TREATMENT OF SEPTIC ABORTION

BY

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The correct management of patients suffering from septic abortion presents a gynaecological problem which still awaits an agreed solution; the main controversy lies between the interventionist school, who advise immediate evacuation of retained products of conception from the uterus in most cases, and the non-interventionists, who postpone operation until later in the course of the illness and avoid it altogether if they possibly can. Although this problem has been deprived of much of its urgency by the advent of powerful antibiotic drugs which produce good results when used in conjunction with either form of treatment, it is still desirable to determine which method will the better curtail the patient's illness, with the least possibility of subsequent ill-health and infertility. As a contribution towards this decision, the results of the treatment received by 267 consecutive cases of septic abortion admitted to the West Middlesex Hospital during the five years 1946-50, inclusive, have been analysed and are here presented for consideration.

Definition

The first difficulty which besets the investigator is the necessity of defining accurately what is meant by a septic abortion. For the results of different observers to be comparable a common standard is necessary; yet many writers on the subject, who show no hesitation in tendering categorical advice to their colleagues, never at any time define the entity about which they are prepared to dogmatize. Probably the best definition is "an abortion (the termination of pregnancy before the 28th week, the foetus not being born alive) in which infection of the genital tract with pathogenic organisms occurs at the time of induction, during the expulsive process, or later during the puerperium."

The diagnostic criteria by which such an infected abortion is recognized are:

1. A febrile reaction on the part of the patient following the induction, or during the abortion or puerperium, in which a temperature of 99° F. (37.2° C.) or over is maintained for 24 hours and is not accounted for by any extraneous lesion. A temperature which does not persist for this length of time should not, in the absence of other signs, be taken as evidence of a septic abortion, for an isolated spike of temperature often occurs in the complete absence of infection.

2. The signs and symptoms of intrauterine sepsis, such as an offensive lochial discharge or a subinvolved tender uterus.

3. The signs and symptoms of extrauterine infection in a case of abortion, shown by tender adnexal swellings, consolidation of the parametria, or tenderness on palpating the pelvic peritoneum.

Table I shows that of a total of 2,322 abortions, comprising all cases of threatened, inevitable, complete, incom-

plete and missed abortion, admitted to hospital during this period, 267 (11.5%) were septic in character. This incidence is rather low, as Studdiford (1950) found 38% of 4,129 abortions occurring in New York over the nine-year period from 1940 to 1949 to be septic in nature, while Bishop (1948) reported 17.3% of 1,380 cases of abortion collected between 1942 and 1947 to be infected.

Classification

Different clinical pictures are produced by an abortion as it passes through its successive stages; infection may be superadded to any of these so that there may be recognized:

I. (a) The septic inevitable abortion, in which uterine contractions have led to dilatation of the cervix, and the infected products of conception project into the cervical canal or through the external os. (b) The septic complete abortion, in which all the products of conception have been expelled and the infection is limited to the decidua basalis. (c) The septic incomplete abortion, in which the bulk of the uterine contents have been expelled but some remain behind in the infected uterus. These cases in which the infection remains intrauterine are called Type I cases of septic abortion.

II. The infection which starts in the uterus spreads to other structures in the pelvis, so that inflammation may occur in the Fallopian tubes, ovaries, pelvic peritoneum, parametria, or pelvic veins. These varieties of extrauterine spread constitute Type II cases.

III. Finally, the infection may become extrapelvic, and generalized peritonitis, septicaemia, or pyaemia may occur. These are referred to as Type III cases.

The classification of the 267 cases of abortion into these types is shown in Table I; it will be seen that in 86.5% of patients the infection remained intrauterine, in a further 10.9% it spread beyond the uterus but remained intrapelvic, whilst in 2.6% generalized spread occurred.

It has been necessary to adopt some index to denote the severity of the patient's illness in addition to this anatomical classification. The length of stay in hospital, which might at first seem a suitable guide, is not reliable, for it is often dependent upon a state of anaemia or malnutrition which calls for weeks of hospital treatment quite apart from any gynaecological disease. The index which has been chosen in this analysis is the degree of pyrexia which the patient develops, the temperature of 100.4° F. (38° C.) being arbitrarily chosen as the dividing-line; cases have been considered to be mild if this temperature has not been reached, and severe if it has been attained or exceeded.

Type I Cases: Principles of Treatment

In cases of abortion in which the infection is confined to the uterus the principles which govern its management are twofold, comprising, on the one hand, treatment to combat the infection, and, on the other hand, treatment to control the abortion. The difficulty arises in combining the two regimes of treatment, for a procedure which is beneficial for one is not necessarily so for the other, and may indeed be actually harmful. In all patients sepsis calls for increase of the general resistance, rest to the inflamed part, drainage of the uterine cavity, and the employment of appropriate antibiotic and chemotherapeutic drugs. The abortion requires treatment according to the stage of its development: (a) If inevitable in character no treatment is required when the abortive process is progressing satisfactorily; oxytocic drugs may be needed when no progress is being made, and immediate operative measures may be necessary when bleeding is excessive. (b) If the abortion is complete no active treatment is called for. (c) If the abortion is incomplete, emptying of the uterine cavity is necessary at some time, but should be immediate if the haemorrhage is profuse.

It will be agreed that active treatment directed towards control of the abortion interferes with the rest which the inflamed uterus requires, and must on *a priori* grounds be prejudicial to the rapid and successful elimination of the

TABLE I.—Incidence of Septic Abortions and Their Classification Into Anatomical and Clinical Types

Total No. of abortions	2,322	
No. of septic abortions	267	11.5%
Type I cases	231	86.5%
" II "	29	10.9%
" III "	7	2.6%
Mild cases on admission	115	43.1%
Severe " " " "	152	56.9%

infection, and may indeed encourage its invasion of extra-uterine territory. It should therefore be undertaken only when the danger from sepsis has subsided. This is clearly not possible when excessive bleeding is present, and in this event active control of the haemorrhage should be given priority; on all other occasions immediate operative intervention is not essential, and control of the infection should first be achieved.

In cases in which haemorrhage has to be curbed it should be done with as little local trauma as possible; for evacuation of the uterine cavity, however expertly performed, entails some manipulation, whereby infecting organisms may be disseminated. Is there any other way in which bleeding may be controlled? Experience has shown that when chorionic or placental material becomes lodged in the cervix the tone of the uterine body is inhibited and the haemorrhage increases. The heaviest bleeding seen in cases of abortion often occurs when the cervical canal contains pieces of chorion or placenta in this way, just as during the third stage of labour post-partum haemorrhage occurs when the separated placenta lies in or is pushed into the cervix. Hence the temporary control of haemorrhage by removing cervical chorionic tissue is to be preferred as an immediate measure to evacuation of the uterine body, as it causes less dissemination of infection and does not require the removal of the patient to the theatre and the administration of an anaesthetic. However, in cases in which severe bleeding results from partial detachment of the chorion from the decidua and the cervical canal lies empty, evacuation of the uterus is obligatory, as it is then the best means available for achieving haemostasis.

Other forms of intervention, such as the administration of oxytocic drugs, packing the uterus, and intrauterine douching, are not essential for the abortive process, and as they are all inimical to the treatment of sepsis they should be avoided.

Mode of Treatment of Type I Cases

The patient is admitted to an isolation ward for septic obstetrical and gynaecological cases, where she is nursed by a specially trained staff. She is propped up in bed with several pillows, but a true Fowler position is undesirable because of its immobilizing effect. An accurate medical and gynaecological history is taken and a general examination is first made, to exclude any extraneous cause of the pyrexia.

The abdomen and pelvis are then examined, and the diagnosis is made without the use of an antiseptic lubricant during the vaginal examination, as this will vitiate subsequent cultures of the vaginal swab. A catheter specimen of urine is collected and tested for the presence of urinary infection. A Sims speculum is then passed into the vagina, and a high vaginal bacteriological swab is taken for aerobic and anaerobic cultures. If chorionic material is present in the cervical canal it is gently grasped with sponge forceps and withdrawn. A full blood count and the determination of blood groups are requested from the pathologist, and if the temperature exceeds 102° F. (38.9° C.), or if rigors have occurred, blood is taken for culture.

When bleeding is excessive and the cervical canal is empty the patient is given an immediate blood transfusion if considered necessary, antibiotic therapy as described below is started, and she is transferred to the theatre for evacuation of the uterus when thought to be fit.

In the absence of severe bleeding, pending the bacteriological diagnosis, sulphonamide and penicillin therapy is begun. The technique at present employed at the West Middlesex Hospital is to give 4 g. of "sulphatriad" followed by 2 g. at four-hourly intervals, and 300,000 units of procaine penicillin twice daily. This sulphonamide mixture is used because its constituents—sulphathiazole, sulphadiazine, and sulphamerazine—by virtue of their independent solubilities in the urine and that of their acetyl derivatives, greatly reduce the danger of urinary crystallization, whilst

enabling an adequate total sulphonamide blood concentration to be maintained. Six pints (3.4 litres) of fluid are given in the 24 hours; the urine is kept alkaline by 60 gr. (4 g.) of potassium citrate every four hours; and ferrous sulphate 6 gr. (0.4 g.) three times a day, or a blood transfusion, is given according to the blood picture. Of the 267 cases of septic abortion here reported, 47 (17.6%) required blood transfusion.

When the results of the cultures become available in 24 hours' time, sulphatriad or penicillin, or both, are continued, according to the nature of the infecting organism. Streptomycin in doses of 1 g. daily has been found very efficacious against sulphonamide-resistant *Bact. coli*, and is therefore used empirically when this organism is cultured and there is no clinical improvement after 24 hours' sulphonamide therapy.

Under this regime the patient may progress in one of three directions: (1) The temperature and pulse rate may fall as the sepsis is brought under control. When these have been normal for 24 hours, treatment for the abortion is adopted; if it is inevitable or incomplete in character, evacuation of the uterus is proceeded with. (2) There may be no response to treatment, and the patient's temperature and pulse rate may remain elevated or may rise. This indicates either that the drugs employed are not reaching the infected uterine contents or that the organisms are insensitive to them. The alternative treatments, therefore, are either to evacuate the uterus immediately or to carry out sensitivity tests to further antibiotics. As these latter tests take 24 hours or more to perform, during which time the septic process is increasing and placing the patient's life further in jeopardy, it has been considered unwise to adopt this refinement of therapy, and consequently, if there is no improvement after 24–36 hours' treatment, evacuation of the uterus is then carried out. (3) Severe haemorrhage may recur while treatment for the sepsis is being undertaken. If vaginal examination shows that further chorionic material is present in the cervical canal it is removed; otherwise the patient is transferred to the theatre for immediate evacuation of the uterus.

Sulphonamides and antibiotic drugs are continued after the operation until the temperature and pulse rate have been normal for 24 hours, or until some contraindication to their use arises.

Results of Treatment of Type I Cases

Surgical evacuation of the uterus under general anaesthesia was performed on 215 occasions (93% of Type I cases), being done 123 (57.2%) times after the temperature had subsided, 53 (24.7%) times in the presence of continuing sepsis, and 39 (18.1%) times because of severe haemorrhage. The danger of the operation can be judged from the proportion of cases which reached a temperature of 100.4° F. (38° C.) or above during their post-operative course or which developed extrauterine spread. It will be seen from Table II that, when evacuation was done after control of the sepsis, only 12 cases (9.8%) became severe, with spread occurring in 4 (3.2%), while operation in the presence of continuing

TABLE II.—Proportion of Mild, Severe, and Spreading Cases Following Evacuation of the Uterus in the Presence or Absence of Pyrexia

	Planned Evacuation with Normal Temperature	Planned Evacuation with Pyrexia	Emergency Evacuation Because of Haemorrhage	Total
No. of cases	123 (57.2%)	53 (24.7%)	39 (18.1%)	215
Mild cases post-operatively	111 (90.2%)	26 (49.1%)	21 (53.8%)	158
Severe cases post-operatively	12 (9.8%)	27 (50.9%)	18 (46.2%)	57
Followed by pelvic spread	4 (3.2%)	7 (13.2%)	1 (2.6%)	12
Followed by general spread	—	—	—	—

sepsis was followed by 27 (50.9%) severe cases and spread in 7 (13.2%). When done because of haemorrhage, before control of the sepsis had time to be established, 18 cases (46.2%) had a severe convalescence, and spread occurred in 1 (2.6%). It will be seen that the results obtained in apyrexial cases are much superior.

Although the principles of treatment have remained unaltered it should be appreciated that antibiotic control has become more efficient during the later years of this five-year period; many cases which were evacuated in the presence of sepsis in 1946 would in 1950 have been first rendered apyrexial by larger doses and more efficient drugs. The figures showing an increased incidence of severe cases and of extrauterine spread after operating in the presence of sepsis cannot altogether be ascribed to the hazards of local intervention, and therefore be submitted to accurate statistical analysis, for the persistence of the pyrexia indicates that the infection is due to more virulent organisms less sensitive to antibacterial agents, or more inaccessible to their effects.

Improved results were not obtained by delaying operation for longer than 24 hours once the temperature had fallen to normal as suggested by Browne (1951), who advises a wait of five days before operating. Table III shows that both

TABLE III.—*Proportion of Mild, Severe, and Spreading Cases Following Evacuation of Uterus after Varying Periods of Apyrexia*

	Evacuation after 24 Hours	Evacuation after 2 Days	Evacuation after 3 Days	Evacuation after More than 3 Days	Total
No. of cases ..	53	25	26	19	123
Mild cases post-operatively ..	46 (86.8%)	23 (92%)	23 (88.5%)	19 (100%)	111
Severe cases post-operatively ..	7 (13.2%)	2 (8%)	3 (11.5%)	0	12
Extrauterine spread ..	2	0	1	1	4

severe cases and extrauterine spread occurred in approximately equal proportions whether operative intervention took place after 24 hours' apyrexia or was deferred for two, three, or more days.

Technique of Operation

A brief description of the technique of evacuation of the uterus may be advisable, as it is not considered an operation suitable for the beginner, who should be supervised on many occasions by a senior gynaecologist before being allowed to operate on his own.

The shaved vulva and the vagina are thoroughly dried pre-operatively, and are then painted with 1/1,000 acriflavine in spirit. After catheterization of the bladder the position of the uterus is determined, the cervix is grasped with sponge forceps or a vulsellum, the whole or half hand is introduced into the vagina, and the forefinger is passed through the cervix into the cavity of the uterus. Placental tissue is gently separated from the uterine wall by the finger, whilst the uterus is steadied by the other hand placed on the abdominal wall, and is then withdrawn by ovum or sponge forceps. This manoeuvre is repeated until the uterine cavity is felt to be empty. It is dangerous to pass a uterine sound into the soft uterus for fear of perforation, and this should not be done.

If the os is not dilated enough to permit passage of the finger, graduated dilators may be employed, provided they are passed gently and care is taken not to tear the cervical tissues. It has been stated by some observers that dilatation of the cervix at the time of operation worsens the prognosis. Table IV shows that it had no prejudicial effect upon 87 (40.5%) patients in whom it was used, as their convalescence was no worse than that of 128 (59.5%) patients in whom evacuation was possible without preliminary instrumental dilatation.

TABLE IV.—*Effect of Dilatation of the Os upon the Post-operative Course of the Disease (Type I Cases)*

	Evacuation Alone	Dilatation and Evacuation	Total
No. of cases ..	128	87	215
Mild cases post-operatively ..	82 (64.1%)	76 (87.4%)	158
Severe cases post-operatively ..	46 (35.9%)	11 (12.6%)	57
Extrauterine spread ..	7 (5.5%)	5 (5.7%)	12

Curettage of the uterus is unnecessary, and may do harm by opening up lymphatic channels, while oxytocic drugs may disperse organisms along them by inducing uterine contractions. Uterine packing will impede drainage of the cavity and should be avoided, together with douches, which disseminate infection along the tubes into the peritoneal cavity. Bleeding is best controlled by complete evacuation of the uterus; if necessary gentle bimanual compression may be applied.

Type II Cases

These patients, in whom spread of infection has occurred into the pelvic tissues, show evidence of salpingo-oophoritis, pelvic cellulitis, pelvic peritonitis, or pelvic phlebitis, the last condition perhaps spreading to involve the veins of the legs. They are managed in the same way as Type I cases, being nursed in an upright position in bed with a kaolin poultice applied to the lower abdomen to relieve pain if necessary, and being given sedatives to ensure a good night's sleep. Aperients or enemata are sometimes required. A correct fluid balance is maintained and antibiotic drugs are given subject to bacteriological control. If there is an inadequate response to therapy, sensitivity tests are carried out against sulphonamides, penicillin, streptomycin, "aureomycin," chloramphenicol, and propamide, when the cheapest drug to which the organism is sensitive is administered. Except in the presence of severe haemorrhage due to retained products, local intervention is interdicted in these cases.

Usually the infection is brought rapidly under control with this treatment. Sometimes an abscess forms and requires drainage; if in the pelvis it should be opened by incision when a fluctuant swelling becomes palpable per vaginam or per rectum, whilst if it rises into the abdomen its outline should be mapped with a skin pencil, and laparotomy and drainage should be performed if it continues to enlarge despite treatment.

Among the 29 cases encountered during the five-year period, operative drainage of a pelvic abscess was indicated on two occasions, once by posterior colpotomy and once by laparotomy. Blood transfusions are often necessary for these cases.

Type III Cases

In these patients, in whom further spread of the infection has occurred, general peritonitis, septicaemia, or pyaemia is present. Treatment is given along the same lines as the other types of cases, with skilled nursing, fluids administered by the intravenous route if required, and appropriate antibiotic therapy. Pyaemic abscesses should be opened and drained if the procedure is surgically feasible.

Follow-up Treatment.—When patients with extrauterine infections responded favourably to treatment and felt fit for discharge from hospital they were sometimes found on pelvic examination to have enlarged or thickened uterine adnexa, not tender on palpation, with a uterus either fixed and displaced in position or with its mobility impaired. These patients were given a course of intrapelvic diathermy twice weekly, which was continued until the pelvic organs felt normal on palpation, or until maximum resolution of the masses had occurred. The first two or three menstrual periods after discharge from hospital were often profuse and painful, but the normal menstrual rhythm and loss were speedily regained in most cases.

Criminal Interference

It is notoriously difficult to obtain reliable histories from patients suffering from septic abortion, and it is often suspected that criminal interference, which the patient will not acknowledge, has taken place. It is considered that some light may be thrown on this problem if the clinical progress of cases of confessed interference is compared with that of cases in which it is denied. Table V shows that the pro-

TABLE V.—*Relation of a History of Criminal Interference to the Severity of Infection*

	Interference Acknowledged	Interference Denied	Total
No. of cases	79	188	267
Mild cases on admission ..	39 (49.4%)	76 (40.4%)	115 (43.1%)
Severe cases on admission	40 (50.6%)	112 (59.6%)	152 (56.9%)
Type II cases	9 (11.4%)	20 (10.6%)	29
„ III „	6 (6.3%)	2 (1.1%)	7

portion of severe cases, and of cases complicated by extra-uterine spread, is almost the same in the two groups. This may suggest that criminal intervention has little influence on the course of the disease, or, alternatively, that most cases are subject to such interference; probably the latter contention is the more correct, and most cases of septic abortion can be considered to be criminal in origin. The reverse, however, is not true, as a history of instrumental interference is sometimes given by patients suffering from complete or incomplete abortion in whom there is no clinical evidence of sepsis during the whole course of their illness.

The Causal Organism

Identification of the infecting organism was possible in most cases, although it was sometimes surprising (and disappointing) that no growth could be obtained from cultures of high vaginal swabs even when the infection was known clinically to be severe. This lack of bacteriological aid illustrates the necessity for beginning empirical antibiotic treatment before the results of cultures become available.

The types of organism present are shown in Table VI, along with the proportion of mild and severe cases and those developing extrauterine spread in association with each

TABLE VI.—*Relating the Severity of the Disease to the Infecting Organism*

Organism	Cases		Classification				Type II Pelvic Spread	Type III General Spread
			Mild *		Severe			
	No.	%	No.	%	No.	%		
Staph. pyogenes	19	7.1	6	31.6	13	68.4	2	0
Staph. sapro- phyticus ..	44	16.5	22	50.0	22	50.0	10	0
Haemolytic streptococcus	14	5.2	3	21.4	11	78.6	2	1
Non-haemolytic streptococcus	27	10.1	13	48.1	14	51.9	0	1
Anaerobic streptococcus	5	1.9	2	40.0	3	60.0	0	0
Bact. coli ..	99	37.1	42	42.4	57	57.6	11	5
Cl. welchii ..	4	1.5	1	25.0	3	75.0	0	0
No growth ..	55	20.6	26	47.3	29	52.7	4	0
Total ..	267	100	115		152		29	7

organism. Where mixed growths were obtained, the causal pathogen alone is indicated. It will be seen that *Bact. coli* was present in 99 (37.1%) cases, 57 (57.6%) of which were severe in character, while spread occurred in 16 (16.2%).

Staphylococci were cultured in 63 (23.6%) cases, 19 being the pyogenic strain and 44 the saprophytic. Both strains gave rise to a high proportion of severe cases (68.4% and 50% respectively), and to 12 cases (19.1%) of extrauterine spread.

The haemolytic streptococcus was encountered on only 14 (5.2%) occasions; 11 (78.6%) of these infections, however, were severe, and spread occurred in 3 (21.4%). The haemolytic streptococcus Group A was isolated from only 3 patients.

Cl. welchii and anaerobic streptococci were also encountered very occasionally (4 and 5 times respectively) as the causative organisms in this survey.

Mortality

During these five years two patients have died, giving a septic abortion mortality rate of 0.75%, and a total abortion mortality rate of 0.09%. The mortality rates reported by observers in recent years are shown in Table VII. These are in no sense comparable, for different workers employ different criteria of sepsis or quote none at all. FitzGibbon (1947), Purdie (1947), and Stallworthy (1948) include only inevitable, incomplete, and septic cases among their total numbers of abortions, while Studdiford (1950) also includes complete and missed cases (but only up to the 20th week of pregnancy), and Davis (1950) combines all types, including threatened, therapeutic, ectopic, and molar abortions. The two deaths in the present series occurred as follows.

1. The patient submitted to an intrauterine injection of "lysol" and was admitted in a moribund condition with signs of general peritonitis and septicaemia. She died shortly after admission. At necropsy two large perforations of the uterus were found, with an extensive area of sloughing extending up the posterior wall of the uterus from the cervix. The infecting organism was *Bact. coli*.

2. The patient was admitted suffering from an incomplete abortion, and, as she appeared quite fit and was free from clinical evidence of sepsis, evacuation of the uterus was performed. Twelve hours later she collapsed and died. There were no post-mortem signs of injury, and the pathologist considered she had died from septicaemia.

Conclusions

There is no doubt that the immediate prognosis of septic abortion has been considerably improved by the introduction of blood transfusions and antibacterial drugs into gynaecology, whatever other form of treatment is employed in addition. Although the mortality rate has been reduced to below 1%, fatal cases will continue to be seen from time to time because criminal interference may cause severe internal damage; and the postponement of legitimate therapy, owing to a desire for secrecy, makes it too late for the patient to be rescued.

After reviewing the treatment received by these 267 cases of septic abortion, and the associated low mortality rate, it is felt that the division of gynaecologists into two schools—the interventionists and the non-interventionists—is to be

TABLE VII.—*Mortality Rates*

Author	Years	No. of Abortions		No. of Deaths		Mortality Rate	
		Total	Septic	Total Abortions	Septic Abortions	Total Abortions	Septic Abortions
FitzGibbon	1919-26	1,952	—	6	—	0.31%	—
Davis	1935-50	2,665	—	6	—	0.26%	—
Ramsay (1948) ..	1937-46	—	1,430	—	47	—	3.29%
Stallworthy	1939-48	803	85	1	1	0.12%	1.18%
Studdiford	1940-9	4,129	1,579	—	17	—	1.08%
Bishop	1942-7	2,317	239 out of 1,380	10	10 (8*)	0.43%	4.18% (3.35%*)
Purdie	1945	481	—	2	—	0.42%	—
West Middlesex cases ..	1946-50	2,322	267	2	2	0.09%	0.75%

* Corrected figure.

deprecated. In fact, any fixed routine of treatment for these cases is undesirable, and it is preferable for each case to be treated individually on its merits according to recognized surgical principles. Thus if haemorrhage is severe it should primarily be arrested by the appropriate surgical measures, while if sepsis is the dominant feature it should first be treated by rest and antibacterial drugs. If this is unsuccessful in the presence of the source of infection after a trial period of 36 hours, the uterine contents should be removed. The convalescence is likely to be more prolonged and severe in these patients, but in the end a satisfactory result will be obtained. It is of no advantage to wait for a longer period than 36 hours of sulphonamide and antibiotic therapy before intervening, for if the infection by then shows no sign of responding to drugs it is unlikely to do so later, unless sensitivity tests are carried out, which are too time-consuming to be done whilst awaiting operation. After evacuation of the uterus, and in Type II and Type III cases, they are invaluable in dealing with resistant organisms.

When the infection has been eliminated, the abortion, if it is inevitable or incomplete, should be treated by evacuation of the uterus. This is best done 24 hours after the temperature and pulse rate have reached a normal level, for although no evidence has been forthcoming that infection may arise in an incomplete abortion when evacuation is delayed, as Stallworthy (1948) suggests, there is definite evidence that improved results are not obtained by delaying operation for longer than this period. If the abortion is complete, as recognized by the character of the lochia and the involution of the uterus, evacuation is unnecessary.

Owing to the efficiency of the modern drugs now available, it is agreed that good results are achieved by both the interventionist and the non-interventionist schools; it is claimed, however, from the present analysis, that the severity and duration of the patient's illness and the mortality rate are reduced to a minimum when a fixed regime of treatment is avoided and operation, if carried out at all, is done at the optimum time for each individual patient. In this series this procedure has involved operation in 93% of cases of intrauterine infection, and the best results have been obtained in those patients in whom the sepsis was controlled before operation.

Modern drugs and blood transfusions are the basis of the successful treatment of patients suffering from septic abortion; most cases, however, still require a planned operation performed by an expert gynaecologist to ensure the best chance of a short illness and the reasonable expectation of future pregnancies to follow.

Summary

An analysis is presented of 267 cases of septic abortion among 2,322 cases of abortion of all types occurring at the West Middlesex Hospital during the five years 1946-50 inclusive.

The septic abortions are classified into three types, dependent upon the anatomical extent of the infection, and into mild or severe clinical cases according to the degree of pyrexia.

The treatment required for an abortion in its different stages and the treatment of sepsis are discussed in so far as they may be complementary or antagonistic.

The results of evacuation of the uterus, which was performed in 215 (93%) cases of uterine infection, are described. Evacuation was performed in 123 (57.2%) cases when the temperature had subsided, in 53 (24.7%) in the presence of continuing sepsis, and in 39 (18.1%) because of severe haemorrhage.

Improved results after evacuation were obtained in the apyrexial cases.

The length of apyrexia before operation did not influence the post-operative convalescence.

The technique of evacuation of the uterus in septic cases is described.

There was no difference in the clinical course of disease in patients who confessed to criminal instrumentation and those who denied it.

Bact. coli infections occurred in 37.1% of cases; staphylococci were present in 23.6%, and haemolytic streptococci in only 5.2%.

A septic abortion mortality rate of 0.75% was obtained, with an overall abortion mortality rate of 0.09%.

Thanks are due to my colleagues of the obstetric and gynaecological department who have collaborated in this survey; special appreciation must be accorded to the sister and nurses of the isolation ward (H2), without whose skill these results would not have been possible.

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POST-MORTEM DIAGNOSIS OF AIR EMBOLISM BY RADIOGRAPHY

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The post-mortem diagnosis of air embolism depends upon the demonstration of bubbles of air within the blood vessels and within one or more of the heart cavities. Bubbles of gas may be found in the blood vessels within a relatively short period after death, through the action of spore-bearing, gas-producing organisms. Bubbles of gas may also pass into the blood vessels through manipulation of the viscera during necropsy (Simpson, 1942). It is therefore necessary to exclude both these possibilities before air embolism can be diagnosed.

Burn (1934a) has shown that spore-bearing gas-producing organisms—for example, *Clostridium welchii*—are capable of invading the tissues of guinea-pigs and rabbits within 5-48 hours after death if the animals are kept at 25° C. In a further study, similar organisms were cultured from human necropsy specimens of the internal organs. The post-mortem interval in these cases was from 1 to 4 hours (Burn, 1934b). Consequently, anaerobic bacteriological examinations are an important part of the post-mortem examination.

In order to prevent air bubbles passing into the blood vessels during dissection it is necessary to ligate all vessels before sectioning. Shennan (1935) has recommended the following procedure in cases of suspected pulmonary air embolism: a small incision is made in the parietal pericardium; the sac is then filled with water and the right ventricle is opened *in situ*. The escaping air can then be detected. However, this procedure has limitations. Unless the main arterial and venous trunks are ligated before incision of the heart, air may, through handling of the organ, enter the blood vessels. Moreover, blood samples for bacteriological culture