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HIV Infection: Implications on Surgical Practice

Peter M. Nthumba and Paul I. Juma
Kijabe, Plastic, Reconstructive and Hand Surgery,
AIC Kijabe Hospital, Kijabe
Kenya

1. Introduction

The human immune deficiency virus (HIV) may have had its origins in Africa; a large percentage of those infected live in sub-Saharan African. HIV is thought to have started and spread unnoticed through the 1960s and 1970s, developing into epidemic proportions in the 1980s. The HIV/AIDS pandemic is currently a global phenomenon that has especially impacted on sub-Saharan Africans because of the large numbers of those affected, as well as poverty and illiteracy so rampant in the continent.

The initial hopelessness of the 1980s and early 1990s because of the social stigma and lack of affordable anti-retroviral therapy was replaced with fresh hope, as a result of on-going initiatives that have over the last decade availed anti-retroviral drugs to a population that had would have had no other possibility of accessing this treatment; health education, civic activism, advocacy, government and international recognition and support. The recognition of the threat that HIV/AIDS poses to the survival of mankind, and the measures taken to counter this threat have significantly eroded the social stigma and other complications associated with HIV/AIDS.

Fear of whole populations being wiped out, as suggested by the large number of HIV orphans in the 1980s and 1990s was transformed into hope by the availability of ARVs, translating into a large population of patients surviving way beyond what was previously possible. Opportunistic infections, which in the pre-ARV era caused so many deaths, have seen a significant reduction since the introduction of HAART. This improved survival has introduced a number of aspects that have, and are impacting on the practice of surgery globally.

The challenge of availing ARVs to the eligible patient population still exists; of an estimated 2.24 million people living with HIV/AIDS in Latin America and the Caribbean in 2008, only 54% were on ARVs (Fink et al. 2011).

2. Aims and objectives

A large population of HIV/AIDS patients present to the surgeon with a variety different of surgical pathologies: these may be familiar or unfamiliar to the surgeon, creating either a dilemma in management or a delay in diagnosis and treatment. Unusual surgical pathologies may present in the background of HIV/AIDS, and surgeons ought to be vigilant

(Nthumba, 2008, Nthumba et al., 2011b). A large body of research on the different aspects of the management of these patients exists, from the experience of surgeons in different surgical disciplines. However, these are scattered, and have not been previously analyzed and collected together; further, misgivings and misunderstandings from the pre-HAART era still exist, as to what should be done for these patients. This chapter examines the impact of HIV/AIDS on the practice of surgery on the global scene, with a review of important surgical milestones, as well as broad overviews of common surgical pathologies in the different disciplines, and provides a summary of current surgical care of the HIV/AIDS patient.

3. Materials and methods

The authors performed internet/PubMed/Medline/Cochrane database searches on HIV/AIDS and surgical pathology and surgical practice; data so collected was used in providing current information under the following sub-topics: 'Surgery and HIV/AIDS', 'HIV/AIDS-related surgical diseases' and 'the last frontier in surgery of the HIV patient: transplantation surgery'.

4. Surgery and HIV/AIDS

4.1 Surgery in HIV infected patients

4.1.1 Risk to the surgeon

4.1.1.1 Universal precautions in the operating room

The risk of HIV transmission from patient to the surgeon depends on the prevalence HIV/AIDS in the population served by the surgeon, the frequency of accidental injuries with exposure to infected blood or body fluids, availability of HIV tests and post-exposure prophylaxis in the institution in which the surgeon works, and importantly, compliance of the surgeon to post-exposure prophylaxis (PEP).

Philips et al identified the scarcity of adequate safe surgical supply as a major obstacle to African surgeons' safety (Phillips et al., 2007). Perception of 'time-wasting' with needle stick injury protocols and the subsequent disruption of operating schedules, and an *ad hoc* assessment of the injury as insignificant were noted as the biggest challenges to the prevention of occupational transmission (McCann., 2009). The three universal precautions are: double-gloving, use of face shields, and hands-free technique.

The frequency of cutaneous injury with sharp instruments in surgical procedures is between 1.5% and 15%, with an average risk of five injuries per 100 procedures. While the estimated risk of exposure from a single bore needle stick injury is 0.3%, that from a suture needle is significantly smaller; no seroconversions have been reported in surgeons after a suture injury needle stick. Needle stick injuries of healthcare workers with exposure to blood of patients on HAART, while on the one hand low-risk because of the low or absent viral loads, may on the other hand pose a significant risk for the transmission of drug resistant HIV, with the danger of seroconversion in the HCW, even after PEP compliance (Beltrami et al., 2002; Phillips, 2007).

A review of reported occupational exposures to HIV infected blood in Brazil between 1984 and 2004 revealed a total of four seroconversions; two of these despite using post-exposure prophylaxis (Rapparini, 2006). The actual number of exposures is much higher than those

reported/recorded, as many HCW find that the post-exposure protocols interfere with their schedules, or residents and other junior doctors manage their own post-exposure care, rather than reporting it. Non-compliance with needle stick injury protocols is commonest amongst senior surgeons (Adams et al., 2010; Kerr et al., 2009).

Of an estimated three million HCW percutaneous exposures to blood-borne pathogens, 170,000 are to HIV, with approximately 500 seroconversions annually; 90% of these occur in the developing world (WHO. 2003).

As of December 2005, globally, there were 106 documented cases of specific occupational exposures that resulted in HIV transmission and seroconversion of the HCW. A further 238 seroconversions in HCW may have resulted from occupational exposures, a total of 344 seroconversions; 5% of these were surgeons. As of March 2005, there were 26 PEP failures (Health Protection Agency. 2005a; Health Protection Agency. 2005b) Eight of 57 HCW who seroconverted after an occupational exposure to HIV despite having used PEP; only two of these incidences occurred in the setting of an operating room (Do et al., 2003). Further, six surgeons thought to have seroconverted after occupational exposure did not either have identified index cases, or their pre-exposure status was unknown (CDC., 2000). Seroconversion following occupational exposure even after post-exposure prophylaxis, though rare, is an unfortunate reality (Looke & Grove, 1990). There are fortunately no reported seroconversions after a suture needle injury to date. Since the 57 HCW seroconversions were reported in 2001 by the CDC, only one seroconversion has been reported in the USA.

Double gloving substantially reduces the risk of percutaneous contact with blood from a perforation. In a study of 66 consecutive surgical procedures, of 32 glove perforations in the double-gloving group, 22 were in the outer glove, 10 in the inner glove, and 4 in both gloves. Most glove perforations (83.3%) had gone unnoticed (Thomas et al., 2001).

Bennett et al estimated that double-gloving reduced the size of the blood innoculum in a normal phlebotomy needle to less than 5%, effectively reducing the risk of transmission from 0.3% to 0.009% (Bennet & Howard, 1994; Kerr., 2009). The benefits of double-gloving far outweigh the perceived loss of tactile sensation and dexterity. Additionally, the 'hands-free' technique of handling sharps has been reported to reduce sharps injuries and percutaneous contamination by up to 60% (Kerr et al., 2009). Lefebvre et al found that while a single glove removed more than 97% of contaminant off a tapered needle, two gloves were needed to remove about 91% of contaminant from a cutting suture needle. Three gloves offered the same protection as did two (Lefebvre et al., 2007).

The discussion on perioperative HIV testing in surgery has gone full circle – from an initial push because of the need to protect healthcare workers and exclude high risk patients with potentially poor outcomes, through a period when this was viewed as an unnecessary process that may have been used to unjustly segregate and exclude HIV positive patients from optimal care, to a time when official healthcare organs such as the CDC recognize perioperative HIV testing as an important and necessary part of blood work up, that is potentially protective for the patient. The consequences of undiagnosed HIV infection are deadly and pose setbacks to public health care (Mullins & Harrison, 1993; Rothman et al. 2003; Cunningham, 2010).

4.1.2 Risk to the patient

While a theoretical risk of surgeon-to-patient transmission exists, the only such reported case is that of a dentist who infected five of his patients. There was also a documented

possible transmission from an HIV infected orthopedic surgeon (Lot et al. 1999). The calculated risk of transmission is less than 1 in 41,667 or 1 in 416,670 (Wittmann et al., 1996). Thus the actual risk for the patient is minimal. Nevertheless, the debate on whether or not an HIV positive surgeon should reveal their serostatus to all potential patients continues to rage, and is unlikely to be resolved any time soon.

4.1.3 Outcomes

Studies have shown that CD4+ counts can be reliably used to predict the outcomes of patients with HIV/AIDS after surgical procedures (Deneve et al., 2010).

HIV infection destroys the immune system: only 12% of patients have a CD4 cell count greater than 500 cells/μL, while 50% have a CD4 cell count below 200 cells/μL (Honda, 2006).

Some surgical disciplines have had conflicting conclusions on the use of the CD4+ counts as a surrogate marker for clinical outcomes. With regard to the gastro-intestinal tract some studies have suggested that CD4+ counts are predictive of outcomes, while some found no relationship (Cacala et al., 2006). Viral load has also been used as a marker, but is not as well established. The lower the CD4+ count, the higher the rates of post-operative infective complications, increased length of hospital stay, and mortality. While urgent surgical operations have been associated with increased morbidity and mortality, the overall post-operative mortality in HIV/AIDS is between 18% and 48% (Deneve et al., 2010).

Patients undergoing oral or transoral surgery have a significantly increased incidence of wound sepsis when compared with those undergoing trans-dermal surgery (Reilly et al., 2009).

Cacala et al in a prospective review of 350 patients in a high HIV prevalence environment concluded that HIV infection did not influence the outcome of general surgical admissions. CD4 counts did not influence in-hospital outcomes in their cohort of patients, findings that concurred with those of a study in a similar environment (Cacala et al., 2006; Kalima et al., 1990).

HIV-infected or exposed pediatric patients may have a higher rate of complications, with poor wound healing and breakdown of reconstructive procedures, although other variables such as the need for emergent surgery, malnutrition and comorbidities including respiratory infections in these children contribute significantly to their poor outcome, besides the HIV infection. Karpelowsky et al found a higher morbidity and mortality amongst HIV positive or exposed children undergoing surgery when compared to HIV negative children. Nevertheless, they noted that life-saving urgent or elective surgery should not be denied children on the basis of their HIV status (Karpelowsky et al., 2009).

4.2 HIV/AIDS-related surgical diseases

4.2.1 Prevention

Male circumcision has been shown to protect men against HIV infection during vaginal sex with women, providing evidence that circumcision has the potential to significantly reduce transmission (Books et al., 2010).

4.2.2 Cardiovascular system

The introduction of HAART has seen an increase in the incidence of deep venous thrombosis, and thrombo-embolic phenomena, with Saber et al (2001) finding a 10-fold increase above that in the general population. Increased incidence of deep venous

thrombosis and thrombo-embolism translates to an increased morbidity and mortality (Saber et al., 2001; Monsuez et al., 2009).
There is also evidence that in the HAART era, HIV patients are at an increased risk of coronary heart disease. Also notable is the fact that hypertension may occur in up to 41% of HIV positive patients who survive for longer than 40 years (Kaplan et al., 2007). Lin et al reported an increased morbidity and mortality amongst HIV positive patients undergoing abdominal aortic aneurysm reconstruction. Low CD4 counts and hypoalbuminemia correlated with poor outcomes (Lin et al., 2004).

4.3 Cutaneous and nodal pathology

Persistent generalized lymphadenopathy is a common feature in HIV patients. While a fine-needle aspiration (FNA) of a lymph node may provide the diagnosis in most instances (non-specific inflammatory lymphadenitis, mycobacterial infection, Kaposi's sarcoma, etc), open lymph node biopsies may be needed to define a lymphoma or to evaluate nodes that continue to enlarge over time. Head and neck diffuse lymphoproliferation causing psychological distress to the patient may be treated by open surgical excision, repeated therapeutic aspirations of cystic lesions or even low grade radiation (Reilly et al. 2009).

4.3.1 Trauma

Patel et al evaluated the influence of chronic illness on the outcome of trauma in over 300,000 trauma patients; they concluded that while pre-existing cirrhosis, dialysis, and warfarin therapy were risk factors for both complications and mortality, HIV/AIDS was only a risk factor for complications. Most of these complications were minor, related to urinary tract and wound infections (Patel et al., 2011).
Harrison et al found that wound contamination had a more significant impact on infectious complications than did CD4+ counts. In the management of compound tibial fractures in HIV patients therefore, the authors recommended the use of external fixation in preference to internal fixation, because of higher infection complications in the latter. Internal fixation of closed fractures in HIV positive patients followed up for a year did not show any increase in infectious complications or non-unions (Harrison et al., 2004).
Edge et al in a study on burn injuries found that 5% of their burn patients were HIV positive patients; besides having a higher infection complication rate, length of stay and mortality did not differ from that of HIV negative burn patients. Their conclusion was that HIV-infected patients (without AIDS) who suffer moderate to severe burn injuries, have the same outcomes as HIV negative patients (Edge et al., 2001).

4.3.2 Abdominal surgery

CD4+ counts in patients with HIV/AIDS undergoing surgery are predictive of outcomes, with increased morbidity and mortality for those with low counts (100 to 250 cells/μL), as well as those presenting for emergent surgery. HIV/AIDS patients undergoing emergent surgery may also have lower CD4+ counts than those undergoing elective surgery (Deneve et al., 2010). The commonest complications after major abdominal surgery include wound infection, pneumonia, intra-abdominal abscesses, peritonitis, and sepsis (Rose et al., 1998).
Whereas mortality rates of HIV positive patients undergoing abdominal surgery have been historically high (0% to 80%), with some authors recommending avoidance of laparotomy in this patient population, HAART has significantly improved outcomes, but even then

mortality remains unacceptably high; urgent laparotomies are associated with even higher mortality in HIV/AIDS patients (Tran, 2000; Deneve et al., 2010; Davidson et al., 1991).

4.4 HIV-associated immune thrombocytopenic purpura

Splenectomy in non-HIV-infected patients has been shown to have significant morbidity related primarily to overwhelming sepsis from encapsulated bacteria. In HIV-infected patients, early studies indicated potentially beneficial results of splenectomy, including a slowing of the progression/deterioration to AIDS, when performed in patients with asymptomatic HIV infection (Tsoukas et al., 1998; Tsoukas et al., 1993).

HIV-associated ITP, first described by Abrams et al in 1986, is a fairly common finding in HIV patients, occurring in both asymptomatic and symptomatic HIV-infected patients (Abrams et al., 1986; Tyler et al., 1990). Unlike in immunocompetent (HIV-negative patients), ITP in HIV-infected patients does not respond well to steroid therapy, and although it may respond to ARV therapy, surgery may be required for refractory ITP. Platelet and CD4 counts rise significantly after splenectomy. Aboolian et al reported an 83% response to splenectomy in AIDS patients as compared to 100% response in HIV-positive (non-AIDS) patients. Splenectomy has not been shown to lead an acceleration of the progression to AIDS, or to the clinical deterioration of those with AIDS (Aboolian et al., 1999). Importantly, there has been no evidence of an increase in overwhelming post-splenectomy infections (Lord et al., 1998; Brown et al., 1994).

Splenectomy has also shown good results in HIV-positive hemophiliacs with ITP. Splenectomy has likewise been shown to effectively restore hematological parameters and reduce the need for multiple transfusions in HIV-infected patients with visceral leishmanisis and significant splenomegaly. Splenectomy does not, however prevent relapsing visceral leishmaniasis (Troya et al., 2007). Power et al reported remission of multifocal leukoencephalopathy in an HIV-patient after splenectomy and ARV therapy (Power et al., 1997).

4.4.1 Laparotomy

Abdominal discomfort in the HIV-infected patient may present acutely in the emergency room, or with a more chronic history. In those presenting with a chronic history, the abdominal discomfort may be secondary to a variety of causes including organomegaly, lymphadenopathy or space-occupying lesions such as abscesses. Organomegaly and/or lymphadenopathy may be secondary to infections or neoplasia. CT scan or ultrasound-guided or laparascopic biopsies have largely replaced open diagnostic laparotomies, as where available, these are able provide sufficient tissue to for the diagnosis of such lesions as KS and lymphomas, as well as drain pus collections. Open laparotomy should largely be performed only for therapeautic purposes such as resection of neoplasia, relief of obstruction or the drainage of complex abscesses.

4.4.2 Biliary tract

Hepatic dysfunction in the HIV/AIDS patient is common, and has a large number of possible causes, including medication, opportunistic infection, tumors (such as Kaposi's sarcoma and lymphomas) and sepsis, amongst other possible causes.

Hepato-biliary pathology in the HIV/AIDS patient may present with jaundice, hepatomegaly, and/or pain. Abdominal ultrasonography and/or CTScan examination may reveal dilated biliary tracts. ERCP may be useful in defining and/or managing hepatobiliary

problems (Rerknimitr & Kullavanijaya, 2001). Narushima et al in 2004 successfully performed hepatic resection for hepatocellular carcinoma in two hemophiliac patients with HCV and HIV co-infection with CD4+ counts lower than 200 cells/μL (Narushima et al., 2004).

4.4.3 Gastro-intestinal tract

Due to the abundance of lymphoid tissue along the GI tract, which may act as a viral reservoir, almost all patients with HIV infection will at some time present with GI symptoms. Common pathologies include candidiasis (oral/esophageal), esophageal cytomegalovirus and idiopathic esophageal ulcer (Rerknimitr & Kullavanijaya, 2001). Upper GI endoscopy is an excellent tool for diagnosis or taking biopsies. Kaposi's sarcoma of the upper GI tract may also be diagnosed.

Abdominal tuberculosis has a similar presentation in HIV/AIDS patients as in the HIV negative patient population, with most patients presenting with fever, weight loss, abdominal tenderness, abdominal lymphadenopathy, ascites and/or hepatomegaly (Sinkala et al., 2009).

4.4.4 Acute appendicitis

Bova and Meagher noted that patients with HIV and a clinical diagnosis of acute appendicitis often had a normal white cell count, a finding that may contribute to delayed diagnosis and therefore increased morbidity and potential mortality (Boya, 1998).

4.4.5 Cardiothoracic surgery

The use of video-assisted thoracic surgery in the management of empyema and pneumothorax in HIV-infected patients has significantly reduced morbidity in the care of these patients.

In the absence of uncontrolled HIV infection, open cardiac surgery, including cardiac valve replacement, has the same outcomes as in HIV-negative patients; however, the lifespan of the replaced valves is compromised in intravenous drug users. Coronary artery bypass surgery in HIV/AIDS patients has also become an established practice. Other surgical indications for surgical intervention include pericardial effusion and tamponade. Heart transplantation has also been reported (Frater et al., 1989; Agaskar et al., 2003; Mestres et al., 2003; Chong et al., 2003; Kumar et al., 2008; Calabrese et al., 2003; Bisleri et al., 2003;).

4.4.6 Obstetrics

Caesarian section is the method of choice for the delivery of babies in mothers known to be HIV positive, as it is known to be protective against mother-to-child transmission (Read & Newell, 2005). It has however been shown, as in other surgical specialties, to be associated with a higher morbidity than in HIV-negative women, with a higher rate of the need for blood transfusion, a higher incidence of post-operative fever and wound infection, even with the use of peri-operative antibiotics (Zvandsara et al., 2007). Fiore et al found higher infection rates amongst HIV positive mothers when compared to HIV negative mothers, irrespective of the mode of delivery, and proposed a modification of antibiotic regimen in HIV positive mothers to counter the increased risk of infective complications (Fiore et al., 2004).

4.4.7 Neurosurgery

It is estimated that 10% of patients with HIV/AIDS develop intra-cerebral mass lesions; majority of these are primary CNS lymphomas and toxoplasmosis. Gliomas also form a significant percentage of primary CNS tumors in the HIV-positive population, as in the HIV-negative patients (Chamberlain, 1994; Hall & Short, 2009).

4.4.8 Otologic surgery

Otologic disease is common in HIV/AIDS patients, with some patients requiring surgical intervention. Otitis media may be the commonest otologic diagnosis in HIV patients. As in other organ systems, CD4 counts appear to be of prognostic value in terms of patient outcomes; while the outcome of patients with HIV infection without AIDS may be equivalent to that of HIV negative patients, patients AIDS have poorer outcomes, with a higher mortality (Kohan & Giacchi, 1999).

4.4.9 Ophthalmic surgery

Retinal disease is the commonest ocular complication in HIV positive patients, affecting between 30% and 70% of patients, while ocular surface squamous neoplasia is the commonest ocular tumor in the HIV patient.

4.4.10 Plastic/cosmetic surgery

HIV-associated lipodystrophy seen most commonly in is HIV patients on HAART, afflicting up 53% of HIV patients. It results in abnormal fat redistribution, with lipoatrophy in the face, limbs and buttocks, and lipohypertrophy of the neck, trunk, and breasts. Accumulation of fat in the cervicodorsal region and anterior neck may also interfere with function, resulting in pain, altered posture, limited range of motion, and sleep apnea (Engelhard, 2006). Surgery is the most effective mode of management.

Cancrum oris is a disease that afflicts children, associated with poverty, malnutrition, poor oral hygiene and infectious disease; in adults, it has been associated with debilitating diseases such as HIV/AIDS, diabetes mellitus and hematological disorders. (Nthumba & Carter, 2009). With the advent of HIV/AIDS, noma appears to be on the increase: successful surgical reconstruction with minimal complications has been reported (Chidzonga & Mahomya, 2008). For lipoatrophy, soft tissue replacement can be achieved by structural fat grafting via autotransplantation, dermal-fat grafts, subperiosteal malar implants, semipermanent soft tissue fillers, off-label silicone injection, and even intramuscular gluteal implants (Nelson & Stewart, 2007; Davison et al., 2008).

4.5 Orthopedics

4.5.1 Musculoskeletal infections

Musculoskeletal infections in HIV-infected or AIDS patients may have a wide spectrum of presentation, including osteomyelitis, septic arthritis, septic bursitis and soft tissue infections such as cellulitis abscesses abscess and pyomyositis, amongst others. Tuberculous infections may likewise involve soft tissue or bones/joints (Tehranzadeh et al., 2004).

While it may be expected that HIV infection would lead to an increase in musculoskeletal infections, some studies have indicated that this may not be so (Bahebeck et al., 2004). Further, these authors reported similar outcomes in both HIV negative and HIV positive

patients (with CD4+ counts above 200/µL) when a similar protocol of management was instituted. WHO stages III and IV benefited from ARV therapy, along with appropriate surgical debridement and antibiotic administration.

While cellulitis is easily diagnosed clinically, the full extent of tissue involvement may not be apparent to the clinician, as this may be anywhere from a subcutaneous infection to osteomyelitis. Ultrasonography or a CTScan may be used to assist with this work-up, but in many low income countries, surgical debridement permits the substantive diagnosis, and treatment. Tissue or pus culture and sensitivity, where available is important in directing antibiotic therapy, which may need to be prolonged, depending on the type and depth of infection, as well as the degree of immunosuppression (Tehranzadeh et al., 2004; Bahebeck et al., 2004).

Pyomyositis is characterized by suppuration of skeletal muscle, and may be diagnosed by CTScan, MRI, ultrasound or aspiration of pus from the involved muscle. Prior to the HIV/AIDS pandemic, this was a preserve of tropical regions, hence the term 'tropical myositis' or 'myositis tropicans'.

Most patients with tropical pyomyositis have some history of trauma; *Staphylococcus areus* is the commonest isolate from abscesses or biopsies of patients with pyomyositis, irrespective of geographical region of origin. Most patients with non-tropical pyomyositis are immunosuppressed, with HIV/AIDS, diabetes mellitus and immunosuppressive therapy, amongst other conditions. In HIV epidemic areas, there is a high HIV seropositivity amongst patients with pyomyositis (Tehranzadeh et al., 2004; Ansaloni et al., 19960). HIV infected patients with pyomyositis may not give a history of trauma, and have been shown in some studies to have CD4+ counts less than 150cells/µL; further, HIV infected patients have been shown to have an increased staphylococcus carrier rate, when compared with IV negative populations (Ganesh et al., 1989).

Pyomyositis may present at any of three stages of evolution: early (invasive) stage (fever, induration), suppurative stage (high fever with muscle induration and pus on aspiration), and a late stage (bacteremia, septicemia, shock and metastatic abscesses). Patients presenting in the late stage may die from shock or multi-organ dysfunction/failure (Chauhan et al., 2004; Gambhir et al., 1992). The mortality rate from pyomyositis ranges between 1% and 20% (Biviji et al., 2002).

Broad spectrum intravenous antibiotics should be administered after an adequate incision, drainage and debridement (Chauhan et al., 2004).

4.5.2 Osteomyelitis

Osteomyelitis is associated with a mortality rate of up to 20% in HIV infected patients (Tehranzadeh, et al., 2004). While multiple organisms may be isolated in patients with osteomyelitis, *Staphylococcus aureus,*is the commonest isolate in HIV positive patients, as in the immunocompetent patient. CD4+ counts in patients with osteomyelitis average 250 cells/L. Mycobacterial species and *Bartonella henselae* may cause atypical osteomyelitis in the HIV infected patient (Mycobacterial and bacillary angiomatosis osteomyelitis, respectively); these often occur in the setting of CD4+ counts less than 100 cells/µL.

4.5.3 Tuberculosis

Of the almost two billion tuberculosis infections worldwide, 2% affect the skeletal system; of the skeletal infections, 60% involve the vertebral column (Govender et al., 2001).

4.5.4 Orthopedic implants

Implant surgery can be safely performed in HIV positive patients with closed fractures, regardless of their CD4 counts. The risk of wound sepsis increases significantly with open fractures, and although 7% of patients with external fixators may require removal because of pin-tract infection, recommended over internal fixation because of the higher infection rates when these are used for the stabilization of compound fractures (Harrison et al., 2002; Bahebeck et al., 2009; Norrish et al., 2007).

Brijlall proposed early implant removal after radiological evidence of fracture healing to avoid increased implant sepsis in HIV positive patients (Brijlall, 2008). After a five year follow-up of 14 HIV positive patients with uncemented hip arthroplasties, the same author reported excellent results; there was no infection, prosthetic loosening or dislocation. The author concluded that based on a careful selection of patients: nutritional status, and CD4 counts above 400 cells/μL arthroplasties can have good results in HIV infected patients (Brijlall, 2008). Habermann et al performed 55 total joint replacements in 41 HIV positive patients. These authors found that while functional outcomes of these patients did not that differ from those of HIV negative patients, and total joint replacements appeared safe in hemophiliacs, irrespective of serostatus, intravenous drug users had an increased incidence of infectious complications after total joint replacement. There was no correlation between CD4+ counts and infection (Habermann et al., 2008). The experience with total joint replacements in HIV populations has been generally favorable, (Habermann et al., 2008; Mahoney et al., 2005; Hicks et al., 2001; Mahoney et al., 2005; Hicks et al., 2001), although the experience of some workers has been less than favorable, with most citing high infectious complication rates (Parvizi et al., 2003; Luck Jr, 1994), there is a growing body of evidence that appropriate preoperative screening of patients, availability of HAART, antibiotic cover, and improved technique have seen a gradual improvement in outcomes after joint arthroplasties, with low rates of complications (Yoo et al., 2010). The success in joint replacement must be tempered by the need for correct diagnosis in the face of unusual presentations of disease processes in HIV/AIDS (Agarwal et al., 2005). Failure to recognize osteoarticular tuberculosis as the cause of osteoarthritis, with subsequent placement of a total knee prosthesis in a patient later found to have a multi-drug resistant strain of tuberculosis may have led to the patient's death from disseminated tuberculosis (Marschall et al., 2008).

4.6 Dental and maxilla-facial implants

Dental implants/prosthetics have been used in HIV positive patients. Short term favorable results with dental osteo-intergration implants were equivalent for HIV seropositive and negative patients (Stevenson et al., 2007). Several studies have shown that while mandibular fractures may have higher infection rates in HIV positive patients, midfacial fractures managed with miniplate osteosynthesis have the similar outcomes in HIV positive and HIV negative patients (Martinez-Gimeno et al., 1992; Schmidt et al., 1995; Strietzel et al., 2006).

4.6.1 Malignancy

Patients with HIV/AIDS have a heightened risk for the development of cancer. The duration of HIV infection, age greater than 40 years, and a history of opportunistic infection are the primary risk factors identified for the development of non–AIDS-defining cancers. A complex interplay between variables such as immunosuppression, co-infection with human

oncogenic biologic agents, an advanced age and traditional risk factors are thought lead to the evolution of malignancy in HIV/AIDS patients.

Grulich et al found an increased incidence of cancers that are associated with a known infectious cause; human herpes virus 8 (Kaposi's sarcoma), human papilloma virus-associated cancers (cervical, anal, vulvar/vaginal, penis, oral cavity and tongue), Epstein Barr Virus (Hodgkin's lymphoma, Non-Hodgkin's lymphoma, nasopharyngeal cancer), Hepatitis B and C (liver cancer), and *Helicobacter pylori* associated gastric cancer (Gruhlich et al., 2007).

Kaposi's sarcoma (KS), Non-Hodgkin's lymphoma (NHL) and cervical cancer in the setting of HIV infection are regarded as AIDS-defining malignancies. The incidence of other cancers, such as skin, liver, anal, colonic, renal, and lung cancer as well as Hodgkin's lymphoma is higher in HIV positive patients compared to HIV negative patients. Malignant melanoma, leukemia, multiple myeloma and head and neck cancers have also been reported at a higher incidence amongst HIV patients (Silverberg & Abrahams, 2007; Patel et al., 2008; Chiao et al., 2003; Ruiz, 2009; Honda, 2006). The introduction of ARVs has seen a reduction in the incidence of KS and NHL, but not in cervical cancer; the effect of ARVs on non-AIDS defining malignancies has been more inconclusive, with most data suggesting an increase in incidence (Silverberg & Abrams, 2007; Nguyen et al., 2010; Honda, 2006). Notwithstanding the evidence of declining incidences of AIDS-defining malignancies, these remain a significant burden of disease in certain parts of the world; 82% of malignancies in HIV-infected patients in Latin America and the Caribbean in 2008 were AIDS-defining cancers (Fink et al., 2011).

Lung cancer is the commonest non-AIDS defining malignancy in the West, and generally affects patients of a much younger age than in non-HIV infected population. Lung cancer does not appear to have any relationship to levels of CD4 counts. In HIV-infected patients, lung cancer has a poor prognosis because of presentation at an advanced stage, and a poor response to therapy. Surgical resection has a similar outcome as in non-HIV-infected patients. Other forms of treatment include radiotherapy and chemotherapy (Nguyen et al., 2010; Spano et al., 2004). CD4 counts in both AIDS-defining and non-AIDS-defining malignancies are predictive of mortality. Although mortality rates from both AIDS-defining and non-AIDS-defining malignancies in patients on HAART in high income countries have declined, mortality rates remain higher for patients with non-AIDS-defining cancers. Older age, smoking, active Hepatitis B co-infection and a longer cumulative exposure to combination antiretroviral therapy were other variables predictive of mortality in patients with malignancies (Monforte et al., 2008).

4.6.2 Cutaneous malignancies

Skin cancers are the most common non–AIDS-defining cancers in HIV infected patients. Similar to HIV negative patients, sun exposure is the main cause of cutaneous malignancies in HIV infected patients. The risk of skin cancer correlates with the level of immunosuppression and inversely with CD4+ counts (Lobo et al., 1992; Honda, 2006).

Kaposi's sarcoma is the commonest cutaneous malignancy in HIV infected patients. It may develop in up to 20% of patients at any stage of HIV disease, with multifocal KS evident at CD4+ counts of less than 200 cells/μL. While the HIV pandemic has seen an increase in the number of KS cases reported, an expected substantial increase did not occur, even in HIV pandemic areas such as sub-Saharan Africa (Nthumba et al., 2011). In Asians, AIDS-related lymphoma is the commonest cancer in HIV patients. KS is a rare cancer in Asian HIV/AIDS

patients (Phatak et al., 2010; Zhang et al., 2011). Even within the continent of Africa, there is in Eastern Africa evidence that the prevalence of Kaposi's sarcoma is much lower incidence, than in Western Africa (Nthumba et al., 2011). There is no good explanation for this inter- and intra-racial difference.

Malignant melanoma and squamous cell carcinoma have an aggressive behavior in HIV positive patients. Nguyen et al recommended aggressive excision of squamous cell carcinoma in HIV patients, with histological control (Nguyen et al., 2010).

Basal cell carcinoma and squamous cell carcinoma have a higher incidence amongst HIV/AIDS patients than in the general population (Chiao, 2010).

4.6.3 Ocular tumors

Ocular surface squamous neoplasia (conjuctival squamous cell carcinoma) occurs in up to 10% of HIV positive patients in sub-Saharan Africa, making it the most common ocular tumor. A disease of the elderly in HIV-negative populations, an exponential increase has been noted in young HIV positive patients. Surgical resection may be curative, although a 30% recurrence rate has been reported. Other therapies include adjuvant chemotherapy, radiotherapy and cryotherapy (Nkomazana & Tshitswana, 2008). Aspergilloma of the orbit has been reported following orbital excenteration for ocular surface squamous neoplasia (Naik et al., 2006).

4.6.4 Cancer management in HIV/AIDS

The treatment of cancers in HIV/AIDS patients remains difficult. While HAART has been shown to improved outcomes in some AIDS-defining malignancies, with a noted significant decline in incidence, non-AIDS-defining cancers appear to be on the increase, even in the HAART era. Cancers in the setting of HIV/AIDS tend to present at an advanced stage; therapy with chemotherapeautic agents or radiotherapy presents real challenges because of the baseline immunesuppression in these patients. Some novel chemotherapeautic interventions in the treatment of AIDS-related lymphoma have shown promise, with improved outcomes reported, after combination therapies of HAART and different chemotherapeautic agents. The immune reconstitution inflammatory syndrome (IRIS) following HAART in AIDS-related lymphoma after receiving chemotherapy and antiretroviral therapy is evidence of improved immunity and may also signify better outcomes (Phatak et al., 2010; Weiss et al., 2006).

4.6.5 Chemotherapy/radiation therapy and chemoradiotherapy

Judicious use of radiation protocols has shown complete response of cervical cancer, an AIDS-defining cancer, where patients are able to complete the full course of radiotherapy; such patients achieved the same outcomes as HIV-negative patients under the same regimen. The primary concern in AIDS patients on radiotherapy is the possibility of enhanced radiation toxicity due to inherent radiosensitivity and glutathione deficiency in AIDS patients (Mallik et al., 2010).

Combination chemoradiation has registered significant success in the treatment of anal cancer, especially in the HAART era, with better outcomes for patients with CD4 counts above 200 cells/μL than for those with lower counts. Toxicity from the intense chemoradiotherapy is the primary concern (Mallik et al., 2010; Oehler-Janne et al., 2006). To date, there has been no evidence that chemoradiation besides toxicity, causes progression of

the tumor or AIDS, and ought to therefore be considered as a viable therapy for HIV/AIDS patients, especially those with CD4 counts above 200 cells/μL.
HAART is an integral part of the treatment of Kaposi's sarcoma. The administration of chemotherapeautic agents, immunotherapy and anti-angiogenic agents in patients with widespread KS has shown significant benefit, while local control may be achieved with radiation therapy, intralesional chemotherapy, cryotherapy and photodynamic therapy. Electron beam therapy has been used to achieve symptom control (Mallik et al., 2010).
With the use or HAART, standard doses of chemotherapy of radiotherapy may be administered to HIV/AIDS patients, with acceptable toxicity for the treatment of lymphomas; primary CNS lymphomas have been shown to respond to a combination of counts chemoradiation and steroids. These lesions are associated with very low CD4, (50 cells/μL or less) (Schultz et al., 1996).

4.7 The last frontier surgery in HIV patient care: Organ transplantation

Longevity of HIV-infected patients because of improved healthcare, especially the availability of HAART, leading to a large population of HIV survivors, has led to the development of long term organ complications (end-stage solid organ failure) that have created a demand for their effective management, transplantation. Renal and liver transplantation are the most accepted and performed transplant procedures in HIV-infected patients. Successful experience with transplantation of these organs has led to transplantation of other organs, such as pancreas and lungs.

4.7.1 Renal transplantation

In appropriately selected HIV-infected patients, the outcome of renal transplants is similar to that of HIV negative patients. Renal transplantation in HIV positive patients is thus an accepted practice in most centers in the world, with the effect that HIV infection is slowly gaining recognition as a chronic medical condition, rather than a contraindication to surgical interventions, including transplantation (Stock et al., 2004; Landin et al., 2010; Tan-Tam et al., 2009).
Notable continuing challenges are in the realm of the pharmacologic interactions between immunosuppressive therapy and some anti-retroviral agents, as well as a higher rate of acute rejection of the renal transplants when compared to HIV negative recipients.
Muller et al introduced an entirely new and previously unexplored, though controversial concept when they reported on their experience with four HIV positive patients who had received their kidneys from HIV infected donors (Muller et al., 2010).
Simultaneous pancreas-kidney transplantation in HIV positive diabetic patients has been reported (Genzini et al., 2010; Miro et al., 2010).

4.7.2 Liver transplantation

Like renal transplantation in end-stage renal disease, liver transplantation is currently accepted as therapy for end-stage liver failure in HIV positive patients, including hepatocellular carcinoma (Viberst et al., 2011; Di Benedetto et al., 2010). In a meta-analysis, HBV co-infection was found to result in improved transplant outcomes, while HCV co-infection had no effect (Cooper et al., 2011; Narushima et al., 2004). The outcome of liver transplants in HIV patients is similar to that of those of HIV negative patients (Sugawara et al., 2011).

4.7.3 Lung transplantation

Successful lung transplantation in an HIV patient with cystic fibrosis and end-stage respiratory failure has been reported (Bertani et al., 2009).

4.7.4 Heart transplantation

Dilated cardiomyopathy leading to end-stage cardiac failure is a common complication in HIV/AIDS patients; the only viable option is cardiac transplantation. Because HAART has improved survival of HIV/AIDS patients, with a 90% 10-year survival rate, heart transplantation has become attractive in well controlled HIV patients. Heart transplantation is still in its nascent stages in HIV patients; the total number of cases is less than 15 to date. Uriel et al reported excellent short term results of heart transplants in seven patients; they had a mean CD4 count of 554 cells/μL, undetectable viral loads, and no AIDS-defining illnesses (Uriel et al., 2009; Calabrese et al., 2003; Bisleri et al., 2003; Jahangiri & Haddad, 2007).

5. Conclusions

The HIV/AIDS pandemic continues to present significant challenges in the care of the patient in totality. The use of HAART has led to an increase in the survival of HIV/AIDS patients, turning this previously fatal disease into a chronic illness. As a result, malignancy, chronic illnesses, and other emerging surgical diseases presenting in these patients, have continued to challenge the ingenuity of the surgical fraternity. Implant surgery, oncology and organ transplantation are fields in HIV/AIDS in which significant progress has been made, and continues to evolve.

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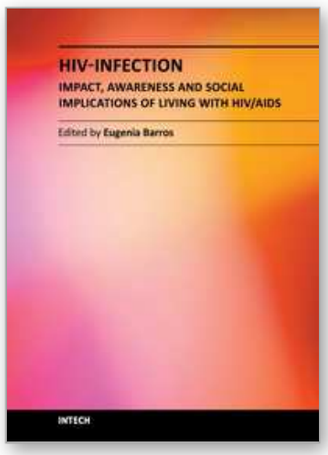
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HIV-infection - Impact, Awareness and Social Implications of living with HIV/AIDS

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The past few decades have seen the escalation of HIV-infections and the 'frantic' search for new drugs to treat the millions of people that live with HIV-AIDS. However because HIV-AIDS cannot be cured, but only controlled with drugs, and the Antiretroviral (ARV) treatment itself results in some undesirable conditions, it is important to generate wider awareness of the plight of people living with this condition. This book attempts to provide information of the initiatives that have been used, successfully or unsuccessfully, to both prevent and combat this 'pandemic' taking into consideration the social, economic, cultural and educational aspects that involve individuals, communities and the countries affected.

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University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

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