Chest symptoms and signs were a pronounced feature. Case 1 was first diagnosed as a simple bronchopneumonia, Case 10 had a bronchopneumonia with blood-stained sputum, and in the remaining cases productive cough with signs of bronchial involvement of greater or lesser degree occurred. Involvement of the central nervous system was not marked. Headache and insomnia were common, and the most seriously ill were irrational and uncooperative, with subsequent partial amnesia; but apart from loss of abdominal reflexes and only sluggish tendon reflexes no clinical signs were found. The spleen was palpable in 4 cases in the first week and tender in 1. The lymphatic glands of the neck and axillae were slightly enlarged to the size of a pea in 4 cases and to a greater degree, and particularly in the tonsillar group of cervical glands, in the 2 cases in which there was an associated pharyngitis. Tenderness was absent in most instances, Case 1 being the exception.

Treatment was systematic; morphine was effective.

Pathological findings were as follows. Albuminuria in the severe cases, with red blood corpuscles or casts in deposits, and a secondary anaemia in two cases: Case 3—R.B.C. 3,300,000; W.B.C. 7,200 (polymorphs 60%, lymphocytes 36%, monocytes 4%); Case 4—R.B.C. 3,300,000, W.B.C. 5,200 (polymorphs 68%, lymphocytes 26%, monocytes 5%, eosinophils 1%).

Notes on Table II

The technique used was that of Felix, agglutination in round-bottom tubes at 37° C. The method of reading, however, was modified, after a preliminary examination, by shaking the tubes and observing the end-point of granularity. This was done in view of the fact that many of the tubes in use were not hemispherical at the bottom. Dreyer's technique was not employed, as Dreyer's tubes were not available. On receipt of a few Dreyer's tubes, however, two pairs of tests were carried out in parallel, using the two methods. The results were identical.

The + sign after the titre shown indicates that though the test was not carried further the result on the last tube suggested that the limit of agglutination had not been reached. 0=less than 1/20, the lowest dilution used.

The results, showing comparatively low titres for OX19, with in most cases marked coagglutination for OX2, and, in some, lesser coagglutination for OXK, would appear to indicate a group reaction. They differ from those to be expected in epidemic or endemic (murine) typhus or in mite typhus, while in South African tick typhus the OXK agglutination usually predominates. The results, however, appear to resemble those which occur in the "OX19 Group" of Indian cases (Boyd, 1935).

Vector and Possible Animal Reservoir.—No laboratory investigation was possible on these points, as there were no guinea-pigs available for inoculation experiments with preparations from possible vectors, and the continued shortage of agglutinable suspensions made it impossible to do serological tests on animals.

We wish to thank Lieut.-Gen. Sir A. Hood, Director-General, Army Medical Services, Major-Gen. A. G. Biggan, the Consulting Physician, and Col. J. F. W. Sandison, Officer Commanding the unit, for permission to publish this record.

TWO CASES OF ANURIA DUE TO SULPHAPYRIDINE CALCULI SUCCESSFULLY TREATED BY URETERIC CATHETERIZATION

BY

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The seriousness of haematuria and anuria complicating sulphapyridine therapy is well recognized, and a number of cases have been reported both in America and in Great Britain. The renal complications of sulphapyridine therapy were well reviewed by Laird (1941) when reporting five cases of haematuria and one of anuria. More recently the literature has been reviewed by Carson and Smith (1942) and by Benson and Percival (1942), who reported respectively the necropsy findings in a fatal case and a case treated successfully by ureteric catheterization.

In the two cases described below relatively small doses of sulphapyridine—9 and 13 g. respectively—were administered, and in both cases haematuria followed by anuria resulted. Both cases were in hospital before haematuria developed, and at first were ambulatory. A high fluid intake was encouraged, but the volume was not measured. Both patients were adult males of good physique, admitted to hospital on account of uncomplicated gonococcal urethritis.

Case I

A man aged 28 was admitted on Nov. 17, 1941. He was given 4 g. of sulphapyridine daily for two days, and on the morning of the third day received 1 g. Soon after the last dose he passed deeply blood-stained urine. Later in the day vomiting and severe renal pain were noted and no more urine was passed. As the anuria persisted he was transferred to the surgical department and cystoscopy was performed after 24 hours' anuria.

The bladder contained a small amount of blood-stained urine. The bladder wall appeared normal except for a well-marked ureterocele on both sides; that on the left side made the passage of a ureteric catheter impossible. A catheter was passed on the right side and the renal pelvis was washed out. On his return to the ward an intravenous drip saline was started, this being continued for two days. A few drops of blood-stained urine drained through the catheter, and 24 hours later he was cystoscoped again. Both ureteroceles were more pronounced, and further attempts to catheterize the left ureter failed; but on catheterizing the right ureter blood and sulphapyridine crystals were seen to escape into the bladder, urine drained through the catheter, and in the subsequent 24 hours he passed 100 oz. of urine through the catheter and per urethram. The catheter was removed after 18 hours. His symptoms rapidly abated, and on discharge from hospital two weeks later his urine was normal. The highest blood urea was recorded on the day of the second cystoscopy, being 72 mg. per 100 c.cm.

Case II

A man aged 27 was admitted on Oct. 14, 1942. He was treated with sulphapyridine, and received a total of 13 g. between admission and 6 a.m. on Oct. 17. At 6.30 a.m. on Oct. 17 he started passing blood-stained urine, 5 oz. being passed between that time and 11 a.m. He then complained of severe pain in both loins and persistently vomited stomach contents containing changed blood. At 7 p.m. his condition had deteriorated, and as he had not passed urine since 11 a.m. he was transferred to the surgical department and cystoscopy was performed. The bladder contained about 1/2 oz. of practically pure blood together with a large amount of sulphapyridine crystals, there were small petechial haemorrhages in the bladder mucosa, both ureteric orifices were congested, and a small pencil of sulphapyridine crystals was seen protruding through the left ureteric orifice. On passing a catheter up the left ureter, crystals, debris, and blood were seen to escape. A catheter could be passed up the right ureter for only about 2.5 cm. On return from the theatre he was started on intravenous drip saline, which was continued for three days till the vomiting ceased. Five ounces of blood-stained urine loaded with sulphapyridine crystals drained from the left ureter and none from the right in six hours, after which the left catheter became blocked.

At 10 a.m. on Oct. 18 both catheters were removed and were found to be blocked with blood and crystals. Fresh catheters were now passed up both ureters, and both ureteric orifices were observed to be more congested. Attempts were made to wash out the renal pelvis with normal saline, but although 5 c.cm. was injected through each catheter no fluid could be withdrawn, presumably owing to oedematous mucosa being sucked into and blocking the catheter orifices. During the next six hours 8 oz. of blood-stained urine drained through the catheters and a further considerable amount leaked around the catheters into the bed. On Oct. 19 5 oz. of slightly blood-stained urine was passed. On Oct. 20 vomiting ceased, and 110 oz. of clear urine was passed. Subsequently the patient recovered rapidly, and on discharge three weeks later he had no symptoms and his urine was normal.

The highest blood urea recorded was 96 mg. per 100 c.cm. on Oct. 21, after which the figure gradually returned to normal.

Discussion

Incidence.—During the last six years one of us has used the sulphonamide group of drugs, and particularly sulphapyridine, in about 4,000 cases. With the exception of the two cases here reported all cases of haematuria have resolved with confinement to bed, cessation of the drug, large quantities of fluid by mouth, and enemata. The incidence is low, but is likely to rise if the less-soluble sulphathiazole replaces sulphapyridine. According to Macartney *et al.* (1942) the relative

solubilities of acetyl sulphapyridine and acetyl sulphathiazole are 32.6 and 5.8 at pH 5.5, and 36.5 and 25.1 at pH 7.5.

Dosage.—In these two cases both the daily dose of 4 g. and the total amounts administered—9 and 13 g. respectively—are low to have brought about anuria, and suggest a personal idiosyncrasy to the drug. The case reported by Laird had 1 g. four-hourly, with a total of 11 g.; the fatal case reported by Carson and Smith received 1 g. four-hourly, with a total of 22 g.; and the successful case reported by Benson and Percival received 21 g. in 3 days. These and other cases make it clear that without an adequate fluid intake anuria may occur with any therapeutically efficient dosage of sulphapyridine and sulphathiazole.

Diagnosis and Treatment.—The diagnosis is obvious, the early symptoms being haematuria, diminished secretion of urine, and pain in the loin which may radiate down to the groin, associated with persistent vomiting. If conservative treatment such as intravenous salines and large quantities of fluid by mouth does not relieve the symptoms quickly—say within six hours—it would seem wise to catheterize the ureters without delay. Such early treatment would appear to give the best chance of recovery and prevent permanent renal damage.

The cystoscopic appearances in Case II are similar to the necropsy findings reported by Carson and Smith, who also found the ureters blocked by crystalline debris. It seems probable in this case that when renal secretion was re-established secondary ureteric obstruction was avoided by the presence of ureteric catheters *in situ*. Having regard to the general condition of the patient, we have little doubt that in the absence of ureteric catheterization this case would have ended fatally.

Attention is drawn to two causes which may make the passage of ureteric catheters difficult or impossible—namely, crystals of the drug in the ureter, and the presence of a ureterocele. Case I demonstrated how rapidly ureteroceles may progress, and it seems likely that had the operation been delayed longer the passage of a ureteric catheter on either side would have been impossible.

Addendum

Since writing this paper one of us (A. G. J.) has had another case which supports the contention that early catheterization is the proper treatment of this condition—to secure drainage from and to provide a method of washing out the renal pelvis, also to prevent subsequent ureteric obstruction from blood and debris.

Briefly, the case history is that of a man aged 26 admitted to hospital with an acute epididymo-orchitis. A centrifuge deposit of urine showed pus cells in moderate number and a few organisms. Culture gave a growth of *B. coli*. He was nursed in bed, fluid intake was approximately six pints daily, and sulphapyridine 5 g. daily was given. On the third day, when a total of 15 g. of sulphapyridine had been taken, he passed deeply blood-stained urine, and complained of severe loin and abdominal pain, with vomiting. Six hours later, as no urine had been passed, he was cystoscoped under a general anaesthetic, and intravenous fluids were started. The bladder was empty but otherwise normal, and catheters were passed easily up both ureters. Almost at once heavily blood-stained urine, containing crystals of sulphapyridine, was recovered from the left side. As there was no secretion from the right side 5 c.cm. of normal saline was injected into the renal pelvis, and secretion from this side was established some two hours later. Urine was passed round the catheters the next morning and they were removed. Subsequent progress was satisfactory, the urine being clear of blood on the fourth day.

Acknowledgments are due to the commanding officers of the military hospitals in which these patients were treated; also to Dr. J. Laurie, medical superintendent of Sharoe Green Hospital, for permission to publish the third case.

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IMMOBILIZATION AND TRANSPORTATION OF THE FRACTURED FEMUR IN WAR

BY

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The ideal method of transporting compound fractures of the femur from forward areas in warfare is undoubtedly the spica plaster. Trueta, following his experiences in the Spanish Civil War, has strongly advocated it. He and Böhler have pointed out the great importance of rest, not only for fractured bone but even more so for the lacerated muscles. They both agree that the most efficient splintage is the unpadded plaster spica. Trueta's method is undoubtedly ideal where distances are short, roads good, train transport luxurious and rapid, and the number of casualties small. In North Africa, however, where work at the field ambulances and C.C.S. has been heavy and quick evacuation imperative, where the roads are bad, and where single-track railways make evacuation slow, the spica plaster has not been found satisfactory. Here there are no ambulance trains de luxe, and patients evacuated to the base travel a distance of 400 miles or more on stretchers, on which the spica does not lie snugly. Bad roads or badly sprung railway trucks cause considerable shaking, resulting in friction sores on the buttocks, chest, or back. Similar conditions occur in sea transport; for the spica does not fit the cot, and the roll of the ship makes retention difficult and friction sores develop.

From the field ambulance or C.C.S. the wounded man is sent back to a forward hospital. Should complications arise or other wounds require treatment, he is retained there until fit to travel to the base hospital. This may be a period of many weeks, so the importance of correct fixation and alignment of the fracture is obvious.

Fractures of the femur have been evacuated to the base hospitals in North Africa by what is known as the "Tobruk" method, a description of which is as follows: When the toilet of the wound is completed a strapping extension is applied to each side of the limb, but circular strapping is not used for fear of subsequent swelling. A long plaster slab extending from the top of the thigh to the extremity of the toes is retained in position with circular plaster bandages. The tapes of the strapping emerge from the plaster above the ankle on either side, the plaster being cut around the points of exit. The plaster is split down the anterior aspect over a piece of rubber tubing which has previously been placed on the limb. A Thomas splint is fitted and the tapes protruding from the plaster are fastened to the end. Further circular plaster bandages from the thigh to the lower third of the leg keep the limb steady on the splint.

The "Tobruk" method is good for a short period, inasmuch as the patient travels in comparative comfort. Shortening, however, invariably occurs. This method is permissible for

the journey from a C.C.S. to a forward hospital, but if retained after a period of four or five days muscle spasm must be overcome by some means or other before full length can be obtained. The "Tobruk" method is mechanically unsound, for the plaster around the knee will counteract the pull of the strapping extension. Another cause of shortening is the failure to apply a perfectly fitting Thomas splint. The art of doing so appears to be dying out, especially among the younger generation of surgeons.

The ideal method of fixing these fractures (a) must ensure adequate fixation over a period of some weeks, (b) must entail the minimum of attention, and (c) must be easily transportable.

Method of Fixation

I have tried out a method in a forward hospital in North Africa which would appear to fulfil these requirements. It is