40,000 feet. It is at present impossible to predict liability to bends from other physical characteristics, and it has therefore been necessary to select flying personnel for very high altitude work by tests carried out in a decompression chamber with two or three exposures on different days for each subject. At present we cannot foretell how long the selection will remain reliable. Protection against bends is possible by breathing oxygen before exposure to low pressure—to displace nitrogen from the blood and replace it by oxygen, which can be used up within the body when the pressure falls. By pre-breathing oxygen for several hours a very high degree of protection against bends is obtained. This has obvious practical difficulties for flying personnel, and can be employed only on missions working to a prearranged time-table. In practice, where available to crews, it is little used, as after selection they very rarely experience decompression symptoms in the air.

In early work the central effects were attributed to raised C.S.F. pressure resulting from bubble formation; but while the escape of gases from C.S.F. is very slow—as shown by McArdle (1945) on oxygen-breathing human subjects from whom C.S.F. was withdrawn for analysis by lumbar puncture—animal experiments have not revealed any great rise in C.S.F. pressure which can be attributed to internal bubble formation. Moreover, little rise in intracranial pressure occurs in man (Peterson *et al.*, 1944). It is most probable that the central effects follow local interruption of circulation by bubbles in blood vessels in the brain. That the peripheral symptoms of pain or itching have a peripheral origin was proved by Squad. Ldr. Pask in a number of cases in which the application of pressure to the affected limb with a special pressure bag removed the symptoms.

Change of Pressure

With rapid change of pressure the sinuses and middle ear must equalize their pressure with that outside; otherwise, symptoms may result from congestion and exudation with rising pressure, or cessation of circulation with falling pressure. This is a matter of great practical importance, as the maintenance of a healthy E.N.T. condition in aircrews is necessary for them to fly without any discomfort. The subject of otitic barotrauma has received much attention in the R.A.F. (Dickson *et al.*, 1943), but sudden change of pressure has no other physiological effects, and, provided the Eustachian tubes are patent, a fall of pressure of half an atmosphere in about half a second can be tolerated by man without any discomfort. Studies on this explosive decompression were first carried out by Armstrong and Heim, and later extended by the R.A.F. It was found that even such a severe change of pressure produced no discomfort in normal subjects. On the other hand, with increasing pressure air must be admitted to the middle ear by opening the Eustachian tube, and this cannot be done rapidly enough to tolerate descent at anything like this rate. Most aircrews can clear their ears by swallowing or by jaw movements, so that they can descend at 4,000 to 10,000 feet a minute without discomfort. (Expansion of gas in the viscera is rarely a practical source of difficulty in high flying.) All personnel can operate to 25,000 feet without oxygen; selected aircrews can operate to about 40,000 feet. Above this height it is essential to apply pressure all over the body surface either by a pressure suit (Marshall, 1937) such as was employed by Adam in 1937 when he took the altitude record to 54,000 feet, or a pressurized cabin or a pressure gondola such as was used in the U.S. Army high-altitude balloon flight to 72,000 feet.

For civil use high-altitude flying has many advantages. It enables aircraft to operate fast and economically, to fly over the weather, and to fly in smooth air. It seems certain that pressure-cabin aircraft will ultimately be employed for all long-distance travel. Passengers inside will not then need to wear oxygen masks to avoid anoxia; nor would they incur the risks of decompression sickness or experience the discomforts of rapid pressure change on their ears. It therefore becomes a matter of engineering to overcome the physiological stresses of altitude to which man has been subjected since the start of flying.

It is interesting to turn to the work of Paul Bert, written in 1877, to see his recommendations on oxygen for aeronauts. "Aeronauts planning very lofty ascents ought in the preceding days to avoid nervous and intellectual fatigue. Before starting they should take meals of substantial food and take with them

some cheering victuals to eat frequently on the way. To be safe it is necessary only to breathe the air whose oxygen content rises proportionately as the pressure falls, and I cannot recommend too strongly that at 5,000 or 6,000 metres a direct and compulsory connexion be made between the oxygen bags and the mouths of the aeronauts." Much of the physiological work for the R.A.F. during this war has been directed towards putting Paul Bert's recommendations into effect.

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IRREPARABLE VESICO-VAGINAL FISTULA IN IRAQ

TREATMENT BY URETEROCOLOSTOMY

BY

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Thirty centuries before the birth of Christ the Sumerians, living on the banks of the River Tigris, recorded their deeds in writing, maintained an army for their own defence, and drank a "liquid closely resembling beer" (Lloyd, 1943). But in spite of this admirable beginning Iraq was but an outlying province of the decadent Ottoman Empire at the outbreak of the First Great War. She was loosely governed by corrupt officials, who were satisfied in the discharge of their duties if a sufficient revenue was extorted from the country and a sufficient quota of conscripts was obtained for the Turkish Army. The real power in the country lay in the hands of the great Kurdish and Bedouin sheikhs, to whom social reform and social services made no appeal.

To-day, a mere 20 years since the foundations of independent Iraq were laid, the structure of a universal health service is well established, its two main pillars a thriving medical school and a school of nursing. But a sad legacy of centuries of ignorance and neglect remains. Tuberculosis is rife, and in every town and village the hideous ravages of smallpox, trachoma, leishmaniasis, and venereal disease are evident. The infantile mortality in country districts is over 50%.

It is with the results of neglect in pre-natal and natal care that this paper deals. In the smaller towns and villages, and in the desert, women are attended during childbirth by their relatives. Hospital care, even when available, is not used unless the relatives consider that life is in danger. This is in part due to distrust of hospitals and in part to the great difficulties of transport in the desert. As a result women may lie in childbirth for seven to ten days without any skilled attention whatsoever, and large fistulae between the bladder and anterior vaginal wall may occur from prolonged pressure of the foetal head.

Material of the Present Series

During the last three years 29 cases of vesico-vaginal fistula have been admitted to the gynaecological wards of the Royal Hospital, Baghdad. Of the 29 cases 25 came from outlying villages or the desert. In all of them the infant was stillborn. The average time in labour was about 120 hours, but six women were known to have been in labour for over 168 hours and one for 240 hours. As a rule the infant was extracted manually by

an unskilled woman in the desert, although six cases had had a forceps delivery in a provincial hospital.

Eleven of the 29 cases were admitted to the surgical wards for ureterocolostomy. All the 11 were judged by the department of gynaecology to be irreparable, and most of them had had one or more attempts at plastic repair. The age of the patients varied from 18 to 40. On the whole the physical health of the women appeared to have suffered very little, although in one case a persistent pyelitis was present. But mentally they were miserable and life was a burden to them. Their clothes were permanently soaked in urine, their vulvae and thighs excoriated and raw, and an all-pervading ammoniacal odour caused them to be shunned by their fellows. It is a striking witness to their misery that, in a land ridden by religious superstition, where a mullah's amulet is trusted more than medical advice, none of these patients refused this very considerable two-stage operation.

Pre-operative Care

The renal function was investigated by intravenous pyelography to demonstrate the presence of two functioning kidneys and by the estimation of the blood urea. Urea-clearance and concentration tests are of course impossible in these cases because of the leak of urine from the fistula. In only two instances was there any evidence of impairment of renal function: Case 4 showed a left renal calculus and Case 9 a mild bilateral hydronephrosis with pyelitis and a blood urea of 56 mg. per 100 c.cm.

In attributing this renal dysfunction to the fistula one must bear in mind the fact that urinary bilharziasis is extremely common in Iraq, and consequent strictures of the intramural part of the ureter are very often met with. It is possible, and even likely, that in a series of 11 hospital admissions taken at random just as high an incidence of mild renal dysfunction might be detected.

Preparation of the Colon.—If sulphasuxidine had been available it would have played an important part in the preparation of the colon, but in its absence our efforts were directed towards obtaining a dry and empty colon in which to implant the ureter. This was achieved by withdrawal of food for 24 hours before operation and the avoidance of enemata within 12 hours of operation. In practice, a purge was given on the evening of the second day before operation, a wash-out the following morning, and no further food. On the evening before operation a low enema was given. This routine gave satisfactory results.

Operation

Anaesthesia.—General anaesthesia was preferred to spinal analgesia in these cases, for a purely technical reason. Under spinal analgesia it was found that the bowel remained in tone and peristaltic waves were frequent, during which the bowel was contracted to a firm rope-like structure. When in this condition it is very difficult to introduce the all-important anchoring suture and later the enfolding layer of sutures. Under general anaesthesia, on the other hand, because of the intact sympathetic inhibitory reflex pathway, the bowel is relaxed and atonic, and the whole operation is simplified.

Technique.—The operative technique followed was that of Grey Turner (1943), with one major modification (see Fig.).

Method of introducing the ureter into the lumen of the colon. (A) A cleft-palate needle carrying the anchoring suture is passed into the lumen and downwards for 1½–2 in. and out again. (B) The broad shank of the needle dilates a round hole in the bowel through which the ureter can subsequently be passed.

Instead of incising the bowel to introduce the ureter, the wall of the bowel was pierced with a cleft-palate needle carrying the anchoring suture. As the needle was pushed down the

lumen for some two inches its broader shank dilated the hole in the bowel wall, into which the ureter fitted snugly. The round hole so made did not tend to tear widely as an incision does, and the risk of leakage is perhaps minimized thereby. The anastomosis was made extraperitoneal, so far as was possible, by bringing a flap of posterior parietal peritoneum over it; but this manoeuvre was by no means always successful, and one patient died of peritonitis from a leaking suture line. All cases were dealt with by a two-stage technique, the interval between the two stages usually being about a month.

Double Ureter.—In two cases a double ureter was encountered, in both on the right side. On the first occasion one was rather at a loss as to what course of action to adopt, but a moment's thought showed it to be a comparatively simple matter. The anchoring suture was inserted through adjacent walls of the two ureters and loosely tied, and thereafter the procedure was as in a normal case, both ureters being inserted through the same hole in the bowel wall.

Post-operative Care

On returning to the ward an intravenous drip infusion of 0.45% saline was instituted and kept going for 48 hours. No fluid was allowed by the mouth for 24 hours. Sulphathiazole was given in 1-g. doses every four hours for the first three days with the object of preventing renal infection in the immediate post-operative period. As a rule the bowels moved with a fluid urinous motion about the third day—but sometimes no urine was excreted for as long as eight days. This suggests strongly that occasionally suppression of renal function may take place after the operation, either reflexly or by blocking of the ureter by oedema. After the second stage, urine was excreted from the bowel almost invariably the first day.

Mortality

Two of the 11 patients died. Post-mortem examination revealed that peritonitis was the cause of death in both cases. But the cause of the peritonitis was not the same in both cases. In Case 3 there was sloughing of the lower end of the ureter at its point of entry into the bowel. This was without doubt due to clumsy technique on my part in dealing with a difficult and obese subject. It was hard to get a sufficient length of ureter mobilized to introduce it without tension into the bowel because of the great amount of fat in the retroperitoneal tissues and pelvic mesocolon. Hence the ureter was stripped too far back and separated from its mesentery for too great a distance, thus being deprived of its blood supply.

The second death occurred in the ninth case in the series, after the second stage. Post-mortem examination showed that the suture line in the colon had failed to heal adequately and a faecal leak had occurred. A diffuse peritonitis resulted, and death ensued on the eighth post-operative day. It is of interest that these two deaths occurred in the two oldest patients in the series. Both were over 40 years of age.

Complications

Pyelitis was the commonest complication. It occurred in 5 of the 11 cases, but it would perhaps be scientifically more accurate to say that it occurred in 5 of the 22 kidneys. The time of onset of the pyelitis is interesting. It appears constantly between the 8th and 14th post-operative days. It was evidenced by raised temperature and pulse, pain in the loin, rigors, and rectal frequency. The last-named is a distressing symptom noted by Grey Turner, and suggests that a proctitis from infected urine is as easily produced as cystitis. The symptoms yielded readily enough to the administration of sulphathiazole, though in one case it was necessary to resort to intravenous dosage. This patient was seen six months after operation, and although her general health was good she still had rectal frequency of about six times a day.

Abdominal Distension.—Mild paralytic ileus was common and was often accompanied by vomiting, but no satisfactory explanation was ever found for this. It is possible that a degree of peritoneal soiling occurred in many cases in spite of scrupulous packing off of the suture line. Another possible explanation is that retroperitoneal dissection is necessary to mobilize the ureters, and the tendency to ileus after retroperitoneal operations is well known.

Discussion

The nine survivors were among the most appreciative and grateful patients I had in Iraq. They were able to return to their husbands and homes and begin a normal life again. It can be realized what that meant when one remembers that their average age was between 18 and 25 years. Nevertheless a far more efficient follow-up system than is possible in Iraq is necessary to compute the end-results of the operation. In Grey Turner's series some patients survived for 20 and 30 years. The mortality of 2 deaths in 11 cases makes the operation one of considerable hazard, certainly not to be undertaken lightly. But the lot of a patient with an incurable vesico-vaginal fistula is such a miserable one that I believe it to be justified. In more skilled hands the mortality is likely to be considerably lower.

Summary

Eleven cases of ureterocolostomy for incurable vesico-vaginal fistula are described. The operative modification whereby incision of the bowel is avoided is described.

There were two deaths in the series, both from peritonitis; the remaining nine patients returned to active life.

It is a pleasure to acknowledge the great help and advice given by Brig. C. Naunton Morgan in this series, the stimulation and practical assistance of the writings of my teacher and chief, Prof. Grey Turner, and the data of Prof. M. McDowall, of the department of gynaecology, Royal Hospital, Baghdad. Dr. Kadhim Shubbar, Dr. Najib-al-Yacubi, and Dr. Ghanim Akrowie were of the greatest assistance in pre- and post-operative care.

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OTITIS EXTERNA

BY

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Otitis externa is one of the most common conditions met with in any ear-nose-and-throat department. This is especially true in the Army over-seas, where it may account for one-quarter of all aural cases, or one-sixth of all E.N.T. patients examined. There are many problems connected with the disease that are worthy of study, and, indeed, many to which there is as yet no answer. This report is mainly based on nearly 1,000 cases of otitis externa seen in the Army. Furunculosis and dermatitis of the auricle are not discussed in any detail, but are mentioned briefly as coexisting affections.

Aetiology

The disease does not respect age or rank. It may occur in children and persist at intervals throughout life. The mechanism appears to be twofold. A meatal congestion is set up, causing irritation, which is attacked by the patient, who scratches the ear voluntarily or involuntarily, or by the doctor, who attempts to diagnose, treat, or remove the cause of the irritation. The result is a break in skin continuity, through which normally present saprophytic or invading pyogenic organisms may enter and cause trouble.

The meatal congestion may be caused by (i) irritants which enter the meatus from the middle ear, (ii) the natural secretions of the meatus, (iii) irritants entering the canal from the outside, (iv) general conditions predisposing to skin infections, or (v) local or general allergy. A brief consideration of the anatomy of the external meatus will show how easy it is for foreign material of all kinds to reach the canal, how difficult it may be for such matter to find its way out once it has reached the downward-sloping inner half of the meatus, and how simple it is to injure the meatal skin in an attempt to remove the irritant. Daggett (1942), in a valuable article, has drawn attention to the deep anterior meatal recess as a reservoir which may retain pus and debris.

The irritant entering the meatus from its inner end is pus, associated with an active otitis media. The meatal floor is constantly bathed in pus, the organisms of which welcome any

disruption in the epithelial surface through which they may enter and multiply.

Wax and sweat are the natural secretions of the external meatus. Wax is secreted by the ceruminous glands of the outer half of the meatus, lines the canal, separates from the walls apparently by the movements of the mandible, and works its way out, bringing with it desquamated epithelium. Unskilled attempts to remove the wax by a match, a Kirby grip, a knitting-needle, or some such similar article may abrade the skin. Similarly, the meatal epithelium may be lacerated by the tip of an aural syringe, especially if the wax is hard and difficult to remove. After syringing, the canal should be thoroughly dried with wool or gauze, and the walls painted with spirit, or the retained solution, if hypotonic, may macerate the skin. In the same way the epithelium may suffer during the removal by scoop, curette, or syringe of the tightly adherent mass of cerumen and epithelium called keratosis obturans, which in its milder forms is more common than is often realized. Sweat may be produced in excess in hot weather, and may, by the discomfort it causes, lead to scratching of the ear. It may cause a matted condition of the hair at the outer end of the meatus, and this in turn results in irritation.

Many things may be introduced into the meatus through its outer end. One of the most common, particularly in soldiers serving over-seas, is salt water, and in the "tideless" Mediterranean the water is permanently dirty in frequented beaches. Daggett, while discounting sea-bathing as an important aetiological factor in desquamative otitis externa, points out that in the heat of the day the water will be evaporated from the meatus, leaving a deposit of salt which may increase skin maceration by hygroscopic action. In Italy these swimming ears presented such a characteristic appearance that one came to regard them as a specific infection.

Cotton-wool or paper may be pushed into the meatus and forgotten—for example, by gunners who use these substances as ear-plugs against muzzle blast. After some weeks the meatal skin reacts to the breakdown of vegetable matter by producing an otitis externa which is often most acute. Dust and sand may be blown into the meatus and, mixing with wax and sweat, cause irritation. Insects, such as the bed-bug or the maggot, may find their way into the canal and, by their movement, scratching, or biting, may set up a most acute infection. Lastly, infection may be transmitted by the finger from some other part of the body.

Chemicals may act on the meatus by a direct burn, such as occurs with caustics, acids, hydrogen peroxide, vesicant gases, etc., or by a local allergic reaction, such as is seen with sulphanilamide powder in susceptible people. Insufflation of sulphanilamide powder was a common practice in the Tunisian campaign, but was discontinued in Italy as a result of adverse reports from otologists. The powder tends to form a hard caked mass, and otitis externa occurs in a significant number of cases.

General conditions which predispose the skin of the meatus to infection are seborrhoeic dermatitis, especially of the scalp, and relapsing furunculosis. It is possible that vitamin deficiency may produce the condition, although there is no positive evidence as yet. In recent years much thought has been given to allergic conditions of the ear, and otitis externa of purely allergic origin has been described.

Bacteriology

Friedman and Hinkel (1941), studying a series of 200 cases, found that in every instance more than one organism was present, and that the commonest were *Staph. albus*, diphtheroids, *Ps. pyocyanea*, and micrococci. Furthermore, they stated that in those cases which most resisted treatment no single organism predominated. A study of 25 normal ears showed the same group with the exception of *Ps. pyocyanea*. Daggett reported that diphtheroids, either alone or in combination with *B. proteus*, *Ps. pyocyanea*, or *Staph. albus*, were found most frequently in 49 cases. In this hospital *Ps. pyocyanea* was obtained as the predominant organism in nearly every case in which a swab was taken. An effort was made to swab the ears of patients showing different varieties of the condition in the hope of being able in future to diagnose the predominant