AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

CERVICAL PATHOLOGY AND VAGINAL MICROBIOME IN INTRAUTERINE DEVICE USERS: RISKS AND OBSERVATIONS

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Abstract: This article studies the correlation between the prolonged use of intrauterine contraceptive devices (IUDs) and the development of cervical pathology. A comparative analysis of clinical, cytological, colposcopic, and microbiological data was conducted in women with and without IUDs. A higher incidence of inflammatory changes and low-grade cervical intraepithelial neoplasia (CIN 1) was revealed among IUD users.

Key words: Intrauterine device, cervix, dysplasia, CIN 1, inflammation, HPV, colposcopy, cytology.

INTRODUCTION

Cervical cancer remains one of the most significant public health concerns affecting women's reproductive health worldwide. According to the World Health Organization (WHO), approximately 600,000 new cases of cervical cancer and more than 300,000 deaths are reported annually, making it the fourth most common malignancy among women globally [1]. The highest incidence and mortality rates are observed in low- and middle-income countries, where access to screening and timely treatment remains limited [1].

The persistent infection with human papillomavirus (HPV), particularly oncogenic types 16 and 18, has been recognized as the primary etiological factor in the development of cervical cancer [2]. HPV infection may lead to cervical intraepithelial neoplasia (CIN), which is classified according to the degree of dysplasia (CIN 1–3) and can progress to invasive carcinoma if left untreated [3].

One of the most widely used long-term reversible contraceptive methods is the intrauterine device (IUD). According to the International Planned Parenthood Federation, more than 150 million women worldwide currently use IUDs [4]. Despite their high efficacy and accessibility, the potential association between prolonged IUD use and cervical pathology, including dysplasia, remains a matter of ongoing scientific debate [5].

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

While the contraceptive effectiveness of IUDs is well established, increasing attention has been directed toward their potential effects on cervical tissue, particularly regarding the risk of dysplasia in HPV-positive women. Some studies suggest that IUD use may induce local inflammatory responses and alter mucosal immunity, thereby promoting HPV persistence and epithelial transformation [6]. Conversely, other evidence indicates that IUD use may reduce the risk of cervical cancer by stimulating local immune defense mechanisms and facilitating the shedding of atypical epithelial cells [7].

The diagnosis of precancerous cervical lesions is based on a comprehensive approach, including Pap smear cytology (Bethesda system), colposcopic evaluation, HPV genotyping, and targeted biopsy when indicated [8]. Well-organized screening programs have been proven to detect cervical dysplasia at early stages and significantly reduce the incidence of invasive cervical cancer [1,8].

In this context, investigating the possible correlation between IUD use and cervical dysplasia is of substantial clinical importance for optimizing contraceptive recommendations and screening strategies among women with HPV infection and other risk factors.

Материалы и методы

This prospective study was conducted at the *Women's Health Center of the Tashkent State Medical University* and included data from 74 women of reproductive age, collected between November 2023 and September 2024.

Study Groups

Participants were divided into two groups:

- Group I (Control group): 40 women who did not use any contraceptive methods;
- Group II: 34 women using intrauterine devices (IUDs).

Exclusion Criteria

Exclusion criteria included: pregnancy at the time of the study, absence of childbirth in medical history, exclusively operative deliveries, presence of harmful habits, elevated body mass index (BMI), sexually transmitted infections (STIs), age under 20 or over 49 years, and incomplete medical records.

Clinical and Laboratory Methods

A comprehensive examination was performed for all participants and included the following stages:

- Clinical evaluation, including detailed medical history and physical examination;
- Gynecological examination, comprising inspection of the external genitalia, vaginal and cervical examination using specula, and bimanual palpation;
- Laboratory tests, including complete blood count (CBC), vaginal smear microscopy, and bacteriological culture with antibiotic susceptibility testing;
- Cytological examination of the cervix using the Papanicolaou (Pap) test;
- Colposcopic assessment of the cervical epithelium and transformation zone.

Statistical Analysis

Data were analyzed using descriptive and comparative statistical methods. Mean values, standard deviations (SD), and standard errors of the mean (SEM) were calculated. The Student’s t-test

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

was applied to determine the statistical significance of differences between groups. A p-value < 0.05 was considered statistically significant.

RESULTS

A. Clinical Evaluation

Analysis of clinical and anamnestic data revealed no statistically significant differences between women in the studied groups.

The mean age of participants was 38.3 ± 0.8 years in the control group and 31.5 ± 2.3 years in the IUD group. The majority of women in both groups resided in Tashkent and the Tashkent region — 82.5% and 88.2%, respectively.

The mean age at menarche was similar across groups: 13.4 ± 0.6 years in the control group and 13.4 ± 0.2 years in the IUD group. Most participants in both groups reported a regular menstrual cycle.

In the control group, the most common menstrual disorders were irregular menstruation (22.5%) and dysmenorrhea (17.5%), while in the IUD group, dysmenorrhea (32.3%) and polymenorrhea (20.6%) predominated (Table 1).

Table 1. Characteristics of the menstrual cycle among the study participants (abs., %)

Menstrual characteristics	Control group(n=40)	IUD group(n=34)
Regular	31(77,5%)	29(85,3%)
Irregular	9(22,5%)	5(14,7%)
Polymenorrhea	2(5%)	7(20,6%)
Oligomenorrhea	2(5%)	0(0%)
Dysmenorrhea	7(17,5%)	11(32,3%)

The age at sexual debut ranged from 17 to 28 years in both groups. The mean age was slightly higher in the control group (21.5 ± 0.34 years) compared to the IUD group (20.2 ± 1.4 years). The majority of women in both groups reported having a single sexual partner (90% in the control group and 88.2% in the IUD group).

Among IUD users, the duration of use varied: 55.9% of women had used an IUD for 1–3 years, while 44.1% had used it for more than 4 years, including 8.8% who had used it for over 10 years.

Analysis of obstetric history showed that 1–3 pregnancies and deliveries were most common in both groups (47.5% and 52.9% for pregnancies; 75% and 76.5% for deliveries, respectively). Spontaneous miscarriages were recorded at a similar frequency in both groups (approximately 25%), whereas the incidence of induced abortions was higher in the control group (62.5%) compared with the IUD group (41.1%).

Evaluation of gynecological history revealed a higher prevalence of cervical erosion in the control group (22.5%) compared to the IUD group (11.8%). Meanwhile, cervical polyps and uterine fibroids were observed with similar frequency in both groups (Table 2).

Table 2. Gynecological diseases among study participants (abs., %)

Diseases	Control group(n=40)	IUD group(n=34)

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

Cervical ectropion with epithelial erosion	9(22,5%)	4(11,8%)
Endocervical polyp	5(12,5%)	3(8,8%)
Uterine fibroid	5(12,5%)	4(11,8%)
Ovarian cyst	2(5%)	1(2,9%)
Endometriosis	1(2,5%)	0(0%)
Adenomiosis	1(2,5%)	0(0%)

A higher frequency of previous gynecological surgeries was observed in the control group (22.5%) compared with the IUD group (11.7%). Cervical trauma (tears) was recorded in 20% of women in the control group and 17.6% in the IUD group.

Analysis of extragenital diseases showed that anemia was the most prevalent condition in both groups: 50% in the control group and 44.1% among IUD users. The second most common disorder was diffuse goiter, occurring in 5% and 8.8% of women, respectively (Table 3).

Table 3. Extragenital diseases among study participants (abs., %)

Diseases	Control group(n=40)	IUD group(n=34)
Anemia	20(50%)	15(44,1%)
Bronchial asthma	2(5%)	0(0%)
Chronic pyelonephritis	1(2,5%)	0(0%)
Arterial hypertension	1(2,5%)	1(2,9%)
Gastritis	1(2,5%)	0(0%)
Diffuse goiter	2(5%)	3(8,8%)
ITP	1(2,5%)	0(0%)
Rheumatoid arthritis	0(0%)	2(5,9%)
Fibrocystic mastopathy	0(0%)	1(2,9%)

B. Gynecological Examination

During gynecological examination, no pathological findings were observed in 37.5% of women in the control group and 35.3% of women using intrauterine contraceptive devices (IUDs), indicating a comparable frequency of normal findings between the groups.

The most pronounced differences were observed in the frequency of vulvovaginal papillomas, which were detected in 20.6% of women in the IUD group compared to 7.5% in the control group. Contact bleeding during examination was also more frequently observed among IUD

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

users (17.6%) than in the control group (12.5%).
Additionally, the incidence of cervical ectopy was higher in the IUD group (14.7% vs. 10%), possibly reflecting mechanical irritation of the cervix and alterations in the local microenvironment (Table 4).

Table 4. Gynecological findings during speculum examination (abs., %)

Visual findings	I группа(n=40)	II группа(n=34)
No visual changes	15(37,5%)	12(35,3%)
Cervical hypertrophy	6(15%)	4(11,8%)
Cervical tears	8(20%)	6(17,6%)
Cervical ectopy	4(10%)	5(14,7%)
Endocervical polyp	5(12,5%)	3(8,8%)
Vulvovaginal papilloma	3(7,5%)	7(20,6%)
Contact bleeding	5(12,5%)	6(17,6%)

C. Vaginal Smear Microscopy
The vaginal cleanliness grade differed between the study groups. Grade I cleanliness predominated in the control group (52.5%), while among women using intrauterine devices (IUDs), higher grades of vaginal contamination — Grade III (20.6%) and Grade IV (29.4%) — were more frequently observed (Table 5).

Table 5. Vaginal cleanliness grades among study participants (abs., %)

Vaginal cleanliness grade	Control gruop(n=40)	IUD goup(n=34)
I grade	21(52,5%)	9(26,5%)
II grade	4(10%)	8(23,5%)
III grade	4(10%)	7(20,6%)
IV grade	11(27,5%)	10(29,4%)

D. Bacteriological Examination
Bacteriological analysis of vaginal smears revealed a higher frequency of Candida spp. detection among women using intrauterine devices (IUDs) (20.6%) compared with the control group (10%).
Additionally, only in the IUD group were identified Enterobacter spp. (8.8%), Streptococcus

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

agalactiae (2.9%), and Klebsiella spp. (2.9%), whereas in the control group, the isolates included Enterococcus spp. (5%), Staphylococcus epidermidis (2.5%), and Serratia spp. (2.5%) (Table 6).

Table 6. Bacteriological findings in vaginal smears of study participants (abs., %)

Microorganisms	Control group(n=40)	IUD group(n=34)
Candida	4(10%)	7(20,6%)
E.coli	4(10%)	2(5,9%)
Enterococcus	2(5%)	0(0%)
Staph.heamolyticus	1(2,5%)	4(11,8%)
Staph.aureus	1(2,5%)	3(8,8%)
Staph.epidermidis	1(2,5%)	0(0%)
Serratia	1(2,5%)	0(0%)
Enterobacter	0(0%)	3(8,8%)
Str.pyogenes	0(0%)	0(0%)
Str.agalactica	0(0%)	1(2,9%)
Klebsiella	0(0%)	1(2,9%)

E. Cytological Examination

Analysis of cytological findings (Pap test) revealed the following differences between the study groups:

- NILM (Negative for Intraepithelial Lesion or Malignancy, normal cytology) was observed in 57.5% of women in the control group and only 23.5% of women in the IUD group;
- NILM with inflammatory changes was detected in 12.5% of the control group and 38.2% of the IUD group;
- ASC-US / CIN 1 (Atypical Squamous Cells of Undetermined Significance / mild dysplasia) was found in 7.5% of women in the control group and 20.6% in the IUD group;
- LSIL / CIN 1 (Low-grade Squamous Intraepithelial Lesion) was identified in 22.5% of women in the control group and 17.6% among IUD users (Table 7).

Table 7. Cytological findings among study participants (abs., %)

Results	Control group(n=40)	IUD goup(n=34)
NILM	23(57,5%)	8(23,5%)
NILM:inflammatory changes	5(12,5%)	13(38,2%)
ASCUS:CIN1	3(7,5%)	7(20,6%)
LSIL:CIN1	9(22,5%)	6(17,6%)

E. PCR Diagnostics

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

PCR testing for human papillomavirus (HPV) revealed high-risk oncogenic types 16 and 18 in 7.5% of women in the control group and 2.9% of those using intrauterine devices (IUDs). HPV types 31 and 33 were detected in 5% of the control group and 2.9% of the IUD group.

F. Colposcopic Examination

Colposcopic evaluation demonstrated a normal colposcopic pattern in 60% of women in the control group and 52.9% of women using IUDs.
Pathological changes were identified in the remaining participants of both groups and included the following findings:

- Acetowhite epithelium was observed in 13.3% of women in the control group and 18.2% in the IUD group.

These areas appeared as whitish or dense white patches, characteristic of various grades of cervical intraepithelial neoplasia (CIN).

- Iodine-negative areas (Schiller's test) were detected in 13.3% of the control group and 24% of the IUD group, indicating epithelial maturation disorders and reduced glycogen content.
- Atypical vessels, represented by tortuous and irregular capillaries, were found in 16.6% of women in the control group and 21.2% of IUD users.
- Punctation (fine dotted vascular pattern) was observed in 6.6% of the control group and 12% of the IUD group.
- Mosaic vascular pattern was identified in 10% of control participants and 6% of IUD users.
- Leukoplakia was found in 10% of women in the control group and 15% of those using IUDs, including both thin and thick forms, appearing as dense whitish plaques with a negative Schiller's test.
- Cervical ectopy of columnar epithelium was noted in 10% of control participants and 14.7% of IUD users.
- Cervical canal polyps were detected in 15% of the control group and 14.7% of IUD users.
- Signs of cervical inflammation (hyperemia and contact bleeding) were observed in 30% of women in the control group and 41.2% in the IUD group.

DISCUSSION

The results of the present study demonstrate that the use of intrauterine contraceptive devices (IUDs) is associated with specific changes in the condition of the cervix and the vaginal microbiota.

Women using IUDs exhibited a significantly higher frequency of inflammatory changes in the cervix, as reflected by the increased proportion of Pap smears showing inflammatory alterations (38.2% vs. 12.5% in the control group). These findings are consistent with previously published data suggesting that mechanical irritation of the cervical mucosa during long-term IUD use may trigger chronic inflammation.

Cytological evaluation also revealed a higher incidence of mild dysplastic changes (*ASC-US* and *LSIL/CIN I*) among women in the IUD group (38.2% vs. 30% in the control group). Although no

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,October ,2025

significant correlation was found with high-grade lesions (CIN II–III), the presence of early stages of cervical intraepithelial neoplasia underscores the importance of close clinical monitoring in these patients.

Colposcopic examination confirmed a greater frequency of pathological findings among IUD users, including acetowhite epithelium, iodine-negative areas, and atypical vascular patterns. These changes may indicate disturbed epithelial differentiation and microcirculatory alterations secondary to chronic inflammation.

Particular attention should be given to the observed dysbiotic shift in the vaginal microbiota: women in the IUD group showed an increased prevalence of candidiasis and bacterial infections, including opportunistic flora (*Enterobacter spp.*, *Staphylococcus haemolyticus*). Such alterations in the vaginal microbiome are likely associated with the long-term presence of a foreign body and local immune dysregulation.

PCR diagnostics identified a low but clinically relevant prevalence of high-risk HPV types. Although the overall HPV detection rate was modest, the risk of persistent infection in the setting of chronic inflammation and epithelial transformation warrants regular follow-up and screening.

In summary, the findings confirm that long-term IUD use influences local immune responses, alters vaginal microbiota composition, and may increase the risk of mild cervical dysplastic processes.

CONCLUSIONS

1. The use of intrauterine contraceptive devices (IUDs) is associated with an increased frequency of inflammatory changes in the cervix and the development of mild cervical intraepithelial neoplasia (CIN I).
2. Women using IUDs demonstrate alterations in the vaginal microbiota, with a higher prevalence of candidiasis and bacterial infections compared to non-users.
3. Colposcopic abnormalities — including acetowhite epithelium, iodine-negative areas, and atypical vascular patterns — are more commonly observed among IUD users.
4. Persistent HPV infection was less frequently detected; however, the presence of dysplastic changes even with negative HPV PCR results underscores the need for regular cytological and colposcopic screening.
5. When selecting a method of contraception, clinicians should consider the potential effects of IUDs on cervical health, particularly in women with a burdened gynecological history or risk factors for cervical dysplasia.

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