circulation which had occurred when the heart fibrillated and just before the perfusion was started rather than to the presence of the emboli in the internal carotids. He was moved from the recovery room to the ward on the fourth day after operation. Convalescence was uneventful apart from transient pain and hyperaesthesia in the right foot caused by the popliteal embolism. This was managed conservatively and the popliteal pulse returned and the symptoms subsided. The ankle pulses were still absent but the circulation in the foot was normal when he was discharged to his home on June 30.

Discussion

One of the strange features of this story was the way in which the pellets had remained in a single mass during their course of 35 yards from gun to patient. This discharge of spread shot "en bal" is, however, recognized and sometimes follows some modification of the cartridge or gun-barrel before firing, with the object of diminishing spread and increasing the range. The pellets which were removed from the heart showed evidence of some process such as this, for they were faceted and, indeed, some were still lightly adherent to each other on removal (Fig. 4). According to the account we received they had not ricocheted during their course, nor had they struck any bone in their transit in the body to account for their deformities. Another feature was the size of the shot. They were number fives. The diameter of the pellets was a little

Fig. 4.—Removed pellets (diameter about 3 mm.) showing facets and light adherence.

over 3 mm., so that they were large enough to be arrested and firmly impacted at the bifurcations of the carotid and brachial arteries in a child of this age. Smaller shot might have progressed further into the cranial vessels.

Barrett (1950) quotes two cases, one fatal and one followed by hemiplegia, due to small pellets entering the carotids from gunshot wounds in the neck. He also quotes cases in which foreign bodies left in the heart have caused complications and death due to thrombosis and embolism. This might have been a complication quite apart from the possibility of further embolism of the shot themselves had they not been removed from the heart. Barrett (1950), D. E. Harken (quoted by Barrett), and other writers in recent years all agree that foreign bodies in the heart should be removed. It was not always possible to do this in the past. The use of extracorporeal circulation should greatly facilitate it in the future, as the operation described here, which would have been impossible without it, shows.

The happy result in this case was made possible by many helpers. We are particularly indebted to the other members of the perfusion team at St. Thomas's Hospital; to the nursing staff in the theatre, recovery room, and City of London Ward; to the staff of the Jenner Laboratory; and to the blood donors. The skilful treatment by Mr. Reid's service made the patient's survival possible in the early hours after wounding.

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ALCOHOL AND ROAD TRAFFIC ACCIDENTS

BY

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The effect of small doses of alcohol on a skill resembling driving has been studied by Drew, Colquhoun, and Long (1958), who showed that performance began to deteriorate at blood-alcohol levels of 20 to 30 mg./100 ml. They disproved any threshold level, but showed rather that impairment of performance was progressive and linearly related to blood-alcohol concentration. At a blood-alcohol level of 80 mg./100 ml. the mean error of performance during their test had increased by about 16%.

Similar reports of the effect of these surprisingly small doses of alcohol on driving ability, judgment, reaction time, and behaviour, with associated blood-alcohol concentrations in the regions of 4 to 65 mg./100 ml., have been reported by Lauer (1939), Bjerver and Goldberg (1951), Loomis and West (1958), and Cohen, Dearnaley, and Hansel (1958).

A special committee of the British Medical Association (1960), reporting on the relationship of alcohol to road accidents, concluded that a concentration of 50 mg. of alcohol per 100 ml. of blood in the driver of a motor vehicle was the highest that could be accepted as consistent with the safety of other road-users.

The purpose of the present investigation was to establish to what extent alcohol was a factor in persons involved in road traffic accidents who arrived at a hospital casualty department. The road traffic accident (R.T.A.) casualties comprised any persons involved in injury with a propelled vehicle—a comprehensive group inclusive of injuries sustained from mishaps to drivers to those occurring from the jolting of passengers on buses.

An attempt was made to obtain blood samples from all such R.T.A. casualties. Uninjured patients were simply asked to give a blood sample, no specific purpose being indicated. Where injury had occurred an additional few millilitres of blood was taken at the time of other blood investigations. The specimens were taken immediately after arrival so that they might reflect, as accurately as possible, the blood-alcohol level at the time of the accident. Blood alcohol was estimated by the method of Conway (1957).

During the 12-months of the investigation 574 R.T.A. casualties were recorded in the admissions register; of these, 398 (69%) had blood-alcohol estimation carried out. The discrepancy between these figures is explained by refusals, omissions, and emergencies which precluded delay. We do not believe that any significant selection resulted.

Results

Accident Rate and Time of Day

The 574 casualties which occurred during the 12 months were subdivided into 24 groups to indicate their hourly incidence during the day (Fig. 1 A). The

peak incidence at 11 p.m. occurs immediately after the closing of licensed premises in the district at 10.30 p.m. A traffic census (Manchester City Surveyor, personal communication) taken on a main thoroughfare adjacent to the hospital and representative of the traffic-flow pattern during the 24 hours indicated a maximum traffic flow at 9 a.m. and 6 p.m. At no time after 6 p.m. did traffic-flow figures approach this peak. The maximum hourly accident rate was thus seen to be unrelated to the maximum traffic flow but to occur in the hour following the closure of licensed premises. The 398 R.T.A. casualties who were subjected to blood-alcohol estimations were also subdivided into 24 groups to indicate their hourly incidence during the day. Similar peak periods are recognized (Fig. 1 B). The close relationship between the two tracings (A and B) confirms that the group with alcohol estimations carried out is representative of the 24-hour period and not a selected sample from casualties occurring during licensing hours.

FIG. 1.—Summated R.T.A. casualties for one year allocated to their hourly occurrence by the clock. A=Total hourly R.T.A. casualties (574). B=Total hourly R.T.A. casualties subjected to alcohol estimation (398).

Alcohol Factor in R.T.A. Casualties

For purposes of comparison in this study, the day has been divided into four significant six-hour periods. That between 6 a.m. and 12 midday includes the peak morning traffic period, and that between 12 midday and 6 p.m. the evening traffic peak. The 6 p.m. to 12 midnight period includes the principal hours of social functions, while the 12 midnight to 6 a.m. period is the one of minimum road usage. The incidence of accidents, using this grouping, shows the familiar pattern, with

FIG. 2.—Percentage of 398 R.T.A. casualties occurring in each six-hour period of the day (D). Percentage of each six-hour group with 20 mg./100 ml. (A), 50 mg./100 ml. (B), and 100 mg./100 ml. (C) blood alcohol content.

predominance of accidents in the 6 p.m. to 12 midnight group (Fig. 2 D and Table I).

TABLE I.—Percentage of R.T.A. Casualties Which Occurred in Each Six-hour Period of the Day

6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
13.6	27.6	39.9	18.8

Three levels of blood alcohol have been chosen for study in this series. These are 20 mg./100 ml. and over, which includes those with small doses; 50 mg./100 ml. and over, levels established as unsafe by investigation committees (World Health Organization, 1954; B.M.A., 1960); and 100 mg./100 ml. and over, where frank intoxication manifestations occur.

The percentage of R.T.A. casualties arriving with these selected levels of blood alcohol in the four six-hour periods of the day is shown in Table II and represented graphically in Fig. 2 A, B, and C. The high

TABLE II.—Percentage of R.T.A. Casualties in Each Six-hour Period of the Day with 20, 50, and 100 mg. of Alcohol per 100 ml. of Blood

Blood Alcohol (mg./100 ml.)	6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
20	16.6	30.9	57.2	73.3
50	1.8	11.8	35.8	61.3
100	1	10.0	22.0	37.3

incidence of alcohol in the period after 6 p.m. and particularly after midnight, together with the fact that over a third of all casualties arriving after midnight have a blood alcohol over 10 mg./100 ml., indicates the magnitude of the problem. This analysed group included drivers, passengers, and pedestrians, and therefore further subdivision is required to apportion the individual incidence.

TABLE III.—Percentage of Drivers Found in Each Six-hour Group of R.T.A. Casualties

6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
14.6	23.9	41.4	20.1

TABLE IV.—Percentage of R.T.A. Drivers in Each Six-hour Period of the Day with Blood Alcohols of 20, 50, 100 mg./100 ml.

Blood Alcohol (mg./100 ml.)	6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
20	17.1	36.8	53.5	64.5
50	0	10.5	33.3	58.3
100	0	7.0	22.2	31.2

FIG. 3.—Percentage of 239 R.T.A. drivers occurring in each six-hour period of the day (D). Percentage of each six-hour group with 20 mg./100 ml. (A), 50 mg./100 ml. (B), and 100 mg./100 ml. (C) blood alcohol content.

Alcohol Factor in R.T.A. Drivers.—Blood-alcohol estimations were carried out on 239 drivers. The incidence of accidents in the 24-hour period again showed the established pattern (Table III and Fig. 3 D). The percentage of these drivers arriving with the selected blood-alcohol levels during the six-hour divisions of the day is seen in Table IV and Fig. 3 A, B, and C. One-third of the accidents between 6 p.m. and midnight occurred in drivers whose blood alcohol was above the level recognized as safe, and after midnight over a half (58.3%) of accident drivers showed this level. After midnight almost a third (31.2%) of accident drivers had blood alcohol levels indicating frank intoxication (over 100 mg./100 ml.).

Alcohol Factor in R.T.A. Pedestrians.—Blood samples were obtained for alcohol estimation in 64 pedestrians. The incidence was once again maximal between 6 p.m. and midnight (Table V and Fig. 4 D). The percentage of these pedestrians arriving with the selected alcohol levels is seen in Table VI and Fig. 4 A, B, and C. These results suggest that the relaxation of care and impair-

TABLE V.—Percentage of Pedestrians Found in Each Six-hour Period of R.T.A. Casualties

6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
12.5	34.3	45.3	7.8

TABLE VI.—Percentage of R.T.A. Pedestrians in Each Six-hour Period of the Day with Blood Alcohols of 20, 50, 100 mg./100 ml.

Blood Alcohol (mg./100 ml.)	6-12 a.m.	12-6 p.m.	6-12 p.m.	12-6 a.m.
20	12.5	27.5	79.3	100
50	0	9	58.6	100
100	0	9	37.9	100

FIG. 4.—Percentage of 64 R.T.A. pedestrians occurring in each six-hour period of the day (D). The percentage of each six-hour group with 20 mg./100 ml. (A), 50 mg./100 ml. (B), and 100 mg./100 ml. (C) blood alcohol content.

ment of judgment with even a low blood-alcohol level increases the risk to the pedestrian on the road. It will be noted that all the pedestrians involved in accidents after midnight were frankly intoxicated.

Alcohol Factor in R.T.A. Passengers.—Too many variable factors occurred in this small series for any reliable conclusion to be reached.

Drink and Age

The 239 drivers who attended were grouped according to their age. Each group covered five years (Fig. 5). The percentage of drivers in each group who showed a blood-alcohol level over 50 mg./100 ml. was assessed (Fig. 5, below baseline). Although the largest number of accidents occurred in the 20-25 age-group, alcohol

TABLE VII.—Total Number of Drivers in Age-groups and Percentage of Each Five-year Age-group with 50 mg. of Alcohol per 100 ml. of Blood

Years	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-
Total drivers in five-year age-groups	31	62	35	26	18	13	11	22	10	8	1	1	1
% drivers in each group with blood alcohol of 50 mg./100 ml. . . .	10	26.2	32.3	44.0	41.0	25.0	27.2	23.7	30.0	—	—	—	—

FIG. 5.—239 R.T.A. drivers divided into five-year age-groups. Above baseline is total number of casualties in each group. Below baseline is the percentage of each group with 50 mg./100 ml. blood alcohol or over.

was a factor in a larger portion of the older age-group drivers. There is a suggestion here that it was not particularly the inexperienced young drinker who became involved in accidents, and that the older driver has not acquired immunity to the deleterious effect of alcohol on his driving.

Discussion

This analysed series is not offered for comparison with a control series of drivers not involved in accidents. It was realized that without compulsory powers for analysis only the co-operation of the non-drinking fraction would be secured. Expert committees of the World Health Organization (1954) and the British Medical Association (1960) had already established that to drive with a blood-alcohol concentration of 50 mg./100 ml. or more was prejudicial to safety. Additional evidence in a controlled series by Holcomb (1938) had shown that above this level (50 mg./100 ml.) the incidence of accident drivers increased as compared with general-population drivers, this incidence rising to 30 to 1 at a blood level of 150 mg./100 ml.

The analysis reveals the large number of accident drivers whose blood alcohol is above this "safe" level and confirms the increased incidence of these accidents in the hours following the closure of licensed premises.

It would seem that to a material extent, but unwittingly, the hospitals have become a refuge for the drinking driver, and, rightly, clinical measures directed to recovery have taken precedence over chemical tests and police investigation. Yet where mutilation and death has occurred and a blood alcohol has soared, but

is secret, public safeguards appear to be prejudiced and justiciary investigation of circumstances hampered by lack of authority to assess the alcohol factor in every case.

Death and mutilation occurred in several instances in this series. The handicap of deficient evidence was manifest in that in no case was a charge of driving under the influence of drink proffered.

Summary

Evidence is presented that alcohol is a factor in many accidents requiring hospital attendance. The preponderance of accidents in relation to the evening licensing period and the high percentage of "unsafe" drivers during this period is referred to, and the protection from police investigation afforded to drunken drivers in hospital is discussed.

We record our thanks to Dr. L. Stent, in whose laboratory the alcohol estimations were carried out, and to Mr. D. J. Moss, M.Sc., who performed the estimations. We are grateful to Sister Prenton and the staff of the casualty department for their help in collecting blood samples.

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SUICIDE IN ALCOHOLICS

BY

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Many alcoholics kill themselves. Though this association between alcoholism and suicide is widely recognized it is poorly documented.

Reports of the frequency of suicide in alcoholic populations are rare. Gabriel (1935) reported that 21% of a group of inebriates subsequently committed suicide, and Dahlgren (1945) found 34 (20%) suicides out of 174 alcoholics for whom the cause of death was known. Lemere (1953) collected from patients narratives of 500 deceased relatives whose drinking had constituted a problem; 55 (11%) had committed suicide. Norvig and Nielsen (1956) found 15 (7%) suicides during a five-year follow-up of 220 male alcoholics discharged from hospital. Reversing the procedure, Robins *et al.* (1959) obtained histories in 119 out of a consecutive series of 134 suicides and discovered that 31 (26%) had been chronic alcoholics. Sullivan (1900) demonstrated high suicide rates in occupations where alcoholism was rife and also anticipated Bandel's numerous observations (summarized by Freudenberg, 1931) of parallels between regional and secular fluctuations in alcohol consumption and male mortality in general and suicide in particular.

The Investigation

Here we report the incidence of suicide in two series of chronic alcoholics. The first consists of 131 consecutive voluntary patients discharged from the Maudsley Hospital after treatment of alcohol addiction; the features of this population have been described by Davies *et al.* (1956), and one of us (N. K.) had at some time attended most of them. Follow-up was from 12 months to 11 years after discharge, the mean being five and a half years. There were 110 males and 21 females, all first admissions to the hospital. The second series comprised 87 patients (62 males and 25 females) admitted to St. Pancras Observation Ward in London, not always for the first time. Their case notes were necessarily less full, but no patient was included in the

series unless at least five years of excessive drinking was recorded. Follow-up in all cases in this series was between four and five years. A few patients were fortuitously common to both series; these included two suicides.

Follow-up information was to hand for most of the Maudsley cases but not for the St. Pancras series. Alcoholics are elusive, frequently changing address, so that even their immediate kin may not know their whereabouts; therefore the laborious process of tracing them often ends in failure. As we were concerned only with suicides, whenever our information was incomplete we searched the quarterly alphabetically arranged death registers in the General Register Office. Where a death was entered corresponding in name and age to one of our subjects we purchased a copy of the death certificate, making sure from the additional data thereon that it did refer to our subject. When necessary the information about the cause of death was supplemented by obtaining a transcript of the inquest proceedings. By this method, apart from changes of name, we made sure of tracing all deaths in England and Wales. Our results for suicide are minima, however, because we would not know of deaths in Scotland, Northern Ireland, or abroad.

All except four of the cases we have counted as suicide were so recorded on the certificate. Our detailed knowledge of the circumstances surrounding the four exceptions allowed us, however, to come to a firm conclusion that the subjects had encompassed their own deaths. Two of these subjects were cases of paraldehyde poisoning, one was a case of coma of unknown origin, and the fourth, who had during a six-months period been admitted several times to different hospitals after suicide attempts, was found drowned a few days after his latest discharge. We have not included the unnatural deaths of two subjects who met their end in road accidents, nor that of another found dead with two empty port wine bottles beside her bed.