BACILLUS COLI INFECTIONS, WITH SPECIAL REFERENCE TO THEIR RECOGNITION AND COMPARATIVE FREQUENCY.

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DURING my first fourteen years in practice I did not meet with, or at all events recognize, any case of infection by *B. coli*. This is not surprising in view of the inadequate treatment which the subject receives in the average textbook. I am really indebted to my friend Dr. Houston, of Queen's University, for directing my attention to the subject some three or four years ago. As my observations have been restricted to cases occurring in an ordinary general practice, my experience may afford some index of the frequency of these infections, and possibly also some indication as to the numbers which are either overlooked or misunderstood. That they are frequently overlooked at present is, I think, certain; and until more accurate clinical pictures of various types are forthcoming I fancy that it will be so in the future.

I have found that the number of these cases has increased in my practice as I adopted the culture method of investigation with greater uniformity. This method is, in my experience, not inconvenient, and the increased interest which it arouses more than outweighs the extra trouble involved. It will be observed that an accurate clinical diagnosis of some (if not all) of the cases referred to below would be impossible, and that Case IV illustrates the striking benefit which may be anticipated from appropriate vaccine treatment, and thus accentuates the practical importance of accurate diagnosis in this type of infection. I propose at present to deal with some of the cases I have met with in the last six months.

CASE I.

A child of 10 months, scalded on buttocks and legs, developed diarrhoea on the third day; next day convulsions, with temperature 104°; died on sixth day, apparently from bronchopneumonia and cardiac failure. Some hours prior to death large wheals appeared all over the body with petechiae. One of the wheals (on the front of the chest) was painted with lin. iodi, about two hours prior to the fatal issue, in order to sterilize the skin; and a hypodermic syringe, previously boiled, was used to obtain a specimen of the exudate. An agar tube was inoculated with a loopful of the contents of the syringe; it proved to be a pure culture of *B. coli*. At the same time one of the blisters on the leg was snipped with sterile scissors, and the platinum loop (previously flamed) was passed into the blister, and then used to inoculate a second agar tube. This also yielded a pure culture of *B. coli*.

Cover-glass preparations from the contents of the blister and the syringe showed a Gram-negative bacillus; no staphylococci or streptococci were seen. There is, therefore, strong presumptive evidence that this was a pure *coli* infection, its source being the child's own motions, and the route of infection being the extensive raw surface on the buttocks and legs.

With regard to the pathogenicity of *B. coli*, one need only note in this connexion that it has been shown by several observers that the virulence of these organisms is increased in typhoid fever and catarrhal conditions of the intestine. There are, therefore, theoretical grounds, as well as the specific evidence afforded by this case, for the statement that in cases where diarrhoea is associated with scalds, especially of the buttocks and lower extremities in young children, there is a grave risk of a fatal septicaemia from *B. coli*, a fact which, I confess, I had not properly appreciated.

The next case appears to raise some points of interest in connexion with "anomalous" febrile attacks and aberrant types of pneumonia.

CASE II.

Man, aged 56; sore throat and fever for a week; rigor tenth day; consolidation of left lung; abundant prune-juice sputum; temperature 103-104° for next four days; then attack aborted. Seven days later became delirious, and temperature reached 105°, but again touched normal in three days. There were occasional subsequent rises to 100°, but he gradually improved and eventually recovered. He was in bed about seven weeks.

A cover-glass preparation from the sputum in the first twenty-four hours of the pneumonia showed a diplococcus (without obvious capsule) and a bacillus in large numbers. A culture was grown from the sputum in the hope of isolating the pneumococcus; the bacillus grew luxuriantly and the attempt proved futile. It was not until the patient had been convalescent for a month that I accidentally discovered that this

culture had a slight odour and contained a motile bacillus. I at once obtained a sample of the patient's urine. It also contained a motile organism. I made a culture from the urine and submitted it with a subculture from the sputum and some of the patient's serum to Dr. Sidebottom, of Victoria University, who very kindly agreed to investigate the matter for me, and to whom I take this opportunity of expressing my thanks. His report is as follows:

"The two cultures were plated and found to be pure. They consisted of a small bacillus, motile and Gram-negative. Both organisms fermented glucose and lactose with production of gas. They produced clotting and acidity in litmus milk. The production of indol was not clear. Both organisms appeared to belong to the *B. coli* group; but there were small differences between them, the organism isolated from the urine showing a tendency to form long filaments. There was no indication of agglutination or stoppage of motility when the organisms were brought into contact with the patient's blood (10:1)."

With regard to the agglutination reaction, it is well to recollect that it was about three months from the onset of the illness until the agglutinating capacity of the serum was tested. Dudgeon and Sargent¹ failed in 52 out of 68 cases of peritonitis due to *coli* organisms to obtain any reaction with a dilution of 1 in 10. Wilson's results² were similar in the case of coliform organisms isolated from the urine. A negative reaction in this case, therefore, is not evidence of any great weight against the conclusion that the bacilli isolated from the sputum and urine had a specific connexion with the patient's illness. A trace of albumen was found in the ordinary routine examination of the urine in the acute stage of the pneumonia, but I wish to state emphatically that there were no bladder symptoms all through. I suggest, therefore, that the case was one of mixed infection by the *B. coli* and *pneumococcus*, that the primary focus of infection was the throat or lung, and that the infection of the urinary tract was secondary when comparative immunity had been achieved, and consequently no obvious inflammation of the urinary tract resulted.

My experience points to the conclusion that in cases of primary infection of the urinary tract there are some signs of cystitis, which may be so slight as to be easily overlooked altogether, or so severe as to cause grave anxiety about the patient's life. But whether the infection of the urinary tract be primary or secondary, mild or severe, the bacilluria appears to persist in most cases for weeks or months. I have recently seen a patient suffering from persistent recurring headaches who has a history of typhoid fever sixteen months ago. He has had no bladder symptoms since, but he has a *coli* bacilluria. I have not been able to find typhoid bacilli, though, of course, it was with the idea of possibly finding typhoid bacilli that I made cultures from his urine.

The following is a good example, I think, of the mildest type of infection of the urinary tract:

CASE III.

A primipara, aged 32, had a normal labour; she was unable to pass urine, however, during the first week. A silver catheter, boiled immediately before use, was passed night and morning. Temperature and pulse were normal until the fourteenth day, when she had a scarlatiniform rash interspersed with urticaria-like wheals which "burned" slightly but did not itch; her temperature was 99°, and pulse 86. Careful inquiry from the patient and the nurse elicited the fact that there had been slight dysuria on the first three or four occasions on which she urinated naturally. She had also appeared a little feverish on the evenings of the twelfth and thirteenth days, but she had not felt ill, and my attention was not called to the matter until the rash appeared. A specimen of the urine (obtained by catheter) was found to be acid; it contained a little pus and a motile Gram-negative bacillus, which on culture was found to be one of the colon group. The patient's blood in dilution of 1 in 10 agglutinated the bacillus, but did not completely inhibit motility; it was found, however, that the observer's blood had an almost equal agglutinating effect upon this bacillus. Beyond rest in bed for another week no treatment was adopted, and no further symptoms developed. The bacilluria persisted for five weeks afterwards, during which the patient appeared in perfect health. No further observations were made.

With regard to the rash, clinically it appeared to be related to the slight febrile condition. If it were, the case suggests that some of the erythematata of the puerperium may be due to a mild *coli* infection which escapes notice. Of course it may be urged that erythematata are uncommon in this kind of infection, but an obvious reply is that the great majority of people do not develop urticaria after eating shell-fish, whereas a minority do. Similarly bacterial toxins may in patients of a certain idiosyncrasy

produce puzzling erythematous eruptions, but fail to do so in the majority of patients suffering from the same form of toxæmia.

The next case illustrates the severe type of infection of the urinary tract. It represents a class of case which might easily be, and I believe has been, mistaken for appendicitis, and be submitted to a useless operation.

CASE IV.

Woman, aged 28; pregnant five and a half months; had vomiting and rigors. Temperature 103°, pulse 130, respirations 32, abdominal tenderness, especially over the right iliac region and towards the right kidney; some dysuria. During the first week, sleeplessness, persistent vomiting, abdominal pain and dysuria were the most prominent features. The urine was acid, contained some pus, which increased in quantity later, and a motile bacillus in enormous numbers, which was Gram-negative, and on subsequent culture proved to be one of the colon group—that is to say, it produced acidity and dotting of litmus milk; fermented lactose; gave a luxuriant brown growth on potato, and did not liquefy gelatine. A three days' broth culture gave a deep purple colour when 1 c.cm. of a 0.02 per cent. solution sodium nitrite and 1 c.cm. hydrochloric acid were added.

In this case alkalis and morphine (by the mouth) proved valueless, owing to the persistent vomiting, and at the end of the first week the case was looking very grave. It was then decided to try the effect of a vaccine made from a six-hours' subculture of the patient's own bacillus. A dose of fifty millions (approximately) was injected on the morning of the seventh day of the illness.

The patient slept well that night without a narcotic. Next morning she said she felt "perfectly well." Her temperature, etc., were normal; the vomiting, the dysuria, and abdominal pain had disappeared. On getting up, however, a week later, there was some return of these symptoms, and, after repeated entreaties on the part of the patient, another dose of vaccine was given, and was followed by the same rapid and gratifying improvement as before. Her subsequent convalescence was satisfactory, and her accouchement was normal.

Before giving the first vaccine injection, the agglutination reaction of the patient's serum was tested against the bacillus grown from the urine. It was found that, whereas observer's serum in a dilution of 1 in 10 had no appreciable effect on this bacillus at the end of one hour, the patient's serum agglutinated it instantaneously—that is to say, it was found to be agglutinated as soon as the preparation was focussed. A considerable number of similar observations with different dilutions were subsequently made in this case. The general result may be stated thus: Obvious clumping occurred in a dilution of 1 in 50 in a few minutes; but even with a dilution of 1 in 10 motility was not completely inhibited at the end of two hours. Careful comparisons with a normal serum or serums are, I think, imperative if any definite conclusions are to be drawn in *coli* infections from the agglutinating capacity of the patient's serum.

CONCLUSIONS.

I do not propose to elaborate further any of the points raised in connexion with these cases at present; but I may briefly summarize the conclusions at which I have arrived from personal observations:

1. These infections are commoner and more important than the average textbook would lead one to believe.
2. They vary within wide limits in respect of their virulence, and therefore in respect of their clinical features.
3. Their recognition is important, not merely from the standpoint of accurate diagnosis, but also from the standpoint of efficient treatment in the severer types.
4. The slighter cases are apt to be overlooked altogether, the severer cases are apt to be misunderstood.
5. Clinical observations alone, however conscientious, are at present quite inadequate; bacteriological evidence is a *sine quâ non* of decisive diagnosis.

REFERENCES.

- ¹ *The Bacteriology of Peritonitis*, p. 147. ² *Journal of Hygiene*, vol. viii, September, 1908.

WE have received from Continental Travel, Limited, a handbook giving an account of Swiss resorts open in the winter, together with information as to the facilities they offer for winter sports and as to the accommodation offered at hotels. Also dealt with are the cruises to the Mediterranean which the company organizes during the spring. The book is of value since, apart from other points, exact information as to Swiss winter resorts is not elsewhere easy to obtain. It is edited by Sir Henry Lunn, and includes a number of articles on winter experiences by different writers, and also a record of a tour round the world. Another similar tour is now it seems in preparation, the leader being, we note, Dr. Thwaites, a former army medical officer.

ON THE DIET OF A PATIENT BEFORE OPERATIONS UNDER GENERAL ANAESTHESIA.

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I do not propose to deal here with special cases, each of which must be treated on its own merits; however, as ordinary healthy patients who have to undergo some simple operation are so frequently subjected to an absurd period of starvation, or are given such totally unsuitable food before an operation, I think it is worth while devoting a little consideration to the subject.

I am fully aware that many members of the profession, especially those of the older school, will disagree with my views; and surgeons, anaesthetists, and general practitioners will be found to have opinions differing widely, not only from mine, but also from those of each other on this important question.

It is a peculiar fact that, though the diet of a patient before an operation is regulated mainly on account of the anaesthetic, it is quite exceptional for the anaesthetist to be consulted on the matter at all. In spite of this, however, he and his much maligned drugs are given all the blame for any unpleasant symptoms that may arise during or after the operation. Of course, a careful and experienced anaesthetist will obtain far better results under any system than one who is less competent; but his results might be enormously improved by subjecting the patient to a more reasonable and thoughtful preparation.

In an able article in the *Lancet* of April 4th, 1908, p. 993, Dr. William Hunter pointed out that the so-called "delayed chloroform poisoning" was actually due to starvation before and immediately after operations; and as this opinion emanated from a credited physician and pathologist, and not from an anaesthetist, I presume it will be accepted as being at least unbiased. In the general conclusions at the end of his paper, he lays down that post-anaesthetic vomiting is essentially toxæmic, due to the profound depression of the liver function, which will be greater if a liver, already weakened by disease or by poor nutrition, be further unduly weakened by food having been withheld for many hours before the administration. This enforced abstinence from food before the administration of an anaesthetic is, he says, largely responsible for the fatal effects of "delayed chloroform poisoning," and such effects could probably be completely prevented by taking care that the patient always had a very nutritious, well-sweetened, and easily digestible meal, two or three hours before the operation.

Moreover, the Sisters in the wards of the hospitals inform me that a result of the preparation of all ordinary operation cases by a routine method is that the patients whose turn comes at the end of a long list in the afternoon are always much more sick, and have far more straining than those who are done earlier, and have therefore not been over-starved to the same extent. It is the practice in many hospitals to prepare every patient as though he would be operated upon at 2 o'clock; whereas, if there be five or six cases to be done one after the other, the unfortunate victim who comes last on the list will be starved for some four or five hours longer than is actually intended. The old idea was that he would therefore have an absolutely empty stomach, and so would probably not vomit at all. Experience, however, shows that instead of suffering less after the operation, he really has far greater discomfort than the patient who is done first, and who is thereby saved from the miseries of the prolonged starvation.

At nursing homes, also, I am told that the patients nearly always suffer more after an anaesthetic if they are prohibited from taking anything by the mouth on the morning of the operation when the latter takes place at 10 or 11 a.m.

The usual errors in preparing patients for an anaesthetic, however, are by no means confined to the length of time during which they are made to abstain from food. They are frequently also given an unsuitable kind of food for their last meal. Thus, one sometimes hears of healthy patients being made to swallow some concentrated meat essence at 6 o'clock in the morning. This might be