

Review Article

HIV and anaesthesia

Safiya Imtiaz Shaikh* and Paramesh Suresh Kenchannavar

Department of Anaesthesiology, Karnataka Institute of Medical Sciences, Hubli 5800022, India

*Correspondence Info:

Dr. Safiya Imtiaz Shaikh,
Professor and HOD,
Department of Anaesthesiology,
Karnataka Institute of Medical Sciences, Hubli 5800022, India
E-mail: ssafiya11@yahoo.com

Abstract

The pandemic of AIDS (Acquired immune deficiency syndrome) is virtually creating a panic among healthcare workers. Out of 40 million HIV infections 5.2 million are in India¹. Because the advances in treatment of HIV infection increase the patient's survival, anaesthesiologists may care for these patients during their practice. HIV infection is a spectrum of disease varying from asymptomatic to multiple organ involvement. Safe anaesthetic management in HIV-infected patients includes understanding basic knowledge of HIV infection, organ involvement, pharmacology and adverse reactions of antiretroviral agents. There are no specific anaesthetic agents and techniques for HIV-infected patients. General anaesthesia should not be withheld on the grounds of HIV infection alone. Regional anaesthesia is safe but one must consider local infection, bleeding problems and neuropathies. Infection control to prevent transmission of infections to and from HIV-infected patients must be strictly conducted.

Keywords: Vertical dimension of occlusion, Tooth wear, Metal frame work, Interocclusal distance

1. Introduction

The acquired immunodeficiency syndrome (AIDS) was first described in the United States in 1981². HIV infection and AIDS are the major global health problems. The WHO/UNAIDS report (2008) has estimated 40 million people worldwide living with this infection, with 2.7 million new infections acquired³. Approximately 25% of HIV infected patients will require surgery during the time of illness⁴. Hence as anaesthesiologists, the knowledge of HIV and its implications becomes an absolute necessity.

1.1 Epidemiology and general considerations

HIV-1 is a retrovirus and a single stranded RNA virus. After it enters the cell the virus is copied by a reverse transcriptase, which enables the virus to produce double stranded DNA, this double stranded DNA is then integrated into the host's cells. The HIV-2 virus is a similar virus that also produces the AIDS syndrome. HIV-2 is common in western Africa⁵. The virus preferentially infects T helper lymphocytes (CD4 T cells) and progressively destroys them, making the host susceptible to opportunistic infections and malignancies. Several modes of infection exist including sexual intercourse (60-70%), mother to child (during pregnancy, labour, and breast feeding) (20-30%), contaminated blood products and organ donations (3-5%), contaminated needles (2-3%).

1.2 Course of HIV infection

The course of HIV is variable. Following infection with HIV, there is a latent period of about 8-12 weeks during which there may be an intense viraemia. This is followed by seroconversion when the antibodies to HIV appear in serum. There is also a rapid fall in viraemia, suggesting that the immunological response has controlled the infection. At this stage one third individuals experience brief illness lasting about 2 weeks. Symptoms include fever, malaise, arthralgia, rash and lymphadenopathy. Then follows an asymptomatic phase of 10-11 years before AIDS develops⁶.

1.3 Multisystem involvement

HIV disease is an extremely complex medical disorder with extensive systemic effects resulting in multi-organ disease. The neurological, pulmonary, cardiovascular, and hematological changes and abnormalities associated with this disease should be of particular concern to the anaesthesiologist⁷.

The initial neurological involvement begins within days of the initial infection⁸. It can be by direct infection, inflammation, demyelination or a degenerative process. It can also be due to opportunistic infections, neoplasms or immune deficiency. Conditions reported with acute infection include: myelopathy, peripheral neuropathy, brachial neuritis, cauda equina syndrome, and Guillain-Barre syndrome⁹. Also recognized are neurocognitive impairment, encephalopathy, autonomic neuropathy and seizures.

Cardiovascular involvement is multi-factorial and includes chronic viral infection, co-infection, drug therapy and immunosuppression all of which work to affect the heart¹⁰. Important and common cardiovascular complications include dilated cardiomyopathy, pericardial effusion, endocarditis and valvular lesions, acute coronary syndrome, vasculitis and pulmonary hypertension.

Pulmonary complications associated with HIV disease are largely related to infectious agents⁵. Also can be due to side effects of medication and associated malignancies. The complications seen are airway obstruction (by Kaposi sarcoma or infections), bronchitis, sinusitis, pneumonia, pneumonitis, atypical infections (tuberculosis, other mycobacteria and fungal infections).

Hematologic abnormalities occur with acute HIV infection and are in fact a hallmark of the disease. This is seen with the development of HIV -thrombocytopenia as the disease progresses secondary to a number of causes, including retroviral infection of megakaryocytes, or drug induced thrombocytopenia⁵. Bone involvement may lead to pancytopenia. Haematological malignancies and coagulation abnormalities are also common.

Gastrointestinal complications encountered are difficulty in swallowing, increased gastric emptying times, bleeding tendencies on nasogastric tube insertion, diarrhea with electrolyte imbalance, hepatobiliary impairment and pancreatitis.

Renal impairment can be multifactorial which includes HIV associated nephropathy, drug induced nephrotoxicity, hypertension, diabetes.

Endocrine and metabolic system complications include lipodystrophy, metabolic syndrome, and disorders of hypothalamic-pituitary-adrenal axis including Cushing's syndrome and Addison's disease, hypo or hyperthyroidism, lactic acidosis.

1.4 Clinical features with anaesthetic importance

HIV disease is an extremely complex medical disorder with extensive systemic effects resulting in multi-organ disease. The neurological, pulmonary, cardiovascular, and hematological changes and abnormalities associated with this disease should be of particular concern to the anesthesiologist.

In the early stages of HIV infection, headache, photophobia, meningoencephalitis, depression, cranial and peripheral neuropathies have been documented. The late phases may be associated with dementia, encephalopathy, myelopathy, myopathy and peripheral neuropathy. The infectious nature of CSF in HIV must be considered. The incidence of peripheral neuropathy is 35% in early HIV infection which rose to 55% in late stages¹¹. Distal symmetric polyneuropathy, inflammatory demyelinating disease, and progressive polyradiculopathy have been reported. Focal cerebral diseases complicating AIDS like cerebral toxoplasmosis, primary CNS lymphoma, and progressive multifocal leucoencephalopathy may increase intracerebral pressure precluding neuraxial anaesthesia.

AIDS is an increasingly recognized cause of, or strongly linked to cardiomyopathy, pulmonary hypertension, right ventricular dysfunction, myocarditis, pericardial effusion, and coronary artery disease. HAART (Highly active antiretroviral therapy) decreases the incidence of pericardial disease at the cost of increased coronary artery disease due to dyslipidaemia associated with some antiretroviral drugs¹². Cavitory lung disease can be due to pyogenic bacterial lung abscess, pulmonary tuberculosis, fungal infections and Nocardia species. Kaposi's sarcoma and lymphoma can also affect the lung. Haematological manifestations may appear at any stage includes hypercoagulable state and thrombocytopenia. Metabolic disorders like hypertriglyceridaemia, hyperinsulinaemia, lipodystrophy, hyponatraemia, hyperkalaemia have been reported.

2. Treatment

Treatment of HIV infection is multidisciplinary which includes

- Antiretroviral therapy
- Treatment of opportunistic infections
- Avoidance of alcohol and smoking
- Psychological counseling
- Nutritious diet

Antiretroviral drugs in current use fall into three categories: (i) Nucleoside analogue reverse transcriptase inhibitors (NRTI), e.g. Zidovudine – inhibit the synthesis of DNA by reverse transcriptase by acting as false nucleotide. (ii) Non-nucleoside reverse transcriptase inhibitors (NNRTI) e.g. Nevirapine – bind to reverse transcriptase in a way that inhibits enzyme activity, and (iii) protease inhibitors (PIs) e.g. Saquinavir – prevent the processing of viral proteins into functional forms. A typical therapeutic regimen will comprise three agents (i.e. two nucleoside analogues combined with a PI or NNRTI); this has been termed highly active antiretroviral therapy (HAART). The aim of therapy is to achieve an undetectable viral load and to improve both duration and quality of life.

3. Drug interactions

Anaesthetic drugs may interact with ARVs (anti retroviral drugs). Anaesthetic agents may induce pharmacodynamic changes to affect the efficacy and toxicity of ARVs, and pharmacokinetic effect of ARVs can affect the absorption, distribution, metabolism and elimination of anaesthetic drugs.

Pharmacodynamic interactions can be managed by avoiding anaesthetic agents such as halothane or methoxyflurane that causes hepatic or renal dysfunction. Propofol and NRTIs (Nucleoside reverse transcriptase inhibitors) may both potentially promote mitochondrial toxicity and lactic acidosis and it may be wise to avoid propofol infusions in patients receiving ARVs.

Pharmacokinetic interactions are more complicated and are primarily due to liver enzyme induction or inhibition, particularly the CYP450 3A4 enzyme¹³. Protease inhibitors and NNRTIs (Non nucleoside reverse transcriptase inhibitors) are the most commonly implicated group of ARVs in drug interactions. Enzyme induction or inhibition can affect the action of several classes of anaesthetic drugs.

Opioids: The effects of fentanyl may be enhanced by ritonavir, due to liver enzyme inhibition and induction. Enzyme inhibition reduces fentanyl clearance and induction, increases metabolism to active metabolites such as nor-mepiridine

Benzodiazepines: Saquinavir may inhibit midazolam metabolism

Calcium channel blockers: may have enhanced hypotensive effects due to enzyme inhibition

Local anaesthetics such as lignocaine may have increased plasma levels due to enzyme inhibition

Neuromuscular blocker effects may be prolonged

4. Perioperative management of ARVs

Due to increasing problems of drug resistance it is recommended that ARV therapy to be continued throughout the perioperative period if at all possible. Naturally this needs to be compatible with surgery and patients gastrointestinal function. Some ARVs are available in liquid form enabling administration via feeding tube or gastrostomy.

4.1 Blood Transfusion

There is evidence that allogenic blood transfusion in HIV infected patient can lead to transfusion related immunomodulation (TRIM) and can result in increase in viral load. Blood should therefore be transfused where unavoidable to maintain patient safety.

4.2 The child with HIV

More than 80% of HIV infections in children are due to transplacental exposure to maternal HIV during the perinatal period. 13% of HIV infected children are exposed during blood transfusions and 5% from blood products for treatment of coagulation disorders. The disease affects many systems but manifestations differ from adults in several ways.

Pulmonary disease is the leading cause of morbidity and mortality. Lymphoid interstitial pneumonitis, neurological abnormalities including progressive encephalopathy with signs of developmental delay, progressive motor dysfunction, loss of milestones and behavioral changes. Failure to thrive from chronic infectious diarrhea and mucocutaneous candidiasis, lymphadenopathy is common presenting features

4.3 Obstetrics and HIV

With the increasing numbers of HIV- infected women, 80% of whom are of childbearing age; pregnancy in the setting of HIV infection has been a focus of much interest, research and often discrimination. With these facts in mind, it must be recognized that many anesthesiologists are now seeing these patients in their practice, or will be, and must address the questions these patients present with confidence⁵. In order to do this the anesthesiologist must be familiar with both the obstetric and anesthetic management of this unique subset of parturients.

The risk of transmission from HIV infected mother to child is around 25%. zidovudine monotherapy has reduced the incidence to 8%. Current evidence supports the use of Nevirapine given to mother at delivery and the neonate within 72 h of delivery to prevent MTCT. A combination of ART and elective caesarean section has reduced the transmission to 2%¹⁴.

Bremerich et al suggested intrathecal mepivacaine with sufentanyl an appropriate anaesthetic option for LSCS. In the post-operative period, narcotics and drug interactions should be kept in mind. The use of epidural blood patch for post puncture headache is safe.

4.4 HIV and pain

Pain is common in advanced HIV disease and can be very difficult to treat. The etiology of this pain can be multifactorial, including opportunistic infections such as herpes simplex, HIV related arthralgia, peripheral neuropathy and drug related pain. Acetaminophen, codeine, morphine, topical capsaicin, viscous xylocaine, amitriptyline, carbamazepine, mexiletine and prednisolone have been used with variable success.

4.5 HIV and critical care

Acute respiratory failure is the commonest cause of ICU admissions in HIV patients. Pneumocystis is the responsible pathogen in 25-50% cases. Pneumatocele and pneumothorax may manifest. Non invasive ventilation techniques may be associated with less incidence of pneumothorax. Intractable seizures with the cause being either a mass lesion or infection like Cryptococcus may present in ICU. The possibility of nosocomial transmission of HIV highlights the need for anaesthetists to enforce rigorous infection control policies to protect themselves, other health workers and their patients¹⁵. Overall mortality rates for HIV infected patients requiring intensive care have improved from approximately 70% in the early 1980s to 30-40% at present. No evidence exists as yet to support whether or not the initiation of ART may improve outcome in critically ill HIV patients.

4.6 Risk of cross infection

In hospital transmission of HIV may occur in three ways-

1. **Patient to anaesthetist:** HIV can be transmitted through sharp injuries, broken skin with body fluids and splashing of mucosal surface. Deep subcutaneous or intramuscular exposure to a blood contaminated needle from a patient with HIV viraemia appears to be the worst type of contact. The risk of transmission by needle stick injury varies from 0.3-0.03%. 20% of anaesthesiologists had atleast a needle injury in a 3 month period; this implies a cumulative risk of 4.5% in a 30 years anaesthesia career.
2. **Patient to patient:** Reuse of syringes, airway devices, should be condemned. Heat and moisture exchange filters or hydrophobic filters are used effectively to minimize the risk of transmission. Laryngoscopes should be properly sterilized before reuse.
3. **Anaesthetist to patient:** Risk appears to be low. The risk has been estimated as 2.4-24 per million procedures. So adoption of universal precautions is mandatory to decrease the in-hospital transmission.

4.7 Infection control

Health care workers should adopt universal infection control precautions for all patients to protect themselves against blood borne infections as in areas of high HIV prevalence many patients will be asymptomatic. If a health care worker suffers a needle stick injury or is exposed to potentially infected blood or body fluids following steps should be taken.

- Needle stick or contaminated wound - wash the area with copious soapy water or disinfectant.
- Contaminated intact skin - wash with soap and water
- Contaminated eyes – gently rinse eyes while open with saline or water
- Contaminated mouth – spit out any fluid, rinse the mouth with water

If the patient is known to be HIV positive the health care should receive post exposure prophylaxis as soon as possible, ideally within 1-2 hours of exposure.

5. Anaesthetic management plan

A multisystem and multidisciplinary approach is recommended. When faced with the anaesthetic management of a patient with HIV or AIDS the first step is to carefully review the status of the patient's disease and current treatment course. With this in mind it is essential that the patient's treatment begin with a careful history and physical examination, laboratory tests, assessment of organ involvement, drug history and side effects. Important to note is that many patients with high CD4 counts (> 500-700/mm³) are less likely to present unusual concerns as they are generally not treated with antiretrovirals and are less likely to present with opportunistic infections as those with more advanced disease. Contrastingly, in those with more advanced disease (CD4 count <200/mm³) a more extensive laboratory evaluation is warranted⁵.

Investigations should include full blood count, clotting function to exclude coagulation abnormalities, biochemical tests including blood glucose, electrolytes, renal and liver function tests, viral load and CD4 count, chest radiography, electrocardiography and echocardiography.

Importantly, despite theoretical concerns over the possibility of immune suppression with general anesthesia, there has not been any clear link to adverse outcomes¹⁶. ASA class is more important than HIV status in the possibility of perioperative complications. When considering a general anesthetic in this population the presence of underlying pulmonary or cardiac disease is more likely to be of significance. Regional anaesthesia is safe but one must take into consideration the presence of local infections, bleeding problems and neuropathies.

Minimise interruptions in ARV therapy as possible to diminish drug resistance. Consider drug interactions with ARV with use of drugs affected by hepatic enzyme induction or inhibition. Strict aseptic techniques to be exercised as HIV infected patients are immunocompromised.

Anaesthetic plan should be tailored to the individual patient and the type of surgery as appropriate.

6. Conclusion

Numbers of HIV infection are increasing across the globe. With the evolution of HAART, HIV has changed from a fatal condition to a chronic condition. Most patients whom the anaesthetist encounters will be healthy but all warrant thorough assessment to tailor appropriate analgesic and anaesthetic techniques. General anaesthesia is considered safe, but drug interactions and their impact on various organ systems should be considered preoperatively. Regional anaesthesia is often the technique of choice. Yet, one must consider the presence of local infections, neuropathies and coagulation abnormalities.

References

1. Parthasarathy S, Ravishankar M. HIV and anaesthesia. *Indian J Anaesth* 2007; 51:91.
2. Gottlieb MS, Schroff R, Schanker HM et al. Pneumocystis carinii pneumonia and mucosal candidiasis in previously healthy homosexual men: evidence of a new acquired cellular immunodeficiency *N Engl J Med*. 1981 Dec 10; 305(24): 1425-31.
3. Joint WHO/United Nations programme on HIV/AIDS—2004 report on the global AIDS epidemic. www.unaids.org
4. Jeremy Prout, Banwari Agarwal. Anaesthesia and critical care for patients with HIV infection. Continuing Education in Anaesthesia, *Critical Care & Pain* . 2005; 5 (5).
5. S Benton, A Reese. HIV and The Obstetric Patient; Anaesthetic Considerations; *The internet Journal of Anaesthesiology* 2009 Nov 1;(24).
6. R Govind. HIV and Anaesthesia . Medical education in HIV and Anaesthesia, University of Kwazulu-Natal 2009 July; 24.
7. Bradley Hare. Clinical Overview of HIV Disease Laurence Peiperl, Susa Coffey, Oliver Bacon, Paul Voldberding, eds. HIV knowledge base. chapter. 2006.
8. Kahn J Walker B. Acute Human Immunodeficiency Virus Type-1 infection. *N Engl J Med* 1998;389:33-9.
9. Cari A, Cooper D. Primary HIV infection. IN: sande MA Voldberding PA, editors. The medical management of AIDS. 5th edition Philadelphia; WB Saunders:1997.
10. Predergest BD. HIV and cardiovascular medicine *Heart* 2003;89; 793-800.
11. Hurstedt W, Evers S, Reichalt D et al. Screening for HIV associated distal symmetric polyneuropathy in CDC classification 1 2 3 . *Data neurological scandinavica* 2000;101(3):183-87.
12. Bergerson B M. Cardiovascular risk in patients with HIV infection. Impact of antiretroviral therapy *Drugs* 2006;66(15).
13. Kharasch E D, Mitchell D, Colles R, Blanco R. Rapid clinical induction of hepatic cytochrome p450 2B6 activity of ritonavir. *Antimicrobial agents and chemotherapy* 2008;52; 1663-9.
14. Kuczokowski K M. Human Immunodeficiency Virus in the parturient. *J clin Anaesth* 2003 May 15; (3):224-33.
15. Avidan, M S, Jones N, and Poznaik, A. L The implications of HIV for the Anaesthetist and The Intensivist *Anaesthesia* 2000;55:344-354.
16. Hughes SC, Dailey P A, Human immunodeficiency virus in the delivery suite, Hughes SC, Levinson G, Rosen M A, Schnider and Levinson Anaesthesia for obstetrics 4th edition , Philadelphia; Lipincot, Williams and Wilkins 2002;583-95.