Journal of Womens Health, Issues and Care

Research Article A SCITECHNOL JOURNAL

Risk Assessment of Sexually Transmitted Infections in Sexual Assault Victims

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Received date: 04 September, 2023, Manuscript No. JWHIC-23-112600;

Editor assigned date: 06 September, 2023, PreQC No. JWHIC-23-112600 (PQ);

Reviewed date: 21 September, 2023, QC No. JWHIC-23-112600;

Revised date: 29 September, 2023, Manuscript No. JWHIC-23-112600 (R);

Published date: 09 October, 2023, DOI: 10.4172/2325-9795.1000461.

Abstract

Objective: Sexual assault is a global problem presenting with medical and legal sequelae, and accompanying risks have been increasing as young women are exposed to more sexual violence in emerging online communities. Sexual assault victims are at risk of acquiring Sexually Transmitted Infections (STIs); therefore, proper management is essential. This study aimed to assess the risks of STIs among sexual assault victims and develop a standardized protocol to provide appropriate care.

Methods: This was a prospective, single-center study of alleged female sexual assault victims aged ≥ 19 years who visited the Seoul South District Sunflower Center. The investigation included documentation of history, laboratory evaluation, and testing for STIs at the time of the first visit, 1-month after the assault (second visit), and 6-months after the assault (third visit). The primary outcomes included the presence of STIs, Gram staining, and culture from vaginal excretion. The variables were analyzed using Fisher's exact test and Firth's logistic regression, and a two-sided P<0.05 was considered statistically significant. Data were analyzed using SPSS 26.0.

Results: From a total of 117 alleged sexual assault victims initially enrolled in the study, 63 completed both the 1st and 6th months follow up. In univariate analysis, victims with a previous experience in sexual intercourse showed a higher risk of positive vaginal Gram staining and culture results at the initial visit than those with no previous experience (P=0.028). The use of prophylactic antibiotics at the initial visit did not result in a lower risk of STIs and bacterial vaginitis at the second and third visit.

Conclusion: The use of prophylactic antibiotics at the initial visit did not reduce the risk of future STIs among sexual assault victims. Although prophylactic antibiotic administration at the initial visit is not a risk factor for STIs, it is important in maintaining the health of sexual assault victims.

Keywords: Sexual assault victim; Antibiotics; Prophylaxis; Sexually transmitted infections

Introduction

Sexual assault refers to a broad spectrum of nonconsensual sexual violence, ranging from any type of unwanted sexual contact to vaginal or anal penetration. It also includes the use of physical force, coercion, or threat and often accompanies intoxication by drugs or alcohol [1-3]. Risks of exposure have been increasing as younger generations have more access to meeting online acquaintances that may have sexually violent intentions, in addition to increased prevalence within colleges or universities [4-6]. In the United States, approximately 1.5 million rape-related assaults against women are reported annually, and approximately one in five women aged 18 years or older have been reported to be victims of completed or attempted rape in their lifetime [7]. Sexual assault is a significant health burden, with multiple medical and legal consequences. It includes not only physical and psychological problems, but also social and legal sequelae [8-10]. Acute traumatic injuries include bruising, laceration, fracture, and those that even lead to death [11]. Psychological consequences include depressive disorder, alcohol abuse, and posttraumatic stress disorder [12]. Particularly, sexual assault victims are at high risk of acquiring Sexually Transmitted Infections (STIs). The most common STIs diagnosed among sexual assault survivors are chlamydia, gonorrhea, bacterial vaginosis, and trichomoniasis; and the overall STIs prevalence in victims is approximately 30%-60% according to previous reports [13-15]. STIs can easily spread and may cause long-term complications, such as pelvic inflammatory diseases, infertility, and chronic pelvic pain. Thus, this study was conducted to assess the risk of STIs in sexual assault victims and establish standard protocols to provide appropriate care or medical treatment, psychological support, STI management, and prevention of repeat sexual assault.

Materials and Methods

Participants

The participants of this study were women aged 19 years and above who were sexual assault victims and visited the Seoul Southern Sunflower Center at Boramae Medical Center between October 2015 and October 2020. Victims who were underage, had intellectual disabilities, or could not consent to participate in the study were excluded. This study was approved by the Institutional Review Board of the SMG-SNU Boramae Medical Center (IRB No. 26-2014-16).

Study design

We recorded the participants' initial visit to the hospital immediately after the sexual assault incidence and the follow-up visits after one month (second visit) and six months (third visit). The visits consisted of the assessments and tests as described below.

Assessment: Co-existing diseases, medical/obstetrical/gynecological medical history, contraceptive, sexual assault situation.

Initial blood test: Complete blood count, electrolyte levels, liver function test, creatinine, urine test, pregnancy test.

STI test: Serology (Syphilis, Hepatitis B antigen, Human immunodeficiency virus), vaginal discharge PCR test (Chlamydia trachomatis, Neisseria gonorrhea, Cytomegalovirus, Mycoplasma, Ureaplasma).

Bacterial vaginitis test: Gram staining and culture of vaginal secretion.

Analytical method

We included the age of the participant, prior sexual experience before the sexual assault incidence, and administration of prophylactic antibiotics at the initial visit of Seoul Southern Sunflower Center as the exposure variables. The result variables were positive for Polymerase Chain Reaction (PCR) test for STIs (conducted on vaginal discharge samples), Gram staining, and culture. IBM SPSS statistics 26.0 package was used to apply the Fisher's exact test and logistic regression with Firth's penalized likelihood method on risk factors evaluation. Values with P<0.05 were noted statistically significant.

Results

From a total of 117 alleged sexual assault victims who initially consented and agreed to enroll in the study at their initial visit, 63 completed the follow-up at both the 1st and 6th months period. All 63 subjects showed negative serology test results at every visit. The participants' age, previous experience of sexual intercourse, use of alcohol or prophylactic antibiotics at the first follow-up visit were analyzed as exposure variables by contingency tables.

Participants were grouped by age into those <30 years old and those 30 years old, according to logistic regression results simplifying risk assessment. Of the 63 participants, 53 were <30 years old and 10 were >30 years old. Five participants had no prior sexual experience before the assault. There were 52 survivors who were in a drunken state when the assault occurred. Of the 63 survivors, 36 prophylactically administered antibiotics, while, 27 did not take prophylactic antibiotics. The results of the PCR test for Chlamydia trachomatis, Neisseria gonorrhea, Cytomegalovirus, Mycoplasma, Ureaplasma, vaginal Gram staining, and culture were used as the primary outcomes.

In the univariate analysis, there were no significant correlations with STIs. The use of prophylactic antibiotics at the initial visit did not result in a lower risk of STIs at the second and third visit. However, victims who had previous experience of sexual intercourse showed a higher risk of positive vaginal Gram staining and culture at the initial visit than those with no prior sexual experience (P=0.028) (Table 1).

Logistic regression with Firth's penalized likelihood				
Univariable analysis				
Response	**Explanatory variable**	**Odds Ratio**	**95% CI**	**P-value**
Chlamydia, V1	Age, continuous	0.956	(0.794, 1.055)	0.454
	Age, 30< *vs.* ≥ 30	4.482	(0.494, 594.863)	0.22
	Sexual contact, (Single+married) *vs.* Virgin	2.112	(0.209, 285.768)	0.59
	Alcohol, Yes *vs.* No	0.626	(0.138, 3.757)	0.575
Chlamydia, V2	Age, continuous	1.012	(0.860, 1.105)	0.833
	Age, 30< *vs.* ≥ 30	2.38	(0.238, 321.623)	0.524
	Sexual contact, (Single+married) *vs.* Virgin	0.248	(0.034, 2.851)	0.227
	Alcohol, Yes *vs.* No	0.65	(0.105, 6.966)	0.676
	Antibiotics, Yes *vs.* No	0.473	(0.074, 2.621)	0.385
Chlamydia, V3	Age, continuous	0.776	(0.426, 1.051)	0.173
	Age, 30< *vs.* ≥ 30	1.947	(0.184, 265.631)	0.637
	Sexual contact, (Single+married) *vs.* Virgin	0.193	(0.024, 2.293)	0.167
	Alcohol, Yes *vs.* No	0.505	(0.073, 5.604)	0.526
	Antibiotics, Yes *vs.* No	0.71	(0.103, 4.893)	0.714
Response	**Explanatory variable**	**Odds Ratio**	**95% CI**	**P-value**
Gonorrhea, V1	Age, continuous	1.018	(0.695, 1.136)	0.827

	Age, 30< *vs.* ≥ 30	1.019	(0.075, 144.608)	0.99
	Sexual contact, (Single+married) *vs.* Virgin	0.487	(0.033, 70.444)	0.677
	Alcohol, Yes *vs.* No	0.204	(0.015, 2.694)	0.203
Gonorrhea, V2	Age, continuous	1.062	(0.825, 1.193)	0.418
	Age, 30< *vs.* ≥ 30	0.6	(0.030, 90.016)	0.769
	Sexual contact, (Single+married) *vs.* Virgin	0.287	(0.013, 43.930)	0.506
	Alcohol, Yes *vs.* No	0.67	(0.033, 100.333)	0.816
	Antibiotics, Yes *vs.* No	0.227	(0.002, 4.422)	0.329
Response	**Explanatory variable**	**Odds Ratio**	**95% CI**	**P-value**
Other STI, V1	Age, continuous	0.99	(0.920, 1.056)	0.757
	Age, 30< *vs.* ≥ 30	1.031	(0.278, 4.119)	0.963
	Sexual contact, (Single+married) *vs.* Virgin	0.205	(0.020, 1.203)	0.081
	Alcohol, Yes *vs.* No	0.807	(0.226, 2.954)	0.739
Other STI, V2	Age, continuous	1.002	(0.926, 1.071)	0.947
	Age, 30< *vs.* ≥ 30	1.496	(0.361, 8.570)	0.596
	Sexual contact, (Single+married) *vs.* Virgin	1.265	(0.213, 13.289)	0.808
	Alcohol, Yes *vs.* No	0.404	(0.109, 1.517)	0.175
	Antibiotics, Yes *vs.* No	0.453	(0.149, 1.335)	0.151
Other STI, V3	Age, continuous	0.958	(0.859, 1.033)	0.294
	Age, 30< *vs.* ≥ 30	3.396	(0.695, 33.413)	0.141
	Sexual contact, (Single+married) *vs.* Virgin	0.605	(0.108, 3.909)	0.572
	Alcohol, Yes *vs.* No	1.927	(0.477, 10.921)	0.374
	Antibiotics, Yes *vs.* No	0.982	(0.337, 2.920)	0.973
Response	**Explanatory variable**	**Odds Ratio**	**95% CI**	**P-value**
CMV, V1	Age, continuous	1.043	(0.945, 1.128)	0.346
	Age, 30< *vs.* ≥ 30	0.718	(0.122, 7.579)	0.744
	Sexual contact, (Single+married) *vs.* Virgin	1.362	(0.127, 186.441)	0.835
	Alcohol, Yes *vs.* No	3.215	(0.336, 430.597)	0.368
CMV, V2	Age, continuous	1.024	(0.872, 1.120)	0.671
	Age, 30< *vs.* ≥ 30	1.908	(0.181, 260.238)	0.648
	Sexual contact, (Single+married) *vs.* Virgin	0.908	(0.078, 126.317)	0.951
	Alcohol, Yes *vs.* No	0.495	(0.072, 5.490)	0.514
	Antibiotics, Yes *vs.* No	0.69	(0.100, 4.751)	0.691

CMV, V3	Age, continuous	0.99	(0.825, 1.086)	0.869
	Age, 30< *vs.* ≥ 30	2.936	(0.304, 393.938)	0.413
	Sexual contact, (Single+married) *vs.* Virgin	0.314	(0.045, 3.540)	0.302
	Alcohol, Yes *vs.* No	0.828	(0.142, 8.690)	0.85
	Antibiotics, Yes *vs.* No	0.701	(0.137, 3.582)	0.659
Response	**Explanatory variable**	**Odds Ratio**	**95% CI**	**P-value**
Gram SC, V1	Age, continuous	0.999	(0.935, 1.067)	0.985
	Age, 30< *vs.* ≥ 30	0.895	(0.238, 3.361)	0.867
	Sexual contact, (Single+married) *vs.* Virgin	11.777	(1.243, 1571.585)	0.028
	Alcohol, Yes *vs.* No	2.619	(0.716, 11.602)	0.149
Gram SC, V2	Age, continuous	1.004	(0.939, 1.072)	0.905
	Age, 30< *vs.* ≥ 30	1.293	(0.350, 5.151)	0.701
	Sexual contact, (Single+married) *vs.* Virgin	1.208	(0.290, 5.431)	0.792
	Alcohol, Yes *vs.* No	0.443	(0.113, 1.569)	0.208
	Antibiotics, Yes *vs.* No	0.767	(0.282, 2.070)	0.6
Gram SC, V3	Age, continuous	1.044	(0.977, 1.122)	0.201
	Age, 30< *vs.* ≥ 30	0.597	(0.157, 2.424)	0.456
	Sexual contact, (Single+married) *vs.* Virgin	0.921	(0.198, 4.570)	0.916
	Alcohol, Yes *vs.* No	0.708	(0.194, 2.816)	0.609
	Antibiotics, Yes *vs.* No	1.326	(0.454, 4.052)	0.608

Note: V1: Initial visit; V2: Second visit; V3: Third visit; CMV: Cytomegalovirus; Gram SC: Gram's Staining and Culture.

Table 1: Logistic regression with Firth's penalized likelihood for related factors for sexually transmitted infections.

Discussion

Despite the recent increase in sexual assault reports and increased risk of exposure to sexual assault, there are very limited studies on predictive models of health risks of sexual assault victims. The health risks associated with sexual assault, including STIs, posttraumatic stress, and sexual dysfunction, have not been studied actively. Although this study consisted of a small number of participants, it provides great value as the first prospective study in the country to follow-up on sexual assault victims and evaluates the risks of STIs.

In this study, there was no statistically significant relationship between the exposure variables of the subject's age, past sexual experience, alcohol consumption at the time of the incident, and administration of prophylactic antibiotics at the initial visit, with the results of the PCR test for STIs. However, there was a significant decrease in the incidence of bacterial vaginal infection at the initial visit among participants who had no prior sexual experience compared to those with past sexual experiences. Bacterial vaginal infection occurs as a consequence of a change in normal vaginal flora, with the main resident normal flora (*Lactobacillus* species) being out numbered by anaerobic bacteria. Although bacterial vaginal infection is often asymptomatic, it can pose a risk to the health of premenopausal women. From a gynecological standpoint, bacterial vaginal infection can increase the risk for pelvic inflammatory disease, pelvic inflammation after abortion, vaginitis after hysterectomy, and atypical cervical cells; whereas from an obstetrical perspective, it can increase the risk for premature rupture of membranes, preterm birth, intra-amniotic infection, chorioamnionitis, and cesarean delivery after intrauterine infection [16].

On the initial visit, victims who had previous experience of sexual intercourse showed a higher risk of positive vaginal Gram staining and culture than those with no prior sexual experience. This difference was not seen in subsequent follow-up tests. Therefore, despite the positive results of vaginal discharge Gram staining and culture, prophylactic antibiotics could potentially reduce the risk of bacterial vaginal infection with women who had previous experience of sexual intercourse. This emphasizes the importance of prescribing prophylactic antibiotics to sexual assault victims who visit the Sunflower Centers.

According to the latest Sexually Transmitted Infections Treatment Guidelines provided by the US Department of Health and Human Services/Centers for Disease Control and Prevention, for sexual assault victims who are treated during the initial visit, regardless of whether testing was performed, post-treatment testing should be conducted only if the person reports any symptoms [17]. These guidelines appear to be quite consistent with the results of our study. Furthermore, all women who are diagnosed with chlamydial or gonococcal infection should be retested after 3 months from the start of treatment, regardless of whether their sex partners have been treated [18]. Starting prophylactic antibiotics for STIs at the initial visit would be beneficial, although, conclusive evidence on its necessity has not been proven by our research results. For sexual assault victims who were properly administered with prophylactic antibiotics at the initial visit, it is cautiously expected that STI repeat testing can be omitted at the 1st month follow-up.

A limitation of this study is the exclusion of intellectually impaired individuals, who have a high probability of being included in the high-risk group for STIs [19]. We recommend separate studies on intellectually impaired or underage sexual assault victims, and subsequently analyzing sexual assault risk factors, STIs, and long-lasting sequelae for each group.

Predictive modeling studies of diseases aim to predict whether the disease will occur in currently healthy individuals within a given amount of time. Such studies help predict the incidence rate of disease in individuals vulnerable to the disease. Of the indices being evaluated, the index that can be easily observed, regularly repeated, and is an important contributor in predicting the disease incidence, should be selected as the risk factor to conveniently predict the incidence of the disease. For efficient disease control, it is important to predict the risk groups that would be diagnosed with the disease and estimate the risk rate through predictive modeling studies of diseases. However, it is equally important to select the most relevant risk factors that predict disease incidence. In predicting incidence, the risk factor that could most closely reflect the current status of the disease needs to be selected first, to increase the level of prediction. To establish a nationwide risk index, constant effort is needed to measure and monitor various risk factors for further collective analysis.

Conclusion

In this study, with respect to the small number of participants who completed both the 1st and 6th months follow up, we observed that it was difficult to continously monitor sexual assault victims. If this study was continued with the acquisition of more participants, the results could be analyzed using multivariate logistic regression analysis, and a larger range of statistically significant results could be expected.

Despite the failure to develop a risk assessment model, it is imperative to continue this study and its design as it could serve as a basis for developing a nationwide, large data analysis and coding system. With this type of analysis, accurate data on the current situation and characteristics of sexual assault victims can be obtained prospectively, which would allow the construction of a systematic model of prevention, intervention, and treatment for the survivors.

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