to be as efficient as 2-methyl-1:4-naphthoquinone in increasing the amount of prothrombin in the blood when there is a deficiency. Moreover, the action of this preparation appears to be more rapid though less sustained than the latter. It has one minor disadvantage in that it is not stable for long in aqueous solution, and so has to be dissolved in water immediately before use.

A close analogy between haemorrhage in jaundice and haemophilia has been made. In both an upset in the coagulation mechanism exists, which is due in the one to prothrombin deficiency and in the other to an unknown congenital defect.

The failure of the patients with cirrhosis of the liver to respond to naphthoquinone preparations suggests that prothrombin estimations may form the basis of an additional test of hepatic insufficiency. This possibility is being explored.

A simple apparatus for determining the coagulation time and prothrombin time has been illustrated and a method of preserving lung extract, used as a source of thrombokinase, has been described.

I wish to thank Profs. J. W. McNee and C. F. W. Illingworth for advice and criticism, the physicians and surgeons of the Western Infirmary for permission to examine and treat the patients under their care, and Glaxo Laboratories Ltd. and Roche Products Ltd. for supplies of vitamin K.

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The committee of the Royal Melbourne Hospital has accepted responsibility for the erection of a new building for the Walter and Eliza Institute of Research in Pathology and Medicine, now in its twenty-first year. The building will provide additional laboratory space and greatly improved facilities. Meanwhile the annual report of the Institute chronicles a large amount of work, some of it routine investigation and some of it called for by the special demands of the war, in the virus department, the biochemical department, and the departments of clinical and neuropathological research. Much of the work has already been published in Australian journals. Last year the Institute started a blood bank, the only one so far established in Melbourne, to meet emergency blood transfusion requirements. A considerable part of the Institute's work has been the determination of the blood groups of nearly 13,000 troops of the A.I.F. in camp in Victoria. Research has also been undertaken on changes observed during storage of blood, and on the treatment of anuria following incompatible blood transfusions. Endeavours have been made to find a solution which, when injected intravenously in small amounts, will cause rapid alkalization of the urine. A dose of 20 c.cm. molar sodium lactate solution shifts the pH of urine to the alkaline side and maintains it there for half an hour, and it is thought that it may be possible to produce more significant effects with larger doses or more concentrated solutions.

EXPERIENCES IN THE RECEPTION AND TREATMENT OF AIR- RAID CASUALTIES

BY

JOHN ROBERT LEE, M.D., B.S., F.R.C.S.

These notes cover a period of two months when intensive enemy air raids occurred over London. During this period 227 patients came under my care and supervision. Many of us have seen and treated badly injured civilians brought to hospital as the result of road, railway, or works accidents in peacetime. It seems to me, however, that only those who have had to deal with victims of air raids can conceive the appalling condition and appearance of many of these patients on their arrival in hospital. A sight which must be seen to be appreciated fully is the almost indescribably filthy condition of many who evidently had been clean and well clad. A patient is brought to the receiving ward with her clothes cut and torn to shreds, her hair singed, filled with dirt, and matted with blood and cement dust, her body and limbs covered with grit and oil, her face blackened, bruised, and bleeding, her eyes, nose, lips, and ears filled with dirt, her head bandaged, and her limbs immobilized by improvised splints at the first-aid post. Truly it is a picture not easy to forget. Most badly injured patients had been given 1/4 grain to 1/2 grain of morphine; the latter seemed too big a dose. Their ages varied from an infant a few hours old, born and bombed on the same day, to a man aged 92. There were twelve children under 14 years and twenty-six patients over 70. Thirty-six patients were dead or moribund on arrival in the receiving-room. The other patients were classified as follows:

Group 1 consisted of those so terribly injured that they died within an hour of arrival.

Group 2 patients were a few so badly hurt and shocked that they died notwithstanding most prompt measures taken for their resuscitation. Two of these were in so much pain that morphine and other usual sedatives failed to relieve. The administration of repeated short inhalations of chloroform was found to be the only way to calm these patients and to relieve their agony.

Group 3 was made up of those suffering from severe shock and loss of blood. These responded to blood transfusion, other resuscitation measures, and good nursing. After some hours—up to twenty-four—they were in a fit condition to be operated on, and made a good recovery. Some in this group had shattered limbs or had lost part of a limb. Others had head injuries with open or closed fracture of the skull. Three had protrusion of brain substance. All three recovered. Four patients had fractured spine. Two had penetrating abdominal wounds. Others suffered from severe burns.

Group 4 included patients less severely injured. They had large lacerated wounds or open or closed fractures, but shock was not so marked.

Group 5 comprised patients suffering with multiple small cuts, abrasions, and bruises.

Our Routine

Faced for the first time with conditions as described, we evolved and adopted the following routine plan. The patient was at once assured he would be safe and well cared for; those who were distressed because they could not see owing to dirt, swelling, or eye injury were told not to fear going blind. Their eyes were thoroughly cleansed and castor-oil instilled at once, and their lips and mouths were also cleaned. The patients then had a

cup of fresh tea with sugar. Antitetanic serum was given to all the wounded. Brief notes were written and any such treatment was recorded on the case sheet, especially if morphine had been administered at the first-aid post. The patient was then sent to the ward. The nursing staff carried out their duties efficiently, often working on far into the night after a long day. Patients well enough were removed from the stretchers and put to bed. Several of those in one of the first three groups were too ill to be moved off the stretchers for some hours. As soon as such a patient arrived in the ward all special measures for resuscitation were begun, and carried out, by the hospital staff and by special teams, whose skill and untiring efforts saved many lives and enabled us to operate and to obtain good results.

Three patients who were very ill and had been given several pints of blood responded very well indeed; then after a few hours they suddenly showed pronounced signs of apparent collapse, with profuse cold clammy sweat, dilated pupils, rapid very feeble pulse, and restlessness. A hypodermic injection was given consisting of morphine grain 1/4, strychnine grain 1/60, and atropine grain 1/100—the tablet known as M.S.A.—with a good result in each case.

All wounded patients were given the full prescribed course of sulphapyridine with the usual routine hygienic and dietetic measures, combined with good nursing. We soon evolved the following method in cases of injuries to the head or limbs with extensive lacerated wounds.

Patients when well enough to be operated on were given preliminary medication, including 1/100 grain of atropine, and taken to the theatre still on the stretchers on which they were admitted. A general or more often an intravenous anaesthetic was administered; then what we termed a "cleansing squad," which included a doctor, sister, nurse, and one or two attendants, removed the patient's clothes, and thoroughly cleansed the injured parts with ether soap and hot water over a large flat dish and mackintosh. In wounds of the head the hair was cut away. The area adjacent to the wound on the scalp or a limb was shaved, washed with a solution of dettol, and placed in a suitable position on sterile towels. The surgeons were then able to operate with reasonable aseptic and antiseptic care. The area adjacent to the wound was painted with dilute tincture of iodine. Wounds were carefully examined and explored, and foreign bodies and debris were removed. Skin edges and other damaged tissues, especially devitalized muscle, were excised. In a few cases sulphanilamide powder was freely placed in the wound, which was then closed by sutures somewhat widely placed and without tension. Rubber tubing or other material was not used for drainage. Suitable dressings were applied and, if necessary, as in a bad wound of a limb, local rest was obtained by the use of a splint for a few days. We found it a good plan in some cases when a patient had multiple wounds, say of head and a limb or two limbs, for two surgeons to operate on the patient, each doing one part, and so lessening the time the patient was under the anaesthetic. The results were gratifying.

Use of Glycerin and Iodine

From experience gained from dealing with those injured in railway and road accidents during recent years, I treated nearly all wounds by using glycerin and iodine instead of sulphanilamide. Our records show uniformly good results. We proved the value of the method in this series. It must be obvious that many wounds cannot be thoroughly excised. Three cases serve to illustrate this point very well.

A young man had a three-inch curved wound along the lower margin of his left orbit which extended deeply into the antrum. The skin was excised, and debris and small foreign bodies and fragments of loose bone were curetted out by using gauze on an artery forceps. The cavity was filled with

glycerin and iodine and the wound was closed with a sub-cuticular suture. After suture the wound was painted freely with the solution. No dressings were applied. The wound healed without any complication. The patient was transferred to a base hospital, and returned to us for discharge within fourteen days of the injury.

Another case was that of a middle-aged woman who had a four-inch oblique wound which extended from near her right external orbital process, with a fracture of the upper jaw, through the zygoma into the pterygoid fossa. Exactly similar treatment was given with an equally good result.

A third patient, a girl aged 15, apparently had a large glass tumbler blown through her left shoulder. Nearly all of the body of the scapula, its neck, glenoid cavity, acromion, and coracoid, the outer third of the left clavicle, and the head and upper three inches of the left humerus were blown away. Her left upper limb was attached to her body by its vessels, nerves, and a band of skin about two inches wide. Her condition was desperate. The huge wounds in front of and behind what was her shoulder were filled freely with glycerin and iodine while resuscitation measures were being carried out. After thirty-six hours she was taken to the theatre and attended to as described herein. Portions of her coat and other clothes, with dirt and debris, were removed from the wounds, then more glycerin-and-iodine solution was constantly applied. Gas gangrene was feared, as cultures showed the presence of *B. welchii*. A dose of anti-gas-gangrene serum was given. She did not develop gas gangrene. At the end of five weeks she was able to move her elbow, forearm, wrist, thumb, and fingers well. The wounds were almost healed, and her general condition was good.

Many patients had literally scores of wounds on the face, body, hands, and legs. Excision was out of the question. These were treated by having the wounds curetted with gauze soaked in glycerin and iodine. On the face no dressings were used. The wounds were frequently painted. The small scabs were shed in about a week. Multiple wounds of the limbs were painted, and a sterile towel was placed so as to prevent contact with the bedclothes. All such wounds healed in less than a fortnight with very little scarring. By this method healing takes place rapidly under a scab with little or no pus, usually in less than a fortnight. There are no repeated painful dressings. The growing tissues are not damaged. The circulation and local nervous mechanism are not interfered with by bandages or other material placed around a limb. Every effort was made to avoid amputation, usually with satisfactory result.

Treatment of Burns

Before the more recent instructions were issued concerning the treatment of burns with tannic acid, two patients, a man and his wife, had severe burns of the face, forearms, and hands. Tannic acid had been applied. We noticed the hard claw-like fingers beginning to develop. The patients complained of much pain in the finger-tips. Hence I treated the cases with zinc oxide cream, which was very freely applied. The patients said the pain ceased after two hours. The black eschars softened and then peeled off, and both patients made an uninterrupted recovery, now having full use of their hands.

Conclusion

On three occasions when we had many severe casualties a mobile team was sent to help us. We found that, while their help was valuable, the disadvantages were that they did not know the run of the hospital, and that the theatre staffs had not worked with them; hence there were difficulties and delays. We were badly bombed on three occasions, and so our telephone service was cut off just when we needed it most. From this cause difficulties of arranging transport and transfers to base hospitals arose. We found it best to keep Group 3 patients under our own

care and treatment. None of these developed gas gangrene or serious sepsis.

The courage and cheerfulness of the patients were most remarkable. For example, one woman about 52 years of age, when asked how she was, said: "Oh, I've only a few cuts and scratches"; and added, "Hitler can't get me; he bombed me once before and blew the roof off my house. I was downstairs this time. My house is now down flat, and I won't be there next time he bombs it." Visitors were allowed freely, but were warned that there were to be "no tears" while in the wards.

I wish to express my thanks to the medical superintendent and his staff, and to the nursing staff, stretcher-bearers, and scouts, for their constant help and real team spirit in great emergencies.

RENAL COMPLICATIONS OF SULPHAPYRIDINE

ACCOUNT OF A CASE WHICH SHOWED GROSS HAEMATURIA AND URAEMIA

BY

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Although haematuria is generally recognized as an occasional complication of sulphapyridine treatment it is a condition which has received little attention in the literature of this country. All the information that I have been able to glean has been culled from communications published in the United States and in Canada, and from a summary of part of this transatlantic work by R. St. A. Heathcote (1940). The object of this paper is to report a case in which haematuria and uraemia occurred, and to give a general description of the renal complications of sulphapyridine (Backhouse, 1939).

Case Report

A second lieutenant aged 26 was admitted to hospital on August 26, 1940, with follicular tonsillitis. He gave a recent history of three similar attacks. There was no elevation of pulse or temperature. He was put on to sulphapyridine and given gargles of potassium chlorate. The following day he felt better and his throat was less painful. On August 28 he vomited several times and passed 10 oz. of deeply blood-stained urine. The sulphapyridine, of which he had received a total dose of 12 grammes, was stopped. He passed 1 oz. of urine during that night, and in the early morning of the 29th had a severe attack of pain in the lower abdomen, which radiated later to the penis. During the day he passed only 5 oz. of urine, which was grossly blood-stained. He continued to vomit throughout the day, and still complained of pain in the abdomen and across the lumbar region. In the evening he was very drowsy.

On August 31 an intravenous "drip" saline was started, as he was vomiting intermittently and had passed no urine for forty-eight hours. At this time his tongue was dry and furred, and occasional hiccups had begun to add to his distress. He was tender in the left iliac fossa and left costo-vertebral angle, and slightly tender in the right iliac fossa. There was no evidence of oedema. A blood count showed Hb 90%; R.B.C. 5,500,000; W.B.C. 11,250—78% polymorphs, 15% lymphocytes, 7% monocytes. During the night he became restless and delirious. The "drip" was stopped on the morning of September 1, by which time he had received 4 pints of normal saline and 2 pints of 5% glucose in normal saline. At the end of the drip his mental outlook was rational and his tongue had become moist. He was still vomiting, but less copiously and less often, and had not yet passed urine. During the afternoon another intravenous "drip" was started, 1 pint of normal saline being followed by 2 pints of 5% glucose-saline, and the same evening he passed about 1½ oz. of bloody

urine after a period of anuria lasting seventy-two hours. The specimen of urine was examined by Major C. E. van Rooyen, who reported as follows: "Specimen consists of about 1½ oz. of blood-stained urine—cloudy, dark, and with much amorphous granular sediment. Microscopical examination: Numerous R.B.C. and pus cells; no bacteria; no crystals of any sort visible." This urine was passed at 8.30 p.m. At 9 p.m. a solution of 4.28% sodium sulphate was substituted for the glucose-saline, and at 9.45 p.m. a further 6 oz. of urine was passed. By the following morning the patient had passed 82 oz. of urine. The "drip" was continued till the morning of September 3, by which time 8 pints of saline and glucose and 2 pints of sodium sulphate solution had been given. From now on his condition rapidly improved and gave rise to no further anxiety. On September 11 a centrifuged deposit of urine showed W.B.C. (average 20 per field), R.B.C. (average 6 per field), 4 epithelial casts, and 1 hyaline cast.

On September 17 an excretory pyelogram revealed no abnormality of outline or function. Tonsillectomy was performed by Major E. A. M. Connal on September 23, and the patient was discharged from hospital on October 4.

Incidence of Renal Complications

Plummer and Ensworth (1939) reported 4 cases of gross haematuria and 1 of microscopical haematuria in 323 patients treated with sulphapyridine. They also observed a mild degree of blood nitrogen retention in 3 patients who showed no haematuria. These authors maintain that in their experience of the toxic effects of sulphapyridine "those involving the kidneys and ureters have been the most disturbing." Duncan Graham of Toronto and his co-workers (1939) observed 4 cases of gross haematuria in 50 patients, Smith and Needles (1939) 1 case among 50; while Tsao, McCracken, Chen, Kuo, and Dale (1939) have reported 5 cases of gross haematuria in a series of 40 patients, but attribute this high incidence to the poor nutrition, dehydration, and avitaminosis which were features of most of their patients. Tsao's patients were children attending a hospital which admits only sick refugee Chinese. In the case of almost all the patients in these various series pneumonia had been the primary disease for which the sulphapyridine was given. My colleague Captain J. A. Scott (personal communication) has noted a case of gross haematuria among 74 patients treated with sulphapyridine for gonorrhoea.

We know from the work of Antopol and Robinson (1939) and of Gross, Cooper, and Lewis (1939) that urinary calculi composed of acetyl-sulphapyridine (64.1%) and sulphapyridine (6.4%) can be produced experimentally in monkeys, rabbits, and rats by the oral administration of large amounts of the drug; and two small stones of acetyl-sulphapyridine were found by Plummer and Ensworth at necropsy in the kidney of a woman who over a period of three months had received 540 grammes of sulphapyridine on account of a subacute bacterial endocarditis. It is important to bear in mind, however, that massive doses of the drug are not essential to effect its precipitation in the urinary tract. Plummer and McLellan (1940) found the crystals in the bladder of a man aged 46 who developed pain in the left flank and haematuria after 11 grammes, and in the case described above only 12 grammes had been given. Nor does this precipitation depend upon a high level of the blood sulphapyridine. In fact, in Plummer and McLellan's case the level was too low to be read.

Nature of the Renal Lesion

In their experimental animals Antopol and Robinson found changes ranging from a simple calculous pyelitis and ureteritis to a marked pyelonephritis. Tsao has reported the post-mortem appearances in a boy aged 8 who had died of uraemia after receiving 7.78 grammes of