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Screening for Cervical Pathologies in Antenatal Women Using Pap Smear at First Visit in a Tertiary Care Hospital: A Prospective Observational Study.

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Abstract

Background
Cervical cancer remains one of the leading causes of morbidity and mortality among women in India. Despite the proven effectiveness of early detection through Pap smear screening, uptake remains limited, particularly during pregnancy a period that offers an ideal opportunity for screening and education.

Objectives
To assess the prevalence of cervical pathologies among antenatal women attending their first antenatal visit using Pap smear screening and to identify the frequency of pre-malignant and malignant cervical lesions.

Methods
This prospective observational study included 200 pregnant women attending their first antenatal visit at Niloufer Hospital, Hyderabad, between April 2021 and October 2022. After informed consent, Pap smears were collected and interpreted using the Bethesda 2001 classification. Demographic and obstetric profiles were recorded.

Results
The mean age was 26.05 ± 6.66 years; 69% were illiterate, and 57.5% were housewives. Pap smear findings revealed inflammatory smears in 37.5%, ASC-US in 10%, LSIL in 4%, and HSIL in 2.5%. Reactive cellular changes were noted in 8.5%, while 35% had normal cytology. The prevalence of pre-malignant lesions (LSIL and HSIL combined) was 6.5%. Only 3.5% of samples were unsatisfactory. Most participants were unaware of cervical screening and belonged to low socioeconomic backgrounds.

Conclusion
Pap smear screening during antenatal visits is both feasible and valuable for detecting cervical abnormalities in underserved populations. A notable prevalence of 6.5% pre-malignant lesions highlights the importance of early detection. Integrating Pap smear into routine antenatal care offers a strategic opportunity to improve awareness, initiate timely referrals, and reduce the burden of cervical cancer.

Recommendations
Integrate routine Pap smear screening into antenatal care to enhance early detection of cervical lesions, improve awareness, and ensure timely referrals, especially among underserved and low-literacy populations.

Keywords: *Pap smear, cervical cancer, antenatal women, Bethesda classification, Low-grade Squamous Intraepithelial Lesion, High-grade Squamous Intraepithelial Lesion, cervical screening, pregnancy.*
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Introduction

Cervical cancer is one of the most common malignancies affecting women worldwide and poses a major public health challenge, particularly in low- and middle-income countries like India. Globally, it is the fourth most frequently diagnosed cancer among women, with over 600,000 new cases and approximately 342,000 deaths reported annually, the majority of which occur in resource-constrained settings [1]. India alone contributes to nearly one-fifth of the global cervical cancer burden, with an incidence rate of 22–22.6 per 100,000 women and a high mortality rate primarily due to late-stage diagnosis and limited access to timely screening and treatment [2].

Cervical cancer is largely preventable through early detection of precancerous lesions. The Papanicolaou (Pap) smear test remains a cornerstone of cervical cancer screening and has significantly reduced incidence and mortality in high-income countries through the early identification of epithelial abnormalities [3]. The Bethesda System (2001) standardizes the interpretation of cervical cytology, enhancing diagnostic accuracy and facilitating appropriate clinical follow-up [4].

Despite its simplicity, affordability, and efficacy, the coverage of Pap smear screening in India remains suboptimal due to various factors, including lack of awareness, sociocultural barriers, and absence of organized national screening programs [5]. This gap is especially concerning given the high burden of disease.

Pregnancy provides a unique opportunity to perform cervical screening, as antenatal care is often the first and only point of contact with health services for many women. Incorporating Pap smear testing during the first antenatal visit enables early detection of cervical abnormalities, timely intervention, and increases awareness among underserved populations [6,7].

This study aims to assess the prevalence of cervical pathologies among antenatal women using Pap smear screening and to highlight the feasibility and importance of integrating cervical cancer screening into routine antenatal care.

Methodology

Study Design and Setting

This was a hospital-based prospective observational study conducted in the Department of Obstetrics and Gynaecology at Niloufer Hospital for Women and Children, Hyderabad, Telangana. Niloufer Hospital is a government-run tertiary care teaching institution affiliated with Osmania Medical College. It serves as a major referral center for obstetric, neonatal, and gynecological care, particularly catering to underserved and low-income populations across Telangana. The study was carried out over 18 months, from April 2021 to September 2022

Study Population

A total of 200 antenatal women attending their first antenatal outpatient department (OPD) visit were enrolled in the study.

Inclusion Criteria

Pregnant women attending their first antenatal OPD visit, regardless of gestational age

Willingness to participate and provision of informed written consent

Exclusion Criteria

Pregnant women with threatened or missed abortion

Women with acute vaginal infections or bleeding per vaginum

Women in the third trimester or near-term gestation

Those with medical contraindications to Pap smear collection (e.g., cervical incompetence, placenta previa)

Sampling Technique

All eligible antenatal women presenting during the study period were recruited using consecutive sampling.

Study Size

The sample size was calculated using the formula for estimating a proportion in a finite population:

$n=Z2\times p\times(1-p)d2$

Where:

n = required sample size

Z = Z statistic for 95% confidence level (1.96)

p = estimated prevalence of abnormal cervical cytology in antenatal women (assumed 15% based on previous studies [6,9])

d = absolute precision (5%)

$n=1.962\times0.15\times(1-0.15)0.052=196$

Thus, a minimum sample size of 196 was required. To account for possible unsatisfactory smears and attrition, 200 participants were included.

Data Collection

After obtaining informed written consent, data were collected using a pre-tested structured questionnaire. The following information was recorded:

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Demographic details: age, education level, occupation, and socioeconomic status (Modified Kuppuswamy classification)
Obstetric history: age at marriage, gravidity, gestational age at presentation, parity, and duration of marriage
Clinical details: presence of abnormal vaginal discharge, lower abdominal or pelvic pain, genital itching or burning, history of intermenstrual or postcoital bleeding, urinary symptoms, previous gynecological infections or sexually transmitted infections (STIs), contraceptive use, and any prior cervical screening (Pap smear or VIA)
Participants were also counseled regarding the procedure and significance of Pap smear testing during pregnancy.

Pap Smear Collection Procedure

Participants were asked to empty their bladder and were placed in the dorsal lithotomy position. A sterile Cusco's speculum was inserted to visualize the cervix. A wooden Ayre's spatula was used to collect exfoliated cells by rotating 360° at the squamocolumnar junction. The sample was immediately smeared on a glass slide, air-dried, fixed with 95% ethyl alcohol, and sent to the Department of Pathology.

Cytological Analysis

Slides were stained using the Papanicolaou technique and evaluated using the Bethesda System 2001. Each smear was classified as satisfactory or unsatisfactory. Cytological abnormalities were reported as inflammatory, ASC-US, LSIL, HSIL, or reactive cellular changes.

Bias Control

To minimize potential sources of bias, several measures were undertaken. Selection bias was reduced by using a consecutive sampling method, enrolling all eligible antenatal women attending their first visit during the study period. Information bias was addressed by employing a standardized, pre-tested questionnaire and ensuring that the same trained investigator conducted all interviews and Pap smear procedures. Observer bias in cytological interpretation was minimized by having all slides reported by an experienced pathologist blinded to the participants' clinical profiles. Additionally, strict adherence to the Bethesda 2001 criteria ensured consistency in reporting.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee (IEC), Osmania Medical College, Hyderabad (IEC/GMC-OGL/228/2024). Written informed consent was obtained from all participants. Confidentiality and anonymity were ensured throughout the study.

Results

Participant Recruitment Flow

During the study period (April 2021 – September 2022), a total of 225 antenatal women presented for their first antenatal visit. Of these, 210 met the inclusion criteria and were examined for eligibility. Ten women were excluded due to acute vaginal infections (n = 4), bleeding per vaginum (n = 3), and advanced gestation near term (n = 3). Among the 210 eligible participants, 10 declined consent for Pap smear collection. Finally, 200 participants were included in the study and underwent Pap smear screening and analysis.

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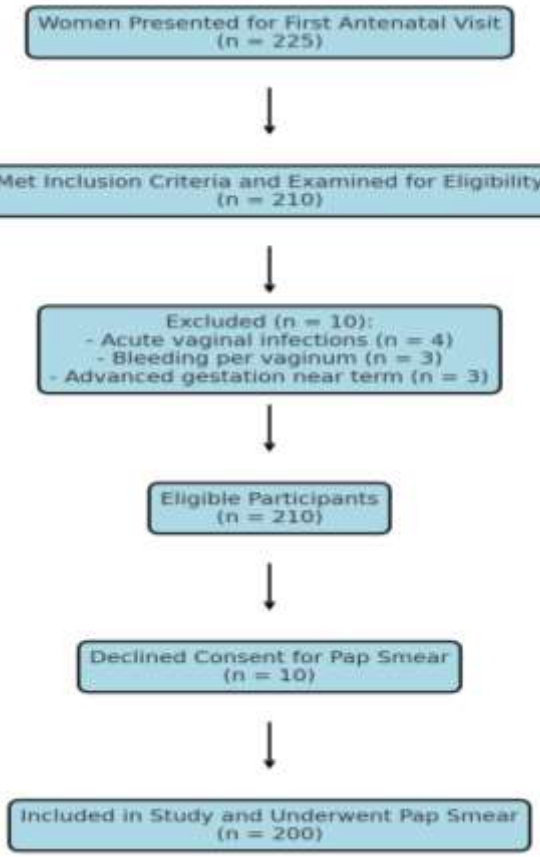

Figure 1. Participant Flow Diagram

Demographic Characteristics

A total of 200 pregnant women attending their first antenatal visit at a tertiary care center were enrolled in the study. The mean age of participants was 26.05 ± 6.66 years. The highest proportion of women (40.5%) was aged between 21–25 years, while 14.5% were under 20 years and 17.5% were between 31–35 years (Table 1).

Table 1: Age Distribution of Study Participants (N = 200)

Age Group (years)	Frequency (n)	Percentage (%)
≤ 20	29	14.5%
21 – 25	81	40.5%
26 – 30	27	13.5%
31 – 35	35	17.5%
36 – 40	22	11.0%
≥ 41	6	3.0%
Total	**200**	**100.0%**

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Regarding educational attainment, 69% of participants were illiterate, with only 4% having completed a degree or higher (Table 2).

Table 2: Educational Status of Women (N = 200)

Education Level	Frequency (n)	Percentage (%)
Illiterate	138	69.0%
Primary	29	14.5%
Secondary	25	12.5%
Degree and above	8	4.0%
Total	**200**	**100.0%**

Occupational distribution revealed that most women (57.5%) were housewives, followed by unskilled (19.5%) and skilled workers (12.5%) (Table 3).

Table 3: Occupation of Women (N = 200)

Occupation Type	Frequency (n)	Percentage (%)
Housewife	115	57.5%
Unskilled	39	19.5%
Skilled	25	12.5%
Semi-skilled	16	8.0%
Professional	5	2.5%
Total	**200**	**100.0%**

Among husbands, more than half (53.5%) were engaged in unskilled occupations, and 27.5% were skilled workers (Table 4).

Table 4: Occupation of Husbands (N = 200)

Occupation Type	Frequency (n)	Percentage (%)
Unskilled	107	53.5%
Skilled	55	27.5%
Semi-skilled	16	8.0%
Semi-professional	10	5.0%
Professional	12	6.0%
Total	**200**	**100.0%**

Socioeconomic Status

According to the Modified Kuppuswamy classification, the majority of participants (63%) belonged to the lower-middle class. About 22% were from the upper-middle class, while 15% were categorized as belonging to the lower class (Table 5).

Table 5: Socioeconomic Status (Modified Kuppuswamy Classification) (N = 200)

Socioeconomic Class	Frequency (n)	Percentage (%)
Lower	30	15.0%
Lower Middle	126	63.0%
Upper Middle	44	22.0%
Total	**200**	**100.0%**

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Reproductive and Obstetric Profile

Most women (69.5%) were married between the ages of 19 and 24 years, with 12% having married at or before 18 years of age (Table 6).

Table 6: Age at Marriage (N = 200)

Age at Marriage (years)	Frequency (n)	Percentage (%)
≤ 18	24	12.0%
19 – 24	139	69.5%
25 – 30	37	18.5%
Total	**200**	**100.0%**

Almost half (49%) of the participants had a marital duration of 5 years or less, and 27.5% had been married for 6–10 years (Table 7).

Table 7: Duration of Marital Life (N = 200)

Years of Marriage	Frequency (n)	Percentage (%)
≤ 5 years	98	49.0%
6 – 10 years	55	27.5%
11 – 15 years	33	16.5%
> 16 years	14	7.0%
Total	**200**	**100.0%**

In terms of gestational age at the time of screening, the majority of women (38%) were between 14.1–20 weeks, followed by 34.5% between 9.1–14 weeks (Table 8).

Table 8: Gestational Age at Time of Screening (N = 200)

Gestational Age (weeks)	Frequency (n)	Percentage (%)
< 9	25	12.5%
9.1 – 14	69	34.5%
14.1 – 20	76	38.0%
> 20	30	15.0%
Total	**200**	**100.0%**

The cohort included a higher proportion of primigravidae (64%) compared to multigravidae (36%) (Table 9).

Table 9: Gravida Status (N = 200)

Gravida Type	Frequency (n)	Percentage (%)
Primigravida	128	64.0%
Multigravida	72	36.0%
Total	**200**	**100.0%**

Pap Smear Cytology Findings

Cytological evaluation was conducted using the 2001 Bethesda System. Inflammatory smears were observed in 75 participants (37.5%), while atypical squamous cells of undetermined significance (ASC-US) were noted in 20 cases (10%) (Table 11).

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Original Article

Table 10: Pap Smear Cytology Findings (Bethesda 2001 Classification) (N = 200)

Cytology Finding	Frequency (n)	Percentage (%)
Inflammatory Smear	75	37.5%
Low-Grade Squamous Intraepithelial Lesion (LSIL)	8	4.0%
High-Grade Squamous Intraepithelial Lesion (HSIL)	5	2.5%
Atypical Squamous Cells (ASC-US)	20	10.0%
Reactive Cellular Changes	17	8.5%
Normal Cytology	70	35.0%
Unsatisfactory Smears	7	3.5%
Total	**200**	**100.0%**

Low-grade squamous intraepithelial lesions (LSIL) were found in 8 women (4%), and high-grade squamous intraepithelial lesions (HSIL) were identified in 5 cases (2.5%). Reactive cellular changes were detected in 17 smears (8.5%), while 70 smears (35%) were reported as cytologically normal. Unsatisfactory samples due to insufficient or poor-quality material were observed in 3.5% (7 cases) of the total sample population.

Discussion

This prospective study examined the prevalence of cervical cytological abnormalities among 200 antenatal women during their first antenatal visit, thereby demonstrating the practicality and clinical relevance of incorporating Pap smear screening into routine antenatal care. The findings strongly support the integration of cervical cancer screening into maternal health services, especially in underserved populations where preventive gynecological care is often lacking.

The average age of the participants was 26.05 ± 6.66 years, aligning with the reproductive age bracket commonly associated with elevated risk for cervical intraepithelial changes. A majority (69%) of the women were illiterate, and 63% belonged to the lower-middle socioeconomic class, reflecting a population segment particularly vulnerable to cervical pathologies. Previous research has shown that socioeconomic and educational disadvantages are key contributors to low screening uptake and higher prevalence of cervical abnormalities [10,15].

In this study, inflammatory changes were identified in 37.5% of smears, which corresponds to previously reported trends in antenatal cohorts [9]. Low-grade squamous intraepithelial lesions (LSIL) and high-grade squamous intraepithelial lesions (HSIL) were noted in 4% and 2.5% of women, respectively, which are slightly elevated compared to earlier studies reporting LSIL and ASC-US at 0.5% and 1% [9]. Such differences may be attributed to varying demographic profiles, sampling techniques, or levels of cytological expertise across studies.

Atypical squamous cells of undetermined significance (ASC-US) were observed in 10% of participants, while 8.5% demonstrated reactive cellular changes. The proportion of unsatisfactory smears was relatively low (3.5%), consistent with findings emphasizing the importance of adequate training and technique in sample collection [8].

Overall, the prevalence of premalignant cervical lesions reported in this study aligns with international data. Long-term institutional reviews have similarly underscored the persistent burden of cytological abnormalities in low-resource settings and the value of regular Pap testing in mitigating cervical cancer morbidity [16]. This study also reaffirms the safety of Pap smear screening during pregnancy, with no procedure-related complications observed, echoing evidence from previous hospital-based investigations [9,11].

Furthermore, international guidelines, including those from the American Cancer Society and its partners, recommend cytological screening at regular intervals for women aged 21 and above, supporting the inclusion of Pap testing during antenatal care as an evidence-based practice [12]. Comparative studies from countries like Australia and the UK demonstrate significantly lower cervical cancer rates owing to consistent screening coverage, in contrast to low-resource nations such as India [13,14].

Given that many women in rural or underserved communities seek healthcare only during pregnancy, antenatal visits represent a critical window to screen for cervical neoplasia, educate about HPV, and provide referral for further care. The integration of cervical cancer screening

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Original Article

into national maternal health programs is both feasible and essential.

Generalizability

The findings of this study are primarily applicable to antenatal women from lower socioeconomic backgrounds attending tertiary public health facilities in urban India. While the use of consecutive sampling and standardized methodology enhances internal validity, generalizability may be limited due to the single-center design, geographical concentration, and predominantly low-literacy population. Nevertheless, the results offer valuable insights for similar resource-limited settings and support the feasibility of integrating cervical screening into routine antenatal care in comparable populations.

Conclusion

This study highlights the effectiveness and feasibility of Pap smear screening for cervical pathologies during the first antenatal visit. A notable number of participants were found to have inflammatory changes and precancerous cervical abnormalities, highlighting the critical role of timely screening and early diagnosis. Given that antenatal visits may be the only opportunity for many women to access healthcare, integrating cervical cancer screening into routine antenatal care is both practical and impactful. Early diagnosis can facilitate timely intervention, reduce disease burden, and improve long-term reproductive health outcomes.

Limitations

The study was limited by its single-center setting and small sample size, restricting generalizability. Use of conventional Pap smear instead of advanced methods may affect diagnostic accuracy. Lack of follow-up on abnormal results and low awareness among participants further constrained the comprehensive assessment of cervical pathology during pregnancy.

Recommendations

Based on the study findings, it is recommended that Pap smear screening be routinely incorporated into the first antenatal visit for all pregnant women, particularly in public healthcare settings. Antenatal care provides a unique and timely opportunity to screen women who may otherwise lack access to preventive services. Health education on cervical cancer and its prevention should be integrated into antenatal counseling sessions to improve awareness and acceptance. Training programs for healthcare providers should emphasize the importance of cervical screening during pregnancy and equip them with the necessary skills. Strengthening awareness campaigns and targeting low-literacy, low-income populations can further enhance uptake and contribute to early detection, timely intervention, and reduced cervical cancer burden. The findings emphasize the urgent need for increased awareness, targeted education, and policy-level inclusion of cervical cytology screening in maternal health programs, especially in low-resource settings.

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List of abbreviations

ASC-US – Atypical Squamous Cells of Undetermined Significance
LSIL – Low-grade Squamous Intraepithelial Lesion
HSIL – High-grade Squamous Intraepithelial Lesion
OPD – Outpatient Department
IEC – Institutional Ethics Committee
HPV – Human Papillomavirus
SPSS – Statistical Package for the Social Sciences
mmHg – Millimetres of Mercury
RC – Reactive Changes
Pap – Papanicolaou
N – Number of Participants

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

UASF-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **BS**-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript, revision of the manuscript

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Original Article

Data availability

Data Available

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Dr. Prithvi Perum, MBBS, MS (OBGYN, Gold Medalist), FMAS, DMAS, Fellowship in Fertility (OASIS Institute), Consultant Robotic and Laparoscopic Surgeon. Dr. Prithvi Perum is an accomplished Consultant Robotic and Laparoscopic Surgeon with over 17 years of clinical and academic experience in the field of Obstetrics and Gynecology. Currently practicing at Medicover Hospitals, Hyderabad, she is widely recognized for her surgical precision, academic contributions, and dedication to women's health.

She completed her MBBS from SVS Medical College, Mahabubnagar, Andhra Pradesh, in 2007, with a strong academic record, achieving a cumulative score of **70%**. Driven by a passion for women's health, she pursued postgraduate studies in Obstetrics and Gynecology at SVS Medical College and was awarded the Gold Medal for academic excellence.

In her pursuit of specialization, Dr. Prithvi obtained a Fellowship in Fertility from the OASIS Institute, further enhancing her expertise in reproductive health. She holds prestigious certifications in Fellowship in Minimal Access Surgery (FMAS) and Diploma in Minimal Access Surgery (DMAS), having trained under the esteemed Dr. R.K. Mishra. To support her academic contributions, she has also undergone formal teaching training for both undergraduate and postgraduate medical education at a recognized Regional Training Centre.

Dr. Prithvi began her professional journey with an internship at Gandhi Hospital (2006–2007) and later worked as a Medical Officer in Pulmonary Medicine at Apollo Hospitals, Hyderabad (April–October 2009). She served as a Junior Resident at SVS Medical College from 2014 to 2017, followed by a year as a Senior Resident at Kondapur Area Hospital (2017–2018). In 2018, she joined the Department of OBGYN as an Assistant Professor, and her outstanding service led to her promotion as Associate Professor in August 2023. Known for her advanced proficiency in laparoscopic and robotic surgeries, Dr. Prithvi specializes in the management of complex gynecological conditions using minimally invasive techniques that offer faster recovery and improved outcomes. Her areas of expertise include fertility treatment, high-risk obstetrics, endometriosis management, fibroid surgery, and uterine anomalies.

Dr. Prithvi Perum is celebrated not only for her clinical acumen but also for her commitment to mentoring future generations of doctors. Her career reflects a deep dedication to the advancement of women's health, academic excellence, and patient-centered care. **ORCID ID:** https://orcid.org/0009-0006-3457-3415

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