BRITISH MEDICAL JOURNAL

LONDON SATURDAY AUGUST 30 1941

CLINICAL OBSERVATIONS ON AIR-RAID CASUALTIES

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The following paper contains the substance of a report prepared for the Medical Research Council's Committee on Traumatic Shock. It is based on 100 cases, 41 of them from the series observed at this hospital and 59* from case records supplied to us by the committee. Observations have not been confined to air-raid casualties, but have also been made on other cases of injury. Accident cases display the same varied features as air-raid casualties; they have the advantage that their observation is easier, since they are not as a rule admitted in large numbers in a short time and since the disturbing features of a bomb attack are absent. We have omitted cases of the so-called crush syndrome and of severe burns, which are being dealt with by others.

With these exceptions, and according to our own experience of many more cases than are here dealt with, this series illustrates the variety of the general reactions to injury shown by air-raid casualties and accident cases. The series, however, is not a random sample. The case reports received from the Committee on Traumatic Shock record for the most part examples of multiple and severe injuries associated with a low blood pressure and receiving transfusion for resuscitation. Our own cases were chosen in the first instance from those described by our colleagues as being "shocked" on admission, and later because they presented features of interest apart from a diagnosis of "shock," though this was applied to the great majority.

General Features

Some of the general features of the cases are summarized in the accompanying table. They are divided into three main groups, according to the level of systolic blood pressure when they first came under observation: in most cases this happened within a short time after admission to hospital; in few was it delayed more than an hour. The groups are those with (I) a raised systolic pressure, over 140 mm. Hg (9 cases); (II) normal pressure, 100 to 140 (28 cases); and (III) low pressure, under 100 (63 cases). The group with

Table showing General Features of the Cases

		I	II	Low Blood Pressure (under 100 mm. Hg)			Total
				III A	III B	III C	
		Raised Blood Pressure (over 140 mm. Hg.)	Normal Blood Pressure (100 to 140 mm. Hg.)	Slow Pulse (under 70 per min.)	Moderate Pulse (70 to 100 per min.)	Rapid Pulse (over 100 per min.)	
Totals		9	28	9	27	27	
Age in years	10 to 19	1	6	—	3	3	12
	20 to 29	3	5	1	3	9	22
	30 to 39	1	7	1	3	7	19
	40 to 49	1	5	—	3	5	14
	50 to 59	1	2	2	6	1	14
	60 and over	1	2	5	9	2	19
Time seen after injury	Within 1 hour	5	12	2	8	4	31
	" 2 hours	2	8	5	9	9	33
	" 4 "	—	4	2	5	7	20
	" 6 "	—	3	—	3	3	9
	" 8 "	—	—	—	1	2	3
	Longer	—	1	—	1	1	3
Injuries	Minor	2	—	2	1	—	5
	Moderate	3	9	1	4	—	17
	Severe	4	14	1	11	11	41
	Internal	—	5	5	11	16	37
Haemorrhage	Little or none	7	3	2	3	—	15
	Moderate	1	3	—	—	—	4
	Severe	—	18	6	17	2	33
	Unknown	1	4	—	2	22	29
Survival so far as known	At least 24 hours	2	—	3	2	3	10
	" 48 "	—	3	1	—	2	6
	" 72 "	—	—	—	1	1	2
	3 days or more	7	18	1	9	3	38
Deaths	Within 24 hours	—	2	2	10	13	27
	" 48 "	—	2	2	2	4	11
	" 72 "	—	—	—	2	1	3
	After 3 days or more	—	2	—	1	—	3

low pressure is subdivided according to the initial pulse rate: (A) slow, under 70 beats a minute (9 cases); (B) moderate, 70 to 100 (27 cases); and (C) rapid, over 100 (27 cases). It will be seen that this classification, originally adopted for convenience, serves to separate the cases into groups differing in certain other respects also; but we regard it as provisional only, and seek a better.

The series includes persons of all ages from 8 to 71, 30 being females. About one-third of them are under 30 and one-third over 50. It is of interest to note that of the 37 patients with initially raised or normal pressure (Groups I and II) only 8 (22%) are aged 50 and over, while they number 25 (40%) of the 63 cases with low pressures (Group III). Again, of those with low pressures, 7 of the 9 with slow pulses (Group IIIA) are aged 50 and over, but only 3 of the 27 with pulse rates over 100 are of this age (Group IIIC). These findings suggest that in injured subjects the

* For these records thanks are due to:

Army Blood Transfusion Service, 19 cases
 Dr. Helen Brown, N.W. London Blood Supply Depot, 8 cases
 Dr. J. McMichael, British Postgraduate Medical School, 7 cases
 Dr. James Dow, St. George's Hospital, 5 cases
 Dr. P. W. Mollison and Dr. Van der Walt, S.W. London Blood Supply Depot, 5 cases
 Dr. T. S. Gavey, Westminster Hospital, 4 cases
 Dr. R. F. Ball, Royal Free Hospital, 2 cases
 Prof. W. Wilson, Aberdeen University, 2 cases
 Mr. J. Ledingham (student), Hackney Hospital, 2 cases
 Dr. G. A. R. Miles, St. Thomas's Hospital, 1 case
 Dr. J. K. Denham, Western Fever Hospital, 1 case
 Dr. R. D. Blachford, Charing Cross Hospital, 1 case
 Dr. C. Wilson, Billericay Hospital, 1 case
 Dr. E. E. Pochin, University College Hospital, 1 case

Thanks are also due to all those at our own and other hospitals whose co-operation made these observations possible.

blood pressure is better maintained, but the pulse rate tends to be faster in the younger than in the older. The series, however, is too small to allow of a close analysis of this and other factors which might influence blood pressure and pulse rate, such as (a) time of coming under observation after injury, (b) the severity of the injury, and (c) the amount of blood lost. A word may be said about each of these factors.

(a) The majority of cases (64) came under observation within two hours of injury—31 within one hour and 33 between one and two hours. The groups differ to some extent in this respect, the interval between injury and observation tending to increase in passing from Group I to Group IIIC. This suggests that the longer the interval the more likely is the blood pressure to be low and the pulse rate fast.

(b) An attempt has been made roughly to classify the injuries, which in most cases were multiple. Those with evidence of internal injury (to contents of skull, thorax, and abdomen) are tabulated separately (37 cases). Of the others, those with small cuts, bruises, and abrasions are tabulated as minor injuries (5 cases); those with simple fractures and flesh wounds with little laceration of the soft parts are tabulated as moderate (17 cases), the remainder as severe (41 cases). The series is too small to allow of a finer subdivision, and for this purpose it is clear that many more cases are required. Nevertheless, this rough classification displays differences between the groups. None in Group I sustained internal injuries; the proportion in Group II is only 5 out of 28, while it rises to 16 of 27 in Group IIIC. Also, the proportion of cases classified as having injuries only minor or moderate in degree decreases in passing from Group I to Group III, Group IIIC containing none.

(c) We have tried also to group the cases according to the degree of haemorrhage—as little or none, moderate, and severe (probable loss of more than two pints of blood, haemoglobin falling below 75%). As a basis we have accepted the observer's estimate when this is recorded, combined with such information as there is of the state of the dressings, the presence or absence of a tourniquet, the reduction of haemoglobin, and in a few cases the estimation of blood volume by the plasma-dilution method. Estimations of the haemoglobin content of the blood at some time during the course are recorded in 64 cases and data for estimation of the blood volume in 18. In 9 instances data are not sufficient to allow any estimate of blood loss. It is to be emphasized that such estimates of blood loss may not be reliable. Accepting them, however, as the best available, the table shows that at least 64 of the 100 cases suffered a severe loss of blood. The degree of haemorrhage is least in Group I, this being assessed as severe in only one of nine cases. The high proportion of those suffering much loss of blood in Group III (45 of 63) is perhaps not unexpected, but the equally high proportion in Group II (18 of 28) is noteworthy.

The haemoglobin content of the blood was estimated soon after observation began and before transfusion in 45 cases. It was abnormally high (128%) in one only, and this case should probably be classified as an example of crush injury. In only one other did the percentage concentration reach 120 (Haldane's scale), while in 6 it lay between 110 and 119 and in 6 also between 100 and 109. There is therefore little evidence of concentration of the blood in these patients, though it is to be remembered that the state of the blood before wounding is unknown. On the other hand, the haemoglobin content was less than 80% in 16 cases; it was between 50% and 60% when estimated about two hours after injury in 3 cases and 45% in a fourth case four and a half hours after injury. The majority of these 45 cases are classified as having sustained severe blood loss; if this assessment is correct then there is considerable individual variation in the rate of dilution of the blood after haemorrhage, and the estimation of haemoglobin within an hour or two of an injury may give no indication of the amount of blood lost.

The data on such symptoms as pallor, cyanosis, coldness, sweating, thirst, nausea, and vomiting are too meagre to allow a close comparison between the groups. It is to be remembered that many of the patients are very dirty and their faces and hands so smeared with blood and dust that

skin colour is obscured. Even when the skin is clean cyanosis is not readily observable in artificial light, often dim because of the black-out. Thirst in many instances can be attributed to dust in the mouth. From the information given, however, the majority of patients in all the groups have cold extremities. Pallor is the rule in Group III, but in Groups I and II a considerable proportion are of a good colour. Sweating is frequent, but less so in Groups I and II than in Group III. Nausea and vomiting are recorded in only about one-quarter of the cases, the proportion being highest in Group IIIA. Approximately half the patients in each group are stated to be in pain; only 5 are said to have no pain. The majority are described as mentally clear, a few as dull, drowsy, comatose, or unconscious, but only 4 are said to be apathetic. Indeed, one of the remarkable features of these cases as a whole is the entire consciousness and what might be described as mental alertness tinged with anxiety, even with severe and rapidly fatal injuries and though the pulse and blood pressure are unrecordable. For example, a woman aged 40 was buried for eighteen hours in a doubled-up position, sustaining severe bruising, a fracture of the pelvis, and injuries to the lungs, in which extensive haemorrhage was found at necropsy. She died about four hours after admission to hospital. During this time her radial pulse could not be felt, nor could her blood pressure be measured. The carotid pulse was barely palpable, very soft, and thin; it varied with respiration, disappearing at the end of inspiration and reappearing with expiration. Her extremities were cold. The observer states that though there were all the signs of a very bad circulation she was remarkably conscious. When asked questions she gave reasonable replies, but with a short latent interval as if she were very tired. She told her name, age, etc., described the bombing, said it had been a very horrible experience, wanted to know if she was going to die, and was anxious not to be a bother to the nurses and doctors. When her feet were washed in hot water she complained that it was too hot; ten minutes before death she said that the pressure of the sphygmomanometer cuff hurt her arm.

Group I (Raised Blood Pressure)

The 9 cases included in this group are of two types. The first comprises those in which injury has occurred in already hypertensive subjects. These need not be considered further, but they require to be borne in mind: the good colour, strong pulse, and raised pressure may mislead by giving a false impression of the patient's state. If the wounds are severe and blood has been lost collapse is likely to occur sooner or later, but is often prevented by early transfusion.

In the second type the rise of pressure seems to be a reaction to injury in previously normal subjects. These patients are younger than those of the first type and the majority are pale; the pulse rates on admission range from 64 to 92 per minute. It is to be noted that though the blood pressure is raised the radial pulse may be small. The injuries vary from multiple minor wounds with little or no bleeding to severe wounds and haemorrhage. In some, blood pressure falls to normal levels in a few hours, but in others it remains high for at least one or two days. Pallor may persist or give way to a normal facial colour even though blood pressure remains high. All these cases were treated with rest, warmth, and morphine; only one (with severe haemorrhage) received in addition a transfusion of two and a half pints of blood. All underwent operation without collapse and all survived so far as is known. The following case exemplifies this type.

A man aged 23 was standing by the kerb when he felt giddy and fell; his leg was caught by the wheel of a passing van.

He sustained a compound fracture of the lower end of the right tibia and fibula; there was little crushing of the soft tissues or bleeding, and the skin wound was small. A sheet-metal worker by trade, he had recently been in the Army, but was discharged as unsuitable; he was instructed to return to his trade, but had not yet done so, complaining of headaches and attacks of giddiness, for which he was attending a neighbouring hospital as an out-patient. A telephone message to that hospital elicited the information that on that morning his blood pressure was 130/90. He seemed to be of a nervous temperament, and said that he and his young lady had been very nervous since a recent air raid. He admitted to smoking thirty to fifty cigarettes a day.

On admission less than half an hour after injury he was pale, mentally clear but anxious, cold, and shivering, and was suffering considerable pain. He was not sweating. His radial pulse was barely palpable, small, and hard, its rate being 64 a minute; his blood pressure was 180/95, and the respirations 16 a minute. He was partly undressed, given 1/4 grain of morphine, and put to bed under an electric cradle, a back splint being applied to the leg. An hour after admission he was warm and flushed. The blood pressure remained at the same level and the pulse small, though its rate increased to 78. He desired but was unable to pass urine. During the next hour the blood pressure fell, to remain at 145/80, the pulse became fuller, and its rate varied between 68 and 85 a minute. He was given 1/100 grain of atropine before operation, which was done two hours after admission, under pentothal, gas-oxygen, and ether, and lasted half an hour. Operation consisted in excising the skin wound, reducing the fracture, and applying a plaster bandage. Little blood was lost. During operation his condition remained good and the blood pressure stayed at about 145/90. A respiratory variation of about 10 mm. in systolic blood pressure developed, the pressure falling with inspiration and rising with expiration. This disappeared on recovery from the anaesthetic.

For an hour after operation he was restless and complained of pain; 1/4 grain of morphine was given, and he became quieter. He first passed urine—acid, of specific gravity 1014—seven hours after admission; it contained a trace of albumin and a few red cells, but no sugar, pus cells, or casts. The blood pressure again rose, and eight and a half hours after admission was 160/95, the pulse rate being 78, the respirations 20, and the mouth temperature 101.2° F. For continuing pain in the leg a third injection of morphine (1/4 grain) was given during the night. He passed urine several times, but no detailed observations were made. A specimen of urine passed the following morning about nineteen hours after admission contained a faint trace of albumin, but no sugar, red cells, pus cells, or casts; its specific gravity was 1014 and its pH 5.4. He was evacuated twenty-four hours after admission to a sector hospital, his blood pressure being 155/110, the pulse rate 76, respirations 20, and mouth temperature 98.8° F. Little is known of his further course, except that the following day the urine was reported to contain no albumin, sugar, or blood. A week later the blood pressure was 120/80 and the pulse rate 74.

Group II (Normal Blood Pressure)

Group II, consisting of 28 cases, is of special interest. It should be realized, however, that it is not a representative sample of the injured admitted to hospital with a normal blood pressure, for the majority of the latter are not severely wounded, have not lost much blood, and do not require transfusion. It represents rather those who in spite of severe injury and haemorrhage yet have blood pressures within normal limits. Such cases are not uncommon. This group emphasizes that a normal blood pressure and pulse rate and even a good facial colour are compatible not only with severe injury but also with much loss of blood. This was so in at least 10 of the cases. In the majority the pulse rate lay initially between 70 and 100 a minute; in few was it slower or faster.

All the patients were treated initially with rest, warmth, and morphine, but only 6 did not finally receive transfusion. These six were not very severely injured and their blood loss was not severe. Except for a temporary fall of blood

pressure to about 90 mm. at operation in 3 of them, the condition of all remained satisfactory and, so far as is known, all survived.

In 13 cases blood pressure fell considerably and pulse rates rose after periods varying from about half an hour to four hours. In most this collapse occurred before operation; in a few it was delayed until during or after it. Transfusion was then given, being followed by a more or less rapid improvement, which was maintained throughout operation and later, except in 3 cases. In these three renewed bleeding caused another fall of blood pressure, which was restored by further transfusion.

In contrast to these are 9 cases in which transfusion was started soon after admission although blood pressure had not fallen below 100 mm. The condition remained satisfactory throughout except in two, which deteriorated following renewed bleeding at operation, though both recovered with further transfusion. This group of cases contains few that progress satisfactorily and undergo operation without transfusion: early transfusion in most cases prevents later collapse. It follows that in assessing the gravity of the condition emphasis should be placed on the severity of the injury and loss of blood rather than on blood pressure. In any case that is severely injured and suspected of considerable blood loss, transfusion should be begun at an early stage. The following case is representative of this group.

A tall well-built lad of 18, as a result of a bomb explosion, sustained multiple severe injuries of the legs and thighs, with much laceration of the muscles and a compound comminuted fracture of the left tibia. His clothes were soaked with blood. He was admitted to hospital half an hour after injury, was given 1/3 grain of morphine, and came under observation half an hour later. He was lying on a metal stretcher placed on the bed. His clothes were cut down the front, the wounds examined, and an electric cradle placed over him. His colour was good; he was warm and not sweating. Though he did not remember what had happened he was mentally clear, and recognized and talked with a mate in a neighbouring bed. His blood pressure was 120/70 and the pulse rate 94. Early operation was advised, and, because of the severity of the wounds and loss of blood and the probability that operation would be long, transfusion was begun one and a half hours after admission. His condition was still good, though he had become a little restless; the blood pressure had risen to 140/70 and the pulse rate to about 100. One bottle of plasma was given in fifteen minutes. Haemoglobin immediately before this was found to be 50% (by photo-electric photometer); second and third samples taken immediately and four minutes after giving the plasma showed the haemoglobin reduced to 43%. From this, blood volume was estimated at 3½ litres. A second bottle of plasma was started. At this time he became pale and complained of cold, though he did not shiver; blood pressure rose to 180/80 and the pulse to 124. Blood began to ooze from the wounds, and the bandages were tightened. The reaction to transfusion soon subsided, blood pressure falling to 140/75 and the pulse to 100. He was given 1/100 grain of atropine, and was lifted from his cut clothes and taken to operation, the plasma transfusion continuing at a slow-drip rate. His condition remained good during operation, the only untoward event being the vomiting of at least a pint of partly digested food, which filled the anaesthetic mask and was perhaps partly inhaled by the patient. Blood pressure remained between 120/60 and 165/75, varying with respiration, the pressure rising with expiration and falling with inspiration. The pulse remained between 120 and 150. The wounds were excised and packed, and plasters were applied to both legs. Two surgeons dealt with the wounds in order to shorten the operation, which nevertheless lasted for one and a quarter hours, but was carried out with very little blood loss. Because of the low haemoglobin and reduced blood volume, two pints of blood were given in the two hours following operation. He then seemed in excellent condition. His colour was good and he was sleeping quietly, blood pressure being 150/80, pulse 124, and respirations 21.

The further unexpected course of this case is also of interest (see second part of paper, under "Deaths"). Six hours later (about twelve hours after admission) the patient was found to be flushed and a little cyanosed, rather restless, and semicomatose. Blood pressure was 100/35, pulse 180, and respirations 40. Examination revealed dullness of the right chest, and radiographs showed a patchy consolidation of the right lung. His condition did not improve and he became delirious. Crepitus was detected in the muscles of the right thigh, and gas infection was suspected. A second operation was attempted nineteen hours after admission, but he died while the anaesthetic was being administered. No gas infection was found. Necropsy and subsequent histological examination revealed congestion and oedema of the lungs and early bronchopneumonia. Fat emboli (not very numerous) were discovered in the lungs, but not in the brain or kidneys.

Group IIIA (Low Blood Pressure, Slow Pulse)

This group comprises 9 patients, of whom 7 are aged over 50. In 2 the injuries were slight and accompanied by little blood loss; 5 sustained internal injuries; blood loss was severe in 6. All were pale; nausea and vomiting are recorded in 5 and sweating in 3.

All were treated initially with rest, warmth, and morphine. Of the two with minor injuries one improved rapidly when the foot of the bed was raised, the other more slowly; both underwent operation and progressed satisfactorily without transfusion. The two younger patients, both with abdominal injuries, improved during the observational period of one to two hours, blood pressure rising to 100 mm. and the pulse rate to between 70 and 90; both, however, collapsed—one at and the other immediately after operation—and each received blood transfusion with benefit.

The remaining 5 patients showed no improvement, and transfusion was given. In 4 the general condition rapidly improved, the blood pressure rising to over 100 mm. All underwent operation: one died on the table as the result of a severe blood loss; the others remained in good condition and progressed satisfactorily. The last patient showed only a temporary slight response to transfusion, and died about five hours after admission while blood was being given. In all the cases the pulse rate rose, but, except in the younger subjects, did not go beyond 100 beats per minute. The following two histories are given as examples of this group.

A woman aged 60 was buried for a short time under debris and sustained a small laceration of the scalp, some bruising of the left forearm, and a crushed left fifth toe. Bleeding had apparently been slight. She was admitted to hospital an hour after the bomb explosion and was said to be suffering from severe shock. She was given 1/4 grain of morphine and sent to the resuscitation ward. She was extremely pale and cold, was sweating and nauseated, but quite conscious. The radial pulse was barely palpable; the carotid rate was 40 a minute. Systolic blood pressure was about 60 mm.; the diastolic was unobtainable. Watched for some time, she did not improve; then the foot of the bed was raised, whereupon her condition improved immediately. Five minutes later sweating had ceased, and she felt much better; the pulse was stronger, and its rate 56; blood pressure was 90/65. After three minutes more the pulse was of good volume and 64 a minute, and the blood pressure 100/65; she remained pale. During the next hour her condition was good, though she still had bouts of nausea. She was then given 1/100 grain of atropine. Operation was proceeded with, the fifth toe being amputated and the scalp wound excised and sutured; little blood was lost. Her condition remained good. Five hours after operation she felt "pretty well" except for occasional nausea. She remained extremely pale; the haemoglobin was 106%, the pulse rate 72, and the blood pressure 165/80. The following morning, twenty-four hours after admission, she looked and felt well; the facial colour was good, the pulse 88, and the blood pressure 145/80. She was then evacuated to a sector hospital.

A man aged 38 was admitted to hospital half an hour after injury by an exploding bomb. His injuries were a perforating wound on the left side of the abdomen and a small incised non-penetrating wound of the lower right chest. He was pale, nauseated, and thirsty, but not sweating; his extremities were cold. Blood pressure measured 80/40 and the pulse rate 64. He was given 1/4 grain of morphine, was undressed, and was warmed by an electric cradle. The foot of the bed was not raised. During the next hour he gradually improved, becoming warm but remaining thirsty and nauseated. Blood pressure rose to 110/65 and the pulse rate to 76, haemoglobin being 112%. After 1/100 grain of atropine had been given operation was carried out under gas-oxygen and ether anaesthesia one and a half hours after admission, and lasted one hour. Laparotomy revealed blood in the peritoneum (measured to be about one and a half pints), a single perforation in the descending colon and three in the upper jejunum, and a tear in the mesentery. The gut was sutured. During operation his condition remained good except that the pulse rate rose to 124; the blood pressure remained at 110/50. Occasional extrasystoles also appeared and a respiratory variation in the blood pressure developed, the pressure rising with expiration and falling with inspiration. Just before he left the theatre his blood pressure was 110/50 and pulse 120; in the ward a quarter of an hour later the pulse had fallen to 104 and was hardly palpable; the systolic blood pressure was 60, the diastolic being unobtainable. Haemoglobin was still 112%. Raising the foot of the bed caused no improvement, and one pint of blood was transfused over thirty minutes; the blood pressure was then 100/65 and the pulse rate 94. A quarter of an hour later blood pressure had risen to 110/65, the pulse rate being 90 and the respirations 20; he slept quietly. His condition remained good throughout the following day, but it deteriorated rapidly next morning. No detailed observations were made, but he became very pale and the pulse feeble. A plasma transfusion was given, but the patient did not respond, and he died while a second bottle of plasma was being given, about thirty-six hours after admission. No adequate explanation for the collapse and death was discovered at necropsy. The state of the abdomen was satisfactory; the repaired perforations were healing and peritonitis was absent. The lungs were congested, and microscopical examination showed small foci of early bronchopneumonia. No fat emboli were discovered in sections of the lungs, brain, or kidney.

Group IIIB (Low Blood Pressure, Moderate Pulse)

This, like the preceding group, contains a high proportion of older people, 15 of the 27 being over 50, including 9 over 60. The majority were severely injured or had sustained internal injuries; the majority also suffered severe blood loss. Most were pale; sweating, nausea, and vomiting are recorded in about one-third. Only one is stated to be apathetic; 12 are said to be mentally clear.

In this group also all the cases were treated initially with rest, warmth, and morphine, but only one was not transfused. In this case (with moderate injuries and little blood loss) initial improvement on raising the foot of the bed was followed by deterioration, and later gradual recovery when fluids were given by the rectum; transfusion would probably have hastened his resuscitation. Another patient improved rapidly, but collapsed during operation, recovering when transfusion was given. A third case was operated on shortly after admission and before the blood pressure had risen from its initial level of 80/66; improvement rapidly followed transfusion after operation.

Fifteen cases showing no recovery after periods of observation of from two to three hours then received transfusion; only one failed to respond, dying shortly. Eleven underwent operation, 6 maintaining their condition then and subsequently, and 3 collapsing but being revived by further transfusion; 2 died on the table.

Nine patients received transfusion without any period of waiting. All except one, who soon died, were benefited and underwent operation; six required further transfusion

during operation, and one died on the table. The following case is typical.

A moderate-sized, lean, and "tough" man of 40 years was admitted to hospital forty minutes after injury by an exploding bomb. His left leg had been severed through the knee and the right severely lacerated, with a gross compound fracture of the tibia and fibula. No tourniquets had been applied, and from information received later it appears that much blood was lost. He was very pale, was not sweating, and was restless and in great pain, but mentally clear; the blood pressure was 85/50 and the pulse rate 84. Morphine 1/4 grain was given. He was not undressed; the foot of the bed was raised and an electric cradle applied. One pint of plasma was given in ten minutes, followed by one pint of blood in fifteen minutes. Meanwhile for continuing severe pain and restlessness 1/6 grain of morphine was administered intravenously; the pain passed quickly and for a time he became quieter and felt better. The blood pressure had risen to 104/56 and the pulse to 100; a second pint of blood was given slowly (over one and three-quarter hours). During this time he became warm and the blood pressure rose to remain at about 116/78, and the pulse rate fell to 80. Pain returned. Operation (lasting only forty minutes) was begun two hours after admission, his clothes being cut off after he was anaesthetized (gas-oxygen and ether). Two surgeons amputated the left leg through the thigh and the right through the knee. About a pint and a half of blood was lost. One and a half pints of blood were transfused during the operation. Following disarticulation of the knee-joint his extremities became cold and clammy; the blood pressure fell to 98/60, but soon rose, reaching 140 systolic, and then settled to remain about 110/64. On recovering from the anaesthetic he vomited, became restless, and pulled the transfusion needle from the vein. The remaining half-pint of blood was administered on return to the ward; 1/4 grain of morphine was given. Blood pressure was then 120/60 and the pulse 100. His general condition remained the same for the next twelve hours, with some nausea and vomiting, much pain, low fever, and sweating. Thereafter infection developed in the right stump; a secondary amputation was performed seven days later and he made a gradual recovery. He first passed urine twenty hours after admission, the volume of this sample being only 6 oz. For the first five days the output of urine was 25 oz. or under daily, the specific gravity being between 1030 and 1018; thereafter the output rose to between 70 and 90 oz. daily. The urine contained albumin, red cells, granular and cellular casts, and sugar for the first three days, and was alkaline in reaction for the first two days. Subsequently the urine remained clear, apart from occasional traces of albumin and sugar and excess of urobilin, for the next seventeen days before transfer.

Group IIIC (Low Blood Pressure, Rapid Pulse)

In contrast with Group IIIA and Group IIIB only 3 in this group of 27 are aged 50 and over; the age distribution corresponds with that of Group II. The injuries are classified as severe in 11 and as internal in 16; severe blood loss is thought to have occurred in 22. The majority were pale, but 3 are stated not to have been pale; about a half were sweating; nausea and vomiting are recorded in about a quarter. Apathy is mentioned in 2 only, 11 being described as mentally clear and 10 as variously confused, drowsy, delirious, or unconscious. Initial pulse rates varied from 100 to 200, being under 110 in 5, 120 in 2, 130 in 6, 140 in 2, while in 6 the rate was faster. In 4 the pulse was too feeble to be counted.

As in the other groups, all the cases were first treated with rest, warmth, and morphine, but all subsequently received transfusions. In 13 transfusion was preceded by a period of watching, during which time only one showed any material improvement. Five of them responded little or not at all to transfusion, and died without reaching operation. The other 8 patients all improved and were operated on; 2 died on the table and 4 required further transfusion. Transfusion was given earlier in 14 cases. Only one patient failed to improve, and soon died; 3 de-

teriorated again, and died without reaching operation. Ten reached operation, 7 of them requiring further transfusion during operation, 3 dying shortly. The following case is given as an example.

A smallish "tough" man aged 38 was admitted to hospital about three-quarters of an hour after injury by an exploding bomb. His right buttock and the back of his right thigh were deeply lacerated; the upper part of the thigh was greatly swollen by haemorrhage into the tissues. There was a compound comminuted fracture of the upper third of the femur and a comminuted fracture of the symphysis pubis. A wound in the right groin penetrated to the recto-vesical pouch, in which a bent half-crown was found at necropsy. The wounds were surgically untreatable, and bleeding continued while he lived. On admission his clothes were already soaked with blood. He was pale and pulseless, was sweating profusely, and was thirsty. His face and extremities were cold. He lay quietly on a stretcher on the bed, still dressed, mentally alert and complaining of pain in his leg. He had been given 1/3 grain of morphine before admission. The foot of the bed was raised and an electric cradle placed over him; his pulse became palpable, its rate being about 200 a minute; blood pressure measured 50/25 and his respirations were sighing. Transfusion was begun twenty-five minutes after admission, one pint of plasma being given in fifteen minutes; his haemoglobin was then 50%. The blood pressure had risen to 85/50 and the pulse rate was 104. Four pints of blood was given during the next four and three-quarter hours. Sweating ceased, and he gradually became warm. The blood pressure rose for a time to 90/45, but fell again, to remain about 80/45, the pulse rate mounting to about 140; respirations were regular at about 20 a minute. He vomited occasionally. Since he was uncomfortable his clothes were cut off, the stretcher was removed, and he was put in bed. He fell asleep, but wakened from time to time and smoked a cigarette. The wound was packed and a rubber bandage applied from knee to buttock. Haemorrhage was not controlled, and it became obvious that nothing could be done to save him. He was then given heroin, 1/8 grain intramuscularly, 1 pint of dextrose intravenously, and a fifth pint of blood over the next five hours. He gradually became worse and rather irrational, and sweating broke out again. His extremities became cold and his breathing stertorous. Blood pressure remained about 80/50 and the pulse about 140. Finally blood pressure fell steeply, the pulse became rapid and irregular, and he died ten and a half hours after admission. He passed no urine throughout, though he occasionally desired to do so; he drank 46 oz. of water. At necropsy, in addition to the injuries noted above, small haemorrhages were found in the sigmoid colon and caecum. The spleen was small, weighing 70 grammes. The bladder contained about 1 oz. of urine. The stomach was dilated. The organs generally were not pale.

[To be concluded]

The British Social Hygiene Council has issued a statistical summary of its educational work during the last decade. It is estimated that through direct education by means of courses, lectures, exhibitions, and other means, 163,000 young people (aged 14 to 25) and 363,000 adults in responsible groups have been reached, while nine million members of the general public have had some contact with this work on its more popular side. Experience has shown that teachers and health welfare workers who have attended a course of lectures impart their knowledge to the young people in their charge, and in this way it is estimated that indirectly over one million of them have been reached, as well as another very large body of adults. The numbers affected by these educational efforts represent something like 35% of the population at risk—that is to say, those exposed during the decade under review to the social dangers which the Council endeavours to control. This educational work has been done at an expenditure of about £166,500, of which £93,500 has been contributed by voluntary funds and £73,000 by local authorities' quota grants—a cost of about 6½d. per person educated. The number of young people's courses is increasing: 646 courses, comprising nearly 2,000 lectures, were held during the period under review.