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ALCOHOL AND DRIVING

BY

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Alcohol is absorbed into the blood at a rate that varies according to several factors, but disappears at a rate that is constant for any individual, varying between 5 c.c. and 20 c.c. per hour. The relationship between the level of alcohol in the blood and urine is constant, but the level is not an index of the amount consumed, as individuals vary.

Legislation penalising driving with a particular level of alcohol in the blood adopts critical levels that vary from 150 to 50 milligrammes per cent. in different coutnries. Breath analysing machines have an optimum error of 20-25%, so are therefore only useful for screening.

For these reasons Dr. Gadd does not favour legislation based on analysis results, but considers that a fair result can best be obtained by a combination of analysis, medical examination and the evidence of eye-witnesses.

When Dr. Ross and I talked about this we decided it might be more interesting if we were as controversial as we could be. So I shall begin, as Professor Christie said, with a few facts on alcohol and then bring up what I think is a controversial issue.

A bottle of gin as purchased is six-tenths water. That means that by volume there is 40% of alcohol in the bottle. That is measuring by volume. If you measure by weight there is 33.3%, that is because the volume of alcohol weighs less than water. If you want to convert alcohol by volume into alcohol by weight, you multiply by 0.83. Proof spirit, measured at 51°F., contains 57.06% alcohol by volume. So the bottle of gin lablelled either 30° under proof or 70° proof means that it contains 70% of 57.06, which is 40% alcohol by volume. Absolute alcohol (100% alcohol) would be 175.1° proof. The Americans, of course, are different. Their proof spirit is 50% by volume and spirits in America are sold between 86° and 100° proof. That is from 43% to 50% by volume. If gin is 60% water, how much water is there in the average man? Well, coincidentally, 60%. So that a 70 kilogramme man, 154 lb., contains in his make-up 42 litres of water. Now if you pour one tot of gin (that is 1¼ fluid ounces here, or 35 cubic centimetres), if you

pour one tot of gin into the average man you would expect that amount of alcohol (one tot, 35 c.c., which contains 11.8 grammes of alcohol), if you pour that 11.8 grammes of alcohol into 42 litres you get a concentration per cent of

$$\frac{11.8 \times 100}{42{,}000}$$

which comes to .028 grammes per cent. And we call that, for ease of speaking, 28 milligrammes per cent. So what we have done there is to pour one tot into 42 litres and we have achieved a concentration of 28 milligrammes per cent alcohol.

This alcohol, taken into the body, distributes itself throughout all the body water, but we cannot say that the blood alcohol would immediately become 28 milligrammes per cent. We are not pouring a small amount into a bucket of water. There is the question of the rate at which this is taken into the body, and that rate is determined by factors such as the presence of food in the stomach, and oil which coats the stomach wall. If you add soda water to your whiskey you increase the rate of absorption, so whiskey and soda will give a particular percentage of blood alcohol more rapidly than whiskey and water taken under identical conditions.

If we were to draw a graph with the vertical axis representing the level of alcohol in the blood, and the horizontal axis the number of hours after drinking, then we would find as we measured the blood alcohol that the absorption could take place in different individuals at different rates. One person might absorb alcohol very rapidly in the first hour. Another absorbs it more slowly, and the third more slowly still. As the absorption comes to an end the blood alcohol level turns over and begins to fall. The fall off in the blood alcohol is the sum of two major factors. 90% of the alcohol is destroyed in the liver, that is not excreted. 10% is excreted either through the urine or in the breath, and there is a variable quantity excreted in the breath. The interesting thing is that the disappearance of the alcohol from the blood takes place at exactly the same rate whatever the initial level is. This disappearance is in the region of 10 c.c. per hour. This figure 10 has been relied upon in evidence. It is a figure which is based on statistics. The gentlemen who are arraigned before you are not statistical quantities. They are human individuals and the rate of disappearance which occurs in normal human individuals is anywhere between 5 c.c. per hour and 20 c.c. per hour. But in any one individual, whatever the amount of alcohol, the rate will always be the same.

It seems obvious from what I have said that there must be a relationship between the measured level of alcohol in the blood and the amount of beer or spirits which has been consumed. How much stress should one put on the measurment of blood alcohol and the inference which is drawn from it? Well, the measurement is fairly reliable. There are two basic, accepted methods, the Cavett and the Kozelka and Hine, and it can usually be assumed that with a properly qualified chemical analysis the accuracy will be 14 milligrammes per cent on either side of the true value. The Kozelka and Hine method is a little more accurate. I should say here that many people prefer to investigate the urine rather than blood for a number of reasons. It is easier to get a large sample; it is easier to check that the substance you are measuring is in fact alcohol; it is easier to carry out a repeat estimation if something goes wrong; it does not involve what might be construed as an attack upon the person, and it is difficult for the subject under consideration to refuse to give a sample. All you have to do is keep him in a room long enough and he will produce it. The relationship between the urine level and the blood level is constant, because the kidney has the power of concentrating the level of alcohol in urine, which is higher than the level in blood. It is higher by a factor of ⅘ and most analysts, I think nowadays use urine, and if they wish to quote the blood level they multiply their urine results by ¾. Some of them take two specimens of urine at a variable period; usually one before the medical examination and one after, and this gives them some idea of the rate of disappearance. One taken, say, two hours after drinking, and one three and a half hours after drinking.

When we come to the translation of alcohol level in milligrammes per cent into the amount of alcohol drunk, we begin to find snags. The factor which has been evolved by a gentleman called Widmark varies from person to person; the weight of the person and particularly the type of body build. As I said, alcohol is distributed throughout the water in the body; it is not distributed throughout the fat in the body. You may have two 70 kilogramme men: one will have considerably more fat in his body than the other, and the distribution of alcohol will be different in those two men. The tables published by the B.M.A., which are frequently used to convert blood alcohol into the minimum amount of alcohol taken, are based upon the smallest quantity of spirit or beer for that particular blood level in a person of that particular weight. Men and women differ also, but does it really help to know the smallest number of whiskies or beers which have been drunk? Two whiskies might have no effect on a tobacco farmer. Two whiskies might well have quite a remarkable effect on a stenographer who does not drink at all. The tendency in many countries, and this is the controversial

point I want to come to, is to lay down a level of blood alcohol above which an accused person is regarded as being under the influence or drink, or whatever phrase you like to use, and below which he is not. I am convinced this is not a good practice, firstly because it rather savours of trial by expert witness. It means that the chemical analyst has merely to state that the level of alcohol is 180 and immediately the chap is condemned. In fact, I would go further than this and say that the various levels laid down in different countries condemn the system at the outset.

Belgium	....	....	....	....	150	milligrammes	per cent.
West Germany	....	....	....		150	„	„ „
Iceland	....	....	....	....	120	„	„ „
Finland	....	....	....	....	100	„	„ „
Norway	....	....	....	....	50	„	„ „

Well, this 150 figure does seem to be a significant figure, because despite the variation in these values, all of those countries will agree that a blood alcohol level of 150 milligrammes per cent would condemn a person. We may say then that it could be alleged that a level of 150 milligrammes per cent, or .15, would indicate intoxication. But there must be some of you who have encountered a level of 150 in practice when the medical practitioner's examination has not corroborated drunkenness. There is an answer to this one, of course. Medical examination measures co-ordination and there are many people with blood alcohols of 150 who can successfully suppress inco-ordination. There are a few people, in fact, who might be judged sober by the average doctor at a level of 240, but experiments carried out in Britain and in America on driving skills and skills similar to driving indicate that judgment begins to be affected at or about the 100 milligramme level. Some people say 120. 100 to 120, there is evidence that one can demonstrate in these tests that judgment is affected and that it is definitely impaired at 150 milligrammes per cent and above. And it is the result of these tests on driving skills which have put the significance into this figure of 150 milligrammes.

I have said that the medical examination does not yield an assessment of judgment as such. This does not lessen the value of the medical examination, because one must remember the intoxicating effect of drugs, including the tranquiliser series, and if illnesses such as diabetes, and I suppose that one must consider the responsibility of a person who knowingly omits to take insulin and so on, but neither the medical nor the chemical examinations can be relied upon to indicate reliably whether or not a driver is under the influence of alcohol. Because of this,

I feel that a very important aspect of evidence is the eye witness evidence of abnormal driving. The behaviour of the drunken driver seems to be very variable; it is unpredictable. He might be creeping along at 15 miles per hour following the gutter with one eye and the speedometer needle with the other, or he may aim at the next intersection and put his foot flat down and just hope. Whichever way, it is not normal driving and it is this abnormality in behaviour which is valuable and which may sometimes be omitted. It is particularly useful, of course, if you have got a good witness, and many policemen are good witnesses.

I would like to mention the question of measurement of alcohol in the breath. I have seen reports on four machines for doing this, the drunkometer, the alcometer, the intoximeter and the breathalyser. The best of these has an error not better than between 20 and 25%. This is considerably greater than the error in the approved methods of testing blood and urine. Also, in the question of the relationship between alcohol in the breath and alcohol in the blood, all the figures obtainable are pure statistics again. The distribution of the figures is very wide. There is a great individual variation and, in my opinion, the only value of breath analysis is a screening test, if it is necessary to screen a lot of people for alcohol levels. It is useful in picking out those who are likely to have a raised alcohol. This means that they must then go ahead with the classical routine procedure of blood or urine.

My main object here has been to submit to you that the establishment of a mandatory level of blood alcohol above which a person is legally intoxicated would not, I believe, be in the best interests of justice. What I would like to do now is to throw this open to discussion.

Discussion

Value of blood or urine analysis.

Question: Do you consider blood or urine analysis to be useful to negative the suggestion sometimes put up in court that the symptoms observed by witnesses to the facts are due to causes other than alcohol?

Dr. Gadd: "Yes, but of course the value of the analyst's evidence must not be overrated. For instance, when the patient has been involved in an accident and has suffered shock and possible injury there may be a loss of body water so that the normal ratio of alcohol to water in the body would be disturbed. It should also be remembered that the effect of nervous shock is often to sober the patient up so that although his blood alcohol may be high he may not exhibit the symptoms which one would expect from a person with such high blood alcohol."

Facilities for chemical analysis.

Question: To what extent are facilities for chemical analysis available in this country.

Dr. Gadd: "The tests are routine ones for properly trained analysts in normally equipped analytical laboratories. The Government analysts' laboratories in this country are so equipped but of course there is the difficulty of transmitting specimens from outlying districts. Alcohol does not travel well, particularly in high temperatures, and it is therefore necessary to add a preserving agent which does not interfere with the accuracy of the test. The fact that there has been a delay between obtaining the specimen and the completion of the analysis may, of course, be inconveient to the courts but unless there is some evidence of lack of care the results should be accurate."

Tolerance to alcohol.

Question: Is the fact that some people can take more alcohol than others due to practice or what?

Dr. Gadd: "I do not know any scientific answer to this question, but from what I have seen I would say that tolerance can be developed in certain individuals. This may be connected with the rate of absorption. As is well known, it is customary in some countries to eat a quantity of olive oil with food and people in these countries can consume an enormous amount of alcohol because the oil coats the lining of the stomach and slows down the rate of absorption."

Question: If tolerance is developed would it be correct to assume that powers of judgment are also retained at a high level?

Dr. Gadd: "We have no accurate way of testing this. The nearest that we have come to it, so far as I know, is by carrying out controlled tests on driving skill. Driving skill of course involves judgment and the tests do indicate that skill (and therefore presumably judgement) is generally impaired when the level of blood alcohol rises above .15 but it must be stressed that these tests also show that some individuals can drive with skill although their blood alcohol is as high as .18 and if they are driving with skill as revealed by these tests it can only be said that they appear to retain their powers of judgment."

Mixing drinks.

Question: Is there any scientific basis for the proposition that if you mix your drinks you become intoxicated quicker than by drinking straight?

Dr. Gadd: "Not in the sense that two different types of alcoholic drinks will have any direct effect on your blood alcohol level. But the effects on the stomach lining may be profoundly different. For instance, the juniper extract in gin has an irritant effect on the stomach lining which pure cane spirit or good whiskey does not have. If you add an irritant to a glass of alcohol you will cause a slight increase in the rate at which it is absorbed, presumably because the irritant will dilate the blood vessels in the stomach lining and there will be a greater area from which the alcohol can be absorbed. It is therefore possible that certain mixtures of drinks will produce this irritant effect and slightly increase the rate of absorption. It is of course also said that mixing drinks causes a worse hangover. In general the unpleasant symptoms of a hangover seem to be caused by the amount of methyl alcohol in the drink. Good quality liquor has very little methyl alcohol but some cheap French brandies have a startlingly high amount."

Question: You have mentioned the alcohol content of gin. Is there any difference between gin and other spirits such as brandy and whiskey?

Dr. Gadd: "For practical purposes they can all be taken as approximatelyy the same in this country — approximately 40% alcohol by volume."

Effect of alcohol on drugs.

Question: What is the effect of alcohol on drugs such as insulin or the barbiturates?

Dr. Gadd: "With barbiturates there is a profound effect and I know a doctor who was in the habit of taking barbiturates and accidentally killed himself by forgetting that if you take two barbiturate tablets and three or four whiskies, you may well go to sleep and not wake up. As far as insulin is concerned, it should be remembered that alcohol is a food containing a considerable number of calories although it contains no vitamins (so you cannot live on it). Most doctors will agree that a diabetic and also a person with high blood pressure should go easy on alcohol."

Question: You have mentioned the doctor who took two barbiturate tablets and three or four whiskies. Is there any ceiling on the amount of alcohol and barbiturates that can safely be taken in combination?

Dr. Gadd: "It depends entirely on the type of barbiturate. Some of them are very fast acting and some much more slow acting. In the case of the fast acting barbiturates which begin to operate almost immediately, unexpected results can be experienced by taking even a small amount

of alcohol but I am not aware of any tests that have been carried out to ascertain the full effects of the combination between measured amounts of barbiturates and alcohol."

Doctor looking at accused in the dock.

Question: Do you think it valuable to ask the doctor while he is giving evidence to have a look at the accused in the dock and compare what he saw when he made his examination with what he sees now?

Dr. Gadd: "This is only valuable if the lapse of time is not too great. If the doctor has been seeing dozens of cases a day and this case comes to court four months later, he may be quite unable to make a useful comparison."

"Was the accused conscious or unconscious when you saw him at the clinic?"

"He was pretending to be conscious but he was not."

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