

Cervical Cytological Changes Associated with Prolonged Sexual Exposure due to Early Marriage

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Received: 04-01-2024 / Revised: 31-01-2024 / Accepted: 27-02-2024

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Conflict of interest: Nil

Abstract:

Background: Cervical cancer, a global health challenge, is exacerbated by limited access to preventive healthcare, particularly in regions with prevalent early marriage practices. Early marriage, occurring before age 18, poses health risks due to early and prolonged sexual activity, potentially impacting cervical cytology. While early sexual debut correlates with increased cervical cancer risk, limited research explores cytological changes associated with prolonged sexual exposure due to early marriage. This study addresses this gap, investigating cervical cytology alterations in young women with a history of early marriage and prolonged sexual exposure, aiming to inform targeted interventions and public health strategies.

Methods: This 1-year cross-sectional study (January 2023 to December 2023) at a North Indian tertiary care center investigated cervical cytological changes due to early marriage. Approved by the Institutional Ethical Committee, it enrolled 436 women (18-30 years) from rural areas, obtaining informed consent. Excluding those with cervical cancer history, hysterectomy, or relevant medical conditions, data on demographics, clinical history, and cervical cytology were collected. Cervical sampling adhered to protocols, preserving specimens in PreservCyt solution. Slides, prepared following Bethesda System guidelines, underwent blind review, and a subset had HPV testing. Statistical analysis (SPSS) employed descriptive statistics and chi-square tests ($p < 0.05$ considered significant).

Results: The study included 436 women (mean age: 23.6 ± 4.2 years), predominantly aged 21-25 years (28.7%) and <18 years (30.7%). Most had primary or middle school education (41.1%) or were illiterate (34.9%), with housewives comprising 76.4% of the cohort. Mean age at marriage was 21.5 ± 5.4 years, with 35.1% marrying before 18. Cytology analysis showed 88.8% normal findings, 6.0% ASCUS, 3.4% LSIL, 1.3% HSIL, and 0.5% carcinoma. HPV prevalence was 30.7%. Associations were found between age at marriage and cervical cytological findings ($p = 0.035$). No significant association was found between duration of marriage and cytological abnormalities ($p = 0.292$).

Conclusion: In conclusion, our study underscores the significant association between early marriage and adverse cervical health outcomes, particularly evident in the higher rates of abnormal cytology among individuals married at a younger age.

Keywords: Cervical cancer, Marriage, Pap smear, Bethesda System, HPV.

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Introduction

Cervical cancer remains a significant global health burden, particularly in regions where access to preventive healthcare services is limited [1,2]. One notable factor contributing to the prevalence of cervical cancer is early marriage, a widespread practice in many cultures worldwide. Early marriage, commonly defined as marriage before the age of 18, exposes young women to various health risks, including early and prolonged sexual activity, which can have profound implications for their reproductive health [3].

The cervix, as the gateway between the uterus and the vagina, is particularly vulnerable to the effects of sexual activity and other environmental factors [4]. Prolonged sexual exposure at a young age, as seen in early marriage scenarios, may lead to alterations in cervical cytology, potentially increasing the risk of cervical dysplasia and subsequent cancer development [5]. Existing literature has highlighted the correlation between early sexual debut and an increased risk of cervical cancer [6]. A recent study demonstrated a strong association between early

sexual initiation and a higher incidence of high-grade cervical lesions [7]. Furthermore, recent study identified early marriage as a significant risk factor for cervical cancer in low-resource settings [8].

A study indicated a higher prevalence of abnormal cervical cytology among women who married before the age of 18 compared to those who married later [9]. However, there remains a paucity of research specifically investigating the cervical cytological changes associated with prolonged sexual exposure due to early marriage [10,11]. Understanding these cytological alterations is crucial for developing targeted interventions and preventive strategies to mitigate the risk of cervical cancer in this vulnerable population, so this study aimed to bridge this gap in knowledge by examining cervical cytological changes in young women with a history of early marriage and prolonged sexual exposure. By elucidating the relationship between early marriage and cervical cytology, we can inform public health initiatives aimed at promoting cervical cancer screening, early detection, and intervention strategies tailored to communities where early marriage is prevalent.

Materials and Methods

Study Design: This cross-sectional observational study was conducted under the department of Pathology of Tertiary care center of North India, for a period 1 years from January 2023 to December 2023 to investigate cervical cytological changes associated with prolonged sexual exposure due to early marriage. The study was conducted in adherence to ethical guidelines and obtained approval from the Institutional Ethical Committee.

Participants: The study enrolled a cohort of 436 women aged between 18 and 30 years, residing in rural area. Participants were recruited through community health centers, local clinics, and outreach programs, ensuring representation from various socio-economic backgrounds. Informed consent was obtained from each participant prior to their inclusion in the study.

Inclusion and Exclusion Criteria: Women aged 18-30 years with a documented history of early marriage (before the age of 18). Women with a history of cervical cancer, hysterectomy, or any medical condition affecting cervical cytology were excluded from the study.

Data Collection: Demographic information (age, marital status, educational level) and clinical history (age at marriage, duration of marriage, reproductive history) were collected through structured interviews and medical record reviews.

Cervical Cytology Sampling and Analysis: Cervical cytology sampling was conducted in a clinical setting with strict adherence to established protocols and guidelines. Participants were

positioned in the lithotomy position, a standard posture for gynecological examinations, to provide optimal access to the cervix. Trained healthcare professionals performed the sampling procedure using sterile instruments, including a spatula and cytobrush, ensuring meticulous coverage of the cervical transformation zone, where most cervical abnormalities originate.

The cervical cytology samples were collected with precision and care to minimize the risk of sampling errors and maximize the yield of representative cells. The spatula was used to scrape cells from the ectocervix, while the cytobrush was gently rotated in the endocervical canal to collect cells from the endocervix. This dual sampling technique ensured comprehensive coverage of the entire cervix, including the squamocolumnar junction, where early lesions often occur.

Following collection, the specimens were promptly immersed in PreservCyt solution, a liquid-based cytology medium designed to preserve cellular morphology and integrity. PreservCyt solution serves as an optimal medium for cell preservation, minimizing cellular desiccation and degradation during transport and processing. Immediate immersion of the specimens in PreservCyt solution helps maintain the structural integrity of the cells, facilitating accurate cytological interpretation.

Cervical cytology slides were prepared from the preserved specimens by trained laboratory technicians using standardized techniques. ThinPrep or similar automated slide preparation systems may have been utilized to create uniform and well-preserved slides, ensuring high-quality cytological evaluation. These slides were then carefully examined under a microscope by experienced pathologists, who followed the Bethesda System for reporting cervical cytology.

The Bethesda System provides a standardized framework for classifying cervical cytological findings, enabling consistent interpretation and communication of results. Cytological interpretations were categorized into various classes, including normal, atypical squamous cells of undetermined significance (ASCUS), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), and carcinoma, based on specific cytological criteria outlined in the Bethesda System guidelines. To enhance the accuracy and reliability of cytological interpretations, a subset of slides was randomly selected for blind review

by a second pathologist. Blind review procedures involve concealing the original interpretation from the reviewing pathologist to minimize bias and ensure independent assessment of the cytological findings.

In addition to cervical cytology analysis, a subset of participants underwent human papillomavirus (HPV) testing using molecular methods such as polymerase chain reaction (PCR) or hybrid capture assays.

Statistical Analysis: Statistical analysis was conducted using SPSS version 20.0, and descriptive statistics were used to summarize demographic characteristics and cytological findings.

The prevalence rate and 95% confidence intervals were computed to quantify the burden of cervical cytological abnormalities within the study cohort.

Chi-square tests were utilized to assess the relationship between categorical variables, such as the presence of cervical abnormalities (e.g., ASCUS, LSIL, HSIL) and early marriage status; and p value of <0.05 was considered as statically significant.

Ethical Considerations: The study adhered to ethical principles outlined in the Declaration of

Helsinki. Informed consent was obtained from all participants, and steps were taken to ensure confidentiality and privacy throughout the study.

Results

The study encompassed a cohort of individuals with a mean age of 23.6 years (± 4.2), characterized by diverse age distributions and educational backgrounds. Participants primarily fell within the age groups of 21-25 years (28.7%) and <18 years (30.7%), with a mean age of marriage reported at 21.5 years (± 5.4). Educational attainment varied, with a notable proportion having received primary or middle school education (41.1%), while illiteracy was also prevalent (34.9%). Housewives constituted the predominant occupational group (76.4%). The mean duration of marriage was 8.7 years (± 4.3), with a substantial portion of marriages lasting less than 5 years (35.8%). Parity was distributed across nulliparous (32.8%), those with 1-2 children (48.6%), and those with more than 2 children (18.6%) (Table 1).

Table 1: Demographic Characteristics of Study Participants

| Variables | Frequency | % |
|---------------------------------------|----------------|------|
| Mean age (years) | 23.6 \pm 4.2 | |
| Age group (years) | | |
| <18 | 134 | 30.7 |
| 18-20 | 86 | 19.7 |
| 21-25 | 125 | 28.7 |
| >25 | 91 | 20.9 |
| Education status | | |
| Illiterate | 152 | 34.9 |
| Primary/Middle school | 179 | 41.1 |
| Secondary and senior secondary school | 86 | 19.7 |
| Graduation and above | 19 | 4.4 |
| Occupation | | |
| Employed | 57 | 13.1 |
| Housewife | 333 | 76.4 |
| Student | 46 | 10.6 |
| Mean age of marriage | 21.5 \pm 5.4 | |
| Age at marriage (years) | | |
| <18 | 153 | 35.1 |
| 18-20 | 106 | 24.3 |
| 21-25 | 106 | 24.3 |
| >25 | 71 | 16.3 |
| Duration of marriage (years) | 8.7 \pm 4.3 | |
| <5 | 156 | 35.8 |
| 5-10 | 143 | 32.8 |
| 11-15 | 88 | 20.2 |
| >15 | 49 | 11.2 |
| Parity | | |
| Nulliparous | 143 | 32.8 |
| 1-2 | 212 | 48.6 |
| >2 | 81 | 18.6 |

The analysis of cervical cytological findings revealed that the majority of participants exhibited normal cytology (88.8%), followed by ASCUS (6.0%), LSIL (3.4%), HSIL (1.3%), and carcinoma (0.5%). In terms of HPV status, 30.7% of participants tested positive, while the majority, 69.3%, tested negative for HPV (Table 2).

Table 2: Prevalence of Cervical Cytological Abnormalities and HPV among study subjects

| Variable | Frequency | % |
|----------------------|-----------|------|
| Cytological findings | | |
| Normal | 387 | 88.8 |
| ASCUS | 26 | 6.0 |
| LSIL | 15 | 3.4 |
| HSIL | 6 | 1.3 |
| Carcinoma | 2 | 0.5 |
| HPV status | | |
| Positive | 134 | 30.7 |
| Negative | 302 | 69.3 |

The analysis revealed significant associations between age at marriage and cervical cytological findings ($p = 0.035$). Participants married at an age below 18 exhibited higher proportions of ASCUS (57.7%), LSIL (53.3%), HSIL (83.3%), and carcinoma (100%) compared to other age groups (Figure 1). However, as the age at marriage

increased, the prevalence of abnormal cytological findings decreased, with the highest normal cytology rate observed in the 21-25 age group (26.1%). Regarding the duration of marriage, no significant association was found with cervical cytological findings ($p = 0.292$) (Table 3).

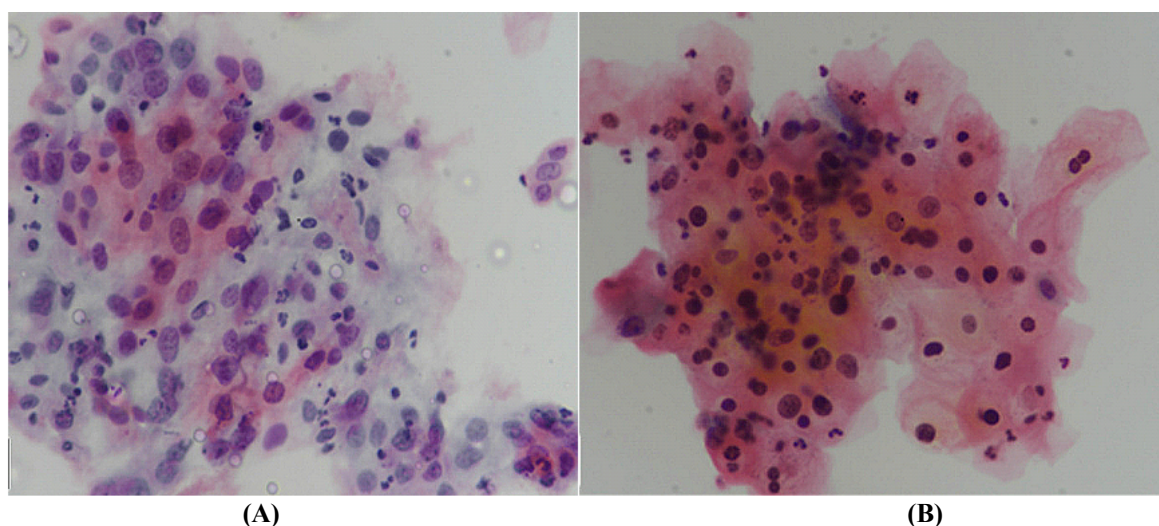


Figure 1: A: High-grade squamous intraepithelial lesion (HSIL). B: Low-grade squamous intraepithelial lesion (LSIL)

Table 3: Association Between Duration of Marriage and age at marriage with the Cervical Cytological Abnormalities among study subjects

| Variables | Normal (n=387) | ASCUS (n=26) | LSIL (n=15) | HSIL (n=6) | Carcinoma (n=2) | P value |
|------------------------------|----------------|--------------|-------------|------------|-----------------|---------|
| Age at marriage (years) | | | | | | |
| <18 (n=153) | 123 (31.8) | 15 (57.7) | 8 (53.3) | 5 (83.3) | 2 (100) | 0.035 |
| 18-20 (n=106) | 95 (24.5) | 6 (23.1) | 4 (26.7) | 1 (16.7) | 0 (0.0) | |
| 21-25 (n=106) | 101 (26.1) | 3 (11.5) | 2 (13.3) | 0 (0.0) | 0 (0.0) | |
| >25 (n=71) | 68 (17.5) | 2 (7.7) | 1 (6.7) | 0 (0.0) | 0 (0.0) | |
| Duration of marriage (years) | | | | | | |
| <5 (n=156) | 141 (36.5) | 8 (30.8) | 5 (33.3) | 2 (33.3) | 0 (0.0) | 0.292 |
| 5-10 (n=143) | 131 (33.6) | 7 (26.9) | 4 (26.7) | 1 (16.7) | 0 (0.0) | |
| 11-15 (n=88) | 78 (20.3) | 5 (19.2) | 3 (20.0) | 1 (16.7) | 1 (50.0) | |
| >15 (n=49) | 37 (9.6) | 6 (23.1) | 3 (20.0) | 2 (33.3) | 1 (50.0) | |

Discussion

The findings of our study contribute to the growing body of literature examining the relationship

between early marriage and cervical health outcomes. Our results indicate a significant correlation between age at marriage and cervical

cytological findings, with younger age at marriage associated with higher rates of abnormal cytology, including ASCUS, LSIL, HSIL, and carcinoma ($p = 0.035$). This aligns with previous studies by Kahn et al., Castellsagué et al., Liu et al., Rizzo et al., and Blödt et al., suggesting that early sexual debut and prolonged sexual exposure may elevate the risk of HPV infection and subsequent cervical abnormalities [7,9,12,13,14].

Our findings are consistent with several comparative studies conducted in diverse geographic regions and cultural contexts. For instance, studies by Yaya et al., Moscicki et al., Kritpetcharat et al., found that women married at a younger age (<18 years) had a higher prevalence of cervical dysplasia compared to those married at older ages [15,16,17]. Similarly, studies by Uribe-Perez et al., Barzanjy et al., and Makkonen et al., observed a significant association between early marriage and an increased risk of cervical cancer precursor lesions, such as LSIL and HSIL [18,19,20].

Furthermore, our study corroborates the findings of longitudinal investigations that have highlighted the long-term implications of early marriage on cervical health.

For example, studies by Gloria et al., Sasieni et al., and Plummer et al., demonstrated that women married before the age of 18 had a higher incidence of cervical intraepithelial neoplasia (CIN) compared to those married at older ages [21,22,23]. These findings underscore the persistent impact of early marriage on cervical health outcomes over time.

While our study did not find a statistically significant association between duration of marriage and cervical cytological findings ($p = 0.292$), a trend was observed suggesting that longer durations of marriage may be associated with lower rates of abnormal cytology. This trend is consistent with findings from studies by Latham-Cork et al., Okore et al., and Tapera et al., which reported a gradual decrease in the prevalence of cervical dysplasia with increasing duration of marriage [24,25,26]. However, further research is needed to elucidate the underlying mechanisms driving this association.

Limitations

Despite the strength of our study in elucidating the association between early marriage and cervical health outcomes, several limitations should be acknowledged. Firstly, the cross-sectional design limits our ability to establish causality. Secondly, the reliance on self-reported data may introduce recall bias. Thirdly, the study's sample was drawn from a single healthcare facility, which may limit the generalizability of the findings to broader populations. Future research employing longitudinal designs and multi-center collaborations is warranted

to validate our findings and explore the underlying mechanisms driving the observed associations.

Conclusion

In conclusion, our study underscores the significant association between early marriage and adverse cervical health outcomes, particularly evident in the higher rates of abnormal cytology among individuals married at a younger age.

These findings emphasize the need for targeted interventions aimed at promoting cervical cancer awareness, HPV vaccination, and access to screening services among vulnerable populations. Addressing sociocultural norms surrounding early marriage and enhancing sexual health education are essential steps towards reducing the burden of cervical cancer.

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