[Vitamin C requirement in patients with acute pneumonia during treatment with antibiotics].
Mochalkin NI.

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Translation of this paper was arranged by Harri Hemilä in Jan 2015
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http://www.mv.helsinki.fi/home/hemila/
http://www.mv.helsinki.fi/home/hemila/VitC_pneumonia.htm
http://www.mv.helsinki.fi/home/hemila/CP.htm (Cochrane review)
http://www.mv.helsinki.fi/home/hemila/CP (Cochrane review references)

This translation is located at:
version 2015-10-21

Russian version is available at:

The data in this paper had been published previously in 1970 by Mochalkin. See comparison of the data at the end of this PDF-file, and see the 1970 paper:
Thus, this paper does not seem to have new data compared with the 1970 paper.

SUMMARY by the author, copied from the Russian text (see through the link above)

VITAMIN C BALANCE IN PATIENTS WITH ACUTE PNEUMONIA DURING ANTIBIOTICOTHERAPY
(English title used by Mochalkin in the summary of the paper)

SUMMARY

N.I. Mochalkin (Odessa)

Two groups (seventy each) of patients with acute pneumonia treated in a hospital are analysed. The first received course treatment with penicillin, streptomycin, oxytetracyclin. The second received the same antibiotics in association with ascorbic acid (AA).

It was found that patients of the first groups showed a rapidly advancing reduction of the AA content in the blood plasma and a reduced urinary excretion of AA. The AA deficit was especially pronounced in the tetracyclin treated patients; in the streptomycin treated patients this deficit was smaller and in the penicillin treated patients still smaller.

Results indicate that antibioticotherapy in combination with ascorbic acid enhanced the recovery of patients with acute pneumonia.
Interest in research into acute pneumonias is undiminished with many studies dedicated to questions of aetiology, pathogenesis, clinical progression, prevention and treatment of acute pneumonias. The level of interest is due to the lack of any reduction in occurrence of the illness for all segments of the population and to the increasing tendency for the illness to be protracted and progress into a chronic form, leading to patient disability and frequently to untimely death (L.I. Fogelson, 1963; A.J. Tsigelnik, 1964; N.S. Molchanov, 1964, 1966; S.M. Gavalov, 1968; V.P. Silvestrov, 1974).

Antibiotics can reduce vitamin content in the body and inhibit the body's immunobiological responsiveness, which in turn significantly reduces the efficacy of therapy and increases the likelihood that side effects will occur.

This study investigated the metabolism of ascorbic acid and the clinical indicators of acute pneumonia in 140 patients divided into two groups, the first group treated with antibiotics exclusively and the second group treated with the same antibiotics in conjunction with ascorbic acid. All patients were male, aged 20 to 61.

The patients were divided into two equal groups. In the first group (70 patients), patients were prescribed antibiotics in average therapeutic doses, but without ascorbic acid (25 were given penicillin, 15 were given streptomycin, 15 were given penicillin and streptomycin, and 15 were given tetracycline).

The second group (70 patients) received the same antibiotics in the same dosage as the first group of patients, but 39 of them were additionally given ascorbic acid orally at a rate of 50 mg per 100,000 IU of antibiotics, i.e. a minimum dose of ascorbic acid*, and 31 patients received ascorbic acid at a rate of 100 mg per 100,000 IU of antibiotics, i.e. the optimum dose of ascorbic acid (N.I. Mochalkin).

* The minimum and optimum doses of ascorbic acid to prevent deficiency of ascorbic acid in the body during antibioticotherapy were determined experimentally on animals and tested under clinical conditions.
The antibiotics and the vitamins were prescribed during the first ten days. The daily dose of penicillin was 6 million IU, the daily dose of streptomycin was 0.5–1.0 million IU intramuscularly, and the daily dose of tetracycline (oxytetracycline) was 0.6 million IU orally.

Efficacy of therapy in both groups was measured on the basis of the time for recovery, temperature, ESR, white blood cell count in peripheral blood, period for the disappearance of moist rale, the time for the pneumonic loci detected by X-ray to disperse and the duration of therapy.

The initial level of ascorbic acid was measured before monitoring the changes in the ascorbic acid content in the blood plasma (in mg%) and in the urinary excretion of ascorbic acid (in mg/hour). Antibiotics were then prescribed; the concentration of ascorbic acid was measured in the plasma (using a method adapted from Farmer and Abt) and in the urine (using a method developed by Zheleznyakova) on days 5, 10, 15, 20 and 30.

The patients were discharged from the hospital only after all the tests indicated normal levels. Clinical laboratory tests were then performed at intervals for a period of one month on the subjects as outpatients.

The vitamin C balance was monitored during both the inpatient and outpatient phases of observation. Table 1 shows the saturation of ascorbic acid in the body during the period that patients were observed (mean values in absolute numbers, comparative values in %)

As the data show (Table 1), the balance of ascorbic acid in the patients significantly changes during antibioticotherapy.

For example, the ascorbic acid content in the plasma in the first group of patients fell to 57.53% by day 5 and to 56.16% by day 10 of therapy. The mg/hour urinary excretion of ascorbic acid fell correspondingly to 76.47% and 61.76%.

Once patients had ceased to take antibiotics and consequently the inflammatory process in the lungs ceased, the impaired metabolism of ascorbic acid slowly recovered. However, it had only reached 93.15% of the background level by day 30.

The picture was very different for patients in group II. Regardless of significant C vitamin intake, by day 5 the ascorbic acid content in the plasma had fallen to 88.73%, after which there was rapid compensation of the subsequent ascorbic acid deficiency, and by day 15 ascorbic acid had recovered to initial levels. By day 30, the concentration of ascorbic acid in the plasma had reached 105.6% of the initial value.

The urinary excretion of ascorbic acid largely reflected the changes in the blood.

The results for the efficacy of the two methods for treating the acute pneumonias are presented in Table 2 (data in %).
Our research therefore indicates that prescribing a course of therapeutic doses of antibiotics resulted in a decrease in the ascorbic acid content in the blood and reduced urinary excretion of ascorbic acid in patients suffering from acute pneumonia. It should also be noted that patients who did not receive sufficient vitamins took significantly longer to recover in terms of the clinical laboratory indicators that were investigated. Antibioticotherapy in combination with ascorbic acid enhanced the recovery of patients with acute pneumonia.

There are currently several different views regarding the mechanism for the adverse effect of antibiotics on vitamin metabolism. There are suggestions that antibiotics may accelerate the destruction of vitamins in organs and tissues or contribute to rapid excretion of vitamins from the body or increase the body's need for vitamins. It may also be the case that hypovitaminosis is a result of a change in the content of the gut that is by antibiotics. Finally, it is also suggested that antibiotics have a direct antivitamin effect.

The difference in the results of therapy in this homogeneous group of patients, in our view, is explained by the state of ascorbic acid metabolism in patients with acute pneumonia. Analysis of our data and the literature data does not leave any doubt that, in the case of acute pneumonia, the intensity of redox processes increases and the body's need for ascorbic acid also increases.

Supplemental ascorbic acid contributes to an increase in the general immunobiological responsiveness of the body, reducing the duration of therapy and improving the outcomes of acute pneumonias.

Therefore, when treating acute pneumonias with antibiotics (penicillin, streptomycin, and oxytetracycline), we would expect to observe ascorbic acid deficiency in the patient. Patients treated with antibiotics without supplemental ascorbic acid recover significantly more slowly.

To prevent vitamin C deficiency and further complications, antibioticotherapy of acute pneumonias must be combined with simultaneous prescription of ascorbic acid.

A minimum dose would be 1 mg of ascorbic acid per 2000 IU of antibiotics. An optimal dose would be 1 mg of ascorbic acid per 1000 IU of antibiotics.
Literature

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— Novikova V.A. in: Materialy VI nauchn. sessii VNIIV MZ USSR [Материалы VI научн. сессии ВНИИВ МЗ СССР], 1967, p. 144
— Sergeev N.V. in: Ostrye pnevmonii [Острые пневмонии], Moscow 1961, p. 120
## Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of patients</th>
<th>Treatment method</th>
<th>Body temperature normalised by 10th day</th>
<th>Indicators normalised by 16th day of treatment</th>
<th>Average treatment duration Mean±SE (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moist rates disappeared</td>
<td>ESR (erythrocyte sedimentation rate)</td>
</tr>
<tr>
<td>I</td>
<td>70</td>
<td>Antibiotics</td>
<td>77,14±5,02</td>
<td>68,57±5,55</td>
<td>58,57±5,89</td>
</tr>
<tr>
<td>II</td>
<td>70</td>
<td>Antibiotics + ascorbic acid</td>
<td>97,14±1,99</td>
<td>98,57±1,44</td>
<td>98,57±1,42</td>
</tr>
</tbody>
</table>
The tables below compare the figures of Table 2 (1975) above with data published previously by Mochalkin (1970) (http://www.mv.helsinki.fi/home/hemila/T5.pdf).

The upper set of three groups I, II, III are the data published by Mochalkin (1970) earlier. Those data were reported as the number of pneumonia patients who were cured by 16th day.

The second set below combines data for groups II and III of Mochalkin (1970).

Then the number of participants in groups I and II+III is transformed to percentages, which are identical with those reported in Table 2 of Mochalkin (1975), see above.

Thus, the Table 2 of Mochalkin (1975) reports the same data as Mochalkin (1970), but groups II and III are combined and reported in percentages. In Table 2 above, the group II is thus the combination of groups II and III of Mochalkin (1970).

The data for groups I, II, and III were reported by Mochalkin in 1970. Comparison II vs III is included in Cochrane review on vitamin C and pneumonia by Hemilä and Louhiala.

### Table 2

<table>
<thead>
<tr>
<th>Groups in 1970</th>
<th>No. of particip</th>
<th>Vit C (g)</th>
<th>Temperature normalization by 10th day</th>
<th>Wet rattle gone</th>
<th>ESR</th>
<th>Leucocytes</th>
<th>Lung X-ray</th>
<th>Duration of recovery (days) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>70</td>
<td>0</td>
<td>54</td>
<td>48</td>
<td>41</td>
<td>57</td>
<td>47</td>
<td>23.7</td>
</tr>
<tr>
<td>II</td>
<td>39</td>
<td>0.25-0.8</td>
<td>37</td>
<td>38</td>
<td>36</td>
<td>38</td>
<td>33</td>
<td>19.1</td>
</tr>
<tr>
<td>III</td>
<td>31</td>
<td>0.50-1.6</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>29</td>
<td>15.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groups II and III combined</th>
<th>ie 37 + 31 = 68</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>70</td>
</tr>
<tr>
<td>II + III</td>
<td>70</td>
</tr>
</tbody>
</table>

### Transformation of integers to % of participants

<table>
<thead>
<tr>
<th>Groups I</th>
<th>No. of particip</th>
<th>Vit C (g)</th>
<th>Temperature normalization by 10th day</th>
<th>Wet rattle gone</th>
<th>ESR</th>
<th>Leucocytes</th>
<th>Lung X-ray</th>
<th>Duration of recovery (days) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>70</td>
<td>0</td>
<td>77.14%</td>
<td>68.57%</td>
<td>58.57%</td>
<td>81.43%</td>
<td>67.14%</td>
<td></td>
</tr>
<tr>
<td>II + III</td>
<td>70</td>
<td>0.25-1.6</td>
<td>97.14%</td>
<td>98.57%</td>
<td>95.71%</td>
<td>98.57%</td>
<td>88.57%</td>
<td></td>
</tr>
</tbody>
</table>

The figures marked by bold are identical with the figures reported by Mochalkin (1975).

Thus, the 1975 paper reports about the same study as the 1970 paper.