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Review

HIV AND SURGERY: AN ISSUE ONLY FOR DEVELOPED COUNTRY? AN OVERVIEW FROM MOZAMBIQUE

Afonso M.T. Fumo[1], Nunzia Garofalo[2], Kajal D. Chhaganlal[1], Francesco Di Gennaro[3], Chiara Boscardin[4], Rita Laforgia[5], Angela De Palma[6], Giovanni Putoto[7], Damiano Pizzol[8]

Summary

The high incidence of HIV, especially in sub-Saharan African countries, and the increase of life expectancy due to effectiveness antiretroviral therapies, have led to an increase of patients undergoing surgery interventions. To date there is still no definitive data on role, outcome and management of HIV positive surgical subjects. This paper reviews the more recent literature about HIV infection, highlighting the main pathologies treated by thoracic, abdominal and orthopedic surgery, without forgetting about other surgery branches. Particular attention was paid to Mozambique, a developing country with one of the highest levels of HIV incidence.

Introduction

The epidemiology of HIV remains one of the main public health problems worldwide. Recent data from the World Health Organization, indicates that close to 36 million people were living with HIV and the most affected were living in the sub-Saharan countries where 1 in 20 adults was affected by HIV [1]. In Mozambique HIV incidence is similar to the other sub-Saharan countries and data from a recent national survey showed an HIV prevalence of 11.5% [2]. The mortality and morbidity of patients with HIV are related to various diseases that affect multiple organs and systems, and may be related to the increased frequency of emergency surgery, postoperative infection rate and an uncertain prognosis depending on the immune status. Thanks to an increase in effectiveness of therapies such as Highly Active Anti-Retroviral Therapy (HAART) and the resulting increase of life expectancy have allowed more and more HIV-positive patients to undergo surgery, and doctors to focus on surgical pathologies

Address of the authors:

[1]*Center for Research in Infectious Diseases, Faculty of Health Sciences, Catholic University of Mozambique; Beira - Mozambique*

[2]*Orthopedics and traumatology department, SS. Annunziata Hospital; Taranto - Italy*

[3] *Department of Clinical Infectious Diseases, University of Bari; Bari-Italy*

[4] *Department of Woman's and Child's Health, University of Padua; Padua - Italy*

[5] *General Surgery Unit "V.Bonomo" University of Bari; Bari-Italy*

[6] *Section of Thoracic Surgery, Department of Emergency and Organ Transplantation, University of Bari "Aldo Moro", Bari, Italy*

[7]*Operational Research Section, Doctors with Africa CUAMM; Padova (PD) – Italy*

[8]*Operational Research Section, Doctors with Africa CUAMM; Beira – Mozambique*

Send correspondence to: *Francesco Di Gennaro, cicciodigennaro@yahoo.it*

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in terms of feasibility and outcome [3]. In fact, although patients with HIV have the same probability of the general population to develop surgical pathologies, due to their immunosuppression status, they are at higher risk of developing other related pathologies such as cytomegalovirus infections, Kaposi's sarcoma, non-Hodgkin's lymphoma and mycobacterial infections, thereby increasing surgery intervention in patients with HIV [4]. In fact, Drapeau and colleagues observed, in HIV positive patients undergoing surgery, a 90% incidence of surgical wound infection, twofold higher compared to the general population [5]. However, surgical intervention may be an option after medical treatment failure in case of complications [6]. Obviously, the outcome of HIV positive patients with surgical conditions is improved by early diagnosis and treatment [7]. To date there is no conclusive data nor definitive guidelines on surgical procedures on HIV patients, and this review describes the state of art of main surgery fields regarding positive subjects. In particular, we focus on thoracic, abdominal and orthopedic surgery, without forgetting other surgery branches, with particular attention to surgical techniques in developing countries.

Thoracic surgery and HIV

Studies about thoracic surgery on HIV positive patients showed on the one hand that they had a higher incidence of postoperative pneumonia, and higher than 12-month mortality rates, and on the other that the initiation of HAART may reduce mortality [8]. Moreover, the interest in organ transplantation in HIV-infected patients has increased, and there has been a steady increase in both the number of transplants and the number of transplant centers serving this population [9]. In this section we performed an analysis of the recent literature dealing with surgery patients positive for HIV.

Cardiovascular system

If in the early years of the HIV epidemic, the principal cardiovascular manifestations were dilated cardiomyopathy, pericardial disease, pulmonary hypertension, and neoplastic involvement of the heart. With HAART we observed a reduction of dilated cardiomyopathy and pericardial disease with an increase number of metabolic abnormalities and cardiovascular disease, including coronary artery disease and acute coronary syndromes, pericardial disease, and dilated cardiomyopathy [10, 11]. Cardiovascular diseases represent a major cause of morbidity and mortality in HIV patients, most of all due to HIV-related cardiomyopathy, which doubles the risk of developing heart failure in comparison to the general population [12]. In addition to hearth failure, many other cardiovascular pathologies can affect, more frequently, HIV positive patients. But the results of surgery, especially in patients following therapy, are not very different from those of the general population. For example, surgical repair of aortic aneurysms not only is feasible but also doesn't lead to remote infectious complications [13]. However, maybe specifically due to the protease inhibitor of HAART, atherosclerosis and thrombosis processes seem to be more frequent and, despite the treatment effectiveness is the same of HIV negative patients, even relapses appear to be greater [14]. Interestingly, although it cannot claim a cause-effect relationship, some authors reported a very uncommon case of biological valve thrombosis in an HIV positive patient [15]. As mentioned above, the outcomes of cardiovascular surgery are not worse in HIV-positive patients, unless we consider patients with an advance disease status [16], and new intervention strategies, such as robotics, are being developed to further improve outcomes and workers' safety [17]. This latter topic is a key point in HIV positive patients. In fact, these patients, thanks to new therapies, reach end-stage heart failure requiring transplantation, however, many centers consider HIV positive status as a contraindication for advanced therapy or transplant [18, 19]. In last years, just hearth transplantation attracted an increased interest and many studies focused on this topic. Recently, in Europe and United States, heart transplantations were per-

formed on selected HIV-infected patients fulfilling strict virology and clinical criteria [20, 21]. Despite the first encouraging results, this topic still leaves many doubts about co-infection and comorbidities, management and treatment [22], and more and larger studies are necessary to clarify these aspects. Of course, all these issues are topical in developed countries, where there is better access to care and improved treatment adherence. In Africa, it is well known that the high number of HIV positive patients is related to a high percentage of associated hearth disease, according to recent studies [23]. Despite this high prevalence of disease requiring surgery intervention, in Africa outcomes after surgery are unknown and the role of HIV or other common infections such as Tuberculosis is still unclear [24].

Respiratory system

People with well-managed HIV now have normal life expectancies and physicians treating these patients are encountering acute and chronic diseases, such as infectious pulmonary complications, chronic obstructive pulmonary disease, lung cancer, pulmonary hypertension, and pulmonary fibrosis. Surgeons are primarily dealing with issues such as pneumothorax, cancer and lung transplant. Pneumothorax in HIV-infected patients is much more frequent than in the general population. Furthermore, in some cases a surgical approach is unavoidable [25]. Videothoracoscopy, that is minimally invasive and considered safe, is a simple and cost-effective technique, and is used as initial therapy [26]. However, for serious problems such as severe pleural infection or bronchopleural fistula, open lung surgery represents the elective intervention [27]. Other acute and emergency diseases more frequent in HIV positive subjects are vanishing lung syndrome and severe obstructive lung disease, which are potentially fatal but preventable conditions [28]. Especially in these patients, it is mandatory to try to prevent emergency care, which means in most cases intubating the patient, due to the particularly high mortality rate following mechanical ventilation in HIV-infected patients [29]. On the other hand, HAART has significantly increased incidence of lung cancer and other non AIDS-cancers in these patients [30]. Despite HIV, patients in good health conditions with lung cancer seem to successfully recover from surgery without complications. The treatment of lung cancer in these patients is not standardized and frequently they remain under-treated, because it entails using conventional criteria, which is used for non-infected patients with lung cancer [31]. Moreover, the increased general wellbeing obtained with HAART in HIV patients, should encourage oncologists to use the standard approach as in non-HIV lung cancer patients to improve prognosis of lung cancer HIV patients [32]. Finally, even if HIV has been considered a contraindication for lung transplantation, with the improvement of management and outcomes, several centers have considered this intervention feasible [33, 34], especially since the approval of organ donations from HIV infected donors to HIV infected recipients [35, 36]. Unfortunately, the available data on this topic is still too little and unique to the developed countries, and further and larger studies are needed to evaluate the feasibility and effectiveness of these interventions.

Others

In addition to the two main chapters described above, not enough data is available about thoracic surgery in HIV positive patients, and these are the main case reports. Spinal cord compressions are reported in different patients due to lymphoma rapid progression or other tumors. In these cases, surgical decompression should be considered and weighed with respect to the patient's general conditions and the prognosis of the lymphoma and or tumor [37, 38]. Moreover, some authors described a unique case of mediastinal pleomorphic sarcoma, that in addition to the rarity of disease and uncommon site of presentation, it was associated with a HIV positive patient [39].

Abdominal surgery and HIV

Abdominal diseases in HIV patients can be increased and worsened due to their immunosuppression status [3]. In fact, appendicitis is often caused by obstruction of the appendicular lumen by a faecolith associated with infections and parasites such as strongyloides and ascaris. Moreover, in positive patients it is also associated with immunodeficiency, resulting in infections such as cytomegalovirus and Kaposi's Sarcoma [3, 5]. Interestingly, Kaposi's Sarcoma may also cause upper and lower gastrointestinal bleeding and represent the first manifestation of HIV [40-42]. In fact, gastrointestinal bleeding is often present in HIV patients, both in advanced stage of HIV/AIDS disease and in initial manifestation of HIV [40]. In these patients the main causes are the opportunistic infections, especially tuberculosis and CMV colitis [41]. However, gastrointestinal bleeding can also occur from drug side effects, and the Rivaroxaban associated with Darunavir/Ritonavir represents a common explanation of watery bloody diarrhea in patients without others risk factors such as Salmonellosis, Shigellosis and Campylobacter jejuni [42]. Regardless of the cause, this evidence suggests an occult blood stool screening as a routine procedure during the follow-up of HIV-positive patients. Another important issue in abdominal surgery is bowel perforation that can be found on the wall of the esophagus, stomach, small intestine, large bowel, rectum, or gallbladder. Cancer, Crohn's disease, diverticulitis, gallbladder disease, peptic ulcer, and ulcerative colitis are common causes of gastrointestinal perforation [43]. Additional causes in HIV patients are the opportunistic diseases such as massive bacterial infections, CMV, lymphomas and Kaposi's Sarcoma [44-46]. In these cases, laparoscopy has been suggested as an elective technique both for exploration and sample collection for histopathological examination [45]. The last condition that leads to abdominal surgery is intestinal obstruction. In the past, tuberculosis was considered the main cause of intestinal obstructions such as obstructed/strangulated hernia, malignancy, adhesions, volvulus and intussusception [47]. Recent and increasing evidence suggested a major role of HIV as risk factor for bowel obstruction [48] and intussusception, which is an important cause of intestinal obstruction, has been reported as consequence of Burkitt lymphoma and Kaposi's sarcoma [49].

Orthopedic surgery and HIV

It is well known that HAART is effective in prolonging life, restoring activity levels, preventing maternal-fetal transmission, reducing infectivity, and generally improving quality of life [50]. However, these drugs are associated with side effects, some of which affect the musculoskeletal system: arthropathies, from inflammatory arthropathy to acute septic arthritis, avascular necrosis, especially of femoral head, although the pathogenesis is not clear, osteopenia-osteoporosis and pathological fractures [51-53]. Fractures are a common injury in developing countries, mostly from road trauma and the population most at risk of HIV – the young mobile adult, is also the group most subject to road trauma. Those providing surgical care to patients with HIV/AIDS should be aware of how outcomes can be influenced, and misperceptions are common. The optimal method of fracture stabilization depends on the time of presentation, severity of soft tissue, other injuries and local resources. Actually, all studies prove that there is no increased risk of wound infection following internal fixation of closed fractures in patients with HIV/AIDS even if the CD4 count was low [54, 55]. Only few studies demonstrate a higher risk for postoperative infections in HIV patients. But all studies agree about risk of infection for open fractures, because the rate of infections in this case is greater in HIV patients [56-57], this risk can be reduced by aggressive debridement, early soft tissue reconstruction, and negative pressure wound therapy where available. Pin track infections in external fixation are more common in HIV patients, but are manageable [58]. Fracture union rates is a questionable topic in the literature, in some studies seem to be lower in patients with HIV/AIDS due to an impaired inflammatory response [59], in others they show that the fracture union rates

are also comparable to those expected in a healthy population [57, 60]. Delayed sepsis of an existing implant has been described, but it is unclear whether this represents reactivation of a latent infection or a recent hematogenous seeding [61, 62]. Patients with HIV/AIDS may be candidates for joint replacement and elective spine surgery, there are good short term functional outcomes and no apparent increase in the risk of early infection [63-66].

Others

The remaining topics about HIV and surgery concern genital anatomic sites. In developed countries was observed a slower wound healing rate in seropositive patients with anorectal disease, but a similar morbidity and mortality among seropositive and seronegative HIV patients [67, 68]. Some authors observed the same outcomes also in low income countries in suggesting that HIV-seropositive patients are benefiting from improved HAART access [69]. Cervical cancer represents the third most common cancer among women worldwide, and considering the high HIV association, greater attention is paid to detect the best treatment for cervical illnesses in terms of effectiveness, safety and affordability [69]. Although there is no final and solid opinion about this topic, the electrosurgical excision procedure seems to be a feasible and safe option for the treatment of cervical intraepithelial neoplasia in HIV positive women, especially in low-resource contexts [70]. From a male point of view, the surgical genital topic mainly regards circumcision. On the one hand, this procedure is considered easy to perform, safe and effective in reducing HIV and others sexual transmitted diseases [71]. On the other hand, circumcision represents a risk factor for higher HIV shading when sexual intercourses resume before wound healing [72]. All these findings suggest greater efforts to optimize both healthcare workers training and patient follow-ups.

Surgery and HIV in Mozambique

Unlike in the past, recent evidence supports the hypothesis that surgical interventions, also in low income countries, are effective also from an economic point of view for their ability to prevent long-term disability [73]. However, this consideration must be contextualized in a setting with high HIV incidence, where many patients still await HAART (or they abandoned it) and without a cost-effective method for staging HIV subjects [74]. To date only a small amount scientific literature is available on surgery performed in HIV positive patients in developing countries, especially in Eastern Africa. In particular, in Mozambique, studies focus mainly on male circumcision and cesarean intervention. Circumcision seems to be an effective method to reduce HIV transmission. However, the authors, unanimously, state that that patients should not increase their sexual risk behaviors and condom use and other behavioral risk reductions remain essential [75, 76]. On the other hand, regrinding gynecology and obstetrics, the authors highlighted especially the risk of HIV vertical transmission and risks for healthcare workers [77, 78]. Finally, a recent study suggests the loop electrosurgical excision procedure in women with cervical diseases, even if the evidence is weak, and many potential drawbacks hinder conclusive statements [79].

Conclusions

This is the first study, to our knowledge, that looks at the main area of surgery in HIV patients in resource-limited settings and specifically in Mozambique. Considering the high incidence of HIV infection, especially in developing countries, and the effectiveness of antiretroviral drugs for increasing life expectancy and operable diseases, it is clear that there is still much to do about this issue. In particular, the evidence in the literature highlights the necessity to train healthcare workers and reduce the risk of accidental HIV transmission, to educate patients and follow them up for an optimal healing and to improve the quality of data collection to carry out effective and well-structured studies.

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References

1. WHO. Global Health Observatory (GHO): HIV/AIDS 2014 Available from: http://www.who.int/gho/hiv/en/
2. Instituto Nacional de Saúde (INS) INdEI, and ICF Macro. National Survey on Prevalence, Behavioral Risks and Information about HIV and AIDS (INSIDA), Calverton, MD, USA. Maputo: INS, INE and ICF Macro 2010 [cited 2014 20/ Sep/2014]. Available from: http://www.measuredhs.com/pubs/pdf/AIS8/AIS8.pdf
3. Weledji EP, Nsagha D, Chichom A, Enoworock G. Gastrointestinal surgery and the acquired immune deficiency syndrome. Annals of medicine and surgery. 2015;4(1):36-40.
4.Saltzman DJ, Williams RA, Gelfand DV, Wilson SE. The surgeon and AIDS: twenty years later. Archives of surgery. 2005;140(10):961-7.
5. Drapeau CM, Pan A, Bellacosa C et al. Surgical site infections in HIV-infected patients: results from an Italian prospective multicenter observational study. Infection. 2009;37(5):455-60.
6. Madansein R, Parida S, Padayatchi N. et al. Surgical treatment of complications of pulmonary tuberculosis, including drug -resistant tuberculosis. International journal of infectious diseases: IJID: official publication of the International Society for Infectious Diseases. 2015;32:61-7.
7. Deneve JL, Shantha JG, Page AJ, Wyrzykowski AD, Rozycki GS, Feliciano DV. CD4 count is predictive of outcome in HIV-positive patients undergoing abdominal operations. American journal of surgery. 2010;200(6):694-9.
8. Nagasaka S, Yazaki H, Ito H et al. Effect of CD4+ T-lymphocyte count on hospital outcome of elective general thoracic surgery patients with human immunodeficiency virus. Gen Thorac Cardiovasc Surg. 2011 Nov;59(11):743-7.
9. Grossi PA. Update in HIV infection in organ transplantation. Curr Opin Organ Transplant. 2012 Dec;17(6):586-93.
10. Mishra RK. Cardiac emergencies in patients with HIV. Emerg Med Clin North Am. 2010 May;28(2):273-82.
11. Boccara F. Acute coronary syndrome in HIV-infected patients. Does it differ from that in the general population? Arch Cardiovasc Dis. 2010 Nov-Dec;103(11-12):567-9.
12. Butt AA, Chang CC, Kuller L et al. Risk of heart failure with human immunodeficiency virus in the absence of prior diagnosis of coronary heart disease. Arch Intern Med. 2011 Apr 25;171(8):737-43.
13. Sadaghianloo N, Goulfier C, Fléron MH, Gaudric J, Koskas F, Chiche L. Surgical repair of descending thoracic and thoracoabdominal aortic aneurysms in patients with human immunodeficiency virus infection: a 10-patient series. Ann Vasc Surg. 2015 May 21.
14. Boccara F, Mary-Krause M, Teiger J et al. Prognosis of Acute Coronary Syndrome in HIV-infected patients (PACS) Investigators. Acute coronary syndrome in human immunodeficiency virus-infected patients: characteristics and 1 year prognosis. Eur Heart J. 2011 Jan;32 (1):41-50.
15. Achouh P, Jemel A, Chaudeurge A, Redheuil A, Zegdi R, Fabiani JN. Aortic biological valve thrombosis in an HIV positive patient. Ann Thorac Surg. 2011 Jun;91(6):e90-1.
16. Robich M, Soltesz E. Cardiovascular surgery outcomes of patients with HIV: New data in the era of combination antiretroviral therapy. J Thorac Cardiovasc Surg. 2015 May;149(5):1461.
17. van Wagenberg FS, Lehr EJ, Rehman A, Bonatti J. Is there a role for robotic totally endoscopic coronary artery bypass in HIV positive patients? Int J Med Robot. 2010 Dec;6(4):465-7.
18. Boignard A, Blanc M, Chavanon O. High-urgency priority heart transplantation in HIV-positive patients on life support: breaking barriers? J Heart Lung Transplant. 2011 Aug;30(8):968-9.
19. Uriel N, Nahumi N, Colombo PC et al. Advanced heart failure in patients infected with human immunodeficiency virus: is there equal access to care? J

Heart Lung Transplant. 2014 Sep;33 (9):924-30.
20. Durante-Mangoni E, Maiello C, Sbreglia C. A European first: successful heart transplant in a human immunodeficiency virus-positive recipient. J Heart Lung Transplant. 2011 Jul;30(7):845.
21. Castel MA, Pérez-Villa F, Miró JM. Heart transplantation in HIV-infected patients: more cases in Europe. J Heart Lung Transplant. 2011 Dec;30(12):1418.
22. Durante-Mangoni E, Maiello C, Limongelli G et al. Management of immunosuppression and antiviral treatment before and after heart transplant for HIV-associated dilated cardiomyopathy. Int J Immunopathol Pharmacol. 2014 Jan-Mar;27(1):113-20.
23. Shaboodien G, Maske C, Wainwright H et al. Prevalence of myocarditis and cardiotropic virus infection in Africans with HIV-associated cardiomyopathy, idiopathic dilated cardiomyopathy and heart transplant recipients: a pilot study: cardiovascular topic. Cardiovasc J Afr. 2013 Jul;24(6):218-23.
24. Mutyaba AK, Balkaran S, Cloete R et al. Constrictive pericarditis requiring pericardiectomy at Groote Schuur Hospital, Cape Town, South Africa: causes and perioperative outcomes in the HIV era (1990-2012). J Thorac Cardiovasc Surg. 2014 Dec;148(6):3058-65.e1.
25.Terzi E, Zarogoulidis K, Kougioumtzi I et al. Human immunodeficiency virus infection and pneumothorax. J Thorac Dis. 2014 Oct;6(Suppl 4):S377-82.
26. Bani-Sadr F, Dominique S, Gueit I, Peillon C, Humbert G. [Clinical and therapeutic aspects of spontaneous pneumothorax in human immunodeficiency virus infection: 9 cases]. Rev Med Interne. 1997;18(8):605-10.
27. Beck JM. Pleural disease in patients with acquired immune deficiency syndrome. Clin Chest Med. 1998 Jun;19 (2):341-9.
28. Tashtoush B, Gonzalez-Ibarra F, Memarpour R, Hadeh A, Smolley L. Vanishing Lung Syndrome in a Patient with HIV Infection and Heavy Marijuana Use. Case Rep Pulmonol. 2014;2014:285208.
29. Pathak V, Rendon IS, Atrash S et al. Comparing outcomes of HIV versus non-HIV patients requiring mechanical ventilation. Clin Med Res. 2012 May;10(2):57-64.
30. Bearz A, Vaccher E, Martellotta F et al. Italian Cooperative Group on AIDS and Tumors. Lung cancer in HIV positive patients: the GICAT experience. Eur Rev Med Pharmacol Sci. 2014;18(4):500-8.
31. Hooker CM, Meguid RA, Hulbert A et al. Human immunodeficiency virus infection as a prognostic factor in surgical patients with non-small cell lung cancer. Ann Thorac Surg. 2012 Feb;93(2):405-12.
32. Fiorica F, Cartei F, Ursino S et al. Safety and feasibility of radiotherapy treatment in elderly non-small-cell lung cancer (NSCLC) patients. Arch Gerontol Geriatr. 2010 Mar-Apr;50(2):185-91.
33. Kern RM, Seethamraju H, Blanc PD et al. The feasibility of lung transplantation in HIV-seropositive patients. Ann Am Thorac Soc. 2014 Jul;11(6):882-9.
34.Bertani A, Grossi P, Vitulo P et al. Successful lung transplantation in an HIV - and HBV-positive patient with cystic fibrosis. Am J Transplant. 2009 Sep;9 (9):2190-6.
35. Muller E, Kahn D, Mendelson M. Renal transplantation between HIV-positive donors and recipients. N Engl J Med 2010; 362: 2336-7.
36. Mgbako O, Glazier A, Blumberg E, Reese PP. Allowing HIV-positive organ donation: ethical, legal and operational considerations. Am J Transplant 2013; 13: 1636-42.
37. Seo JY, Ha KY, Kim MU, Kim YC, Kim YH. Spinal cord compression by B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma and Burkitt lymphoma in a patient seropositive for human immunodeficiency virus: a case report. J Med Case Rep. 2014 Oct 1;8:324.
38. Roopesh Kumar VR, Madhugiri VS, Sasidharan GM, Shankar Ganesh CV, Gundamaneni SK. Multifocal spinal malignant peripheral nerve sheath tumor in an immunocompromised individual: case report and review of literature. Eur Spine J. 2014 May;23 Suppl 2:236-41.
39. Hernandez A, Gill FI, Aventura E, Mason C, Shellito J. Mediastinal pleomorphic sarcoma in an immunodeficient patient: case report and review of the literature.

J La State Med Soc. 2012 Jan-Feb;164 (1):21-5.
40. Ayoola R, Guha A, Daram S. GI bleeding as the initial presentation of HIV/AIDS. Gastrointestinal endoscopy. 2015.
41. Nagahashi M, Aoyagi T, Yamada A, Rashid OM, Adams BJ, Takabe K. Intestinal Co-infection of Tuberculosis and CMV can Cause Massive Lower GI Bleeding in a Patient with HIV. Journal of surgery and science. 2013;1(1):12-5.
42. Lakatos B, Stoeckle M, Elzi L, Battegay M, Marzolini C. Gastrointestinal bleeding associated with rivaroxaban administration in a treated patient infected with human immunodeficiency virus. Swiss medical weekly. 2014;144:w13906.
43. NLM. Gastrointestinal perforation: Causes 2015 [cited 2015 19/Jul/2015]. Available from: http://www.nlm.nih.gov/medlineplus/ency/article/000235.htm
44. Heise W. GI-lymphomas in immunosuppressed patients (organ transplantation; HIV). Best practice & research Clinical gastroenterology. 2010;24(1):57-69.
45. Leone V, Misuri D, Fazio C, Cardini S. [Abdominal tuberculosis: clinical features, diagnosis and role of surgery]. Minerva chirurgica. 2007;62(1):25-31.
46. Ling J, Coron R, Basak P, Jesmajian S. Recurrent lower gastrointestinal bleeding due to primary colonic Kaposi's sarcoma in a patient with AIDS. International journal of STD & AIDS. 2013;24 (11):908-11.
47. Adhikari S, Hossein MZ, Das A, Mitra N, Ray U. Etiology and outcome of acute intestinal obstruction: a review of 367 patients in Eastern India. Saudi journal of gastroenterology : official journal of the Saudi Gastroenterology Association. 2010;16(4):285-7.
48. Willson TD, Podbielski FJ, Lutfi R. An unusual cause of high-grade obstruction in an HIV-positive patient. The American surgeon. 2013;79(2):E71-2.
49. Ramdial PK, Sing Y, Hadley GP, Chotey NA, Mahlakwane MS, Singh B. Paediatric intussusception caused by acquired immunodeficiency syndrome-associated Kaposi sarcoma. Pediatric surgery international. 2010;26(8):783-7.
50. The Joint United Nations Programme on HIV/AIDS (UNAIDS) www.unaids.org/sites/default/files/media_asset/20150714_FS_MDG6_Report_en.pdf
51. Carson JS, Bostrom MPG. HIV-associated osteopenia and osteoporosis. Curr Opin Orthop 2006;17:456–61
52. Panayotakopoulos GD, Day S, Peters BS, Kulasegaram R. Severe osteoporosis and multiple fractures in an AIDS patient treated with short-term steroids for lymphoma: a need for guidelines. Int J STD AIDS 2006;17:567–8.
53. Chokotho L, Harrison WJ, Lubega N, Mkandawire NC. Avascular necrosis of the femoral head in HIV positive patients-an assessment of risk factors and early response to surgical treatment. Malawi Med J. 2013 Jun;25(2):28-32.
54. Bates J, Mkandawire N, Harrison WJ The incidence and consequences of early wound infection after internal fixation for trauma in HIV-positive patients. J Bone Joint Surg Br. 2012 Sep;94(9):1265-70
55. Aird J, Noor S, Lavy C, Rollinson P. The effect of HIV on early wound healing in open fractures treated with internal and external fixation. J Bone Joint SurgBr. 2011;93B:678–83.
56. Harrison WJ. HIV/AIDS in trauma and orthopaedic surgery. J Bone Joint Surg Br. 2005;87B:1178–81.
57.Harrison WJ. Open tibia fractures in HIV positive patients. Malawi Med J. 2009 Dec;21(4):174-5.
58. Norrish AR, Lewis CP, Harrison WJ. Pin-track infection in HIV positive and HIV negative patients with open fractures treated by external fixation. J Bone Joint Surg Br. 2007;89B:790–3.
59. Lavy CBD, Thyoka M, Pitani AD. Clinical features and microbiology of 204 cases of septic arthritis in Malawian children. J Bone Joint Surg Br. 2005;87B:1545–8.
60. Gardner RO, Bates JH, Ng'oma E, Harrison WJ Fracture union following internal fixation in the HIV population. Injury. 2013 Jun;44(6):830-3
61. Graham SM, Bates J, Mkandawire N, Harrison WJ Late implant sepsis after fracture surgery in HIV positive patients. Injury. 2015 Apr;46(4):580-4.
62. Phaff M, Aird J, Rollinson PD Delayed implants sepsis in HIV-positive patients following open fractures treated with or-

thopaedic implants. Injury. 2015 Apr;46 (4):590-4.
63. Graham SM, Lubega N, Mkandawire N, Harrison WJ Total hip replacement in HIV-positive patients. Bone Joint J. 2014 Apr;96-B(4):462-6
64. Anand ER, Scott LA, Harrison WJ Hip and knee replacement in the HIV positive patient. Malawi Med J. 2012 Mar;24 (1):14-6.
65. King JT, Gordon AJ, Perkal MF et al. Disparities in rates of spine surgery for degenerative spine disease between HIV-infected and uninfected veterans. Spine (Phila Pa 1976). 2012 Apr 1;37(7):612-22
66. Yoshihara H, Yoneoka D National trends and in-hospital outcomes in HIV-positive patients undergoing spinal fusion. Spine (Phila Pa 1976). 2014 Sep 15
67. Madiba TE, Muckart DJ, Thomson SR. Human immunodeficiency disease: how should it affect surgical decision making? World J Surg. 2009 May;33(5):899-909.
68. Horberg MA, Hurley LB, Klein DB et al. Surgical outcomes in human immunodeficiency virus-infected patients in the era of highly active antiretroviral therapy. Arch Surg. 2006 Dec;141(12):1238 -45.
69. Haac BE, Charles AG, Matoga M, La-Course SM, Nonsa D, Hosseinipour M. HIV testing and epidemiology in a hospital-based surgical cohort in Malawi. World J Surg. 2013 Sep;37(9):2122-8.
70. Huchko MJ, Woo VG, Liegler T et al. Impact of loop electrosurgical excision procedure for cervical intraepithelial neoplasia on HIV-1 genital shedding: a prospective cohort study. BJOG. 2013 Sep;120(10):1233-9.
71. Tobian AA, Kacker S, Quinn TC. Male circumcision: a globally relevant but under-utilized method for the prevention of HIV and other sexually transmitted infections. Annu Rev Med. 2014;65:293-306.
72.Tobian AA, Kigozi G, Manucci J et al. Rakai Health Sciences Program. HIV shedding from male circumcision wounds in HIV-infected men: a prospective cohort study. PLoS Med. 2015 Apr 28;12 (4):e1001820.
73. Chao TE, Sharma K, Mandigo M et al. Cost-effectiveness of surgery and its policy implications for global health: asystematic review and analysis. Lancet Glob Health. 2014 Jun;2(6):e334-45.
74. Hyle EP, Jani IV, Lehe J et al.The clinical and economic impact of point-of-care CD4 testing in mozambique and other resource-limited settings: a cost-effectiveness analysis. PLoS Med. 2014 Sep 16;11(9):e1001725.
75. Centers for Disease Control and Prevention (CDC). Voluntary medical male circumcision - southern and eastern Africa, 2010-2012. MMWR Morb Mortal Wkly Rep. 2013 Nov 29;62(47):953-7.
76. Njeuhmeli E, Forsythe S, Reed J et al. Voluntary medical male circumcision: modeling the impact and cost of expanding male circumcision for HIV prevention in eastern and southern Africa. PLoS Med. 2011 Nov;8(11):e1001132.
77. Verkuyl DA. Practising obstetrics and gynaecology in areas with a high prevalence of HIV infection. Lancet. 1995 Jul 29;346(8970):293-6.
78. Libombo A, Folgosa E, Bergström S. A case-control study on post-caesarean endometritis-myometritis in Mozambique. Gynecol Obstet Invest. 1995;39(3):180-5.
79. Moon TD, Silva-Matos C, Cordoso A, Baptista AJ, Sidat M, Vermund SH. Implementation of cervical cancer screening using visual inspection with acetic acid in rural Mozambique: successes and challenges using HIV care and treatment programme investments in Zambézia Province. J Int AIDS Soc. 2012 Jun 18;15 (2):17406.