I am frequently asked the paths of infection in "coll" bacilluria. Dr. Box has recently insisted upon the upward infection from without in children, and there is no doubt that is very frequently the route. But as in adults it is a common sequela of appendicitis, mucous colitis, and other intestinal troubles, even following prolonged voluntary retention of urine, I am certain the lymphatic route is common. Few people are aware of the frequency of primary coll urethritis, and the tendency of such an infection is undoubtedly to spread upwards rather than downwards. The manifestations and symptoms of coli infection are legion, and, though the commonest effect is pyuria, many patients exhibit general toxæmia of varying grade, from headache and slight feverishness to profound septic intoxication.

Passing over pure surgery, which I am convinced is the correct form of treatment in acute coll nephritis in some of its forms, it may be remarked that drugs fall us utterly all too frequently.

Many patients have been through the whole gamut of urinary antiseptics and disinfectants without receiving any permanent benefit. In passing, I would like to state that the addition of small doses (about 3 gr.) of an iodide renders more efficient the action of almost every urinary disinfectant drug with which it is not incompatible. It is these people with resistant coli-form bacilli who have provided such an immense field for treatment with bacterial emulsion. There is a consensus of opinion that such a vaccine cannot be prepared from a stock laboratory "coll," but must be made from each patient's own infecting bacillus. I find that in general 200 millions is an appropriate first dose, and that gradual increase of about 100 millions is sufficient. Such a vaccine may be given every eighth day, and it is not essential to control the treatment by the opsonic index.

A note of warning may be sounded that vaccines, to which lysol has been added as preservative, are occasionally the subject of complaint from ladies, who attribute rose spots, which are apt to appear on the face, to its use. Hence I use glycerine, which has the advantage of yielding a better emulsion of more lasting keeping quality. In my experience under vaccine treatment, the subjects of coli bacilluria can be promised diminution of pus, gradual loss of toxic symptoms, increased appetite, and consequent increase of weight. The outlook becomes brighter. A tendency to melancholia, so often exhibited by "coll"-infected people, completely disappears. They must not be promised absolute cure of bacilluria, but, under a course of vaccine treatment, the infected tissues will gain a certain degree of immunity, such as the intestinal epithelium may be considered to possess, and consequently the bacilli are rendered harmless.

The treatment of certain intestinal intoxications is at the present time being attacked upon novel lines. Briefly put, the practice is to turn out the entire intestinal flora by the introduction of a new and harmless intestinal inhabitant. There are two strains of the *B. acidi lactici* whose services have been engaged for this interesting operation. Metchnikoff, Tissier, and Fournier have shown that by frequent small doses of these lactic acid bacilli the other bacteria of the bowel are gradually eliminated and replaced by the *B. acidi lactici*.

I have wondered whether, in cases of intestinal disorder, accompanied or complicated by coli bacilluria, the turning out of the intestinal coli-form bacilli might leave the opsonins freer to work upon the coli bacilli infecting the urinary epithelium, and thus hasten the cure.

Again, speaking speculatively from the bacteriologist's point of view, I wonder whether malachite green, which proves in culture media inimical to the growth of the colon bacillus, would be of any service internally.

I do not intend to discuss gonococcus infection at great length. The subject of the sequelæ of gonorrhoea is one of the utmost importance to the general practitioner, and which exercises a most peculiar influence upon the mental attitude of some patients.

The persistence with which the latter allow urethral threads to prey upon their happiness is most deplorable, and, as such threads are nearly always the expression of a secondary infection of soil prepared by the gonococcus, it behoves us to prevent such an event, or, if it has come about, to cure it.

All other remedial agencies failing, the assistance of the bacteriologist is invited, and his duty is first to

examine the threads, carefully determining the presence or absence of gonococci, and isolating the other organisms. These threads usually present a staphylococcus, and a bacillus of the xerosis type. The latter is negligible, but a vaccine should be prepared from the staphylococcus. If gonococci persist, to each dose of the staphylococcus emulsion a small dose of gonococcus vaccine should be added. The latter vaccine is of the greatest service in gonorrhoeal rheumatism, and suffices, under properly graded administration, of itself not only to permanently cure the systemic infection, but also to remove the concomitant effects, such as infiltration of tendinous structures and the consequent swelling and stiffness.

In pure gonococcus infections of the urethra which light up with extraordinary virulence at each attempt at topical medication, gonococcus vaccine is again most useful, raising the resistance of the tissues until a point is reached when local applications act like a charm in curing the disease.

I may mention that this vaccine is the most difficult of all to prepare, owing to the well-known reluctance of the gonococcus to grow upon any artificial medium except such as contain human protoids or their derivatives, and to its own constitutional delicacy in artificial surroundings.

THE DIAGNOSIS OF IMPACTED CALCULUS IN THE URETER.*

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THE diagnosis of impacted stone in the ureter presents many difficulties. According to Hurry Fenwick:

Before the routine employment of expert radiography in cases of renal pain the diagnosis of stone in the kidney and ureter was merely speculative. The clinician was rarely certain as to whether a stone was present or not, or if he was assured in his own mind that a calculus did exist, he could not say whether it was imprisoned in the kidney or whether it had passed into and become arrested in the ureter, so similar are the symptoms of stone in either position. The surgeon was forced, therefore, to explore first the kidney and then the ureter before he could declare the patient free from stone.

In the BRITISH MEDICAL JOURNAL of June 17th, 1905, Fenwick gives the following three great features of ureteric stone shadows: They are in the line of the ureter; their outlines are sharp; and their shapes are more or less oval. He also draws attention to the value of a shadowgraph ureteric bougie in the precise surgery of renal calculus.

The case I wish to record is one in which an erroneous diagnosis of impacted calculus in the ureter was made in spite of the assistance of an excellent radiogram taken with a shadowgraph bougie *in situ*.

A man aged 26 was admitted to Sir Patrick Dun's Hospital on January 18th, 1908, suffering from two fistulae in the right flank, from which urine flowed continuously.

Previous History.

He stated that he had been operated on in another hospital about six months previously, and that four stones had been removed from his kidney, one about the size of a damson and three smaller ones. Since the operation urine had flowed continuously from the wound, which had never completely healed. He complained that he passed very little urine, and that more came through the fistula in his side than through the bladder. The pain he had suffered from had been relieved by the removal of the stones.

Examination.

An oblique scar was found in the lumbar region, from two small openings in which urine came in drops. The bladder was examined with the cystoscope. The right ureteral orifice appeared small and almost obliterated; no movement or efflux of urine was observed. Urine was seen flowing freely from the left ureter.

Diagnosis.

The possibility of obstruction of the right ureter by a calculus naturally suggested itself, and Dr. Watson kindly took a radiogram of the patient. A small oval shadow was found in the line of the ureter just at the upper part of the sacro-iliac articulation, and this was confirmed by a second radiogram a few days later. The diagnosis of an impacted stone in the ureter now seemed clear. There was obstruction of the ureter, and the x-rays showed a suitable shadow in the right place. But in order to exclude the possibility of the shadow being

* Read before the Surgical Section of the Royal Academy of Medicine, in Ireland.

due to a calcified lymph gland or other cause outside the ureter, I thought it advisable to pass a bougie opaque to the x rays up the right ureter, to prove that the shadow was in the exact line of the ureter. This was done under cocaine, and I was rather surprised that the bougie passed easily without causing the slightest pain until it reached the kidney, when the patient said he felt a slight pain like the old pain he had suffered from before the stones were removed from his kidney. Another radiogram was then taken, and it was found that the shadow cast by the supposed stone lay exactly in the line of the ureter.

Operation.

The ureter was exposed by an iliac extraperitoneal incision. It appeared dilated down to the place where the shadow had been localized, but no stone could be felt. Thinking the stone might have moved during the necessary manipulations, the ureter was opened and explored, a sinus forceps being passed up to the kidney and a large probe downwards into the bladder, without finding a stone. The ureter was sutured and the wound closed, a cystoscope was then passed, as it was thought the stone might have entered the bladder; there was no stone in the bladder. Apparently the only solution now left was that the stone might have been assisted out of the ureter by the passage and withdrawal of the bougie, and escaped from the bladder while the urethra was still occluded, and lost while the man was walking back to bed.

The mystery was not solved until another radiogram was taken a week after the operation, and the shadow found still present exactly in the same place, proving that it was due to some other cause besides a calculus in the ureter. What the shadow is due to I am not prepared to say; there were several enlarged glands in the region of the ureter, but they all felt soft and not calcified. An atheromatous patch in one of the vessels might explain the case, but the shadow is rather large, and the patient is young for this.

After-History.

This has been satisfactory, the patient being the only one not disappointed by the operation. The dilatation of the ureter with canterization of the fistulae resulted in an immediate increase in the amount of urine passed by the urethra and a gradual diminution of the leak.

The mistake made in this case could, I think, have been avoided by means of a stereoscopic radiogram, and in future I intend to have this done in all cases of supposed calculus in the ureter.

In conclusion I wish to express my thanks to Dr. Watson, Radiographer to Sir Patrick Dunn's Hospital, for his skill and trouble in taking several radiograms of the case.

Arris and Gale Lectures

ON

THE PHYSIOLOGICAL AND PATHOLOGICAL EFFECTS WHICH FOLLOW EXPOSURE TO COMPRESSED AIR.

DELIVERED IN THE THEATRE OF THE ROYAL COLLEGE OF SURGEONS ON MARCH 18TH AND 20TH, 1908.

By M. GREENWOOD, JUN., M.R.C.S., L.R.C.P.,

SENIOR DEMONSTRATOR OF PHYSIOLOGY IN THE LONDON HOSPITAL MEDICAL COLLEGE; DIRECTOR OF THE LONDON HOSPITAL STATISTICAL DEPARTMENT; LATE RESEARCH SCHOLAR OF THE BRITISH MEDICAL ASSOCIATION.

LECTURE II.

WE have seen that the analyses of arterial blood in animals, besides being technically difficult, are not free from objection. In the case of man, the difficulty becomes a practical impossibility so far as the arterial blood is concerned. We have, therefore, attacked the problem indirectly. If a condition of diuresis be induced by drinking large quantities of water, the abundant secretion which results will, on analysis, give us some idea of the percentage of gas dissolved in the blood. When the kidney is actively secreting, the saturation of the urine must approximate somewhat closely to that of blood in the renal artery, and its study is of much interest. Our experiments (Hill and Greenwood, 1907, A) were carried out in the following manner. The observer drank at least two pints of water, and ten or fifteen minutes later entered the cylinder, the pressure then being raised a definite amount. As soon as the pressure was stationary he emptied his bladder and then, ten or fifteen minutes later, emptied it again. Samples of the urine were run into glass bulbs with rubber connexions, care being taken to drive out any bubbles of air that happened to be present. The junctions were then clamped and the dissolved gas subsequently

pumped out and analysed. By this device, samples of urine actually secreted in definite intervals, after a given pressure limit had been reached, were available for analysis.

As a preliminary, we determined the volume of nitrogen dissolved in the urine under normal conditions. This was found to be 1.14 per cent. The individual analyses differed but little, so that we are not likely to be much in error in assuming the coefficient of solubility of nitrogen in urine to be, at body temperature and 760 mm. pressure, .01.

Table Summarizing Results at Various Pressures.
(Hill and Greenwood.)

Pressure and Time of Exposure.	Number of Analyses.	Mean	Calculated Value, if Saturation were Attained.
+0 lb.	6	1.14	1.1
+30 lb. up to 10 min.	5	1.99	3.3
+30 lb. more than 10 min.	7	2.32	3.3
+45 lb. up to 10 min.	4	4.29	4.4
+45 lb. more than 10 min.	8	4.23	4.4
+30 lb. (during decompression)	7	3.63	3.3
+15 lb. (during decompression)	8	2.75	2.2
+0 lb. (on decompression)	6	1.99	1.1
+0 lb. 15 min. later	4	1.69	1.1
+0 lb. more than 15 min. later	3	1.13	1.1

It is evident from these results that saturation of the kidney and, *a fortiori*, of the arterial blood is practically complete in ten minutes under a pressure of three atmospheres. For a total pressure of four atmospheres the time would seem to be slightly less; on two occasions full saturation was attained in eight minutes.

Another point brought out in the table is the slowness with which equilibrium is re-established on lowering the pressure. We have always decompressed at a uniform rate of twenty minutes for each atmosphere, but the urine invariably contained an excess of gas at the end of the experiment. With rapid decompression the difference is yet more striking, as will be clear from the next table, the material for which we owe to the kindness of Lieutenant Damant and Mr. Catto.

Observations on a Diver.

Depth.	Time Below, and Nitrogen Percentage Actually Found.	Theoretical Amount.
80 ft.	Below 48 min 20 sec. Ascended in 6 min 5 sec. Sample taken 20 min. 30 sec. after ascent. $N_2 = 1.73$	1.1
84 ft.	Below 46 min. Ascended in 5 min. Sample taken 11 min. after ascent. $N_2 = 1.60$	1.1
80 ft.	Below 46 min. Ascended in 4½ min.: First sample 4 min. after ascent. $N_2 = 2.50$ Second sample 20½ min. after ascent. $N_2 = 1.38$	1.1 1.1
72 ft.	Below 44 min. Ascended in 6 min.: First sample 5 min. after ascent. $N_2 = 2.11$ Second sample 20 min. after ascent. $N_2 = 1.03$	1.1 1.1

I think, therefore, we are entitled to conclude that the saturation of arterial blood is more rapidly effected than the analyses quoted above suggest; direct proof is, however, lacking.

Naturally, results obtained from an organ the circulation through which is so rapid as in the case of the kidney, under the conditions of our experiment, cannot be transferred to the tissue liquids at large. It would be illogical to conclude that ten minutes' exposure is adequate to produce any high degree of saturation in organs the circulation through which is slow. The best way to settle the point would be by the analysis of samples of venous blood, but we have not, so far, been able to overcome certain technical difficulties in the way of carrying out such observations. Some experiments, conducted by Drs. Haldane and Boycott and Lieutenant Damant (Admiralty Committee, 1907), are of interest in this connexion. They found that for a pressure of +45 lb. rapid decompression is not, in the case of