical Division, Bellevue Hospital, and the Department of Medicine, New York University College of Medicine.

In the course of observations on the urinary excretion of vitamin C the question arose as to the stability of vitamin C in bladder urine. It has been shown in reports from this[1] and other laboratories[2, 3] that the vitamin C content of drawn bloods remains unchanged for periods up to 24 hours. It is well known, however, that the vitamin C content of voided urine diminishes rapidly unless suitable means of preservation are used. Whether or not the vitamin C content of bladder urine remains unchanged has apparently not been considered.

In order to answer this question, several experiments were done in which vitamin C solutions of known concentration were instilled into the bladder and then later removed at varying intervals, and analyzed. The subjects were patients whose urines contained insignificant amounts of vitamin C and in whom the blood plasma concentration of vitamin C was very low. On the morning of the experiment, the patients were catheterized, the urine discarded and the bladder washed with 20 cc of sterile saline and then 20 cc of air. The catheter was then clamped. After a one-hour control period the clamp was opened, the urine removed, and the bladder again washed with saline and air. As the excretion of vitamin C at low plasma levels is constant,[4] we assumed that the hourly excretion during the remaining period of the experiment would be approximately the same as during the control period. Therefore, the mg of vitamin C excreted during the one-hour control period was multiplied by the number of hours during which the solution of vitamin C was allowed to remain in the bladder, and this amount was subtracted from the total amount recovered. Ten cc of a standard vitamin C solution (prepared immediately prior to use) were instilled into the

* This investigation has been aided by a grant from the Josiah Macy, Jr., Foundation.

1 Friedman, G. J., Rubin, S. H., and Kees, W., PROC. SOC. EXP. BIOL. AND MED., 1938, **38**, 358.

2 Farmer, C. J., and Abt, A. F., PROC. SOC. EXP. BIOL. AND MED., 1938, **38**, 399.

3 Cushman, M., and Butler, A. M., PROC. SOC. EXP. BIOL. AND MED., 1938, **39**, 534.

4 Friedman, G. J., Sherry, S., and Ralli, E. P., in press.

TABLE I.

Exp.	Plasma Vit. C, mg %	Vit. C instilled, mg	Time in bladder, hr	Amt of urine excreted, cc	Vit. C recovered, mg	Vit. C control, mg	Corrected Vit. C recovered, mg	% recovery
I	.12	0.486	1	260	0.459	.000	0.459	94.5
II	.12	0.528	1	178	0.485	.000	0.485	92.0
III	.10	29.9	3	197	32.2	.120	32.1	107
IV	.03	10.9	5	334	10.8	.142	10.7	98.2
V	.00	9.55	5	232	10.7	.460	10.3	107
VI	.03	4.70	3	205	4.70	.078	4.62	98.3

bladder from a pipette through the catheter and the catheter washed through with 20 cc sterile saline, and then clamped. After varying periods of time the catheter was opened, the urine removed and the bladder washed with sterile saline and air. All specimens were immediately acidified with 10% by volume of glacial acetic acid. Vitamin C was determined in the photoelectric colorimeter by the method described by Evelyn.[5]

In experiments I and II, 10 cc of a 5 mg % solution were placed in the bladder on 2 separate occasions and 94.5% and 92% of the 0.5 mg recovered respectively after a period of one hour. When the same amount of vitamin C was added to the same urine but left standing in the dark at room temperature for the same time (one hour) only 65% was recovered. In experiment III, 10 cc of a 300 mg % (30 mg) solution were instilled into the bladder and left there for 3 hours. The entire amount was recovered at the end of the 3 hours. In experiments IV and V, 10 cc of a 100 mg % (10 mg) solution were placed in the bladder. The recovery figures after 5 hours were 98.2 and 107%. The pH of the urines in all 5 experiments fell between 6 and 7.

The possibility arose that the use of saline might act as a protection against the destruction of the vitamin C instilled into the bladder. The fact that large amounts of urine were excreted into the bladder during the experimental period argued against this but as a further check in experiment VI, vitamin C was dissolved in the urine withdrawn at the end of the control period, and this was reinstilled into the bladder. 4.70 mg of ascorbic acid was injected in this manner and 4.62 mg or 98.3% was recovered at the end of 3 hours.

Summary. When amounts of synthetic ascorbic acid varying from 0.5 to 30 mg were instilled into the human bladder, 92 to 107% was present in the urine after periods of 1 to 5 hours. It is, therefore, concluded that no appreciable destruction of ascorbic acid occurs in the human bladder.

[5] Evelyn, K. A., Malloy, H. T., and Rosen, C., *J. B. C.*, 1938, **126**, 645.