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Prevalence, risk factors, and pregnancy outcomes of cervical cell abnormalities in the puerperium in a hyperendemic HIV setting

Hoplang C. Maise^{1,*}, Dhayendre Moodley¹, Motshedisi Sebitloane¹, Suzanne Maman², and Benn Sartorius³

¹Department of Obstetrics and Gynaecology, University of KwaZulu-Natal, Durban, South Africa

²Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, USA

³Discipline of Public Health Medicine, School of Nursing and Public Health, College of Health Sciences, University of KwaZulu-Natal, Durban, South Africa

Abstract

Objective—To investigate the impact of cervical cell abnormalities detected in the puerperium in association with HIV-1 infection on pregnancy outcomes.

Methods—The present study was a secondary data analysis of pregnancy outcomes, Pap smear results, HIV results, and participant demography from a behavioral intervention randomized controlled trial of 1480 pregnant women aged 18 years or more conducted at a periurban primary health clinic in South Africa during 2008–2010. The Pap smear was performed 14 weeks after delivery.

Results—In total, 564 (38.1%) women were HIV-1-positive and 78 (8.0%) of 973 women with a categorized Pap smear result tested positive for cervical cell abnormalities; 42 (4.2%) women had low-grade squamous intraepithelial lesions (LGSILs) and 7 (0.7%) had high-grade lesions (HGSILs). In an adjusted analysis, HIV infection was significantly more common among women with LGSILs (28/42 [66.7%]) or HGSILs (6/7 [85.7%]) when compared with the other Pap smear categories ($P<0.001$). The rates of premature birth, low birth weight, and non-live births were similar among HIV-infected and -uninfected women with abnormal cervical cytology.

Conclusion—Pregnant women with HIV were more likely to be diagnosed with higher grades of squamous cell abnormalities than those without HIV. There was no association between squamous cell abnormalities/HIV comorbidity and adverse pregnancy outcomes.

*Correspondence: Hoplang C. Maise, Department of Obstetrics and Gynaecology, University of KwaZulu-Natal, Durban, South Africa, maisehc@ukzn.ac.za.

Author contributions

HCM conceptualized the present substudy, interpreted the statistical analysis, and wrote the manuscript. DM assisted in the conceptualization of the substudy and the interpretation of the statistical analysis, and helped to write the manuscript. BS performed the statistical analysis and contributed to the development of the manuscript. MS assisted with the data interpretation and the editing of the manuscript. SM was the principal investigator of the primary study and edited the manuscript.

Conflicts of interest

The authors have no conflicts of interest.

Keywords

Birth outcomes; HIV; Pap smear; Puerperium; Squamous cell abnormalities

1 INTRODUCTION

In 2015 alone, an estimated 526 000 new cases of cervical cancer were reported globally, and in the same year, an estimated 239 000 women died from the disorder [1]. Cervical cancer is the leading cause of cancer-related death in women in most parts of Sub-Saharan Africa [1]. Persistent infection with a high-risk type of HPV is associated with the disease: of the 15 high-risk types, HPV-16 and HPV-18 account for 70% of cases of cervical cancer [2].

Cervical cytology and HPV testing are currently the most effective screening tools used in the prevention of cervical cancer [3]. Cervical cancer precursors can be detected by cervical cytology, commonly known as the Papanicolaou (Pap) test. Consistent evidence indicates that HIV-positive women have a higher prevalence of HPV infection, the infection is more persistent, and the prevalence of pre-invasive cervical lesions is higher [4]. In 2014, cervical cancer was ranked in the top 10 causes of death among women in South Africa, which is also one of the four countries globally with the highest HIV prevalence in women of reproductive age [5,6]. Moreover, there is growing evidence of a high prevalence of high-risk HPV infection and cervical intraepithelial neoplasia (CIN) 2/3 among HIV-infected women of reproductive age in South Africa [7,8].

Studies of cervical lesions in pregnancy are sparse, and the available studies report a low but a wide range of prevalences of cervical cancer (0.1–12 per 10 000 pregnancies) and CIN (0.13–0.27 per 10 000 pregnancies) [9,10]. There is no evidence that pregnancy itself increases the rate of CIN progression to invasive carcinoma [11,12]. Pregnancy outcomes have also been reported as unaltered by cervical cancer or CIN [9]. A multivariable analysis of more than 3000 women with a HPV prevalence of 10% concluded that HPV was not an independent risk factor for preterm delivery [13].

Many previous studies were conducted in settings with a low prevalence of HIV, and it is becoming increasingly evident that HIV-positive pregnant women are more likely to have a high prevalence of HPV and pre-invasive cervical lesions [14,15]. Although HIV is independently associated with adverse pregnancy outcomes, to our knowledge, there are no studies that have evaluated pregnancy outcomes in women with HIV and HPV infection/CIN [16]. In the present study, we investigated the impact of cervical squamous cell abnormalities in association with HIV infection on pregnancy outcomes.

2 MATERIALS AND METHODS

The South Africa HIV/AIDS Post-test Support (SAHAPS) study, a randomized controlled trial of a behavioral intervention, enrolled 1480 pregnant women at a periurban primary health clinic in Durban, South Africa, between May 1, 2008, and June 30, 2010. Women were eligible for enrollment if they were 18 years or older, had a current intimate partner,

and intended to continue with postnatal/child immunization at the same facility. All women received basic prenatal care, HIV testing and counselling, and screening for sexually transmitted infections (*Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Trichomonas vaginalis*) in pregnancy. Women were reassessed at 6, 10, and 14 weeks, and at 9 months after delivery. A Pap smear was performed at the postpartum visit at 14 weeks and sent to the routine laboratory services for cytology.

The main findings of the SAHAPS study have been published previously [17]. We performed a secondary data analysis of select variables such as pregnancy outcomes, Pap smear results, HIV results, and patient demography extracted from the parent database. The study was approved by the institutional review boards of the University of KwaZulu-Natal, Durban, South Africa, and the University of North Carolina at Chapel Hill, NC, USA. Written informed consent was obtained from all women who participated in the main study.

Cervical smears were obtained through the standard method [18]. Smears were analyzed by the cytological laboratory using microscopy after Pap staining. The Bethesda classification [19] was used to report the findings. Patients were managed in accordance with the standard protocol for low-grade squamous intraepithelial lesions (LGSILs) and atypical squamous cells of undetermined significance (ASCUS), for which a repeat Pap smear is recommended after 6–12 months. Women with high-grade squamous intraepithelial lesions (HGSILs) were referred for colposcopy. The present data are limited to the screening phase and thus do not include the management of lesions.

Births occurring before 37 weeks of pregnancy were defined as preterm. The pregnancy duration was determined by obstetric measurements and in the absence of ultrasonography done before 24 weeks; an average measure obtained on the basis of symphysis fundal height, last menstrual date, and palpation was used to estimate the pregnancy duration at the first prenatal visit. A low birth weight was defined as a weight of less than 2500 g in term deliveries (pregnancy duration $\geq$ 37 weeks), and a stillbirth was defined as fetal demise at a pregnancy duration of 21 weeks or more. A spontaneous abortion was defined as fetal demise before 21 weeks.

The data were analyzed using Stata 13.0 SE (StataCorp, College Station, TX, USA). Ninety-five percent confidence intervals (CIs) were constructed around prevalence point estimates (prevalence of CIN in the puerperium). The association between continuous demographic and clinical characteristics with CIN status was assessed using the standard *t* test or the nonparametric Wilcoxon rank-sum test if the normality assumption was not upheld. Differences in frequencies of categorical demographic or clinical characteristics by CIN status and associations with perinatal outcomes were assessed using the Pearson χ^2 test or the Fisher exact test if an expected cell count contained fewer than five observations. Multivariable logistic regression was employed to assess factors associated with CIN after controlling for the confounding influence of other covariates. Model fit and validity were confirmed. $P < 0.05$ was considered statistically significant.

3 RESULTS

Of the 1480 pregnant women enrolled in the SAHAPs study, 564 (38.1%, 95% CI 35.7%–40.1%) women tested HIV-positive at their first prenatal visit. Pap smear results were not available for 471 (31.8%) women in this cohort. Among the 1009 women who had a Pap smear result in the postpartum period, categorization was not possible for 36 (3.6%) and 895 (88.7%) women had normal smears. The HIV prevalence ($n=317$ [31.4%] vs $n=153$ [32.5%]; $P=0.720$), age distribution ($n=504$ [50.0%] vs $n=245$ [52.0%] <25 years; $P=0.468$), prevalence of non-live births ($n=38$ [3.8%] vs $n=18$ [3.8%]; $P>0.999$), prevalence of preterm births ($n=191$ [18.9%] vs $n=89$ [18.9%]; $P=0.942$), and prevalence of a low birth weight ($n=42$ [4.2%] vs $n=14$ [3.0%]; $P=0.205$) were comparable between women who had a Pap smear result and those who did not.

Of the 973 women with a categorized Pap smear result at the postpartum visit, 78 (8.0%; 95% CI 6.4%–9.9%) women tested positive for squamous cell abnormalities. Abnormalities included 29 (2.9%; 95% CI 2.0%–4.1%) atypical (ASCUS) cases, 42 (4.2%, 95% CI 3.1%–5.6%) cases of LGSILs or HPV infection, and 7 (0.7%; 95% CI 0.3%–1.4%) cases of HGSILs. The mean age of women presenting with some form of squamous cell abnormality was 24.9 ± 4.9 years, which did not differ significantly from the mean age of women with no abnormalities (25.7 ± 5.4 years). The proportion aged 24 years or older was higher among women with HGSILs than among those with LSILs, but the difference between all groups was not significant in adjusted analyses ($P=0.548$) (Table 1).

Multivariable analysis indicated that HIV infection was significantly more common among women presenting with LGSILs (66.7%) or HGSILs (85.7%) than in other groups ($P<0.001$) (Table 1). Of the 1009 women with a Pap smear result, 34 (3.4%) were HIV-positive and also had squamous cell abnormalities. Moreover, the proportion of women with at least one previous pregnancy was significantly higher among those with HGSILs than among other groups ($P=0.023$) (Table 1).

Pregnancy outcome data were available for 792 (78.5%) of the 1009 women with a Pap smear result. There were 8 (1.0%, 95% CI 0.5%–2.0%) spontaneous abortions, 17 (2.1%, 95% CI 1.3%–3.4%) stillbirths, 767 (96.4%, 95% CI 94.8%–97.5%) live births, and 4 (0.5%, 95% CI 0.2%–1.2%) neonatal deaths. Among the 767 live births, 131 (17.1%, 95% CI 14.7%–19.9%) were premature and 30 (3.9%, 95% CI 2.8%–5.9%) newborns were of low birth weight. There were no birth weight and preterm data for 144 (18.8%) and 3 (0.4%) live births, respectively.

Live birth occurred for 292 (96.4%) of 303 women with HIV infection and 475 (97.1%) of 489 women without HIV infection ($P=0.343$). Among the live births, the frequencies of preterm births were also not significantly different between women with and without HIV infection ($n=49$ [16.8%] vs $n=82$ [17.3%]; $P=0.473$). However, low neonatal birth weight was more common among women with HIV infection ($n=14$ [4.8%]) than among those without this disorder ($n=11$ [2.3%]; $P=0.049$).

In a separate bivariate analysis (Table 2), birth outcomes were compared between women with and without cytological abnormalities. No marked differences in the prevalences of low

birth weight and non-live births in these comparator groups were identified. Although the proportion of preterm births was higher among women with HGSILs as compared with women with LGSILs, ASCUS, or normal cytology, this association was not statistically significant ($P=0.222$).

In comparing the pregnancy outcomes among HIV-infected and HIV-uninfected women with a cytological abnormality, the rates of premature birth, low birth weight, and live birth were similar across all groups (Table 3). The frequency of a low birth weight was, however, significantly higher among HIV-positive women with a normal cytological result when compared with their HIV-negative counterparts ($P=0.026$) (Table 3).

4 DISCUSSION

A Pap smear routinely performed approximately 3 months after delivery revealed cervical squamous cell abnormalities in 8% of the study population. Notably, older women with one or more previous pregnancies were more likely to be diagnosed with HGSILs, whereas younger women were more likely to present with atypical squamous cell appearance or LGSILs. We can also confirm that HIV-1 infection was certainly related to LGSIL or HGSIL detected after delivery, with the prevalence of HGSILs among women with HIV comorbidity being less than 2%. We believe this is the first study to determine the effect of cervical lesions in combination with HIV infection on pregnancy outcomes. Although the presence of cervical lesions by itself has not previously been associated with poor birth outcomes, the underlying pathogenesis of HPV infection has been associated with preterm birth [9,20]. In the present study, where we expected HIV-positive women with LGSILs or HGSILs to have worse pregnancy outcomes than HIV-uninfected women with LGSILs or HGSILs, there was no evidence of this association and neither was this evident for LGSIL or HGSIL alone.

A limited number of studies of pregnant women reported the prevalence of CIN in pregnancy to range between 1% and 5% [9,21]. Methodological variations in diagnosis and social determinants are possible reasons for the heterogeneous prevalence rates. Infection with HPV is known to be the necessary cause of CIN; hence, molecular techniques such as HPV DNA and HPV mRNA tests are likely to yield a higher prevalence of CIN 1 [22]. Conventional cytology is known to be less sensitive, and in the majority of the studies abnormal cytology results were largely classified as ASCUS. In such cases, high-risk HPV DNA tests are more likely to identify CIN 1 [22]. Using conventional cytology as a routine screening test in the present study population still yielded a higher proportion of women (5.0%) with low-grade or high-grade lesions, and if the atypical cytology results are included, the prevalence of abnormal cervical cytology in the present population is likely to be approximately 8.0%.

The timing of screening in pregnant women could be another potential reason for varying prevalence rates. Some studies presented findings from screening in pregnancy, whereas other studies—including the present study—have presented findings from screening in the postpartum period [23]. However, there is evidence that noninvasive CIN diagnosed in pregnancy has a tendency not to progress during pregnancy, and 48%–70% of cases have regressed to complete remission after delivery [11,12]. Only high-grade CIN is more likely

to persist after delivery, and the present prevalence of HGSILs in postpartum women (0.7%) is higher than that in most other reported studies of pregnant women (0.4%) [23]. A large population-based study in Brazil [14] confirmed that the prevalence of HGSILs (0.4%) in pregnant women was similar to that in their nonpregnant counterparts. There are few studies that have investigated the association between CIN and HIV in pregnancy, but most studies did not compare their findings with an HIV-uninfected group of pregnant women [14,15]. In the present study, when compared with women with a normal Pap smear, the prevalence of HIV infection was twofold higher in women with LGSILs and almost 2.5 times higher among women with HGSILs after delivery. This association between HIV and cytological abnormalities is consistent with findings from two other South African studies of nonpregnant women and could mainly be related to an increased persistence of high-risk HPV infections in HIV-infected women [8,24].

Generally, infections and associated morbidity in pregnancy are likely to alter pregnancy outcomes. Yet, there was no evidence of greater adverse pregnancy outcomes among HIV-infected women with cervical cell abnormalities in the present South African study cohort. Only a handful of studies have reported pregnancy outcomes for a population with cervical cell abnormalities, and none of these explored the outcomes in pregnant women with HIV coinfection. Findings from these limited studies were indicative of an association between preterm delivery and CIN/HPV infection. The present findings appear reassuring and indicate that HIV and LGSIL or HGSIL do not alter pregnancy outcomes. We have previously shown that untreated sexually transmitted infections in pregnancy could contribute to adverse pregnancy outcomes [25].

There are several limitations to the present study as a result of it being a retrospective data analysis. These limitations include missing pregnancy outcome data, missing Pap smear results for a large proportion of the study population, and lack of quality control measures in the performance of Pap smears.

In conclusion, the present findings confirm that HIV-infected postpartum women are more likely to be diagnosed with higher grades of cervical cell abnormalities, compared with postpartum women without HIV infection. Given the low prevalence of HGSILs at the postpartum visit and the lack of an association between birth outcomes and HGSIL/HIV comorbidity, cervical screening may be postponed to the postpartum period but remains essential. There is also a need for additional studies to review the impact of the recently introduced national HPV vaccination program in South Africa.

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Synopsis

HIV-infected pregnant women are likely to present with higher grades of cervical cell abnormalities in the puerperium but without any evidence of adverse pregnancy outcomes.

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Table 1
Characteristics of women with and without squamous cell abnormalities in the puerperium.^a

Characteristic	ASCUS (n=29)	Diagnosis deferred (n=36)	HGSILs (n=7)	LGSILs (n=42)	Normal Pap smear (n=895)	Unadjusted P value	Adjusted P value ^b
Age, y						0.072	0.548
<24	18 (62.1)	22 (61.1)	1 (14.3)	24 (57.1)	436 (48.7)		
24	11 (37.9)	14 (38.9)	6 (85.7)	18 (42.9)	459 (51.3)		
Education						0.405	0.749
No formal school	3 (10.3)	1 (2.8)	0	1 (2.4)	54 (6.0)		
Primary	9 (31.0)	13 (36.1)	5 (71.4)	18 (42.9)	368 (41.1)		
Secondary	17 (58.6)	22 (61.1)	2 (28.6)	23 (54.8)	472 (52.7)		
Missing	0	0	0	0	1 (0.1)		
Socioeconomic status						0.709	0.503
Low	11 (37.9)	15 (41.7)	2 (28.6)	16 (38.1)	338 (37.8)		
Moderate	12 (41.4)	13 (36.1)	3 (42.9)	19 (45.2)	339 (37.9)		
High	5 (17.2)	8 (22.2)	2 (28.6)	6 (14.3)	197 (22.0)		
Missing	1 (3.4)	0	0	1 (2.4)	21 (2.3)		
Previous pregnancies						0.035	0.023
0	17 (58.6)	1 (2.8)	1 (14.3)	17 (40.5)	310 (34.6)		
1-2	6 (20.7)	4 (11.1)	4 (57.1)	19 (45.2)	329 (36.8)		
3	6 (20.7)	2 (5.6)	2 (28.6)	6 (14.3)	256 (28.6)		
Missing	0	29 (80.6)	0	0	0		
HIV status						<0.001	<0.001
Negative	18 (62.1)	25 (69.4)	1 (14.3)	14 (33.3)	570 (63.7)		
Positive	11 (37.9)	11 (30.6)	6 (85.7)	28 (66.7)	325 (36.3)		
<i>Neisseria gonorrhoeae</i>						0.766	0.714
Negative	28 (96.6)	32 (88.9)	6 (85.7)	39 (92.9)	836 (93.4)		
Positive	1 (3.4)	4 (11.1)	1 (14.3)	2 (4.8)	48 (5.4)		
Missing	0	0	0	1 (2.4)	11 (1.2)		
<i>Chlamydia trachomatis</i>						>0.99	0.412

Characteristic	ASCUS (n=29)	Diagnosis deferred (n=36)	HGSILs (n=7)	LGSILs (n=42)	Normal Pap smear (n=895)	Unadjusted <i>P</i> value	Adjusted <i>P</i> value ^b
Negative	25 (86.2)	30 (83.3)	6 (85.7)	34 (81.0)	723 (80.8)		
Positive	4 (13.8)	6 (16.7)	1 (14.3)	8 (19.0)	161 (18.0)		
Missing	0	0	0	0	11 (1.2)		
<i>Trichomonas vaginalis</i>						0.654	0.893
Negative	26 (89.7)	30 (83.3)	5 (71.4)	36 (85.7)	761 (85.0)		
Positive	2 (6.9)	6 (16.7)	2 (28.6)	6 (14.3)	123 (13.7)		
Missing	1 (3.4)	0	0	0	11 (1.2)		

Abbreviations: ASCUS, atypical squamous cells of undetermined significance; HGSIL, high-grade squamous intraepithelial lesion; LGSIL, low-grade squamous intraepithelial lesions.

^aValues are given as number (percentage) unless indicated otherwise.

^bAdjusted for age group, education, socioeconomic status, and presence of other sexually transmitted infections (as appropriate).

Table 2

Pregnancy outcomes among 792 women with and without squamous cell abnormalities in the puerperium.^a

Pregnancy outcome	ASCUS (n=26)	HGSILs (n=7)	LGSILs (n=33)	Normal Pap smear (n=726)	Unadjusted P value
Birth outcome					0.918
Spontaneous abortion	0	0	1 (3.0)	7 (1.0)	
Stillbirth	1 (3.8)	0	0	16 (2.2)	
Live birth	25 (96.2)	7 (100.0)	32 (97.0)	703 (96.8) ^b	
Birth weight ^c					0.403
<2500 g	3 (12.0)	2 (28.6)	0	25 (3.6)	
2500 g	21 (84.0)	5 (71.4)	31 (96.9)	536 (76.2)	
Missing	1 (4.0)	0	1 (3.1)	142 (20.2)	
Pregnancy duration at delivery ^c					0.552
Preterm (<37 wk)	4 (16.0)	3 (42.9)	4 (12.5)	120 (17.1)	
Term (≥ 37 wk)	21 (84.0)	4 (57.1)	28 (87.5)	580 (82.5)	
Missing	0	0	0	3 (0.4)	

Abbreviations: ASCUS, atypical squamous cells of undetermined significance; HGSIL, high-grade squamous intraepithelial lesions; LGSIL, low-grade squamous intraepithelial lesions.

^a Values are given as number (percentage) unless indicated otherwise.

^b Includes 4 neonatal deaths.

^c Among live births.

Table 3

Pregnancy outcomes among 792 women with and without squamous cell abnormalities and/or HIV infection in the puerperium.^a

Pregnancy outcome	ASCUS			HGSILs			LGSILs			Normal Pap smear		
	HIV + (n=11)	HIV – (n=15)	P value	HIV + (n=6)	HIV – (n=1)	P value	HIV + (n=21)	HIV – (n=12)	P value	HIV + (n=265)	HIV – (n=461)	P value
Birth outcome			0.576			—			0.364			0.176
No live birth	0	1 (6.7)		0	0		0	1 (8.3)		11 (4.2)	12 (2.6)	
Live birth	11 (100.0)	14 (93.3)		6 (100.0)	1 (100.0)		21 (100.0)	11 (91.7)		254 (95.8)	449 (97.4)	
Birth weight ^b			—			—			—			0.032
<2500 g	0	0		0	0		0	0		14 (5.5)	11 (2.4)	
2500 g	7 (63.6)	13 (92.9)		4 (66.7)	0		16 (76.2)	11 (100.0)		190 (74.8)	346 (77.1)	
Missing	4 (36.4)	1 (7.1)		2 (33.3)	1 (100.0)		5 (23.8)	0		50 (19.7)	92 (20.5)	
Pregnancy duration at delivery ^b			0.209			0.429			0.166			0.288
Preterm (<37 wk)	3 (27.3)	1 (7.1)		2 (33.3)	1 (100.0)		4 (19.0)	0		40 (15.7)	80 (17.8)	
Term (≥ 37 wk)	8 (72.7)	13 (92.9)		4 (66.7)	0		17 (81.0)	11 (100.0)		212 (83.5)	368 (82.0)	
Missing	0	0		0	0		0	0		2 (0.8)	1 (0.2)	

Abbreviations: ASCUS, atypical squamous cells of undetermined significance; HGSIL, high-grade squamous intraepithelial lesions; LGSIL, low-grade squamous intraepithelial lesions.

^aValues are given as number (percentage) unless indicated otherwise.

^bLive births only.