RISK OF OCCUPATIONAL EXPOSURE TO HIV INFECTION AT MUHIMBILI ORTHOPEDIC INSTITUTE DAR ES SALAAM TANZANIA

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CERTIFICATION

The undersigned certify that he has read this dissertation and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled:

RISK OF OCCUPATIONAL EXPOSURE TO HIV INFECTION AT MUHIMBILI ORTHOPEDIC INSTITUTE, DAR-ES-SALAAM TANZANIA

in partial fulfilment of the requirements for the degree of Master of Medicine (Orthopedic and Trauma) of the Muhimbili University of Health and Allied Sciences.

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Date 31st Dec, 2007

DECLARATION

AND

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I Harry Matoyo , declare that this dissertation is my own original work and that it has not been presented and will not be to any other University for a similar or any other degree award.

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Acknowledgement

I wish to convey my deepest thanks to Prof. J. Kilewo of the Muhimbili University of Health and Allied Sciences (MUHAS) my teacher in epidemiology who tirelessly assisted me from the initial stages of my work, without whom, this work would have not been possible.

My special thanks go to Dr. C. N. Mcharo, who not only agreed to be my supervisor in this work, but he was the base of my knowledge in orthopedic and trauma. He never stopped feeding me with basic and new knowledge during my training. He always made me feel at home while in operating theater.

I give my sincere thanks and deep appreciation to Prof. L.M. Museru my teacher and the Executive Director of Muhimbili Orthopedic Institute (MOI), who made me fall in love with orthopedics and trauma. He supported me with my work from A-Z.

I wish to express my appreciation to Dr. ADA. Kinasha, the Medical Director at MOI. Without his support this work would not have been possible.

My gratitude goes to Mrs. Rose. N. M Mpembeni of MUHAS, my teacher in biostatistics. She was always there for me during my work whenever I needed help. She made my work become possible.

I would like to convey my appreciation to all staff at MOI laboratory, and all staff at MOI who assisted me in one way or another during my work.

Finally, my wife Dorothy and son Larry deserve my love and appreciation for keeping up with me during my training and for their encouragement and tireless

assistance to enable me do this work. Their support was a constant source of inspiration and encouragement

ABSTRACT

TITLE: Risk of occupational exposure to HIV infection at Muhimbili Orthopedic Institute, Dar-es-salaam Tanzania

BACK GROUND: Health care workers (HCWs) can be infected with HIV as a result of their work while handling HIV infected patients. The main cause of infection in occupational settings is exposure to HIV infected blood via a percutaneous injury or mucous membrane. There is still a serious lack of information about the various factors that cause accidents with needles and other sharp objects in Tanzania. Surveillance programs that provide in-depth analysis of needle stick accidents are needed, if at all we want to minimize these accidental blood exposures.*-

Universal Precautions are needed when handling any patient regardless of HIV serostatus. Extra precautions may be needed when handling a known HIV infected surgical patient, however it is not easy to know the HIV serostatus of patients we are dealing with especially in emergency situations like trauma patients, so we need to find ways of predicting these patients even before testing them.

OBJECTIVES:

1. To determine risk of occupational HIV infection among healthcare workers at MOI by:

- Determining HIV seroprevalence among trauma patients attended at MOI

- Determining the incidence of accidental blood exposure during patient handling and in handling surgical equipment and hospital materials among health care workers at MOI and to describe their dynamics

2. To investigate common factors present among HIV infected trauma patients, from their social/medical history and physical examination so as to assess if it is possible to predict HIV infection in trauma patients even before HIV testing has been done

METHODOLOGY:

Study setting: The study was conducted at Muhimbili Orthopedic Institute, a teaching and referral hospital with 145 beds

Study design: Voluntary prospective study

Inclusion criteria: Being a trauma patient attending treatment at MOI

Exclusion criteria: Trauma patients who could not consent due to their clinical conditions and those who refused to consent

Study population: Healthcare workers and trauma patients at MOI.

Sample size: All healthcare workers (340) at MOI and 437 trauma patients.

Study duration: This was a 10 months study from 5th April 2006- 10th February 2007

Ethical issues: Ethical clearance was received from the directorate of research and publication at MUHAS. Patients were recruited in the study only after giving a written informed consent.

Data collection:

- Questionnaires completed by health care workers following accidental blood exposures from attended trauma patients
- Laboratory forms for HIV testing trauma patients after counseling
- Questionnaires for trauma patients interviewed by attending physician for linking trauma patients with HIV infection risk factors

Results:

Fifteen accidental blood exposures to 14 healthcare workers occurred and their dynamics were documented. Of the 15 exposures, twelve were percutaneous injuries while 3 were mucous membrane exposures. Majority (12) exposures occurred during the afternoon. Six of those exposed were physicians of these, 2 were senior physicians (orthopedic surgeon and resident) and 4 were junior physicians (interns and registrars). Six of those exposed were nurses. One of those exposed was a health attendant while the other was an assistant anesthetist.

Of the15 exposures 3 were from HIV positive patients. Six among 15 exposures occurred after the surgical procedure meaning these were preventable exposures if universal precautions against surgical settings infectious diseases had been observed. The 3 mucous membrane exposures were also preventable if protective eye shields were used during these surgical procedures.

437 trauma patients were interviewed and tested for HIV infection. Of the 437 HIV tested patients, 44 (10 %) were HIV positive (seroprevalence). The majority (75 %) of HIV infected patients came from age group of 25-44 years ($p<0.01$).

The majority of the HIV infected trauma patients were asymptomatic at presentation and there was no link of their HIV seropositivity to their social or medical history

Conclusion and recommendations:

- Annual risk of acquiring occupational HIV infection at MOI was calculated to be 0.4 %.
- Majority of accidental blood exposures (9 out of 15 exposures 6 being post surgical exposures and 3 being mucous membrane exposures without protective eye glasses) were preventable, meaning adoption of universal precautions against surgical setting infections will significantly reduce this risk.
- Relying on Preoperative knowledge of the HIV serostatus of these patients so as to take extra precautions against occupational HIV will be un-rewarding. Instead universal precautions are needed when handling any patient regardless of HIV serostatus
- To reduce needle stick injuries, an effective program must include employee training.
- There is a need to change some surgical techniques adopting new safer techniques (handling tissues with instruments, use of staples during skin suture)
- A continuous monitoring and reporting system must be established for all occupational blood exposures in the hospital as during the study 4 (29 %) of the blood exposed HCWs didn't know if it was necessary to report and where to report the incidences

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LIST OF ABBREVIATIONS:

1. AIDS = Acquired Immunodeficiency Syndrome
2. CDC = Centre for disease Control
3. CSF = Cerebrospinal fluid
4. HCP = Healthcare personnel
5. HCW/s = Healthcare worker/s
6. HIV = Human Immunodeficiency Virus
7. Lab. tech = Laboratory technician
8. Med. Student = Medical student
9. MUHAS = Muhimbili University of Health and Allied Sciences
10. MOI = Muhimbili Orthopedic Institute
11. NA = Not applicable
12. NACP = National Aids Control Program
13. PEP = Post exposure prophylaxis
14. Pt/s = patient/s
15. PI = Principle Investigator
16. STDs = Sexually transmitted diseases

INTRODUCTION

Back ground:

Health care workers (HCW) can be infected with HIV as a result of their work while handling HIV infected patients (occupational HIV exposure). The main cause of infection in occupational settings is exposure to HIV infected blood via a percutaneous injury or mucous membrane. A percutaneous injury refers to an injury resulting from a needle prick, or a cut with a sharp object [1]. Any percutaneous or per-mucosal exposure to blood or body fluids represents a potential source of HIV infection [2].

Occupational HIV infection is understandably an area of considerable concern for many HCW and it can be devastating for the person concerned [3]. The concern for occupational HIV infection has been increasing worldwide and especially in Sub Saharan countries. More than 40 million people around the world are living with HIV, out of these two thirds (25.4m) are from Sub Saharan Africa, which has only 10% of the total world population [4, 5]. These HIV infected people are the ones who pose great risk of occupational HIV to HCWs

According to other studies the average risk of HIV transmission from infected patients to the HCW after percutaneous exposure is 0.3% (3 out of a thousand needle pricks may result in HIV infection) and 0.09% for mucous exposure [6]. Percutaneous injury can carry a higher risk of HIV transmission of higher than 0.3% in deep injury, terminal HIV-related illness in the source patient, visible blood on the device which caused the injury and injury with needle which had been placed in a source patient's artery or vein [7]. Determinants of successful

transmission of HIV in occupational settings are: seroprevalence of attended patients, injury frequency and conversion rate to HIV infection after exposure [8, 9]. The injury incidence is not known at MOI so is the HIV seroprevalence of the trauma patients been attended at MOI and therefore the occupational HIV risk at MOI is not known

Presently there are 106 documented cases of HCWs who seroconverted following occupational HIV exposure and 238 cases of possible occupationally acquired infection world wide by 2004[3]. Among the 106 documented cases, 53% were nurses/midwives, and only 14% of them were doctors. There are no reported cases of occupational HIV either from Tanzania or any of the Sub Saharan countries. This is most likely due to poor surveillance system in these countries.

Factors influencing the risk to an individual HCW to acquire occupational HIV over a life time career include the number and types of blood contacts experienced by the worker (cumulative life time risk), the prevalence of HIV infection among patients treated by a worker, and the risk of transmission of infection after a single blood contact [10, 11, 12]. A study done by Gumodoka B et al (1993) in 9 hospitals in Mwanza region (Tanzania) to investigate occupational exposure to HIV among HCW showed an average of 5 pricks and 9 splashes per year to HCW giving an annual occupational risk of HIV transmission of 0.27% for health workers. Among surgeons, the risk was 0.7% if no special protective measures were taken [13]. A prospective study on the risk of exposure to HIV during surgery in Zambia by Consten EC et al in1995 with the aim of investigating the relative risk of occupational HIV transmission for surgeons practicing in tropical Africa compared

with their Western counterpart concluded that :"Although occupational exposure rate was relatively low, the HIV seroprevalence was so high that the relative cumulative seroconversion risk for surgeons in tropical Africa is estimated to be 15 times higher than in western countries"[14]

The frequency of blood exposure among HCW varies according to occupation, procedures performed, and use of preventive measures as revealed by de Graaf R et al in their study on "Occupational risk of HIV among Western health care professionals posted in endemic areas". In their study it was revealed that majority of injuries occurred during routine activities and were self inflicted. Injuries with hollow needles usually occurred after the actual medical act, due to carelessness or being in a hurry because of emergency. Poor quality equipments, lack of professional skills or a combination of these factors were among the factors that caused injuries [15]. Surveillance programs that provide in-depth analysis of needle stick accidents are needed if at all we want to minimize these accidents [7]

Universal Precautions are needed when handling any patient regardless of serostatus [16, 2] and "extra precautions" are needed when handling a known HIV infected surgical patient including avoidance of hand to hand passage of sharp instruments and increased use of staple devices instead of suturing. There is need of restriction of inexperienced theater staffs including students in assisting operations [17]. Between 63-65% of HIV infected patients admitted in emergency departments are unaware of their HIV serostatus [1]. Unfortunately not all patients will volunteer to be HIV tested before surgery therefore the author thought of a tool which could be used to predict HIV infection even without HIV testing these

patients. A prospective study done at the KIWAKKUKI AIDS information centre in Moshi Tanzania in 2003 showed that HIV infected clients are highly symptomatic at presentation and there was a strong association between seropositivity and symptoms of weight loss, fever, rash, cough and diarrhea [18].

Statement of the problem

In many countries for many years health care workers have become infected with HIV as a result of their work [19]. Occupational HIV infection is understandably an area of considerable concern for many HCW and it can be devastating for the person concerned. The concern for occupational HIV infection has been increasing worldwide especially in Sub Saharan countries. More than 40 million people around the world are living with HIV, of which two thirds (25.4m) are from Sub Saharan Africa, which has only 10% of the total world population [4, 5]. These HIV infected people are the ones who pose great risk to HCW for occupational HIV infection. Presently there are 106 proven cases of HCWs who were seroconverted following occupational HIV exposure and 238 cases of possible occupationally acquired infection (not proven) by 2004 world wide [11]. Of 106 proven cases, 57 came from USA, 35 came from Europe and only 14 cases were reported from the rest of the world. Of 14 cases which came from the rest of the world only 5 cases were reported from Africa by 2 countries (South Africa 4 cases, Zambia 1 case). Tanzania and many other Sub Saharan countries has no data showing how many HCWs are infected occupationally or how many occupational blood exposures occurs in these countries so as to determine the risk of occupational HIV infection [11]. Since Sub Saharan countries have the highest seroprevalence among countries

of the world, and is already clear that seroprevalence is one of the determinants of risk of occupational HIV infection, we would expect many cases of occupational HIV infection to come from Africa. That this not so implies that there is deficiency in our surveillance and reporting system and it is high time that we start collecting such data. Tanzania is not different from other countries faced by the high risk of occupational HIV infection. We need to investigate this problem to see how significant the risk of occupational HIV is and how to solve this problem

The main cause of infection in occupational settings is exposure to HIV infected blood via a percutaneous injury or mucous membrane. There is still a serious lack of information about the various factors that cause accidents with needles in Tanzania. The frequency of blood exposure among HCW varies according to occupation, procedures performed, and use of preventive measures [15]. So far very few studies if any have been carried out in the Sub Saharan region to elucidate the risk of HIV to HCW from attended patients. Surveillance programs that provide in-depth analysis of needle stick accidents are needed [7] if at all we want to minimize these accidents.

Rationale of the study:

This study needs to be done now as the Tanzanian HIV seroprevalence is so high (8.8%), [20, 21]. The risk of occupational HIV infection is also high, as seroprevalence is related to risk of occupational HIV [11]. In order to reduce the risk there is need to be clear about factors related to occupational HIV infection especially percutaneous injuries. Only through that it will be possible to prevent or reduce these occupational exposures in our set up.

Results of the study will create and raise awareness about the risk of acquiring occupational HIV infection and therefore make healthcare workers adhere to universal precautions against HIV and other infectious diseases.

❖ OBJECTIVES

1. To determine risk of occupational HIV infection among healthcare workers at MOI by:
   - Determining HIV seroprevalence among trauma patients attended at MOI
   - Determining the incidence of accidental blood exposure during patient handling and in handling surgical equipment and hospital materials among health care workers at MOI and to describe their dynamics
2. To investigate common factors present among HIV infected trauma patients from their social/medical history and physical examination so as to see if it is possible to suspect a HIV infected trauma patient even before HIV testing the patient

LITERATURE REVIEW

.History of occupational HIV transmission

The risk of HIV transmission to medical personnel has been recognized since 1984, with the first reported case of HIV transmission to a health care worker following a needle stick injury. Since that time, substantial information regarding occupational exposure and outcomes has been collected. In 1995, the Centers for Disease Control and Prevention (CDC) published a report of known cases of occupational exposure in France, the United Kingdom, and the United States. This retrospective case-control study gave improved information regarding risk factors for transmission. [22]

Presently there are 106 proven cases of HCW who were seroconverted following occupational HIV exposure and 238 cases of possible occupationally acquired infection (not proven) by 2004 world wide[3]

Risk of occupational HIV infection:

All healthcare personnel (HCP) who come in contact with blood or bloody fluids of HIV-infected patients in hospitals or laboratories are at risk for occupational exposure to HIV [22]. The risk varies depending on the:

- Type of exposure: percutaneous injury carries more risk. The risk after percutaneous exposure is estimated to be about 0.3% i.e. 3 out of a thousand needle pricks may result in HIV infection. The risk after a mucous membrane exposure is estimated to be lower; about 0.09%. This includes contact with the mucous membranes of the eyes, nose and mouth, or contact with chapped, abraded or inflamed skin [22].

- Quantity of blood: exposure to large quantities of blood from an HIV positive source as indicated by a deep needle stick, exposure to needle placed directly into a vessel, or visible blood on the injuring device is associated with an increased risk of transmission. While the rates of transmission have been best studied regarding the use of large bore needles (< 18 gauge), suture needles appear to have a comparable rate of transmission [22]
- Disease status of source patient: exposure to blood from patients with terminal illness increases the risk. This likely reflects the risk associated with exposure to higher levels of virus in blood (higher viral loads).
- Post-exposure prophylaxis (PEP): PEP has been found to be effective in limiting the risk of HIV transmission to HCWs [22]

Other factors posing a risk to the surgeon are:

- Length of the procedure
- Volume of blood loss, and
- Whether the operation involves major vascular or intra abdominal/ gynecologic surgery

Blood and bloody fluids are considered infectious. Other Potentially infectious materials include semen, vaginal secretions, CSF, pleural, peritoneal, pericardial, amniotic fluids or tissue. The most frequent areas of contact are the hands. Face contacts are common in orthopedics and obstetrics. Eye or mucous membrane contacts may occur in cases where there is splattering of blood

NEEDLE STICK INJURIES

Needle stick injuries are wounds caused by needles that accidentally puncture the skin. These injuries can occur at any time when people use, disassemble, or dispose of needles. When not disposed of properly, needles can become concealed in linen or garbage and injure other workers who encounter them unexpectedly. Needle stick injuries are far too common a hazard. Some hospitals have reported that one third of nursing and laboratory staffs suffer such injuries each year [7]

Available statistics probably underestimate the severity of the problem because many workers do not report their injuries. This makes it difficult to know exactly how serious the problem is or how well prevention programs work. [7]

Nursing and laboratory staff usually experience 30 to 50 percent of all injuries during clinical procedures. Equipment design, nature of the procedure, condition of work, staff experience, recapping and disposal have all been mentioned as factors that influence this occurrence [7]

Injuries commonly occur when workers try to do several things at the same time, especially while disassembling or disposing of needles. Work conditions that might contribute to an increase in the number of needle stick injuries include: Staff reductions where nurses, laboratory personnel and students assume additional duties, difficult patient care situations, working at night with reduced lighting. New staff or students tend to have more needle stick injuries than experienced staff [7]

Recapping can account for 25 to 30 percent of all needle stick injuries of nursing and laboratory staff

Injuries occur in three different ways: The needle misses the cap and accidentally enters the hand holding the cap, the needle pierces the cap and enters the hand holding it, the poorly fitting cap slips off of a recapped needle and the needle stabs the hand [7]

METHODOLOGY

Study area

The study was conducted at Muhimbili Orthopedic Institute. A referral and teaching hospital with 145 beds in Tanzania

Study design

This was a voluntary prospective study. Health care workers working in various sections at MOI hospital (casualty, theater, wards and laboratory) were asked to complete a detailed questionnaire after every procedure in which an accidental blood exposure from attended trauma patient had occurred. Health care workers were informed in the clinical meetings that the study will be conducted to determine risk of occupational HIV infection among MOI health care workers. Details of the study were presented in one of these clinical meetings by the author. Health care workers were requested to cooperate by reporting incidences of accidental blood exposure. Posters were placed in all sections of the hospital reminding health care workers about reporting these incidences. Forms were distributed to supervisors in all sections where occupational blood exposure was possible. In the operating theater, runner nurses were supposed to remind healthcare workers who had accidental blood exposure to fill in the forms after the procedure. Forms were submitted to the investigator directly or to supervisors of the sections.

Clinically stable trauma patients were told about the study including counseling for HIV testing. Those who consented to the testing had their blood drawn for HIV testing. Attending physician then completed a laboratory form and a standard questionnaire.

Study period

This was a 10 months study conducted from 5th April 2006 to 10th February 2007

Study population

Study included 340 healthcare workers (including 138 nurses, 101 medical attendants, 82 physicians (54 intern doctors), 12 anesthetists/anesthetist assistants and 7 laboratory technicians). No consent was needed for a HCW to participate in the study. There were 437 trauma patients with a male to female ratio of 2:1, age ranging from 1-86 years with a mean age of 35.7 years.

Exclusion criteria

Patients who could not consent due to their clinical condition and those who refused to consent were excluded from the study.

Data collection procedure

Health care workers working in various sections at MOI (casualty, theater, wards and laboratory) were asked to complete a detailed questionnaire after every procedure during which an accidental blood exposure from attended trauma patient had occurred. Trauma patients who consented to join the study were drawn 5 milliliters of blood, laboratory forms and standard questionnaires were completed by the attending physician

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A minimum of 384 trauma patients were supposed to be recruited in my study according to formula:

Z^2pq/d^2 where:

Z = % point of the normal distribution corresponding to the level of significance (taken to be 1.96)

P = Expected prevalence of the condition in the population (taken to be 50 %)

q = 1- p (50 %)

d = Maximum likely error (5 %).

Data Management and analysis

Data were entered and processed using EP info and descriptive statistics were performed with the SPSS for windows 10 statistical package

To estimate the one year probability of acquiring occupational HIV infection during various procedures performed by the HCW at MOI, the following actuarial model was used [8, 9, 23]

The annual probability of a successful transmission of HIV can be calculated as follows:

1. The product of three independent factors:

(P1 x P2 x P3) (eq.1)

Where:

P1 = seropositivity of the patient to HIV (HIV seroprevalence)

P2 = occurrence of an injury at risk of transmission of HIV (injury frequency)

P3 = efficiency of transmission in causing HIV infection (seroconversion rate)

Or as:

2. The product of the following formula:

$1 - (1 - FP)^{NY}$

Where

F = seroprevalence of attended patients

P = known risk of occupational HIV

N = number of injuries in a year

Y = number of working years of HCW (in this case 1 year)

Limitation of the study

- Being a voluntary study, it is possible that other healthcare workers had accidental blood exposures without reporting however the unreported case is expected to be very few
- Being a voluntary study, a lot of time was being spent on patients counseling for HIV testing and some of them (1/3 of the counseled patients) were reluctant to be tested. It is possible that the social and medical history they were giving was not correct as a lot of people are sensitive with anything concerning HIV infection.
- Health care workers who were accidentally exposed by blood from HIV positive patients were not followed to see if they seroconverted this was because the duration of the study was short (one year)

- Not all HCWs included in the study were present at MOI during the whole period the study was conducted. Intern doctors and residents had to rotate to other departments and annual leaves were being taken by other HCWs during this period of the study.

Ethical issues

Ethical clearance was received from the directorate of research and publication at MUHAS. Patients were recruited in the study only after giving a written informed consent

RESULTS

A total of 340 healthcare workers and 437 trauma patients were involved in the study. Of 340 healthcare workers, 138 (40 %) were nurses, 101 (30 %) were health attendants, 82 (24 %) were physicians including 54 intern doctors who rotated in the department of orthopedic and trauma for the duration of one month, 12 (4 %) were anesthetist/assistant anesthetist and 7 (2 %) were laboratory technicians. Out of them 14 (4.1 %) healthcare workers had accidental blood exposure during the 10 months of the study in various sections of the hospital (1 HCW had 2 separate exposures).

Of 14 (4.1 %) workers who had accidental blood exposure (see table1 below), 6 (4.3 %) were nurses, 6 (7.3 %) were physicians, 1 (8.3 %) was anesthetist and 1 (1 %) was a health attendant. Among 6 physicians 1 was an orthopedic surgeon, 1resident, 1 registrar (twice), 3 intern doctors (all working/rotating in the department of orthopedic and trauma

Table1. Positions of HCWs and blood exposures

Position of HCW		N exposed		N unexposed		Total	%
		N	%	N	%	N	%
Health attendant		1	(1)	100	(99)	101	(100)
Nurse		6	(4.3)	132	(95.7)	138	(100)
Physician	Senior	2	(9)	20	(91)	22	(100)
	Junior	4	(6.6)	54	(93.4)	60	(100)
Anesthetist		1	(8.3)	11	(91.7)	12	(100)
Lab. Technician		0		7	(100)	7	(100)
Total		15	(4.4)	325	(95.6)	340	(100)

Of 15 exposures (see table 2 below), 12 were prick injuries where 6 pricks had moderate penetration (broken skin, bleeding) and another 6 pricks had deep penetrations (pricks or deep cuts with or without bleeding). Three were mucous membrane exposure in the eyes. Among the 3 mucous membrane exposures 2 were from splash of blood in the eye and 1 was from sharp bone fragment in the eye.

Among the15 exposures, 12 exposures occurred in the afternoon time, 9 (60 %) exposures sustained during the procedure and 6 (40 %) sustained after the procedure.

Among 15 exposures, 4 were from HIV infected source patients (3 percutaneous, 1 mucous membrane splash).

Table2. Particulars of blood exposure incidents for HCW at MOI

Label	Values	Number of values
Pts age/years	20-39	12
	40-59	3
Sex	F	9
	M	6
Time of exposure	morning	1
	afternoon	12
	evening	2
Place of work	casualty	4
	Theater	7
	Wards	4
Position of HCW	HA	1
	Nurse	6
	physician	7
	anesthetist	1
Type of exposure	percutaneous	12
	mucous	3
Depth of percutaneous	superficial	-
	moderate	5
	Deep	7
Time	During procedure	9
	After procedure	6
Serostatus of source pt	HIV positive	4
	HIV negative	11

The cause for prick-injuries were suture needles (42 %) followed by needle for blood drawing (25 %), needle for IV line (17 %), scalpel blade and other sharp injuries (8 % each) as shown in Table3 below.

Table3. Causes of percutaneous injuries and depth of penetration

Cause of injury	Depth of penetration			Total/ %
	superficial	moderate	Deep	
Needle for blood drawing	-	2	1	3 (25)
Needle for iv line	-	1	1	2 (17)
Suture needle	-	3	2	5 (42)
Scalpel blade	-		1	1 (8)
Other sharp instruments	-		1	1 (8)
Total	-	6	6	12 (100)

Superficial penetration = scratch without bleeding

Moderate penetration = broken skin bleeding

Deep penetration = prick or deep cut with or without bleeding

437 trauma patients were tested for HIV. Of 437 HIV tested patients, 292 (67 %) were male and 145 (33 %) were female with a male to female ratio of 2:1. Age ranged from 1- 86 years with a mean age of 35.7 years. Age distribution of 437 patients is shown in Table 4 below. Majority of the patients were aged between 25 and 45 years. Majority of HIV infected patients were between the ages of 25-44years ($P<0.01$)

Table 4

HIV seroprevalence by age

Age group	Number tested	HIV reactive	Prevalence %
1-24 yrs	118	3	2.5
25-44	206	33	16
>45	113	8	7
Total	437	44	10.06

The annual probability of a health care worker to acquire occupational HIV infection at MOI with HIV seroprevalence (P1) of 10.06%, injury incidence of 12 pricks 3 mucous membrane exposure (P2) and a known seroconversion rate of 0.3 for percutaneous injuries and 0.09 rate for mucous membrane exposure (P3) is:

P1 x P2 x P3 (for percutaneous) + P1 x P2 x P3 (for mucous membrane)

(10.06 x 12 x 0.3) + (10.06 x 3 x 0.09)

(0.36) + (0.027)

0.387

~ = 0.4 %

Or

{1 – (1 – FP) NY} + {1 – (1 – FP) NY}

{1 – (1- 10.06 x 0.003) 12 x 1)} + {1 – (1 – 10.06 x 0.0009) 3 x 1}

{1 – (1 -0.03) 12} + {1 – (1 -0.009) x 3}

{1 – (1- 0.36)} + {1 – (1 – 0.027)}

{1 – (0.64)} + {1 – (0.973)}

= 0.36 + 0.027

0.387

~ = 0.4 %

Table 5 below shows distribution of patients by marital status. Married patients had the highest seroprevalence of 12 % while under16 had the least seroprevalence of 5.8 %

Table5. Prevalence of HIV infection by marital status

Marital status	Number tested	Number positive	Prevalence (%)
Married	183	22	12
Single	80	8	10
Separated	27	3	11.1
cohabiting	81	6	7.4
Widow/er	19	2	11
Under 16	52	3	5.8
Total	437	44	10.06

Table6. Patients HIV serostatus versus HIV related symptoms/factors

History of		HIV reactive/ %		HIV non reactive		Total	
Blood transfusion	Yes	2	(5)	41	(95)	43	(100
	No	42	(11)	339	(89)	381	(100)
STDs/STI	Yes	10	(19)	43	(81)	53	(100)
	No	34	(9)	335	(91)	369	(100)
Drug addiction	Yes	5	(8)	61	(92)	66	(100)
	No	39	(11)	319	(89)	358	(100)
Diarrhea	Yes	2	(22)	7	(78)	9	(100)
	No	42	(10)	373	(90)	415	(100)
Fever	Yes	2	(12.5)	14	(87.5)	16	(100)
	No	42	(10)	366	(90)	408	(100)
Cough	Yes	3	(25)	9	(75)	12	(100)
	No	41	(10)	371	(90)	412	(100)
Herpes zoster	Yes	1	(33.3)	2	(67.3)	3	(100)
	No	43	(10)	377	(90)	420	(100)
Tuberculosis	Yes	2	(25)	6	(75)	8	(100)
	No	42	(10)	374	(90)	416	(100)
Weight loss	Yes	2	(15)	11	(85)	13	(100)
	No	42	(10)	369	(90)	411	(100)
Lymphadenopathy	Yes	2	(18)	9	(82)	11	(100)
	No	42	(10)	371	(90)	413	(100)

From table 6 above, of 43 patients who had blood transfusion before, only 2 (5 %) had HIV infection. Of the 66 patients who had history of using recreational drugs before (cocaine, heroine, marijuana etc) only 5 (8 %) had HIV infection. Nineteen percent of 53 patients who had STDs were HIV positive while 9 % of 369 patients who denied history of STDs had HIV infection.

Forty two (95 %) patients who were HIV positive had no history of diarrhea.
Forty one (93 %) of HIV infected patients had no history of cough
Forty two (95 %) HIV infected patients had no history of body weight loss

- No HIV positive patient was found to be wasted

- No HIV positive patient was found to have non specific dermatitis
- No HIV positive patient was found to have kaposis sarcoma

1. The incidences of occupational blood exposure at MOI from April 2006-February 2007 (~ 1 year) was 15

2. The HIV seroprevalence of trauma patients attended at MOI from April 2006-February 2007 was 10.06 %

3. Annual risk of a MOI health care worker to acquire occupational HIV was 0.4 %

4. Most HIV infected trauma patients attended at MOI were not symptomatic at presentation and there was no strong association between seropositivity and symptoms or signs of HIV infection

DISCUSSION

The aim of this study was to

1. Determine the risk of occupational HIV at MOI by finding incidences of occupational blood exposure and their dynamics, and HIV seroprevalence for trauma patients attended at MOI
2. To determine if HIV infected trauma patients are symptomatic at presentation as was found in a prospective study at the KIWAKKUKI AIDS information centre in Moshi Tanzania in 2003 where it was shown that HIV infected clients were highly symptomatic at presentation and that there was a strong association between seropositivity and symptoms of weight loss, fever, rash, cough and diarrhea [18]

Risk of acquiring occupational HIV infection at MOI

Annual risk of acquiring occupational HIV infection of 0.4 % at MOI is significant. HCWs at MOI are potentially at risk of acquiring occupational HIV infection in every 4 incidences out of 1000 pricks per annum and every effort to reduce the risk is needed. The 0.4 % annual risk of acquiring occupational HIV infection for MOI healthcare workers obtained in this study was higher than that of 0.27 % obtained by Berege et al for Mwanza health care workers in 1993 where they reported an annual average of 5 pricks and 9 splashes among healthcare workers [13]. During this study there were more percutaneous injuries than mucous membrane exposure

compared to Mwanza study, and this is taking into account that risk of HIV transmission after percutaneous injury is higher than mucous membrane exposure

HIV seroprevalence

The 10.06 % HIV seroprevalence for trauma patients attended at MOI was higher than that of NACP which is 7 % based on household surveys and 8.8 % among blood donors during 2003[5]. Seroprevalence being one of the three determinants of risk of occupational HIV infection is obvious that if it is high then the risk too will be high unless occupational blood exposures are limited to the lowest level. Consten EC et al (1995) estimated the relative cumulative risk of HIV seroconversion for surgeons in tropical Africa to be 15 times higher than in western countries because of higher seroprevalence in tropical Africa compared with their Western counterpart [14]

Relative cumulative seroconversion risk

Risk of acquiring occupational HIV infection can be estimated as a cumulative risk for a HCW who will be working for more than one year by the formula:

1-(1-FP) NY (14, 10), where F = seroprevalence of attended patients, P= known risk of disease transmission in this case 0.3 %, N = number of injuries in a year and Y = number of working years for the HCW. For example for a HCW who will be working for 20 years then the cumulative risk of getting HIV infection will be 8 %. The Figure of 0.4 % as an annual risk may look to be small, but 8 % as a cumulative risk for the same health care worker after working 20 years it is when you realized that it is convincingly significant. Factors influencing cumulative life

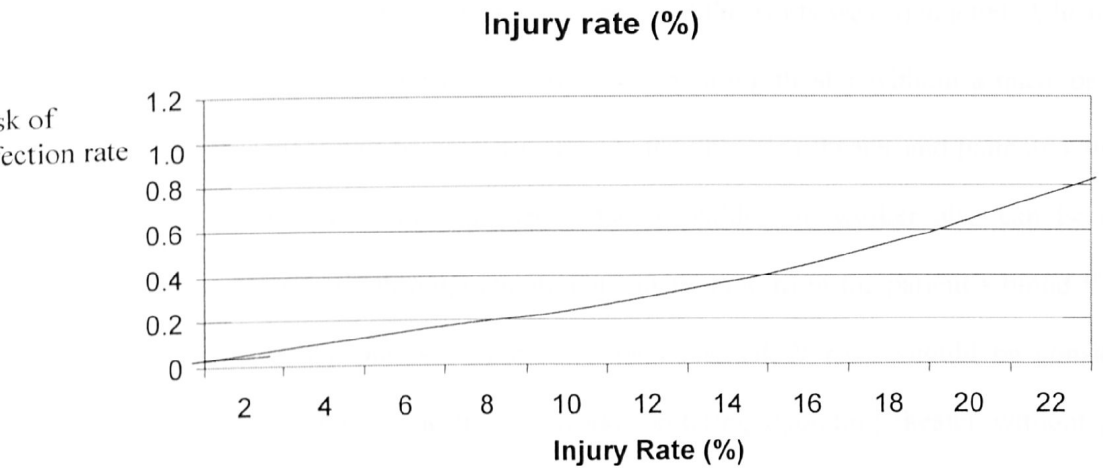
time risk to an individual HCW over a life time career include the number and types of blood contacts experienced by the worker. It is obvious the physician who had 2 blood exposure of the 15 exposures observed in this study had more risk of acquiring HIV than the other physicians who had one exposure. Depending on the type of exposure, health care workers who had and will be having percutaneous injuries will be having more cumulative life time risk than those who had or will be having mucous membrane exposures.

Injury rate as determinant of risk of occupational HIV infection

Among the three determinants of the risk of occupational HIV infection (seroprevalence, injury rate, and seroconversion rate), it is the injury rate which is likely to change frequently, and it is the injury rate which if brought down by adhering to universal precautions against transmission, the risk will be brought down significantly.

Figure1 below shows relationship of injury rate and infection rate, where 15 exposures correspond to 0.4 % risk of infection

Figure1. Relation of injury rate and HIV infection rate



Blood exposure to Mucous membrane

Of 15 blood exposures, 3 were mucous membrane exposures of the eyes. Universal precautions, reflects the concept that all blood and body fluids are potentially infectious, and must be handled accordingly. Personal protective equipment (gloves, gowns, laboratory coats, face shields, eye protection, mouthpieces, resuscitation bags should be used to prevent blood and other potentially infectious material from reaching a HCW clothing, skin, eyes, mouth, or mucous membranes [22]. Many HCWs at MOI during the study were not using these universal precautions particularly protective eye shields during surgical procedures and proper disposal of the sharp objects (needles and scalpel blades). If these universal precautions were observed by the MOI health care workers including strictness of the administrative team on making sure the precautions were being followed then it is not expected to have a single case of mucous membrane exposure. Orthopedic and trauma operations are the leading blood splashing

procedures yet most of the operating team members were not wearing eye protective glasses during the period this study was conducted. A health care worker is strictly not allowed to enter operating theater without a mask or a cap because there will be contamination to the operating theater and patients will get infection, but it is not considered that a health care worker also can be occupationally exposed through eye mucous membrane from the patient's blood if not protected. In the author's opinion, patient and HCW risks should be considered equally, meaning a healthcare worker entering operating theater without protective eye glasses or face shield should be strictly prohibited. Mucous membrane exposure can be limited to zero unlike percutaneous injuries whose incidence can be reduced but not totally eliminated

Recapping needles

Among the universal precautions against infectious diseases is that HCWs should not recap needles by hand or purposely bend, break or remove them from disposable syringes or otherwise manipulate them by hand. Of the 12 prick injuries that occurring during this study, 2 incidences occurred during recapping of a used needle. Risk of occupational HIV infection is high depending on the amount of blood a HCW is exposed to. Hollow needles are believed to carry more blood than a suture needle[22]. The 2 percutaneous exposure which occurred during recapping needles are believed to have carried high risk as all had blood which were drawn from patients one of whom was

HIV positive. If universal precautions and safety measures of disposing used needles were adhered to these exposures wouldn't have happened.

Exposure after the procedure

Six among the 12 needle prick injuries happened after a procedure and all were sustained by nurses and health attendant (3 were from suture needles which were left inadvently by doctors after suturing, 2 were after putting blood samples in container and 1 was from scalpel blade which was also left inadvently by a doctor after suturing). If guidelines dealing specifically for proper needle disposal were properly followed then these injuries could be minimized significantly. There were no reasons for the 3 doctors not to dispose the suture needles in puncture-resistant containers which were always available in all working places

Sharp instruments

One among the 12 prick injuries was sustained by a sharp instrument for inserting suction drain. An instrument which is rarely used in the theater and drains has always been inserted successfully without it. Among the suggested measures to protect a HCW against occupational HIV is to replace sharp instruments by blunt instruments where possible [17]

Employee tiredness

Among the 15 blood exposures, 12 (80 %) exposures happened in the afternoon. This signifies that tiredness make HCW to become careless, supporting findings of de Graaf R et al in their study on Occupational risk of HIV which suggested tiredness to be among the causes contributing to prick injuries

Casualty injuries

The casualty, a delicate section where in most cases health care workers work under stress due to emergencies and where most of the minor surgical procedures are conducted didn't carry an increased risk of accidents compared to the operating theater (26 %, 47 % respectively). A Similar finding was observed in a multi centric national survey on more than 15000 surgical procedures in Italy in 1997 [23]. It is likely that the perceived extra risk, generally attributed to the emergency setting, is counterbalanced by the frequent adoption of addition precautionary procedures and if this practice could be copied in all sections of the hospital then these exposures could be reduced.

Loading needles during surgical procedure

- Of the 12 percutaneous injuries reported in this study, one injury was sustained by a nurse who was loading a needle on the needle holder. Loading a needle to the needle carrier using forceps could have prevented such injury

HIV infected trauma patients

In this study, most of the HIV positive trauma patients were not symptomatic at presentation and there was no link to HIV infection from their social and medical history. This implies that educational programs directed at improving adherence to the established guidelines to prevent transmission of infections in the surgical setting are probably more important than knowledge of the serologic status of the patients. This observation reemphasizes the concept that "universal precautions

should be practiced during all surgical procedures instead of being selectively applied to known carriers of HIV [24]. Preoperative knowledge of the seropositivity of a patient for a transmissible disease does not influence the dynamics of intra operative prick injuries as was shown by Andrea Pietrabissa in his study, "Reducing the risk of infections for the surgeon" [23],

CONCLUSION

This study has shown that:

- Health care workers at MOI have a 0.4 % potential annual risk of acquiring occupational HIV infection, from the patients attended to upon being exposed to blood following percutaneous injuries and contact with mucous membranes
- HIV infected trauma patients are usually not symptomatic at presentation in emergency departments like MOI. Preoperative knowledge of the HIV seropositivity of these patients is not important in the prevention of occupational HIV. Instead universal precautions are needed when handling any patient regardless of HIV serostatus
- Risk of occupational HIV infection among HCWs at MOI can be greatly minimized by adherence to the established guidelines to prevent

transmission of infections in the surgical setting, as most of the accidental blood exposures that occurred were preventable.

- All HCWs should wear protective eye glasses or face shields whenever performing surgical procedure as all the 3 staff exposed by mucous membrane during the study were not wearing protective glass
- Needles, scalpel blades and other sharp instruments should be handled with care to prevent accidental injuries and should be disposed immediately after use in puncture resistant containers located near the area of use
- Recapping needles or purposely bending, breaking or removing them from disposable syringes should be avoided. In situations where recapping is considered necessary, develop safe approaches which workers can follow. Workers should never move an exposed needle tip towards an unprotected hand

RECOMMENDATIONS

- To reduce needle stick injuries, an effective program must include employee training. Workers need to know how to properly use, assemble, disassemble, and dispose of needles. Workers need to understand the risks associated with needle stick injuries and know the proper means to prevent them. Specifically, the training programs should address:

- Risk of injury.
- Potential hazards.
- Recommended precautions for use and disposal of needles.
- Procedures for reporting injuries.

❖ During operations, sharp instruments should be placed in a neutral zone on the nurse's stand so that the surgeon and the nurse do not touch the same sharp instrument at the same time

❖ Junior and inexperienced health care workers should be supervised during various procedures until they acquire enough experience to work on their own, and they should be regularly insisted on the risk of occupational infections and the measures they have to take to prevent themselves

❖ Protective eye glasses should be worn during any surgical procedure

❖ Surgeons must handle tissues with instruments where possible and minimize the use of fingers especially during suturing. Use of staple devices during skin suturing has to be implemented and emphasized

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