the total loss of blood during the entire operation did not exceed one tablespoonful. Fifteen patients were in labour at the time of the operation, and eighty-five were not in labour; the uterine contraction was equally successful in all of them.

Provided that narcotic drugs have been withheld, the child kicks and cries immediately it is withdrawn from the uterus. For a tired foetus, at the end of a long obstructed labour, in many instances this freedom from drugging at Caesarean section spelt life instead of death. The placenta is extruded by the strong contraction of the uterus, and the membranes rarely present any difficulty. Suture of the uterine wound is performed neatly and firmly, for the edges are clean-cut, and any tendency to relax subsequently actually increases the tension of the sutures.

After completion of the operation, the patient is carried to bed very gently, and her legs are elevated higher than the head. The lower half of the mattress is raised so that the legs are kept up, with the body horizontal and the head on a pillow. This position is maintained for five or six hours, and for twenty-four hours every effort is made to keep the patient quiet. A few hours after operation the uterine pains may be severe, and morphine is a great help. At one time we employed scopolamine in addition, but an anxious case of violent mania dissuaded us from the use of this drug. Abdominal distension for two or three days occurred in 20 per cent., but this is a frequent sequel to any abdominal section. During the periods of influenzal epidemics, and in sufferers from bronchitis, mild lung complications occurred, but there were no fatal cases from pneumonia.

By far the most unsatisfactory aspect of this procedure was "spinal headache," which occurred in 24 per cent. of this series. The headache started within twenty-four hours of the operation; it was suboccipital in location, and lasted, either continuously or intermittently, for one hour or for as long as a fortnight—in the majority of cases for twenty-four hours. Undoubtedly headache occurs after plain diagnostic lumbar puncture, after spinocain, novocain, stovaine, and percaïne. There is good evidence that the following precautions are valuable: (1) use only solutions which have been freshly prepared; (2) do not allow much cerebro-spinal fluid to escape; (3) avoid puncturing the blood vessels on the anterior wall of the vertebral canal; (4) do not inject air bubbles; and (5) handle the patient gently; do not move her more than is necessary, and keep her quiet for twenty-four hours after operation.

There were no permanent complications attributable to spinal anaesthesia; the method was especially valuable in cases of phthisis, heart disease, kidney disease, diabetes, and goitre causing tracheal obstruction. Only one patient died at, or just after, operation, and she was actually expiring from heart failure before the operation commenced.

I have gone into this method at some length, for Professor Whitehouse and I believe that it is valuable, if carefully carried out.

OPERATIONS ON THE GRAVID UTERUS AND ITS CONTENTS.

Hysterectomy of the gravid uterus in the later stages of pregnancy is a severe procedure. Most frequently the operation is called for in the presence of concealed accidental haemorrhage, or for severe sepsis in the pelvic organs. It is one of the most anxious operations of surgery.

The patient is toxic, suffering from shock, and bloodless. The more powerful anaesthetic agents, chloroform and ether, disturb the patient too much; their use is followed by serious post-operative reaction, and pneumonia or failure of the heart or kidneys may follow.

Spinal analgesia may produce a dangerous fall in blood pressure in a patient who is already nearly pulseless. But one patient, aged 26, after Caesarean hysterectomy under "spinal analgesia" in 1923, although she suffered from extremely severe post-operative pneumonia, recovered and reported this year that she was in good health.

Gas-oxygen is a most valuable aid. Eight Caesarean hysterectomies were performed under gas and oxygen for concealed accidental haemorrhage; each patient was nearly

in a dying condition when the operation was commenced. One patient died half an hour after the operation was completed; one died on the sixteenth day, but the remaining six recovered.

In conclusion, therefore, I would summarize my views as follows.

1. By a wise choice of method, the anaesthetist may be able to offer valuable help to the obstetrician and to the gynaecologist.
2. In the more severe procedures, gas-oxygen is the best agent for general anaesthesia.
3. Spinal analgesia has an important place in the technique of Caesarean section.

I have to offer my thanks to Mr. J. T. Hewetson, Professor Whitehouse, Mr. Lewis Graham, Miss Hilda Shufflebotham, Mr. Alfred Danby, Mr. Kenneth McMillan, and Mr. R. P. Graham for permission to refer to patients who have been under their care. To Sister M. H. King of the General Hospital, and to Sister Knight of the Maternity Hospital, Birmingham, I owe my grateful thanks for very ready help.

THE DIAGNOSIS OF UNDULANT FEVER.*

BY

G. S. WILSON, M.D., F.R.C.P., D.P.H.,
PROFESSOR OF BACTERIOLOGY AS APPLIED TO HYGIENE, LONDON
SCHOOL OF HYGIENE AND TROPICAL MEDICINE.

It is becoming increasingly apparent that infection with organisms of the *Brucella* group, particularly with the bovine type of *Br. abortus*, is by no means always followed by typical undulant fever. Persistent malaise, often accompanied by irregular fever, chronic ill-health, obstinate headache, joint pains, neurosis, certain skin rashes, abortion in women, and focal infections of the internal genital organs in men, seem to be not uncommon manifestations of *abortus* infection. Any attempt, therefore, to ascertain the true frequency of disease caused by this organism must take into account not only the clinically recognizable cases of undulant fever, but also those numerous cases of illness in which no definite diagnosis has been made.

The methods available for the diagnosis of *Brucella* infections will be dealt with in turn.

THE AGGLUTINATION TEST.

This is best performed by mixing graded quantities of the patient's serum with a formalized, heat-killed suspension of *Br. abortus*, incubating in a water bath at 55° C., and reading the results after four and eighteen hours. A strain of *abortus* should be selected that has been recently isolated; many strains after continued subculture in the laboratory tend to lose their agglutinability. Enough agglutinating suspension may be prepared at one time to last for several months. There is no necessity, in England at least, to use more than one strain; *Br. melitensis* and the bovine and porcine types of *abortus* are agglutinated to a more or less equal degree by a serum prepared against any one of them, and the idea that it is possible to distinguish between these three types by direct agglutination is erroneous. In Tunis, however, according to Burnet¹ two distinct antigenic types of *melitensis* are met with, necessitating the use of two suspensions in routine agglutination tests.

The serum should be diluted from 1 in 10 to 1 in 5,120; if only one or two dilutions are put up, a certain number of significant reactions will be missed.

The interpretation of a positive agglutination reaction is often a matter of considerable difficulty, and demands close co-operation between the clinician and the bacteriologist. Many workers have emphasized the dangers of non-specific agglutination. It is noteworthy that this phenomenon has been met with chiefly in areas in which undulant fever is endemic. Evidence has been accumulating to suggest that in such areas a certain proportion of the population is suffering from a latent *Brucella* infection, and that the occurrence of agglutinins in the serum of these persons is really the result of infection, and

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not an expression of non-specific agglutination. Indeed, with the exception of the bacillus of tularaemia, it is doubtful whether any other organisms are able to give rise to agglutinins for the *Brucella* group. Comparatively little exact work has, however, been carried out on this question, and it is impossible to say more than that in the past the importance of non-specific agglutination has been considerably overestimated. Subject to this reservation the following general propositions are put forward.

1. A titre of 1 in 80 or less, in the absence of clinical symptoms, is probably indicative of past infection with an organism of the *Brucella* group, not necessarily, however, attended by definite disease. Exact evidence in support of this statement is not easy to bring forward; it rests partly upon analogy with other diseases, and partly upon the results of examination of Wassermann serums. Harrison and Wilson,² who examined 998 Wassermann serums in Manchester, found that 50, or 5 per cent., agglutinated *Br. abortus* to a titre of between 1 in 10 and 1 in 80. On the other hand, only 4, or 0.4 per cent., reacted at a titre of 1 in 160 or over. Such a high proportion of positive results in low dilutions, in a country whose milk supply is fairly frequently infected with *Br. abortus*, seems to be most readily explicable on the assumption that there are always a considerable number of people who, during the past two or three years, have suffered from a mild invasion with this organism.

2. A titre of 1 in 100 or over, in the absence of clinical symptoms of disease, probably indicates a latent infection, or repeated past infections, not necessarily accompanied by definite disease. It appears to be not uncommon for veterinary surgeons and probably others, who come into close contact with aborting animals, to give a positive reaction in a fairly high dilution. Thus Huddleson and Johnson,³ who examined the serums of forty-nine practising veterinary surgeons, found that no fewer than thirteen agglutinated *Br. abortus* to a titre of between 1 in 100 and 1 in 500. Only three of the forty-nine gave a past history of undulant fever. It may be added, in support of Proposition 1, that fifteen of the forty-nine reacted positively in a dilution of 1 in 50, indicating the existence of a past infection. Similarly Thomsen (see Bang⁴) examined eight veterinary students just before leaving college; all reacted negatively to agglutination. But of twenty-nine young veterinary surgeons who had been in practice for six to twelve months, twenty reacted positively; of these only three gave a definite history of undulant fever. These observations indicate that only a minority of those infected with *Br. abortus* develop clinical symptoms of disease; the remainder suffer from a latent infection, which can be detected only by laboratory tests.

3. A titre of 1 in 100 or over, in the presence of pyrexia and other symptoms of disease, may be considered as practically diagnostic of active infection with an organism of the *Brucella* group. This statement is founded on the wide experience of Kristensen and Holm⁵ in Denmark, and on that of workers in other parts of the world. The demonstration of a rise, followed by a subsequent fall in titre during the course of the disease, strongly confirms the diagnosis.

4. A titre of between 1 in 20 and 1 in 100, in the presence of clinically undulant fever, may likewise be considered as practically diagnostic of active infection. It is abundantly clear that a patient may suffer from typical undulant fever, with a positive blood culture, without ever developing agglutinins up to a titre of 1 in 100.

5. The complete absence of agglutinins from a patient's serum does not necessarily exclude the diagnosis of *Brucella* infection. Such cases are uncommon, and appear to be more frequent in *melitensis* than in *abortus* infections (Burnet¹).

It will be realized that the agglutination test is of very real value, but that it is by no means infallible.

BLOOD CULTURE.

The patient's blood should be withdrawn during a pyrexial period, defibrinated, and distributed in 5 c.cm. quantities into at least two flasks containing 100 c.cm. or more of broth. The exact medium used does not seem to

be of great importance, but probably the most suitable is the liver infusion broth, originally described by Holth,⁶ and later recommended by Stafseth.⁷ One of the flasks should be incubated aerobically, in case the infecting organism is *Br. melitensis*, or the porcine type of *abortus*; the other should be incubated in an atmosphere of 90 per cent. air and 10 per cent. CO₂, in case the infecting organism is the bovine type of *abortus*. (These remarks apply to England; in South Africa the bovine type of *abortus* appears to be capable, even in primary culture, of growing aerobically (Bevan⁸).) Growth is often slow, and may not occur for two to four weeks; it is advisable to plate out on liver infusion agar every five days, incubating the plates both aerobically and in 10 per cent. CO₂. The flasks should not be discarded until positive subcultures have been obtained, or until subcultures over a period of five weeks have proved sterile.

The isolation of the infecting organism from the blood of the patient is clearly the most satisfactory way of establishing the diagnosis, and every effort should be made, by repeated blood cultures if necessary, to attain this end. It must be admitted, however, that success is by no means uniform. In undulant fever due to *Br. melitensis*, it is generally possible, sooner or later, to recover the infecting organism; according to Nattan-Larrier,⁹ blood cultures are positive in about 80 per cent. of cases. When, however, the disease is due to the bovine type of *abortus*, failure is often met with, and the percentage of positive results appears to be very much lower.

CULTIVATION FROM MATERIAL OTHER THAN BLOOD.

According to Kennedy,¹⁰ it would appear that about 75 per cent. of cases with *melitensis* fever excrete the organism in the urine; the excretion is, however, inconstant, and repeated samples may have to be examined before a positive result is obtained. Whether *Br. abortus* passed out by the urinary tract, it is at present impossible to say.

Recently Amoss and Poston¹¹ have succeeded in cultivating *Br. melitensis* and the porcine type of *abortus* from the stools of patients with undulant fever. Their technique involved the preliminary concentration of the organisms by agglutinating serum, and their subsequent growth on eosin-methylene-blue plates.

Sometimes pus from a focal abscess is available (Simpson and Fraizer¹²). The organisms may be recovered by direct plating on liver infusion agar, preferably containing 1 in 10,000 gentian violet, as recommended by Huddleson, Hasley, and Torrey.¹³

At autopsy cultures should be made from the spleen, liver, and mesenteric glands.

ANIMAL INOCULATION.

Cultivation of *Brucella* strains in liver infusion broth, or on liver infusion agar, with or without gentian violet, is so straightforward that little advantage is to be gained by the inoculation of guinea-pigs. This method may, however, be employed for the examination of pus or other material contaminated with secondary organisms. The animals should be injected subcutaneously into the thigh, and killed three to six weeks later; cultures should then be made from the sublumbar glands and from the spleen. It is interesting to note that there is a considerable discrepancy between the accounts in the literature of the lesions caused by the bovine type of *abortus* in guinea-pigs. In England the macroscopic lesions are extremely slight, and may be overlooked; generally, there is nothing more than a slight enlargement of the sublumbar glands and of the spleen; occasionally minute nodules may be seen on the surface of the spleen and liver by aid of a magnifying glass. But in America it appears to be not uncommon for *Br. abortus* to give rise to lesions that may be actually confused with those of tuberculosis (Schroeder and Cotton¹⁴). That this is not always the case, however, is evident from a recent paper by Hasley.¹⁵

THE INTRADERMAL REACTION.

This reaction, which was first described by Burnet,¹⁶ consists in the intradermal inoculation into the anterior face of the upper arm of 0.05 or 0.1 c.cm. of a filtrate of a twenty-day-old broth culture of *Br. melitensis*.

Br. abortus. A positive reaction is characterized by the appearance in six hours of a slightly raised oedematous plaque, 4 to 6 cm. in diameter, distinguished in colour from that of the surrounding skin; the reaction, which may be accompanied by pain, persists for about two days. According to Burnet, the intradermal test is often positive when the agglutination reaction is negative, and he considers, therefore, that it is of greater diagnostic value than the agglutination test. This may hold true in *melitensis* infections, but it is doubtful in *abortus* infections; Huddleson and Johnson,³ for example, in a small series of cases, encountered one subject who failed to react to the intradermal test, even though his serum had an agglutinin titre of 1 in 500. The test has the advantage of simplicity, and is well worthy of trial on a large scale.

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HYDRONEPHROSIS DUE TO KINKING OF THE UPPER END OF THE URETER.

BY

R. P. ROWLANDS, M.S., F.R.C.S.,
SURGEON TO GUY'S HOSPITAL.

HYDRONEPHROSIS is usually due to obstruction of the flow of urine along the ureter. The obstruction may be a stone or other body within the ureter, it may be a stricture or kink of the wall, or it may be something pressing upon the ureter from outside, such as an abnormal vessel,¹ fibrous band, or tumour.

Here I am chiefly concerned with a valvular condition² of the upper end of the ureter which is often overlooked until the kidney has become seriously damaged or even destroyed by long-continued obstruction, with or without added septic infection. I have had reluctantly to remove many such kidneys which could have been saved by timely operation.

After nephrectomy there is always the fear that the remaining kidney may become fatally obstructed, for the anatomical abnormality is sometimes bilateral. Hence the importance of drawing attention to this condition so that the obstructed kidney can be saved, and not have to be removed.

Etiology.

There is very often a congenital narrowing at the upper end of the ureter where it joins the renal pelvis; and sometimes there is a valvular fold of mucous membrane there, or the ureteral orifice is not at the lower end of the infundibulum of the pelvis, but on one or other side of the pelvis. The ureter then runs for some distance along one wall of the pelvis, and is usually adherent to it. Any distension of the pelvis in these circumstances is likely to obstruct the ureteral orifice in a valvular manner; this increases the distension and dilatation of the pelvis. A similar state of obstruction is well known in the large arteries and in the oesophagus. In the former a sacular aneurysm may obstruct the distal part of the artery; in

the latter a full oesophageal pouch frequently obstructs the distal part of the gullet.

In the course of time, attacks of obstruction marked by renal pain become more frequent, the pelvis gradually dilates, and inflammatory adhesions take place around the pelvis, and these tend to increase the obstruction. In one case of pyonephrosis I found the upper ureter folded into three complete kinks by such adhesions; the kidney was pyonephrotic, and so thin that it could not be saved. Mobility of the affected kidney certainly adds to the obstruction, and great descent of the kidney may be an important cause of kinking of the ureter, but mobility is also a result of repeated distension of the kidney.

Symptoms.

There is a history of repeated attacks of pain in the loin behind and in front. These attacks sometimes begin during childhood or adolescence, but more often during early adult life. The pain rarely extends downwards to the groin or thigh, and there is rarely any dysuria or abnormal urine. These points distinguish this condition from stone, but not from obstruction of the ureter by abnormal blood vessels. Gradually the attacks become more severe and more frequent, and before long a renal swelling may become noticeable during the attacks. The appendix is frequently removed in mistake and without benefit, and I have known fruitless operations undertaken for supposed cholecystitis or for ileal kink. In the course of time a typical hydronephrotic swelling may be found during the attacks, and pyonephrosis sometimes develops, with or without pathological urine.

Diagnosis.

Some of the pitfalls have been mentioned. We have to distinguish this renal affection from those of the other abdominal viscera by exercising care and caution, and making complete examinations. The location of pain and tenderness in front and behind the kidney is very important. Cholecystography is often invaluable in excluding disease of the biliary tract. We have then to distinguish this from other renal conditions, especially from other kinds of obstruction of the ureter, such as stone and abnormal renal blood vessels.

The entire absence of blood, pus, or albumin is against stone, and so is a negative good radiogram, although this can never be quite conclusive. Ureteral catheterization and pyelography, and possibly uroselectan, should generally establish the diagnosis long before the hydronephrosis becomes visible or palpable. Finally, these repeated attacks call for operation, which serves completely to establish the refinements of diagnosis, and to cure the condition by simple operative measures.

Operation.

The kidney is explored through the usual time-honoured and excellent oblique incision in the loin below the last rib. The kidney is carefully separated and delivered, and turned forward so that the renal pelvis and ureter can be minutely examined from behind. Any abnormal renal vessel or band of fibrous tissue obstructing the ureter is tied and divided. If none of these, or stone, is found, and yet the ureter is of normal size and the pelvis is dilated or distended, the diagnosis of valve ureter is established, and the condition is treated either by enlarging the opening, as shown in Fig. 1, or after Fenger's method

FIG. 1.—Valve ureter; ureteroplasty. The incision made to overcome the valve and stricture is shown. A continuous suture of fine catgut is inserted as demonstrated in the figure.

¹ *The Operations of Surgery*, vol. ii, p. 582.

² The late Sir Henry Morris described this abnormality in his standard work *Surgical Diseases of the Kidney and Ureter*, vol. ii, p. 423.