INFLUENCE OF VITAMIN C ADMINISTERED AFTER RADIATION

Pages with reference to book, From 70 To 72

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Abstract

Postradjatjon administration of vitamin C was evaluated for its possible effects on reducing Or reversing the effects of radiation. Stomach, duodenum, testes and bone marrow of male guinea pigs were examined for the effects of radiation e.g. degeneration, necrosis and cellularity. There was no significant difference in the effects of radiation between animals that received vitamin C and those that did not. The study, therefore, showed that vitamin C when given after exposure has no influence on the effects of radiation (JPMA 37: 70 ,1987).

INTRODUCTION

Radioactive materials and sources are widely used in nuclear reactors, industries, medicine and many other fields. Persons working in these areas are trained to observe strict precau-tionary measures but still accidents as a result of failure of safeguard equipment or procedures do occur. Accidents are also likely to occur during transportation of radioactive material including nuclear fuel. As a result, persons working in such professions are liable to exposure to harmful radiation. In addition, persons living in adjoining areas who are not involvedin handling of such material also run a risk of radiation exposure when accidents take place.

Individuals exposed to these accidental radiations can suffer great damage like gastrointestinal ulceration, bone marrow depression and even death. Man and domestic mammals are probably the first to suffer and are the ones most severely affected. The LD50 for paramecium is about 300,000 r, for amoebae 100,000 r, Esch. coli 5000 r, frogs 700 r, mice 400-650 r, pigs 275 r and the human being 450-500[1].

All drugs known to influence the effects of radiation are effective only if given before the exposure[2] and accident is an unexpected event. Therefore it is not practically possible to administer radioprotective drugs before such accidents. The search is, therefore, on for drugs which can reverse or reduce the effects of radiation even if used after exposure. Vitamin C has some radioprotective effect[3,4] but its action if given after radiation had not yet been determined. This study was undertaken to determine whether vitamin C reduces or reverses the effects of radiation if given after the exposure.

MATERIALS AND METHODS

Thirty five male guinea pigs were divided into seven groups as shown in Table.

TABLE

Grouping of the Animals according to the Schedule of the Experiment.

Group No.	No. of animals	Average weight at the start of experiment	Radiation (Single whole body exposure)	Vitamin C	Day on which animals died/ sacrificed.
I	5	585.6 gm	No radiation	Nil	Sacrificed on 8th day after the start of experiment.
IIA	5	626.6 gm	300 rads	Nil	Sacrificed on 8th day after radiation.
IIB	5	562.4 gm	300 rads	5 mg as single daily dose for 7 days after radiation	Sacrificed on 8th day after radiation.
IIIA	5	637.8 gm	300 rads	Nil	Three animals (No. 1,3 & 5) died on 12th, 12th & 11th day after radiation respectively. The other two animals sacrificed at scheduled time on 15th day after radiation.
IIIB	5	598.6 gm	300 rads	5 mg as single daily dose for 14 days after radiation.	One animal (No.2) died on 14th day after radiation. The rest were Sacrificed at scheduled time on 15th day after radiation.
IVA	5	499.6 gm	300 rads	Nil	One animal (No.3) died on 14th day after radiation. The rest were sacrificed at scheduled time on 29th day after radiation.
IVB	5	620.8 gm	300 rads	5 mg as single daily dose for 28 days after radiation.	Three animals (No. 1,2 &3) died on 13th, 12th & 13th day after radiation respectively. The other two animals were sacrificed at scheduled time on 29th day after radiation.

Five animals (group I) were neither given radiation nor vitamin C while thirty were given 300 rads of radiation as a single whole body exposure from a Cobalt 60 unit. After exposure, fifteen animals (II B, Ill B & IV B) were given 5 mg of vitamin C (dissolved in water) by mouth daily after radiation till death/sacrifice, while other fifteen animals (II A, III A & IV A) were not given vitamin C. Animals of group II (A & B), III (A & B) and IV (A & B) were scheduled to be sacrificed on 8th, 15th and 29th days after radiation respectively. Three animals of group III A, one of III B, one of IV A, and three of IV B, however, died before the scheduled time (on 1 lth-l4th days after radiation).

At autopsy, the stomach, duodenum and testes of all the animals (sacrificed and died before scheduled time) were examined with naked eye and preserved in 10% buffered formalin. Five to six micron thick paraffin embedded sections were stained with haematoxylin and eosin, Gomori's trichrome, Van Gieson and PAS stains. Bone marrow smears from the upper end of femur of all the animals were also made which were then stained with Wright's stain.

RESULTS

At autopsy, the stomach, duodenum and testes of all the animals were examined. The stomach, and duodenum of irradiated animals showed areas of dark browh discoloration with naked eye. These were the areas of mucosal necrosis and ulceration on microscopic examination. The tests of irradiated animals showed no significant changes on gross examination while varying degrees of reduction in spermatogenie cells and areas of degeneration and necrosis were seen on microscopic examination. Bone marrow smears of all the irradiated animals showed mild to moderate reduction in cellularity and a relative decrease in myeloid count. Stewart & Dische[5] also observed similar effects of irradiation during radiotherapy on bone marrow in patients with ankylosing spondylitis.

All the above noted changes were similar in both treated and untreated animals. The study, therefore, showed that postradiation administration of vitamin C has no influence on reducing or reversing the effects of radiation.

DISCUSSION

There may be several reasons for the failure of vitamin C to reduce or reverse the effects of radiation. One reason might be that vitamin C was administered approximately 5—10 minutes after irradiation and not immediately within seconds after exposure. It is possible that the drug might have proved effective, provided it had been given within seconds. This possibility invites a further study to be carried out in future to determine the role of time factor in the reversal of radiation-induced cell injury by vitamin C.

Another reason for the ineffectiveness of vitamin C in this study could be that the dose was not sufficient. The dose for the present study was calculated from human therapeutic dose which is 500 mg for a 70 Kg man. The only ready source of reference available at the time of experiment was the work of Ghauri (1982)[4]who studied the influence of vitamin C on the effects of radiation. He used this drug in the same dose and found it to be radioprotective. It is possible that the dose required for post-radiation improvement is much higher than needed for radioprotection.

Yet another explanation for the ineffectiveness of vitamin C might be. that the drug was administered through the oral route. It is possible that the drug might have reversed or reduced the effects of radiation if it would have been given through parenteral route, thus attaining high serum concentration immediately after administration.

It is suggested that the influence of different doses of vitamin C given parenterailyon the effects of radiation should be investigated.

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