

a distinct physiologic effect which correlates with an observed biochemical change.

ACKNOWLEDGMENT

The photomicrographs were made by Miss E. Louise Craig of the Walter Reed Army Institute of Research.

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DISCUSSION

PRESIDENT DAVIS: The Hand Clinic at the Cook County Hospital tells me they have seen a number of cases there at that hospital with abrasions, redness and swelling, and subcuticular undermining of the skin. They found that the most

effective care in those people is to give them Vitamin C, to dress them cleanly, and then splint their hands. In about 48 hours the wound is healed, they say.

They also have a rather large clinic with burned patients at County Hospital, and they routinely give those patients a high Vitamin C intake

when they have had an area of 10 per cent or more of the body surface burned, at least a thousand milligrams a day. This paper is open for discussion.

DR. HARTZELL: Dr. Davis, ladies and gentlemen, it has been a pleasure to hear this presentation by Dr. Levenson and his colleagues. It calls attention, again, to the value of Vitamin C, which I think has recently been somewhat overlooked.

They have shown that following injuries, there has been a drop in ascorbic acid in the urine, blood and tissues. Hemorrhages were frequent in the wounds, and collagen production scanty.

Several years ago, Dr. Winfield and Dr. Irwin and I checked the blood of 20 patients in whom abdominal wound disruption had occurred a few hours previously, and in 19 of these people the percentage of ascorbic acid in the blood was at sub-scurvy level. In only one was it normal, and in that patient large doses of Vitamin C had been given 12 hours previous to the disruption.

We found in seriously ill individuals, people with perforated ulcers, advanced gastrointestinal problems, the concentration of Vitamin C was low.

It would seem reasonable that all people who are seriously sick should be provided with additional quantities of ascorbic acid to facilitate repair and healing. [Applause]

DR. LUND: It was a great pleasure to me to hear my former colleague, Dr. Levenson, bring forth this wonderful quantitative work, based on such a well planned experiment.

The quantitative work on humans that he and I did together on Vitamin C back in '44 and '45 could not be controlled as carefully as this. Now that he has shown the way, I think it might be possible to repeat these experiments on humans.

The changes in humans probably wouldn't take place quite so fast, because we are not quite as sensitive to scurvy as a guinea pig is, but I agree with Dr. Hartzell in his discussion. We mustn't forget that Vitamin C after any severe injury disappears rapidly, and as far as those of us who work in the municipal hospitals are concerned, a great many patients come in with a great deal of deficiency. [Applause]

DR. DUNPHY: I would like to congratulate Dr. Levenson on this very careful and informative study. I think it emphasizes the fact that there are quantitative aspects to ascorbic acid metabolism which we have not fully appreciated until recently.

Dr. Leon Edwards, working in our laboratory, has been interested in Vitamin C changes in the protein-starved rat, an animal that does not become scorbutic, and I would like to show you a slide summarizing some of his data. Unfortunately, I left the slide in my room at the Drake, but this gives me an opportunity to exercise the only

prerogative that I think is given to the Recorder of this Association, namely that of producing his own slide on a moment's notice. Could I have that slide, Doctor Gilchrist? [Laughter]

I have been rather upset about accepting this position as Recorder, because, in looking over the old correspondence, my secretary found a letter from Dr. Womack to Dr. Blades which read, "Dear Brian: It's a crummy job. The only thing worse is being secretary." [Laughter]

Very briefly, this slide shows what I mean. These studies were made by implanting a polyvinyl alcohol sponge into the healing wound and then extracting it so we are measuring only changes in newly produced tissue. You will see that in the normal animal immediately after implantation the concentration of ascorbic acid in the wound is low but rises progressively during the next 2 weeks. Indeed, it continues to increase for over a month.

In the protein-starved animal the concentration of ascorbic acid is very low. The animal has a low ascorbic acid concentration in his connective tissue, to begin with and it falls after wounding and never shows a rise comparable to that which occurs in the normal animal.

In contrast to Dr. Levenson's studies, when we gave large amounts of ascorbic acid to the protein-starved rat, we were not able to correct the defect in healing. We are sure that ascorbic acid may be involved in the faulty healing of the protein-starved animal, but the block does not rest solely on a deficiency of ascorbic acid itself. Thank you. [Applause]

DR. LEVENSON: I would like to thank each of the discussants and would like to raise a question that Dr. Dunphy just touched upon, namely, the question of what happens to Vitamin C in a normal animal who is wounded, or the animal who is injured and then is further wounded.

Actually, we don't know. There are many possibilities which merit investigation; among these is the possibility of the "accumulation" of ascorbic acid in the wound, or in the site of injury. Only limited information is available about this, the experiments Dr. Dunphy just cited and the older studies of Dr. Bartlett at the Massachusetts General Hospital.

One of the major stumbling blocks in pursuing this problem is the technical one of measuring ascorbic acid and its metabolites. Unfortunately, the chemical methods which are now available are non-specific, in that they measure other compounds as well as ascorbic acid, dehydrascorbic acid, and diketogulonic acid. Until we have a technic where we specifically know what we are measuring, we are in the usual difficult problem of interpreting the data. The use of labeled ascorbic acid in following the metabolic fate of Vitamin C in the normal and the injured animal should prove informative.

Thank you. [Applause]