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Challenges and opportunities in managing pregnant patients with abnormal cervical cytology and positive HPV result in Poland: a single-center retrospective analysis

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Abstract: Objectives: The study examined the natural progression of squamous intraepithelial lesions (SIL) and human papilloma virus (HPV) infection during pregnancy, comparing initial and postpartum results. It also assessed delivery mode's impact on outcomes and strategies to improve follow-up care for women with abnormal cervical cancer screening results.
Methods: This retrospective study analyzed data from 59 pregnant women with SIL/positive HPV, assessing variables such as cytology, HPV status, and delivery mode. Statistical tests included Wilcoxon rank-sum and Fisher's exact tests.
Results: The average age of patients was 29 years. Over 50% were primigravidas. A significant reduction in abnormal cytology was observed postpartum (89.83% vs. 62.50%, p = 0.009), with an increase in normal results (10.17% vs. 37.50%). No significant differences were found in HPV status (88.89% vs. 81.25%, p = 0.655). Colposcopy findings were stable for 76.32% of patients between Visits 1 and 2, with 50% stability between Visits 2 and 3. Postpartum, 30.43% showed regression, while 8.70% showed progression (p = 0.017, p_{adj} >0.050). Higher regression rates were observed after vaginal birth compared to the cesarean section (45.45% vs. 15.38%, p = 0.182) but no significant differences were found (p = 1.000).
Almost 60% of patients were lost to postpartum follow-up.
Conclusion: Further studies with a larger population of Polish patients are needed. Cervical cancer screening should be optimized and integrated into a national registry. Pregnant patients with abnormal screening results should be managed by experts, and strategies to enhance patient compliance must be implemented.

Keywords: cytology, HPV, colposcopy, pregnancy, mode of delivery, compliance.

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Introduction

The organized cervical cancer screening program, introduced in Poland in 2006, includes women aged 25 to 64 who have not undergone a screening cytology test in the last three years [1]. Data from the National Health Fund (NFZ) on the implementation of preventive programs shows, as of May 1, 2024, that cytological examinations under the organized screening were performed on only 11.34% of eligible women [2]. At the same time the Central Statistical Office's (GUS) latest report states that 13% of Polish women have never had a cytology [3]. A review and synthetic analysis conducted in 2022 revealed that in over 200 countries, Poland included, two out of three women aged 30–49 years have never undergone cervical cancer screening [4, 5]. The organized program is thus inefficient, whereas the number of women participating in parallel opportunistic screening is unknown. According to the Regulation of the Polish Minister of Health dated August 16, 2018, regarding the organizational standard of perinatal care, cytology must be performed by the 10th week of pregnancy or during the woman's first visit to the gynecologist if it has not been conducted within the previous six months [6]. This legal regulation effectively helps identify women who have not previously undergone cytology or do not undergo regular screenings — whether organized or opportunistic — but simultaneously is in conflict with the organized screening program and leads to overscreening in some patients.

Regular cytological examinations allow for the detection of precancerous changes and cancer at an early, treatable stage of the disease. Studies show that up to 5% of all cytological smears are abnormal and require further diagnostics [7, 8]. The rate is similar during pregnancy [9]. Unfortunately, due to the lack of mandatory reporting of each cytological examination in Poland, the data on pregnant women is unavailable. An abnormal cytology result during pregnancy should prompt an immediate colposcopy and/or referral to a gynecological oncologist. Even though biopsy and/or colposcopy determined squamous intraepithelial lesion (SIL) during pregnancy is not associated with pregnancy complications, investigation should not be postponed until after delivery [10–12].

The primary aim of this study was to analyze the natural course of SIL and HPV infection during pregnancy, and to compare initial findings with postpartum results. To achieve this, we assessed cytology, HPV status, and colposcopy, focusing on the regression, stability, and progression of these parameters. Additionally, we examined the impact of delivery mode — vaginal birth (VB) versus cesarean section (CS) — on outcomes. Challenges encountered during data collection led us to further investigate patient compliance with recommended follow-up and to reflect on the possibilities of improving health care in Poland for pregnant women requiring additional follow-up due to abnormal cervical cancer screening results.

Methods

Study group and data collection

This retrospective study analyzed medical records of pregnant women referred to the colposcopy unit at the University Hospital in Kraków, between June 2021 and May 2024. Eligible participants were women over 18 years of age with abnormal cytology result and/or a positive HPV test. Patients under 18 were excluded. Data collected included age, obstetric history, cytology, HPV, histopathology results, follow-up visits, gestational age, and delivery mode. All data were recorded in Excel.

AI tools were used to enhance language clarity, but key tasks such as data interpretation and scientific conclusions were solely performed by the authors.

Statistical Analysis

A significance level of 0.05 was adopted. Data normality was confirmed using the Shapiro-Wilk test. Descriptive statistics were used for data characterization, with medians or averages reported for continuous variables, and frequencies and percentages for categorical variables. The Wilcoxon rank-sum test was used for non-normal continuous data, and Fisher's exact test for categorical data. Post-hoc tests with FDR adjustment and Cramér's V were used for effect size. All analyses were conducted using R (version 4.3.1) on Windows 10 Pro.

Results

Characteristics of the Study Group

We analyzed data from 59 pregnant women referred to our colposcopy unit due to abnormal cytology and/or positive HPV test results. Their characteristics are presented in Table 1. The average age was 29 years (range 18–39), with 41.68% reporting tobacco use. Half of the participants (50.85%) were in their first pregnancy, while 28.81% had given birth once, and 13.56% had two or more children. Patients presented at gestational ages ranging from 6 weeks and 6 days to 34 weeks and 6 days. Referral cytology showed LSIL in 38.98%, HSIL in 32.20%, both ASC-H and NILM in 10.17%, ASCUS in 6.78%, and AGC-NOS in 1.69%. HPV testing was conducted in 45.76% of the participants, with 16.95% testing positive for types 16/18, and 54.24% had never been tested for HPV. None of the patients were vaccinated against HPV. All women attended the recommended prepartum appointments, with the majority (52.54%) having two visits planned.

Table 1. Characteristic of the study group.

Characteristics	
N (%)	59 (100.00)
Age, Av (range, in years)	29 (18–39)
Gestational age at first visit, Me (range, in weeks+days)	20+1 (6+6 — 34+6)
Smoking, n (%)	
Yes	24 (40.68)
No	35 (59.32)
Gravidity, n (%)	
Primigravida	30 (50.85)
Multigravida	29 (49.15)
Parity, n (%)	
Primipara	17 (28.81)
Multipara	8 (13.56)

Table 1. Cont.

Characteristics	
Cytology, n (%)	
NILM	6 (10.17)
ASCUS	4 (6.78)
LSIL	23 (38.98)
ASC–H	6 (10.17)
HSIL	19 (32.20)
AGC	1 (1.69)
Cytology performed during pregnancy, n (%)	
Yes	54 (91.53)
No	5 (8.47)
Previous cytology, n (%)	
NILM	32 (54.24)
ASCUS	6 (10.17)
LSIL	6 (10.17)
HSIL	1 (1.69)
Not performed or unknown	14 (23.73)
HPV test, n (%)	
Negative	3 (5.08)
16/18	6 (10.17)
Other than 16/18	8 (13.56)
Positive (various types)	10 (16.95)
Not performed	32 (54.24)
HPV vaccination, n (%)	
Yes	0 (0.00)
No	59 (100.00)
Prepartal appointments, n (%)	
One	22 (37.29)
Two	31 (52.54)
Three	5 (8.47)
Four	1 (1.69)
n (%), number and percentage of patients; Av, average; Me, median	

Statistical analysis

As shown in Table 2, of the 24 patients who attended postpartum follow-up, 89.83% had abnormal cytology during pregnancy, which decreased to 62.50% postpartum (p = 0.009). Normal cytology increased from 10.17% to 37.50%.

Table 2. Changes in cytology results observed in patients at the first visit during pregnancy and after delivery.

Characteristics	First visit in pregnancy	First visit after delivery	p^*
n (%)			
Number	59 (100.00)	24 (100.00)	
Cytology, n (%)			
Abnormal	53 (89.83)	15 (62.50)	**.009**
Normal	6 (10.17)	9 (37.50)	
*n (%), number and percentage of patients; * Exact Fisher test*			

In terms of HPV status (n = 16), no significant change was found between pregnancy and postpartum results (p = 0.655). The data are included in Table 3.

Table 3. Changes in HPV results observed in patients at the first visit during pregnancy and after delivery.

Characteristics	First visit in pregnancy	First visit after delivery	p^*
n (%)			
Number	27 (100.00)	16 (100.00)	
HPV results, n (%)			
Positive	24 (88.89)	13 (81.25)	.655
Negative	3 (11.11)	3 (18.75)	
*n (%), number and percentage of patients; * Exact Fisher test*			

Colposcopic findings, as indicated in Table 4, showed stability in 76.32% between the first two visits, with 18.42% showing progression. Between the second and third visits, 50% remained stable, with an equal rate of progression. Postpartum, regression increased to 30.43%, though progression still occurred in 8.70%. Despite significant findings (p = 0.017), no pair of groups showed statistically significant changes over time (p_{adj} >0.050). No invasive changes were detected. Progression was defined as worsening from minor to major changes or an increase in lesion size.

Table 4. Changes in colposcopy results observed in patients at the first visit during pregnancy and after delivery.

Characteristics	Visit 2 vs. Visit 1 during pregnancy	Visit 3 vs. Visit 2 during pregnancy	Postpartum visit vs. last visit during pregnancy	p^*
n (%)				
Number	38 (100.00)	6 (100.00)	23 (100.00)	
Changes in colposcopy, n (%)				
Progression	7 (18.42)	3 (50.00)	2 (8.70)	**.017**
Regression	2 (5.26)	0 (0.00)	7 (30.43)	
Stable	29 (76.32)	3 (50.00)	14 (60.87)	
*n (%), number and percentage of patients; * Exact Fisher test*				

Cytology regression, presented in Table 5, was higher in vaginal birth (45.45%) compared to cesarean section (15.38%), though not statistically significant (p = 0.182). HPV status showed no

significant differences between delivery methods (p = 1.000). Colposcopy findings were similar, with regression in 50.00% for vaginal birth and 15.38% for cesarean section (p = 0.199).

Table 5. Changes in cytology, HPV, and colposcopy results in patients at the postpartum visit by delivery mode.

Characteristics	Delivery mode		
	Vaginal delivery	Cesarean section	p^*
n (%)			
Number	15 (44.12)	19 (55.88)	
Postpartum cytology in relation to initial results, n (%)			
Regression	5 (45.45)	2 (15.38)	.182
Stable	6 (54.55)	11 (84.62)	
Postpartum HPV in relation to initial results, n (%)			
Regression	0 (0.00)	1 (14.29)	1.000
Stable	1 (100.00)	6 (85.71)	
Postpartum colposcopy in relation to initial results, n (%)			
Progression	0 (0.00)	2 (15.38)	.199
Regression	5 (50.00)	2 (15.38)	
Stable	5 (50.00)	9 (69.24)	
n (%), number and percentage of patients; * *Exact Fisher test*			

Discussion

One of the primary objectives of our study was to examine cytological changes after delivery. Pregnancy-related physiological and anatomical changes result in the production of more metaplastic cells, while reactive changes and inflammation make the evaluation of atypical squamous cells more challenging in this population [13, 14]. In our cohort, nearly 90% of patients had abnormal cytology at the first visit during pregnancy, which decreased to approximately 63% postpartum. Simultaneously, the percentage of normal cytology results increased after pregnancy (37.5% vs. 10.17%). A 2022 study of 219 women reported a postpartum regression rate of squamous intraepithelial lesions (SIL) of 39%, with progression to invasive disease observed in only two patients [15]. During pregnancy, most histologically confirmed high-grade cervical intraepithelial neoplasia (CIN) either persisted or regressed to lower-grade CIN or normal [16]. These findings are consistent with a Polish study, which showed that by the end of the postpartum period, 50% of cases remained unchanged compared to baseline, 2.9% showed progression, and 47.1% exhibited regression [17].

Pregnancy does not alter the natural history of HPV [18]. Our analysis of HPV test results during pregnancy and after delivery showed no statistically significant differences in the proportion of positive and negative results. During pregnancy, 88.89% of women tested positive for HPV, which decreased to 81.25% postpartum. Conversely, the percentage of negative results increased from 11.11% during pregnancy to 18.75% after delivery. The absence of significant differences suggests that HPV infection remains persistent and is not notably affected by pregnancy. This finding aligns with the natural course of persistent HPV infection.

The primary aim of colposcopy during pregnancy is to exclude invasive disease and, for patients with pre-invasive conditions, defer treatment until after delivery [11]. Pregnant patients with suspected or confirmed HSIL CIN2+ lesions are not candidates for expedited treatment. Instead, they undergo surveillance with colposcopy and age-based testing every 12–24 weeks [18], as was done in our study. The surveillance interval is individualized based on gestational age, the experience of the colposcopist, who should be trained and certified by a recognized body, and the risk of loss to follow-up [19]. Colposcopic features of invasive cancer are consistent between pregnant and non-pregnant women and may include abnormal vessels, irregular surface contour, mosaicism, and punctuation [11, 20]. However, after 20 weeks of gestation, visualizing the cervix becomes more challenging due to physiological changes like hyperemia, making it harder to identify cancerous lesions and increasing the risk of missing a diagnosis [18, 21]. To analyze colposcopic findings, we compared results from consecutive visits during pregnancy and postpartum with the final examination conducted during pregnancy. In most cases (76.32%), the cervical image between the second and first visit remained stable. Progression, defined as a change from grade 1 to grade 2 and/or involvement of a larger lesion area, was observed in 18.42% of cases. At the third visit, compared to the second, 50% of cases were stable, while the remainder showed regression.

Opinions on cervical biopsy during pregnancy are mixed. American Society for Colposcopy and Cervical Pathology guidelines recommend an initial biopsy similar to non-pregnant patients but advise against repeat biopsies unless there is suspicion of invasion [18]. However, even a biopsy sufficient for diagnosis cannot definitively rule out histological invasion, as punch biopsies might only demonstrate SIL [11]. Some authors suggest that colposcopic impressions during pregnancy correlate well with biopsy results and postpartum findings when performed by expert colposcopists, indicating that biopsies may not be necessary unless invasive cancer is suspected [19, 20, 22]. In our study, cervical biopsies were performed only when colposcopy results were unclear or invasive disease was suspected. Of the 59 patients, only two underwent biopsies, and in both cases, histopathology revealed massive inflammation, excluding both cancer and SIL.

Postpartum colposcopy is recommended at least 4 weeks after delivery to allow sufficient time for cervical healing [18]. In our group, the final comparison, which included postpartum follow-up visits, showed regression in over 30% of cases, with approximately 61% remaining stable. Progression was observed in less than 9% of women. All patients who had multiple visits to our colposcopy unit were advised to return for check-ups every 10 to 12 weeks. Additionally, they were advised to undergo cytology, and preferably an HPV test, 6 to 8 weeks after delivery, followed by a postpartum visit.

The final stage of our study aimed to evaluate the impact of delivery mode on the outcomes mentioned above. A recent meta-analysis suggests that delivery mode does not affect the natural course of SIL in pregnant women and should not determine the mode of delivery [23]. To assess the impact of delivery mode on cytology, HPV, and colposcopy results, we compared patients who underwent vaginal birth (VB) with those who had a cesarean section (CS). Cytology tests in the VB group showed a higher rate of regression compared to the CS group (45.45% vs. 15.38%), although this difference was not statistically significant. We also found no effect of delivery mode on HPV status or colposcopy results. While there was a trend toward better cytology outcomes and colposcopy results in the VB group, HPV results remained unchanged. Similar studies have shown no significant differences in progression or persistence rates between vaginal delivery and CS [15, 23]. In summary, our results suggest trends indicating more favorable outcomes for VB

compared to CS. However, due to the number of patients lost to postpartum follow-up and the lack of statistical significance, these findings should be interpreted with caution. Further studies with larger sample sizes are needed to confirm these trends.

We recognize significant limitations in a study aiming to describe the natural history of abnormal cytology and HPV in pregnant patients. Between June 2021 and May 2024, approximately 90,000 children were born in the Małopolska province [24], where our colposcopy unit operates. Given that an estimated 5% of cytologies are abnormal [7–9], around 4,500 pregnant women in the region would require further diagnostics. However, only 1.3% (59/4,500) were referred to the largest university hospital's colposcopy unit. This small sample size, combined with substantial loss to follow-up, hinders an accurate understanding of the natural progression of these conditions.

In Poland, there are no accredited colposcopy units or dedicated colposcopy clinics. Additionally, many patients seek care in the private healthcare sector, outside official registries. Estimating the number of active colposcopists is challenging, as certifications are issued by various independent societies. The Polish Society of Colposcopy and Cervical Pathophysiology (PTKiPSM) is the only organization officially affiliated with the European Federation for Colposcopy (EFC) and currently has 406 certified members [25]. The standardization of colposcopy, as highlighted by the ESTAMPA study [26], began in Poland with the "Colposcopy 2020" project, which was designed for opportunistic purposes but may be adapted within an organized screening program.

In terms of diagnostic methods, at the time the data for this manuscript were collected, LBC was available under public health insurance in only a few centers, and most women had to pay out-of-pocket for this service. As a result, our study analyzed both conventional cytology and LBC. Similarly, HPV testing was not included in the national screening program and was often prohibitively expensive for patients, limiting its routine use. When LBC, HPV testing, or co-testing were unavailable as primary tests, PTKiPSM permitted conventional cytology alone or with subsequent HPV testing [27]. Notably, after submission of this manuscript, the NFZ implemented changes (effective July 1, 2025) introducing a new protocol based on high-risk HPV testing with genotyping in triage combined with LBC, performed at five-year intervals.

To address these challenges, we propose several steps. First, a unified register of cervical cytology results — coordinated by the laboratories performing specimen evaluation and including medical data from sample collection — should be established. Second, colposcopist training should be standardized and overseen by a recognized authority. This would ensure the value of certifications and align the skills of certified gynecologists with EFC quality indicators and colposcopy performance standards [20, 28]. Expert colposcopists should be affiliated with designated colposcopy units where patients with abnormal results would be referred for follow-up.

Improving patient compliance is also critical. Proven strategies include patient education, as well as the implementation of an active call-and-recall system. Furthermore, barriers to compliance should be minimized by ensuring that LBC and HPV testing are covered by public health insurance and replace conventional methods. Centralizing patient care by connecting individuals to a nearby colposcopy unit could also enhance adherence. Finally, utilizing reminders, personalized interactions, and telemedicine may reduce loss to follow-up. These strategies are particularly important for patient populations with low screening and follow-up rates, as delays in care, especially during pregnancy, can have serious consequences when follow-up is not properly arranged.

Conclusions

Further studies with a larger population of Polish patients are necessary. Cervical cancer screening, including opportunistic pathways, needs to be optimized and integrated into a nationwide registry. All pregnant patients with abnormal screening results should be strictly managed by expert colposcopists, and methods to improve patient compliance must be implemented.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare no financial interests/personal relationships which may be considered as potential competing interests.

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Ethical considerations and Patient Consent Statement

This study complied with the Declaration of Helsinki and was approved by the Jagiellonian University Medical College Ethics Committee (No. 118.0043.1.164.2024, dated May 13, 2024).

Abbreviations

AGC-NOS	— Atypical Glandular Cells — Not Otherwise Specified
ASC-H	— Atypical Squamous Cells — cannot exclude HSIL
ASCUS	— Atypical Squamous Cells of Undetermined Significance
CIN	— Cervical Intraepithelial Neoplasia
CDB	— Colposcopy-Directed Biopsy
CS	— Cesarean Section
EFC	— European Federation for Colposcopy and Pathology of the Lower Genital Tract
GUS	— Główny Urząd Statystyczny [Central Statistical Office]
HPV	— Human Papilloma Virus
HSIL	— High Grade Squamous Intraepithelial Lesion
LBC	— Liquid Based Cytology
LSIL	— Low Grade Squamous Intraepithelial Lesion
NFZ	— Narodowy Fundusz Zdrowia [National Health Fund]
NILM	— Negative for Intraepithelial Lesion or Malignancy
PTKiPSM	— Polskie Towarzystwo Kolposkopii i Patofizjologii Szyjki Macicy [Polish Society of Colposcopy and Cervical Pathophysiology]
SIL	— Squamous Intraepithelial Lesion
VB	— Vaginal Birth

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