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2,665 CASES OF ABORTION

A CLINICAL SURVEY

BY

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This review is based on a series of consecutive cases of abortion under my care at St. Giles' and Dulwich Hospitals, London. The two hospitals are relatively closely situated in a working-class suburb, with approximately the same number of gynaecological beds, under the same consultative direction. They therefore offer excellent opportunity for comparison of different methods of treatment, for these can be carried out under fairly comparable conditions. During the past 15 years (with the exception of a wartime interval) advantage has been taken of this opportunity to assess the value of varying treatments, and it was the primary object of the present investigation to determine the relative merits of active and passive treatment in cases of incomplete abortion, and to settle, if possible, some of the issues of this perennial source of argument. A second object was to compare the potency (if any) of different chemotherapeutic agents in infected cases. For these purposes a detailed analysis was made of enough cases to reduce percentage error to a reasonable minimum—the actual number recommended by our statistical adviser was 2,500, and this has been only slightly exceeded, the cases being almost evenly divided between the two hospitals concerned. The results of this analysis are given below, and it is suggested that they are definite enough to be of therapeutic significance.

During the course of this investigation various secondary factors—age, parity, morbidity, etc.—had necessarily to be considered. These proved of sufficient interest to merit analysis, and they are classified below under the appropriate headings.

Age

The average age of the patients was 29 years, the youngest being 17 and the oldest 49. This corresponds with the figures given by Gellert (1926), who found the average age between 20 and 30 years; only 3% of his cases were younger than 20 years. Similarly, the report of the Children's Bureau of New York (1934) gives an average of 25 to 29 years.

The age incidence seems at first sight surprisingly high, but this is explained by the fact that abortion is much commoner among married women, and that the average age of marriage is fairly high—the Registrar-General's report for 1945 gives it as 24 years. Again, however, the type of patient is important. At St. Mary Abbots Hospital, which admits a large number of "luxury trade" women—manicurists, hairdressers, West End shop assistants, dancers, etc.—the average age of 100 consecutive abortion patients was 23 years, 14 being below 19 years. This type of girl, attrac-

tive, away from home, and fascinated by "glamour," is much more liable to abortion than the more respectable working-class girl. She is also, *pari passu*, much more subject to dangerous complications (see below).

Civil State

Of the 2,665 women 2,350 were married, 303 were single, and 12 widows. This is in accord with McIlroy's (1929) report, that abortion is most frequent amongst the married, and with the statistics of Roesle (1929), who states that one-sixth of all his cases were unmarried. Richelt, on the other hand, found that 65% of his large series were unmarried.

These figures seem to vary considerably, not only in different countries but in different parts of the same country or even town. In rural communities, and in the purlieus of wealthy districts, the proportion of single girls is higher. At Paddington Hospital nearly 50% of all full-term deliveries in the large maternity unit are in single women, and a similar proportion exists amongst the abortion cases. In the two hospitals under consideration, however, convention again shows its influence, the great majority of the patients being "respectable" married women.

Analysis of the cases on this basis shows that the question of wedlock is an important one from the clinical aspect, for the complication rate is much higher in illegitimate abortions. In the present series of 315 unmarried women severe complications—gross haemorrhage, virulent infection, pelvic abscess, etc.—were present in 43 (14%) of the cases, while the corresponding figure for the 2,350 married patients was only 6%. This difference is *not* due, as is generally supposed, to later abortion, with its increased risk, in the single women, for the average duration of the pregnancy in these patients was 12.4 weeks, as against 12 weeks for all the cases. The most likely explanation lies in a combination of several factors—the inexperience of these girls, their isolation, and the desperate nature of their predicament.

Period of Gestation

The average period of gestation was 12 weeks. This corresponds roughly with the figures given by Roesle (1929) and Kopp (1936). The former found 60% of abortions occurring at the third and fourth months, the latter 58% between the second and third months. The main reason is that the average woman waits for two missed periods before being quite certain of her pregnancy. It then takes

another two or three weeks for her to make the necessary "contacts" to terminate the pregnancy.

The great majority (87%) were between ten and fourteen weeks pregnant, and there was wide variation in the remainder, from the earliest at five to the latest at 26 weeks. In two cases the patient was not pregnant at all, but had attempted criminal abortion in the belief that she was.

Period in Hospital

The average stay in hospital was thirteen days, the longest being fourteen weeks, and the shortest one day. These figures are somewhat deceptive, for 86% of the women went home eight or nine days after admission. The high average is provided by the very long periods of hospital treatment in infected and other complicated cases.

Previous Abortions

In 253 (9.5%) of the cases there was a history of one or more abortions, details of which are given in Table I.

TABLE I.—*Previous Abortions (253 Cases)*

No. of Abortions	No. of Cases	No. of Abortions	No. of Cases
1	189 (74%)	5	3 (1.2%)
2	38 (15%)	6	1 (0.5%)
3	15 (6%)	7	1 (0.5%)
4	5 (2%)	8	1 (0.5%)

These figures do not correspond with those given by Kopp (1936), who found that 25% of cases had had one previous abortion, 30% two, and 34% three; but her patients belonged mainly to the more prolific section of the population of New York, and are hardly comparable with our own.

Previous Full-term Pregnancies

Of the patients 669 (39%) had one or more children; this series is further analysed in Table II.

TABLE II.—*Previous Full-term Pregnancies (669 Cases)*

No. of Children	No. of Cases	No. of Children	No. of Cases
1	209 (31%)	7	3 (0.5%)
2	202 (30%)	8	7 (1%)
3	90 (14%)	9	3 (0.5%)
4	86 (13%)	10	6 (1%)
5	49 (7%)	11	3 (0.5%)
6	13 (2%)	12	2 (0.3%)

Roesle (1929) found that 10% of all his cases had one child, 7% two, 7% three, and 10% four or more. Kopp's analysis similarly gives a less steeply descending scale than my own, the ratio being 9:1, 8:2, 6:3, 4:4, 3:5, 2:6, the first figures applying to cases and the second to children.

It will be observed that roughly one-third of all the women had one or more children, and that two-thirds of these had either one or two, with a rapidly descending scale for the rest. The explanation of this is somewhat obscure. It might lie in the fact that sterility is a common post-abortion complication, or in the similar decrease in fertility following the second or third child. Another explanation may be that the somewhat crude circumstances attendant on criminal abortion might make many women prefer to go through with the subsequent pregnancy.

Spontaneous or Induced Abortion

The figures given by different authorities on this subject are variable. In their large individual series the indicated percentages of spontaneous abortion are given by du Puy

(1932) as 58, Plass (1936) as 34, Kopp (1936) as 28, Sangmeister (1943) as 25, and Berle (1942) as 18. Parish (1939) found that 25% of 1,000 cases were spontaneous, 48% admitted illegal interference, the causation in the remaining 27% being unknown. The Derby City Hospital (1939) statistics give about 40% as due to criminal interference, while the corresponding figure given by the Society for the Provision of Birth Control Clinics (1939) is 27%. Of 3,000 cases investigated by the Joint Council of Midwifery (1939) 23% admitted to induced abortions, and the Interdepartmental Committee on Abortion (1939) came to the conclusion that 40% of the abortions in this country may be due to illegal interference.

My own view is that all these figures are vitiated by the fact that they depend on two fallacies: one, the very doubtful veracity of such patients, and, two, the individual opinion of medical officers. Most of the latter are psychologically inexperienced, and do not realize that a direct inquiry is practically useless. It is remarkable how often a patient who has denied interference will react affirmatively to a sudden accusation; and my own impression is that the great majority—perhaps 90%—of all abortions are induced in one way or another. The testimony of ward sisters, who are in the closest personal contact with the patients, bears this out; for most of them, when asked for their opinion, will corroborate this impression.

Methods of Procuring Abortion

The methods employed to procure abortion vary widely. The great majority were self-induced, either medicinally or by douching. Purgatives, "female pills," quinine, and herbal preparations comprised most of the former, but a curious specialty of the district was a tablespoonful of powdered ergot taken in a wineglassful of hot port.

The douche apparatus was usually a simple enema syringe, but, as it was found too difficult to insert the nozzle into the cervix, most patients preferred to use a "whirling spray" the top of which had been unscrewed. In both cases the injected solution was usually hot soapy water, with varying added quantities of lysol or other antiseptic. Sticks of slippery-elm bark were not very popular, being regarded as ineffective—due, probably, to the difficulty of inserting them into the cervix. They were indeed usually recovered from the vagina, and occasionally from the urethra or bladder. Knitting-needles, crochet hooks, and similar instruments were used only by a very few desperate patients.

Midwives and others acting as professional abortionists usually preferred a vaginal or uterine douche to more active measures, but some "stirred up" the uterine contents with a long sound. Curettage—usually without anaesthesia—was occasionally resorted to by some medical practitioners, but these generally preferred intrauterine paste injection.

Paradoxically, all but one of the deaths and the most severe complications in this series followed douching and not the theoretically more dangerous intrauterine manipulations. This corresponds with the figures cited in the Memorandum presented by the London County Council to the Interdepartmental Committee on Abortion (1939), which show that in nearly half of the 55 fatal cases in which there was known interference some kind of douching or uterine injection had been employed, while instruments were responsible for only 12. The explanation no doubt lies in the comparative infrequency of instrumental abortion, the dangers of which must be disproportionately high compared with those of douching. In the latter the degree of pressure employed is probably the important factor.

Injection introduced gently can be rapidly isolated by local uterine reaction, but fluid injected under the considerable tension of a vigorously squeezed enema syringe easily strips up the decidua and penetrates the sinuses, or passes directly through the tubes to the peritoneal cavity.

Types of Abortion

These are classified in Table III. Of the 95 cases of threatened abortion 61 continued with the pregnancy, 9 aborted completely, and 25 incompletely, the last all necessitating curettage. Of the 62 cases of inevitable abortion

TABLE III.—Types of Abortion

Type	No. of Cases
Threatened	95 (3.6%)
Inevitable	62 (2.3%)
Complete	192 (7.2%)
Incomplete	2,250 (84.4%)
Therapeutic	28 (1.0%)
Ectopic	32 (1.2%)
Molar	6 (0.2%)

44 aborted completely and 18 were surgically evacuated. The incomplete abortions were completed spontaneously in 771 cases (34.3%) and by operation in the remaining 1,479 cases.

Morbidity

The great majority of the cases showed some rise of temperature (Table IV). This was practically always initial, and usually subsided after evacuation—spontaneous or operative—of the retained products.

TABLE IV.—Highest Recorded Temperature

Temperature	No. of Cases
Normal	431
99° F. (37.2° C.)	913
100° F. (37.8° C.)	794
101° F. (38.3° C.)	341
102° F. (38.9° C.)	87
103° F. (39.4° C.)	77
104° F. (40° C.)	16
105° F. (40.6° C.)	6

In 431 of the patients the temperature was normal throughout. Included in this number were all the spontaneous, most of the therapeutic, and many of the threatened abortions. This high figure does not contradict the suggestion of the high incidence of criminal interference, for, though Taussig's dictum that practically every case of induced abortion shows some rise of temperature is undoubtedly true, there remain many afebrile cases in which such interference is undoubted and even admitted. A temperature of 101° F. or over is, however, diagnostic of an attempt to procure abortion, and it is noteworthy that such a rise can occur from abortion following the simple self-administration of abortifacient drugs or from local manipulations which leave the pregnancy undisturbed.

The cause of the fever in the great majority of cases is local in the uterus, as shown by the immediate fall after spontaneous or operative completion of the abortion. The pathology is an acute endometritis, secondary either to the introduction of an external infecting agent or to the presence of necrotic retained products. In the more heavily infected cases the pyrexia varies with the degree and rapidity of septic extension, from the prolonged remittance of pelvic abscess to the fulminating rigors of septicaemia; all types were present in this series. The temperature chart is, in fact, one of the most valuable adjuncts in the diagnosis of the infective complications of abortion, for most varieties give a characteristic record, from the low remittance of uterine sepsis and the higher remittance of pelvic abscess to the "Matterhorn" record of general infection.

Bacteriology

Swabs were taken from the vagina, cervix, and uterus in 50 consecutive cases. (It was impossible at first to avoid contamination of the uterine swab, but later this difficulty was mainly overcome by protecting it with a surrounding glass cannula. The results, however, were so similar in both series of cases that it was found unnecessary to separate them.)

In only two cases were the swabs sterile on culture. In all the rest a copious growth was obtained, the predominant organisms being *Staphylococcus albus* and *Bact. coli*, with smaller numbers of several of the commoner bacteria in many cases (Tables V and VI)

TABLE V.—Cultures from the Genital Tract (50 Cases)

	No. of Cases
<i>Staph. albus</i> alone	11
<i>Staph. albus</i> + <i>Bact. coli</i>	10
<i>Staph. albus</i> + diphtheroids	4
<i>Bact. coli</i> alone	4
Diphtheroids alone	2
Diphtheroids + <i>B. proteus</i>	1
<i>Staph. albus</i> + <i>Cl. welchii</i>	2
<i>Str. (N.H.)</i> + <i>Bact. coli</i> + Doederlein's bacillus	2
<i>Staph. albus</i> + <i>Corynebacterium xerosis</i>	2
<i>Str. (N.H.)</i> + diphtheroids	1
<i>Staph. aureus</i> (N.H.) alone	1
<i>Staph. aureus</i> (N.H.) + diphtheroids	1
<i>Str. viridans</i> + <i>Str. faecalis</i>	1
<i>Str. viridans</i> + <i>Staph. aureus</i> (N.H.)	1
<i>Str. (N.H.)</i> + <i>Cl. welchii</i>	1
<i>Bact. coli</i> + diphtheroids + Doederlein's bacillus	1
<i>B. proteus</i> alone	1
<i>Str. haem. (C.)</i> , <i>Staph. albus</i> , + <i>Bact. coli</i>	1
<i>Staph. albus</i> , <i>Bact. coli</i> , + <i>C. xerosis</i>	1
No growth	2

TABLE VI.—Cultures from the Genital Tract (50 Cases)

	No. of Cases
<i>Staph. albus</i>	35
<i>Bact. coli</i>	23
Diphtheroids	18
<i>Str. (non-haemolytic)</i>	6
<i>Cl. welchii</i>	3
Doederlein's bacillus	3
<i>B. proteus</i>	3
<i>Corynebacterium xerosis</i>	3
<i>Staph. aureus</i>	3
<i>Str. viridans</i>	2
<i>Str. faecalis</i>	1
<i>Str. haemolyticus G</i>	1
No growth	2

This high incidence is significant of active infection, for, though the vagina is more heavily contaminated in the later weeks of pregnancy, it is relatively "clean" during the first three months, when the bacteriology corresponds roughly with that of the non-pregnant organ (Miller, 1933). In the latter Eeles (1925) found non-haemolytic streptococci in only 20% of nulliparae and 25% of multiparae, with a correspondingly low percentage of staphylococci, *Bact. coli*, *B. proteus*, diphtheroids, and Gram-positive bacilli. No *Cl. welchii* or haemolytic streptococci were present in any of his 50 cases. The figures given by Duncan (1947) in 133 consecutive patients admitted for hysterectomy are as follows: 90 smears were negative and 44 positive, the latter showing Gram-negative cocci and bacilli and Gram-positive cocci; only 46 of the group had positive cultures, the majority of which were *Bact. coli*. Even immediately before delivery the vaginal contamination is considerably less than during abortion, as shown conclusively by Taylor and Wright (1930), who in 1,123 cases found *Staph. albus* in 58%, *Staph. aureus* in 1%, Doederlein's bacillus in 35%, diphtheroids in 25%, coliforms in 31%, and various types of streptococci in 5%. The difference in the bacteriology of the uterus is greater, for, though all uterine swabs in the abortion series gave a heavy mixed growth on culture, it has been shown by several workers that the puerperal cavity investigated at caesarean section is sterile in 50% of cases (Harris and Brown, 1928; Armstrong and Burt-White, 1929; Gundel and von Oettingen, 1930).

The cervix showed the greatest difference. In almost all the abortion cases it was heavily infected, while in the course of another investigation I found the cervix sterile in 50% of third-day puerperas, with relatively poor growth in the remainder; in only 25% were rich cultures obtained. (There was no difference in the incidence of virus infection, for inclusion bodies were universally absent.)

Complications

The complications and related conditions encountered in this series are shown in Tables VII, VIII, IX, and X.

TABLE VII.—Gross Infection

	No. of Cases
General:	
Septicaemia	5
Pyæmia	1
Local:	
Local severe uterine infection	41
Parametritis	25
Salpingitis	19
Pelvic peritonitis	16
General peritonitis	4
Pelvic abscess	13

TABLE VIII.—Other Complications and Multiple Abortion

	No. of Cases
Other complications:	
Gross hæmorrhage (Hb below 60%) necessitating blood transfusion	68
Pyelitis	9
Femoral thrombosis	3
Pulmonary embolism	1
Cerebral embolism	1
Hysteria	1
Insanity	1
Drug gastritis	3
Vaginal burns	2
Vaginal necrosis	2
Vaginal laceration	2
Multiple abortion:	
Twins	3
Triplets	2
Rupture of uterus	4
Acute appendicitis	1

TABLE IX.—Associated Conditions

	No. of Cases
General:	
Influenza	8
Mitral stenosis	6
Coryza	5
Pneumonia	3
Syphilis	3
Scarlet fever	1
Coincident ectopic pregnancy	1
Local:	
Retroversion	13
Fibroids	13
Prolapse	5
Acute gonorrhoea	4
Primary chancre	1
Ovarian cyst	1

TABLE X.—Molar Pregnancy

	No. of Cases
Carneous mole	3
Hydatidiform mole	2
Chorion epithelioma	1

Retroversion

There were 13 cases (0.5%) in which the abortion was associated with retroversion. The period of gestation varied from eight to twelve weeks, with an average of ten weeks. Three of the patients gave a history of one previous abortion and one of two, while nine had at least one living child. In nine cases the patient had aborted incompletely before admission. The uterus was replaced in the remainder, but in only one case was this successful in producing continuation of the pregnancy. Acute retention of urine occurred in two patients, both of whom subsequently miscarried. It is difficult to be certain, particularly when abortion is already in progress, how far it has been caused by incarceration, and in only four of these cases was actual impaction definitely present. But even if all the abortions were due to this factor, the frequency of retroversion as a general cause remains almost negligible. The difficulty of conserving such pregnancies once bleeding has begun is also well demonstrated in these figures.

Injuries

Rupture of the uterus occurred in four cases. In one, an inexperienced surgeon extracted a piece of what he thought was omentum during the course of a therapeutic abortion. This proved to be a very fatty appendix epiploica, and at laparotomy (A. D.) the corresponding hiatus was found at the border of the pelvic colon. The intestinal mucosa itself was intact, but there was a perforation at the lowest part of the body of the uterus on the right side of the cul-de-sac. The tear had incidentally produced a complete rupture of the uterine artery (a rare accident), with profuse parametric hæmorrhage. This was fairly easily controlled by suture, and the patient made a rapid and uninterrupted recovery. In two other cases the perforation had been followed by traction on the small intestine, a loop of which presented at the vulva. In the first the bowel was almost undamaged, and was returned through the uterine tear into the abdomen. In the second there was extensive damage with strangulation, necessitating resection and anastomosis. This was carried out *in situ*, and the repaired gut replaced in the same way. Both patients were too shocked to withstand laparotomy, but both made a complete recovery. In a further case the rupture was self-produced.

Mrs. A, aged 38, a 4-para, was admitted as an emergency case with the history that during an attempt to induce abortion by means of a syringe she had felt a pain of extreme intensity in the abdomen at the moment she was injecting the contents of the syringe. She was nearly three months pregnant, and had had some hæmorrhage that morning. Seen four hours after the injection, she was collapsed and in great pain. Temperature was 97° F. (36.1° C.), the pulse 110 and thready, and the colour good. There was some loss per vaginam, the abdomen was tense, very tender all over, but not rigid. The signs of initial shock soon disappeared, but were rapidly replaced by those of internal hæmorrhage, and operation six hours later revealed an abdomen full of blood. This was scooped out and was found to contain the foetus in its sac with the placenta, both lying quite free. The uterus was raised, to expose a perforation on the anterior wall high up, 2 cm. long, and bleeding freely. A rapid supravaginal hysterectomy was carried out with continuous blood transfusion, and the abdomen closed with interrupted silk-worm-gut sutures taking in all layers. (This rapid method of abdominal closure is ideal in these cases; the scar seems to hold at least as well as the more orthodox layered one, and acute herniation is not more common.) The patient made a good recovery, except for an intra-abdominal abscess which had subsequently to be drained.

Careful subsequent questioning of this very frank patient led to the conviction that this was not a case of perforation by direct trauma, but of explosive rupture due to a forcible injection. There was a long clean hole too extensive and clear-cut for a perforation, and absence of the mucosal protrusion which seems characteristic of the former. The foetus and placenta seem rather to have been literally blown out of the uterus than squeezed through the narrow rent by muscular contraction.

Ectopic Abortion

There were 32 cases of extrauterine gestation in the series—an incidence of 1.2%. Of these, 28 were married and 4 single. The average age was 33 years, the youngest being 18 and the oldest 44.

Two patients had one child, three had 2 children, three had 3, two 4, one 6, and one 12. Only two of the patients had previously aborted, each of them twice. The period of gestation varied from 5 to 18 weeks, with an average of 7 weeks for all cases. The gestation was in the right Fallopian tube 15 times and in the left 17, and there was a coincident intrauterine pregnancy in two cases. The mortality rate was 0.3%, only one patient dying at operation.

Mortality

There were six deaths in the series—a mortality rate of 0.26%. This figure is considerably less than that given in most foreign statistics. Freudenberg (1932), for example, gives a figure of 1.2% for Germany, and Taussig (1936), collecting statistics from a variety of countries, obtained an average of 2.1%, and assumes a mortality of somewhat less than 2% for the United States.

The discrepancy is a considerable one, but is probably explained by the exclusion from our own figures of patients dying at home under local medical care, and of the not inconsiderable number of cases of sudden death. Two of the latter were seen at necropsy, but as they were not admitted they are not included in this hospital series.

The cause of death was *Cl. welchii* septicaemia (2 cases), traumatic vaginal and uterine necrosis with pelvic abscess (2 cases), traumatic perforation of the uterus with secondary peritonitis (1 case), and staphylococcal septicaemia (1 case).

The physical signs and post-mortem changes found in these cases are characteristic, and are almost exactly paralleled in the large series described by Hill (1936) and by Dawbarn and Williams (1938). A point of interest is the high average length of gestation, which was 15 weeks, compared with the average of 12 weeks for the whole series. This corroborates the well-known fact that the dangers of abortion rise proportionately with the period of gestation, with considerably added risk after the third month.

Of great interest is the actual cause of death in those patients dying suddenly during an attempt to procure abortion. One such patient, found dead in a bathroom with an enema syringe by her side, showed no fatal post-mortem pathology, the only positive finding being some soap solution in the uterus, which also contained an undisturbed foetus of about 14 weeks.

The actual injection of fluid is apparently unnecessary for a fatal issue, for cervical stimulation alone can cause sudden death. Michel and Morin (1922) have reported the case of a woman who, under the mistaken impression that she was pregnant, attempted abortion with an enema syringe, but died before any fluid had been injected; and cases have been recorded of women dying during the course of an ordinary vaginal examination (Mondor, 1936).

It is possible that reflex sympathetic shock may be the fatal factor in some of these cases, and the recent discovery of a rich submucous nerve plexus surrounding the external cervical os (Davis, 1938) provides considerable support for this theory. It is probable, however, that death in the majority of cases is due to cerebral embolism of injected fluid, for there are several reports of such patients dying in convulsions. These are usually epileptiform (Möller, 1922), but they are commonly followed, if death is not immediate, by signs of gross cerebral damage. Thus one of Neidhardt's (1915) cases showed hemiplegia, facial palsy, and unequal pupils; and similar signs were present in cases reported by Walcher (1926) and others. Cerebral symptoms are also seen in some of the cases which recover (Burgerhout, 1926), and I recently saw a woman in whom epileptiform convulsions were followed by transitory hemiplegia shortly after a paste injection.

The pathology in these cases is that of air embolism, and confirms the clinical view that the symptoms are due to multiple capillary gas embolism in the lungs or brain. It is true that the normal post-mortem intravenous formation of gas may sometimes be extremely rapid, but in two cases seen by me there had certainly been no time for this process, and it may be accepted that the air found in these

and other cases was introduced, and not the natural gas of putrefaction. Confirmatory evidence is provided by the histological appearance of the affected organs, which show small multiple perivascular necroses.

In spite of these findings, however, it appears that air alone is not responsible for the changes described, but that it must be injected in soap-bubble form to cause embolism. Parade (1929) has shown experimentally that intravenous injection of a moderate amount of air is relatively safe, but that in combination with soap it is fatal; and a patient in the present series injected enough air (under considerable pressure) into her uterus to produce abortion, but without any apparent metastatic effect. It is true that soap and extraneous fat have rarely been chemically identified in the affected organs, but the amount necessary to provide bubble covering is so minute that it might easily escape ordinary analysis. On the other hand, Müller-Hess and Hallermann (1932) believe that the solid constituent of the injected material is the sole embolic factor, and Brack (1932) found paste emboli in the lungs in two cases.

Lipiodol, which is not easily miscible with air, may similarly be embolic to the lungs (where it can occasionally be demonstrated radiologically), but never, apparently, with fatal result. The accidental intravasation of this material is a fairly common phenomenon, and as its employment is frequent and universal the absence of distant complications indicates that it is relatively safe in intravenous injection. Other theories have been advanced to explain the peculiar changes of injected soap solutions. Balthazard (1920) suggests that strong emulsions change the haemoglobin into alkaline haematin, causing death by asphyxia, but I was unable to effect this change *in vitro*. Környey (1934) states that the soap may cause haemolysis and also destroy the capillary walls, allowing of extravascular permeation and direct damage to the surrounding tissues, which are also rendered ischaemic by the same process. There is, however, no histological proof of this theory, and the same applies to the suggestion made by Haselhorst and Schaltenbrand (1933) that the basic process is a rapid and universal clot formation.

On the whole, therefore, the most reasonable theory of the cause of death in these cases is that of a multiple minute air-bubble embolism. This explains the infrequency of pure air or pure fat embolism, and the danger of their combination. That this danger is a considerable one has repeatedly been stressed by a variety of authors, and the reported deaths from embolism following abortion are almost universally due to the intrauterine injection of some sort of soap solution. (The uterine paste employed by many abortionists is composed of olive oil, cocoa butter, caustic soda, and potassium iodide, and so is essentially a soap. Otherwise a simple household soap emulsion is used, some tincture of iodine being added as an antiseptic.) Englemann (1932) reports 17 deaths from this cause, and the literature abounds with records of similar fatalities, the result of either therapeutic or illegal abortion.

It may be assumed, therefore, that, though a few of these patients die suddenly from reflex sympathetic inhibition of the cardiac or respiratory centres, the result of cervical plexus stimulation, the cause of death in the majority is some form of soap-bubble embolism—cerebral, pulmonary, or coronary.

The presence of a direct venous pathway to the brain has been demonstrated by Batson (1940), who found a free anastomosis between the pelvic and perivertebral veins, material injected into the former being easily conveyed via the latter to the dural sinuses. This by-pass from the caval

pathway is facilitated by a rise in intravenous tension, and it is easy to understand how it may equally be opened under the pressure—often 100 mm. Hg—exerted by the Higginson syringe. It is unnecessary, therefore, to postulate patency of the foramen ovale to explain the mechanism of pelvic-cerebral embolism.

Treatment

The uterus was evacuated immediately in all cases of gross haemorrhage, except for the necessary interval for resuscitation and blood transfusion where required. Other incomplete abortions were treated with hot enemata and oxytocics, with operative evacuation within a few hours if these failed or were incompletely successful. An exception was made in those cases with high temperature, general peritonitis, or other signs of gross sepsis, when operation was delayed until improvement in the patient's general condition allowed of safe intervention.

The argument of active versus passive treatment of infected incomplete abortion has provided endless but inconclusive controversy. The statistics collected by Taussig from several clinics in many countries endorse the view of most teachers that expectant treatment is the safer, but the more recent figures given by Corston and Stallworthy (1947) and by Purdie (1947) indicate that immediate evacuation is apparently as safe. Our own experience confirms the latter finding. The duration in hospital of 251 consecutive cases treated by immediate operation was 9.5 days, while that of a control series of 338 cases treated expectantly was 13 days. This discrepancy may be explained partly by the varying degrees of experience of the operators concerned. Operative evacuation of an infected uterus is a delicate, highly dangerous procedure, and when performed by junior house-officers, who are so often delegated to this inconvenient task, the results are inevitably bad. In the hands of the skilled obstetrician, however, accidents are rare and the advantages considerable. The infecting agent is removed, the abortion is properly completed, and the period of convalescence is materially shortened.

The employment of an injection of oxytocin direct into the uterus is another factor which has materially modified the older view of the greater safety of conservative treatment. The contraction so produced materially reduces the risks of infective embolism, of perforation, and of gross haemorrhage, and makes evacuation so much the safer. The disadvantages of the method are the possibility of shock and the reactionary atony which occasionally follows the contractions. The former is rare and usually slight, and the latter is easily controlled by bimanual compression and the intravenous injection of ergometrine. Packing the uterus is unnecessary.

Chemotherapy

Various types of sulphonamide were given to 373 patients. The average stay in hospital of these cases was 13 days, while that of a control group of 200 untreated cases was 12 days—a difference of no statistical significance. These figures correspond with those of Studdiford (1939) and confirm the impression that chemotherapy here is largely useless, except in a few cases of specific susceptible infection. This is hardly surprising, in view of the mixed and very varied bacteriology generally present (Studdiford, 1939), and it is probable that the indiscriminate routine administration of sulphonamides to all cases of abortion is at least misdirected.

Peritonitis

There were four cases of true general peritonitis, as distinct from the common local pelvic peritonitis with associated "peritonism." Two were treated conservatively

and both recovered, while a third died following laparotomy and drainage. This confirms the general experience that opening the abdomen in these cases serves mainly to introduce fresh organisms into an already virulently infected cavity, and that drainage of the meagre quantity of semi-purulent exudate usually present is both harmful and unnecessary. On the other hand, Falk and Blinick (1947) found that medical treatment, including sulphonamides and penicillin in varying dosages and routes of administration, fluid balance, and the use of small and large repeated blood transfusions, serums, vaccines, various non-specific therapies, oxytocics, Wangenstein drainage, etc., were equally of no avail in their relatively large series of cases.

There would thus appear to be little choice between simple drainage and conservative treatment, so that the bias must necessarily be in favour of the latter. There remains, however, the more radical treatment of hysterectomy. This once popular method has recently been revived, with good results, by Falk and Blinick, but it is at best a desperate measure, and the radical removal of uterus, tubes, and ovaries which it involves would make most surgeons hesitate before embarking on so formidable a procedure in a desperately ill and generally young patient. However, in one of our cases, that of a 4-gravida in fair condition, in whom perforation was certain, the operation was completely successful, and one must conclude that there is a definite though necessarily limited indication for its use in post-abortion peritonitis.

Pelvic Abscess

There were 13 cases of pelvic abscess. Three resolved under medical treatment, two ruptured spontaneously (one per rectum, the other per vaginam), and eight were drained by operation. This was invariably colpotomy, even when the abdomen had been opened for other complications, as occurred in two of the cases, and it is undoubtedly the ideal method of drainage. It is easy, moderately safe, and provides excellent gravity drainage, and it should more often replace the relatively inefficient abdominal methods commonly adopted, all of which necessarily involve intra-peritoneal spread of the pus, apart from the added risk and discomfort of a major operation.

Therapeutic Abortion

There were 28 cases in the series, an incidence of 1% (Table XI). The indications were cardiac disease (6), chronic nephritis (5), molar pregnancy (5), pulmonary tuberculosis (3), epilepsy (2), disseminated sclerosis (2), pernicious vomiting (2), hydronephrosis (1), malignant hypertension (1), and carcinoma of cervix (1).

The indications were those usually accepted as necessary for therapeutic induction, with the possible exception of pulmonary tuberculosis, but the difficulty of obtaining suitable sanatorium accommodation for these patients is usually an overriding factor. Two further conditions—rubella in early pregnancy and high multiparity—have recently been added to our list of indications, but there are none in the present series. Several patients with temporary mental instability were referred by psychiatrists, but this was invariably transient, the result of unwanted pregnancy, and interruption was refused.

Methods of Therapeutic Abortion

The uterus was evacuated vaginally in 18 cases and abdominally in ten. Intrauterine paste injection was used in two cases, both patients being too ill for more direct

TABLE XI

No.	Civil State	Age	Weeks of Amenorrhoea	Previous Abortions	Previous Full-term Pregnancies	Indication	Method
3841	M	32	12	1	4	Mitral stenosis	D. and c. and vaginal sterilization
4017	M	25	20	0	1	"	Abdominal hysterectomy
4149	M	30	8	1	2	"	Paste injection
4182	M	25	14	0	1	"	D. and c.
2741	M	26	8	1	0	"	"
4806	M	40	6	1	1	Paroxysmal tachycardia	"
8380	M	27	12	0	1	Chronic nephritis	"
2043	M	30	24	0	1	"	Abdominal hyst. and sterilization
2906	M	34	24	0	1	"	Abdominal hyst.
2496	M	33	26	0	0	"	"
3777	M	21	10	1	0	"	D. and c. and vaginal sterilization
5898	M	40	20	1	10	Missed abortions.	Vaginal sterilization
3860	M	29	20	0	0	"	Paste injection
4786	M	39	7	1	3	"	D. and c.
4198	M	35	16	0	0	Hydatidiform mole	Vaginal evacuation
4306	S	31	24	0	0	Chorion epithelioma	Panhysterectomy
3287	M	28	10	0	1	Pulmonary tuberculosis	Abdominal hysterectomy
3234	M	36	18	0	1	"	"
2338	S	22	8	0	0	"	D. and c.
4179	M	31	12	0	0	Epilepsy	Abdominal hyst. and sterilization
4401	M	38	10	0	4	"	D. and c.
4345	M	25	20	0	0	Disseminated sclerosis	Abdominal hyst. and sterilization
1978	M	39	10	1	4	"	D. and c.
2615	M	26	8	0	1	Pernicious vomiting	"
7225	M	22	8	0	2	"	"
3995	M	33	10	0	3	Hydronephrosis	"
3213	S	24	24	0	0	Malignant hypertension	Abdominal hyst.
13	M	42	12	1	4	Carcinoma cervix	D. and c.

procedures. General anaesthesia with thiopentone-cyclopropane was usually employed, except in patients with cardiac failure or extensive pulmonary tuberculosis, when heavy premedication and local procaine injection was the method of choice. In vaginal evacuation oxytocin is withheld until adequate dilatation of the cervix, which it renders spastic. The special dilator used (see Fig.) is

The graduated dilator used.

tapered to the end, and has the advantage over the non-graduated Hegar type in minimizing cervical laceration. With the largest necessary dilator remaining in place, 10 units of oxytocin are injected direct into the uterine body, and firm retraction awaited. This usually takes place within three minutes, the amniotic sac being extruded intact and with very little haemorrhage. The sequence is by no means invariable, but it approximates most nearly to the mechanism of spontaneous abortion, and even when broken allows of considerable reduction of the profuse haemorrhage which is the invariable accompaniment of non-medical evacuation.

Oxytocin contraction also reduces the risk of instrumental perforation, and allows of curettage when the uterine contents have been fragmented. Extrusion may be similarly aided during abdominal hysterotomy: the contraction

produced minimizes the blood loss of the incision and expresses the gestation sac intact after some minutes.

Sterilization was carried out in five cases at the time of the abortion, in two by the vaginal route. This method is comparatively easy, and is eminently suitable for cardiac cases, but haemorrhage from "catspaw" laceration in the soft uterus may be troublesome, and the operation is best performed after an interval of some weeks.

Summary

The average age of 2,665 abortion patients was 29 years, the youngest being 17 and the oldest 49; 2,350 of the women were married, 303 were single, and 12 were widows.

The average period of gestation was 12 weeks, 87% of the cases being between 10 and 14 weeks pregnant.

The average stay in hospital was 13 days, but 86% of the patients went home eight or nine days after admission, the high average being due to the relatively few complicated cases.

A history of previous abortion was obtained from 9.5% of the patients: 74% of these had had one, 15% two, 6% three, 2% four, 1.2% five, and 0.5% six, seven, and eight respectively.

Of the patients 29% had one or more children: 31% of these had one, 30% two, 14% three, 13% four, 7% five, 2% six, 0.5% seven, 1% eight, 0.5% nine, 1% ten, 0.5% eleven, and 0.3% twelve.

The incidence of spontaneous abortion is low. Probably 90% of the cases were induced, in the majority by the patient herself.

The method of choice for procuring abortion was vaginal douching under pressure. Professional abortionists employed intrauterine douching or catheterization. A small minority used slippery elm and similar foreign bodies.

Of the clinical types of abortion 3.6% were threatened, 2.3% inevitable, 7.2% complete, 84.4% incomplete, 1% therapeutic, 1.2% ectopic, and 0.2% molar.

There was a rise of temperature in 84% of all cases. This was usually moderate and initial, subsiding rapidly after completion of the abortion.

Genital infection was present in all but two of 50 consecutive cases examined bacteriologically. Cultures yielded a copious growth, the predominant organisms being *Staph. albus* and *Bact. coli*. Inclusion bodies were not identified in any case.

Gross infection was the commonest complication. There were five cases of septicaemia, one of pyaemia, and 118 with severe local septic involvement. Of these 41 had severe metritis, 25 parametritis, 19 salpingitis, 16 pelvic abscess. Gross haemorrhage, necessitating blood transfusion, occurred in 68 cases. Retroversion was present in 13 cases, showing the comparative rarity of the association. There were four cases of traumatic rupture of the uterus.

Of the abortions 32 were ectopic, an incidence of 1.2%. In two a coincident intrauterine gestation was present.

There were six deaths, a mortality of 0.26%. Three patients died from *Cl. welchii* septicaemia, two from burns (the result of local corrosive injection), and one from *Staph. aureus* septicaemia. A further patient (not included in the series) died from soap-bubble cerebral embolism. It is suggested that this last is the mechanism in most sudden fatalities.

Treatment was mainly directed, when the abortion was inevitable or incomplete, to evacuation of the uterus, either medically or surgically. Active treatment was apparently superior to conservative, as shown by the lessened period in hospital and incidence of complications. Chemotherapy was largely useless in the presence of infected retained products, except in a few cases of specific susceptible infection. (Penicillin was not available for this series, but survey of a more recent group in which it was administered as routine shows it to be similarly ineffective.) Peritonitis remains the most fatal complication, and it is probable that radical operation is the treatment of choice. For pelvic abscess colpotomy provides the most direct route for drainage and the shortest convalescence.

Therapeutic abortion was performed 28 times, combined with sterilization in five cases. The indications were invariably gross

physical disease: in no case referred for psychological reasons was the mental factor regarded as strong enough for interruption of the pregnancy.

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Before the war the Department of Scientific and Industrial Research produced a series of twelve leaflets, "Methods for the Detection of Toxic Gases in Industry." Leaflet No. 7, "Carbon Monoxide," has just been completely revised and now describes a new, simpler, and more accurate method of detection developed during the war at the Royal Aircraft Establishment. Dangerous concentration of carbon monoxide may occur in many industries, particularly steelworks, foundries, gas works, coke oven plant, and wherever gas producers and water gas plant are used. It is most dangerous when formed unknowingly, as by the improper use of geysers, boilers, braziers; in mine explosions ("after-damp"); in the smoke from fires; and in the exhaust gases from internal combustion engines. In the new test a sample of air is drawn through an indicator tube which is stained by the carbon monoxide. The length of the stain gives the concentration present in the air. Complete instructions for carrying out the test are given in the leaflet (H.M.S.O. Price 6d., 15 cents U.S.A., by post 7d.).

HABITUAL ABORTION

PROPHYLACTIC VALUE OF PROGESTERONE PELLET IMPLANTATION

BY

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For the purpose of this study "habitual abortion" is defined as "idiopathic" abortion before the end of the fifth month of pregnancy, occurring on two or more consecutive occasions immediately preceding the pregnancy, in which pellet implantation has been used. Abortion is regarded as "idiopathic" if no recognized organic cause has been found. "Primary" habitual abortion refers to the condition in which all previous pregnancies have resulted in abortion. "Secondary" habitual abortion indicates that one or more previous pregnancies have proceeded beyond the 28th week.

Material

The present series consists of 45 patients who have received an implant of six 25-mg. pellets of progesterone during the pregnancy under consideration. The implantation was carried out according to the technique described elsewhere (Bishop, 1949).* No other treatment or precautionary regime was prescribed. These 45 cases represent all the patients with a history of habitual abortion treated by this method at the Chelsea Hospital for Women since 1947. It has been possible to obtain direct information concerning the outcome of the treated pregnancy in each of these cases.

Of these patients, 33 fall into the group of "primary" habitual abortion and 12 into the group of "secondary" habitual abortion.

Implantation was performed as early as possible—that is, as soon as the patient was referred to us for treatment. In most cases this was before the tenth week of pregnancy.

Results

TABLE I.—Results

No. of Successive Abortions Immediately Preceding the Treated Pregnancy	No. of Patients	Outcome of Treated Pregnancy		Percentage Successful Results
		Success	Failure	
A. Primary Habitual Abortion				
2	20	18	2	90
3	8	7	1	88
4 or more	5	3	2	60
B. Secondary Habitual Abortion				
2	8	6	2	} 100
3	1	1	0	
4 or more	3	3	0	
C. Primary and Secondary Habitual Abortion Combined				
2	28	24	4	86
3	9	8	1	89
4 or more	8	6	2	75

*It should be emphasized that progesterone pellets, unlike other compounds suitable for implantation, tend to extrude unless implanted deeply: in this series the pellets were implanted beneath the deep fascia of the thigh.