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Research Article

Knowledge, Attitude and Practice of Surgical Residents Handling Possible Carriers of Hepatitis B, C or HIV Viruses

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Abstract

Background: Surgical residents have the greatest risk of exposure to blood-borne pathogens while learning a new surgical skill. However, this risk could be decreased by adherence to standard precautions (SPs) and by better knowledge and effective practice after exposure.

Objectives: To determine the level of Knowledge and attitudes towards HIV/AIDS, hepatitis B and hepatitis C as well as practices among the rotating surgical residents when they exposed to different types of infection transmission from the patients.

Methodology: KAP Survey: the questionnaire was handed to 63 previously identified surgical residents (by Simple random selection). Questionnaires were filled between April 2nd 2018 and June 2nd 2019.

Results: The incidence of sharp objects injuries was found to be 84.1%. 74.6% of respondents claimed that they followed SPs. General surgery trainees showed better knowledge and attitude in the emergency room (ER) than orthopedics residents ($p = 0.04$) but overall, this is below the expected level.

While 60.3% of respondents are not vaccinated against Hepatitis B virus (HBV), 23% of them attended a training course in biosafety. 41% did not read a book or even an article about infection control while 23% have neither enough knowledge nor safe practice at operating theaters.

Regarding immunoglobulins and booster vaccine time of administration 70% of trainees lack the knowledge about proper timing for taking immunoglobulins against HBV. 49% answered that they will take a booster vaccine. 51% do not know when to test themselves if injured by a known Hepatitis C virus (HCV) patient. 31.4% answered by testing themselves properly if injured by a known Human Immunodeficiency Virus (HIV) patient. The timing of receiving post exposure prophylaxis (PEP) after exposure was known only to 11.8% of the candidates.

Among three trainees (6%) injured by known positive Hepatitis B Surface Antigen (HBsAg) patients only one of them was vaccinated. Two trainees did the advanced measures but one trainee, who was not vaccinated, did only the simple measures by removing the gloves and washing the wound. No one was injured by a known patient with HCV or HIV.

Overall, 25.4% of respondents demonstrate an acceptable level of knowledge, attitude and practice. There was no significant difference between orthopedics and general surgery trainees. However, that level is not correlated to what trainees think about their adherence to safety measures.

Conclusion: In conclusion, this study showed significant decline in the levels of knowledge, attitude and practices among the residents in protecting themselves against famous blood- borne diseases. Nevertheless, more than half of surgical trainees will react ineffectively to sharp object injuries if exposed to possible carriers of hepatitis B, C or HIV viruses.

Keywords: Standard Precautions (SPs); HIV/AIDS; Hepatitis B; Hepatitis C; Hepatitis B Surface Antigen (HBsAg); Hepatitis C Virus (HCV); Post Exposure Prophylaxis (PEP)

Introduction

Literature Review

The United Nations (UN) estimates that Sudan has the highest rate of HIV infection in North Africa and Middle East [1-3]. The number of people living with HIV/AIDS is estimated to be about 600,000. The prevalence of HIV in Sudan is 0.76%. In 2002 an estimated 2.6% of the adult population in Sudan had HIV/AIDS [1-3].

More than 2 billion people globally have been exposed to hepatitis B and it is estimated that 350 to 400 million people have chronic hepatitis B infection. Hepatitis B is a leading cause of death worldwide [4,5].

Sudan also is a highly endemic area for HBV, and more than 5% of blood donors are chronically infected [6]. The reported prevalence of HBV chronic infection varied from region to region and ranged between 5% and 7% in the general population and 26% in hospital patients [4,6].

Operating surgeons have the second highest injury rate than most healthcare professions. Exposure rates for surgical operating room technicians were nearly eight times the average rate for all occupational groups combined [7-9].

In the hospital setting, the highest proportion of percutaneous injuries occurred in the OR, with over 30% of all reported hospital sharps injuries occurring in this setting [10,11].

Incidence of skin injury is about 0.8 punctures per 100 hours of operating time (210 skin punctures per working lifetime) [12]. Fear of contracting serious diseases has caused psychological stress among healthcare providers and hence family members' emotional suffering [13,14].

The annual number of needle stick and other percutaneous injuries among healthcare workers in the USA is estimated to be 600,000 to 800,000. Half of these injuries will not be reported [15].

Seroprevalence of HCV and HIV have been estimated as 1.2% and 0.16% among surgeons [16,17].

In studies of health care practitioners (HCP) who sustained injuries from needles contaminated with blood containing HBV, the risk of developing clinical hepatitis if the blood was positive for HBsAg and hepatitis B envelope antigen (HBeAg) was 22% - 31%. The risk of developing serologic evidence of HBV infection was 37% - 62%. By comparison, the risk of developing clinical hepatitis from a needle contaminated with HBsAg positive, HBeAg negative blood was 1% - 6% and the risk of developing serologic evidence of HBV infection was 23% - 37% [18].

While SPs serve as a foundation for the prevention of blood exposure, researches showed that they are not always implemented [19].

There is no reported data regarding the frequency of complications resulting from needle-stick injuries among surgeons in Sudan.

According to Sudan National AIDS Control Program (SNAP), training modules in PEP have been developed and used to conduct sensitization as well as training of officers at federal and states levels. PEP kits were made available in 21 sites covering all the 15 states of Sudan [20].

Purpose of the Study

The purpose of this study is to provide a broad overview of how trainees react toward blood-borne pathogens in order to facilitate a discussion on ways to advance the field of occupational blood exposure prevention in training programs.

Adequate knowledge and practice

Universal precautions

Refers to the practice of avoiding contact with a patient's bodily fluids by means of wearing nonporous articles such as medical gloves, goggles and face shields. This practice was introduced in 1985 - 1988. In 1987, the practice of universal precautions was adjusted by a set of rules known as body substance isolation. In 1996, both practices were replaced by the latest approach known as standard precautions (health care) [21,22]. A study by Beekmann, Vlahov, and Koziol., *et al*. found a temporal relationship between the implementation of SPs and a reduction in percutaneous injuries [23].

Vaccination

Test for anti-HBs if a person has been vaccinated, but vaccine response is unknown. Baseline testing is not necessary if vaccine response is known. If an exposed person has been vaccinated and he is a known responder to the vaccine, no PEP is necessary [21].

Post exposure prophylaxis

Any preventive medical treatment started immediately after exposure to a pathogen (such as a disease-causing virus) in order to prevent infection by the pathogen and the development of disease [24-26].

In the case of HIV exposure, PEP is a course of antiretroviral drugs which reduces the risk of seroconversion after events with high risk of exposure to HIV (e.g. unprotected anal or vaginal sex, needlestick injuries or sharing needles). The CDC recommends PEP for any HIV negative person who has recently been exposed to HIV for any reason [27]. To be most effective, treatment should begin within an hour of exposure. After 72 hours, PEP is much less effective, and may not be effective at all. Prophylactic treatment for HIV typically lasts four weeks [26].

While there is compelling data to suggest that PEP after HIV exposure is effective, there have been cases where it has failed. Failure has often been attributed to the delay in receiving treatment (greater than 72 hours post exposure), the degree of exposure, duration of treatment (lack of adherence to the 28-day regimen) or all three combined. However, given that - for non-occupational exposures - the time and level of exposure are based on patient-supplied information, absolute data is unavailable. PEP can also slow down the development of antibodies while the medications are still being taken. This can result in false negatives on an antibody test if the proper waiting period is not observed after completion of medications. The standard antibody window period begins after the last day of PEP treatment. Doctors will advise patients who received PEP to get an antibody test at 6 months post exposure as well as the standard third month test [28].

The antiretroviral regimen used in PEP is the same as the standard highly active antiretroviral therapy used to treat AIDS. It requires close compliance and can have unpleasant side effects including malaise, fatigue, diarrhea, headache, nausea and vomiting [26,29].

A report from early 2013 revealed that a female baby born with HIV virus displayed no sign of the virus two years after high doses of three antiretroviral drugs were administered within 30 hours of birth. The findings of the case were presented at the 2013 Conference on Retroviruses and Opportunistic Infections in Atlanta, U.S. and the baby is from Mississippi, U.S. The baby is considered to be the first child to be "functionally cured" of HIV [30].

Sharp objects injury

Defined as partial introduction of a hollow-bore needle or sharp instrument contaminated by blood or other potentially infectious material into the body of an HCP [31].

An exposure that might place HCP at risk for HBV, HCV, or HIV infection is defined as a percutaneous injury (e.g. a needle stick or cut with a sharp object) or contact of mucous membrane or non-intact skin (e.g. exposed skin that is chapped, abrade or afflicted by dermatitis) with blood, tissue, or other body fluids that are potentially infectious [31,32].

Potentially infectious materials include -in addition to blood and body fluids containing visible blood- semen and vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid. Feces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomitus are not considered

potentially infectious unless they contain blood. The risk for transmission of HBV, HCV, and HIV infection from these fluids and materials is extremely low [31,32].

High risk objects

Needles, sharp hand-held instruments or procedures dealing with sharp pathology e.g. Bone spicules, usually in poorly visualized or confined spaces (e.g. orthopedic surgery, trauma surgery, internal cavity surgery).

Management and post exposure prophylaxis against HBV, HCV, and HIV is by promoting hepatitis B vaccination, treating all patients as potentially infectious and using barriers to prevent blood/body fluid contact. Preventing injuries by eliminating unnecessary handling of sharp objects, using devices with safety features, developing safe work practices for handling needles and other sharp devices and finally safely disposing of sharps and blood contaminated materials.

General measures to reduce the risk of occupational exposure

The following measures will help to minimize the risk of exposure to Blood-borne pathogen [32]:

- Washing hands with soap and water before and after contact with each patient, and before putting on and after removing gloves.
- Changing gloves between patients.
- Covering existing wounds, skin lesions and all breaks in exposed skin with waterproof dressings. Wearing gloves if hands are extensively affected.
- Wearing gloves where contact with blood or other body fluids is anticipated.
- Avoiding sharp instruments utilization where possible, and where sharps usage is mandatory, exercising particular care in handling and disposal is recommended.
- Avoiding wearing open footwear in situations where blood may be spilt or where sharp instruments or needles are handled.
- Clearing up spillage of blood promptly and disinfecting surfaces with appropriate disinfectant.
- Wearing gloves when cleaning equipment prior to sterilization or disinfection, when handling chemical disinfectant and when cleaning up spillages.
- Following safe procedures for disposal of contaminated waste.

Post exposure management

Accidental injuries caused by sharps (including needle-sticks) must be dealt with immediately [32]:

- Encourage free bleeding, but under no circumstances should the wound be sucked. The wound should be washed liberally with soap and water, but without scrubbing. Skin antiseptics should not be used. The wound should then be covered with a waterproof dressing. Contaminated skin, conjunctivae or mucous membranes, should be washed immediately. This applies to all situations at all times.
- The injured person must report the incident, regardless of its extent, to on-site manager, a senior or departmental safety officer immediately. If a patient receives a potentially contaminated sharps injury, inform the in-charge consultant and the ward manager.
- Because the injured person may be distressed (even if not visibly so) a senior member of staff must address that and take responsibility for further action.
- A full accident record must be kept and it should include the following details:
    1. Time of incident.
    2. Exact nature of incident.
    3. Geographical source or location of needle/sharp instrument.
    4. Source patient (i.e. individual on whom the “sharp” was originally used)
    5. Status of the source patient regarding blood borne pathogen infection.
    6. Source patient risk factors for blood borne pathogens e.g. known or suspected to have been engaged in intravenous drug abuse.
    7. Injured person hepatitis B status.

- During office hours, the Occupational Health Department will be responsible for making an initial risk assessment and instigating further action.
- Outside working hours, the Emergency Unit and Emergency Admissions Unit will be responsible for making an initial risk assessment and instigating further action.
- After initial contact with the injured person, the covering department should contact the member of medical staff designated to cover sharps/inoculation injuries.

If required, the designated doctor may need to interview the source patient (if known) or the medical practitioner responsible for their care to establish if there are any possible indicators of blood borne infection including risk factors for HIV infection, Hepatitis B and Hepatitis C [32,33]. If necessary, a medical practitioner other than one involved can access the patient notes provided that permission was taken from the patient. Consent must be taken from the patient for screening of blood-borne infection including specifically HIV, hepatitis B and C by the doctor in charge of his care. This should be undertaken regardless of the risk factors suspected. The doctor in charge of the source patient should counsel the patient prior to consent being sought [34].

Laboratory testing without consent will not normally be undertaken. However, in some exceptional circumstance's samples may be tested but only after consultation with experienced medical colleagues and a Medical Virologist.

Once the initial risk assessment has been made one of, the following courses of action must be followed.

Risk of HBV exposure

A sample of blood should be taken from the exposed employee, patient or visitor for testing against hepatitis B or for storage if necessary. Samples should be processed through the Occupational Health Department when appropriate. If blood has been taken from staff in an area other than Occupational Health or out-of-hours the request form should indicate, "Copy to Occupational Health".

It will be necessary to provide counseling for the individual who has received the "sharps injury". The type of counseling provided will depend on the type of exposure:

1. If the source patient is known to be infected with hepatitis B, the injured individual must have a blood sample taken immediately and sent for testing to establish his hepatitis B status. Immunoglobulin (available from a Medical Virologist) can then be given at the earliest possible time if required. The injured party should then be referred to Occupational Health for counseling and follow up at the earliest possible time.

2. The level of immunity of the injured person will be determined in the virology department, by testing a blood sample taken at the time of the injury and/or by review of previous relevant laboratory data. The decision to use hepatitis B immunoglobulins (HBIG) or hepatitis B vaccine will be based on total risk assessment. HBIG is available via the on-call Medical Virologist).

3. If the source patient is known or shown to be non-infectious for hepatitis B, the exposed person must be counselled accordingly. If an exposed member of staff has not received a course of immunization, he should be offered vaccination for future protection.

Risk of HCV exposure

If the source patient is known to be infected with hepatitis C, the injured individual should be counselled and referred to Occupational Health. The latest guidance from the Public Health Laboratory Service advises that if the source patient is viremic (RT-PCR positive) then the injured individual should have blood tested at six and twelve weeks. If they are not viremic then a blood sample should be taken at the time of the injury for storage and a further sample taken six months after the injury.

Unknown status

When the source patient is unknown, or refuses to undergo testing, the area from where the "sharp" came from should be identified whenever possible and a risk assessment of possible contamination by a blood borne viral agent can be made.

The injured person should then be referred to an occupational Health officer at the earliest possible time. Blood samples should be taken or a review of previous relevant laboratory data to establish the hepatitis status of the exposed worker.

They should then be counselled and offered a course of hepatitis B vaccine or a booster depending on the vaccination status.

Other

It must be remembered that a part from the viral blood borne agents documented above, other pathogens such as syphilis may be transmitted by blood/body fluid exposure and these agents should be taken into account when the risk assessment is carried out.

If the donor patient's status is unknown, the clinician in charge of the patient must undertake an assessment of the "donor". The clinician must establish whether the "donor" is in a "higher risk" group or not. Further advice as to what patients are in the "higher risk" group is available from either the Occupational Health Physician during working hours, or the on-call Medical Virologist (or Medical Microbiologist) out of hours. The clinician in charge of the patient will take blood samples and counsel the patient. Employees should be referred to the Occupational Health at the earliest possible time and they will be responsible for the taking of blood samples for storage and/or serological testing [35-38].

Justification

Surgeons in training have the greatest risk of exposure to blood-borne pathogens, due to their numerous encounters involving the use of sharp instruments and the increased propensity for injury while learning new technical skill sets [39].

The hazard of injury is further compounded by the high prevalence of HIV, HBV and HCV among hospitalized surgical patients. This risk can be decreased by adherence to standard precautions and by better knowledge and effective practice after exposure.

Previous studies have focused on health workers either generally or on categories of health workers other than surgeons [44,45]. In order to decrease this risk in the future, this study was conducted.

Objectives of the Study

General objectives

To assess the degree of Knowledge, Attitude and Practices of the surgical residents in the qualifying training program in protecting themselves against blood transmitted diseases, before and after management of possible carriers of hepatitis B, C or HIV viruses and how they will react if exposed to infected materials or sharp objects.

Specific objectives:

1. To assess the trainees' basic knowledge about safety precautions.
2. To assess trainees' practices in operating rooms and emergency rooms and the incidence of sharps injuries and how it can be lessened in the future.

Methodology

Study design

This study is a cross-sectional KAP study conducted between April 2018 and June 2019.

Study population

Orthopedic surgery and general surgery residents from various teaching hospitals enrolled in Sudan Medical Specialization Board (SMSB) training programs in Sudan during the study period.

Study sample

Simple random selection by selecting odd numbered trainees from the list of all rotating trainees (57 in general surgery and 82 in orthopedics) provided by e-Registration office of SMSB. 63 included in the study.

Survey instrument

A questionnaire consisting of 58 questions was developed. Survey design and refinement involved literature review. Its validity was documented by a pilot study using a random sample (n = 7) drawn from newly graduated orthopedic consultants during a 1-month period for face validity, content validity and feasibility. Feedback was integrated into the final survey.

Data collection

The study was conducted through a written standardized questionnaire by the residents who were surveyed. It involved face-to-face (53 residents) and telephone interviews (10 residents).

The questionnaire included questions related to demographic data such as age, gender, field of specialization and training year. This is followed by questions related to various study domains; knowledge, attitude and practice that were carefully reviewed from similar studies and were modified according to the recom-

mendations from the pilot study to reflect its appropriateness for the trainees in Sudan.

Data analysis

Data was analyzed using Statistical Package for Social Science (SPSS- 21) software and the results were expressed in tables and figures. The test of significance was calculated using a P value of 0.05.

Ethical considerations

Survey was administered with a blank, sealable envelope for confidentiality. Participation was voluntary, and completion of the survey was considered implied consent for study participation. The approval for the study was obtained from the ethical committee of the orthopedic surgery board at the SMSB.

Results

A total of 69 surgical residents were invited to participate in the survey. At the end of the survey period, which ran from 2/4/2018 to 2/6/2019, Sixty-three (n = 63) candidates responded by completing the survey, which represents a return of 91.3%.

Considering age distribution, fourteen candidates were under twenty-five years, nine candidates were between twenty-five and thirty years and forty candidates were more than thirty years.

Two residents were females and the rest 61 residents (96.8%) were males (Figure 1). Thirty-eight were Orthopedics surgery residents (60.3%) and the rest twenty-five were General surgery residents (39%). The training levels of all the respondents (n = 63) was represented as follows: eight were in the first year, fourteen were in the second year, sixteen were in the third year and twenty-four were in the fourth year.

Forty-seven candidate (74.6%) said they always follow safety precautions (Table 1 and figure 2), of those who were not able to follow safety precaution; 6.3% due to high job demands and 14% because it is not always available. with a P value < 0.05 (Figure 3).

Less than half of the candidates (47.6%) attended the basic surgical training course with no difference between general surgery and orthopedics trainees (p value > .05) (Figure 4). 23.8% cannot participate because of inconvenient timing and 4.8% cannot afford to attend (Figure 5).

Figure 1: Distribution of male and female residents among the study group.

Figure 2: Distribution of orthopedics and general surgery residents according to their assumed adherence to safety precautions.

Figure 3: Reasons why residents do not always follow safety precautions.

	Orthopaedics			General Surgery	
	With	Without	Total	With	Without
Residents with enough knowledge, attitude and practice	22.7%	77.3%	100%	31.5%	68.5%
Residents with assumed knowledge, attitude and practice	75.5%	24.5%	100%	70.5%	29.5%

Table 1: Relation between actual and assumed levels of knowledge, attitude and practice

Figure 4: Relation between surgical field and attendances of surgical training course.

Figure 5: Reasons why residents are not attending the basic surgical training course.

Only 25.4% attended a workshop about infection control and 40% did not read a book or even an article about infection control. Furthermore, six trainees, all in general surgery (9.6%), don't wear double gloves claim it reduces hand sensitivity.

Figure 6: Distribution of residents according to their attendance of infection control workshop.

Figure 7: Distribution of residents according to their contact with an infection control article or book.

Figure 8: Difference between of enough knowledge to safe practice at ER.

Surprisingly, about 30% of the registrar do not wash their hands before or after wound debridement at ER after they said it is necessary. 13.7% of residents do not use double gloves in wound debridement at ER and 10% believe it is not necessary (Figure 9). Around 30% have enough knowledge and safe practice in the ER (Figure 10).

Figure 9: Distribution of residents according to their knowledge and practice at ER.

Figure 10: Distribution of residents according to usage of double gloves. P value < 0.05.

Although 61.9% of trainees notice the perforations after the surgical procedure is completed, only 4.8% of candidates knew about or used an indicator under glove. These perforations were more common among Orthopedics trainees with a p value of 0.007 (Figure 11).

Figure 11: Relation between surgical field and when glove perforation noticed.

When it comes to skin closure, seventy-one percent of candidates prefer skin staplers, but only 27% use it because it is protective and 44.4% used it because it is quick. 15.9% said it is not available and 4.8% do not know how to use it (Figure 12).

Figure 12: Relations between the causes for not using skin stapler and the rotation year of the candidate.

Among all the participants 74.1% know that HBV has the higher risk of transmission. Overall, twenty-three percent have enough knowledge and safe practice at OR (Figure 13).

Figure 13: Relations between the causes for not using skin stapler and the rotation year of the candidate.

Although, thirty one percent of residents know when to test themselves if exposed to HBV (Figure 13), 22.2% do not know when to test and 6.3% will never test themselves.

Although 70% will take immunoglobulins if exposed to HBV, 44.4% don't know its price or availability and only 7.9% know the proper time to use it. 52.4% will get a booster vaccine and 38.1% said they don't know to take it or not. A total of 19% have enough knowledge and attitude about HBV (Figure 14).

Figure 14: The time when trainees will test themselves if exposed to Hepatitis B virus.

Considering exposure to HCV, only19% will test themselves 4 - 6 months after exposure and 42.9% do not know when to test themselves. 90.5% do not have enough knowledge and attitude about HCV. However, the practice is different when they expose to HIV as only 33.3% will test themselves properly (both at start and after 6 weeks) and 63.4% will take post exposure prophylaxis (Figure 15).

Despite the post exposure prophylaxis (PEP) is free, only 23.8% knew that while 14.3% think it is expensive, 58.7% don't know anything about it (Figure 16). 52.4% of trainees don't know if it is available or not and only 12.7% know that it is 2 drugs combinations, but the most important information about the timing of receiving PEP after exposure which is the first golden hour was known only to 15.9% of the candidates, (Figure 17) with no difference among surgical field. With significant P value > 0.05 (Figure 18) only 15.9% have enough knowledge and attitude about HIV. Sixty-point three percent of the tested sample were not vaccinated against HBV.

Figure 15: Relation between general knowledge and knowledge about HBV.

Figure 16: Attitude of taking post exposure prophylaxis by trainees in response to exposure to HIV.

Figure 17: Knowledge of residents about the price of HIV post exposure prophylaxis.

Figure 18: Knowledge of residents about the proper time for HIV post exposure prophylaxis.

Incidence of sharp objects injuries among surgical trainees was found to be 84.1% and 76.5% were injured more than once (Figure 19). Same percentage (76.5%) reported that their injury was on the first 2 years of rotation (Figure 20). 79.4% of the candidates related their injuries to poor organization climates and 84.1% said high workload is also a reason for these injuries. Twenty eight percent did nothing, 52.4% did simple measures and only 4.8% started advance measures like counseling or checking the patient immune status (Figure 21). One of the candidates did screening for HIV for his patient 1 month later and it came positive.

Three residents (4.8%) were injured by a known HBsAg patient and only one of them was vaccinated (Figure 22). Two did the advanced measures but one, who was not vaccinated did only the simple measures. (He removed the glove and washed his wound). No trainees were injured by a known patient with HCV or HIV.

Figure 19: Distribution of residents according to their sharp object injuries.

Figure 20: Frequency of sharp objects injuries and its relation to years in rotation.

Figure 21: Distribution of residents according to their response to sharp objects injuries in a patient with unknown status.

Figure 22: The vaccination status of residents.

Out of all respondents, 25.4% have accepted knowledge, attitude (Figure 23) and practice, with no difference between orthopedics and general surgery residents.

Figure 23: Distribution of residents according to their actual level of knowledge attitude and practice.

Figure 24: Relation between actual and assumed levels of knowledge attitude and practice.

Discussion

Attending and resident surgeons have the highest frequency of percutaneous and mucocutaneous exposures, accounting for over

50% of all exposures in the OR setting. Reduced exposure incidents were associated with high senior management support, high levels of safety feedback and training. Studies showed that blood contact rates can be decreased from 12.3% to 7% in the year following the implementation of the prevention plans [42,44].

In this study, male and female (less than 4%) were not evenly represented, and the opinions of both male and female were combined and represented without making reference to a specific gender.

The largest group of trainees was on the last year of rotation, which may explain the age difference (63.5% were more than 30 years).

At the start of this study74.6% said they stick to safety measures (Figure 2) and of the other group; 14.3% claimed it not always available.

When analyzing their source of knowledge, we found that less than half of the trainees had not attended a basic surgical training course, which will be reflected in their response. This attendance can be improved by better time adjustment .39.7% of trainees did not even read a book about infection control.

General surgery trainees showed better knowledge and attitude at ER (p value 0.04) but the overall is below the accepted level (41.3%) this was clear in their attitude; 29.4% of the trainees said they do not wash their hands at ER after they said it is necessary.

13.7% of residents do not use double gloves in wound debridement at ER and 9.8% think it is not necessary. Local study showed that only 33% of doctors were always wearing gloves [43]. But when looking back to the international literature approximately one-third reported not wearing gloves during an invasive procedure and 46% - 68% do not always wash their hands after patient care [51].

Although glove failure represents a significant risk of exposure to bloodborne pathogens for operative personnel, only 4.8% of candidates knew or used an indicator under glove and 62% of registrars notice the perforations after the surgical procedure is completed. This study shows that orthopedics trainees pay less attention towards gloves perforation (Figure 10).

Because suture needles are involved in the majority of OR percutaneous injuries, studies showed that usage of blunt needles and skin staplers can reduce this risk.

This study showed that 71.4% prefer skin staplers, mostly senior trainees with a P value of 0.03- but only 27% use it because it is protective, and 44.4% use it because it is quick.15.9% said it is not available and 4.8% (mostly in the first 2 years P value 0.04) do not know how to use it (Figure 11).

All of these attitudes reflect a low level of knowledge at OR (23.8%) and no significant difference between surgical and orthopedics trainees which caused a high incidence of sharp objects injuries with a p value < 0.05 (Figure 23).

Similar results were obtained from study about surgery trainees in Nigeria where most (85.6%) do not routinely use all the protective measures advocated for the reduction of transmission of blood borne pathogens during surgery, with the majority ascribing this to non-availability [45].

Only15.9% have enough knowledge and attitude about HIV which related to the overall knowledge, (p value 0.001) but not related to the surgical field or the rotation year. 60.3% of the tested sample was not vaccinated against HBV, which correlates with the local literatures that showed that more than 50% of health care workers are not vaccinated against HBV [51].

The international literature showed difference in awareness in relation to location where some places (e.g. 75% in Denmark and Mexico) [46] has better awareness, but in other regions like Nigeria [47] and India [48] low levels of awareness exists.

Incidence of sharp objects injuries among surgical trainees was found to be 84.1% these finding was a little higher than what reported in the literature; 74% in Saudi Arabia [49] 80% in Pakistan [49] and 83% in UK [50].

76.5% were injured more than once which were in line to that reported in the literature. 4.8% started advance measures which reflect a very low response level when compared to the international literature. (49% in UK and 47.2% in South Africa) [50].

Three residents (4.8%) were injured by a known HBsAg patient only and 1 of them was vaccinated. Tow did the advanced measures

but one, who was not vaccinated, did only the simple measures. (He removed the glove and washed the wound). No one was injured by a known patient with HCV or HIV.

After analyzing 55 questions we found that 25.4% have accepted knowledge, attitude and practice with no difference between orthopedics and general surgery trainees and that level is not related also to what registrars think about their adherence to safety measures (Table 2 and figure 23).

	Frequency	Percent
Residents with knowledge, attitude and practice	16	25.4
Residents without knowledge, attitude and practice	47	74.6
Total	63	100

Table 2: Percentage of residents who have accepted levels of knowledge, attitude and practice.

This result is similar to a local study published on June 2012 at The International Journal of Risk and Safety in Medicine which showed that Healthcare workers had poor knowledge about Universal Standard Precautions Guidelines, and do not fully appreciate their occupational risk regarding hepatitis B infection [51].

		Surgical field		Total
		Orthopaedics	General surgery	
Reasons for not following safety precautions	Interference with patient	0.0%	20.0%	6.25%
	Unanticipated need	0.0%	40.0%	12.5%
	High job demands	27.3%	20.0%	25.0%
	Not always available	72.7%	20.0%	62.5%

Table 3: Distribution of residents according to the reason of not following safety precautions.

P value 0.039.

Conclusion

This study reveals the degree of knowledge attitude and practice among surgery residents between years 2018 and 2019 and can serve as a basis for comparing the change that will occur with time.

The study shows low levels of Knowledge, Attitude and Practices of the residents in protecting themselves against blood-transmitted disease.

Almost half of surgical residents will react ineffectively if been exposed by sharp objects to possible carrier's hepatitis B, C or HIV viruses.

Drawbacks

Inability of the study to include other medical field such as nurses. In addition, close-ended questions might give the candidates a hint. Furthermore, longer period of time is needed to increase sample number.

Recommendations

1- More studies with bigger size and longer duration may be needed in the future with multidisciplinary approach.

2- Vaccination, basic surgical training course and infection control workshops should be mandatory before starting any kind of specialty training.

3- Educatory equipment's as posters should be available at workplace showing what to do and whom to contact after exposure.

4- Every hospital should establish a blood borne pathogen management policies and they should implement it (e.g. training, hepatitis B vaccination, exposure reporting, PEP access, etc.).

5- Providing an access of counseling channels for exposed personnel (telephone no., web site) especially after working hours.

6- Positive work conditions and developing education system about blood borne pathogens and sharp objects injuries. This system should target medical practitioners, nurses, pharmacists, other healthcare workers, interpreters, and people working with highly affected communities.

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