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

gross dislocation of the knee-joint. This swelling was most pronounced on the inner side of the lower third of the thigh. The knee-joint showed a moderate effusion. A stellate fracture of the right patella without displacement of the fragments was readily palpable. There was no evidence of injury to the skin, except for a small superficial abrasion on the inner side of the knee. The thigh was tremendously swollen as far as the pelvis, and in girth was half as big again as the sound limb; the swelling was soft, and gave a feeling of fluctuation. There was no tenderness on pressure, except to a slight degree on the inner side of the limb. Passive and active movements were possible without causing pain, but the patient thought the movements were restricted, and he attributed this to the tension which he experienced in the limb. He was able to move the leg at the knee- and ankle-joints, but complained of stiffness of the toes and numbness of the foot. Sensation was present throughout the leg, but was diminished in the sole of the foot. A diagnosis of rupture of the popliteal vein, with gross contusion of the limb, was made and conservative treatment adopted, since it was felt that a collateral circulation would be maintained.

On March 17th the swelling had not increased, the foot and leg were warm, no appreciable movement in the toes could be obtained, and the sole of the foot was anaesthetic. Next day there was no movement in the toes, the sole of the foot and the toes were anaesthetic, and gangrene appeared a certainty. By March 20th there was definite gangrene of the foot. No pulsation was felt in the tibial arteries. As it was thought that the opportunity to save the limb had been missed it was decided to wait for a line of demarcation to form before carrying out amputation. Examination on March 22nd showed the gangrene to be limited to just below the knee-joint. Anaesthesia was present to the same limit, but the skin for some distance above this was not sufficiently vascularized to remain viable. By this time a blue-black ecchymosis extended on the posterior aspect of the thigh as far as the ischium, and on the lateral aspect almost to the iliac crest. For the past four days the temperature had varied from 99.8° to 100.5° F. in the evening, dropping each morning practically to normal; the pulse rate varied between 90 and 110. The patient complained of no pain, and felt comparatively fit. He had an obvious anaemia, and arrangements were made for a blood transfusion during or immediately following the operation.

OPERATION

The operation was begun under gas, oxygen, and ether anaesthesia. An Esmarch's tourniquet was applied, and anterior and posterior flaps were cut allowing for an 8 to 9 inch stump. The skin and the fascial partitions were bellied out with blood clot. The latter had interfused every plane, and reached about two-thirds up the length of the thigh. This was quickly expressed, the amputation performed, and the vessels rapidly ligatured. The tourniquet was released and the suture of the skin flaps begun, when it was seen that the patient had suddenly collapsed and died. The usual resuscitative measures were carried out, including intracardiac injection of adrenaline, but it was obvious that death had occurred with the release of the tourniquet. The suddenness of the fatal issue was thought to be due to the stale histamine-impregnated blood clot bathing the raw wound and flushing the general circulation when the tourniquet was removed. Prior to this the patient's condition had been satisfactory.

The ubiquitous blood clot had so isolated the various structures that dissection of the amputated limb was comparatively easy. The popliteal artery and vein were found completely severed, transversely, at the same level, about one inch above their bifurcations. About an inch separated the distal and proximal ends, and the vessels were occluded by a clot for one-half to three-quarters of an inch within the lumen. The vessels were inspected closely, and no macroscopic evidence of degeneration was observed. No lesion was found in the neighbouring structures, and the lower limits of the blood clot seemed to be those of the popliteal space.

Several authors mention the theory of the mechanism of the injury. It is explained that proximally the pop-

liteal artery and vein are fixed by the tendinous arch of the adductor magnus, while distally they are fixed by the tendinous arch of the soleus and tibialis posticus and by the anterior tibial artery piercing the interosseous membrane. An additional factor in the mechanism is the proximity of the posterior surface of the femur. Further, a sudden blow or exaggerated movement causes a marked distension of the walls of that part of the vessels within the fixed points. Normally there is a restriction of extension at the knee-joint, so that any tendency to an increase of this movement leading to hyperextension and slight backward movement of the femur will separate the fixed points, and by compressing the popliteal space will increase the vascular tension. The injury to the vessel has been likened by many to a fixed, taut-drawn cord snapping when suddenly tapped or pulled.

Diagnosis

The diagnosis has been very well epitomized in an excellent article by Wakeley and Reid. The signs and symptoms would appear to vary slightly, for they describe the pain as extreme or acute, and the swelling as becoming stony hard. In the case described above the pain was slight, and the swelling was soft and fluctuant, giving the impression of underlying fluid, although no blood was obtained by aspiration in several directions. Paraesthesia of the limb, often in a descending direction to the toes, is mentioned by several. In cases of partial rupture weak pulsation may be appreciated in the tibial arteries. With those few exceptions the above description appears to be fairly typical of the condition.

There can be no doubt that this injury must be regarded as one of the most urgent emergencies, and treatment may be compared with the urgency required in arterial embolism. Treatment by embolectomy in the latter condition is unlikely to meet with success unless performed within six to ten hours of the initial impaction of the embolus. In rupture of the popliteal artery it is doubtful if the limb can be saved unless treatment is carried out long before six hours have elapsed. Knowing that the main blood supply to the limb is severed, the aim should be to conserve the collateral circulation. With a little imagination it is easy to visualize the local condition: the blood surging from the ruptured vessels, tearing its way through the tissues, and separating the structures in its course. The collateral blood vessels, which have not been torn across, are almost certainly compressed by the increased tension within the limb, rendering the maintenance of a collateral circulation and the avoidance of gangrene by conservative measures an impossibility. An early diagnosis is therefore imperative, and here the gross swelling of the limb around and above the knee-joint, the absence of pulsation in the tibial arteries, the feeling of tension experienced by the patient, the stiffness and difficulty in movement of the toes, and the dullness or loss of sensation in the sole of the foot are especially emphasized.

Treatment

With conservative treatment gangrene must surely ensue, leading to amputation of the limb. Failure of local treatment must have the same result, but several instances are recorded in which local treatment has led to the avoidance of gangrene. The treatment indicated, therefore, is to make every possible effort to conserve the limb. The earlier the treatment is begun the better the outlook, every minute counting towards a successful result. Given a diagnosis, local treatment should be carried out at once. It is likely to meet with certain success if done within three hours of the accident, and

the chances thereafter will diminish with the lapse of time. It is doubtful if recovery would be obtained when movement in the toes was impossible or if anaesthesia of the sole of the foot and toes was complete. The treatment should be to explore the popliteal space, using a tourniquet only if haemorrhage should become uncontrollable. The ruptured artery and vein will readily be found, as the site of rupture is practically constant with the divided ends, not much more than one inch apart. Ligation of the proximal and distal ends of both artery and vein should be carried out. The blood clot should be expressed, milking it down from the thigh and ensuring a thorough clearance in the popliteal space and the region of the knee-joint. The wound should then be closed without drainage, and the treatment completed by giving a blood transfusion, for, though variable, in most cases it will be found that a considerable amount of blood has been lost.

No case is recorded apparently of arteriorrhaphy proving successful. Apart from tending to precipitate thrombosis it is extremely doubtful if it would lead to better results than ligation.

In view of the fatal case recorded here, the sole case encountered, criticism may be made of this somewhat dogmatic expression of opinion. The impression of the futility of conservative treatment was so vividly marked that immediate effort made in local treatment appeals as the only common-sense procedure holding out any chance of avoiding the tragedy of an amputation. Criticism levelled at the publication of an isolated case can be disregarded: the case is so rare that it is unlikely that many will be encountered in the practice of any single surgeon, and it is possible that others may profit by what, with the wisdom of after-knowledge, have been considered mistakes.

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In his report as director of the Molteno Institute for Research in Parasitology (*Cambridge University Reporter*, May 21st, 1935) Professor D. Keilin mentions that Dr. P. Tate and Miss Vincent have continued their work under the Medical Research Council on the action of new synthetic quinoline compounds on avian malaria. A number of these compounds were found to have a strong anti-malarial action, and one of them has a therapeutic index twice as great as that of plasmoquine. They also continued their work on the biology of English and Continental strains of the mosquito, *Culex pipiens*, which transmits bird malaria. Dr. H. P. Bayon investigated the effect of feeding liver to, and injecting liver extracts into, fowls suffering from the form of progressive anaemia described in 1929 as erythromyelosis. Feeding with liver, yeast, and iron increases the haemoglobin for a short time, but it does not stop the fatal course of the disease. The injection of liver preparations brings about a remarkable increase in haemoglobin and in the number of erythrocytes, the shape of which is also improved. A fowl lymphoma was transmitted by inoculation.

MECKEL'S DIVERTICULUM

BY

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Historical

Johann Friedrich Meckel, an eminent pathologist born in 1781, was the discoverer of Meckel's diverticulum of the intestines. He was considered the foremost comparative anatomist in Germany prior to Johannes Müller, and has been called the German Cuvier. Some of his best literary achievements consisted of his treatises on pathological anatomy (1812-18), normal human anatomy (1815), an atlas of thirty-three plates representing human abnormalities (1817-26), and his best work, "A System of Comparative Anatomy" (1821-30). Wolff's monograph, "The Development of the Intestine," was also translated by him. Meckel died when he was 52 years of age, in 1833, at the height of his career. His brother,

FIG. 1.

August Albrecht Meckel, became professor of anatomy and forensic medicine at Berlin in 1821, and died in 1829. Their father, Philipp Friedrich Meckel (1756-1803) of Berlin graduated from Strasbourg in 1777, and became professor of anatomy and surgery at Halle in 1779. He was the favoured obstetrician at the Russian Court. The grandfather of Johann Friedrich Meckel, of the same name, was born at Wetzlar in 1724. He graduated from the University of Göttingen, and at the graduation exercises delivered a notable dissertation on the fifth nerve, since known as Meckel's ganglion. He was the professor of anatomy and obstetrics in Berlin and the first teacher of midwifery at the Charité.

Embryology and Anatomy

Embryologists have demonstrated that, at the seventh week of foetal development, the mid-gut becomes completely closed off from the umbilical vessel (yolk sac) by the atrophy of the connecting yolk stalk. The point of final closure of the mid-gut represents a level on the future ileum, about two and a half to three inches above the ileo-caecal valve.

In approximately 2 per cent. of all individuals the intra-abdominal portion of the yolk stalk fails to disappear in a variable degree. This persistent remnant, an intestinal tubular appendage, is known as Meckel's diverticulum. The distal end may adhere to the