upon the predisposing and the actual causes of puerperal sepsis as will lead to a much larger measure of prevention and to more effective treatment, and there can be little doubt that a very real contribution to that end will be reckoned among the many good results of this Congress.

A CLINICAL AND BACTERIOLOGICAL INVESTIGATION OF PUERPERAL FEVER

IN THE ROTUNDA HOSPITAL, DUBLIN.*

BY

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THE 57 cases of acute puerperal fever considered in this paper were treated in the Rotunda Hospital during the past four years. The deaths numbered 29 (51 per cent.). Fifteen cases developed amongst patients wholly treated in the hospital and 9 died; 25 developed in the hospital district and 7 died; 17 were patients sent into hospital either late in labour with complications, or after delivery with fever, having been previously treated but not in the hospital district, and of these cases 13 died.

INCIDENCE OF INFECTION.

During the four years 14,380 confinements were attended—6,810 in the hospital and 7,570 in the hospital district—and of these 40 appear as acute puerperal sepsis, with 16 deaths; this gives an incidence of infection of 2.8 per 1,000 and a mortality of 1.1 per 1,000. Of the hospital cases, 25 were spontaneous deliveries, 2 were simple low forceps, and 1 a breech; of these 28 cases 8 died. Two cases were first seen after complete abortions, and both died. Of the remaining 10 cases Caesarean section was performed in 2 and pubiotomy in 1, secondary post-partum haemorrhage occurred in 1, and in 6 manual removal of the placenta was practised; of these 6 died.

Three cases were almost certainly not of genital origin.

Case 1 was spontaneously delivered and had returned home after a perfectly normal puerperium; on the eleventh day she suffered from retention of urine, and had to be relieved by catheter; on the fourteenth evening she had a rigor, and died seven days later. The history suggests that infection occurred at the time of catheterization.

Case 2 died of acute endocarditis; her morbidity started with acute tonsillitis; laparotomy was done on the twenty-second day and the peritoneum and pelvic organs found normal. Uterine swabs were persistently sterile.

Case 3 had been seriously ill with rigors and high fever for several days before labour; she was confined prematurely of a macerated foetus, and died of acute endocarditis. The only reason for suspecting a genital origin in these two cases was the removal of the placenta manually.

Excluding these three cases, there remain 27 infections after normal deliveries, with 7 deaths; and 8 infections after complicated labours, with 4 deaths. Among 17 cases sent into hospital on account of difficulty or complications previously treated, 13 deaths occurred; omitting 4 cases that ended in spontaneous delivery, although 3 died, there are 13 seriously protracted labours followed by infection, with 10 deaths. Although the incidence of infection amongst cases wholly treated in the hospital is only 2.2 per 1,000, compared with 3.3 per 1,000 cases attended in the hospital district, the mortality in the hospital is 1.3 per 1,000, against 0.9 per 1,000 in the district.

Conclusions.

The incidence of acute puerperal infection should not reach 1 per 1,000. It must be recognized that complicated cases met with in the district are sent into hospital early for treatment.

* Abridged text of a paper preliminary to a discussion on puerperal sepsis at the British Congress of Obstetrics and Gynaecology, London, April 22nd.

Any interference in labour, other than low forceps over the perineum and simple laceration of the perineum, considerably increases the incidence of infection and the resulting mortality.

Impacted labour, particularly with devitalization of the pelvic tissues and debilitating haemorrhages, increases the incidence more than any other cause, and the resulting mortality is very great.

SOURCE OF INFECTION.

There has never been any traceable connexion, by vaginal examination, between two cases in the hospital or in the district, but there have been suspicious instances of a second case developing while another was under treatment, although there has not even been ward contact.

Table showing Nature of Infecting Organisms.

	Cases.	Deaths
Haemolytic streptococci ...	32	14
Non-haemolytic streptococci ...	8	4
Anaerobic streptococci ...	1	1
Streptococci not classed ...	6	1
Gram-positive cocci (smears only examined) ...	3	2
<i>Bacillus welchii</i> ...	1	1
Cases not examined ...	6	6

There is little reason to suppose that the three unclassified cocci were other than streptococci, or that the six fatal cases not examined would have varied from those examined. One case gave *Staphylococcus aureus* from the uterus, but haemolytic streptococci from the heart and lungs post mortem.

Conclusions.

From these and other observations* it may be concluded:

- (1) That acute puerperal infection is almost invariably due to streptococci, most commonly haemolytic.
- (2) That cultures made from the interior of the uterus during the puerperium are of the greatest possible value in diagnosis. Material should be cultured within a few hours if a negative result as to streptococci is to be accepted.
- (3) That blood cultures are a further assistance if they are positive, but when negative do not exclude serious infection.
- (4) That when haemolytic streptococci are obtained from any part the prognosis is most serious, and probably the infection is always exogenous in origin.
- (5) That non-haemolytic streptococci from the uterus is serious, and from the blood most serious.
- (6) That non-haemolytic streptococci from the uterus, the blood, or from the uterus and blood, is probably often of an extragenital origin.
- (7) That negative results for streptococci from the cervix may usually be accepted, provided the culture is not dominated by other organisms.
- (8) That cultures from the blood positive to either haemolytic or non-haemolytic streptococci are equally serious, but neither is necessarily fatal.
- (9) That *Staphylococcus aureus*, *Bacillus coli*, and gonococci are likely to produce local infections, but do not tend to become general.

CLINICAL MANIFESTATIONS.

Onset of Fever and Period of Invasion.

Of the 57 cases recorded, 24 had a sudden onset, in 6 with rigor and 2 with profuse sweating, the previous temperature having been perfectly normal; 4 had a sudden rise, 2 with rigor, and preceded by slight elevation; 4 had a gradual rise to a high level. The remaining 25 all had elevation of temperature ante partum, from delivery, or within thirty-six hours after delivery, except 7, who were in collapse when delivered or first seen and died without rallying, and 2 others who developed high temperatures when they recovered from the primary collapse.

* Omitted here.

Of the 28 cases with a sudden rise, one had protracted labour requiring pubiotomy, in 2 the placenta was removed manually, one had late post-partum haemorrhage, and in one the presentation was a breech; otherwise the labours were easy. In 21 cases the onset was on the third or fourth day, and in 4 on the second day. The cases with a gradual onset were all easy deliveries. The 25 cases with elevated temperature from or before the first day include only 6 cases with easy deliveries, but 2 of these were abortions, one had post-partum haemorrhage, and one had innumerable vaginal examinations, leaving only 2 easy deliveries not interfered with. In several of these cases collapse temperature, with very rapid or imperceptible pulse, developing shortly after delivery and persisting to death, was the only indication of infection. In such cases the peritoneum will invariably be found infected, without any reaction or symptoms. Professor Crichton of Capetown reported that, having seen an observation on this subject in the last Rotunda report, he had a blood culture made just before death in a case of unaccountable shock following delivery by craniotomy, and found pure haemolytic streptococci. The fact has been established in the Rotunda Hospital, not only in maternity cases that have been tested, but also in gynaecological cases dying of apparent post-operative shock.

Conclusions.

That the incubation period of acute puerperal sepsis is probably three days.

That when the patient is not debilitated the onset is sudden, sometimes with rigor.

That damage to tissues and debility from protracted labour disguise the onset.

That collapse setting in after delivery and progressing to rapid death is often the only evidence of infection introduced during a protracted labour.

That "labour shock" is never a justifiable diagnosis of the cause of death after protracted labour until infection has been excluded by a cultural examination of a swab from the peritoneal cavity. These cases are frequently the most rapid and virulent type of sepsis.

PROGNOSIS.

Rigors occurred in 14 of the 57 cases in the table and in 2 of the 22 morbidity cases. Profuse sweating, which was probably an abortive rigor, occurred in 3 cases. In 4 cases rigor or sweating only occurred at the onset of fever, in 13 cases they were repeated or developed later. Three patients had rigors almost daily for several weeks, and 2 recovered. Six cases with rigors died.

The occurrence of rigors indicates the more serious type of infection, but nothing as to the course likely to be followed. High persistent or remittent temperature with high spikes is always indicative of serious infection. A four-hourly chart is essential to show the characters. In the second week persistent high temperature is bad, but very high spikes are not necessarily of ill omen if the remissions are good. The pulse commonly follows the temperature; when proportionally lower it is good, but when above the prognosis is bad.

The lochia seldom shows change unless after protracted labour, when it may be profuse and is often fetid. Absence of lochia on the second or third day of fever is a bad sign, but change to pus or the appearance of pus after absence may be considered a definite improvement. Necrosis of tissue or even gangrene and puerperal ulcer of the vulva and vagina do not necessarily indicate acute infection. In the absence of necrosis and fetid lochia the involution of the uterus is frequently normal.

DURATION.

Taking the duration of the disease from the first evidence of fever until either death or recovery, then 14 cases terminated in the first week; only 3 recovered, the other 11 succumbed to the shock of invasion. In 13 patients the fever persisted for over twenty-two days, and 8 of these finally died; 9 developed secondary conditions such as abscesses, peritonitis, or endocarditis. The remaining 30 cases terminated in the second or third week—20 recovered and 10 died.

Conclusions.

The duration of the fever is most commonly ten to twenty days. A number of patients succumb from the intensity of the onset, and this is promoted by protracted labour causing damage to tissue. When a partial resistance is established secondary complications develop and the cases may be very protracted; the prognosis is not improved—it depends upon the site and nature of the secondary developments.

TREATMENT.

Acute puerperal fever appears to be due to invasion by an exogenous organism, and the result depends upon the powers of the patient to resist the invasion or establish a resistance to overcome the infection. So far no specific remedy has been found, and dependence must be placed on general tonic treatment. When evidence of resistance appears, as by local formation of pus, benefit will be derived from drainage or removal of the abscess, but removal of tissue will not produce benefit if resistance has not previously developed.

Antistreptococcal Serum.—Polyvalent serum was used in 34 of the cases in the table, and 17 died. Of the 24 cases not given serum 10 died. The dose given varied from 20 to 100 c.cm., most commonly 20 or 30 c.cm., repeated once or twice. Prophylactic doses of 30 to 60 c.cm., sometimes repeated in 30 to 40 c.cm., were given in 16 cases; 5 of these cases are included in the table, and all died; they were all cases of protracted labour treated outside the hospital. The remaining 11 cases did not develop infection, but only 2 were treated outside the hospital. No conclusions can be drawn from these facts, but serum does no harm, and is given as a routine in suspected cases in doses of 30 c.cm. repeated once or twice.

Iodine.—Intravenous injections of 10 c.cm. of colloidal iodine are given on the same day or the day after serum is started, and repeated in doses of 10 to 40 c.cm. at twenty-four to forty-eight hour intervals. The results sometimes suggest extraordinary benefit, and the injections are never detrimental.

Sodium Bicarbonate.—Intravenous injections of sodium bicarbonate solution (0.9), 20 to 40 ounces repeated once or twice, or given by repeated rectal injections, appear to do good in some cases, especially when the patient begins to show debility.

Douching appears to be useless in the symptomless cases, and entails the risk of peritoneal infection directly through the Fallopian tubes, which are quite patent in the unresisted cases. On the other hand, when pus has formed in the uterus a single or even repeated douche is of unquestionable benefit. Also in cases with profuse fetid lochia a simple douche does good; but no attempt should ever be made to remove material with either a dull or sharp curette or even the finger, and a douche is better not resorted to until drainage by sitting up, even out of bed, has been tried and failed. All cases should be drained by free movement and frequent sitting upright.

Operative Procedures.—Whenever pus forms it should be evacuated—cellulitic abscesses, above Poupart's ligament, through the vaginal fornices, or even by laparotomy. If multiple abscesses form in the uterus, hysterectomy, vaginal or abdominal, is indicated. If peritoneal fluid forms it should be drained. When there is suggestion of pus formation in the pelvis but the site is doubtful, a laparotomy is advisable, as any site can be reached and the pelvis drained. Until localization has developed operative measures appear useless. All cases that continue into the third or fourth week should be closely watched for local abscess formation.

Post-mortem Examination.

In the great majority of the cases that died an examination of the abdomen and pelvis at least was made. With the exception of the cases with sloughing or necrosis of tissue the organs showed little or no change from the normal, beyond anaemia and slight flabbiness. In no case without evidence of reaction were the pelvic veins thrombosed, and thrombosis was absent when looked for in the few cases with pus formation.