EFFECTS OF ACUTE ETHANOL INTOXICATION IN THE DOG

by

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Introduction

Chairman Bjerver: The next paper, to be presented by Mr. Garriott, concerns ethanol intoxication in the dog. Ethanol is widely recognized as a euphoric on the central nervous system, but the effects on other body systems are less well known.

Ethyl alcohol is reported to cause increases in various blood components and to have an effect on the cardiovascular system. The effects of acute and lethal intoxication on plasma free fatty acids, blood glucose, serum glutamic oxalacetic transaminase, arterial blood pressure, and cardiac rate in dogs were studied.

Ethanol was infused at the rate of 1.25 gm./kg/hr in seven dogs until death. Blood samples were drawn at 15 minutes, 30 minutes, one hour, and hourly intervals thereafter for the above determinations. Blood pressure and electrocardiogram were monitored continuously. The results were compared with those of two other groups of four dogs each in which sodium pentobarbital or normal saline was infused. Pentobarbital was administered at the rate of 15 mg/kg/hr until death. Normal saline was likewise continuously infused for five hours in the saline control group.

In all dogs there was approximately a 50% increase in blood-glucose during the first two hours. In all ethanol dogs this hyperglycemia continued to death. In contrast, in the pentobarbital dogs a near-normal level was reached at four hours.

The mean plasma free fatty acids were uniformly higher than the saline controls and the free fatty acid levels of the pentobarbital group declined slowly and from two hours until death were significantly lower than the saline controls. A similar pattern was evident with serum glutamic oxalacetic transaminase activity, i.e., the ethanol dogs were elevated over the saline controls and in the pentobarbital dogs was uniformly less than in the saline controls. Initial elevations in arterial blood pressure occurred in the ethanol dogs. After three hours a reversal and fall in blood pressure occurred.

At death the mean arterial blood-alcohol was 670 mg. %. A depression in heart rate as well as decrease in mean arterial blood pressure suggesting circulatory distress began three hours after the alcohol infusion was started. At this time the mean alcohol level was 530 mg. %. Respiratory difficulty was not evident for at least one more hour.

DISCUSSION

Professor Drew: Do you have any explanation why there was a drop in glucose after two hours and a rise again after three? Is this a stress response? I am wondering if it was an example of a kind of collapse phenomenon.

Mr. Garriott: This is what it is presumed to be. You mean as it occurred in all three groups—first an increase, the drop at three hours, and then the rise again? In the saline group, there was nothing, no drug present, so that the effect of stress was evident. Probably this rise again (I can't explain the drop and the rise, in fact probably the whole hyperglycemia) is due just to stress.

Professor Drew: Wouldn't Selye argue that there are three stages in physiological response to stress in which the third is the collapse phenomenon. You seem to have three stages in a number of your things, but you are not interpreting them in a Selye type of way, you are simply saying they occur.

Mr. Garriott: That certainly would be the case there, but the later increase would be a recovery, I guess, from the collapse effect.

Professor Drew: Isn't it a bit difficult to explain it as a recovery when, in fact, they are recovering in order to die?
Mr. Garriott: No, it would be difficult to explain it that way, but this is the way it was observed.

Question: There are great similarities with these effects of alcohol, and the one which you would expect after large doses of oxaloacetic, would it allow you to speculate that some of the alcohol reaction might be due to metabolites formed during the breakdown?

Mr. Garriott: This is certainly possible. This was a very acute experiment of course. The animals were infused until death, and there was probably not a large metabolism or not much of a chance for metabolism of a lot of the alcohol. I thought that could be attributed to the effects of the oxalocetate. I couldn't say for sure.

From the curve of the blood-alcohol levels, you could not observe any effects of metabolism because it is almost a straight line curve until death.

Dr. Taylor: Do you have any idea how these various pressure effects and effect of glucose and fatty acids are modified, either by alcohol or beta blocking agents, for example. Have you done any work or contemplated any work of that nature?

Mr. Garriott: No, we haven't. As I say, it has been done with hexamethonium, and so all factors have depressed the hyperglycemia. I don't know if any work with a beta blocker has been done. There may have been some, but I am not aware of it.

Question: This hyperglycemia is depressed with the alpha blocker?

Mr. Garriott: Yes, according to Klingman.

Dr. Goldberg: I am coming back to Dr. Redetzki's question because, as I understand in these experiments, you are up to blood-alcohol level of about 400 through 500 mg. %? This must have been anywhere from perhaps 315 mg. %, which is quite a bit. I would guess without knowing that you wouldn't reduce it by small amounts of alcohol plus antibuse. So in answer to the question put by Dr. Redetzki, I guess you should say, as Selye did, that you can do it graphically rather easily and infuse the same amount and see what happens. I think it is quite an interesting question. I can see your point.

Mr. Garriott: It would be interesting to try and see if we could produce any of the effects.