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Seroprevalence Rate of the Human Immunodeficiency Virus Infection in Surgical Patients

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All patients (age>14 yr) admitted to the surgical department of Vajira Hospital, between January 1991 and December 1993 were evaluated for HIV infection within the first 24 hours of admission. This study was aimed to establish the incidence of HIV in the surgical patients by grouping into 28 subgroups according to their subspecialties, type of admission (emergency or elective) and sex. Twenty thousand and nineteen patients underwent HIV antibody assay, of whom 277 had positive results with confirmation by Western blot analysis (1.38%). Out of 277 cases, 237 were males (85.56%) and 40 were females (14.44%). Accident and emergency accounted for 79.42 per cent of all the cases.

By univariate and stepwise regression analysis, the emergency male subgroups of 5 subspecialties: trauma, general, plastic, neurological and orthopedics surgery, had the higher HIV incidence rate (r=0.899, p<0.000001). It should be noted that instead of routine HIV testing of patients admitted to surgical services, the 5 subgroups mentioned above should be the groups targeted for HIV testing. Routine testing should be discouraged.

In spite of the appropriate and understandable concern about the human immunodeficiency virus HIV transmission to health care workers, there has been paradoxically poor observance of universal precautions in hospital settings.[1] Improved compliance with universal precautions was based on their perception of the patient's risk of harboring HIV.[2] Mandatory testing for HIV in all surgical patients has been the policy of some hospitals in Thailand. Nevertheless, the question of cost-effectiveness, compulsive testing of low incidence groups may raise the frequency of false-positive results,[3] with a negative HIV screen rendering the window-period of recent infection in some patients, such knowledge could decrease the surgeon's risk of acquiring HIV infection, presumably by changes in practice that will decrease his or her risk of acquiring infection.[4] Although the rate of transmission from HIV-positive patients is approximately 0.3 per cent,[5] the incurability and universal mortality of the acquired immuno-deficiency syndrome caused by HIV raises concern over even a single preventable infection.[6] According to the reasons many health care providers wish to know the HIV status of their patients. Vajira Hospital is a 1,000-patient-bed public treaching hospital affiliated with the Srinakharinwirot University. The hospital provides medical and surgical services to middle and low socio-economic patients in Bangkok community. We undertook this study to determine the seroprevalence of in-patient surgical services and identify the high-risk group of patients in different subspecialty of surgical services. The HIV testing was carried out in all of them during a 3-year period.

PATIENTS AND METHODS

From January 1991 to December 1993, 22,294 patients were admitted to the surgical service of Vajira Hospital. Because of non-routine HIV testing in pediatric patients (age<14 yr), 2,260 children were excluded from this study. Except two, all 20,032 adults were included in this study. The HIV antibody analysis was carried out with standardized enzyme-linked immunoassay system (Third Generation r-DNA, Abbott, USA) during the official-hour and rapid test (Serocard, Bangkok RIA) after the official-hour. Each specimen initially reactive was reevaluated by enzyme-linked immunoassay. All repeated reactive specimens were analyzed by Western blot testing (New Lov-blot 1, Pasteur, France) for reactivity with HIV protein.

Statistical Analysis

Seroprevalence rates were compared by the χ^2 test or Fisher's exact test where appropriate. The age-specific seroprevalence rate were compared with the other range of age by the χ^2 for trend. Variables associated at a significant level of $p<0.05$ with the higher risk for HIV infection were then entered into a stepwise regression analysis to evaluate their independent predictive effect.

Validation Study

The surgical subspecialty, type of surgical illness included in the study were grouped in order to identify patients with a low-risk of HIV. We may have biased that the prevalence rate of non-emergency surgical patients (0.61%) was similar to that obtained from general population (0.74-0.80%) during the same period of study.[7]

RESULTS

A total of 20,032 surgical patients (age≥14 yr) was screened for HIV antibody. Two hundred and ninety-seven cases were found to have positive results. Thirteen seropositive cases were not confirmed by Western blot analysis. Of 13 cases; 2 were dead, 10 were against advise and only one with indeterminate result was not repeatedly confirmed, were also excluded from the study samples because all of them could not be documented by Western blot. Confirmed with Western blot analysis, 277 of 284 patients were positive results and 7 had negative. Out of 20,019 patients, 277 (1.38%) had positive results, of whom 237 were males (85.56%) and 40 were females (14.44%). They consisted of 220 (79.42%) emergency and 57 (20.58%) elective cases. Two of them had a history of heroin addiction and only one patient had history of being prostitute.

Factors Predictive of High-incidence HIV rate

In Table 1, when the type of illness (emergency vs elective cases) were statistically controlled, the male group had the odd ratio of Mantel-Haenszel, ORMH = 3.546 ($p<0.0001$) comparable with the female group. When the sex was also controlled, the emergency group had ORMH = 2.996 ($p<0.0001$) comparable with the elective group. However, both types of illness and sex had no interaction with the high-incidence population (Woofl's heterogeneity test; χ^2 = 0.1019, p = 0.7495). The mean age of those with HIV infection was 31.01 ± 11.77 years (range, 14 to 84 years). In this study, the highest age-specific seroprevalence rate (2.70%) was among patients between 24 and 33 years of age; χ^2 for trend = 85.423, odd ratio (OR) = 1.672, p < 0.000001. The trauma group had the highest seroprevalence rate (4.48%); χ^2 = 53.211, OR = 3.675, 95% confident interval = 2.503-5.373, p < 0.000001.

Table 1 Characteristics of the Surgical Patient Population.

Characteristic	Seropositivity/ seronegativity	Seroprevalence rate (%)	Odd ratio	95% Confident interval	Two-tailed p-value
Type of illness:					
Emergency	220/10419	2.07	3.454*	2.554-4.679	< 0.000001
Elective	57/9323	0.61			
Sex:					
Male	237/11685	1.98	4.085**	2.886-5.804	< 0.000001
Female	40/8057	0.49			
Range of age (years):#					
14 - 23	74/4,331	1.63	1.000	-	
24 - 33	126/4,532	2.70	1.672	-	< 0.000001#
34 - 43	49/2,515	1.91	1.172	-	
44 - 53	12/1,913	0.62	0.337	-	
≥ 54	18/6,451	0.28	0.167	-	
Subspecialty:@					
Trauma surgery	34/724	4.48	3.672	2.503 - 5.373	< 0.000001
Neurosurgery	40/1,758	2.22	1.731	1.212 - 2.451	0.002
Orthopedic surgery	76/4,185	1.78	0.407	1.067 - 1.849	0.014
Plastic surgery	24/1,737	1.63	0.983	0.630 - 1.523	NS
General surgery	85/8,354	1.01	0.604	0.463 - 0.786	0.00012
Urological surgery	16/1,752	0.90	0.629	0.365 - 1.067	NS
CVT	2/1,214	0.16	0.111	0.035 - 0.451	0.00028
Overall total	**277/19,742**	**1.38**			

Note: ***Crude odd ratio (OR), Adjusted OR for sex = 2.996; χ^2 MH = 57.747, p < 0.000001**
****Crude odd ratio (OR), Adjusted OR for type of illness = 3.546; χ^2 MH = 60.089, p < 0.000001**
Woolf's heterogneity test for both adjusted ORs; χ^2 = 0.1019, p = 0.7495.
#χ^2 for trend = 85.423
@ χ^2 for comparing with the others.

Therefore, the population sample should be divided into 28 subgroups according to surgical specialties, types of illness and sex (Table 2). A univariate analysis of all 21 subgroups potentially predictive of a high incidence HIV-infected patients demonstrated that nine subgroups were associated with an increased risk ($p<0.05$). Stepwise regression analysis using the nine subgroups demonstrated that only the emergency male in 5 subgroups; trauma surgery, orthopedics surgery, neurosurgery, general surgery and plastic surgery were the factors predictive of high HIV incidence rate ($r = 0.899$, $p<0.000001$) with the predictive power of 80.95 per cent (Table 3).

DISCUSSION

Guidelines for the prevention of nosocomial HIV infection have been published and updated since 1982.[8,9] The Royal College of Surgeons of Thailand are now concerned that the recommended measures in surgical practice are currently being applied inconsistently or selectively to patients whose health care providers perceive as having a risk of harboring the virus.[10] For the purposes of analysis, patients were not considered to know HIV status at the time during their admission. As routine history taking, this study design made no attempt to interfere with or influence the manner in which risk-factor assessment was performed or whether risk factor information was obtained at all. Due to unreliable informations concerning homosexual, prostitutes or intravenous drug users in both seropositive and seronegative groups, all of the 20,019 surgical patients were almost considered to be unknown HIV status.[11] Factors associated with

Table 2 Seroprevalence Rate and Odd Ratio According to Subspecialty, Type of Surgical Illness and Sex.

Subgroup*	Seroprevalence rate (%)	Odd ratio	95% confident interval	p-value
TM	28/562 (4.98)	8.34	5.40 - 12.87	< 0.001
TF	5/162 (3.08)	3.96	1.46 - 10.80	0.0039
GEM	48/1980 (2.37)	3.09	20.6 - 4.66	< 0.0000001
GEF	9/1822 (0.49)	0.81	0.40 - 1.63	NS
GXM	20/2068 (0.96)	1.58	0.95 - 2.62	NS
GXF	8/2484 (0.32)	0.53	0.25 - 1.10	NS
PEM	18/655 (2.67)	4.40	2.60 - 7.43	< 0.00001
PEF	1/164 (0.61)	0.99	0.14 - 7.16	NS
PXM	3/349 (0.85)	1.40	0.44 - 4.45	NS
PXF	0/277 (0)	0	-	-
BEM	2/175 (1.13)	1.86	0.46 - 7.56	NS
BEF	0/117 (0)	0	-	-
NEM	33/1154 (2.78)	4.57	2.99 - 3.99	< 0.0001
NEF	5/328 (1.50)	2.47	0.99 - 6.12	0.0442
NXM	2/186 (1.06)	1.75	0.43 - 7.12	NS
NXF	0/90 (0)	0	-	-
OEM	58/2168 (2.61)	4.28	2.98 - 6.16	< 0.00001
OEF	10/919 (1.08)	1.77	0.91 - 3.46	NS
OXM	7/359 (1.91)	3.15	1.45 - 6.75	0.0024
OXF	1/739 0.14)	0.22	0.03 - 1.60	NS
UEM	2/57 (3.51)	5.57	1.39 - 22.32	0.0069
UEF	0/8 (0)	0	-	-
UXM	12/1307 (0.91)	0.50	0.80 - 2.78	NS
UXF	2/396 (0.50)	0.83	0.20 - 3.37	NS
CEM	0/101 (0)	0	-	-
CEF	0/47 (0)	0	-	-
CXM	2/564 (0.35)	0.58	0.14 - 2.37	NS
CXF	0/504 (0)	0	-	-
Elective**	**57/9380 (0.61)**	**1**	**-**	**-**

Note * **M = Male, F = Female, E = Emergency, X = Elective, T = Trauma, G = General, P = Plastic, B = Burn, N = Neuro, O = Ortho, U = Uro, C = Cardio-vascular-thoracic (CVT).**
** **All elective cases were used as baseline; odd ratio = 1**

HIV infection included sex, age, surgical subspecialty and emergency or elective case (Table 1). In a previous study, in 203 critically ill or severely injured emergency patients, only trauma (particutarly penetrating trauma) and age of 25 to 34 years were associated with HIV infection.[12] In the current study, the high rate of seroprevalence among men with emergency presentation (p<0.0001) in five categories; trauma surgery, orthopedics surgery, neurosurgery, general surgery and plastic surgery were independently associated with an increased likelihood of HIV infection.

Among the 20,019 patients, 2,315,400 baht (92,616$) in patient charges were incurred. The author attempted to determine which selective policy of HIV testing would provide useful and mostly effective. The current study has found that an increased incidence of HIV infection among the 5 surgical subspecialties yielded the optimized cost-effectiveness rather than the other two policies of HIV testing (Table 4). Beyond the question of cost-effectiveness, mandatory screening of low-incidence groups may raise the fre-

Table 3 The five Subgroups that were the Higher Risk for HIV Infection by Stepwise Regression Analysis.

Subgroup	Seroprevalence rate	Coefficient fctor	Standard error	95% Confident interval	t	p>(t)
TM	2.745	0.046	0.014	0.017 - 0.075	3.251	0.004
OEM	2.575	0.095	0.026	0.040 - 0.150	3.590	0.002
NEM	2.434	0.059	0.019	0.019 - 0.099	3.025	0.006
GEM	2.341	0.082	0.022	0.037 - 0.127	3.790	0.001
PEM	2.100	0.093	0.016	0.059 - 0.126	5.676	0.000
Constant value	-	0.042	0.107	0.196 - 0.639	3.896	0.001

Note: * **All 5 subgroups were the factors predictive of high HIV incidence rate (F = 119.55; r = 0.899, p < 0.000001) with the predictive power of 80.95%**

Table 4 Cost-benefit of Various Policies of HIV Testing in the In-patient Surgical Services.

Policy	No of patients	No of positivity	Total cost (Baht)	Effectiveness (%)*	Relatively positive proportion#	Benefit index (%)†
All patients	20,019	277	2,365,400	100	1.0	100
Emergency only	10,639	220	1,305,900	149.50	0.79	118.1
Male only	11,922	237	1,452,900	143.70	0.86	122.9
5 subgroups	6,648	187	870,500	203.30	0.68	137.2

Note: * **Effectiveness = percentage of incremental HIV detection**
Relative positive proportion = number of HIV patients detected by that policy were divided by total positive cases detected by mandatory screening (277).
† **Benefit index = (Effectiveness) x (Relatively positive proportion).**

quency of false-positive results,[3] in which 18 cases were found in this study. The author and other investigators[2,11,12] have found that emergency surgery including trauma remains a challege to the doctine of universal precautions because of its high seroprevalence rate. Health care providers should take appropriate barrier precautions when examining such patients or handling their body fluids. It is clear that in emergency department, it was inconsistently applied toward identifying patients at risk for HIV infection. However, it is impossible to identify the risk factors in patients presented with altered mental status, shock or critically ill.[11-13] Even a patient with previously seronegative history may not be reliable. Moreover, emergency departments tend to be understaffed, resulting in their failure to follow universal precautions. Accidents usually occur when personnel are under pressure, and these tend to involve undertrained residents or students.

This study firmly supports the recommendations of selective HIV testing in patients with emergency presentation. However, infection-control precautions should be consistently applied, particularly health-care workers coming in contact with blood or other fluids, whether HIV infection is known or suspected.[14] It should be also suggested that only fully trained surgeons should deal with HIV patients at emergency room as well as operating room.

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