almost entirely "interesting" cases of rare diseases or with advanced physical signs. This has some justification, for the specialist naturally collects cases in his own specialty, and the loudest murmur is the one for the beginner to listen to. On the other hand, the senior student who has learnt to recognize physical signs can apply his knowledge in clinics, which is the nearest thing to general practice that hospitals provide. Out-patient clinics are fairly good for this purpose if they are not overcrowded, but municipal clinics that some London students go to are better, and the dispensary system in Scotland probably best of all. Another major problem in general practice is the maladjusted, possibly mildly neurotic, patient. A field in which a great deal of good can be done, it is almost entirely neglected by present-day medical education. Psychology consists of a few lectures in the major psychoses, illustrated by the most amusing inmates that the mental hospital can produce. This is a most important omission that can and should be rectified. Also in general practice in industrial centres diseases due to working conditions and industrial processes are constantly being met, yet training in recognizing them is confined to possibly two lectures in a public health course. In all these ways could medical education be more closely related to the needs of the doctor after qualifying.

The manner in which teaching is carried out falls short of the ideal. Units tend to be much too large for the best results, as, particularly in the wards, the information does not reach many of the listeners, and there is no opportunity at all of asking questions or taking part in discussion. Lectures are often compulsory, in which case the student is denied even the simple criticism of stopping away, and the lectures may become slovenly as a result. Reading from textbooks has been redundant since the invention of printing. During the last two years, when many schools have been evacuated, it has been found that the formation of seminar groups between teacher and students, with free discussion, has led to the most successful results. At the same time the ability to criticize lecturers has resulted in marked improvements. Thus the formation of staff - student groups to discuss the organizational problems in a school is found to be effective from all points of view, revolutionary though it may seem. The other alternative suggestion is that the staff of a medical school should have had a pedagogical training, or at least be chosen for teaching ability rather than for research. Many feel, however, that this would kill any scientific life in the teaching through replacing scientists by orators, for if the research worker is good he will have such a clear idea of his subject that he cannot talk badly about it. The way forward shown by helpful mutual criticism between teachers and taught seems to be by far the most promising.

The provision of smaller teaching units also enables students to get far more practical experience of the various techniques, such as lumbar puncture, intravenous infusions, and so on, that he will need to be able to do as a doctor. Opportunity for this varies greatly in various medical schools, and it cannot be doubted that the complete divorce of the student from practical work is very bad. On the other hand, there is often required a tremendous amount of attendance at operations which in fact can demonstrate nothing to those more than a yard from the operative site. Perhaps most important of all is training in casualty work, for minor surgery plays a large part in a practising doctor's life. The aerial warfare of to-day makes it doubly important; in fact, the teaching of this subject has been greatly extended since the beginning of the war, but there is doubtless still room for improvement in some places.

Conclusion

A great many of the points mentioned can be easily changed by local adjustment; and usually the staff are very willing to accept suggestions for improvement. Broadly, however, the aims of medical teaching can only be altered, so that they fulfil the needs of the doctor and enable him to serve the community to the best of his ability, on a national scale. The British Medical Students' Association is going to present, by invitation, a memorandum to the Planning Commission set up by the B.M.A., and by this means it is hoped that the necessary changes will be effected.

CLINICAL OBSERVATIONS ON AIR-RAID CASUALTIES*

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Comments on Treatment: (a) Transfusion

It is apparent that the great majority of the cases in all groups respond well to treatment, at least for a time. The simple measures of rest, warmth, morphine administration, and the head-down position, however, are usually insufficient to effect lasting improvement. We have seen that only 17 cases escaped transfusion; none of these is regarded as having suffered severe blood loss, the haemorrhage being assessed as little or none in 13, moderate in 2, and as unknown in 2. In the majority, also, the injuries are classified as minor or moderate (4 and 7 respectively), in only 4 as severe, and in 2 as internal. In several of them transfusion probably ought to have been given, and would have hastened improvement.

The other 83 cases received transfusions in amounts and at rates that differed greatly. Blood and plasma together were given in 50 instances, blood alone in 13, and plasma in 15; sometimes serum was used instead of plasma, and in a few various salines were added. The amounts, including those given before, during, and in some cases after operation, vary from one pint to thirteen pints (this last amount being administered over a period of twenty-eight hours); 23 received two pints or less, 29 from two to four, 18 from four to six, and 13 more than six pints. In general these amounts are related to the blood loss rather than to the nature of the injury, the larger transfusions being given mainly where bleeding was renewed either before or at operation. The amount required for resuscitation varies so greatly from patient to patient that no definite ruling on this point can be given. While the end in view seems to have been the replacement of lost blood, the restoration and maintenance of normal systolic blood pressure (100 mm. Hg and over) is used as the chief indication that an adequate amount has been received.

In most cases the early transfusions were given at a rate of about one pint in a quarter or half an hour; later transfusions, unless to combat renewed bleeding, were administered more slowly—one pint over one or more hours. More rapid transfusions have been given, apparently without other than good effect; in one instance two pints was administered in fourteen minutes with general

* Concluded from p. 297.

improvement and a rise of blood pressure from 40/20 to 130/70 mm. Hg. The rise of pressure, however, accompanying a rapid transfusion is not always maintained; for example, in one case the blood pressure rose from 70/38 to 134/50 when two pints of plasma was given in twenty-five minutes, but soon fell away again to below 100 mm. Further, rapid transfusion is not always well tolerated; in one case restlessness developed during the transfusion of one pint of plasma in five minutes and one pint of blood in eight minutes; in two others restlessness and increased rate and depth of respiration were noted to come and go with the speeding and slowing of the transfusion. On the other hand a slow transfusion may be ineffective, the blood pressure remaining low or continuing to fall until the rate is increased. Thus in one case (fractures of skull and legs; severe blood loss but no continuing bleeding) 1,400 c.cm. of plasma was given over a period of eleven hours. At the start (one and a quarter hours after injury) the patient was pale, sweating, restless, and excited, and was vomiting; the blood pressure was 100/65 and the pulse rate 125. During the transfusion period the patient became worse, and was semi-comatose, with sighing respirations; pallor persisted, the blood pressure fell gradually to 70/40, and the pulse rate rose to over 140. The rate of transfusion was then quickened (how much is not stated), and after half an hour the blood pressure had reached 110/68; improvement continued, and after another half-hour (during part of which time oxygen was also given) the blood pressure was 120/80, the facial colour good, and the patient fully conscious. Another patient (leg severed through thigh; much laceration), who had lost much blood before and at least a pint during operation, became very ill towards the end of it. Although a blood drip was running slowly, his respirations became rapid (25 a minute) and shallow, and his radial and carotid pulses failed, being palpable only for short spells, and then grossly irregular. After the end of the operation his face and extremities suddenly became pale and he sweated profusely; he lay motionless and apparently unresponsive, though round from the anaesthetic (pentothal, gas-oxygen-ether). The bottle of blood was nearly empty and no more was available; plasma was not obtained until a quarter of an hour. During this time oxygen was given by B.L.B. mask without improvement. The plasma was then transfused at the rate of one pint in twenty minutes. The observer remarks that he expected the patient to die, but that in fifteen minutes there was a remarkable change: the pulse was regular and of good volume, its rate 120 a minute; the blood pressure was 135/70 and the respirations 15; his mental condition had improved greatly, and he conversed normally.

In most cases improvement is pronounced within a few hours of beginning transfusion, being shown by a lessening of pallor (sometimes restoration of a good colour) the cessation of sweating, a feeling of warmth, and a rise of blood pressure to over 100 mm.; slow pulses tend to increase and rapid ones to fall towards normal rates. In some the improvement is dramatic in its rapidity. In a few the response is slow: thus in one instance transfusion of two pints of plasma in the early stages raised the systolic blood pressure from 50 to 90 mm. but no further, though recovery took place later. This case also illustrates that one factor slowing improvement is delay in beginning transfusion. The patient was not admitted to hospital until five and a half hours after injury; transfusion was begun seven and a quarter hours after injury. Blood pressure was not established at normal levels until some time after operation—about thirty-nine hours after injury.

As a general rule, in the absence of continued bleeding, if no material improvement takes place after giving two or

three pints of blood or plasma at an adequate rate, later improvement is unlikely. Only 6 patients showed no improvement after amounts varying from two to six pints, and all soon died; in 3 failure to respond was associated with uncontrollable bleeding; this factor was not evident in the others.

(b) Reaction to Transfusion

A reaction to transfusion is recorded in 15 cases (18%). Rigors are noted in 14, but in one case pallor, a feeling of coldness, and a temporary rise of blood pressure occurred without rigors. We believe from our own experience that reactions are even more frequent than is shown. Unless the patient is carefully watched reactions may be easily overlooked when shivering is slight or absent and the only signs are increased pallor, coldness, a diminution in the pulse volume, and a temporary rise of blood pressure.

(c) Operative Treatment and Anaesthesia

Eighty-three cases underwent operation; the time after admission at which operation was begun and the duration of operation are noted in 68. Operation was begun within two hours in 18 cases, four hours in 23, six in 5, twelve in 20, and twenty-four hours in the remaining 11. In the majority operation lasted an hour or less (49 cases), between one and two hours in 15, and between two and three hours in 4. Too many factors seem to have influenced these times to allow analysis to bring out clearly what we have gathered from our own experience—namely, that the sooner operation is begun, after resuscitation in those cases requiring it, and the more rapidly it is carried out, the better for the patient. The danger of delay is illustrated by two comparable cases. Both patients were young and healthy men with badly smashed legs, and were severely ill on admission. They were soon revived by transfusions; in both, double amputation was rapidly carried out by two surgeons operating together, transfusion being continued. In one case operation was begun within two hours of admission, and the patient survived. In the other operation was delayed for seventeen hours; the patient became gravely ill during operation, responded poorly to further transfusion, and died about eight hours later.

It has been seen that a considerable proportion of cases deteriorate at operation. The data given are too meagre for an analysis of the factors involved, but in at least 9 cases renewed bleeding was the chief. These findings serve to emphasize three practical points. The first is the necessity for carefully watching the patient during operation for signs of deterioration: the best indicator is the state of the blood pressure. The second is the importance of keeping blood loss at operation minimal; and the third, the need for continuing transfusion at drip rate during operation so that at any time it can be speeded up to compensate for further haemorrhage.

Data on the induction and course of anaesthesia are scanty, and in 23 of the 83 cases no note is given of the anaesthetic used. The gas-oxygen-ether anaesthetic was used in 45, ether in 4, pentothal or evipan in 4, a local anaesthetic in 5, and a spinal in 2. We are of the opinion that too little attention is paid to this aspect of treatment, and from our own experience we urge that the anaesthetic should be administered by a skilled anaesthetist. The series affords no material for comparing the efficacy of different anaesthetics: from what we have seen the gas-oxygen-ether mixture well administered is a safe and satisfactory anaesthetic. It is of interest to note that in two cases a spinal anaesthetic was given before operation for "shock"; in both of them the blood pressure fell further and was later restored by transfusion.

Phasic Variations in Blood Pressure : Cardiac Irregularities

In passing, attention is drawn to a commonly occurring phasic variation in blood pressure, corresponding to the "pulsus paradoxus." The pressure rises with expiration and falls with inspiration. The amplitude is often no more than 5 to 10 mm.; but it may greatly exceed this, and in one case reached 50 mm. It often becomes apparent during anaesthesia, but occurs apart from this. It does not seem to be associated with any particular injury or with obstructed respiration. Its significance is not understood, and further observations are required.

Cardiac irregularities also are not infrequent. Extrasystoles are the commonest, but auricular fibrillation and pulsus alternans have been met with. These irregularities usually pass off as the patient's condition improves.

Disturbance of Renal Function

A feature of interest is a commonly occurring disturbance of renal function; its frequency is unknown, for observations have been insufficient. The chief characteristics are a delay in passing urine (up to thirty-six hours) and the presence of abnormal constituents in the urine for a day or two (albumin and red blood cells, less often casts, and occasionally sugar). The delay in passing urine is in most cases not due to retention, for the bladder does not fill, and in some patients who have died without passing urine little has been found in the bladder at necropsy. The delay may be followed by several days of reduced urinary output in spite of plentiful fluid intake, which may be succeeded by a period of increased diuresis. In some instances the blood urea is raised. While in most cases the disturbance is relatively slight and transient, in a few it is more severe and longer-lasting, and in two cases death appears to have been due to renal failure. In neither was the renal failure adequately explained at necropsy, though in one case fat emboli were discovered in the kidneys. Examples of the disturbance are given in the case histories quoted under Groups I and IIIA (pp. 294 and 296). Whether all these cases fall into one category or whether or not the renal disturbance is the same as that occurring in the "crush syndrome" remains unknown. So far as evidence goes the disturbance is not clearly related to age, blood pressure, severity of wounds or haemorrhage, or transfusion. Further observations are necessary.

Deaths

Although most of the cases responded so well to treatment, yet in a high proportion improvement was only temporary. The table (p. 293) shows that of the 100 patients 44 are known to have died: none in Group I; 7 (or one-quarter) of Group II; 4 (or just under one-half) in Group IIIA; and 15 and 18 (or more than a half) in Groups IIIB and IIIC respectively. This probably does not fully represent the mortality of the series, for, as the table also shows, the after-history is no more than twenty-four hours for 10 cases, forty-eight hours for 6, and seventy-two hours for 2. None of the 5 patients with minor injuries died, and only 1 of the 17 with injuries classified as moderately severe. Of the 41 with severe injuries 14 (34%) died, and no fewer than 28 (76%) of the 37 with internal injuries. The majority (27) of the deaths occurred within twenty-four hours of admission to hospital, 11 within forty-eight, 3 within seventy-two, 1 on the fourth day (renal failure), the other 2 on the eighth day (one from renal failure and one from gas gangrene). Fourteen died without reaching operation, 6 died on the table, and 23 died after operation.

In 21 instances death can be accounted for more or less satisfactorily by the nature of the internal injuries; in 8 cases details are insufficient from this point of view. Gas gangrene accounts for two deaths, renal failure also for two; one is attributed to too deep anaesthesia. Insufficient transfusion is probably responsible for one, only one pint of plasma having been given though severe haemorrhage was likely. In another, death occurred when operation had lasted two hours, and in this case also transfusion was begun late.

In the remaining 8 cases death is not readily accounted for. They are alike in that all had improved greatly with transfusion and all except one underwent operation and remained for a time in a more or less satisfactory condition. Then unexpectedly these patients deteriorated progressively and died. The recorded details of the later course are too meagre for further comment in three cases, but in the others the description suggests a pulmonary or cerebral complication. In one, restlessness, delirium, rising pulse and respiration rates, a profound fall of blood pressure, cyanosis, and convulsive attacks are described; in two others the symptoms were similar though convulsions were lacking. A third displayed intense headache, extensor plantar reflexes, and coma. Plasma transfusion did not improve the state of two, nor did venesection a third; oxygen was tried without avail in several. In none was a satisfactory explanation for death found at necropsy. Fat emboli were looked for in six cases, and were found in the lungs, brain, and kidneys in two and in the lungs only in three; they were not very numerous, and it is doubtful if death can be rightly attributed to this cause. No common feature in their injuries or treatment suggests an explanation. More observations are required. It is probable that such cases are more frequent than the series suggests: the final stages are apt to be missed, since they occur at a time when the interest in resuscitation has passed.

Concluding Remarks

The majority of these cases were regarded on admission to hospital as instances of shock. If this is accepted, then it is clear that "shock" is no readily recognizable clinical entity. The survey of the cases, we think, bears out our impression that the grounds for the diagnosis of "shock" depend rather on the personal views of the individual making it than on definite and well-established criteria. In our experience the term is so loosely used in practice as not to give an indication of what we should expect to see at the bedside; it does not tell us how ill the patient is, what symptoms and signs he displays, or what treatment he requires. We prefer not to apply this label to these cases. We have shown that there is much to be learnt of the reaction or reactions to injury, and believe it is only by continued observation and analysis that we can learn more. Haemorrhage plays an important part, but is not the sole factor involved. Many more accurate and detailed case records are needed: attention is drawn to the "Memorandum on the Observations required in Cases of Wound Shock," which appears in this issue at page 332.

These observations have taught us much about treatment. Many of these patients are severely injured and have lost much blood; left untreated, they soon become dangerously ill, if they are not so already. The simple measures of rest, warmth, and morphine administration are usually insufficient for their recovery, but a transfusion of blood or plasma properly given is a most potent means of restoring or maintaining the circulation.

In assessing the need for transfusion emphasis is placed on the severity of the injury and blood loss rather than on

blood pressure; nevertheless, the course of the blood pressure is the best available indicator of response to treatment, and its determination should not be omitted. In severely wounded cases with evidence of blood loss, transfusion should be begun without delay, whatever the blood pressure. Early transfusion should be given at the rate of about one pint in fifteen minutes or half an hour; later transfusions, unless to combat renewed bleeding, more slowly—one pint over one or more hours. More rapid rates may not be well tolerated; slower ones may prove ineffective.

The restoration and maintenance of blood pressure to about or above 100 mm. is a good indication that an adequate amount has been transfused. The response to transfusion may be dramatic in its rapidity; usually it is more gradual. Few cases fail to respond: in the absence of continued bleeding, lack of improvement after the giving of two to three pints of plasma or blood indicates small chance of recovery.

Operation should be carried out as soon as possible after the patient is revived. At operation as little as possible should be done as quickly as possible, and blood loss must be kept minimal. The gas-oxygen-ether mixture is a safe and satisfactory anaesthetic; its administration should be in skilled hands. Transfusion ought to be continued during operation and the patient carefully watched for signs of collapse.

In the post-operative period the patient still requires to be carefully watched for several hours; transfusion is often necessary. Even in patients well restored and safely past operation, death may occur unexpectedly within forty-eight hours.

In many cases, owing to the nature of their wounds, improvement is but temporary and is followed by deterioration and death. Nevertheless, because of the difficulty in foretelling the outcome, transfusion should not be withheld, no matter how dangerously wounded the patient appears to be when he comes under observation.

MEMORANDUM ON THE OBSERVATIONS REQUIRED IN CASES OF WOUND SHOCK

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The following memorandum was prepared for the Medical Research Council's Committee on Traumatic Shock and issued in February, 1941, to a number of medical officers in the London area. The memorandum has proved useful, and is now published in the hope that medical officers elsewhere may also help in collecting the required information. Case records should be sent to the Secretary, the Committee on Traumatic Shock, Medical Research Council, c/o the London School of Hygiene, Keppel Street, London, W.C.1. A brief account of the observations made so far also appears in this and the previous issue (pp. 293 and 329).

Close observation of air-raid casualties shows that in spite of all the work already done, especially in the last war, little is known of the nature and treatment of traumatic or wound shock. In the first place there is in practice a wide variation in the application of the diagnosis of "shock." Some medical officers apply the label "shocked" to any patient, however slightly wounded, who seems ill, is perhaps pale, and has a weak pulse. Others

restrict it to cases displaying low blood pressure, a rapid thready pulse, pallor or cyanosis, a cold and sweating skin, shallow and rapid respiration, and often vomiting, restlessness, a lessened sensibility, and a dulled mental state: To the majority the criteria of "shock" are severe injury and low blood pressure. It follows that those who apply the diagnosis in the first sense see many more cases and obtain better results in the treatment of "shock" than those who apply it with more restraint.

Secondly, the clinical manifestations presented by injured patients are varied: some cases of so-called "shock" recover quickly with only rest and warmth, some require transfusion, and others die whatever treatment is given. It seems likely that there are different types of "shock," but we have not yet learnt to distinguish them clearly at the bedside. Prognosis is often at fault and treatment in doubt. Moreover, the lack of a common basis of diagnosis makes it impossible to assess the efficacy of the various methods of treatment adopted.

For these reasons it is better to avoid the diagnosis of "shock" and to replace it by an accurate and complete record of a patient's state and progress, together with the treatment given. It is only by accumulating and analysing such records that we can hope to learn if the patients do fall into different clinical groups, with differing prognoses and requiring different treatments. It is only thus we may pave the way for further observation and experiment directed towards understanding the mechanism of "shock" in its various forms.

The same need for careful observations on "shocked" and wounded soldiers was realized in the last war, and much was accomplished by special observers in France in spite of difficulties associated with active service abroad. Much remains to be done, and the opportunities for observation are more favourable now than then. Valuable material is passing through our hospitals either unrecorded or insufficiently documented. It is important that case records should be made on a uniform plan, and the following notes have been compiled for the guidance of medical officers who have the opportunity of dealing with air-raid casualties and who are willing to undertake such work. On page 333 is an example of the type of detailed case record desired.

This work is exacting; it often requires that an observer should remain by one patient almost continuously for hours. It follows that only one or at most two cases can be satisfactorily dealt with on any single occasion unless the medical officer has available helpers on whose observations he can rely. A few records fully documented are of far greater value than scrappy notes on many cases. Observations need not be confined to air-raid casualties: they are equally valuable when applied to accident cases or surgical emergencies.

NOTES ON OBSERVATIONS

A complete record should be kept of all that happens to a patient from the time he comes under observation until he is out of danger or dies. It is most important that all observations should be recorded at the time they are made and that the times of the observations should be noted. These points are often overlooked by unpractised observers, and require emphasis.

An attempt should be made also to find out what happened to the patient before he came under observation. The circumstances of the injury should be inquired into: when the patient was injured; what he was doing at the time; how near the bomb fell; whether he was buried or left exposed; whether or not blood was lost, and how