



## The possible value of ascorbic acid as a prophylactic agent for urinary tract infection

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The effect of ascorbic acid on urine pH was studied in spinal cord injury patients. Their urine was not colonized by urease positive microorganisms. The study was designed to compare the baseline urine pH value and the urine pH value after the administration of placebo or ascorbic acid 500 mg/6 h. The diet and medical treatment were not controlled. A significant decrease in urine pH value was not obtained. There was no clinical benefit from the use of ascorbic acid.

**Keywords:** ascorbic acid; urinary acidifying agent; urinary tract infection; spinal cord injured patients

### Introduction

Many patients with a spinal cord injury have a neuropathic bladder and the urine is often colonized by bacteria. Sometimes such patients can synthesize a urease enzyme which helps to alkalize the urine by the conversion of urea into ammonia.<sup>1</sup>

In the urine there are hippuric-acid and beta-hydroxybutyric acid, which are bacteriostatic and need a low pH to attack the bacteria wall with an antibacterial action.<sup>1</sup>

To reduce the frequency of urinary infection in such patients, acidification has been used as a prophylactic to inhibit bacterial growth.

In our department we have used ascorbic acid in a dose of 2 g four times a day, as a previous study demonstrated the value of acidifying the urine, controlling the diet and providing pharmacological treatment.<sup>3</sup> In the literature there is a controversy about the acidifying capacity of ascorbic acid.<sup>4–8</sup> Also in high doses there may be the appearance of oxalate crystals.<sup>2,9</sup>

### Objective

The aim of this study was to measure the clinical effectiveness of ascorbic acid as a prophylactic agent for urinary tract infection.

### Materials and methods

The study involved patients with a traumatic spinal cord injury, treated in our Spinal Cord Injury Unit. All agreed to participate in the study.

A randomized, simple-blind study was made with ascorbic acid, and as the placebo, lactose. There was no control over the diet, nor of drugs with an alkalizing effect that could modify the urine pH.

Initially, for a week, patients did not receive any acidifier, then patients were randomized in two groups: (1) giving ascorbic acid 2 g day (one tablet of 500 mg four times a day). (2) giving placebo of lactose (one capsule four times a day).

At the beginning, no patient had clinical signs of infection that could modify the results. They had a neuropathic bladder and used intermittent catheterization or had an indwelling catheter. The established definitions of the Center for Diseases Control (CDC), Atlanta USA were used for the diagnosis of a urinary tract infection.<sup>10</sup>

Estimation of the urine pH, and uroculture were carried out to identify any microorganisms and to see if they were urease positive.

Clinical symptoms of urinary infection were analyzed by the same physician to ensure homogeneity.

Statistical analysis of the results was made by applying Fisher's exact test for proportion comparison, and the *t* Student Fisher's test for mean comparison.

### Results

Thirty-eight patients began the study, which started in February 1990, and finished in July 1991. Twenty-five patients were omitted for different reasons.

Thirteen patients completed the study. The distribution between the two groups (ascorbic acid–placebo) was well balanced. No statistical differences were observed (Table 1).

**Table 1** Description of the 13 patients who completed the study

|                              | Treatment group             |                       | p     |
|------------------------------|-----------------------------|-----------------------|-------|
|                              | Ascorbic acid<br>6 patients | Placebo<br>7 patients |       |
| Sex                          |                             |                       | >0.05 |
| men                          | 4                           | 5                     |       |
| women                        | 2                           | 2                     |       |
| Injury level                 |                             |                       | >0.05 |
| tetraplegia                  | 1                           | 0                     |       |
| paraplegia                   | 5                           | 7                     |       |
| Type of bladder emptying     |                             |                       | >0.05 |
| long-term catheterisation    | 1                           | 2                     |       |
| intermittent catheterisation | 5                           | 5                     |       |
| Mean baseline pH             | 5.95 ± 1.41                 | 5.92 ± 0.55           | 0.96  |
| Age (years)                  | 27.83 ± 11.75               | 25.57 ± 9.91          | 0.72  |
| average age: 14–50 years     |                             |                       |       |

**Table 2** Urine pH values

| Patient number | Treatment     | Mean baseline pH | Mean pH Ascorbic ac. | Mean pH (*) difference |
|----------------|---------------|------------------|----------------------|------------------------|
| 1              | placebo       | 5.26             | 5.07                 | -0.19                  |
| 2              | ascorbic acid | 5.46             | 5.92                 | +0.46                  |
| 3              | ascorbic acid | 5.40             | 5.17                 | -0.23                  |
| 4              | ascorbic acid | 5.48             | 5.16                 | -0.32                  |
| 5              | placebo       | 5.96             | 6.57                 | +0.61                  |
| 6              | placebo       | 5.95             | 5.24                 | -0.71                  |
| 7              | ascorbic acid | 5.71             | 6.18                 | +0.47                  |
| 8              | placebo       | 5.56             | 5.57                 | +0.01                  |
| 9              | placebo       | 5.52             | 5.00                 | -0.52                  |
| 10             | ascorbic acid | 8.76             | 7.59                 | -1.17                  |
| 11             | placebo       | 6.31             | 5.72                 | -0.59                  |
| 12             | placebo       | 6.87             | 5.78                 | -1.09                  |
| 13             | ascorbic acid | 4.86             | 5.07                 | +0.21                  |

Mean and standard deviation for ascorbic acid groups:  $-0.10 \pm 0.62$ . Mean and standard deviation for placebo group:  $-0.35 \pm 0.55$ . (\*) Sign -: pH decrease with the administration of ascorbic acid in relation to the control week. Sign +: pH increase with the administration of ascorbic acid in relation to the control week

The differences between the mean pH values for the two groups were obtained with the mean urine pH values during the first control week (mean baseline pH) and the mean urine pH after administration of ascorbic acid or placebo (Table 2). Statistical analysis of these differences failed to demonstrate any significant difference.

Patients developed their urinary infection between the sixth and eighth day after beginning the administration of ascorbic acid or placebo. Two belonged to the ascorbic acid group and one to the placebo group. A statistical difference was not observed between the two groups.

## Discussion

In this study, a decrease in the urine pH and the possible prophylactic effect of ascorbic acid were not

obtained when there was no control over the diet nor of alcalizing drugs.

We consider that many external variables can modify the urine pH value, especially diet and pharmacological treatment.

## Conclusion

The administration of ascorbic acid is not effective as a urinary acidifier in conditions without controlling the diet and pharmacological treatment. Also, it is not a useful drug to prevent urinary tract infection.

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