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**Research and Clinical Picture.**

From the Kantonsspital Stans (Switzerland). (Chief physician: Dr. J. Gander.)

Vitamin C in the treatment of pneumonia.

By J. Gander and W. Niederberger.

During investigations about vitamin C metabolism in older people, we were surprised to learn about the noticeably favorable effects of ascorbic acid administration in a case of inflammation of the lungs, which led us to ask: is there perhaps a disorder in vitamin C metabolism in cases of pneumonia and if this situation is remedied, does it have a favorable effect on the course of the disease?

The following five important personages will speak to the accuracy of such an assumption:

1. The good experience with vitamin C-rich fruits and fruit juices under feverish conditions and cases of pneumonia. Already in use for a very long time, the particularly favorable outcome of this procedure again proves to be very pleasing to well-known diet specialists. "In very general terms, fruit should be made one of the major food groups for patients with fever, to a much greater extent than is now customary", says von Noorden, for example.

2. The surprisingly large number of vitamin C deficiency diseases that are diagnosed regularly after pneumonia has been overcome (Schroeder, Guldager and Poulsen, Harde and staff).

3. Animal experiments by Stiner, as well as by Heymann, which show that chronically occurring vitamin C deficiency disease surprisingly does not usually result in scurvy, but rather in pneumonia, most often in the central lobe.

4. The noteworthy parallels between cumulative pneumonia mortality and cumulative occurrence of vitamin C deficiency disease. An independent experiment over a period of one year showed us that vitamin C deficiency disease, influenced by a still unknown weather factor, occurs more frequently from October to about the end of May, and especially in December and April, than in the other months. But it is precisely during this time that pneumonia mortality is greater!

Fig. 1. Extent of vitamin C deficiency disease following pneumonia. Comparison with normal cases and scurvy.

Fig. 2. Cumulative occurrence of vitamin C deficiency disease.  
Pneumonia mortality (according to Henschen).

5. The increase in pneumonia mortality in old age. Our previous research material showed us that vitamin C deficiency disease in general, among healthy persons, could reach the following values: up to 50 years 0-1000 mg, in older age groups: 1500 to 2500 mg. A comparison with pneumonia mortality in the various age groups shows surprising parallels.

Fig. 3. Extent of vitamin C deficiency disease in persons of various ages among healthy individuals,  
Pneumonia cases of death in various age groups  
(according to Henschen.)

All of these observations indicated that during the genesis of pneumonia, vitamin C metabolism takes on a very significant meaning and that in cases of pneumonia, likely results in better and quicker recovery under the effects of vitamin C. We therefore began to systematically study the course of pneumonia under the administration of vitamin C, with one of us (G) working primarily on the therapeutic issues and the other (N) concentrating on the methodical issues. We thus proceeded in four stages: we first checked to see whether the administration of vitamin C had a favorable effect in the traditional treatment of pneumonia. This was found to be true. We thereupon began to completely eliminate the existing vitamin C deficit, using the Klein method of Jezler und Niederberger as a means of control, initially within 2-3 days, and finally on the first day of the illness. The results became more and more favorable, so that we finally dared to attempt treatment by eliminating the vitamin C deficiency disease on the first day of the illness, without the administration of other medications.

We currently have observation material from about 15 cases. One typical example from each of the four stages described shall be reproduced here:

1. Stage: usual treatment of pneumonia + administration of vitamin C without determining the absorbing capacity of C and without early application of Redoxon (oxidation reduction) treatment.

C. A. 73-year-old. Pneumonia in the right inferior pulmonary lobe. Strikingly strong toxic phenomena: hectic (flustering) redness, soft arrhythmic pulse, sharp rheumatic pains, pressure sensitivity of the nerve trunks of the right arm, continuous vomiting, dyspnea (shortness of breath) temperatures between 38 and 39<sup>0</sup>. Treatment: on the first day of the illness, large doses of Coramin, Digalen, etc., on the second day 4 ccm Solvochin, 10.0 camphor oil and morphine. On the third day of the illness, after significant deterioration of condition, vitamin C in the form of two Redoxon ampoules is given intramuscularly. The usual treatment is maintained, except for Solvochin and morphine; instillation of glucose and 10.0 of calcium Sandoz is also administered. After just 400 mg of vitamin C, the patient felt significantly fresher, the neuritic manifestations abated entirely, the hectic redness disappeared, the vomiting ceased and the pneumonia eased according to the lytic type. A far lesser disintegration of strength was observed during convalescence than would have been expected according to the severity of the clinical picture.

2. Stage: usual pneumonia treatment + gradual elimination of the vitamin C deficiency disease.

N. M. 3-year-old. Pneumonia of the right inferior pulmonary lobe. Temperature 40.5. Appearance poor, pulse coursing. Face cyanotic, extremities cool, moist, motor restlessness. •Treatment: Cardiazol-Chinin 1 ampoules and Redoxon 3 ampoules daily intramuscularly, then 300 mg Rodoxon by mouth, dissolved in sugar water. Temperature remained very high during the first three days. The condition was quite serious. As the vitamin C deficiency disease of 1200 mg was eliminated on the third day, the fever suddenly fell critically to the norm.

3. Stage: usual pneumonia treatment + elimination of the vitamin C deficiency disease on the first day of the disease.

N. E. 20-year-old. Soldier. Lobar pneumonia of the right middle and inferior pulmonary lobes, onset of collapse, temperature 39.5. Pulse weak, extremities cool, facial color cyanotic, appearance tired and suffering, sputum tinged with blood. Treatment: Redoxon 18 ampoules intramuscularly during the course of 8 hours, then 2 tablets of Redoxon every two hours. In addition, 10.0 calcium Sandoz, camphor, Solvochin and Transpulmin administered in the usual way. The urine was checked every three hours for vitamin C excretion. After a total of 2100 mg of vitamin C, given within 8 hours, the vitamin C deficiency disease was eliminated, the temperature immediately dropped critically back to the norm, the pains eased completely without the use of narcotics, the pulse became strong and the patient felt noticeably well. On the day the fever fell, a pleuritic exudate was evident. Puncture resulted in a cloudy liquid, which contained bacteriologically gram-positive streptococcus (enterococcus). The pleural sac had to be opened up and drained. The patient endured this operation under a general feeling of well-being.

4. Stage: Elimination of the vitamin C deficiency disease on the first day of illness without the use of other medications.

B. R. 9-year-old. Patient fell ill with lobar pneumonia of the left inferior pulmonary lobe on August 6, 1936 in a holiday colony. Six hours after the onset of the initial chills and fever, Redoxon medication was started. After taking 1000 mg of Redoxon by mouth, even though the vitamin C deficiency was eliminated and critical defervescence set in, local pulmonary findings showed still massive depression and twanging large and medium-sized bubbly rales. The general condition was so good, that transportation home for the patient could be arranged as early as August 8<sup>th</sup>. According to reports from the parents, the patient continued to remain without fever.

The preliminary overall results of our studies with vitamin C in cases of pneumonia are: ascorbic acid has a positive influence on the course of the illness, particularly if the vitamin C deficiency disease is eliminated on the first day of the illness. Recovery then almost always sets in with satiation of the organism and the fever subsides, usually critically, back to the norm, as the following graph for the case described above under item 3 shows:

The existing pains disappear, so that the administration of narcotics can be limited. The pulse remains in good tone, side effects are completely lacking. In particular, in the cases we observed, there was never any collapse observed that could have been caused by the blood pressure lowering effect of the vitamin C.

Fig. 4 N.E. 20-year-old. Disease history above under "3<sup>rd</sup> Stage"

The general condition is always favorably influenced to a noticeable extent, as is the convalescence, which proceeds better and more quickly than in cases of pneumonia which are not treated with vitamin C. Still remaining for some time are the depression, the bronchial breathing and the rales, obviously because the organism is unable to pursue the rapid course of recovery together with the clearing up of the pathological substrate. We have not seen any failures up to now, despite the fact that some of the cases being treated were of a various serious nature.

Vitamin C therefore appears to be a very valuable therapeutic aid for the treatment of pneumonia.

We would nevertheless prefer to view this current information as only preliminary, which inspires further investigation, but is not yet to be interpreted as absolute fact. This is true in the case of pneumonia, because generally known final conclusions are only possible based on extensive material stemming from various cities and countries.

In particular, the issue of whether vitamin C achieves its optimum effect in the treatment of pneumonia alone or in conjunction with calcium, must undergo detailed examination. We got the impression that the combination of vitamin C with calcium further improved the therapeutic effect and helped speed up resorption.

Since pneumonia must be treated under all possible conditions, the apparatus with which the elimination of vitamin C deficiency disease can be determined, both in its structure and handling, must be as easy as possible. For this reason, we selected the procedures of the medical clinic of Basel for our initial investigations (Jezler and Kapp, Jezler and Niederberger), since these were very reliable and at the same time, simple and manageable.

With the Klein method of Jezler/Niederberger, we determined the reduction value of normal urine during the first visit to the patient ill with pneumonia, then applied the vitamin C treatment and after 3 – 5 hours – this is the time during which normal vitamin C metabolism or metabolism that has been returned to normal first begins to show in excretion in the urine – again checked the reduction value of the urine. We were thus able to determine that the recovery, especially the reduction of fever, momentarily always set in at the time the reduction capacity of the urine had doubled, but increased to a minimum of 5 mg percent. Thus, contrary to views still frequently voiced, vitamin C deficiency disease is to be considered eliminated if the reduction capacity of the urine has doubled within 3 – 5 hours after vitamin C application and exceeds a minimum of 5 mg percent.

If we could have carried out the titration ourselves or if we had trained personnel at our disposal, we would have made out all right with the Jezler/Niederberger method. But in any instances where untrained nursing personnel were on hand – and this is almost always the case in the home treatment of pneumonia – and we ourselves were unable to carry out the titration after 3 – 5 hours, difficulties set in and we were forced to work out an even easier procedure. We finally succeeded in doing this with the help of the tablets of dichlorophenolindophenol "Roche", a blue dye, which is immediately discolored by vitamin C.

20 ccm of 5 mg-percent urine still enables the blue color of the solution of 1 tablet of dichlorophenolindophenol "Roche" to disappear in approx. 50 cm of water. If we were to then place such a dye solution into a beaker or bottle and add 20 ccm of urine from a patient ill with pneumonia, there would for the most part be no discoloration before the vitamin C treatment. As soon as the vitamin C deficiency disease was eliminated, or the reduction value rose to over 5 mg-percent, the blue color disappeared immediately.

We therefore had the principle for the following simple method: a bottle with a cubic capacity of 70-100 ccm (beakers are not as well suited for use in the home of the patient as they are in surgery practice, since they are too breakable) is filled with 50 ccm of water, 1 tablet of dichlorophenolindophenol is added, to which 20 ccm of urine is added after the tablet dissolves and observed to see whether or not discoloring occurs immediately.

In more than 95 percent, i.e. in all cases where the original reduction value of the urine is below 5 mg-percent, this procedure works just fine. In some cases, however, the original value of the urine is over 5 mg-percent, so that the normal urine already discolors the solution. These cases can also be easily determined, however, by following the above procedure, but by adding the 20 ccm of urine in portions of 5 ccm each to the dye solution instead of adding the 20 ccm all at once. The amount that discolors is divided by 2 and for the next control, instead of the 20 ccm, half of the urine quantity that discolored is used.

Based on all of these experiences and preliminary work, we can now recommend the following procedure for the treatment of pneumonia: Before going to the patient, you should equip yourself with the following utensils:

1. Vitamin C in the form of tablets and ampoules<sup>1</sup>
2. Dichlorphenolindophenol, "Roche" in tubes of 20 tablets
3. A bottle, as shown in Figure 5

Fig. 5. Bottle for Determining Vitamin C Deficiency Diseases. This is set up as follows: take a medicine bottle with a capacity of 70-100 ccm and a screw-off top, fill it completely with water and then take out 4 times 5 ccm, marking the respective water level on the bottle using an ampoule file [rasp]. It is a good idea to keep a small supply of such bottles on hand.

If pneumonia is diagnosed, then one would assume that the vitamin C deficit at this moment may have already reached values of 1000-2000 mg or more and would from the very start apply high doses of vitamin C. Approx. 500 mg would be in the form of injections and about 300 mg in the form of tablets, which would be ingested in water, fruit syrup, sugar water, etc. The following orders would then be given to the relative or nursing personnel: over the course of the next three hours, another 18 tablets or 900 mg of vitamin C are to be given, 3 tablets approx. every half hour. If it becomes impossible to administer these doses due to gastrointestinal upsets (Stepp), it will then be necessary to effect fast saturation by means of 3-4 daily injections of 500 mg.

Approximately 3-4 hours after the visit, the urine must be checked using dichlorphenolindophenol "Roche". The process of checking the urine is demonstrated at the first visit, so that it will be carried out correctly by the person in charge, by proceeding as follows: take the bottle mentioned under item 3, fill it up to the first mark with spring water and add one tablet of dichlorphenolindophenol. After it dissolves, add 5 ccm portions of urine (lines 2-5 on the bottle!), shake briefly after each addition and look to see whether or not discoloring has occurred. If the color remains the same after 20 ccm of urine, fill up the entire bottle with urine for the next check. But if discoloring occurs beforehand, mark the spot up to which the urine should be filled (= half of the amount of urine which discolored) with a leucoplast and fill up to this point. The relatives/caretakers then receive instructions to carry out the experiment as previously demonstrated after 3-5 hours using fresh urine and to report the results.

Disappearance of the blue color indicates that the vitamin C deficiency disease has been eliminated, while non-disappearance indicates that it still exists. In the latter case, vitamin C is to be offered again. In this case it is important to return to the patient as quickly as possible, re-inject, have the patient take tablets again and carry out the urine test after 3-4 hours. The vitamin C deficiency disease is generally eliminated after the second check. If not, vitamin C is given once again until the urine begins to discolor the blue reagent.

While we were coming close to reaching a specific conclusion through our experiments regarding the treatment of pneumonia with vitamin C, we became aware of the work of Hochwald from the Klinik Nonnenbruch in Prague on the same subject. His starting point was the observation gleaned from an animal experiment that vitamin C possesses anti-allergic properties. Since the croupy form of pneumonia is now included among the allergic diseases based on new views, particularly those represented by the Nürnberg pathologist Lauche, Hochwald began to study the effect of administering vitamin C in more detail. Following an initial report at the Verein deutscher Aerzte (association of German physicians) in Prague on

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<sup>1</sup> For all of our experiments we used Redoxon "Roche", of which one tablet contains 50 mg and one ampoule contains 100 mg of vitamin C. Purchase price: 20 tablets RM 2.27. 6 ampoules RM 533.

February 7th of this year, the results were promising. The course of pneumonia was able to be shortened and a lytic defervescence achieved from the time of the very first injections. At the same time improvement could be observed in general condition, blood count and X-ray findings.

In the meantime, Hochwald has laid down his experience in a detailed publication entitled "Observations on the Effects of Ascorbic Acid in Croupy Pneumonia" and has kindly allowed us to have a look at the manuscript before it is published. We are thus in a position to reproduce some of his conclusions here.

"Ascorbic acid, injected as early as possible in large doses (individual doses of 0.5 g every 1 ½ hours, where possible until complete defervescence) provided a medicinal benefit in croupy pneumonia, which was expressed in improvement of general condition (prostration, dyspnea, etc.), rapid defervescence, earlier disappearance of local diagnostic findings, normalization of leukocytic blood count, and in suitable cases of urinary diagnostic findings as well."

Venturing out from vastly different starting points and independent of each other, both Hochwald and we arrived at almost the same conclusions in our examination of Vitamin C in cases of pneumonia.

Thanks to the fact that we were in possession of the analysis apparatus for vitamin C deficiency disease developed by the Staehelin-Klinik and not yet publicized at the beginning of our experiments, we had the opportunity to study and clarify the dosing issue in more detail and to also make the procedure available for practitioners who handle the majority of the patients ill with pneumonia. We were then also able to determine that, in general, the high doses as used by Hochwald – up to 5000 mg per the respective total of 10,000-15,000 mg - are never necessary or are only necessary on an exceptional basis, and that one can generally get by on about 1000-2000 mg. The vitamin C therapy for pneumonia will therefore be significantly cheaper and applicable not only for the clinical picture, but also for actual practice.

If we look at the vitamin C therapy for pneumonia a little more closely, then it is basically nothing more than the re-establishment of a physiological state which had become abnormal due to the illness. Elimination of the vitamin C deficiency disease is therefore, strictly speaking, not a medicinal intervention. Even when it is undertaken very quickly, there are no unpleasant side effects to be feared, so that from this standpoint as well there are no obstacles standing in the way of verification.

In conclusion let us emphasize again that the results turn out best when the vitamin C deficiency disease is eliminated on the first day of illness. Special note must be made of this fact during the verification process.

In summary: in cases of pneumonia, elimination of a vitamin C deficiency disease on the first day of illness resulted in such surprisingly favorable results, that it seemed to us that vitamin C represents a valuable enrichment of pneumonia therapy. As much detailed verification as possible is needed, however. To make this possible, a procedure was worked out which allows the elimination of vitamin C deficiency disease on the first day of illness in patients with pneumonia.