Diagnostic Utility of Endocervical Curettage in Women Undergoing Colposcopy for Equivocal or Low-Grade Cytologic Abnormalities

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OBJECTIVE: To estimate the diagnostic yield of endocervical curettage (ECC) when performed as part of a colposcopic procedure in the multicenter ASCUS-LSIL Triage Study (ALTS), a randomized trial of management strategies for women with equivocal or mildly abnormal cytology.

METHODS: A total of 1,119 women in ALTS had colposcopic examinations that included an ECC performed at the discretion of the colposcopist. We compared the results of ECC and concurrent cervical colposcopic evaluation, with or without biopsy, in prediction of final histopathologic diagnosis. This was defined as the worst histopathologic result from that colposcopy or any subsequent procedure during 2 years of follow-up.

RESULTS: Overall, 3.7% of ECCs yielded a diagnostic abnormality of cervical intraepithelial neoplasia (CIN) 2+ compared with 21.7% of colposcopically directed biopsies. In women ultimately found to have CIN 2+ in the trial, the overall sensitivity of colposcopically directed biopsy was 72.5%, compared with 12.2% for ECC. In women under 40, the marginal contribution of ECC, independently of biopsy, was only 2.2%. By contrast, among women 40 and older, the sensitivity of biopsy dropped while the sensitivity of ECC improved, resulting in 13.0% increased detection with ECC, independently of biopsy. However, in women 40 and older, the combined sensitivity of ECC and biopsy was only 47.8% for a single colposcopy procedure.

CONCLUSION: As an ancillary diagnostic technique to colposcopically directed biopsy, ECC is of questionable value in younger women. However, in women aged 40 and older, the sensitivity of colposcopic biopsy decreased and the sensitivity of ECC increased. Thus, ECC may be useful in older women undergoing colposcopy for equivocal or mildly abnormal cytology.

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Clinicians often perform endocervical curettage (ECC)—circumferential scraping of the canal with a curette—as part of colposcopic evaluation of women referred for evaluation of abnormal cytology. However, the diagnostic utility of the procedure has long been debated. The technique can be problematic in terms of discomfort to the patient, adequacy of specimen collection, pathologic interpretation, and cost.

Some advocate the use of ECC in every woman undergoing colposcopy, even if the entire transformation zone can be visualized, to avoid missing cases of precancer and invasive cervical cancer in the canal.[1–3] Others believe that ECC has virtually no utility and

should be used only in select cases as an adjunct to colposcopy.[4–6]

Consensus guidelines for managing women developed under the aegis of the American Society for Colposcopy and Cervical Pathology[7] advise endocervical sampling for women referred with high-grade cytology, low-grade cytologic findings when no lesion is identified on colposcopic examination, or when the colposcopic examination is unsatisfactory. Endocervical sampling is considered "acceptable" in the context of a satisfactory colposcopic examination and an identified lesion.

We examined the utility of ECC in the multicenter ASCUS-LSIL Triage Study (ALTS), a randomized trial of management strategies for equivocal or mildly abnormal cytology, and evaluated the diagnostic yield of ECC in this setting for detection of CIN 2, CIN 3, and cancer (CIN 2+). Our primary goal was to estimate how much ECC contributed to detection of CIN 2+, beyond the information provided by concurrent colposcopically directed biopsy.

MATERIALS AND METHODS

The ASCUS-LSIL Triage Study was a randomized trial conducted by the National Cancer Institute (National Institutes of Health, Rockville, MD) comparing three triage strategies for women with atypical squamous cells of undetermined significance (ASCUS) or low-grade squamous intraepithelial lesions (LSIL), including immediate colposcopy, human papillomavirus (HPV) DNA testing, and conservative management by repeat cytology. Details of the design, methods, and primary results of ALTS have been published elsewhere.[8] Briefly, women with ASCUS or LSIL cytology were recruited to participate in the study at four clinical centers: University of Alabama at Birmingham (Birmingham, AL), Magee-Womens Hospital of the University of Pittsburgh Medical Center Health System (Pittsburgh, PA), the Oklahoma University Health Sciences Center (Oklahoma City, OK), and the University of Washington (Seattle, WA). The National Cancer Institute and local institutional review boards approved the study. A total of 5,060 women enrolled in the study from January 1997 to December 1998, and these included 3,488 women with ASCUS and 1,572 with LSIL cytology. The ALTS participants were followed at 6-month intervals for 2 years. Routine follow-up and exit visits concluded in January 2001.

The enrollment visit included a pelvic examination with the collection of cells for liquid-based ThinPrep (Cytyc Corporation, Marlborough, MA) cytology and HPV DNA testing, as well as the taking of photographs of the cervix for visual screening (Cervicography, National Testing Laboratories Worldwide, Fenton, MO). The ASCUS-LSIL Triage Study participants were referred to colposcopy depending on study arm: in the immediate colposcopy arm, all women were sent for colposcopy at the enrollment visit or soon thereafter, regardless of enrollment test results; in the HPV arm, women were referred to colposcopy if the enrollment HPV test for carcinogenic types was positive or (uncommonly) missing, or if the enrollment cytology was high-grade squamous intraepithelial lesion (HSIL), which occurred rarely in the absence of a positive HPV result; in the conservative management arm, women were referred to colposcopy if cytology was HSIL. At the semiannual follow-up visits, regardless of randomization arm, colposcopic examinations were triggered by HSIL cytology or, rarely, safety net concerns based on quality control reviews. Histologic CIN 2+ was treated by loop electrosurgical excision procedure (LEEP). At the exit visit, all women were scheduled for a colposcopic examination; the threshold for offering LEEP was lowered to persistent CIN 1, cytologic LSIL, or HPV-positive ASCUS.

The colposcopic examinations were performed by gynecologists and experienced nurse-colposcopists. Colposcopically directed cervical biopsies were obtained of any lesion suspicious for CIN. Endocervical curettage was performed according to the clinicians' judgment, often in cases where the transformation zone or proximal extent of a cervical lesion was not adequately visualized. Endocervical curettage was performed with an endocervical curette, according to routine local practice, and processed as a histopathologic specimen.

Clinical management was based on the clinical center pathologists' cytologic and histologic diagnoses. In addition, all cytology and histology slides were sent to the Pathology Quality Control Group for masked, independent review diagnoses.

Four-milliliter aliquots of the residual PreservCyt (Cytyc Corporation) were used for HPV DNA testing by Hybrid Capture 2 (Digene Corporation, Gaithersburg, MD). An additional cervical specimen was collected into specimen transport medium (STM; Digene Corporation) for L1 consensus primer PGMY09/11 polymerase chain reaction amplification and reverse-line blot hybridization for HPV typing (Roche Diagnostics, Alameda, CA).

Participants' first colposcopic procedure that included an ECC, whether or not a biopsy was performed, was included in the analysis. (The default procedure at colposcopy was to biopsy any lesion suspicious for possible CIN; therefore, absence of a

biopsy indicated "no lesion identified.") Women were censored at the time of LEEP treatment.

As the main analysis, we examined the performance of ECC and colposcopic biopsy in detecting the primary disease endpoint, defined as cumulatively detected histologic CIN 2+ over the 2-year trial. Cervical intraepithelial neoplasia 2+ represents the current clinical threshold for treatment in the United States.

Standard contingency table analysis and logistic regression were used to identify predictors of whether ECC was performed. We calculated χ^2 statistics with *P* values and odds ratios (ORs) with 95% confidence intervals (CIs). Trends were assessed in the regression models by treating the predictor variable as continuous (which assumes a linear trend). Analyses were performed with Stata 8.0 analytic software (StataCorp LP, College Station, TX) and SAS 9.1 (SAS Institute, Cary, NC).

To examine whether the appearance of the cervix might help explain the contribution of ECC and biopsy, we evaluated 106 cervigrams (obtained proximate to the colposcopy procedure) from women who had selected combinations of colposcopic biopsy and ECC results as follows: 1) all 10 women with negative biopsies but positive ECC (Biopsy–/ECC+); 2) 20 age-matched controls for women from group 1, randomly selected from among those with negative biopsies and negative ECC (Biopsy–/ECC–); 3) all 31 women with concordant positive biopsies and ECC (Biopsy+/ECC+); and 4) 45 age-matched controls for women from group 3, selected from among those with positive biopsies and negative ECC (Biopsy+/ECC–). Cervigrams were digitized and compressed following parameters previously described[9] for optimal resolution and quality. The evaluations were performed by one colposcopist (J.J.), masked to diagnoses and HPV status of the patients, using the Boundary Marking Tool software, developed by staff from NCI and the National Library of Medicine.[10] The evaluator first determined if the cervical image was adequate for visual evaluation. If adequate, the boundaries around the following sites were separately delineated: 1) any acetowhite lesions, 2) the external border of the ectocervix, 3) the squamocolumnar junction, and 4) the cervical os. The software measured these areas in pixels. The area values for each woman for sites 1–4 were compared with the median values for each site. Finally, the evaluator provided a diagnosis based on the worst-appearing area. Once the evaluations were completed and the results collected for analysis, the evaluator also performed a separate, unmasked evaluation of the cases and controls looking for clues to ECC performance.

RESULTS

In ALTS, ECC was performed in 1,524 (18.4%) of 8,265 total colposcopy procedures (including multiple colposcopies for many women). Endocervical curettage was performed at the clinician's discretion, and clinicians varied in their frequency of obtaining an ECC. Parameters associated with whether or not an ECC was performed are presented in Table 1. Women who were older were more likely to have an ECC performed than younger women. There were clinical center-specific tendencies in use of ECC, even adjusted for all other variables. Not surprisingly, there was a significant trend with increasingly severe enrollment cytologic abnormality: women with HSIL cytology were more than five times more likely to have an ECC performed than women with negative cytology results. An inadequate colposcopic evaluation or missing cytology result was also associated with having ECC. Endocervical curettage was also performed more often in association with colposcopic procedures following LEEP treatment (data not shown). After controlling for more overt clinical determinants, underlying HPV status was unrelated to whether or not ECC was performed.

To consider the clinical contribution of ECC, we analyzed participants' first colposcopic procedure that included ECC, performed before treatment. For these 1,119 colposcopic procedures, the clinical center biopsy results are compared with the ECC findings in Table 2. Overall, 3.7% of ECCs were positive for CIN 2+, compared to 21.7% of corresponding tissue biopsies; only 0.89% (10 of 1,119) of all ECCs contributed to detection of CIN 2+ independently of (missed by) the cervical biopsy. Limiting the analysis to women with CIN 2+ detected at the first colposcopy, 4.0% (10 of 253) were diagnosed by ECC only and not by biopsy.

We selected subgroups from the four possible combinations of biopsy and ECC results, using the clinical center pathology interpretation of CIN 2+ as the threshold for a positive result. As outlined in the Materials and Methods section, all women with Biopsy–/ECC+ and Biopsy+/ECC+ results, as well as age-matched controls from Biopsy–/ECC– and Biopsy+/ECC– combinations, were included. The four groups (reordered) are compared in Table 3 by clinical findings and the results of review of cervigrams obtained proximate to the colposcopic procedure. Not surprisingly, women with concordant negative biopsy and ECC results had the lowest HPV positivity and lowest risk for high-grade CIN endpoints diagnosed cumulatively over the trial, whereas women with concordant positive results had the high-

Table 1. Characteristics of Women With and Those Without Endocervical Curettage at Colposcopy*

	ECC Performed (n=1,508)		No ECC Performed (n=6,707)			
	n	Row (%)	n	Row (%)	OR†	95% CI
Age (y)						
18–22	455	14.4	2,697	85.6	1.0	Reference
23–29	461	16.3	2,369	83.7	1.1	0.9–1.3
30–39	302	21.2	1,124	78.8	1.7	1.3–2.2
40–49	192	33.0	390	67.0	3.2	2.4–4.4
50–81	98	43.6	127	56.4	4.0	2.6–6.0
Study center						
Alabama	163	6.7	2,281	93.3	0.5	0.4–0.7
Oklahoma	525	34.2	1,011	65.8	3.6	2.9–4.5
Pennsylvania	454	28.8	1,123	71.2	3.0	2.5–3.8
Washington	366	13.8	2,292	86.2	1.0	Reference
Parity						
Never pregnant	566	16.3	2,901	83.7	1.0	Reference
1	344	16.1	1,791	83.9	1.0	0.8–1.2
2–3	496	22.0	1,760	78.0	1.2	0.9–1.4
4 or more	99	28.2	252	71.8	1.3	0.9–2.0
Clinical center enrollment cytology result						
Normal	336	10.1	2,985	89.9	1.0	Reference
ASCUS	462	18.7	2,003	81.3	1.7	1.4–2.1
LSIL	366	22.7	1,245	77.3	2.0	1.6–2.6
HSIL	339	43.0	450	57.0	5.4	4.1–7.0
Missing	5	17.2	24	82.8	2.5	0.9–6.6
HPV PCR results						
HPV negative	375	18.0	1,709	82.0	1.0	Reference
Nononcogenic HPV positive	163	16.5	827	83.5	1.0	0.8–1.3
Oncogenic HPV positive	927	18.9	3,985	81.1	0.9	0.7–1.1
Colposcopic impression						
Normal	295	10.8	2,426	89.2	1.0	Reference
Cervicitis/atrophy/polyp	59	25.4	173	74.6	2.2	1.4–3.5
Atypical metaplasia	155	17.3	740	82.7	1.6	1.2–2.1
Low grade	672	18.9	2,893	81.2	1.7	1.4–2.1
High grade	273	37.8	450	62.2	2.8	2.0–3.8
Inadequate	54	68.4	25	31.7	7.8	4.4–13.9

ECC, endocervical curettage; OR, odds ratio; CI, confidence interval; ASCUS, atypical squamous cells of undetermined significance; LSIL, low-grade squamous intraepithelial lesions; HSIL, high-grade squamous intraepithelial lesions; HPV, human papillomavirus; PCR, polymerase chain reaction.

* Women are counted for each colposcopic procedure and, therefore, may be included in one or both categories multiple times.

† Odds ratios mutually adjusted for all variables shown in table and also for study arm and timing of colposcopy (before or after any treatment).

est HPV positivity and highest proportion of abnormal visual colposcopic evaluations of the cervix and risk of significant disease. For women with discordant biopsy and ECC results (with only one of the two procedures at colposcopy demonstrating CIN 2+), the HPV positivity and risk of disease was intermediate, although closer to the concordant Biopsy+/ECC+ group in terms of predicting final cumulative histologic diagnosis. However, for women with Biopsy–/ECC+ findings, a low proportion was associated with abnormal visual findings on the preceding cervigram (20%) or on colposcopic impression (20%)–comparable to the group with concordant negative results on biopsy and ECC–indicating that lesions diagnosed by ECC only (and not by biopsy) are usually not visualized on the ectocervix.

Masked re-evaluation of the cervigrams (by J.J.) confirmed that women with positive biopsies were more likely to have a visible acetowhite lesion compared with biopsy-negative women. The comparison of the areas of other sites–ectocervix, squamocolumnar junction, and os–did not show any statistically significant difference among the groups of patients (data not shown). An unmasked evaluation of cervigrams from women with concordant positive biopsy and ECC showed that one third had an acetowhite lesion very close to the os. In such cases, we could not rule out contamination from the ectocervical lesion at

Table 2. Endocervical Curettage and Biopsy Results for First Colposcopic Procedures That Included an Endocervical Curettage

	ECC Result					
Cervical Biopsy	Negative	Atypical Metaplasia	CIN 1	CIN 2	CIN 3+	Total
No biopsy*	230	4	5	4	0	243
Negative	272	6	5	2	0	285
Atypical metaplasia	77	4	3	1	0	85
CIN 1	226	19	15	3	0	263
CIN 2	140	9	19	12	0	180
CIN 3+	36	2	6	13	6	63
Total	981	44	53	35	6	1,119

ECC, endocervical curettage; CIN, cervical intraepithelial neoplasia.
* The default procedure at colposcopy was to biopsy any lesion suspicious for possible CIN; therefore, absence of a biopsy indicated "no lesion identified."

Table 3. Comparison of Clinical and Cervigram Findings for Combinations of Concordant and Discordant Colposcopically Obtained Biopsy and Endocervical Curettage Results

	Biopsy: Neg	Biopsy: Neg	Biopsy: Pos	Biopsy: Pos
	ECC: Neg	ECC: Pos	ECC: Neg	ECC: Pos
	n=20	n=10	n=45	n=31
Age 40 y and older	35	30	0	10
HC2 positive	55	80	93	97
HPV16	10	50	58	65
Cervigram positive*	20	20	58	71
Colposcopic impression high-grade	15	20	42	65
Final cumulative histopathology				
CIN 2+ by clinical center	15	100	100	100
CIN 3+ by pathology QC	10	50	47	84
Total acetowhite area on cervigram†				
No acetowhite lesion	52.6	37.5	15.0	3.5
Median area or less	26.3	50.0	40.0	44.8
Greater than median area	21.1	12.5	45.0	51.7
P=.002‡				
Cervigram review interpretation†				
Normal	62.5	62.5	15.8	10.4
Low Grade	31.3	12.5	52.6	31.0
High Grade	6.3	25.0	31.6	58.6
P<.001‡				

ECC, endocervical curettage; neg, negative; pos, positive; HC2, Hybrid Capture 2; HPV, human papillomavirus; CIN, cervical intraepithelial neoplasia; Path QC, pathology quality control.
Data are presented as percentages.
* Initial cervigram interpretation by National Testing Laboratories Worldwide (NTL, Fenton MO).
† Acetowhite and cervigram review interpretations performed by J. Jeronimo as outlined in Materials and Methods.
‡ Fisher exact test was used to calculate P values.

the time of the procedure as a factor for a positive ECC.

To compare the sensitivity of ECC and colposcopic biopsy to identify CIN 2+, including possibly missed prevalent disease, we considered women with a cumulative diagnosis of histologically confirmed CIN 2+ (either detected at that first colposcopy or at a subsequent procedure during ALTS). The first colposcopic biopsy and ECC findings, collapsed into categories of less than CIN 2 and CIN 2+, are shown in Table 4. The sensitivity of ECC was 12.2% (95% CI 8.9–16.2%) compared with 72.5% (95% CI 67.4–77.3%) for biopsy. The marginal contribution of ECC to detect CIN 2+ independently of biopsy was 3.0% (95% CI 1.4–5.4%), yielding a combined sensitivity for ECC plus biopsy of 75.5% (95% CI 70.6–80.0%).

An analysis stratified by age showed that, in women 40 and older compared with women less than 40, the

Table 4. Sensitivity of Biopsy and Endocervical Curettage for Cumulative Cervical Intraepithelial Neoplasia 2+ Diagnosed Throughout the Study*

	Endocervical Curettage Result		
Biopsy Result	Less Than CIN 2	CIN 2+	Total
Less than CIN 2	82	10	92
CIN 2+	212	31	243
Total	294	41	335

CIN, cervical intraepithelial neoplasia.
* Cumulative CIN 2+ (n=335) includes cases diagnosed at first colposcopy (n=253) and cases diagnosed during follow-up or at exit from ALTS (n=82; these women were, by biopsy and endocervical curettage, less than CIN 2 at first colposcopy).

sensitivity of ECC increased while the sensitivity of cervical biopsy decreased (Tables 5 and 6). In women under 40, the cervical biopsy was 75.3% (95% CI 70.2 to 80.0%) sensitive, and ECC was 11.2% (95% CI 7.94–15.3%) sensitive for CIN 2+. The marginal contribution of ECC was only 2.2% (95% CI 0.9–4.6%), yielding a combined sensitivity of ECC plus biopsy of 77.6% (95% CI 72.6–82.1%) for detection of CIN 2+. By contrast, among women 40 and older, the sensitivity for detection of CIN 2+ for biopsy dropped to 34.8% (95% CI 16.4–57.3%), while the sensitivity of ECC increased to 26.1% (95% CI 10.2–48.4%). The increased marginal contribution of ECC to identify CIN 2+ was 13.0% (95% CI 2.8–33.6%), resulting in a combined sensitivity of ECC and biopsy of 47.8% (95% CI 26.8–69.4%) for a single colposcopy procedure.

DISCUSSION

In ALTS, ECC was performed at the discretion of the clinician in 18% of colposcopy procedures. Clinicians were highly variable in their use of ECC. Older age and increasing severity of cytology and of colposcopic impression were the main factors associated with the clinicians' decision to perform an ECC. A missing cytology result or an inadequate colposcopic evaluation also prompted ECC.

Table 5. Sensitivity of Biopsy and Endocervical Curettage for Cumulative Cervical Intraepithelial Neoplasia 2+ Diagnosed Throughout the Study in Women Under 40*

	Endocervical Curettage Result		
Biopsy Result	Less Than CIN 2	CIN 2+	Total
Less than CIN 2	70	7	77
CIN 2+	207	28	235
Total	277	35	312

CIN, cervical intraepithelial neoplasia.
* Cumulative CIN 2+ (n=312) includes cases diagnosed at first colposcopy (n=242) and cases diagnosed during follow-up or at exit from ALTS (n=70; these women were, by biopsy and endocervical curettage, less than CIN 2 at first colposcopy).

Table 6. Sensitivity of Biopsy and Endocervical Curettage for Cumulative Cervical Intraepithelial Neoplasia 2+ Diagnosed Throughout the Study in Women 40 and Older*

	Endocervical Curettage Result		
Biopsy Result	Less Than CIN 2	CIN 2+	Total
Less than CIN 2	12	3	15
CIN 2+	5	3	8
Total	17	6	23

CIN, cervical intraepithelial neoplasia.
* Cumulative CIN 2+ (n=23) includes cases diagnosed at first colposcopy (n=11) and cases diagnosed during follow-up or at exit from ALTS (n=12; these women were, by biopsy and endocervical curettage, less than CIN 2 at first colposcopy).

Overall, 3–4% of ECC samples were diagnosed as CIN 2+; the marginal diagnostic yield (independently of biopsy) was only 0.9%. When CIN 2+ was diagnosed only by ECC, and not by biopsy, women were less likely to have a visible acetowhite lesion, suggesting the lesion was located in the canal. However, in one third of women with concordantly positive biopsies and ECC, an acetowhite lesion was identified close to the os. This raises the possibility that the positive ECC was due to tissue contamination in some of these cases and emphasizes the importance of colposcopists taking care to try to avoid contamination of ECC specimens when lesions are located near the os.

We considered the performance of ECC and biopsy among women with a cumulative diagnosis of CIN 2+, including cases diagnosed subsequently to the first colposcopy (during follow-up or at exit) to allow for detection of missed prevalent disease. The sensitivity of biopsy and the sensitivity of ECC for cumulative CIN 2+ varied by age: biopsy was more sensitive in younger than in older women, whereas the reverse was found for ECC. Therefore, the marginal contribution of ECC (ie, in addition to the biopsy) was accentuated in older women. In women less than 40 years of age, ECC yielded only 2% increased detection of CIN 2+ over the biopsy findings. By contrast, in women 40 and older, ECC increased sensitivity for CIN 2+ by 13%.

Is it worth performing ECCs in women under 40 to increase detection of CIN 2+ by 2%? Performing an additional test will always increase sensitivity, but the marginal gain in sensitivity must be balanced against the marginal costs in terms of patient discom-

fort and the costs of testing. In our analysis, among 888 women under age 40, biopsy detected CIN 2+ in 235. Of the remaining 653 women, seven cases of CIN 2+ were detected by ECC alone. Therefore, the risk of undetected CIN 2+ associated with *not* performing ECC would have been 7 of 653, or 1.1%. (By comparison, the overall risk for CIN 2+ detected at follow-up or exit was 70 of 653, or 10.7%, among women diagnosed as less than CIN 2 at first colposcopy.) Should ECC be performed based on a 1.1% risk? The question raises broader medical and societal issues beyond the scope of this paper regarding cost-effectiveness and what is acceptable risk (Castle PE, Sideri M, Jeronimo J, Solomon D, Schiffman M. Risk management to guide the prevention of cervical cancer. Am J Obstet Gynecol [in press]).

The large size and the 2-year follow-up in ALTS with virtually complete ascertainment of disease are two major strengths of these data. However, ALTS was not designed to evaluate endocervical sampling. Endocervical curettages were performed inconsistently, at the discretion of the clinician. Therefore, we have data on a selected subset of women rather than the entire study population, and we cannot provide true sensitivity and specificity figures for ECC. Another caveat is that women in ALTS were referred with minor cytologic abnormalities and were followed intensively. Therefore, CIN 2+ lesions identified in ALTS were probably, on average, smaller and less severe compared with lesions diagnosed in general practice. In addition, for analyses of cumulative CIN 2+, some cases detected in follow-up or at exit may have been incident (not missed prevalent) disease. A final limitation is that ALTS had relatively few women 40 years of age or older, a group in which ECC showed potentially greater diagnostic value.

The use of ECC has been debated in the literature over the past 40 years. Helmerhorst's meta-analysis of studies before 1992[11] showed that ECC appeared to increase colposcopic sensitivity for diagnosis of cancer but did not for diagnosis of CIN 3. Most of the studies reviewed showed that the rate of ECC positivity in women with unsatisfactory colposcopy (31%, range 21–70%) was higher compared with the rate of ECC positivity in women with satisfactory colposcopy (17%, range 2–62%). However studies conducted before more widespread, intensive screening of the population and advances in colposcopy technology may not be applicable.

A more recent study by Irvin et al[4] reported low diagnostic utility of ECC. In their study of 304 patients being evaluated for abnormal cytology, the results of ECC changed the management of 13 patients (4.3%). Of these, none had an underlying carcinoma that would have been missed if ECC had not been performed. The authors concluded that ECC did not significantly contribute to the management of women with abnormal cytology. They also stated that ECC did not help to avert conization in women with unsatisfactory colposcopy because they believe that a negative ECC cannot be relied upon to rule out endocervical disease or invasion in such cases. They advocated instead that conization be performed in all women with abnormal high-grade cytology and unsatisfactory colposcopy.

Ferenczy[2] advocated for the use of ECC along with colposcopic evaluation in all women being evaluated for abnormal cytology. He argued that a negative ECC would help to avoid diagnostic cold knife conization for women presumably without disease in the endocervical canal. Conversely, women with positive ECC, implying endocervical lesions, could be sent directly to cold knife conization or a more definitive surgical procedure without further outpatient treatment. Ferenczy emphasized that the utility of ECC is contingent upon accurate sampling of endocervical cells, preparation of the specimen, and pathologic interpretation and that ECC specimens are often misinterpreted due to abundant blood, mucus, and other cellular material that obscure the epithelium.

Massad and Collins[6] studied the predictors of an abnormal ECC to determine what factors increase the yield of this procedure in the workup of CIN. Among 2,287 women undergoing colposcopy, an abnormal ECC changed the management of 105 women (4.6%). They found that older women, with higher parity, earlier age at first intercourse, and an unsatisfactory colposcopy were more likely to have an abnormal ECC result. They concluded that ECC may be avoided in women with satisfactory colposcopy who are nulliparous or have no colposcopic lesions.

Pretorius et al[1] recently studied 364 women from a screening population in China with satisfactory colposcopy and CIN 2+ final pathologic result and found that 20 of the 364 cases (5.5%) of CIN 2+ were diagnosed solely by an ECC result, slightly higher than our finding of 3.0%. They concluded that ECC should be performed, even when the colposcopic examination is satisfactory. However, it is important to note that the women in this study were older compared with ALTS, with a mean age of 42 years (range 32–50 years).

To summarize, the literature is conflicted about the utility of ECC. The clinical need to detect colposcopically occult disease or decide the extent of excisional therapy based on ECC is confounded by

low diagnostic yield and potential contamination of ECC specimens when lesions are located near the os. In addition, the limited sensitivity of ECC may lead to women and clinicians being falsely reassured by a negative ECC result.

In our analysis, ECC showed minimal diagnostic utility in women under 40, suggesting this common procedure may be overused. Although ECC did increase sensitivity for detection of CIN 2+ among women 40 and over, conclusions must be tempered by the relatively small number of cases in this analysis. Future studies evaluating and comparing different endocervical sampling methods in search of a more useful test to identify lesions in the endocervical canal should consider such possible age differences.

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