

# The microbiologic effect of digital cervical examination

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**OBJECTIVE:** The purpose of this study was to determine whether digital examination introduces vaginal organisms into the cervix.

**STUDY DESIGN:** Thirty-five women with reported ruptured membranes at  $\geq 34$  weeks' gestation underwent a sterile speculum examination and a standardized semiquantitative, semiquantitative endocervical culture before and immediately after digital cervical examination.

**RESULTS:** Cultures taken before digital examination demonstrated a mean of  $2.8 \pm 1.7$  different types of organisms, whereas cultures taken after digital examination demonstrated a mean of  $4.4 \pm 1.5$  different types of organisms ( $P < .0001$ ). Twenty-eight patients (80%) had heavier growth or a greater number of different organisms in the postexamination culture than in the pre-examination culture. The state of the fetal membranes (ruptured as opposed to intact) did not alter these relationships.

**CONCLUSION:** An immediate effect of digital examination is the introduction of vaginal organisms into the cervical canal. (Am J Obstet Gynecol 1999;180:578-80.)

**Key words:** Cervix, digital examination, rupture of membranes

It is a widely held belief that digital examination of the cervix introduces vaginal organisms into the cervical canal. In the setting of intact membranes, this practice causes little concern. In the setting of ruptured membranes, particularly in preterm gestations, many clinicians withhold digital examination for fear of inoculating vaginal organisms into the cervix and uterus.

Circumstantial evidence suggests that digital examination may have adverse effects on patients with ruptured fetal membranes. In a retrospective analysis of patients with preterm premature rupture of membranes, Lewis et al<sup>1</sup> concluded that digital examination of the cervix decreases the latency period from rupture of membranes to delivery. Presumably this effect is related to chorioamnionitis resulting from bacteria introduced into the cervix during digital examination. These investigators also noted that patients who had undergone digital examination were more likely to have positive culture results from amniotic fluid obtained by amniocentesis. In another retrospective study, Adoni et al<sup>2</sup> concluded that patients with preterm premature rupture of membranes who underwent digital examination had a shorter latency period than did those who underwent speculum examination. Interestingly, that study was unable to demon-

strate a significant difference in the incidence of chorioamnionitis between the 2 groups. More recently Seaward et al<sup>3</sup> demonstrated that the risk of clinical chorioamnionitis increases as the number of digital examinations increases in patients with term rupture of membranes.

All these studies suggest an association between digital examination and intrauterine infection, but none has demonstrated with certainty that digital examination introduces bacteria into the cervix and uterus. Because there is no definitive evidence to support this belief, we chose to prospectively determine whether digital examination introduces vaginal organisms into the cervix.

## Material and methods

Because the issue of digital examination is most important in patients with ruptured membranes, we chose to study women presenting to the labor and delivery suite with reported ruptured membranes. At our institution women with preterm premature rupture of membranes before 34 weeks' gestation are managed expectantly, and digital examination is routinely withheld in these cases. We chose to study patients at  $\geq 34$  weeks' gestation with reported ruptured membranes because we routinely deliver these women if rupture of membranes is confirmed. Patients with a previous vaginal examination or coitus within 24 hours, those with antibiotic therapy within 7 days, and those with cervical cerclage were excluded from enrollment in this study. Thirty-five patients were enrolled in this investigation, which was approved by the Human Subjects Review Committee of The Ohio State University Medical Center.

During routine sterile speculum examination to diag-

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nose rupture of membranes a study endocervical culture was performed. Rupture of membranes was diagnosed if pooled vaginal fluid yielded positive nitrazine and fern test results. Immediately thereafter study subjects underwent digital cervical examination in the routine fashion with a sterile latex glove and bacteriostatic lubricant (Surgilube; E. Fougera & Co, Melville, NY) followed by a second sterile speculum examination and another study endocervical culture. Labor was defined as the presence of uterine contractions at least every 4 minutes noted on external monitor.

Culture swabs were plated on MacConkey agar in a standardized quadrant pattern and grown under aerobic conditions. On the assumption that aerobic bacteria are not preferentially introduced into the cervix with respect to anaerobic bacteria during digital examination, we did not seek to isolate anaerobes. Laboratory personnel were blinded to the purpose and order of these cultures. Organisms were identified in a semiquantitative manner according to colony morphologic characteristics without the use of antibiotic susceptibility testing. Growth of each type of organism was quantified as light if it was noted in the first quadrant, moderate if it was noted in the second or third quadrant, and heavy if growth was noted in all quadrants. Data were analyzed by the unpaired 2-tailed *t* test, paired 2-tailed *t* test, and analysis of variance as appropriate.

Before we proceeded with our study it was necessary to demonstrate that sterile speculum examination alone did not introduce vaginal organisms into the cervix. Five patients underwent 2 serial sterile speculum examinations and cervical cultures without an intervening digital examination. Cultures after the first and second speculum examinations were then compared. No increases in growth or increases in the number of isolated organisms were noted when the second culture was compared with the first. In fact, 3 patients had no detectable growth on the second cervical culture; thus the number of organisms may have been reduced by the first cervical swab. These findings suggest that sterile speculum examinations alone do not introduce vaginal organisms into the cervix.

## Results

Twenty-five patients (71%) had rupture of membranes and 10 (29%) had intact membranes. Patient characteristics are depicted in Table I. Among patients with ruptured membranes the mean ( $\pm$  SD) time from rupture to examination was  $2.6 \pm 1.9$  hours (range 0.5-8.0 hours). No significant differences were noted in patient characteristics between the patients who had ruptured membranes and those who had intact membranes.

Table II demonstrates the numbers of different types of organisms detected before and immediately after digital examination. Among all patients, cultures taken be-

**Table I.** Patient characteristics

	All patients (N = 35)	Ruptured membranes (n = 25)	Intact membranes (n = 10)
Age (y)	24.3 $\pm$ 5.9	24.6 $\pm$ 6.0	23.7 $\pm$ 5.7
Parity (No. of patients)			
Nulliparous	20/35	15/25	5/10
Multiparous	15/35	10/25	5/10
Gestational age (wk)	37.9 $\pm$ 1.7	37.9 $\pm$ 1.8	37.9 $\pm$ 1.1
Dilatation (cm)	2.3 $\pm$ 1.5	2.6 $\pm$ 1.5	1.6 $\pm$ 1.3

Values are mean  $\pm$  SD unless otherwise indicated. For all comparisons, *P* > .05 by unpaired *t* test.

**Table II.** Numbers of different organisms isolated before and immediately after digital cervical examination

	All patients (N = 35)	Ruptured membranes (n = 25)	Intact membranes (n = 10)
Before digital examination	2.8 $\pm$ 1.7	2.7 $\pm$ 1.8	3.1 $\pm$ 1.6
After digital examination	4.4 $\pm$ 1.5	4.4 $\pm$ 1.3	4.2 $\pm$ 1.9
Statistical significance	<i>P</i> < .0001	<i>P</i> < .0001	<i>P</i> = .001

Values are mean  $\pm$  SD.

fore digital examination demonstrated a mean of  $2.8 \pm 1.7$  different types of organisms, whereas cultures taken after digital examination demonstrated a mean of  $4.4 \pm 1.5$  different types of organisms (*P* < .0001). This significant increase in the variety of isolated organisms after digital examination was observed both in patients with ruptured membranes and in those with intact membranes. Among patients with ruptured membranes the time from rupture to examination did not have any effect on the number of different organisms isolated.

When the pre-examination and postexamination cultures were compared, 20 of 35 subjects (57%) demonstrated an increase in the quantity of growth of at least 1 isolated organism after digital examination. Among patients with ruptured membranes 16 of 25 (64%) had an increase in the quantity of growth of at least 1 isolated organism. Increased growth and increased numbers of isolated organisms both indicate the introduction of vaginal organisms into the cervix. Overall 28 patients (80%) had heavier growth or a greater number of different organisms in the postexamination culture than in the pre-examination culture. Twenty-one of 25 patients with ruptured membranes (84%) and 7 of 10 patients with intact membranes (70%) had heavier growth or a greater number of different organisms in the postexamination culture than in the pre-examination culture (*P* = .53, not significant).

The most commonly isolated organisms were *Lactobacillus* species, coagulase-negative staphylococci, and  $\gamma$ -hemolytic streptococci. Although they were less common, a number of potentially pathogenic organisms,

including group B *Streptococcus agalactiae*, *Enterococcus* species, and several aerobic gram-negative rods, were isolated from the cultures. Race and the presence of labor did not influence the number of different organisms detected in either the pre-examination or the postexamination culture.

### Comment

An immediate effect of digital examination of the cervix is the introduction of vaginal organisms into the cervix. This effect is similar in patients with ruptured membranes and in those with intact membranes. Previous studies suggested this causal relationship but were unable to prove it. In nonrandomized studies of patients with preterm premature rupture of membranes, Lewis et al<sup>1</sup> and Adoni et al<sup>2</sup> concluded that digital examination was associated with a shortened latency period because of the introduction of bacteria into the cervix. Such a conclusion may not be valid because of selection bias; patients in whom delivery was imminent were more likely to receive digital examinations. In a prospective investigation of patients with term premature rupture of membranes, Seaward et al<sup>3</sup> demonstrated that the risk of clinical chorioamnionitis increases as the number of digital examinations increases. These investigators also demonstrated a significant association between clinical chorioamnionitis and the duration of labor. Because there is often a direct correlation between the duration of labor and the total number of digital examinations, it is not possible to conclude that digital examination led to chorioamnionitis in this study.

Although we were able to clearly demonstrate the translocation of bacteria from the vagina to the cervix during digital examination, our study was not designed to address the issue of chorioamnionitis. We did not seek to distinguish anaerobes, nor did we attempt to characterize all the organisms that a digital examination can

carry from the vagina into the cervix. The microbiology of the vagina has been well characterized, and we did not seek to characterize it again. By means of standardized cultures, we were able to demonstrate increased bacterial growth within the cervix after digital examination. Our results mirrored the composition of the vaginal flora. The most frequently isolated organisms were nonpathogenic, but many potentially pathogenic organisms were isolated. Because the postexamination culture was performed immediately after the digital examination, our study did not address any effect of time on the postexamination cultures. The combined effects of amniotic fluid flowing from the cervix and of bacterial replication through time could alter our results.

Despite these limitations this prospective investigation demonstrates that digital examination introduces vaginal organisms into the cervix. Although this study was performed on patients with reported rupture of membranes at or near term, our findings can probably be generalized to include patients with preterm premature rupture of membranes. On the basis of our data, it would be prudent to withhold digital examination in the treatment of patients with preterm premature rupture of membranes who are being managed expectantly.

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