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AN ANALYSIS OF VASOMOTOR PHENOMENA (FAINTS) OCCURRING IN BLOOD DONORS*

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The removal of two-thirds of a pint of blood for the Transfusion Service has little effect on the majority of blood donors. A small group—about 5%—show certain vasomotor phenomena, which are commonly called "faints," although loss of consciousness is uncommon. The object of the present investigation was to analyse more precisely the characteristic features of these vasomotor attacks. Records were obtained of 48 donors who fainted. Initial observations were often made on donors before bleeding and not followed up when fainting did not occur. Factors which may influence the incidence of these faints, such as age, sex, time since last meal, type of work, atmosphere and temperature of the room, are being studied in a larger series and will be reported upon later.

A regular routine is adopted for bleeding donors. Donors from factories and institutions are usually fetched by car from their place of work in parties of three or four. On arrival at the clinic they are given their cards, and every effort is made to set their minds at rest if they show any signs of nervousness. As a rule they are bled as soon as they arrive, but at rush periods there is often an unavoidable queue of them, usually good-humoured and cheerful. Having removed their coats, donors are taken by a nurse to the room for bleeding. Here they lie on a couch with their head and shoulders raised to an angle of about 40 degrees; in cold weather they are covered with a blanket. The arm is supported on a pillow, and the skin of the front of the forearm is cleaned by a nurse. A sphygmomanometer cuff is put on the upper arm and a pressure of 80 mm. Hg applied: for routine bleeding the cuff is kept at this pressure, which has been found to be the optimum to obtain a satisfactory flow in most donors. It is occasionally found, however, that the blood flows better if the pressure is lowered to 40 mm. Hg. Approximately 0.2 c.cm. of local anaesthetic—novutox—is injected at the site of venepuncture; this produces a sharp sting, due to its antiseptic content. The venepuncture needle is then inserted. Each step is explained to the donor. The bleeding takes from three to ten minutes, depending on whether the needle is well in place and on the size of the vein. The nurses talk to the donors throughout the proceedings. The donors remain on the couch for two to three minutes after the removal of the needle while the arm is being bandaged. They then get up and walk to the recovery room, where they lie flat for ten to fifteen minutes; they then sit up in a chair, have a cup of tea and a biscuit, and leave shortly afterwards. It has been found that donors prefer to move

away from the slightly medical surroundings of the bleeding-couch, even though they have to walk to another room for the rest period. Most donors show no after-effects, and are able to return at once to their work.

In addition to recording symptoms in donors about to faint, signs such as colour changes, sweating, convulsions, vomiting, and incontinence, and blood pressure and pulse rate before and at intervals after bleeding were observed. Since the majority of donors are factory workers, anxious to return to work, we are not able to keep them lying down for a long period before bleeding in order to obtain a baseline for pulse and blood-pressure levels in the recumbent position. It should be noted that blood pressure and pulse readings taken before the attack are with the donor's head and shoulders propped up, those during it with the donor lying flat, and some of the later ones with the donor sitting.

Treatment.—When donors faint the head of the bleeding-couch is immediately lowered and the nurse does her best to assure them that nothing serious has occurred. They remain on the couch until well enough to walk to the recovery room. Adrenaline has been given in some cases, and is thought to have hastened recovery. Controlled observations on this point are now being made. In some cases smelling-salts are used; the effect of these on pulse and blood pressure is unknown.

Type of Donor who Faints

A history of previous fainting, either associated with or independent of bleeding, was present in over half the donors who fainted. In just under half there was evidence of nervousness, either objectively or by the donor's own confession. A type which is likely to faint is that exemplified by Case 47—a weedy, furtive, and bumptious little man aged 26, who showed considerable apprehension. He was described at the time as an obvious social misfit, and gave a history of previous faints. On the other hand most unlikely people may faint—e.g., No. 37, who works in the blood depot, is in excellent health, and is not nervous. She has fainted on two successive occasions, both times after the full amount of blood had been removed. Also Case 11, a woman doctor who normally has a low blood pressure—80/50—and a pulse rate of 56. Burly and phlegmatic policemen faint surprisingly often; the man who insists on reading a newspaper and smoking a cigarette to soothe or hide his nervousness is also a likely victim. The incidence of faints is increased if those waiting to be bled or being bled observe a donor faint. Even allowing for these factors, it is usually not possible to predict which donors will faint.

* A report to the Medical Research Council from the North-West London Blood Supply Depot.

About equal numbers faint after the full amount has been taken and during the actual bleeding. However, since it is sometimes reported that donors have fainted after their return to work, the incidence of fainting is probably higher after than during venesection.

Signs

Flushing.—In 5 cases a preliminary flush was seen on the face—e.g., in Case 7; it was not looked for elsewhere. In some cases this flush was especially watched for and definitely did not occur. It should be noted that many donors flushed when the local anaesthetic was given. This, apparently a reaction to the pain, happened immediately afterwards, and lasted about half a minute, whereas flushing preceding fainting came on later.

Pallor.—Pallor of the face was an almost constant finding, occurring in at least 41. In the more severe cases it was seen also in the hands. It was usually one of the earliest features of the attacks, although often preceded by subjective symptoms such as a feeling of warmth. In only one case (No. 42) is it certain that no pallor occurred throughout the attack, while in three others (Cases 4, 5, and 10) its onset was delayed. In Case 5 the patient did not become pale until four minutes after complaining of faintness and dizziness, while Case 10 felt faint after being bled, but did not become pale until she collapsed after walking to the recovery room. Apart from being fairly mild there was no other distinguishing feature in these three cases.

Sweating.—Sweating was mostly associated with pallor, and varied from slight clamminess to drenching perspiration apparently over the whole body, since the clothing was soaked.

Slowing of the Venous Stream.—Slowing of the stream was observed in only 6 of the cases in which the attack occurred during bleeding. The attack was well developed before slowing took place.

Convulsions.—Convulsions associated with loss of consciousness were present in 7 instances. It is not common for loss of consciousness to occur without convulsions, though it has been observed—not in this series—when donors walking to the recovery room collapse to the ground; convulsions preceding loss of consciousness have not been seen. The convulsions were much the same in type. The usual premonitory signs—faintness, pallor, etc.—were followed by loss of consciousness, a tonic spasm throughout the body with deviation of the head and eyes to one side, and fixed dilated pupils. Then clonic movements of varying intensity occurred, to be followed by a period of stertorous snoring respirations which were almost constantly accompanied by a bright facial flush with no trace of cyanosis. This flush faded rapidly with the recovery of consciousness, leaving the patient cold and clammy as before. The rest of the attack followed the usual course, the patient having little or no recollection of what had happened. Cases have been seen that have had more than one bout of convulsions, but there were none in this series.

Other signs were: sighing respirations (3 cases), and uneasy movement of head and limbs (3 cases). Vomiting is not a common feature (1 case), although its incidence is probably higher than this series would lead one to suppose.

Blood Pressure and Pulse

Blood Pressure.—A high blood pressure and a high pulse rate were often seen before bleeding (Table I), due pre-

TABLE I.—Blood Pressure and Pulse in 48 Donors who "Fainted" after Bleeding

| Case No. | Age | Sex | Blood Pressure | | | | | | | Pulse | | | | | | |
|----------|-----|-----|-----------------|---------------------------|---------|---------|---------|---------|---------|-----------------|---------------------------|---------|---------|---------|---------|---------|
| | | | Before Bleeding | Time after Onset of Faint | | | | | | Before Bleeding | Time after Onset of Faint | | | | | |
| | | | | 5 min. | 10 min. | 15 min. | 20 min. | 30 min. | 40 min. | | 5 min. | 10 min. | 15 min. | 20 min. | 30 min. | 40 min. |
| 1 | 30 | M | — | — | 75/50 | — | 85/60 | 85/70 | 125/90 | — | — | 60 | — | 64 | 70 | 68 |
| 2 | 18 | F | — | 95/75 | — | 90/55 | — | 120/80 | — | — | 76 | — | 88 | — | 80 | — |
| 3 | 34 | F | 125/85 | 85/— | 95/55 | 85/55 | — | 95/65 | 110/85 | 92 | 52 | 74 | 68 | — | 68 | 76 |
| 4 | 25 | F | 130/95 | 95/65 | 95/55 | 95/55 | — | 95/60 | 115/— | 88 | 72 | — | — | — | — | — |
| 5 | 27 | M | — | 85/50 | 115/70 | — | — | — | — | — | 64 | 80 | 72 | — | — | — |
| 6 | 30 | F | 150/90 | 100/65 | — | — | 115/75 | — | — | 140 | 80 | 84 | — | — | — | — |
| 7 | 40 | F | 135/65 | 105/65 | 145/90 | — | — | 115/75 | — | 68 | 64 | 64 | — | — | 64 | — |
| 8 | 20 | F | 135/105 | 95/60 | 115/65 | — | 115/75 | 110/80 | — | 120 | 76 | 84 | — | 88 | 88 | — |
| 9 | 19 | F | 115/75 | 105/70 | 105/75 | — | — | — | — | 96 | 84 | 88 | — | — | — | — |
| 10 | — | F | 115/75 | 85/65 | — | — | 115/75 | 105/65 | 105/60 | 84 | 72 | — | — | 84 | 96 | 105 |
| 11 | 34 | F | 80/50 | — | — | — | — | — | 80/50 | 56 | — | — | — | — | 65 | — |
| 12 | 48 | M | — | 90/55 | 125/85 | — | — | 125/90 | — | — | 46 | 68 | — | — | 84 | — |
| 13 | 22 | F | — | 95/55 | 95/70 | — | 100/65 | — | — | — | 56 | 80 | — | 74 | — | — |
| 14 | 45 | M | — | 70/40 | 95/60 | — | — | 125/85 | — | — | 36 | 52 | 56 | — | 60 | — |
| 15 | — | — | — | — | — | 105/80 | 62/40 | — | — | — | — | — | — | — | — | — |
| 16 | 31 | F | — | — | — | 120/80 | — | — | 75/40 | — | — | — | — | — | — | — |
| 17 | 36 | M | — | 100/60 | 110/75 | — | — | 110/70 | 110/85 | — | 62 | 76 | — | — | — | 76 |
| 18 | 26 | M | — | 120/80 | — | — | 120/80 | — | — | — | 50 | — | — | 54 | — | — |
| 19 | 22 | F | — | 60/— | 100/60 | — | — | — | 80/45 | — | 45 | 64 | — | — | — | 68 |
| 20 | 18 | F | — | 80/65 | 100/60 | — | — | — | 110/65 | — | 48 | 56 | — | — | 60 | — |
| 21 | 36 | M | — | 70/— | 100/50 | — | — | 115/75 | — | — | 54 | 58 | — | — | 64 | — |
| 22 | 51 | F | — | — | 70/— | — | — | 60/— | 70/— | — | — | 68 | 82 | — | 68 | 64 |
| 23 | 27 | F | — | 45/15 | — | 70/50 | — | 86/50 | — | — | 60 | — | 65 | — | 86 | — |
| 24 | 35 | M | — | 70/50 | — | — | 105/65 | — | — | — | — | — | — | — | — | — |
| 25 | 47 | F | 110/90 | — | 80/65 | — | — | 110/80 | — | — | — | — | — | — | — | — |
| 26 | — | — | — | — | 130/90 | — | — | 140/95 | — | — | — | 78 | — | — | 80 | — |
| 27 | 25 | F | — | — | 85/60 | — | — | 105/90 | 115/80 | — | — | 42 | — | — | 60 | 64 |
| 28 | 19 | F | — | 100/60 | — | 90/60 | — | — | — | — | 74 | — | 74 | — | — | — |
| 29 | 35 | F | 120/60 | 90/50 | — | 90/50 | — | 95/55 | 80/45 | 82 | 54 | — | 72 | — | 54 | 74 |
| 30 | 39 | F | 110/65 | 80/40 | 85/40 | — | — | 90/50 | 90/50 | 80 | 56 | 56 | 67 | — | 64 | 64 |
| 31 | 41 | F | 130/80 | 90/60 | 110/80 | — | — | 100/70 | — | 84 | 64 | 66 | — | — | — | — |
| 32 | — | — | — | 90/70 | 90/70 | — | — | — | — | — | 74 | 72 | — | — | — | — |
| 33 | 38 | M | — | 95/60 | — | 115/70 | — | — | — | — | 60 | — | 68 | — | — | — |
| 34 | 20 | F | — | 110/70 | 130/90 | 100/75 | — | — | — | — | 76 | 90 | 88 | — | — | — |
| 35 | 34 | M | 130/90 | 115/65 | 110/65 | — | — | 125/80 | — | 82 | 60 | 72 | — | — | 62 | — |
| 36 | — | — | — | 70/50 | 80/60 | — | — | 75/50 | 100/65 | — | 50 | 80 | — | 80 | 77 | 84 |
| 37 | 40 | F | 115/80 | 85/60 | — | — | 115/70 | — | — | 82 | 60 | — | — | 70 | — | — |
| 38 | 50 | M | — | 95/60 | 115/80 | — | — | 110/70 | — | — | 76 | 66 | — | — | 68 | — |
| 39 | — | M | 145/80 | 85/55 | — | — | — | 95/55 | — | 60 | 40 | — | — | 56 | — | 56 |
| 40 | 52 | M | 125/75 | — | 40/— | 55/— | — | — | 110/70 | — | — | 40 | 48 | — | — | 56 |
| 41 | 28 | F | 165/95 | 80/55 | 135/95 | — | — | 65/35 | 140/85 | 136 | 60 | 84 | — | — | 60 | 96 |
| 42 | 28 | F | 115/75 | 105/75 | — | — | 115/70 | 100/70 | 105/65 | 84 | 72 | — | — | 84 | 136 | 96 |
| 43 | 43 | F | 180/95 | 100/70 | — | 105/75 | — | 95/70 | 105/75 | 112 | 60 | — | 66 | — | 72 | 66 |
| 44 | 31 | M | 120/70 | 55/35 | 105/65 | 115/75 | — | 115/75 | — | 70 | 38 | 60 | 54 | — | 52 | — |
| 45 | 27 | F | 165/75 | 145/70 | — | — | — | — | — | 110 | 82 | — | — | — | — | — |
| 46 | 45 | F | 165/85 | 95/60 | 120/75 | — | — | — | — | 84 | 60 | 86 | — | — | — | — |
| 47 | 26 | M | 165/100 | 145/85 | 145/75 | 135/75 | 125/75 | 135/85 | — | 80 | 72 | 80 | 20 | 60 | 72 | — |
| 48 | 47 | F | — | 75/45 | — | 115/65 | 95/70 | 90/65 | — | — | 40 | — | 64 | 80 | 80 | — |

sumably to nervousness. In this series it was not possible in most cases to take readings at the onset of the attack, but five minutes afterwards the blood pressure was considerably lowered in nearly every instance, Case 47 being a notable exception. No constant relation between the level of the blood pressure at this period and the severity or duration of the attack was noted—e.g., Cases 23 and 44 both had low pressures at five minutes, the former was still low at thirty minutes, while the latter felt and looked well with a normal blood pressure at fifteen minutes. Case 47 had a blood pressure of 165/100 before bleeding. He had a typical convulsive attack, at the end of which his blood pressure was still raised (165/88). It may be argued that a fall in pressure may have occurred during the four minutes the attack lasted. Such a speedy recovery has not, however, been noted in any other case. Many donors who show no untoward effects (Table II) have a slight fall in blood pressure, but in those who faint the fall is larger.

Pulse Rate taken at the Wrist.—As is the case with blood pressure, high figures in the pulse rate before bleeding were not unusual. A fall in the rate was common to all donors, being more pronounced in those who fainted.

TABLE II.—Blood Pressure and Pulse in 26 Donors who did not Faint

| Case No. | Sex | Age | Blood Pressure | | | Pulse | | | | |
|----------|-----|-----|-----------------|---------------------|---------|-----------------|---------------------|--------|---------|---------|
| | | | Before Bleeding | Time after Bleeding | | Before Bleeding | Time after Bleeding | | | |
| | | | | 5 min. | 15 min. | | 30 min. | 5 min. | 15 min. | 30 min. |
| 1 | F | 27 | 128/75 | 122/78 | — | 115/72 | 77 | 69 | — | 75 |
| 2 | F | 26 | 98/52 | 92/56 | 94/54 | — | 58 | 64 | 58 | — |
| 3 | M | 21 | 130/90 | 145/95 | 145/85 | — | 80 | 94 | 76 | — |
| 4 | M | 40 | 110/75 | 102/65 | — | — | 82 | 82 | — | — |
| 5 | F | 28 | 142/90 | — | — | 120/— | 74 | — | — | 94 |
| 6 | F | — | 135/70 | 128/80 | 120/75 | — | 90 | 90 | 78 | — |
| 7 | F | 38 | 120/70 | 110/80 | — | — | 75 | 80 | — | — |
| 8 | F | 21 | 130/80 | 120/90 | — | 108/80 | 83 | 93 | — | 80 |
| 9 | M | 54 | 188/110 | 178/115 | — | 140/90 | 87 | 90 | — | 92 |
| 10 | F | 22 | 112/80 | 125/88 | — | 90/70 | 130 | 126 | — | 120 |
| 11 | M | 64 | 215/130 | 215/135 | 180/105 | — | 86 | 82 | 72 | — |
| 12 | F | 35 | 155/95 | 135/85 | 135/95 | — | 80 | 88 | 80 | — |
| 13 | F | 54 | 160/100 | 165/95 | 155/95 | — | 100 | 88 | 86 | — |
| 14 | F | 37 | 120/80 | 135/85 | 125/95 | — | 86 | 88 | 86 | — |
| 15 | F | 34 | 120/80 | 100/76 | — | — | 102 | 76 | — | — |
| 16 | F | 53 | 160/95 | 170/105 | 170/95 | — | 94 | 92 | 82 | — |
| 17 | M | 36 | 125/80 | 135/90 | 125/75 | — | 66 | 64 | 62 | — |
| 18 | M | 31 | 180/100 | 175/105 | 170/105 | — | 90 | 90 | 84 | — |
| 19 | F | 52 | 125/60 | 140/90 | — | — | 84 | 74 | — | — |
| 20 | M | 57 | 155/95 | 140/85 | — | — | 64 | 62 | — | — |
| 21 | M | 36 | 140/90 | 135/85 | 135/85 | — | 92 | 90 | 74 | — |
| 22 | F | 54 | 195/100 | 150/95 | 145/85 | — | 90 | 74 | 62 | — |
| 23 | F | 22 | 125/95 | 125/85 | — | 105/85 | 72 | 74 | — | 72 |
| 24 | F | 60 | 105/75 | 120/70 | — | — | 80 | 80 | — | — |
| 25 | F | 22 | 80/62 | 100/70 | — | — | 80 | 76 | — | — |
| 26 | F | 18 | 144/90 | 122/75 | — | — | 106 | 80 | — | — |

As can be seen in Table II, the pulse rate by no means always fell and rose with the blood pressure (Case 9).

Symptoms

The following are the commonest symptoms: faintness, dizziness, or giddiness (28); nausea or an uneasy feeling in the epigastrium (14); feeling of heat (7), which, when it occurs, is usually the first indication that something is wrong. Very rarely there was a sensation of coldness (1). Other uncommon symptoms were sensations of tingling (4), general numbness (1), yawning (3), a desire to defaecate (2), blurred vision (1), and ringing in the ears (1). It is not uncommon for donors to sleep after a severe faint, sometimes for as long as two to three hours, although there were no examples in this series. Only two cases of actual defaecation were seen during a year's observation of donors. Both occurred on the same morning. They are not included in this series, and detailed observations were not made. The first case was that of a young man who had a severe and prolonged faint; he expressed the desire to defaecate, and had to be carried to the lavatory and supported there. He had only one loose motion. He had to be detained for some time afterwards, and left more than

an hour after bleeding. The other case was that of an older man, who also had a prolonged and severe faint.

Clinical Types

Faints vary in severity. They may be arbitrarily divided into the following clinical types: (a) mild, showing a transitory pallor, clamminess, and faintness, with pulse and blood pressure which fall but recover their original level rapidly—e.g., Case 6; (b) severe, showing great pallor, with drenching perspiration, and a large fall in pulse rate and blood pressure, which take a long time to return to normal—e.g., Case 39; (c) mild or severe, with associated vomiting; (d) mild or severe, with associated convulsions; (e) mild or severe, with both vomiting and convulsions (severe type, Case 29). There is not a case in this series with vomiting alone, but such do occur.

Recovery Period

The recovery period varies greatly, from a few minutes to an hour or more. In 38 cases an attempt was made to discover whether the blood pressure or the facial pallor returned to normal first. In 18 cases the relationship was missed, as they were first seen when pallor and low blood pressure were present together, and later when both were back to normal. In 8 cases the blood pressure was normal while pallor was still present. In 2 cases the colour was normal before the blood pressure, while 10 cases were sent away with a low blood pressure. The probability is that in the last-mentioned group the colour returned to normal before the blood pressure, since patients are not discharged as a rule until they look and feel well. The time taken for recovery of blood pressure varies. In Case 22, for instance, forty minutes after the onset of the attack the systolic blood pressure was still only 70 mm. Hg, while in Case 44 the pressure returned to 115 mm. Hg fifteen minutes after the onset.

It is not uncommon to see donors improve temporarily, then relapse—e.g., Case 41: this is a mild example of the repeated faint. A man of 60 had to be kept for over two hours because whenever he lifted his head he fainted again. It is not uncommon to hear of factory workers fainting an hour or two after they have returned to work apparently quite well.

Recovery in cases with convulsions (Cases 7, 9, 15, 29, 30, and 47) tends on the whole to take longer than in cases without convulsions. Experience in the past has shown that patients with convulsions are likely to sleep for one to three hours before returning home. They often wake up feeling perfectly well, and are always anxious to come back and "behave better" next time. They do not seem alarmed by their experience.

Discussion

Points which appear of particular interest in the series of "faints" described here are: (1) That pallor may persist when blood pressure returns to normal. (2) The prolonged nature of the attack in certain instances: the ordinary "vasovagal faint" is usually considered a transitory phenomenon.

The present vasomotor phenomena have many points in common with those recorded by Lewis (1932) in soldiers with "effort syndrome." He cites as predisposing factors youth, poor physical condition, fatigue, and emotional stress. The possible influence of such factors in causing the donor to faint will be discussed at a later date. In Lewis's cases syncope was the central feature of the attack, and was accompanied by feelings of irritability, dizziness, nausea, pallor, sweating, and a fall in blood pressure and pulse rate. In some cases clonic spasms were noted. Lewis

points out that these attacks rarely occurred while the subject was lying down. The majority of faints in donors, however, take place in the recumbent position, which may well account for the fact that in most cases loss of consciousness does not occur. The removal of blood also introduces a possible modifying factor which was not present in the type of patient studied by Lewis, although there is no obvious relation between the amount of blood removed and the severity of the attack.

Ferris, Capps, and Weiss (1935) and Weiss and Baker (1933) in their investigations of patients suffering from hypersensitivity of the carotid sinus also produced, by pressure on the sinus, phenomena very much like those described here. That unconsciousness and convulsions were more common in their cases may again possibly be accounted for by the difference in posture, since some at least of these patients were sitting or standing. They found a lack of relation between pulse and blood pressure, and in some cases there was no fall in either. They postulated three mechanisms responsible for these attacks: (1) vagal, causing slowing of the heart or asystole which might result in a secondary fall in blood pressure; (2) depressor reflex, causing a primary fall in blood pressure; and (3) cerebral, due to local anaemia from contraction of small cerebral vessels, causing fainting without pulse or blood-pressure change.

All the cases in this series could be placed in one or other, or a mixture, of these categories. It does not seem likely, however, that fainting attacks occurring in donors are due to hyperirritability of the carotid sinus, for it is an uncommon condition and more frequent in older persons and arteriosclerotics, whereas the incidence of faints in donors is higher in the younger section of the population. It seems reasonable to suppose, however, that the attacks in donors are brought about by the same efferent pathways as those in the carotid sinus syndrome and that the carotid sinus is one of many receptor organs from which the afferent impulses start.

Phemister and Livingstone (1934) describe a case, closely resembling those in this series, of a man aged 28 who fainted while blood was being drawn for a Wassermann test.

Stead (1940) and Wallace and Sharpey-Schafer (1941) have made some observations on collapse after and during bleeding, and have recorded phenomena similar to those here described, but since they were removing much larger quantities of blood (760 to 1,220 c.cm.) it is difficult to correlate their results with the observations in this paper.

It is not possible from the data available from this series to interpret details of the vascular changes which take place.

Case Histories

Case 5.—Male aged 27. Two or three minutes after bleeding had started the nurse noticed flickering of the eyelids, and soon afterwards the donor felt breathless and faint. The respirations were deep and sighing: B.P. 75/45, P. 60. The blood was flowing well and the donor's colour was good. The needle was removed and the head of the couch lowered. Four minutes later the patient was pale and sweating, but was breathing normally: B.P. 85/50, P. 64. After a further four minutes he walked into the recovery room. Sixteen minutes after bleeding the donor felt and looked perfectly well: B.P. 125/85, P. 72.

Case 6.—Female aged 30. She had neither been bled nor had fainted before: B.P. 150/90, P. 140. She was pale beforehand, but flushed when bleeding started. After three minutes the flush faded: P. 100. She began to sigh and make vague gestures with her hands. Suddenly she became very pale and felt nauseated. The stream was slowing, and after four minutes the needle was removed, 450 c.cm. of blood having been taken: B.P. 85/50, P. 56. She was very pale and clammy; the head of the couch was lowered. Three minutes after the bleeding

had stopped the donor's colour was returning and she felt better: B.P. 100/65, P. 80. She was allowed to walk to the recovery room. Twelve minutes later she was still a little pale, but felt quite well. Twenty-one minutes after bleeding the colour was quite restored: B.P. (sitting) 115/75.

Case 7.—Female aged 40; weight 10 st. Before bleeding, B.P. 135/65, P. 68. Three minutes after venepuncture the donor flushed and went pale in the course of half a minute; she felt faint and the bleeding was stopped. She lost consciousness and there was twitching of the right arm and leg, with head and eyes deviated to the left: B.P. 95/—, P. 52. Two minutes after the convulsion the patient was very pale and clammy; the head of the couch was lowered. Four minutes later she was a little less pale: B.P. 105/65, P. 64. After a further 6 minutes the colour was much better: 26 minutes after bleeding the patient looked normal and felt quite well: B.P. (standing) 115/80, P. 64.

Case 9.—Female aged 19. This donor was nervous beforehand: B.P. 115/75, P. 96. She became pale in the course of bleeding and the stream slowed. Three minutes later she had a right-sided convulsion lasting half a minute; after this, B.P. 85/65, P. 84. Ten minutes later she felt quite well and her colour was normal: B.P. 105/75, P. 88.

Case 10.—Female. B.P. 115/75 before bleeding, P. 84. Immediately after bleeding she felt sick and dizzy; she was sweating slightly but was not pale: the head of the couch was lowered. After 5 minutes she walked to the recovery room and collapsed on a bed; 2 minutes later she was pale: B.P. 115/75, P. 80. After 38 minutes she felt well and had a good colour: B.P. 105/60 only, P. 105.

Case 11.—A woman doctor aged 34. She was not nervous: initial B.P. 80/50, P. 56. At the end of bleeding she felt slightly faint and nauseated and had a desire to defaecate. She was pale: B.P. 70/50, P. 82. The pallor persisted for 20 minutes; 40 minutes later B.P. still 80/50, P. 65. Subsequent observation has shown this to be the donor's normal blood pressure.

Case 23.—Female aged 27. She was rather nervous and had fainted once before. At the end of bleeding she flushed and then became pale, and the skin was clammy: B.P. 45/15, P. 60; 15 minutes after bleeding, B.P. 70/50, P. 65; 30 minutes after bleeding, B.P. 86/50.

Case 29.—Female aged 35. She was not nervous beforehand, but had fainted on two previous occasions unassociated with bleeding: initial B.P. 120/60, P. 82. After bleeding, which took ten minutes, B.P. 108/60, P. 79. She immediately felt hot and clammy, and as if her stomach were turning over. Her legs tingled and she had a desire to sit up, but was unable to do so, "as if something were smothering me." She lost consciousness; her eyes rolled and the pupils were dilated; the jaws were clenched and there were clonic movements of the upper limbs. After the attack she raised her head and wondered where she was. The clamminess was more marked, but began to disappear after 15 minutes: B.P. 90/50, P. 72. Thirty minutes later she sat up for tea; she felt sick and vomited, but felt better afterwards: B.P. 80/45, P. 74; colour improving. Sixty minutes after the attack, B.P. 60/30, P. 76; 20 minutes later, B.P. 80/50, P. 68; and after a further 15 minutes, B.P. 100/60, P. 67.

Case 30.—Female aged 39. Before bleeding, B.P. 110/65, P. 80. After bleeding she felt hot and her "body sinking"; she knew she was about to faint; there were restless movements of the head and legs. She lost consciousness and had mild tonic and clonic spasms; afterwards she was cold and clammy: B.P. 80/40, P. 56. An hour later she was sent home by car: B.P. 90/50, P. 64.

Case 37.—Female aged 40. As this donor was known to have fainted before, she was watched carefully. Initial B.P. was constant before bleeding at 115/80. She showed no untoward signs until two minutes after bleeding had been stopped, when she felt her head buzzing and suddenly became cold, clammy, breathless. She felt better as soon as the head of the couch was lowered. After 4 minutes, B.P. 85/60, P. 64; after 7 minutes, B.P. 100/70, P. 64; after 11 minutes, still a little pale; after 20 minutes, B.P. 115/70, P. 70, colour normal.

Case 39.—Male. Initial B.P. 145/80, P. 60. After the blood had been flowing for 5 minutes the patient became pale and the hands clammy; the stream began to slow: B.P. 75/40. After 6 minutes he complained of faintness and dizziness; the

pallor increased. The needle was removed and the head of the couch lowered. Two minutes later he was still pale: B.P. 85/55, P. 40. Five minutes later his colour was a little better. Twenty minutes later he was still rather pale, but feeling well: B.P. 95/60.

Case 41.—Female aged 28. She was nervous beforehand, but had neither fainted nor been bled before: B.P. 165/95, P. 136. During bleeding she felt throbbing in the left arm, sick, "peculiar," and faint. She covered up her eyes and said she felt warm. Bleeding was stopped after 4 minutes, when 250 c.cm. had been taken. Two minutes later the donor was very cold and clammy: B.P. 80/55, P. 60. Eight minutes later she was still pale but not sweating; she said she felt better, and walked into the recovery room. After 33 minutes she said she felt quite well, but while the blood pressure was being taken she felt faint and lay down: B.P. 65/35, P. 60. After 43 minutes she was still pale; she walked across the room and sat down. At 56 minutes she was still pale, but felt well: B.P. 140/85, P. 96.

Case 42.—Female aged 28. Initial B.P. 115/75, P. 84. She was quite well during bleeding, but 3 minutes later felt sick and dizzy, but was not pale: she was sweating slightly. The head of the couch was lowered; 5 minutes later she walked to the recovery room, where she "flopped down on a bed." After two minutes, B.P. 115/75, P. 80; 20 minutes later, B.P. 100/70, P. 136; 38 minutes after bleeding she felt and looked normal.

Case 47.—Male aged 26. This donor was very nervous and had often fainted before, but had not previously been bled. After bleeding for one minute, when only 100 c.cm. had been taken, he became pale; the pulse slowed and became impalpable. The needle was removed and the head of the couch lowered. He suddenly developed a typical convulsive attack, during the course of which he was pale, cold, and clammy; towards the end he flushed and then became pale again, recovering consciousness in 4 minutes. After 25 minutes he stood up; he was very pale and sat down again. Five minutes later he was still pale and feeling faint. Fifty-six minutes from the onset he was still faint and pale. Discharged and sent home by car. Before bleeding, B.P. 165/100, P. 80; at end of attack, B.P. 165/85, P. 60; after 8 minutes, B.P. 145/85, P. 72; after 13 minutes, B.P. 135/75, P. 80; after 22 minutes, B.P. 125/75, P. 60; after 30 minutes, B.P. 135/85, P. 72; after 56 minutes, B.P. 120/75, P. 64.

Summary

Observations have been made on a group of donors who fainted as a result of blood withdrawal, and the incidence of the different signs and symptoms has been analysed. Illustrative cases are given.

The majority of donors show a fall in pulse rate and blood pressure, but this is not invariable.

The faint in donors has so many points in common with the syncopal attacks described by Lewis in soldiers with effort syndrome, and by Ferris, Capps, Weiss, and Baker in individuals with hyperactive carotid sinuses, that it appears possible that the underlying mechanism of their production is the same. Modifications of the picture are probably due to the fact that the donor is in a recumbent position.

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C. P. Ward (*Arch. Pediat.*, 1941, **58**, 83), who records a personal case, illustrates the rarity of encephalomyelitis in measles by the fact that there were only five examples of this complication among 11,747 cases of measles. His patient was a girl aged 6 years, who developed severe encephalitis at the height of measles. For several days the prognosis appeared hopeless, but the encephalitis subsided and was followed shortly afterwards by transverse myelitis with flaccid paralysis and incontinence of urine. After nine days of complete paralysis recovery began and became complete, except for spastic paresis of the legs noted two months later.

LOCAL EFFECTIVENESS OF SODIUM SULPHACETAMIDE (ALBUCID SOLUBLE) IN TREATMENT OF EXPERIMENTAL ULCERS OF THE CORNEA

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There has been considerable discussion recently as to whether sulphonamides are capable of exerting their chemotherapeutic action when applied locally. Extensive trials have been made of the value of these drugs in the treatment of infected wounds and burns (see Colebrook, 1941; Buxton, 1940). While no general agreement has yet been reached, the consensus of opinion, based on clinical evidence, would seem to be that they are effective for some types of infections provided they are applied prophylactically or in the early stages of the infection.

There is, however, little experimental evidence concerning the value of locally applied sulphonamides in the treatment of infected wounds. A number of investigators have shown that some sulphonamides will prevent the development of gas gangrene when given locally together with the infecting organism. A delay of a few hours, however, greatly decreases the effectiveness of the drugs, and most, if not all, of the infected animals rapidly die (Legroux, 1940; Hawking, 1941; Gordon and McLeod, 1941). Nitti (1939) showed that the local application of sulphanilamide to wounds infected with streptococci in rabbits would prevent death of the animals.

The Investigation

It appeared to us that the eye would provide a very satisfactory medium for the study of the action of locally applied drugs on infection. The course of the infection can be followed accurately, and observations can be made as often as desired without unduly disturbing the animals. Moreover, each experiment can be very satisfactorily controlled, since one eye in each animal can be used for comparison. Rambo (1938) performed a few such experiments on rabbits, and the results suggested that the injection of sulphanilamide together with haemolytic streptococci into the anterior chamber of the eye would prevent the occurrence of a destructive infection.

Progressive septic lesions of the eye can easily be produced experimentally by infecting the cornea with *B. pyocyaneus* (see Axenfeld, 1908). It has, moreover, been shown (Joy, 1940) that the course of such lesions in rabbits can be favourably influenced by the oral administration of sodium sulphapyridine. We therefore decided to determine whether the local application of a sulphonamide would affect the course of such an actively progressive and destructive lesion.

In deciding which sulphonamide to use in these experiments we considered that the following properties were desirable: (i) it should have a high solubility in order to produce a reasonably high local concentration; (ii) it should be non-irritant; (iii) it should form a solution which does not deviate a great deal from neutrality; and (iv) it should readily penetrate into tissues.

Few of the known sulphonamides possess the above properties. One compound which does, however, conform