

# Microbial and Antibiotic Sensitivity Pattern of High Vaginal Swab Culture Results in Sekondi-Takoradi Metropolis of the Western Region of Ghana: Retrospective Study

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## To cite this article:

Verner Ndudiri Orish, Jones Ofori-Amoah, Mahama François, Bruku Kwesi Silverius, Ebenezer Kofi Mensah. Microbial and Antibiotic Sensitivity Pattern of High Vaginal Swab Culture Results in Sekondi-Takoradi Metropolis of the Western Region of Ghana: Retrospective Study. *European Journal of Clinical and Biomedical Sciences*. Vol. 2, No. 5, 2016, pp. 45-50. doi: 10.11648/j.ejcbcs.20160205.13

**Received:** September 12, 2016; **Accepted:** November 1, 2016; **Published:** November 23, 2016

**Abstract:** Vaginal discharge in women is sometimes caused by candida or aerobic bacteria organisms like *E. coli*, staphylococcus aureus, and  $\beta$ - haemolytic streptococcus. Culture and sensitivity testing are done from high vaginal swab (HVS) specimen collected from women who come to the clinic complaining of vaginal discharge. Isolation and antibiotic sensitivity of these organisms are key to the successful treatment of the cause of vaginal discharge. This study tends to evaluate the microbial and antibiotic sensitivity pattern of high vaginal swab culture results in the Sekondi-Takoradi metropolis of the Western region of Ghana. This is a 3-year retrospective study conducted in the Public Health laboratory of Effia-Nkwanta Regional Hospital. Records of HVS culture and sensitivity results for 2010-2012 were retrieved and reviewed. A total of 3783 culture and sensitivity results were reviewed. 1483 yielded no growth of pathogenic organisms. Candida species were the predominant microbial organism, 63.2% (1455/2300). Bacteria identified were mostly the aerobic types (845); with *Escherichia coli* being predominant, 29.9% (235/845), while *Morganella morganii* was the least bacteria, 0.2% (2/845). Adult women (20-50) had the most pathogens isolated from them, with 79.9% of candida (1047/1455) and 71.2% of the aerobic bacteria (602/845). The least organism isolated was seen in the elderly and children, with 6.3% (92/1455) of candida, 9.7% (82/845) of aerobic bacteria and 6.9% (101/1455) of candida and 8.04% (68/845) of aerobic bacteria respectively. The cephalosporins showed the best antibiotic sensitivity. Candida spp. and aerobic bacteria were the predominant microbial organisms identified from HVS results in the Sekondi-Takoradi Metropolis. Proper laboratory diagnosis to identify causative organisms is vital for optimal therapeutic outcome.

**Keywords:** Vaginal Discharge, High Vaginal Swab, Bacterial Vaginosis, Vulvovaginal Candidiasis

## 1. Introduction

Infections of the genitourinary tracts or reproductive tract infections are a major problem of women's sexual health. They are commonly seen in women of reproductive age and usually present with vaginal discharge [1]. They include

sexually transmitted infections (STI), bacterial vaginosis (BV), aerobic vaginitis and candidiasis [2]. Sexually transmitted diseases in women occur when there is an introduction of sexually transmitted organism into the vagina,

mostly through sexual activity [3]. It is a major problem for women of reproductive age all over the world. It poses a major challenge to female sexual health, especially in women in developing countries in Africa [4]. WHO estimated that 75% to 80% of all new cases of sexually transmitted diseases are in developing countries [5]. The majority of these diseases are the four most common ones like gonorrhea, Chlamydia, syphilis and trichomoniasis [5].

Bacterial vaginosis is the invasion of the vagina with anaerobic bacteria organisms. It occurs when there is alteration of the vaginal ecology with gross depletion of the normal bacteria flora lactobacilli with overgrowth of anaerobic polymicrobial organisms [6, 7]. It is the commonest form of vaginal infections in women of reproductive age [8]. It constitutes almost 40% of cases in women attending sexually transmitted disease clinic [9-11]. In pregnant women, it constitutes almost 30% of all cases [12, 13]. The common organisms implicated in bacterial vaginosis include *Gardnerella vaginalis*, *Mycoplasma hominis*, and anaerobic bacteria such as *Peptostreptococci*, *Prevotella* spp, and *Mobiluncus* spp [14].

Aerobic vaginitis is the accumulation of aerobic organisms, such as *E coli*, Group B streptococci, etc., in the vagina [15-17]. It is a term used to refer to vaginal flora abnormality distinct from bacterial vaginosis [15]. Aerobic vaginitis, like bacterial vaginosis, causes depletion of normal bacteria flora lacto bacillus. It is clinically characterized with red and inflamed vagina, yellowish vaginal discharge with burning sensation and dyspareunia [15]. It has been implicated in pregnancy complications, preterm delivery, preterm rupture of membrane and ascending chorioamnionitis [18].

Candidiasis is a fungal infection which affects the oral mucosa and the genital tract. *Candida albicans* is the commonest candida species implicated in about 80% of vaginal yeast infections, while the remaining is between *candida glabrata* and *tropicalis* [19]. Vaginal yeast infection or candidal vulvovaginitis is the commonest cause of vaginal discharge outside the STI and BV, and most adult women would have experienced this infection at least once in their lifetime [19].

Sexual health is a serious public health issue in Ghana with the Ministry of health involved in most sexual and reproductive health programs [20]. Sexually transmitted or reproductive tract infections are not notifiable in Ghana despite prevalence studies highlighting the burden in women who attend sexual health and other clinics [21]. There is decline in fertility in Ghana and other evidence implicating the consequences of reproductive tract infections [20]. It is very important to evaluate vaginal pathogens in women who come in with complaints related to the reproductive tract; this will aid in the adequate surveillance of reproductive tract infections and go a long way in the control of infections and prevention of debilitating sequelae. Thus, this work tends to evaluate the pattern and trend of vaginal pathogens of High Vaginal Swab culture results in the Public Health Laboratory of Effia-Nkwanta regional hospital.

## 2. Methods

Study was done in the public health laboratory in Effia Nkwanta regional hospital, Sekondi-Takoradi of the western region of Ghana.

### Study site

Effia-Nkwanta Regional Hospital is a secondary health-care institution and is the only referral hospital for the whole western region, located in the south-western part of Ghana in the Sekondi-Takoradi metropolis. It serves all other hospitals within the entire 22 districts of the western region and subdivisions of 13 major districts. Sekondi-Takoradi is within the Shama-Ahanta east and west metropolitan area. It is the administrative capital of the Western Region with land area of 385 square kilometres, about 242 kilometres to the west of Accra, the capital city of Ghana. The region is approximately 280 kilometres from Cote d'Ivoire border and has an estimated population of roughly 335, 000. It is presumed to be Ghana's third largest city with industrial and commercial centres, as well as tourist interests.

### 2.1. Data Collection

The retrospective study was carried out in the public health laboratory. High vaginal swab culture and sensitivity records from 2010 to 2012 were collected.

### 2.2. Specimen Collection and Processing

High vaginal swabs specimen were received from patients seen within the hospital either on admission or from gynecology outpatient department, and from other peripheral hospitals and clinics within the metropolis. In either case, specimens were collected by trained nurses and patients were instructed to go quickly to the Public Health laboratory. On arrival at the public health laboratory, patients demographics were collected, and few drops of normal saline added to the collected specimen for microbial examination. Specimens were then inoculated into blood agar and/or chocolate agar, prepared from nutrient broth (Tulip Diagnostic Limited, India). Standard culture and sensitivity procedures were followed and the results interpreted by a Microbiologist [22].

### 2.3. Result Interpretation

Only pathogens isolated and identified were reported in the results. Normal vaginal flora were not reported and designated as "no pathogen isolated".

### 2.4. Data Analysis

All data were double entered into Microsoft excel, spreadsheet and SPSS. Frequency distribution was done for all variables using the SPSS version 21.

### 2.5. Ethical Clearance

Approval was granted for this work from the office of the Western Regional clinical coordinator of the Ghana Health Service, Sekondi-Takoradi.

### 3. Result

Of the total number of HVS results reviewed (3783), 39.2% yielded no pathogen from culture (Figure 1). *Candida* spp. was the predominant pathogen isolated (63.2%), while bacteria growth identified were predominantly the aerobic

organisms (Figure 1). *Escherichia coli* was the predominant bacteria noted (29.9%), and *Morganella morganii* as the least identified bacteria (0.2%). The distribution of the various aerobic bacteria isolated in this study is represented as showed in Table 2.

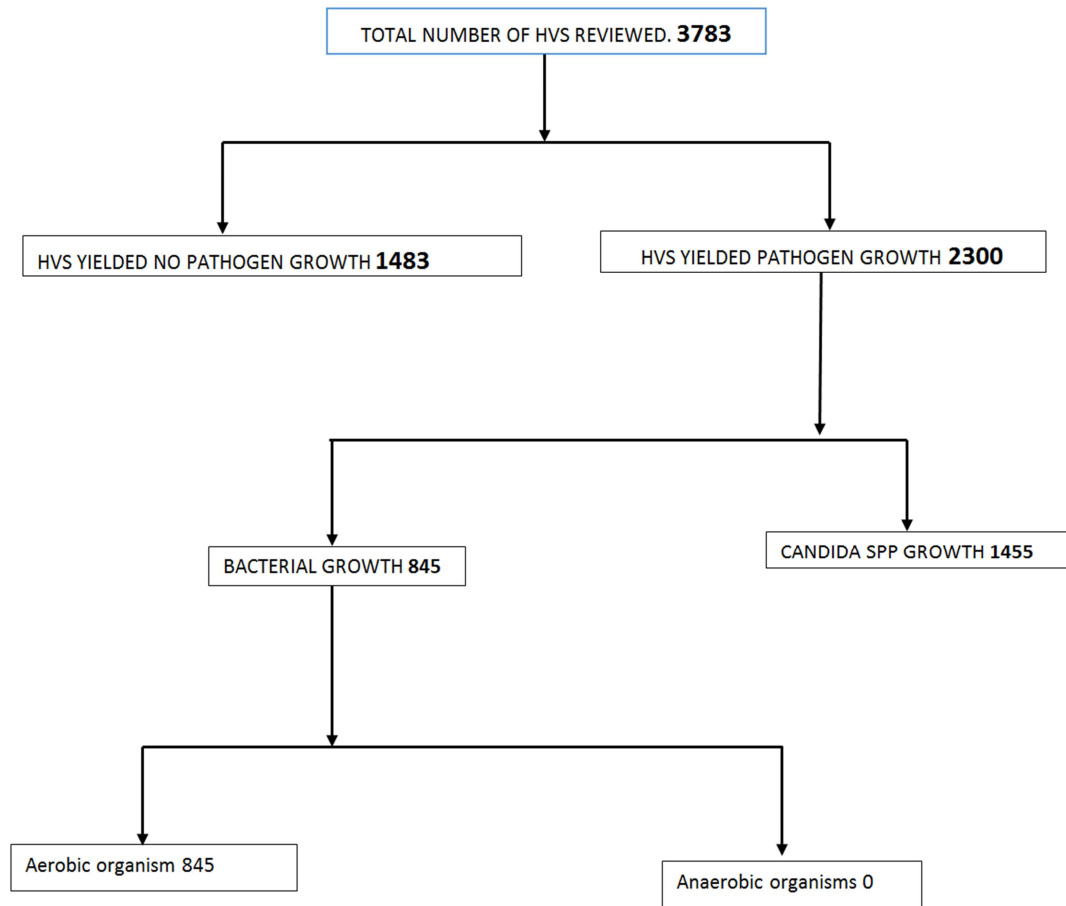


Figure 1. Flow chat – Overview of HVS results.

The reviewed cases were grouped into children (0-12 years), teenagers (13-19 years), adults (20-50) and elderly (51 and above) (Table 2). Adult women had the most pathogens isolated from them, with 79.9% of *Candida* and 71.2% of the aerobic bacteria. The least microorganism isolated was seen in the elderly and children, with 6.3% of *Candida* and 9.7% of aerobic bacteria, and 6.9% of *Candida* and 8.04% of aerobic bacteria, respectively.

Table 1. Characteristics of culture result.

Organisms	Frequency	Percent
E-coli	292	34.5
staph aureus	176	20.8
proteus spp	96	11.4
Enterobacter spp	84	9.9
Beta haemolytic strept	50	5.9
streptococcus pyogenes	51	6.0
citrobacter spp	42	4.9
Non-haemolytic strept	30	3.6
klebsiella spp	18	2.1
providencia spp	4	0.5
morganella morganii	2	0.2

Table 2. Organism prevalence at different age groups Org.

	Age group				Total
	0-12	13-19	20-50	51 and above	
Candida spp	101	215	1047	92	1455
E-coli	23	29	211	29	292
staph aureus	17	25	113	21	176
proteus spp	9	10	69	8	96
Enterobacter spp	7	9	60	8	84
Beta haemolytic strept	5	9	30	6	50
streptococcus pyogenes	2	2	45	2	51
citrobacter spp	2	4	33	3	42
Non-haemolytic strept	1	1	26	2	30
klebsiella spp	1	2	12	3	18
providencia spp	1	0	3	0	4
morganella morganii	0	2	0	0	2
Total	169	308	1649	174	2300

Table 3 showed percentage sensitivity of bacteria isolates to various antibiotics for the sensitivity. Cephalosporins (i.e. Cefotaxime, Cefuroxime Ceftriazone) were seen to have the

highest percentage antibiotic sensitivity for most organisms cultured; whilst Tetracycline and Penicillin were among the drugs with the lowest percentage sensitivity.

**Table 3.** Antibiotic Percentage Sensitivity.

	<b>E. Coli</b>	<b>Staph Aureus</b>	<b>Proteus spp</b>	<b>Enterobacter spp</b>	<b>Beta Hemolytic Strep</b>	<b>Strept pyrogens</b>
Cefotaxime	62	49	87	68	50	96
Cefuroxime	43	67	68	42	74	71
Tetracycline	11	16	8	17	14	14
Gentamicin	42	42	68	39	10	18
Amikacin	55	49	60	55	-	-
Chloramphenicol	28	43	22	20	44	53
Ampicillin	17	28	18	13	54	57
Contrimoxazole	17	10	22	14	16	10
Penicillin	49	10	46	48	24	12
Erythromycin	49	59	49	48	42	53
Ceftriaxone	58	47	65	55	100	98

**Table 3.** Continue.

	<b>Citrobacter spp</b>	<b>Non-Haemolytic Strept</b>	<b>Klebsiella</b>	<b>Providencia spp</b>	<b>morganella morganii</b>
Cefotaxime	57	60	67	25	100
Cefuroxime	31	73	38	25	50
Tetracycline	12	20	6	0	0
Gentamicin	50	13	33	25	100
Amikacin	62	100	56		
Chloramphenicol	14	43	33	25	0
Ampicillin	17	50	0	0	0
Contrimoxazole	19	13	22	25	0
Penicillin	48	30	-	-	-
Erythromycin	-	50	-	-	-
Ceftriaxone	59	-	61	75	100

## 4. Discussion

This is a retrospective review of the HVS culture and sensitivity of women who attended the Effia-Nkwanta Regional Hospital, Sekondi-Takoradi metropolis, Ghana from 2010 to 2102.

Not all the HVS results revealed pathogenic organisms, as about 40% of the HVS results over the period yielded no growth of pathogens. Several reasons might explain this; but it is important to note that not all vaginal discharges reported by women during visits to the clinic are disease conditions or are caused by pathogenic organisms [23-25].

Candida species were the most prevalent organisms isolated in this study. This result is in line with and similar to reports from other hospital based studies [26, 27]. High vaginal swab culture among children yielded one of the least growths for candida species. Low prevalence of vaginal candidiasis in children is an expected finding, since there are low levels of estrogen resulting in a preponderance of anaerobic vaginal flora which antagonizes the growth of candida organisms [28-30]. Low estrogen level can also explain the low levels of candida species isolated among the elderly in this study, as vaginal candidiasis is mainly a disease more common among premenopausal woman [31].

It is very interesting to note that the HVS culture in this study yielded only aerobic organisms typically seen in cases of aerobic vaginitis [15,16]; and no anaerobic organisms as seen in bacterial vaginosis. Aerobic vaginitis is very much

distinct from bacteria vaginosis, as the pathogenic organisms' composition and clinical presentation are very much different [15]. Though both can be associated with vaginal discharges, aerobic vaginitis is marked with clinical signs of inflammation presenting as yellowish discharge and vaginal dyspareunia [15]. However, in both conditions, there are depletion of lactobacillus and lactate in the vagina [15]. There is also a clinical possibility of a mixture of both infections in a woman as evident by both aerobic and anaerobic organism in the vaginal exudate [15].

*Escherichia coli* was the predominant aerobe followed by *staphylococcus aureus*. This is in contrast with some study that showed staphylococcus as the predominate species [15, 16]. However, both *Escherichia coli* and *Staphylococcus aureus* are very much associated with aerobic vaginitis, as they are very often isolated in aerobic vaginitis than in the normal flora [15]. In contrast to findings of most studies, *Proteus* spp were isolated at a relatively higher frequency in this study. *Proteus* organisms are bacteria associated with urinary tract infection and strongly linked to pyelonephritis, kidney stones and fever [32, 33]. The reason for this observation is not very clear, and necessitates further studies. Vaginal pathogens were found to be more in adult women between the ages of 20-50. This is a well reported finding in several other studies [15, 16, 34]. Although adult women have lactobacillus in their vaginal flora which serves as check for other pathogenic organisms, other activities of these women like sexual activities and indiscriminate use of antibiotics can predispose them to vaginal infections [16, 35].

Cephalosporins were found to be the most effective antibiotics against the bacteria isolates in this study. Cefuroxime, a second generation cephalosporin, was the least sensitive among the cephalosporins, with 43% for *Escherichia coli*, 67% for *Staphylococcus* and 74% for *Beta-hemolytic streptococcus* sensitivity. Ceftriaxone and cefotaxime, both third generation cephalosporins were more effective. This high anti-bacterial sensitivity by the cephalosporin is in conformity with the work of Mumtaz and his colleagues in 2008 [16].

Penicillin resistance was also observed in this study, as ampicillin and penicillin had only 17% sensitivity for *Escherichia coli*, 28% for *staphylococcus* and 54% for  $\beta$ -haemolytic *streptococcus*. The penicillins are widely prescribed and often misused, in addition to the production of  $\beta$  lactamase by *staphylococcus* and other various bacteria, has lead to their resistance, as observed in this study. Penicillin and tazobactam ( $\beta$  lactamase inhibitor) combination would rather yield a better anti-bacterial effect [16, 36].

#### 4.1. Conclusion

The study showed candida and aerobic bacteria as the predominant pathogens isolated. It also shows that some women had no pathogen isolated from their HVS culture result. It is important to note that vaginal discharges in some women are not caused by pathogenic organisms. It is possible that some women who come to hospital with vaginal discharge are treated with empirical antibiotics without relying on culture and sensitivity. As evident from the this study, this practice should be discouraged, as this will lead to unsuccessful treatment, frequent visits of these women to hospital, drug resistance and other medical and social problems.

#### 4.2. Limitations

There are obvious limitations to this study, as it is only a retrospective review that did not capture the medical conditions and clinical presentations of these patients. A prospective and clinical study will be required to complement this effort for a more comprehensive understanding of the vaginal pathogen distributions among women in this region.

### List of Abbreviations

STI: Sexually transmitted infection  
HVS: High vaginal swab  
BV: Bacterial Vaginosis

### Declaration

#### Competing interest

Authors declare that they have no competing interest.

### Authors' Contributions

ORISH Verner conceived, planned, executed the study and

drafted the manuscript as well as analysis of data; Jones Ofori-Amoah edited/reviewed and revised the manuscript; Mahama François and Bruku K. Silverius imputed the data into SPSS software and contributed to analysis of the data; Ebenezer K Mensah outlined the methodology involved in HVS collection and investigation, and also contributed in drafting the manuscript. All authors have read and approved the final manuscript.

### Acknowledgement

Authors wish to thank the staff of the Public Health Laboratory–Effia Nkwanta Regional Hospital for their cooperation, and to our research assistants that collected the data from the records.

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