MODE OF DEATH IN THE ACCIDENTS
FROM CHLOROFORM

In all the cases in which the symptoms which occurred at the time of death are reported, there is every reason to conclude, as shown above, that death took place by cardiac syncope, or arrest of the action of the heart. In forty of these cases the symptoms of danger appeared to arise entirely from cardiac syncope, and were not complicated by the over-action of the chloroform on the brain. It was only in four cases that the breathing appeared to be embarrassed and arrested by the effect of the chloroform on the brain and medulla oblongata, at the time when the action of the heart was arrested by it; and only in one of these cases (No. 42) that the breathing was distinctly arrested by the effect of the chloroform, a few seconds before that agent also arrested the action of the heart.

It was previously shown that chloroform vapour has the effect of suddenly arresting the action of the heart when it is mixed with the respired air to the extent of eight or ten per cent., or upwards; and we must therefore conclude that, in the fatal cases of its inhalation, the air the patients were breathing just before the accidents occurred contained this amount of vapour. There was no means adopted, so far as is reported, to regulate the proportion of vapour in the inspired air, in any case in which an accident happened; and there was the liability in every case that ten per cent. or more of vapour might be present in the air the patient breathed; and in no case did death occur in the manner that it occurs when the vapour of chloroform does not exceed five per cent. of the inspired air.

There is in a great number of the cases an evident connection between the accident and the probable strength of the mixture of vapour and air. In six cases the accident occurred just after the commencement of the inhalation; in two of the cases, Nos. 27 and 37, the fatal symptoms occurred just after fresh chloroform had been applied on the handkerchief and sponge; and in several cases, in which the circulation was suddenly arrested just after the patient had been rendered insensible, the insensibility had been induced so quickly as to prove that the vapour must have been inhaled in a very insufficient state of dilution.

THE TWO KINDS OF SYNCOPE

Dr. Patrick Black has made an objection to the fact of the patients having died of paralysis, or over-narcotism of the heart, in the accidents from chloroform.* He says that paralysis of the heart would be death by syncope, but that the symptoms before death, and the conditions of the organs met with afterwards, are not in accordance

with such a view of the case. In order to show that both the symptoms and the after death appearances, in the fatal cases of inhalation of chloroform, are consistent with paralysis of the heart, it is necessary to point out the difference between ordinary syncope and cardiac syncope. One of the best examples of ordinary, or what may be called anæmic syncope, is that which occurs in a common blood-letting, whilst the patient is in the sitting posture. When the bloodvessels, especially the veins, which at all times contain the greater part of the blood in the body, do not accommodate themselves fast enough to the diminished quantity of blood, the right cavities of the heart are supplied with less and less of the circulating fluid; and in a little time are not supplied at all, when the heart ceases to beat, in accordance with the observation of Haller, that it does not pulsate when it is not supplied with blood. The moment the heart ceases to supply blood to the brain there are loss of consciousness and stoppage of respiration; but on the patient being placed in the horizontal position the blood flows readily into the right cavities of the heart from the great veins of the abdomen and lower extremities; the heart immediately recommences its contractions; the brain is again supplied with blood, and respiration and consciousness return.*

* See some interesting papers on the value of recumbent position in syncope, by Dr. Richardson, in the Association Medical Journal for 1854. I entirely agree with Dr. Richardson that no kind of syncope commences at the brain, and that, during recovery, the heart always resumes its functions before consciousness is restored. The restoration of the heart's action in ordinary syncope by the re-supply of blood to its cavities, without any alteration in the condition of the brain, was well proved by Dr. Richardson by means of some interesting experiments on animals which I had the opportunity of witnessing.

The blood may remain in the ordinary quantity; but if the bloodvessels do not keep up their usual support, and exert a sufficient pressure on their contents, the same kind of syncope will occur as that from blood-letting. The late Sir George Lefevre related the case of a lady who fainted whenever she left her bed, and assumed the upright posture; no cause could be found for this until it was ascertained that she suffered from varicose veins of the legs: bandages to these extremities prevented the fainting. It is obvious that in this case the mechanism of the syncope was the same as that in blood-letting; the distension of the varicose veins under the weight of the superincumbent blood had the same effect in preventing the supply to the right cavities of the heart, as if the blood had been entirely removed. The faintness which often occurs on first rising, when a person has long kept the recumbent posture from any local cause, is probably of the same kind; the veins not having had to support the weight of the usual column of blood for some days or weeks, lose their tone we may presume, and yield when they are all at once subjected to the weight of a column of blood extending from the lower extremities to the heart, so that this organ ceases to be properly supplied with the circulating fluid.

In cardiac syncope, on the other hand, the cavities of the heart, or at all events the right cavities of this organ, are always full, whether the syncope depend on paralysis of the heart by a narcotic, or inherent weakness of its structure, or on its being overpowered by the quantity of blood with which it is distended. After death from this kind of syncope, if the blood has not been displaced by artificial respiration or
other causes, the right cavities of the heart and the adjoining great veins will be found filled with blood, and the lungs will in many cases be more or less congested. The appearances in short will be very much the same as in asphyxia by privation of air, which ends in a kind of cardiac syncope, the stoppage of the heart being partly due to over-distension of its right cavities, and partly to loss of power in its structure, from the want of a supply of oxygenated blood through the coronary arteries. In death by anæmic syncope, on the contrary, all the cavities of the heart are found empty, or nearly so, and the same is frequently the case with the adjoining great veins, whilst the lungs are usually pale.

The syncope occasioned by some kinds of mental emotion is of the ordinary or anæmic kind, and consequently the condition of the brain must act first on the bloodvessels, and not directly on the heart. Certain persons are liable to faint on witnessing a surgical operation. Now if the mental emotion of these persons acted directly on the heart, whilst the rest of the vascular system was unaffected, the distribution of the blood would be nearly the same as in asphyxia, where the circulation is first impeded in the lungs, and is ultimately arrested by loss of power in the heart. If the action of the heart were weakened, or stopped, in the first instance, by the kind of emotion under consideration, the arteries would be emptied by their contractility and elasticity, and the blood would accumulate in the right cavities of the heart and the great veins leading to them. In a medical student fresh from the country, who is by no means deficient in blood, the jugulars would become distended and the face livid, and the recumbent posture would probably do but little towards removing the symptoms. The phenomena which are witnessed, however, indicate a very different condition of the vascular system. The person about to faint from the cause indicated, frequently becomes pale before he feels anything wrong; and when requested to retire and sit down, often says that there is nothing the matter with him. In a short time he faints, and falls, if no one catches hold of him; but the moment he is in the recumbent posture he recovers. In such a case as this, the effect of the mental emotion must first be exerted on the veins, or the veins and capillaries, through the nerves which supply these vessels; they allow themselves to become distended, and the heart ceases to act for want of its supply of blood, as in syncope from blood-letting, and anæmic syncope from any cause.

Several authors have attributed the empty state of the heart met with after death, in certain cases of fatal syncope, to want of power in the left ventricle to supply the right cavities of the heart; but this is to argue as if the blood passed out of the body after leaving the right ventricle, and the left ventricle had to supply a newly-formed fluid. The effects of want of power in the left ventricle are the same as those of an obstruction at the origin of the aorta; the lungs become congested; and the right cavities of the heart more or less distended, from the blood not being able to pass readily through the lungs. Patients who die of heart disease die with the cavities of that organ full. Some patients, indeed, with fatty disease of the heart, die suddenly of anæmic syncope, and the heart is found empty; but in these cases it is evident that death is not
Sir,—Recently a new long-acting analgesic drug has been given preliminary clinical trials in this hospital. The drug, diagrammatically represented below, is the pectinate of dihydro-hydroxycodeinone, the pharmacology of which has been studied in France (Aubry, 1953).

The investigation here was divided into two parts: first, the use of the drug as premedication in place of morphia and pethidine, etc. The patients were selected at random; no great variation in age or severity of illness was sought, the cases ranging from hernia to nephrectomy, in the adult age groups. A fixed dose of 10 mg of dihydro-hydroxycodeinone pectinate (Proladone) was given intramuscularly one hour before operation, atropine in suitable doses also being administered. The normal effect of premedication, the production of sedation and the reduction of the total amount of anaesthetic agent used, was employed, the patients recovering within the hour after operation.

After these totally unexpected results it was decided that to proceed further with this part of the trial was useless and the second part of the trial was commenced. Patients were now given normal premedication, morphia, papaveretum or pethidine, and atropine or scopolamine, and the anaesthetic was that usually administered. Dihydro-hydroxycodeinone pectinate, 10 mg intramuscularly, was given either in the theatre or immediately on return to the ward. Selection was as before, and the results are given below.

<table>
<thead>
<tr>
<th>Effect of Dihydro-hydroxycodeinone Pectinate in 100 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of operation</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Number of cases</td>
</tr>
<tr>
<td>Number of cases of nausea and/or vomiting</td>
</tr>
<tr>
<td>Cases requiring further analgesics</td>
</tr>
</tbody>
</table>

Number of patients requiring no further postoperative analgesic = 77.
In 23 patients given dihydro-hydroxycodeinone Pectinate further analgesic drugs were needed in:

1 case within 2 hours of dihydro-hydroxycodeinone
5 cases ,, 4
10
14
18

These results bear out the original French statement that this drug is a long-acting analgesic (Truchard, 1954), its effects lasting from eight to twelve hours. Further trials are in progress, the use of the drug in children and in malignant disease being investigated. I am grateful to Messrs Crookes Laboratories for their generous supply of the drug (Proladone).

O. H. BELAM,
Whittington Hospital, London, N.19.

REFERENCES


PRELIMINARY COMMUNICATION

A NEW HAEMOSTATIC DRUG

Sir,—From time to time attempts are made to reduce haemorrhage at operation by the pre-operative administration of drugs which lower the clotting time. A drug with this property has recently been introduced to this country. This is sodium-\(\alpha\)-naphthylamine-\(4\)-sulphonic acid or “Naphthionin S.N.S.”

“Naphthionin S.N.S.” is chemically related to Congo Red. The way in which it reduces the clotting time is not known for certain, but it probably stimulates the production of fibrinogen and thromboplastin by the reticulo-endothelial system. The drug is administered intravenously (100 mg in 10 ml) and its effect reaches a peak 1–3 hours after injection. Several authors have reported successful clinical trials of the drug in reducing blood loss at operation. A similar trial carried out at the Queen Victoria Hospital, East Grinstead may be of interest to your readers.

Clinical trial.

One hundred dental operations performed at the Queen Victoria Hospital, East Grinstead, between November 23, 1955, and February 10, 1956, were used for the survey (table I).

<table>
<thead>
<tr>
<th>Type of case used for survey</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of wisdom teeth</td>
<td>48</td>
</tr>
<tr>
<td>Multiple extractions and dental clearance</td>
<td>34</td>
</tr>
<tr>
<td>Removal of buried roots</td>
<td>5</td>
</tr>
<tr>
<td>Removal of buried teeth</td>
<td>5</td>
</tr>
<tr>
<td>Removal of dental cysts</td>
<td>4</td>
</tr>
<tr>
<td>Insertion of Gunning's splint and wiring</td>
<td>1</td>
</tr>
<tr>
<td>Removal of fibroma of palate</td>
<td>1</td>
</tr>
<tr>
<td>Antrostomy</td>
<td>1</td>
</tr>
<tr>
<td>Alveolectomy</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Certain dental cases admitted between these dates were not used for the survey, e.g. (1) major operations in which controlled hypotension was used; (2) children under 15 years of age; (3) miscellaneous cases inadvertently left out.

There was no selection of cases apart from this. Ages varied from 17 to 86. Several had intercurrent conditions such as hypertension, coronary disease, and chronic bronchitis.

The 100 cases were arbitrarily divided into two groups of 50. The patients in one group (A) all received 100 mg of “Naphthionin S.N.S.” intravenously 1 to 3 hours pre-operatively. Those in the second group (B) did not. During each operation the dental surgeon was asked to assess the amount of bleeding and to state whether it was average, more than average, or less than average. This assessment was made on: (a) the number of swabs used; (b) the amount of blood in the sucker bottle; (c) general impressions of operating field. The surgeons were not aware of the group to which each patient belonged. The results are given in table II.

Some of these cases were retained in hospital for more than 24 hours owing to bruising and swelling of the jaws. The incidence of this complication in Group A was 18 per cent and in Group B 20 per cent. No toxic side effects of the drug were noticed in any of these cases.
A further 20 cases have since been given 200 mg (double the previous dose) of "Naphthionin S.N.S." and compared with a control group of 20. In this series, Naphthionin appeared to have a rather more pronounced effect on the bleeding (table III).

Some of the patients receiving 200 mg of "Naphthionin S.N.S." complained of a sensation of heat all over the body and constriction of the chest. These symptoms were not accompanied by objective signs and always disappeared in about 5 minutes.

### Discussion.

Two points seem to emerge from this survey:

(a) "Naphthionin S.N.S." appears to be quite safe in the doses mentioned.

(b) The percentage of cases in which bleeding was thought to be less than average was higher in the group receiving the drug than in the control group.

More objective experiments will be required to determine the degree to which bleeding can be reduced at operation by the use of "Naphthionin S.N.S."

A. J. HEBER
East Grinstead

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ON CHLOROFORM AND OTHER ANAESTHETICS continued from page 189

occasioned by the disease of the heart, but by some condition of the bloodvessels which accompanies it.

Chevalier was, I believe, the first to draw marked attention to cases of sudden death arising from an empty state of the heart, in a paper in the first volume of the Transactions of the Royal Medical and Chirurgical Society; and he rightly attributed the emptiness of the heart to a loss of power in the blood vessels. His words are as follows:—

"The disease I have now described may, perhaps, be termed asphyxia idio-pathica. The essential circumstances of it evidently denote a sudden loss of power in the vessels, and chiefly in the minuter ones, to propel the blood they have received from the heart. In consequence of which, this organ, after having contracted so as to empty itself, and then dilated again, continues relaxed for want of the return of its accustomed stimulus, and dies in that dilated state."

(To be continued)