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

BY

R. T. GRANT, M.D., F.R.S.

The Clinical Research Unit, Guy's Hospital

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

MEDICAL RESEARCH COUNCIL

Hospital:
Name: A. B.

Age: 33 years.

Sex: Male.

Date and Time of Admission: 8/11/40, 7 p.m.

Time of Injury: 6.30 p.m.

Time	Pulse	B.P.	Resp.	Observations	Time	Pulse	B.P.	Resp.	Observations
p.m. 7.25 7.50	?	70/?		I.M.H. gr. 1/4. 3 c.cm. A.T.S. B.L.B. mask on. Said to be ashen pale and sweating profusely. Pulse impalpable, rapid breathing, cold extremities.	9/11/40 a.m. 12.30 (cont.)				Suddenly forehead and extremities pale and sweating. Doctors present take a grave view. Carotid pulses barely palpable and only in bursts at wrist. With some delay another vein needed. Coming round from anaesthetic.
8.00 8.30	?	60-70/?	28	Plasma, Group O, 1 pint started. Skin colour fair. Warm. Pinhead pupils. Mental state clear. B.L.B. mask in place—tolerated well.					Transferred to bed in theatre; foot of bed raised; bed moved to resuscitation room next door to theatre. Hot cradle on. B.L.B. mask on. Very ill. Only about 50 c.cm. of blood left in transfusion bottle. Plasma is being fetched, but very slowly. Transfusion rate a slow drip to make blood last; but if drip speeded up he immediately improves, only to fall away again when it is slowed.
8.45	128	70/50	18	Injuries: Leg off at level of lower right thigh. Severely lacerated. Has been cleaned up and packed. No sweating. Exposed hand rather cool. Apparently no other injury. Pulse (rt. radial) regular, thin volume. No pause after expiration; resps. regular. Skin colour of face still quite good. Hand not particularly cold, but slightly bluish.	12.45	?		25?	Breathing very shallow. Pulse as above. B.P. unrecordable. Fair colour in skin of forehead and lips. Sweating on forehead. Exposed extremities cold.
8.50				Has had 1 pint of plasma. Blood, 1 pint, started. Patient sleeping. Rt. arm bandaged from elbow to wrist to keep warm. Rt. hand exposed.	12.50	?		?	Breathing very shallow. Extremely ill. Citrate and plasma at last; run in pretty rapidly, about 1 pint in 20 mins. Pulses still as before. Lies quiet; does not talk; appears semi-conscious. I went away thinking he would die. Miraculous change. Pulse good volume. Mental state clear and normal. Feels better. This pint of plasma finished.
9.00	120	78/56	17	Respiratory variation of B.P. Hand cold. Slight sighing resps. Blood running at about 3 drops a second. Skin of face paler but not bloodless. Lips appear to be slightly cyanosed. Lying quite quiet. Patient feels not too bad. Has had hot cradle over lower part of body and legs since 8.45 p.m. Rt. hand exposed.	1.00	120	135/70		Blood, 1 pint, started. Pulse regular and no fluctuation. Mentally quite normal now. Thirsty. Lips moistened with water. Sips of water.
9.15	122	84/56	17	Rt. hand cold. Forehead and cheeks cool. Colour of face definitely paler. Blood taken from rt. thumb. Squeezing and congestion + to get blood drop. Hb 80-82% (Gowers's method). Patient quiet and drowsy.	1.10 1.15	128	120/70	15	Pulse good volume and regular, with occasional poor beats. Forehead moist. Ears and nose warm.
9.30	120	92/58	16	No respiratory variation of B.P. now. Lips pinker. Ears cool to warm. Still quiet. Foot of bed raised. Ears' and lips' colour better. Mental state clear. Patient says his back is burning.	1.30	128	125/70		Warm, quite comfortable, not too hot. Skin colour good. Entirely rational. Feeling well in himself. Resps. deep and even. Pulse regular and even. Remarkable recovery. Now in good condition. Hb from blood at 1.45 a.m. = 88% (Gowers's method). Blood: about 250 c.cm. of this last 550 c.cm. has now gone in.
9.45 9.55 10.00	124 122	100/60 118/79	16 15	Hand not so cool, but coolish—more blood in it. Veins visible. Thirsty—sips of milk. Exposed hand cool but warmer. Skin of face, ears, and lips good colour. Patient quiet and co-operative. Free flow of oxygen into B.L.B. mask.	1.55	128	120/80	14	Patient feeling quite well—good colour in face; nicely warm ears and hand. (B.P. a bit high.) Has had a good sleep. Has been taking fluid (water), but brought some up again. Fluid intake about 2 pints +; 1 pint output by vomiting after 2 cups of tea. Passed water about 12, not in excess quantity. Did not feel he wanted to pass any water. Mental state normal. Pulse quite regular and good volume. Patient still a bit thirsty. Hb 83-87%, taken from rt. thumb. Easy flow.
10.15	124	140/70	14	Exposed hand good colour though still cool. Colour of cheeks, lips, and ears still good. Pulse thin. Vasoconstriction.	p.m. 12.20	120	140/85		Previous History: Always been very fit. Weight about 12 stone. Height 6 ft. 2 in.
10.20				Has now had 1 pint of blood. Second pint of blood started. O ₂ still bubbling through mask. Stump has bled a little but not much. Patient asked for pillow under rt. leg. Still quiet and cool.	10/11/40 a.m. 6.00 10.00 11/11/40 p.m. 3.30	80 96		20 20	Temp. 97-6° F. Temp. 100-2° F.
10.30	128	136/70	16	Exposed hand warming. Colour of exposed hand good; also cheeks, ears, and lips a good colour. B.P. shows respiratory variation.			150/88	20	General condition good. For last 2 days pulse average 96-106. Temp. swinging 98°-100-6° F. Mental condition fine. Having sulphapyridine, which gives him a headache and makes him feel sick. B.P. 150/88 three times. ? excitement. Skin hot. Lips and skin a little pale. Pulse good volume. Hb taken = 84%. Thumb blood easily obtained.
10.35				Hb (rt. thumb) 98%—Gowers's method. Hb (congestion and squeezing +) was done after he had had 1 pint of plasma, 1 pint of stored blood and 100 c.cm. of new bottle of blood.	15/11/40 p.m. 3.00	100	140/80		Pulse good volume, regular. Mentally normal. Since Monday, 11/11/40: Average temp. = 98-4°-100° F. swinging. " pulse = 98-104. " resp. = 20.
10.40 10.45	144	134/68	17	O ₂ now off. Slight rhythmical fluctuation of B.P. Resps. regular and even so far.					Sulphapyridine stopped 12/11/40. Had 2 pints of blood, Group O, on 13/11/40. On 15/11/40 Hb was 90%.
10.50				Vomited 1 oz. Face a bit congested. Forehead sweating. Lips not so pink. Quite rational. Says he was in house about 6.30 p.m. Bomb dropped and house fell on him. Also coal-gas escape.	16/11/40				Evening. Fairly sudden onset of pain in chest. Got worse, and limited inspiration. Doctor thought he could detect signs of pleurisy. No cough. No sputum; slight haemoptysis. Temp. persisted about 100°-101° F. Pulse went up from 100 av. to 110-120. Given sulphapyridine and sulphathiazole in large doses.
11.00 11.15	132 128	136/70 130/90	14	I think a bit bluer since O ₂ off. Hb on last few drops of last bottle of blood done—106% approximately. ? a fair sample. Quite clear-headed.	18/11/40				Seen at 3 p.m. Feels better, but now on sulphathiazole instead of sulphapyridine. Still some pain. Still no cough or sputum. I should think probably an infarct.
11.25 11.30 11.45	128	134/85	16	Slightly more fluctuation in B.P. Feels good in himself. Pupils still pinhead. Hands warmish, good-colour. Blood in skin veins. Comfortably warm. Calm. Probably fit for operation.	19/11/40 21/11/40 22/11/40 22/11/40				One small haemoptysis. No cough. No sputum. Pulse 116-120. Temp. 101°-102° F. Temp. 99°-100-4° F. Pulse av. 100.
9/11/40 a.m. 12.30	?	?		Hb 96-100%. Anaesthetic started. Pentothal intravenously, ? how much, followed by gas-oxygen and ether; 80% O ₂ and not much ether or N ₂ O necessary to dope him. Moved into theatre. Blood drip not now running very well. Moved on to table. Stump wound (about through knee) cleaned up and isolated in sterile towel. Amputation through about middle of femur. Well and rapidly done. Total operation time about 30 mins. Tourniquet above operation field: On about 20 mins. A fair amount of blood loss. I should say at least 1½ pints, but this may be an over-estimate.					Recommencing of pleuritic pain in his opposite side (rt.). Mild attack. Respirations normal. Pulse normal. General condition good. Radiograph ? small opacity just above left diaphragm.
				Operation finished. Stump sewn up. Operated on with head lowered and legs raised, and blood drip running in badly, partially subcutaneously. Now flat out. Rapid breathing (and shallow). Pulse at wrist impalpable except in bursts, when gross irregularity of rate and rhythm can be detected. Has been like this for the last 15 mins.					

Note.—To bring the readings of the Gowers haemoglobinometer used to a "normal" standard in which the blood of average healthy men is represented as containing 100% haemoglobin, correct the readings here recorded by subtracting from them $\frac{R \times 30}{100}$, where R is the given reading.

much; what treatment he was given. The amount and time of administration of morphine or other drug should be noted, as also the time of application of a tourniquet. It may be impossible to get this information from the patient, but it can often be obtained sooner or later from other witnesses. *The injuries* observed on admission and later, including radiographic and operation findings, should be fully described.

The general condition of the patient should be noted. State, for example, if he is mentally clear, apathetic, drowsy, comatose, talkative, delirious; what his memory is for events up to and since the time of injury (concussion); whether he is frightened or calm; if he is in pain; whether the eyes are sunken and closed, or staring; what is the state of the pupils. Some patients are deafened by the explosion; even in the absence of deafness it is advisable to examine the ear drums for rupture (blast). *The general build and nutrition* should also be noted—for example, whether the patient is short and fat, tall and thin.

Loss of Fluid

A close watch should be kept on loss of fluid from the body by haemorrhage, sweating, vomiting, and the passage of urine and faeces. When possible the amounts lost in this way should be measured. Thirst and nausea should also be noted. An attempt should be made to estimate fluid lost from the circulation into the tissues—for example, when blistering is extensive or when the limbs become swollen. In the latter case the swelling of the limbs may be estimated by measuring their girth or by noting displacement when immersed in water.

Haemorrhage.—It is difficult and often impossible to estimate how much blood has been shed. The colour of the skin and mucous membranes is of little value, as they may be rendered pale by local vasoconstriction or by drainage of blood to other parts of the body. The usual methods of estimating circulating blood volume (dye or carbon monoxide methods) are not readily applicable to severely injured patients. An indication may be got, for example, from the state of the dressings, by measuring the amount of blood lost at operation, by soaking dressings, etc., in water and subsequently noting the volume of water and estimating its haemoglobin content. Some indication also may be obtained from the state of the blood. Thus the estimation of the haemoglobin and the red cell number or volume (haematocrit) before and after the administration of plasma may give an approximate idea of the circulating blood volume. A single estimation of the haemoglobin content of the blood is of little or no value for showing the amount of blood lost from the circulation; of greater value is a series of readings which may reveal a progressive dilution or concentration of the circulating blood. In this connexion it is important to note the method used for estimating haemoglobin, the site from which the blood sample is drawn, if much squeezing or venous congestion is required to obtain a flow of blood, and if the finger or ear is cold. It is said by some that a concentration of the blood is an early and valuable sign of "shock"; on the other hand, others say that many cases regarded as "shocked" show no evidence of blood concentration, while some claim that concentrated blood may be found in the cold extremities of normal subjects.

Sweating.—The amount of fluid lost from the body by sweating may be considerable. Its outbreak, degree, and cessation should be noted. Sweating may be associated with a pale skin as in "shock"; associated with a hot flushed skin it may indicate that the patient is being overheated.

Thirst, Nausea, and Vomiting.—Thirst should be noted; it is often severe, especially when dust has been inhaled. Nausea and vomiting are frequent; the amount and character of the vomit should be noted. Undigested food may be vomited hours after injury. Nausea and vomiting may be associated with either a rise or a fall of pulse rate and blood pressure.

Urine and Faeces.—The passage of these should be noted. Many patients do not pass urine until fifteen to thirty hours or more after injury, and the urine then and for a time subsequently often contains albumin, blood, and casts. The anuria does not seem to be necessarily associated with low blood pressure or severe injury; further observations are required. When facilities are available other urinary investigations should be undertaken. For instance, estimations of blood urea are of interest.

Observations on the *state of the circulation* are regarded as of chief importance in the condition of "shock," and much information may be gathered from observations on the blood pressure, pulse rate, and skin colour and temperature.

Blood Pressure

Blood pressure is regarded at the moment as one of the most important guides to the patient's state and progress;

Diagram of apparatus used in taking serial blood-pressure readings.

serial readings are essential. The frequency of readings depends on circumstances: they may be required every five, ten, or fifteen minutes in the early stages, or at hourly or longer intervals in the later stages. A respiratory variation in blood pressure is often present, the pressure rising with expiration and falling with inspiration.

For serial readings it is of great help to use a modification (see diagram) of the auscultatory method usually employed. A flat stethoscope diaphragm D having the exit tube bent parallel to the diaphragm is incorporated in the inner and lower edge of the sphygmomanometer cuff C. An aluminium strip A ($1\frac{1}{32}'' \times 3\frac{3}{8}'' \times 4''$), suitably bent and stitched to the cuff and exit tube of the diaphragm, holds the latter in position on the cuff. If the rubber bag R comes close up to the end of the cuff it is necessary to add another piece of cloth to accommodate the diaphragm. A rubber tube B, 6 inches long, is attached at one end to the diaphragm and at its other bears the female part of a male-and-female metal junction. The male part of the junction is inserted into a rubber tube E, 18 inches long; at the other end of this tube a metal Y-piece receives the two rubber tubes of a binaural stethoscope. The rubber tube F of the sphygmomanometer cuff is cut to 6 inches in length and bears the male part of another male-and-female metal junction. (The second tube from the cuff, if present, is cut short and sealed, not being required.) A rubber tube G, 18 inches long, bears the female part of the metal junction at one end; at the other it connects through a metal Y-piece with the manometer and pressure bulb. The diaphragm is placed and held over the brachial artery above the elbow, while the cuff is applied in the usual manner and fixed by a buckle. The stethoscope and manometer are connected by the rubber tubes. Readings may then be taken no matter what the position of the patient's arm. This method avoids the necessity for disturbing the patient by repeatedly exposing an arm, and readings may be made even during sleep. It is more convenient to use an aneroid than a mercurial manometer, particularly when blood-pressure observations are made in the operating theatre, thus avoiding the necessity for a stand for the manometer in a space already sufficiently occupied by surgical staff and instruments. The length of tubing allows the observer to stand at some distance from the patient. With this modification, also, the pulse rate may be counted by inflating the cuff till the pulse becomes audible and maintaining the pressure for the quarter-minute or half-minute necessary.

It is of advantage to have several cuffs, with the diaphragm incorporated, so that observations can be made on more than one patient, leaving the cuffs on the arm and disconnecting stethoscope and manometer at the junctions.

Pulse

In addition to the rate, the rhythm and quality should be noted. Irregularities in force and rhythm are often encountered as transient phenomena in air-raid casualties. Alternation, sinus arrhythmia, extrasystoles, and fibrillation have all been met with. Where a portable electrocardiograph is available records would be of interest. A point which has been noted is that though in some instances the radial pulse is hardly palpable the blood pressure may be within normal limits or be raised. The observations on pulse and blood pressure are important because they are used as a basis for judging the patient's progress. It is said by some that a rising pulse rate indicates improvement, and by others, on the contrary, that it indicates deterioration. Both may be true, depending on the circumstances. A rise of pulse rate and a fall of blood pressure may indicate that a cold patient is becoming warm or that haemorrhage is taking place. It is to be remembered that $1/100$ grain of atropine may considerably increase the pulse rate.

Skin Colour and Temperature

It is important to observe closely the phenomena displayed by the skin, and how these change with the passage

of time. Note the colour of the skin, whether it is pale or flushed, and whether the tint is a normal pink or is cyanotic. It is to be remembered that cyanosis is not easily recognized in artificial light, especially if this is dim. For the observation of colour it is of advantage to carry a torch giving a white light. It is to be remembered also that pallor or greyness of the face may be due only to a coating of plaster dust, the pale tint being enhanced by smears of blood on the face.

Skin temperature is particularly useful in assessing the state of the peripheral circulation: a cold skin indicates poor, a warm skin good, peripheral circulation. It is not necessary to estimate skin temperature by a thermometer; it is sufficient to record whether the skin feels cold, cool, warm, or hot to the observer's hand. The observer's hand should be warm. Note where the skin temperature is taken, because it is only in the hands and feet, nose and ears, that skin temperature is a good index of the skin blood-flow. On the trunk, forehead, and muscular parts of the limbs the skin is warmed mainly by underlying structures, and skin temperature may be high although skin circulation is at a standstill. The extremity of which the skin temperature is noted should be exposed to room air: a hand withdrawn from under a heated cradle may be warm without the warmth indicating a good peripheral blood-flow. The nose, or the hand of an arm exposed for transfusion, is a convenient site for watching changes in skin temperature. It will be found, for example, that low blood pressure is usually accompanied by pallor and coldness of the skin: as the blood pressure rises the skin becomes pinker and warmer. In certain instances, however, the exposed hand may remain warm although blood pressure falls. The onset of a rigor is often preceded or accompanied by the appearance of pallor and a drop in skin temperature. It is to be remembered that evaporation of sweat cools the skin surface.

Body Temperature and Respirations

Estimations of temperature in the mouth or axilla are very liable to error, and it is best to note rectal temperature. Remember that a patient may be thoroughly chilled by exposure and may require prolonged heating to become comfortably warm, although his body temperature may have been but little or not at all lowered. Rectal temperature is the best guide to blood temperature.

In addition to rate of respirations, the depth, regularity, etc., should be noted. Cheyne-Stokes respiration should be looked for. Attention should be paid to the development of abnormal signs in the chest (collapse, oedema).

Handling the Patient

Details of the handling of the patient should be recorded. Notes should be kept, for example, of when the patient is undressed (whether or not the clothes are cut off), moved from stretcher to bed, taken to the theatre, and examined surgically. The method of warming by cradle or electric blanket should be recorded, also the time of application and of the withdrawal of heat. Note, too, when the end of the bed is raised and how much, and when it is lowered. The effect of handling should be observed—whether or not blood pressure or pulse alters, or pallor or sweating develops.

There is considerable difference of opinion on how best to handle patients. For example, in some hospitals it is the general rule, as soon as possible after admission, to transfer the patient from stretcher to bed, to undress him, cutting the clothes off if necessary, to examine him completely, and then allow him to rest while being warmed. At other hospitals it is the custom not to undress the injured patient until he is in the operating theatre and under the

influence of an anaesthetic. Data are wanting by which the relative value of the different methods of handling a patient can be assessed.

Treatment

In addition to such points as have already been mentioned note should be kept of all drugs given, the dose and time being recorded—for example, A.T.S., morphine, atropine, oxygen, sulphanilamide. A record should be kept of all fluids administered, whether by mouth, rectum, or vein. When blood or plasma is given the rate of transfusion should be noted. Any difficulty in entering a vein with a needle or cannula or of getting the fluid to enter the vein should be recorded. Note the temperature of the fluid administered: rigors may follow the intravenous administration of cold fluids. It is of value to note whether varying the rate of transfusion appreciably alters the patient's state. It has been found, for example, in some cases that blood pressure falls when the rate of transfusion is reduced; in others that nausea, restlessness, and respiratory distress accompany speeding of the transfusion.

Operative treatment, the anaesthetic employed, and the progress of the patient while he is in the operating theatre and subsequently, all require description. An attempt, too, should be made to follow the progress of the patient if he is transferred to another hospital. In the event of death the manner of death should be recorded and every effort be made to obtain a post-mortem examination. Fat emboli should be looked for.

It is of value also if during the course of the case and at the end the observer gives his general impressions. For example, he may state that judging by the rise of blood pressure the patient now seems fit for operation; that the case appears to be one mainly of loss of blood; that he is surprised at the turn events have taken. In this way he is led to learn from his observations and to look for further evidence in future cases to support or correct his impressions.

Medical Memoranda

Sulphonamide in the Treatment of Corneal Ulcer

Sulphonamides have in recent months been used locally in various surgical and skin conditions. The suggestion arose to try this method in seriginous ulcers of the cornea, and since October, 1940, we have treated these cases with prontosil applications. The following preparation was used:

Prontosil soluble 5% 5 c.cm.
Paraffin. molle ad 1 oz.

It was inserted into the conjunctival sac twice daily for prolonged periods. No other disinfectant was used.

In judging the results of any treatment of seriginous ulcer it has to be borne in mind that we are dealing with a disease which has to be attacked from several sides, since almost always there are complications, with their special features and dangers, which may influence the course of the disease. Iritis, invariably present, has to be held in check by mydriatics and by the application of heat; increased ocular tension often necessitates surgical intervention in the form of paracentesis; a diseased lacrimal sac has to be excised.

In any given case it is difficult to say to which of the various factors of treatment success or failure has been due; and it will be understood, since prontosil replaces only one of the weapons used, that a conclusion as to its efficiency can be arrived at only by comparing a series of cases in which it has been used with a corresponding series in which other anti-bacterial agents have been employed.

COMPARISON OF RESULTS

Two series of cases are considered: (1) the prontosil series, comprising all patients so treated who have been discharged from hospital two weeks or more; and (2) the "previous" series, consisting of the first 20 cases of seriginous ulcer treated in 1940, in which either argyrol or mercurochrome had been used. The latter series contains a number of cases in which the cautery had been employed, when the ulcer could not be prevented from spreading. No form of cautery, chemical or heat, has been used in the prontosil series, but in 9 cases treatment was supplemented by local irradiation with ultra-violet light (Duke-Elder's mercury vapour lamp). This subsidiary treatment was chosen for two reasons: (1) In cases in which the ulcer did not come to an early standstill it did not seem justifiable to resort to an experimental drug only. (2) On theoretical grounds local irradiation appeared well fitted to supplement the bacteriostatic action of the drug. Since ultra-violet light acts more in the nature of stimulating the tissue to anti-bacterial activity than as a direct bactericide, it only partly overlaps the effect of prontosil.

The table shows that the results of treatment with prontosil, as judged by the visual acuity remaining when the ulcer had healed, compare favourably with those of the orthodox treatment. The most striking feature of the prontosil series was the transparency of the resulting scar of the cornea, even in many cases in which the infiltration had gone very deep into the corneal tissue. Perhaps this was mainly due to the fact that the cautery was never

Visual Acuity of Affected Eye on Last Visit to Out-patient Dept., with Refraction Corrected	Prontosil Series	Previous Series
6/6 or better	6	1
6/6 to 6/18	7	8
6/18 to 6/60	5	3
Less than 6/60	2	6
Eye lost	0	2

required to arrest the spread of the ulcer. The rapidity of healing was the same in the two series, the average period of in-patient treatment being 10½ days in each.

Summing up we would say that the results of treatment of seriginous ulcer of the cornea by the application of prontosil ointment are encouraging, especially when used in conjunction with local ultra-violet light. It might prove a valuable addition to our therapeutic weapons against this dangerous affection of the eye.

We would like to express our thanks to Mr. Alexander MacRae for allowing us to treat these cases and for his encouragement and advice.

A. PHILIPP, L.R.C.P.&S.Ed., D.O.M.S.
K. W. STUART, M.B., B.S.,
House-surgeons, Newcastle-upon-Tyne Eye Hospital.

Renal Complications of Sulphapyridine

After reading the article by Mr. Leedham-Green (*Journal*, 1941, 1, 586) I am prompted to record the following case.

CASE REPORT

The patient, a boy aged 5, had had three attacks of tonsillitis during last winter. Two of these were followed by mild otitis media, the first attack being treated with sulphanilamide. The second attack occurred a week after the tonsillitis, and as there was considerable injection of the malleus region of the ear-drum, with a temperature of 101°, I decided to give sulphapyridine. He had an initial dose of 1 gramme in the morning. About four hours later he began to vomit, and vomited several times during the afternoon. He refused to take fluids on account of the vomiting which they almost immediately initiated. He passed no urine from about midday until evening, when a small quantity was voided; this was not measured and was not seen by me. That evening he seemed better, but as the temperature was 99.6° another 0.5 gramme of sulphapyridine was given, also a small drink of water—all he would take.

The next morning he complained of abdominal pain centred round the umbilicus and spreading laterally towards the flanks. He vomited about 6.30 a.m. and again shortly afterwards, and voided a small quantity of thick cloudy urine, which was not