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RESEARCH LETTER

Urgent Focus on Occupational Exposure to HIV in Orthopedic Surgery: A 10-Year Retrospective Study of 215 Surgeries in a Chinese Hospital

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Research Letter

After more than 40 years of continuous struggle with human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS) is still one of the most widespread and harmful infectious diseases in the world.[1,2] With the use of antiretroviral therapy (ART), the living quality of people living with HIV (PLWH) has been significantly improved, and life expectancy has tended to be normal.[3] During this period, there is an increasing number of events requiring surgical treatment, especially for patients with severe conditions and ineffective conservative treatment.[4] In these operations, degenerative orthopedic diseases such as cervical spondylosis, lumbar disc herniation, and osteoarthritis plague most patients.[5] Medical staff have a high chance of contact with all kinds of sharp instruments during orthopedic surgery, the sharp property of bone compared with other human soft tissues makes the risk of occupational exposure greater. Protection against occupational exposure (OE) is a critical issue when performing orthopedic surgery on PLWH.

Retrospective analysis was used in this study. A total of 215 hIV patients who underwent surgery in the orthopedics department of our hospital from November 2010 to December 2020 were included by reviewing the medical records. The study was conducted by the Declaration of Helsinki, and the study protocol was reviewed and approved by the Ethics Committee of Beijing Ditan Hospital, Capital Medical University. Excel 2016 was used to establish a database and calculate the corresponding frequency and incidence.

Demographic Information About the Patients

By reviewing the medical records of PLWH who have undergone orthopedic surgery in our hospital from 2010 to 2020, 215 patients were included in the study, including 177 males and 38 females, with an average age of 40.32 ± 8.33 years. The duration of HIV infection ranged from 1 to 12 years (median 6 years). 198 patients were treated with ART, the most used regimen was tenofovir/lamivudine/efavirenz (133 patients). A total of 180 people had viral loads below the detection level (< 20 copies /mL), and the remaining patients had a median viral load of 642 copies /mL. According to the type of surgery, there were 24 cases of non-fracture open injuries, 35 cases of open fractures of the extremities, 112 cases of closed fractures of the extremities, and 44 cases of spinal surgery. All open injuries were treated with emergency surgery, 59 cases, and the remaining 156 cases were treated with elective surgery.

Occurrence of Occupational Exposure

The surgical treatment of 215 patients was completed. A total of 25 cases of OE occurred, mainly before 2015, and the incidence of OE was 11.6%. There were 6 cases of tertiary OE (The source of exposure was body fluids, blood, or medical devices or articles containing body fluids or blood; The type of exposure was the exposure source stabbing or cutting the skin, but the degree of injury was severe, which was the deep wound or the cut object with obvious blood), of which 5 cases occurred in emergency surgery and 1 case occurred in elective surgery. The cause of exposure was a sharp

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stab or cut, and the injury was deep. All the patients with 5 times of tertiary exposure in emergency surgery had open injuries, and the main cause of exposure was related to non-standard operation (The principle of sterility was not followed, the inventory of instruments was not strict, and the operation technique and experience were insufficient). All patients undergoing elective surgery were confirmed to have HIV infection before surgery. Since 2015, we have continuously summarized experience, strengthened protection education, and carried out the correct protection process (See the "Measures to prevent occupational exposure to HIV" section below). The occupational protection process is smooth, the measures are in place, and the OE is significantly reduced, and all of them are primary exposures (The source of exposure was body fluids, blood or medical devices or articles containing body fluids or blood; The type of exposure is that the exposure source is contaminated with the damaged skin or mucosa, the exposure dose is small and the exposure time is short). See Figure 1 for the specific infection situation each year.

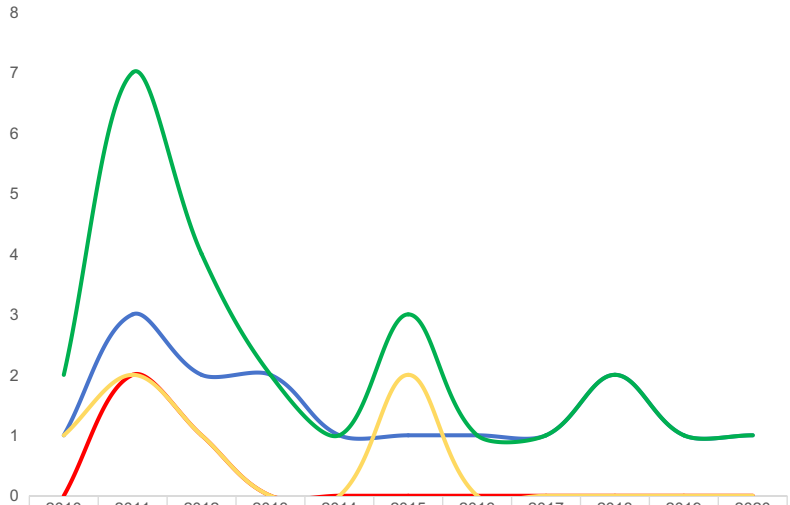
Classification of Occupational Exposure

OE in medical settings is classified into primary, secondary, and tertiary exposures according to the severity and type of exposure. Primary exposure refers to a milder exposure condition where the risk of infection is relatively low due to the small amount and short duration of exposure. However, the need for prophylaxis still needs to be assessed based on the viral load level of the source of exposure. Secondary exposures are more severe than primary exposures, with an increased risk of infection due to greater exposure or prolonged exposure, or the presence of stab wounds or cuts despite less severe injuries. At this point, the decision to use prophylaxis needs to be based on the viral load level of the source of exposure, and an intensive dosing schedule may be used. Tertiary exposure is the most serious type of occupational exposure and carries an extremely high risk of infection due to the severity of the injury and the potential for large amounts of virus to enter the body. At this point, immediate wound management and initiation of a prophylactic medication regimen are mandatory, and an intensive medication regimen is often required to reduce the risk of infection.

Causes of Occupational Exposure

Insufficient Attention

With the increasing number of surgeries for PLWH, surgeons will gradually appear paralyzed and less vigilant for the protection of OE. When there is more than one operation in a day, HIV-infected patients should be arranged for the last



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Primary Exposure	1	3	2	2	1	1	1	1	2	1	1
Secondary Exposure	0	2	1	0	0	0	0	0	0	0	0
Tertiary Exposure	1	2	1	0	0	2	0	0	0	0	0
Total	2	7	4	2	1	3	1	1	2	1	1

Figure 1 The number of occupational exposures from 2010 to 2020. This is the occupational exposure in the department of Orthopedics of our hospital from 2010 to 2020. The blue line represents the primary exposure, the red line denotes secondary exposure, the yellow line signifies tertiary exposure, and the green line represents the sum of exposures.

operation in principle. Due to the long operation time, the surgeon is prone to fatigue, difficulty in concentration, decreased concentration, and decreased vigilance of protection. Lack of knowledge about AIDS can also lead to insufficient awareness of self-protection.

Improper Operation and Protection

For example, when the surgeon sutures the skin, the needle is taken directly by hand; When the surgeon uses sharp instruments, the assistant performs other operations such as hemostasis at the same time. Failing to wear protective equipment or not wearing protective equipment effectively will inevitably increase the risk of OE.

The Principle of Universal Precautions Was Not Observed

The universal precautionary principle was proposed by the Centers for Disease Control and Prevention in 1995 and implemented throughout the United States in 1996. The principle of universal protection includes: all patients' blood, body fluids and articles contaminated with body fluids should be regarded as infectious source materials, and medical staff should take protective measures when they contact with these materials. They are summarized as safe disposal of sharp instruments; All instruments should be strictly disinfected; Hand hygiene Standards for Medical Staff were followed when washing hands. Use protective equipment to avoid direct contact with body fluids; Safe disposal of waste.[6]

Panic During Emergency Surgery

Among the 6 cases of tertiary OE in this study, 5 cases occurred in emergency surgery, and all of them were open injuries. HIV-infected patients were more likely to conceal their HIV infection due to fear of hospital refusal to perform surgery, especially for emergency surgery patients. Most hospitals cannot rapidly screen for HIV, and the medical staff's lack of vigilance, preoperative preparation, and protection are not enough.

Measures to Prevent Occupational Exposure to HIV

Strengthen Training and Education

Studies have shown that nurses' training in wearing protective equipment and their work experience in caring for PLWH are very important for the prevention of OE,[7] and only half of the OE events in hospitals worldwide are reported.[8] This shows that most medical workers have an insufficient understanding of OE. It is very important to strengthen training and education, so that medical staff can realize the importance of protection, and have a comprehensive grasp of HIV infection and protection, and all surgical procedures during the operation should be standardized. Intraoperative vigilance is particularly important. The surgeon is often focused on the operation and easy to neglect protection. Therefore, medical staff should remind each other to be vigilant during various operations.

The Principle of Universal Protection Shall Be Strictly Observed

This is the fundamental guarantee to avoid OE to HIV. It should be implemented in all aspects of preoperative, intraoperative, and postoperative. No matter whether the patient is infected with HIV or not, it should be treated as if the patient is infected with HIV, and effective protection should be given to avoid the occurrence of OE.

Wear the Necessary Protective Equipment

During the operation, blood or body fluid may be splintered, and medical staff must wear disposable anti-infiltration protective surgical gowns, work caps and gloves, anti-infiltration masks, protective glasses (or face screen), and boots. All needlestick injuries and cuts in this study occurred in the hands. For the protection of intraoperative OE, hand protection is particularly important. In 2000, the United States passed the Needlestick Safety and Protection Act, which resulted in a significant reduction in needlestick injuries in non-surgical procedures, but not in operating room.[9]

Specific Protection of Medical Staff During Operation

During the operation, the personnel in the operating room should be reduced as much as possible, warning signs should be set up outside the operating room, and special people should be itinerant to pass items. Simple and effective methods should be used to reduce the exposure. During the operation, the hemostasis was gentle, and the oozing blood was removed by a suction device as far as possible. Other suture devices may be used. Clinical observation shows that it does not affect the healing of surgical incisions, and can save suture time. It not only reduces the patient's incision exposure time and infection risk but also avoids the risk of OE caused by traditional needle and thread sutures.

The Operation Protection Process

The protection process runs through the whole process of preoperative, intraoperative, and postoperative, which can be summarized as follows: ① Careful preoperative preparation. The preoperative visits should be conducted, ensuring comprehensive psychological preparation, reinforcing safety protection education, and adequately equipping surgical personnel with surgical articles and protective equipment; ② Strict intraoperative protection. We should wear appropriate protective equipment, strictly adhere to the prescribed operational procedures, enhance isolation measures, and employ non-contact technology for the transmission of sharp instruments; ③ Indispensable postoperative management. This includes the disinfection of postoperative operating personnel, and the disposal of intraoperative instruments and disposable articles; ④ Post-exposure prophylaxis is very important. Emergency treatment, preventive medication, psychological care, and follow-up should be guaranteed.

In conclusion, the OE rate among PLWH during orthopedic surgery is reported to be 11.6%. A comprehensive analysis of the underlying causes of such exposures and the implementation of enhanced preventive measures can significantly contribute to ensuring smooth surgical procedures for PLWH while minimizing the occurrence of OE.

Data Sharing Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

Ethics Statement

The study was conducted by the Declaration of Helsinki, and the study protocol was reviewed and approved by the Ethics Committee of Beijing Ditan Hospital, Capital Medical University. Written informed consent has been obtained from the patients and their anonymous information will be published in this article.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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