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Date

TRANSIENT BACTEREMIA DUE TO SUCTION ABORTION: IMPLICATIONS FOR SBE ANTIBIOTIC PROPHYLAXIS

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INTRODUCTION

Bacterial endocarditis continues to be a devastating disease. Even though we have learned about the antibiotic treatment of bacterial endocarditis, it continues to be associated with significant morbidity and mortality as well as the staggering costs of prolonged hospitalization. Therefore, it is of the utmost importance to attempt to prevent this disease whenever possible, particularly in patients whose conditions predispose them to contract subacute bacterial endocarditis, i.e. patients with congenital, rheumatic, arteriosclerotic or syphilitic intracardiac deformities and those with intracardiac prostheses.

Earlier work by other investigators has demonstrated that the prophylactic use of antibiotics can reduce the incidence of transient bacteremia in patients undergoing dental extractions, and by this mechanism, hopefully, decrease the risk of subacute bacterial endocarditis (14).

It is important to identify the medical and surgical procedures in which microorganisms indigenous to the site of manipulation gain access to the bloodstream. Transient bacteremia has been demonstrated following dental and gingival manipulation, urologic instrumentation, massage of infected tonsils and boils

and sigmoidoscopic examinations (18,23). The more routine the procedure, the more important it is to know the incidence and character of the transient bacteremia induced.

With the advent of liberalized abortion laws there has been a sudden upsurge in the number of women obtaining suction abortion. This study investigates the incidence and character of transient bacteremia following suction abortion. It has been the practice in abortion clinics, including the Dana Clinic and the Women's Health Services in New Haven, to administer prophylactic antibiotics to any woman with questionable heart sounds or a significant history of cardiac disease. A careful search of the literature reveals no published studies on the incidence of transient bacteremia after abortion by suction curettage. The literature on transient bacteremia following any type of manipulation of the healthy female genital tract is scant, consisting of three studies of the puerperal period with reported incidences of bacteremia varying from 0 to 2.3% to 11% (7,3,36).

METHODS

Subjects. Fourteen subjects aged 19 to 35 years who were to undergo first trimester abortion by suction curettage at the Dana Clinic volunteered to participate in the study. None of these women had systemic disease, a history of heart disease or murmurs detected on routine physical examination by the attending physician, nor had any of the subjects received antibiotics within the preceding ten days. These subjects had bimanual pelvic examinations one to three hours before the abortion procedure.

Four healthy non-pregnant women of child-bearing age who volunteered to have their blood sampled served as control subjects.

Blood sampling procedure. The patient's forearm was scrubbed with bedatine solution and wiped with 70% alcohol. A 21-gauge scalp-vein-infusion set was introduced into a forearm vein and secured with tape. A volume of 7.5 cc. of blood was withdrawn into a sterile, heparinized syringe and 1.5 cc. of blood was flushed back into the infusion set to heparinize the line. The syringe was removed and replaced with a second heparinized syringe. Of the withdrawn sample, 5cc. were injected into a bottle of thioglycollate broth and 1cc. was saved in the syringe to be pour-plated in the laboratory.

Timing of samples. To demonstrate that the bloodstream was free of bacteria prior to the abortion procedure a baseline sample was drawn from each experimental subject before the procedure was begun. Blood samples were then withdrawn from the heparinized infusion set at the following times: during cervical dilatation, during suction curettage, at the conclusion of the abortion procedure (hereafter referred to as 0 minutes), at 2 minutes, 5 minutes, 10 minutes, 20 minutes, 30 minutes and when the patient was ready to dress, usually 35 to 60 minutes after the abortion procedure had been completed. Samples were drawn from the control subjects at similar intervals. According to this schedule 10 samples were to be obtained from each subject.

Laboratory procedures. The pour plates made from 1cc. of each blood sample mixed with nutrient agar were incubated aerobically at 37°C. for 48 hours.

The thioglycollate bottles were incubated for seven days at 37°C., at which time each bottle was subcultured to blood agar plates for aerobic incubation and chocolate agar plates for anaerobic incubation. (The chocolate agar was made by adding 15% sheep cells to Proteose #3 Agar [Difco, Lab, Detroit, Michigan] while at a temperature of 95°C. This was further enriched by adding 1.2% Supplement B and 1 mg/ml. menadione). Plates were incubated for 48 hours. The chocolate agar plates were incubated in anaerobic jars with Gas Paks (Baltimore Biological Laboratories, Cockeysville, Maryland).

Colonies were selected from plates showing growth, and in most cases identification was accomplished by gram stain, morphology, colonial appearance and oxygen requirements. In the case of Propionobacterium acnes (anaerobic diptheroids), additional identification measures included catalase, indole and nitrate tests. Corynebacterium vaginale was confirmed by reverse satellite technique, using Streptococcus pneumoniae (35). The methods proved sufficient for identification of the organisms isolated.

Data Analysis. The culture results were examined to determine the incidence of bacteremia, its time of onset, and its duration. The organisms isolated are considered both in terms of the frequency with which they were isolated and the isolation of more than one species from a subject. Because of the small size of the study formal statistical analysis of the data was not considered to be appropriate.

RESULTS

A total of 154 blood samples for culture were obtained from fourteen volunteer subjects undergoing suction abortion and four control subjects. Nine of the fourteen abortion patient subjects had baseline blood samples that yielded no bacteria on culture. A total of seventy-one blood samples were obtained from these nine women. Four of the fourteen experimental subjects had organisms isolated from their baseline blood cultures. A total of 35 blood samples were drawn from these women. The culture results from these samples will be reported separately from the results of the nine patients in the study group. The ten blood specimens of one experimental subject were inadvertantly destroyed and are lost from the study. Thirty-eight blood samples were obtained from the four control subjects. (Table I).

Of the 144 blood samples cultured in the laboratory, 107 cultures (74.3%) were positive for diptheroids. Table II shows that diptheroids were found with increasing frequency as the study progressed and were present in all the cultures of blood drawn from the control subjects. The possible significance of these diptheroids was analyzed separately. Blood cultures which grew diptheroids only are not reported as positive in the following analysis of culture results.

Of the nine experimental subjects in the study group, seven (77.7%) developed at least one positive culture (Table III). The number of samples per subject yielding positive cultures ranged from one of eight (12.5%) to five of 10 (50%) and three of five (60%).

The first positive cultures occurred as early as the time of dilatation and as late as the last sample which was obtained forty to sixty minutes after the end of the abortion procedure (Table IV). Four patients had positive cultures from samples drawn during the abortion procedure or within five minutes of its conclusion. In three patients the first evidence of bacteremia occurred twenty minutes or longer after the conclusion of the suction curettage.

Three of the experimental subjects in the study group (Patients B, E, and I, Table III) had intermittently positive cultures. For example, Patient I, from whom ten blood samples were obtained, had a positive blood culture at the time of dilatation. Her next sample, drawn during the suction curettage, was negative. The three samples drawn at the conclusion of the suction abortion and at two and five minutes post abortion were all positive. The next three samples were sterile but the final culture was positive.

Bacteremia was present even at the final period of study in three subjects.

Eight microorganisms were isolated from the blood samples of the experimental subjects: Fusobacteria (3 patients), Peptostreptococcus (2 patients), Microaerophilic streptococcus (2 patients), Peptococcus (2 patients), Lactobacillus (2 patients), Veillonella (1 patient), Corynebacterium vaginale (1 patient), Bacillus species (1 patient), (Table V).

Four subjects with positive cultures had more than one organism isolated: Patient D had four organisms recovered from her cultures, Patient I had three, and Patients B and E each had two organisms isolated. (Table VI).

The four abortion patient subjects whose baseline blood cultures were positive had bacteremia with: Alpha streptococcus (Patient L); Lactobacillus, Peptostreptococcus, and Peptococcus (Patient G); Lactobacillus (Patient J); and tiny gram negative rods which were not viable on subculture and could not be identified (Patient F). (See Table VII).

The organisms isolated from the baseline blood samples of these four patients were isolated from at least one subsequent blood sample in each patient. Alpha streptococcus was isolated from eight of nine blood samples drawn from Patient L who was asymptomatic at the time of the abortion.

Organisms different from the organism isolated from the baseline sample were isolated from later samples in Patients

F and L. In Patient L later samples grew Peptococcus, Veillonella, and a microaerophilic gram positive coccus. Peptococcus was isolated from one of Patient F's later blood samples (Table VII).

A pattern of intermittent positive and negative cultures was found in these four patients who had positive baseline cultures and is similar to the pattern described above for the study group subjects.

The thirty-eight blood samples obtained from the control subjects yielded no growth when cultured except for the diptheroids mentioned above.

The pour plates from both the experimental and control subjects repeatedly demonstrated no growth.

DISCUSSION

Transient bacteremia occurred during or soon after a suction abortion in seven of the nine study group subjects. The result of this study indicate that transient bacteremia is a common sequella of suction abortion. The bacteremia was detected within five minutes of the completion of the procedure in just over half of the patients closely relating the bacteremia to the instrumentation of the uterus. However, in one patient, the first positive culture was obtained more than thirty minutes after the suction curettage was finished. This suggests that seeding of the blood stream may occur across the raw surface of the endometrium even after instrumentation has stopped.

The bacteremia, as demonstrated by positive blood samples, was intermittent in three patients which might indicate clearing of organisms from the blood stream and reseeding. On the other hand it could be due to a large dilution factor. If only a very small number of organisms had gained access to the blood stream, they might not be detected in every 5cc. sample of blood.

The latest time for drawing blood samples for this study was determined by the time at which the subject was ready to dress and go home, generally forty to sixty minutes after the completion of the abortion procedure. Positive cultures were

grown from three samples drawn at this time. The bacteremia following suction abortion is thus shown to exist as long as one hour after the procedure and might possibly last longer.

The microorganisms isolated from the blood of the women who were undergoing suction abortion are all normal genital-tract flora (Table VIII). This supports the conclusion that they entered the blood stream from the genital tract.

The organisms isolated were predominately anaerobes. Recent investigation has demonstrated that anaerobes are commonly found among the normal flora of the genital tract (16). Anaerobic endocarditis is a rare event and usually afflicts severely debilitated patients (13,15). Consequently, anaerobic bacteremia may not be a major concern in the prevention of subacute bacterial endocarditis in an abortion clinic population.

More than one organism was isolated from the blood of four study group subjects. Anaerobic isolates from the female genital tract are typically mixed cultures and may contain faculatative organisms, particularly Lactobacillus (16). These observations support the theory that the genital tract may be the site of origin of the organisms isolated from the blood of these abortion patients.

Organisms were isolated from the baseline blood samples, drawn before the initiation of the abortion procedure, in four of the experimental subjects. The organisms isolated from the

baseline blood samples of these subjects were also recovered from later samples as well suggesting that these patients were bacteremic with the onset of the bacteremia preceding the abortion instrumentation. It is unusual to find such a large incidence of positive blood cultures in patients with no known focus of infection (37). All patients at the abortion clinic undergo bimanual pelvic examination one to three hours prior to the abortion procedure. It is possible that the manipulation of the gravid uterus and the vaginal and cervical mucosa during the bimanual exam caused the bacteremia in these women.

Alpha hemolytic streptococcus was isolated from eight of nine blood cultures obtained from Patient L including the baseline culture. She was asymptomatic. However, she had many large uterine fibroids and both the pelvic examination and the abortion procedure may have been more traumatic in this patient. Table VIII demonstrates that the Alpha hemolytic streptococcus is found among the normal flora of the genital tract in some women. It is possible that the manipulation of the uterus at the time of the bimanual examination may account for the presence of Alpha hemolytic streptococcus in Patient L's blood. An Alpha hemolytic streptococcal bacteremia following pelvic examination or an abortion procedure would pose a very real risk to the patient with intracardiac deformities.

The results of the blood cultures of the abortion patient subjects of this study strongly suggest that endogenous genital tract organisms gain access to the bloodstream of women having abortions. The enterococcus, although not isolated from the blood of any of the women in this study, is found in the vaginal and cervical flora in approximately 25% of women with a range of 4% to 49% (Table VIII). Enterococcus could thus be introduced into the bloodstream of the suction abortion patient and could predispose to the development of enterococcal endocarditis.

Diptheroids were grown from 107 of the 144 blood samples cultured in the laboratory in this study. All thirty-eight of the cultures drawn from the control subjects grew only diptheroids. Contamination is one possible explanation for the recovery of diptheroids from so many cultures. Diptheroids are ubiquitous members of the human normal flora and are continually being shed from skin and hair. These microbes are more resistant to exposure and drying than many other members of the normal flora. For these reasons they are frequently encountered as a contaminant in the laboratory (43).

The significance of diptheroids cultured from clinical specimens remains uncertain. Anaerobic diptheroids are among the anaerobes most frequently encountered in culture but are rarely the apparent cause of infection. During a forty-five month survey of all anaerobic cultures at the Massachusetts

General Hospital, Bornstein et al. recovered anaerobic diptheroids from seventy-four cultures but in only one case were they able to verify a pathogenic role (5). Reviewing all blood cultures growing anaerobes during a fifteen month period at the Mayo Clinic, Wilson found Proprionibacterium acnes in the blood cultures of 151 patients but only one of these patients was felt to have a significant bacteremia.

Diptheroid endocarditis has been reported but is rare and is usually associated with open-heart surgery (13,20,21,27). In the present study diptheroids have been regarded as laboratory contaminants. The possibility that they represent, in some instances, a transient diptheroid bacteremia cannot be excluded. However, diptheroid bacteremia would not appear to present a major threat of endocarditis to the abortion-clinic population.

The initial study design projected a subject sample of twenty-five to thirty-five abortion patients from each of whom ten cultures were to be obtained. Many of the clinic patients were unwilling to enroll in the study even though the purpose as well as the procedure for the study was explained carefully to each woman individually. The reason most often given by the women who refused to participate in the study was a squeamishness about needles and blood-drawing.

Fourteen women volunteered to be study subjects. Although no formal investigation was made into the motivation of the women who did volunteer for the study, they appeared to the investigator to fall into two groups. Several of the women who volunteered had experience working in a hospital as either nursing or laboratory personnel. Two of the volunteers were noted by the clinic social workers to be experiencing more of an emotional crisis than the average abortion patient. The social workers were surprised when these women volunteered to be in the study. Perhaps, the sense of making a contribution to others by participating in this study may have filled a psychological need for these women.

Although ten specimens were to be drawn from each subject, specimens were missed in several patients either because the needle became dislodged or the vein compressed due to patient activity. If the patient consented to have the needle replaced, the sampling was resumed. Table III shows which samples were obtained from each subject.

The pour plates made from lcc. of the blood from each sample were intended to allow quantitative analysis of the bacteremias demonstrated. However, these pour plates were persistently without growth. This probably indicates the bacteremias, demonstrated by the positive subcultures from the bottles of innoculated thioglycollate broth, were the result of a very small

number of organisms gaining entry into the blood. The pour plates were incubated aerobically. Our primary concern was to document the presence or absence of the organisms most frequently implicated as pathogens in subacute bacterial endocarditis. In retrospect, judging from the predominance of anaerobic organisms isolated, it appears that anaerobic incubation of our pour plates may have provided additional information.

To our knowledge this is the only study of the incidence of transient bacteremia post elective suction abortion. The abortion procedure is comparable to a normal obstetric delivery since the raw surfaces of the uterus are exposed to whatever bacterial flora harbor in the genital tract. There are three studies of puerperal bacteremia available for comparison.

In 1958 Burwell and Metcalfe (7) reported an unpublished study by Ramsey and Swartwout at the Boston-Lying-in-Hospital in which a series of seventy-four blood cultures from seventeen women were obtained at intervals during and after labor. Not one of these cultures was positive. Burwell does not describe the culture techniques or whether any cultures were incubated anaerobically. Nevertheless, Burwell felt that seeding from the raw lining of the uterus into the bloodstream was theoretically so plausable that he still recommended antibiotic prophylaxis for cardiac patients.

Redleaf and Fadell (36) published a larger study in 1959. They obtained blood cultures from 101 consecutive patients taking one specimen immediately after delivery and a follow-up culture on the morning of the first postpartum day. Incubation was both aerobic and anaerobic. The authors observed an 11% incidence of bacteremia and concluded that, although few pathogenic organisms were isolated, the hazard of bacteremia was sufficient to warrant antibiotic prophylaxis for cardiac patients.

By the mid-sixties antibiotic prophylaxis was frequently given during labor and the puerperium in the management of the parturient cardiac patient. Increasing awareness of the pitfalls of overzealous use of antibiotics led Baker (2,3) to raise once again the issue of the incidence and significance of asymptomatic puerperal bacteremia and to undertake a study with a still larger patient sample. In his first study 1,779 blood cultures were obtained from 396 patients at delivery and at 12 hours, 24 hours, 48 hours, and 72 hours postpartum. A transient becteremia was detected in 1.5% of the patients studied. Noting that in dental extraction studies the postextraction bacteremia occurred minutes after the procedure and rarely lasted longer than a few hours, Baker repeated his study altering the specimen schedule to obtain samples immediately after delivery of the placenta and at 15 minutes, 30 minutes, 12 hours, and

24 hours postpartum. Two thousand five hundred and eighty-three blood cultures were drawn from 519 patients. Bacteremia was demonstrated in twelve patients, a 2.3% incidence.

In our study of bacteremia following suction abortion seven out of nine patients, 78%, developed positive cultures, a significant increase over the 11% observed by Redleaf and Fadell and the 2.3% observed by Baker and the absence of bacteremia observed by Ramsey and Swartwout. This difference in the incidence of bacteremia obliges us to reconsider the assumed analogy between suction abortion and normal labor and delivery. Our study suggests that the barriers between the systemic circulation and the uterine cavity may be more significantly disrupted during the suction abortion procedure than during delivery.

Samples were taken more frequently in the immediate post-procedure period in our abortion study than in any of the studies of the puerperal period. This was done because it is well known that even symptomatic bacteremias seeded from infected sites that are not intravascular are usually intermittent and thus difficult to document with positive cultures unless the cultures are taken repeatedly and with sufficient quantity of blood drawn (51). In the case of transient bacteremia following surgical manipulation of the female genital tract the innoculum may be small and the bacteremia a truly fleeting event. Okell and

Elliott (34) in their classic study on bacteremia following dental extraction found that the number of organisms detected in peripheral venous blood was relatively small: 26 per cent of the positive cultures showed less than 1 organism per ml. and only 11 per cent of the cultures had more than 10 viable units per ml. of blood. Microorganisms gaining access to the blood were rapidly cleared, and blood obtained 10 minutes after the procedure was usually sterile. Baker increased his incidence of positive cultures from 1.5% of patients to 2.3% of patients by additional sampling at 15 minutes and 30 minutes.

The present study demonstrates a striking incidence of anaerobic bacteremia following suction abortion and supports Gorbach's previous observations that these represent genital tract flora. The risk of endocarditis secondary to anaerobic bacteremia is unknown. Weinstein and Rubin (52) in a 1973 review of infective endocarditis state that both microaerophilic streptococcal species and anaerobic streptococcal species are more commonly implicated in infections of the endocardium than in the past. These species produce a subacute syndrome similar to that of the classical agent, Streptococcus viridans. Gorbach (15), surveying recent reviews of series of clinical cases of endocarditis with an aggregate total of 1498 cases, found anaerobes implicated in only 55 cases (3.8%). Peptostreptococcus and Microaerophilic streptococcus accounted for 53 of the cases. Although anaerobic streptococci may be associated with endocarditis more frequently than in the past, the overall incidence

is still low. Both Fusobacteria and Veillonella, which were recovered in the present study, have on rare occasions been isolated as causative agents in endocarditis (13).

The low incidence of anaerobic endocarditis implies that anaerobes have a limited pathogenicity for the endocardium, an implication which is supported by the fact that anaerobic endocarditis most frequently occurs in an impaired host (13). Most abortion clinic patients do not have impaired host defense mechanisms. With anaerobic organisms accounting for less than 4% of cases of infective endocarditis (13,15) the risk of anaerobic endocarditis in the abortion patient would appear to be quite small.

Because the present study strongly suggests that organisms endogenous to the female genital tract gain access to the systemic circulation during suction abortion, an examination of the range and character of the normal flora of the female genital tract would be helpful in assessing the risk of subacute endocarditis subsequent to such a transient bacteremia. Table VIII reviews six studies of vaginal and/or cervical cultures on healthy non-pregnant, pregnant and parturient women. The variability of the genital tract microflora is striking. There is immense variability between subjects as well as in consecutive cultures from the same subject (41,42).

The female genital tract routinely harbors a mixed flora in which relatively nonpathogenic organisms, Lactobacillus, diptheroids, and Staphylococcus epidermidis, predominate . Pathogens, appearing as commensals in the genital tract, show greater variability from individual to individual, both in frequency and type of organism than nonpathogens. Walsh (50) has demonstrated a slightly increased incidence of potentially pathogenic organisms in the genital flora of clinic patients over private patients. Otherwise there has been little success in identifying factors which might help to predict the character of genital tract microflora for a particular patient at a particular time.

The commensal potential pathogens of particular interest in assessing the risk of subacute bacterial endocarditis ensuing from a transient bacteremia after instrumentation of the genital tract are the Streptococci. Gorbach found a 53% incidence of facultative streptococci in the cervical mucous of thirty healthy women (16).

The classic pathogenic organism in subacute bacterial endocarditis is Streptococcus viridans. In the preantibiotic era, Streptococcus viridans was responsible for more than 90% of cases of subacute bacterial endocarditis. By 1966 it was found to be the causative agent in only 70-80% of cases of subacute bacterial endocarditis and by 1973 it appeared to be the agent in only 35-45% of cases (51). Table VIII demonstrates that alpha hemolytic

streptococci are not discovered among the flora of the female genital tract with any great consistency. White's (55) reported incidence of 14.3% is enough to maintain concern about exposure to this organism when genital flora gain access to the bloodstream. In the present study alpha hemolytic streptococcus was isolated from the blood of patient L on eight of the nine samples drawn including her baseline culture.

The enterococcus is found in the vaginal and cervical flora with a frequency that averages 25% but is considerably greater in some studies (Table VIII). In recent years enterococcus has received attention as a causative organism in subacute bacterial endocarditis because of the increasing frequency with which it is implicated and the difficulty it poses in treatment. Enterococcus is reported to be the pathogenic organism in 10% of the cases of subacute bacterial endocarditis (52).

Mandell (29) reviewed 38 cases of enterococcal endocarditis seen at the New York Hospital-Cornell Medical Center from 1945 through 1968. In this group there were sixteen women whose ages averaged 37 years. Forty-seven per cent of the patients in this study had histories indicating a probable genito-urinary tract portal of entry for the infecting organism. Included in this subgroup were seven women with a history of abortion, pregnancy, caesarian section, or genito-urinary instrumentation within the three months prior to admission.

Because of the frequency with which it may be cultured from the female genital tract, its pathogenicity for the endocardium, and the difficulties enterococcal endocarditis poses in treatment, the enterococcus is the organism that most threatens the abortion patient with intracardiac lesions when she is exposed to a transient bacteremia as a consequence of the abortion procedure. Antibiotic prophylaxis ought to be given to these women to protect them from the enterococcus.

Baker felt the 2.3% incidence of transient bacteremia documented in his study of the puerperal period was too small to warrant routine prophylaxis of parturient cardiac patients. Burwell, on the other hand, after reporting a small study in which no bacteremias were found in seventeen patients concluded that subacute endocarditis was such a severe disease and that conceptually the potential for bacteremia in the puerperal period seemed so great that he advised prophylaxis. Since antibiotic prophylaxis is an empiric practice, the effectiveness of which has never been definitively verified, the decision to use antibiotic prophylaxis is a clinical judgment.

Most clinicians agree with Burwell that any manipulation of the genito-urinary tract including normal labor and delivery and abortion in a woman at risk for endocarditis should be covered with prophylactic antibiotics (28,39,53). It is the feeling of this author that the clinical case material supports

the assumption that the risk of endocarditis is real for these patients. Mandell's report that seven of sixteen women with enterococcal endocarditis had antecedent gynecologic or obstetric events is discussed above. Lein and Stander (25) reviewed the cases of thirty-one female patients with subacute bacterial endocarditis and found eight instances which could be directly attributed to preceding obstetric and gynecologic procedures. These procedures were: two criminal abortions, two vaginal deliveries with manual removal of the placenta, three vaginal deliveries and one curettage with conization. The organisms involved were: Streptococcus viridans in two cases, Staphylococcus aureus in two cases, non-hemolytic Streptococcus in two cases, and Pseudomonas aeroginosa in one case. In one case no organism was isolated.

There have not been any reports in the literature of bacterial endocarditis subsequent to a legally performed abortion procedure although there are several studies both prospective and retrospective reviewing the complications of abortions performed since the relaxation of the legal prohibitions on abortion (17,33,48,49). The follow-up time in these reports, the time between the procedure and when the patient is contacted concerning complications, is often quite short, usually about two weeks, although in one report (17) patients were contacted two months after the procedure. It is conceivable, although unlikely, that a case of subacute endocarditis might have been missed if the incubation period was longer than the follow-up time.

However, with the great controversy raging over abortion these days I feel certain that any cases missed in the gynecologic studies would be picked up by those in infectious disease who would be called upon to treat the endocarditis. In just such a fashion have two cases of endocarditis following IUD insertion made their way into the literature (10, 12).

The conclusion suggested by this paper is that the risk of endocarditis in cardiac patients following an abortion procedure is significant. Hundreds of thousands of abortions have been performed in the United States since legalization and yet no cases of endocarditis have been reported. Although it can not be verified, it seems likely that the antibiotic prophylaxis routinely given abortion patients who have a history or physical signs that suggest that they are at risk for endocarditis has been effective.

CONCLUSION

In this study we have demonstrated a 78% incidence of bacteremia subsequent to abortion by suction curettage. Although the organisms cultured in this study were predominately anaerobes which probably pose a very small risk of endocarditis to the cardiac patient, these anaerobes do demonstrate that genital tract organisms can gain access to the bloodstream of the abortion patient. Reviewing the literature on the flora endogenous to the female genital tract demonstrates that facultative streptococci, particularly enterococcus, are found routinely in the genital tract and so may gain access to the bloodstream during the abortion procedure. It appears to be sound to continue the current practice of providing prophylaxis with penicillin and streptomycin (Table IX reviews the American Heart Association's recommendations for antibiotic prophylaxis) for any woman undergoing suction abortion whose medical history or physical signs suggest that she is at risk for subacute bacterial endocarditis.

TABLE I

NUMBER OF SUBJECTS AND BLOOD SAMPLES DRAWN

	Subjects	Blood Samples
Experimental Subjects	14	116
Baseline culture negative	9	71
Baseline culture positive	4	35
Blood samples lost	1	10
Control Subjects	4	38

TABLE II

FREQUENCY OF BLOOD CULTURES CONTAMINATED WITH DIPTHEROIDS

Subject	Culture for positive for Diptheroids/Total Sample
Experimental subjects:	
Baseline culture negative:	
A	0/8
B	1/8
C	5/8
D	7/10
E	5/5
I	10/10
K	8/10
M	8/8
N	4/4
Baseline culture positive:	
F	0/10
G	6/9
J	7/7
L	8/9
Control subjects:	
O	8/8
P	10/10
Q	10/10
R	10/10
TOTAL:	107/144

TABLE III

INCIDENCE OF POSITIVE CULTURES IN STUDY GROUP AND CONTROL GROUP

Patients	baseline	dilate	suction	0 min.	2 min.	5 min.	10 min.	20 min.	30 min.	End	positive cultures/ total cultures
Study Group:											
Baseline culture negative:											
A	-	-	-	-		-		-	-	-	0/8
B	-	-	-	+			-	-	+	-	2/8
C	-	-	-	-		-	-	+	+		2/8
D	-	-	-	-	-	+	+	+	-	-	3/10
E	-	+	+	-	+						3/5
I	-	+	-	+	+	+	-	-	-	+	5/10
K	-	-	-	-	-	-	-	-	+	+	2/10
M	-	-				-	-	-	-	+	1/8
N	-	-	-	-							0/4
Baseline culture positive:											
F	+	+	+	+	+	+	-	-	-	-	6/10
G	+	+	+	+	+	+	+	+	-		7/9
J	+		-	-	-	+	-	+			3/7
L	+	+	+	+	+	+	+	+	-		8/9
Control group:											
O	-			-	-	-	-	-	-	-	0/8
P	-	-	-	-	-	-	-	-	-	-	0/10
Q	-	-	-	-	-	-	-	-	-	-	0/10
R	-	-	-	-	-	-	-	-	-	-	0/10

TABLE IV

TIMING OF FIRST POSITIVE CULTURES

Time of Sample	Number of patients with First positive culture
Dilate	2
Suction	0
0 minutes	1
2 minutes	0
5 minutes	1
10 minutes	0
20 minutes	1
30 minutes	1
End	1

TABLE V

STUDY GROUP: MICROORGANISMS ISOLATED FROM BLOOD CULTURES

Organisms	Number of subjects from whom organism was isolated
Fusobacteria	3
Peptostreptococcus	2
Microaerophilic streptococcus	2
Peptococcus	2
Lactobacillus	2
Veillonella	1
Corynebacterium vaginale	1
Bacillus species	1

TABLE VI

STUDY GROUP: NUMBER OF ORGANISMS ISOLATED PER SUBJECT

Subject	Number of organisms isolated
Patient B	2
Patient C	1
Patient D	4
Patient E	2
Patient I	3
Patient K	1
Patient M	1

TABLE VII

MICROORGANISMS ISOLATED FROM THE BLOOD OF EXPERIMENTAL SUBJECTS WITH POSITIVE BASELINE CULTURES

Subject	Baseline Sample	Later Samples
Patient F	Tiny gram negative rods (not viable for culture)	Tiny gram negative rods (not viable for culture) Peptococcus
Patient G	Peptostreptococcus Peptococcus Lactobacillus	Peptostreptococcus Peptococcus Lactobacillus
Patient J	Lactobacillus	Lactobacillus
Patient L	Alpha hemolytic streptococcus	Alpha hemolytic streptococcus Peptococcus Veillonella Microaerophilic gram positive cocci

TABLE VIII

AEROBIC AND FACULTATIVE ORGANISMS CULTURED FROM THE GENITAL TRACT OF HEALTHY WOMEN

STUDY	1	2	3	4	5	6	7	8	9
NUMBER OF SUBJECTS	30	15	28	19	100	100	79	79	280
Organism	%	%	%	%	%	%	%	%	%
Lactobacillus epidermidis	73	93	84	77	-	-	92	90	82
Staphylococcus	57	-	-	59	-	-	27	29	66
Staphylococcus aureus	-	-	-	3.9	0.5	2.3	-	-	4.6
Streptococcus species	53	-	-	-	-	-	-	-	-
Alpha hemolytic	-	-	-	15	7	-	-	-	-
Beta hemolytic	-	-	-	1	10	14	6	5	9
Enterococcus	-	33	23	20	4	5	49	40	41
Non-hemolytic	-	-	-	-	16	23	16	23	4
Micrococcus species	-	4	8	-	-	-	13	10	37
Diptheroids	-	-	-	17	-	-	13	13	83
Candida species	27	12	23	13	10	10	-	-	24
"enteric group"	-	-	-	-	17	11	-	-	-
E. coli	20	13	38	6	-	-	11	10	19
Proteus species	10	1	6	1	-	-	5	1	6
Alkaligenes faecalis	3	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	-	-	-	1	-	-	-	-	0.5
Aerobacter cloacae	-	-	-	-	-	-	4	4	-
Klebsiella aerogenes	-	-	-	-	-	-	-	-	1
Neisseria species	13	-	-	-	-	-	-	-	1
Hemophilus vaginalis	-	-	-	-	33	31	-	-	-
Mycoplasma	-	-	8	-	-	-	-	-	11

ANAEROBIC ORGANISMS CULTURED FROM THE GENITAL TRACT OF HEALTHY WOMEN

STUDY	1	2	3	5	6	7	8	9
ORGANISM	%	%	%	%	%	%	%	%
Bacteroides species	57	-	8	-	-	-	-	5
Peptostreptococcus	33	6	37	1	2	-	-	22
Veillonella	27	-	-	-	-	-	-	-
Clostridium species	17	-	-	1	0.5	-	1	-
Bifidobacterium	10	-	-	-	-	-	-	-
Peptococcus	7	-	-	-	-	-	-	-
Eubacterium	3	-	-	-	-	-	-	-

Sources:

STUDY 1: Gorbach, et. al., "Anaerobic microflora of the cervix in healthy women" Am. J. Obst. & Gynec. 117:1053, 1973.

STUDY 2: Walsh, H., Hildebrandt, R.J., Prystowsky, H., "Further Observations on the microbiologic flora of the cervix and vagina during pregnancy" Am. J. Obst. & Gynec. 96:1129, 1966. Group I in this study were private white patients.

STUDY 3: Ibid. Group II were black ward patients.

STUDY 4: White, C.A., Koontz, F.P., "Bacterial Flora of the Cervix during pregnancy" Obst. & Gynec. 32:402, 1969.

STUDY 5: Slotnick, I.J., Stelluto, M., Prystowsky, "Microbiology of the female genital tract," Am. J. Obst. & Gynec. 85:519, 1963. Group I: Parturients receiving vaginal examinations (cervical cultures).

STUDY 6: Ibid. Group II: parturients receiving rectal examination. (Cervical cultures).

STUDY 7: Slotnick, I.J., Hildebrandt, R.J., Prystowsky, J., "Microbiology of the female genital tract: cervical and vaginal flora during pregnancy." Obst. & Gynec. 21:312, 1963. Group I: vaginal cultures.

STUDY 8: Ibid. Group II: cervical cultures.

STUDY 9: De Louvois, J. Stanley, V.C., Hurley, R. "Flora of lower genital tract in 280 unselected pregnant women" in The Normal Microbial Flora of Man, Skinner, F.A. and Carr, J.G., editors, Academic Press, New York, 1974, p. 164.

TABLE IX

FROM THE AMERICAN HEART ASSOCIATION:
A SUGGESTED PROPHYLAXIS FOR GENITOURINARY TRACT SURGERY AND INSTRUMENTATION: 1972 (1)

I. For Most Patients:	
Penicillin	600,000 units of procaine penicillin G mixed with 200,000 units of crystalline penicillin G intramuscularly one hour prior to procedure and one daily for two days following the procedure.
PLUS	
Streptomycin	1 to 2 grams intramuscularly one hour prior to procedure and one daily for the two days following the procedure.
OR	
Ampicillin	25 to 50 mg/kg given orally or intravenously one hour prior to procedure; and then 25 mg/kg every six hours for the remainder of that day and for the two days following the procedure.
PLUS	
Streptomycin	(As above)
II. For patients suspected to be allergic to penicillins:	
Erythromycin	500 mg. orally one and one-half to two hours prior to procedure and then 250mg. every six hours for the remainder of that day and for two days following the procedure.
PLUS	
Streptomycin	(As above)
OR	
Vancomycin	0.5gm. to 1.0gm. intravenously one hour prior to procedure and the 0.5gm. intravenously every six hours for the remainder of that day and for the two days following the procedure.
PLUS	
Streptomycin	(As above)

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