# *CLOSTRIDIUM WELCHII* INFECTION FOLLOWING ABORTION

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The death rate from abortions is still appalling. At Groote Schuur Hospital alone, 24 patients died from this cause during the past 5 years. Although there was a marked drop in abortion mortality between 1942 and 1952 in England and Wales, the incidence has remained practically unchanged since 1953 (Table I).[1] The effective treatment of haemorrhage and the control of most cases of sepsis by antibiotics were no doubt responsible for the earlier improvement. The present stalemate is due to the fact that certain causes of death have remained unchanged and become relatively more important. These residual causes require greater attention if a further saving of lives is to be achieved. Prominent amongst them is *Clostridium welchii* infection.

During the year 1 July 1958 to 30 June 1959, 1,436 incomplete abortions were treated at the Groote Schuur Hospital; of these 502 were septic. *Cl. welchii* infection was a prominent factor amongst the seriously ill and fatal cases. There were 10 such cases, representing an incidence of 1 in 140 abortions and 1 in 50 septic abortions; 3 of these 10 died. In view of the increasing importance of this infection, the subject is reviewed in the light of our experience at Groote Schuur Hospital.

TABLE I: DEATHS FROM ABORTION: ENGLAND AND WALES (REGISTRAR GENERAL)[1]

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|---|---|---|---|---|---|---|
| 1942 | .. | .. | 313 | 1952 | .. | .. | 90 |
| 1944 | .. | .. | 313 | 1953 | .. | .. | 76 |
| 1946 | .. | .. | 157 | 1954 | .. | .. | 76 |
| 1948 | .. | .. | 125 | 1955 | .. | .. | 68 |
| 1950 | .. | .. | 103 | 1956 | .. | | 72 |

The *Cl. welchii* organism was isolated independently in 3 countries in 1892 and has since been commonly called after the name of one of its discoverers. It is a short gram-positive rod, non-motile and encapsulated. It is an anaerobe, fermenting sugars to produce an inflammable mixture of carbon monoxide, carbon dioxide and hydrogen. The clinical features are largely due to the effects of two of the toxins which it produces; a myotoxin which causes disintegration of protein with the production of gas, and a haemotoxin which destroys red blood corpuscles.

Considering its wide distribution, *Cl. welchii* infection is less common than might be expected. The organism is present in the vagina of about 5% of healthy pregnant women,[2] and has indeed often been found in the floor dust of labour wards and on the hands of attendants.[3] The discrepancy between opportunity and infection has occupied the attention of numerous workers. All are agreed that the presence of dead or traumatized tissue is essential for the production of the infection. Another important factor is the virulence of the organism. Butler[4,5] investigated this aspect and found over 600 different strains; severe infections are produced by only 5% of the strains—those which are heavily encapsulated and resistant to phagocytosis by human leucocytes, produce an alpha toxin and are fatal to guinea-pigs. Russell and Roach[6] laid down two other postulates

for growth, namely, that the organism must be introduced *into* the uterus and the dead or damaged tissue must remain in the uterus for a sufficient time for incubation. It is no wonder, then, that *Cl. welchii* infection is so much commoner after abortion than after childbirth and it is particularly favoured by criminal methods of procuring abortion, including the use of a syringe. In 6 out of the 10 cases described here, such a history was obtained.

## CLINICAL FEATURES

Although *Cl. welchii* has often been cultured in cases where it does not appear to affect the clinical picture, yet true infection with the organism produces a most serious condition. The clinical picture is then related to the effects of the bacillus and the myotoxin and haemotoxin it produces. The haemotoxin haemolyses red blood cells and the myotoxin causes disintegration of protein (including renal and hepatic epithelium, muscle, and blood vessels) with the production of gas. The cases encountered at the Groote Schuur Hospital demonstrate the various clinical types, which can be conveniently classified as follows according to the groups proposed by Douglas *et al.*[7]

1. *Cl. welchii present in the Vagina*

Here it may be a harmless saprophyte, and such cases are not included in the present series. In the bacteriological service at Groote Schuur Hospital, virulent strains are tested for, and the presence of *Cl. welchii* is only reported when such strains are present. On the basis of the presence of *Cl. welchii* in 5% of normal vaginae, one would have expected about 70 such cases in the group of abortions under review.

2. *Local Uterine Infection*

It is extremely difficult to diagnose these cases and to distinguish them from infection with the less dangerous organisms. Diagnosis will depend on the bacteriological report, which involves a delay of a few days. In the meantime *Cl. welchii* infection should always be considered—and vigorously treated—when the abortion is criminally induced, or when pyrexia, tachycardia or hypotension is marked. The presence of gas in the tissues, jaundice, or anuria makes the diagnosis much more likely.

*Case 1.* H.S., aged 32 years, gave a history of 3 months' amenorrhoea and having attempted to induce an abortion 2 days before. This was followed by severe lower abdominal pain and some vaginal bleeding. She was found to be shocked. (BP 50/30 mm. Hg, pulse rate 110 per minute). Temperature 101·4°F. Slight lower abdominal tenderness. Cervix patulous, and uterus enlarged and tender. She was put on penicillin (2 million units 6 hourly), antiserum, and levophed, and responded to this treatment, passing the ovum 24 hours later. For a week pyrexia and tachycardia continued, and then all abnormal physical signs disappeared. The cervical swab showed *Cl. welchii* and coliform bacilli.

*Case 2.* E.J., aged 19 years, was admitted with a history of having had a 3 months abortion induced 24 hours before, but the bleeding had continued. She looked ill; temperature 103° F. and pulse 110. Lower abdomen slightly tender; offensive vaginal discharge; products of conception felt protruding through the cervix. Uterus the size of a 10 weeks pregnancy; adnexa normal. She was treated with penicillin and streptomycin. The temperature and pulse became normal in 48 hours, but by that time the bacteriological result was received, reporting the presence of *Cl. welchii* and *Staph. aureus*. Accordingly no evacuation was performed but the dosage of penicillin was increased. After 7 days *Cl. welchii* was no longer isolated, the pelvic condition was normal, and she had made a complete recovery.

*Case 3.* M.V., aged 20 years, was admitted with a history of 14 weeks' amenorrhoea, followed by profuse vaginal bleeding. BP 80/40, temperature 98° F, pulse 120 and Hb. 10 g.%. Cervix dilated by a large mass of ovular tissue. The placental remains were removed digitally and 2 pints of blood given. She became pyrexial and was put on penicillin and streptomycin. A cervical swab revealed a heavy mixed growth of *Cl. welchii*, beta haemolytic streptococcus, and *Proteus mirabilis*, and the dosage of penicillin was increased and chloromycetin was given as well. For a further week pyrexia and tachycardia continued, and then she recovered.

*Case 4.* S.K., aged 38 years, was admitted with a history of a 3 months abortion 6 hours before. Temperature 102°F, pulse 120, Hb. 10 g.%, BP 80/50. She was transfused and put on penicillin and streptomycin. Cervical swabs showed a profuse growth of *Cl. welchii* and a scanty growth of coliform bacilli and *Staph. aureus*; and the dosage of penicillin was increased. Pyrexia continued for a further week and then the temperature gradually subsided. By this time pelvic examination showed that the abortion was complete.

*Case 5.* C.A., aged 19 years, had an induced abortion 3 days before admission and stated that she had passed very little urine since that time. The uterus was about the size of a 10 weeks gestation, with patulous cervix through which placental tissue could be felt. In view of the anuria, *Cl. welchii* infection was suspected. Treatment was started immediately—penicillin in large dosage, antiserum, and treatment for anuria. Blood urea 218 mg.% and potassium 5·9 mEq./litre on admission; these rose gradually to 560 mg.% and 7·6 mEq./litre on the 18th day; and this was then followed by a decrease to normal. The urinary output was negligible for 10 days and then returned to normal. Temperature rose to 101°F on the 5th day. The cervical swab confirmed the presence of *Cl. welchii*. One month after admission the findings were normal.

*Case 6.* Y.M., aged 18 years, was admitted with a history of 4 months' amenorrhoea followed by vaginal bleeding of 2 days. Her general condition was good but the temperature was 101°F and there was an offensive vaginal discharge, bacteriological examination of which showed *Cl. welchii*. She was treated with penicillin and the temperature dropped to 99°F. Two days after admission profuse vaginal bleeding necessitated evacuation of the uterus, after which the temperature rose to 104°F but the pyrexia gradually settled and the patient was discharged on the 10th day.

3. *Pelvic and Peritoneal Spread, causing Peritonitis, Local or Generalized*

Here, again, the diagnosis is difficult and before bacteriological confirmation is obtained the features mentioned above should raise the suspicion of *Cl. welchii* infection.

*Case* 7. J.J., aged 30 years, was admitted on 7 August 1958, 4 days after a 3½ months abortion had been induced, soon after which she developed rigors and jaundice set in rapidly. Temperature 96°F., but pulse 120. She was pale (Hb. 5 g.%) and deeply jaundiced. Abdomen distended and tender, cervix patulous, and parametria thickened and tender. Vaginal swabs showed a heavy growth of *Cl. welchii*, coliform organisms, and enterococci. Blood urea 385 mg.%, serum bilirubin 9·3 mg.%. She was put on penicillin and transfused with 3 pints of blood. She passed 60 c.c. of urine daily and was treated as a case of lower nephron nephrosis. She died on the 5th day after admission, her pulse having remained elevated, although she never developed pyrexia.

*Case* 8. A.K., aged 26 years, was admitted on 3 April 1959 with a history of having been 2 months pregnant and having induced an abortion with a syringe the night before. Temperature 104°F, pulse 120. Tenderness and rigidity of lower abdomen. Placental tissue protruding through cervix. A vaginal swab was taken and the patient was put on penicillin. The pyrexia settled within 48 hours and an evacuation was performed. The next day the bacteriological report was received, *Cl. welchii* having been cultured. Tachycardia and abdominal tenderness continued for a further week, but all physical signs had disappeared in 10 days.

4. *Blood-stream Infection*

(*a*) *Bacteraemia.* The patient may show no evidence of systemic infection, or only local uterine sepsis.

(*b*) *Septicaemia.* In this condition negative blood cultures are frequent, because an anaerobe does not survive in the circulatory system for long.

*Case* 9. S.J., aged 27 years, was admitted on 9 November 1958 in a confused and stuporose state. A 3 months abortion had been induced the day before. Temperature 104°F., pulse 110. She was stuporose and at times violent, and presented the signs of a hemiparesis. Lower abdomen very tender; slight vaginal bleeding; uterus could not be outlined. Cervical swabs and blood cultures were taken and the patient was put on intravenous chloromycetin. Report received 3 days later—*Cl. welchii* and *Staph. aureus* in the blood culture, both organisms sensitive to chloromycetin. In spite of the chemotherapy the temperature remained in the region of 104°F, her pulse continued to rise, and she became completely comatose and died 7 days after admission. The urinary output was reasonably good throughout. Post-mortem examination showed a generalized pyaemia.

(*c*) *Metastatic gas gangrene.*

*Case* 10. H.J., aged 23 years, was admitted on 10 December 1958 with a history of 2 months' amenorrhoea followed by vaginal bleeding and pain in the legs for 1 day. Her temperature was subnormal, her pulse imperceptible, and her blood pressure unrecordable. There was lower abdominal tenderness which made the vaginal examination unsatisfactory. Marked subcutaneous emphysema of both legs, arms and abdomen. Penicillin (12 million units) and gas antiserum (120,000 units) were given, as well as levophed, cortisone and digoxin, but the patient died 11 hours after admission. A vaginal swab yielded a mixed growth of *Cl. welchii* and anaerobic streptococci.

As demonstrated by the above 10 cases, most patients develop symptoms within one or two days after the abortion. Depending on the severity of the infection, the patient may have chills, muscle pains, and collapse. The temperature may be high and persistent, or subnormal; the pulse is nearly always rapid, the blood pressure often drops, and there may be evidence of peripheral circulatory failure. The haemotoxin may produce acute haemolytic anaemia, with icterus and haemoglobinuria (case 7). The myotoxin may contribute to renal and hepatic dysfunction and may result in the production of gas in the tissues which may be felt as crepitus or be demonstrable by X-ray (although gas is said to be present in 20% of cases[8] it was only observed in 1 of the 10 cases in this series). Renal failure results in oliguria, anuria, and a rising blood urea (cases 5 and 7). The abdomen is often distended and tender. Laboratory findings show a leucocytosis of 20 - 40 thousands per c.c., an elevated serum bilirubin and, of course, the demonstration of virulent strains of *Cl. welchii* in cervical swabs.

## TREATMENT

Before the advent of antibiotics, therapy was mainly local and consisted of douches, such as potassium permanganate, hydrogen peroxide, mercurochrome, or zinc peroxide. Gas-gangrene antitoxin was used but the results were disappointing.[9] Today, therapy consists of killing the organism with antibiotics, attempting to neutralize the toxin with antiserum, treatment of oliguria when present, supportive care, and possibly surgery in specially selected cases.

Most antibiotics have been tried against the clostridium organism, but penicillin in very high dosage was most frequently used in this series (8 million units daily, in divided doses, has been suggested, but if oliguria is present a smaller amount must be given). In our series, *Cl. welchii* showed a sensitivity to most antibiotics, although in 8 of the 10 cases the organism was insensitive to streptomycin; in only 1 case was it insensitive to penicillin. In all cases a variety of other organisms was found in addition to the clostridium. The suggested doses of antisera vary. One regimen[10] is to give 40,000 units intravenously 6 hourly for 8 doses, twice daily for 1 day, and then once daily for 2 days. Another method[11] is to give 50,000 units by the intramuscular or intravenous route 6 hourly for 4 - 6 days. Because of the danger of serum reaction and the uncertainty of its effectiveness, we only use antiserum when there is clinical evidence of activity of the *Cl. welchii* toxins (e.g. gas in the tissues, jaundice, or oliguria). Oliguria is treated on present-day principles, including the use of the artificial kidney, when indicated. Supportive care includes cautious blood transfusion and, when necessary, cortisone, levophed, or digitalis. The most controversial point in the treatment is the place of surgery and diametrically opposite opinions have been expressed in the literature. Mahn and Dantuono[11] curetted most of their cases within 24 - 48 hours, with a mortality of 73%. In our series curettage was not performed, if the diagnosis was known, but if placental tissue was protruding into and through the cervix, this was removed with minimal manipulation. We think that more extensive surgery should be reserved for cases where bleeding is severe or infection is prolonged and worsens in spite of conservative measures.

## SUMMARY AND CONCLUSIONS

1. With the control of most other infections by antibiotics, *Cl. wechii* infection is assuming a relatively greater importance as a cause of serious illness and mortality after abortion. At Groote Schuur Hospital virulent strains of *Cl. welchii* were present and responsible for infection in 1 out of every 50 septic abortions; 10 such cases were encountered in 1 year, 3 being fatal.

2. The 10 cases are described; they illustrate many of the clinical features and the problems encountered in this type of infection.

3. To await laboratory confirmation of the presence of virulent strains might mean a fatal delay. The clinical grounds for suspecting the infection at an early stage, and the necessity for the institution of immediate and vigorous treatment, are discussed.

4. The complications and the methods of treatment are described, and illustrated.

We should like to thank Prof. James T. Louw, Professor of Gynaecology and Obstetrics, University of Cape Town, at whose instigation this review was undertaken, for his encouragement and advice. Prof. A. Kipps and the Department of Bacteriology carried out all the bacteriological investigations and gave valuable advice, which is gratefully acknowledged. Thanks are also due to Dr. J. G. Burger, Superintendent of Groote Schuur Hospital, for permission to publish data about the cases.

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