remain pocketed after the wound has healed superficially. These remarks apply particularly to cases treated in large institutions where the operator cannot do his own dressings. It is not denied that most patients do well on almost any type of post-operative treatment provided the operation has been efficiently performed; now and again, however, one does see abscesses in the wounds of well-performed mastoidectomies, and I believe it is due to a failure in post-operative treatment.

4. Incision.—Two types of incision were used. The one which gives the best exposure of the mastoid process is one which I learned from Mr. Gill-Carey, surgeon to the Central London Throat, Nose and Ear Hospital and used on about one-half of these cases. It is a semi-circular incision from just above the upper attachment of the pinna to the tip of the mastoid, extending backwards to the hair line. This incision goes through skin and subcutaneous tissues only. After these have been reflected forward, the periosteum is incised by a vertical cut at the anterior end of the wound; after a backward incision at the upper and lower ends of this cut the periosteal flap is reflected posteriorly. Besides giving a good exposure this incision does away with the necessity for a horizontal posterior incision when dealing with post-sinus cells. Its disadvantages are that the retractor does not always hold very firmly in the wound, and that, should it prove necessary to leave the wound open, the flap falls in and secondary suture becomes essential. On the other half of these cases the more usual incision down to the bone was used. It had the same limits above and below as the first, but extended posteriorly only about half an inch behind the attachment of the pinna. A horizontal back cut was often necessary to explore the post-sinus cells. The first incision is to be preferred for the exposure it gives and for cosmetic reasons, except where the wound has to be left open.

5. Sutures.—Various sutures and suture materials for the skin were tried. The double stitch, going deep and returning superficially, although everting the edges well, tends to cause scarring later. The simple stitch with horse-hair gave the best cosmetic results.

6. Post-auricular Depression.—The presence or absence of a depression behind the ear after operation is not dependent on the size of the cavity, the site of the incision, or upon whether the periosteal edges are approximated or not; probably it depends on some inherent property of the tissues concerned.

7. General versus Special Wards.—Owing to the great number of mastoid cases admitted to the hospital in the spring of 1934, a number of the above patients were nursed in the general wards. These had a more uninterrupted recovery and healed more quickly than those in the ear, nose, and throat wards. This was, I think, due to the absence of cross-infection. I did not hear that the general cases gained any corresponding benefit from the intrusion.

Summary

In the above series of ninety-one consecutive cortical mastoidectomies, comprising patients of all ages, eighty made an uninterrupted recovery. Six patients were readmitted for further operation, and five died in hospital.

The majority were in hospital for three weeks; the average time from operation to final dismissal was ten weeks.

A review of the eighty-six surviving cases after six months showed that seventy-seven patients had dry ears, soundly healed wounds, and normal hearing. In eight the hearing was impaired, and in a similar number there was persistent discharge.

In the operative technique, adequate opening up, careful curettage, and lavage of the aditus is important.

In the post-operative treatment, after the first five days, firm packing of the depth of the wound for about a week shuts off the middle ear from the operation area, and prevents reinfection of the latter.

My thanks are due to Mr. E. C. N. Strong, my successor, for the skill and attention he devoted to many of these cases during the healing stages; to the medical superintendent, Mr. R. P. S. Kelman, and to members of the lay and nursing staff of Selly Oak Hospital for their kind co-operation in the collecting of the above statistics; and to Mr. J. D. McLaggan, surgeon and dean of the Medical School, Central London Throat, Nose and Ear Hospital, for his valuable help and criticism in connexion with this paper.

Bournemouth.

BACILLARY DYSENTERY: A SUMMARY OF TREATMENT

WITH BRIEF STATISTICS OF AN EPIDEMIC

BY

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ROYAL AIR FORCE MEDICAL SERVICE

In the treatment of an acute epidemic disease, more particularly when specific measures are available, there should be no delay at the start. Hesitation means handicap, whether from uncertainty in diagnosis or from misjudgement of the severity of infection. Throughout the course of treatment practice should conform to theory, not to hypothesis, speculation, or experiment.

Theoretical Considerations

The toxæmia, and the orderly sequence in clinical events following infection, serve to distinguish bacillary dysentery from the many miscellaneous causes of this unpleasant symptom. When an exotoxin is present, as with the Shiga bacillus, the effect appears early and is severe. The amoebic disease has none of these general features. Amoebic dysentery is a non-vector protozoal disease. It may acquire high endemicity, but cannot become epidemic. The morbid process differs, and the course of disease is necessarily distinct.

The degree of severity in bacillary dysentery is the basis of clinical classification, the disease being either (1) mild, (2) severe, or (3) fulminating (choleraic): serum treatment is indicated in all except the mild cases. Clinical judgement depends on a recognition of underlying mechanisms. For example, in the Shiga infection there is early histotoxic anoxæmia, often manifest in the patient as a peculiar bluish flush, and giving way sooner or later to pallor. There is loss of tone in capillary and vasomotor areas, and a resulting fall in blood pressure. The signs denoting severity are those of imminent collapse, and are in terms of the circulatory system; they are not of the arresting nature of tenesmus or of strangury, and need not occur in proportion to the degree of fever or the frequency of stool. Bacillary dysentery is more than "an abdominal disease." It is for this reason that many cases which begin mildly become later severe or fatal.

Early exhaustion, which is due to toxæmia, is amenable to treatment, and certain drugs are of some value. Late exhaustion results from tissue depletion. It is less amenable to treatment, and all drugs are useless. It should not, however, be considered an inevitable and vague state of dissolution. To toxæmia is added deprivation and loss of most of the papulum out of which biochemical balance is effected. The mechanism of the syncope is that of peripheral circulatory failure. The principles of treatment are therefore as follows: improvement of tissue nutrition; increase of blood volume in

terms of venous return ; conservation of body fluids and of body heat ; and conservation of energy, especially in the posture and effort of defaecation, or in the distress of incontinence.

Necrosis or ulceration of the colon is a lesion entailing certain difficulties in treatment. The necrosis is superficial, but cellular reaction in the underlying layers may be severe. In the peritoneum this reaction is usually negligible, but occasionally may be severe enough to cause death. There is general thickening of the bowel—often from caecum to rectum—into the semblance of a tube of chewed leather, lined by dark green blood-and-bile-stained shaggy coagulum. This is a lesion for which it is useless to continue pouring down salines by mouth. The position should be considered. The bowel, upper and lower, has been emptied by an initial purge, serum has been administered, and toxæmia is therefore no longer a danger. The patient's diet has for several days consisted of fluids. The over-persistent use of salines will now cause elimination or excretion of nothing but valuable nutritive fluid, will aggravate hypotension, and will precipitate collapse. Even the injunction "salines four-hourly till the stools become faeculent" may be dangerous advice.

It would be unwise, moreover, to attempt per-rectal irrigation of the ulcerated area with antiseptic solutions of a strength whereby absorption would be toxic, or of a nature whereby too astringent an effect would be equally undesirable. Local administration of such solution can produce harm more readily than good. The sole purpose of irrigation should be the removal of irritation from debris accumulated within the lumen of the bowel or on the surface of the lesion.

Treatment in Practice

The ol. ric. cum opio purge is a sound preliminary, but is unsuitable for patients who, when first seen, have already spent two or more miserable days of diarrhoea. It is of special benefit when there is more early colic than early diarrhoea. It is too valuable to be omitted just because the laboratory requires specimens without oil: specimens can always be had before the oil is given.

USE OF SERUM

Given early, serum is the most effective single therapeutic measure in this disease. It should be given promptly in every severe case of epidemic dysentery without waiting for bacteriological reports on cultures. Specimens are plentiful. Macroscopic and microscopical examination of faeces should be done as part of the "condition on admission." There is sufficient evidence at hand for immediate decision. Exactitude of dosage and route of administration matter less than that the serum should be given promptly. The initial dose should be 40 to 80 c.cm., repeated if necessary on the following day. The intramuscular route is the method of preference.

It is well to remember that bacillary dysentery is a disease "at first worse than it seems and later as bad as it looks." There is a type of patient who suffers quietly and uncomplainingly for a few days, and subsequently becomes alarmingly collapsed during a period of relaxed observation. Pallor, frequent and small-volume pulse, and systolic blood pressure under 90 mm. Hg are then discovered for the first time. It is the management of this type of case that often decides whether the mortality figure for an epidemic is to be high or low. It might be said that the very worst cases succumb in spite of treatment; the very mild cases recover irrespective of treatment; the cases initially severe receive prompt treatment and so recover; but the cases beginning in a mild way and later becoming

severe miss the benefit of early serum and so tend to run a more precarious course.

Concerning the customary guides to severity—namely, fever and frequency of defaecation—three things should be kept in mind. (a) That the time of examination may happen to be at any point in the rapid sequence of fever (subnormal → continued → remittent → irregular → normal), or in a similar and roughly corresponding sequence in the stools (diarrhoeal → mucosanguineous → "ulcerative type" → sanguino-faeculent → semi-formed). (b) Although the above order is usual in Shiga infection there may be any variation. (c) In the worst type of case the patient has neither fever nor time for defaecation.

The serum is antibacterial as well as antitoxic. It is perhaps for this reason, or because of the benefit accruing from the globulins, that serum given late in the disease, though less effective than when given early, nevertheless produces undoubted improvement. Such use, however, implies a failure in early diagnosis or a failure in the estimation of degree of severity.

Bacteriophage has much in the nature of its inception to justify great expectations in dysentery. Nevertheless its failure is such that its use in treatment may amount to dangerous experiment. It proscribes the use of serum, and suspends other treatment with no appreciable benefit and with the risk that such omission entails. With its *in vitro* success and its *in vivo* failure this substance would appear to have been introduced prematurely into therapeutics.

SALINES AND DIET

Sodium sulphate in mixture (3 j to fl. 3 j) is stock treatment, but the routine scheme should be varied for the individual. When an initial purge has been given, one ounce of the mixture should be administered two-hourly for one day, four-hourly for the next two or three days, and then dropped, as soon as possible, to a single early morning dose. When no initial purge is given, hourly doses for eight hours can be used during the first day, two-hourly the second day, four-hourly on the day following, and can be suitably tapered off. There can be no fixed rule; pulse, blood pressure, nature of stool—all have to be considered.

Diet is all-important. The dictum "fluids and plenty of them" refers not to the diet itself but to the simple flavoured drink which should be present in a jug by the bedside and duly replenished. Milk should never be given, either fresh, diluted, or disguised, for it induces colic and an aggravation of abdominal symptoms. Occasional ice-cream has no contraindication. Chicken tea, arrowroot, beef-tea, and Brand's essence are mentioned in the order in which they appear to be of value, and, incidentally, in the patient's order of preference. The laxative effect of meat extracts is to be remembered. Rigorous mouth hygiene is important, and chewing gum is both useful and comforting.

This two-hourly dietary, varied suitably but not overstepped, serves to tide the patient over his initial toxæmia, but it should not be prolonged unnecessarily. There should be a gradual increase to custard; tea, with an egg and thin bread-and-butter; steamed fish; minced chicken; milk puddings (except rice); and mashed potato. There will be intolerance of certain foods or temporary discomfort following others, but these are not signs for a return to fluids. Likewise it is well to note, but not to be alarmed at, some traces of blood reappearing in the stools.

The diet in late marasmus requires separate consideration. Here the emaciation is extreme. The body weight of an adult male may drop under 4 stone. The patient's appearance may suggest a skeleton or a shadow, and is a spectacle of the horror of disease. There is fretful childishness as well as pitiful enfeeblement. This is a

condition requiring light but highly nutritious diet of a wide range, with vitamin preparations given with a definite purpose in view and not haphazard. A nursing staff with infinite patience and a tactful cajolery is as necessary as a suitable diet. A remarkable feature of this condition is the degree of emaciation and the duration of this precarious vegetative state that is compatible with complete recovery.

RELIEF OF PAIN

This is a necessity in every case. In the treatment of this disease there is no place for morphine. Opium itself, however, in the form of the tincture, has its limited use at first with the purge, and occasionally later, but before exhaustion sets in. Hypodermic preparations of the total alkaloids of opium do not appear to have all the dangers of morphine alone, and, suitably restricted, are permissible in emergency. The pain of tenesmus may be relieved by hot water rectal irrigation. Anal pain is relieved by atropine in suppository. Prolapse and haemorrhoids, old and recent, are temporarily relieved by local bathing with hot water, thorough drying, and subsequent application of the non-aqueous calamine cream to the skin. The pain of strangury is relieved by belladonna in alkaline mixture in suitably large doses. The general abdominal discomfort is made easier, when practicable, by radiant heat. The pain of iritis will be mentioned later.

INTRAVENOUS MEDICATION

This is called for in every severe case. It is used *early in toxæmia* for serum, when the necessity for the latter would appear too urgent for intramuscular injection, and *early in exhaustion* for 5 per cent. glucose in normal saline. The time-indication for glucose in saline is important. If left too late the therapeutic opportunity is lost. Moreover, venous collapse is not just a matter of badly filled or empty veins. The walls of the vein lose tone, and, even when it is filled, it slips away from the needle like an elusive worm refusing to be pinned down. To cut down and expose such a vein is of no avail when collapse of the walls is present. The ordinary intravenous needle and 35 c.cm. funnel is satisfactory, used with a burette clamp at the bedside to hold the funnel. Not more than 500 c.cm. is run in, and the procedure should not take less than half an hour. Stronger solutions of glucose have no advantage, and increase dehydration. Hypertonic saline solutions produce serious disturbance in an already lowered intracranial tension.

Continuous intravenous saline finds its application of value in the marasmus of dysentery. The method, just described, of injecting 300 to 500 c.cm. in half an hour amounts to a "shock" dose; used at the right time it may serve, or it may have to be repeated. In marasmic patients, however, the continuous method *must* be used. The patient is changed and "made comfortable." The selected arm is splinted and secured. One litre of normal saline (without glucose) is run in at an even rate, and should not take less than ten hours for the total amount. This is immediately followed by one litre of 5 per cent. glucose in normal saline solution, given at the same rate.

Due attention to detail ensures that there is no difficulty. The patient may grow restless and may indicate that the procedure increases his fatigue, but presently he falls into a calm sleep, from which he awakes considerably refreshed and much improved. The exact rate of flow is less important than that the maximum permissible rate be not exceeded.

Hypotension and tachycardia are features for which the treatment can be only indirect. In early exhaustion, however, strychnine-atropine-adrenaline combinations, or

coramine, or intravenous strophanthin may induce some general improvement, with temporary disappearance of these signs. Later in the disease all drugs are useless. As a result of inanition, wasting, and feeble, shallow breathing, there is progressive deflation of the lungs and upward displacement of the diaphragm. Necropsies in dysentery show a body cavity that is thus "all abdomen." Receding from view in the insignificant thorax is the shrivelled, blubber-like piece of lower lobe, or whole lung, huddled against the spine. This evidence supplies one of the many reasons for the fact that hypotension and tachycardia disappear only with convalescence.

ENEMATA

Local treatment by enemata is necessary in relief of symptoms and as an aid to repair of the mucosa. This method should be used before sphincter control is lost. The fluid used must be a bland fluid; there must be a gentle but thorough lavage from sigmoid to caecum; there must be a complete removal of all necrotic material—shreds, clots, and sloughs. The most suitable fluid is water. Plain tap water at blood temperature is used as a two-pint irrigation. After irrigation, 20 c.cm. of plain serum in half a pint of water may be run in to be retained. There is immediate soothing of abdominal discomfort and of rectal uneasiness. If carried out during the evening this procedure does much to secure a restful night.

The use of starch and opium seems only to have the added value of suggestion when the patient is told that he is having an opium enema; on the following day, however, he is usually worse. For late ulceration several solutions may be tried, but suitability varies. Tannic acid solutions produce alarming cyanosis from sudden increase of toxic absorption when the ulcerated area proves to be unsuspectedly large. Eusol and rivanol appear to be relatively harmless and not superior in results to tap water. Suspensions of kaolin or charcoal relieve discomfort from accumulation of gas in the colon. Silantox is a useful preparation; its therapeutic claim appears not to have been exaggerated.

SPECIAL SYMPTOMS

Conjunctivitis and arthritis are associated symptomatic features in this disease. They are toxæmic manifestations, the endotoxin being accounted responsible. The incidence does not depend on the severity of the disease. The less frequently used term "dysenteric rheumatism" would seem to be more applicable than "dysenteric arthritis." These conditions may disappear in some cases without treatment, but they require all due care. The conjunctivitis is at first palpebral, spreading to canthi, then suffusing the whole surface. Irrigations are required to clear the sac. Iritis occurs less frequently, but is considerably more troublesome. It comes as an added affliction to a weary patient and brings an agony of pain. Atropine and heat in its special application brings grateful relief, but the cure takes time. In the case of joints, aspiration of a large effusion relieves pain and tension; wrapping up in plain wool, or capsicum wool, is usually all that is required.

Vomiting is most common, and is of less import at the onset than when it occurs late in the disease. It may then be the most serious of symptoms. Black vomiting, sudden abdominal distension, and general collapse are signs indicating immediate use of the Ryle tube. Acute dilatation of the stomach may occur as a fatal complication in dysentery.

Persistent fever means persistent infection, but this statement need not necessarily refer to infection inside the colon. More probably the fever is due to some

complication. There are two instances of this: (1) septico-pyæmia from boils, with septic arthritis of knees and other joints simulating dysenteric rheumatism; and (2) acute spreading peritonitis where signs of colitis continue. In both these instances the supervening local and general signs may be imperceptibly grafted on to those of the existing disease. Recovery is slow. Blood pressure and body weight are useful guides to progress. Convalescence is a stage of relaxed but not relinquished supervision.

The mortality rate in the severe type of bacillary dysentery is between 40 and 60 per cent. By careful and timely application of proved measures, as detailed above, a mortality rate under 10 per cent. has been secured.

Statistics of an Epidemic

The foregoing summary is based on notes and observations made on cases of dysentery arising during four years of service in Iraq. A recent epidemic of *B. shigae* infection in a community (approximately 1,500) of British Forces near Baghdad serves to illustrate several important points. A chart showing the daily case incidence, and a table giving relevant meteorological information, are printed below.

Chart showing daily incidence.

	Date, November, 1934								
	7th	8th	9th	10th	11th	12th	13th	14th	15th
Maximum shade temperature F°	78	74	78	80	80	79	80	77	74
Minimum shade temperature F°	60	65	53	48	52	49	48	56	48
4-foot earth temperature F°	80.8	80.5	80.3	80.2	80.0	79.9	79.6	79.3	79.1
Maximum humidity percentage	57	51	54	54	50	49	57	65	57

In this epidemic there occurred, within two weeks, a total of ninety-two cases, classified as sixty-one mild and thirty-one severe. Such a classification may appear to depend on arbitrary standards of severity, but with a "full view" of the disease, and with some collateral standard of morbidity such as cholera gravis, this grouping of clinical types can be done without bias or over-assessment. The incidence of certain features of this epidemic is shown as follows:

Cases		Cases	
Conjunctivitis ...	17	Early dysphagia ...	3
Iritis ...	1	Exhaustion psychosis...	4
Arthritis ...	6	Multiple boils ...	4
Stomatitis ...	1	Acute dilatation of	
Parotitis ...	2	stomach* ...	1
Severe hiccup ...	2	Septico-pyæmia* ...	1
Late vomiting ...	3	Peritonitis* ...	1

* Fatal.

Hypotension was an additional feature worthy of special note. In all but eight cases the systolic pressure fell and, for weeks remained below 110 mm. Hg, as follows: in thirty-seven cases under 110, in twenty cases under 100, in thirteen cases under 90, and in fourteen cases under 84 mm. Hg. The figures given here are not merely from single readings, but are taken from arterial blood pressures under continuous observation.

Bacteriophage, from several different sources, and including "shigaphage" and "intestinaphage," was used in the treatment of fourteen of the cases. There was no apparent benefit, either in general improvement or in symptomatic relief. The three fatal cases of this series belonged to the group so treated. In contrast to this was the immediate and lasting improvement resulting, in other cases, from the use of serum.

The mortality percentage for this epidemic was 3.25. The causes of death are shown on the above table of complications.

Conclusions

The treatment of bacillary dysentery requires, *first*, an awareness of all the features of this disease, which leads to rapidity and certainty of diagnosis and to a proper estimation of severity in the individual case; *secondly*, a recognition of the approved value of serum as a specific measure (not to be neglected on account of any preoccupation with the unsupported claims of bacteriophage); *thirdly*, a conformity of practice with theory, especially in those general measures affecting circulation and nutrition; and, *fourthly*, a restraint in the use of solutions in local irrigation of the colon, where therapy should be physical from the irrigation itself rather than chemical from any substance in solution.

RUPTURE OF THE POPLITEAL ARTERY AND VEIN

BY

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No matter how extensive and varied the individual's experience, the occurrence of unusual cases constantly reminds him of the humility of his erudition. The multiplicity and variety of injuries met with in the everyday practice of traumatic surgery surely suggest sufficient responsibilities to the surgeon to render the recognition of the conditions and the possibilities of their treatment an absolute necessity. So often the balance of the issue depends on an accurate diagnosis and a preconceived line of treatment. It is because it is considered that this rare injury demands treatment so urgent that every hour, or even minute, counts in its success, that this record of a case and a few observations are published.

Case Report

A tram driver, aged 48, was knocked down on March 16th, 1935, by a lorry, which had mounted the pavement to avoid colliding with an Austin Seven and a tramcar which had pulled up suddenly in front of it. The lorry weighed 2½ tons and carried a six-ton load, and the off-side front wheel was said to have passed over both of the man's legs in the region of the knee. The man was unable to walk, and he was admitted to Hillingdon County Hospital. On admission he was not very shocked, but complained of slight pain and a feeling of tightness in the right knee-joint. The temperature was 97° F., pulse 88, respirations 20. There was a small haematoma over the right olecranon process.

Examination of the right lower limb revealed very marked distortion of the contour of the knee, suggesting at first sight