SURGICALLY ACQUIRED DISEASES

Jay Phillips, D.P.M.
Dennis Martin, D.P.M.

Acquisition of blood-borne communicable diseases is of concern to all health care personnel. Due to the invasive nature of the surgical procedures, the surgeon is at increased risk of contacting infected body fluids. There are two basic means by which blood can come in contact with the surgeon and potentially transfer infectivity: 1) parenterally, and 2) mucous membrane exposure.

Parenteral exposure includes any action that would allow infected blood to directly enter the surgeon's circulatory system. Examples include accidental needle stick injuries, scalpel or other sharp instrument puncture wounds, and handling of contaminated fluids without proper precautions. This last example would include handling of bloodstained dressings during the postoperative period.

With the widespread use of power instrumentation in performing osseous procedures, the additional risk of exposing the mucous membrane of the eye to infected fluids is ever present. This might occur as droplets and bone chips are generated from the wound as the instrument penetrates and oscillates through the tissues.

Virtually any organism that is blood-borne is capable of being transferred from patient to surgeon during the perioperative period. A list of the most common organisms is given in Table 1.

Table 1

A. Hepatitis B virus
B. AIDS virus
C. Syphillis
D. Cytomegalovirus
E. Gonococcus

From this list, the two most feared and devastating if acquired are the HTLV-III virus and the hepatitis B virus. These two subjects are given extensive consideration in the sections following this introduction.

Since the most thorough history and physical examination cannot reliably identify all patients infected with blood-borne pathogens, blood and body fluid precautions should be consistently used for all patients. The Center for Disease Control has just recently published a list of universal precautions that should be used in the care of all patients (1).

1. Use appropriate barrier precautions to prevent skin and mucous membrane exposure when contact with blood or other body fluids of any patient is expected. This includes use of gloves when touching blood or body fluids, mucous membranes, or non-intact skin of all patients. Gloves should be changed after contact with each patient. Protective eyewear or face shields should be worn during procedures that are likely to generate droplets of blood to prevent exposure to the eyes.
2. Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood. Hands should be washed immediately after gloves are removed.
3. Take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices used during surgery. To prevent needle-stick injuries, needles should not be recapped, purposely bent, or broken by hand, removed from disposable syringes, or otherwise manipulated by hand.
4. Mouthpieces, resuscitation bags, or other ventilation devices should be available for use in areas in which the need for resuscitation is predictable.
5. Health care workers who have open or exudative lesions should refrain from all direct patient care until the condition resolves.
6. Pregnant health care workers should be especially familiar with and strictly adhere to precautions to minimize the risk of HTLV-III transmission.

Specific precautions that should be adhered to for patients having or suspected of having hepatitis B or AIDS will be discussed in their respective sections that follow.

AIDS: The Risk of Transmission During Surgery

Due to the rapid spread through so called high risk populations and deadly sequelae that result from infectivity, the acquired immunodeficiency syndrome (AIDS) has created fear and anxiety among surgeons and other health care personnel. Most of the concern and confusion is a result of ill-informed publicity relating to the facts and legitimate risks of the disease. However, with a working knowledge of the disease, a thorough preoperative evaluation, and proper perioperative precautions, the surgeon can take a more confident attitude toward treating the patient with AIDS or AIDS Related Complex (ARC).

The causative agent of AIDS is named Human T-cell Lymphotrophic Virus Type III or HTLV-III. The HTLV-III virus is one of the retroviruses, a particular group of RNA viruses, that has a propensity to infect T-cell and in particular the T_4 subset (helper-inducer). The virus replicates rapidly within the T-cell, causing pathological changes and eventual destruction of the cell. It is this depletion of helper T-cells that is responsible for a majority of the clinical symptomatology associated with the AIDS patient. There is a resultant lymphopenia as well as an abnormal T_4/T_8 (helper/suppressor) ratio. The normal T_4/T_8 ratio is approximately 2:1. However, in the AIDS patient the ratio is depressed or reversed ranging from 0.4/1 to 1/1 (2). Secondary to these selective T_4 defects, functional abnormalities then occur in both the T-cell and B-cell components of the host immune system.

These secondary defects include:

decreased delayed type hypersensitivity,
inappropriate serologic response following immunization,
decreased monocyte and macrophage chemotaxis,
decreased natural killer cell activity,
spontaneous polyclonal activation of immunoglobulin with increased I_gG and I_gA, and an increased number of circulating immune complexes that adhere to and remove platelets from the circulation.

This extensive immune embarrassment ultimately results in a high susceptibility to a variety of opportunistic infections and malignancies. Examples include pneumocystitis carini pneumonia, toxoplasma gondi encephalitis, cryptosporidium enteritis, disseminated cytomegalovirus, mycobacterium avium intracellulare complex, and Kaposi's sarcoma. The HTLV-III virus has been identified and recovered from feces, urine, vaginal secretions, semen, tears, saliva, and blood. Only blood, vaginal secretions, and semen have been implicated in transmission from person to person (1).

Though the virus can potentially infect anyone coming in contact with contaminated fluids, there are certain high risk groups that account for the large majority of the cases. These groups include male homosexuals (approximately 74% of all cases), IV drug abusers (particularly those sharing needles- approximately 17%), hemophiliacs and other transfusion recipients, Haitian immigrants, bisexuals, prostitutes, and children of infected mothers (3-5). Once infected, antibody formation to the virus usually begins between 2 to 12 weeks of incubation at which time it can be detected in the serum. Seropositivity, however, is not a direct correlate to clinical symptomatology which does not occur until 2 to 5 years after infection.

Between 13% and 34% of antibody positive patients followed up to six years have developed AIDS, and another 25% to 40% have developed AIDS related disorders. Of the remaining percentage of seropositive patients, some may remain asymptomatic while others will go on to develop AIDS or related disorders (6). Regardless of whether clinical symptomatology is present or not those patients testing positive for HTLV antibodies must be considered infectious and capable of transmitting the virus.

As mentioned earlier surgeons have legitimate concern about the risk of transmission during the perioperative period due to the invasive nature of surgery. From the preoperative injection to the final dressing change, the surgeon can be exposed to the patient's blood and any blood borne agents carried with it. Several extensive studies have been performed attempting to identify the risk involved to healthcare workers who have had accidental exposures to fluids from AIDS patients.

In December of 1986 the CDC in Atlanta published a report that summarized national surveillance data concerning cases of AIDS in health care workers. Through May 1, 1986, out of 16,748 adults reporting with AIDS, 922 or 5.5% were employed in healthcare or laboratory settings. The data was reviewed with the intention to answer three main questions: 1) how many cases of aids have been identified in health care workers? 2) how many of these workers have recognized risk factors for AIDS? 3) for those workers in whom no risk factors can be identified, can any occupational exposures be implicated as the source of HTLV infection? The reported results were very favorable. Out of the 922 reported patients, 95% belonged to one of the recognized high risk groups for AIDS. Of the remaining 88 patients with no identifiable risk, 54 were reclassified after obtaining further information. Only five of the 34 patients left in the study could report a history of parenteral or mucous membrane exposure to blood during employment since 1978, and in no case was there exposure from an HIV infected person. Seroconversion for HIV antibody was not identified in any of these workers after the reported exposures (7). There have been numerous other comprehensive studies that reported similar results dealing with the risks of HTLV-III transmission to health care workers (8-11).

Though the likelihood of transmission during accidental exposure appears to be low, the devastating results of infectivity demand strict perioperative precautions. This begins in the preoperative period with a thorough history and physical examination. Considering the fact that at any one time a majority of individuals infected with the virus are asymptomatic and are unaware of it, a well delivered question and answer session may be the surgeons best tool for identifying high risk patients. Realizing that many people may be afraid to face the possibility of AIDS or are concerned about confidentiality, indirect inquiry about the early signs and symptoms of infection may ease the patient into this delicate topic and produce a more reliable history.

Early signs and symptoms may include fatigue, night sweats, intermittent fevers, bouts of diarrhea, weight loss, inability to concentrate, and a feeling of disorientation. Once the ice is broken, questions regarding high risk behavior may be more honestly answered. Examples include a past history of sexually transmitted diseases, intravenous drug abuse, Hepatitis B infection, blood transfusions, or homosexual relationships.

When performing the physical part of the exam special attention should be given to skin, lymph nodes, and mucous membranes. A variety of lesions including oral condidiasis (thrush), hairy leukoplakia of the tongue, molluscum contagiosum, bullous impetigo, scars in the anticubital fossa, if found on examination should alert the physician to potential HTLV-III infection. Hairy leukoplakia which are corrugated white plaques adhered to the lateral margins of the tongue is said to be virtually diagnostic for AIDS (12). In August, 1987, the CDC published their revision of the case definition for Acquired Immunodeficiency Syndrome. This is an extensive breakdown of what constitutes an AIDS patient based on the presence of certain indicator diseases and the status of laboratory evidence of HTLV-III infection. You are referred to this report for a more detailed presentation of the AIDS patient (13).

After the history and physical examination, one should have a good idea of whether or not the patient is or has potential to be infected. Further information may be obtained through routine preoperative blood work. Nonspecific signs of a malfunctioning immune system may include a WBC less than 3,000/mm^3 with an ESR greater than 20 mm/hr. More specific tests for AIDS, not routinely ordered, include measuring T-cell subsets and performing HTLV antibody tests. An absolute T_4 cell count of less than 300/mm^3 and a T-cell helper/suppressor ration (T_4/T_8) below one are suggestive of HTLV-III induced immune deficiency (13).

The initial screening test for HTLV antibody is an enzyme linked immunosorbent assay (ELISA). Patients exposed to AIDS will usually develop detectable levels of antibody against the virus within 6-12 weeks (14). The sensitivity of the currently licensed ELISA test is approximately 99% which makes the probability of false negative results remote. The specificity of the test can also reach 99% or greater if repeat testing of initially reactive specimens is repeated. Supplemental tests, specifically the Western Blot test, are used to validate repeatedly reactive ELISA results. This test uses electrophoresis to identify specific antibodies to the HTLV antigens. This test is more expensive than ELISA and is not used as an initial screening test.

Prior to testing, the patient should be informed that the test is being performed, that the results will be kept confidential to the extent permitted by law, and that appropriate counseling will be offered if testing turns out to be positive. Regulations regarding the reporting of positive results vary from state to state and are in constant flux. Unless the patient exhibits signs of immunosuppression or gives a suspicious history, it is not necessary to perform HTLV antibody tests prior to surgery. It is also not necessary for surgeons and other health care personnel to have routine serologic testing performed, since the risk of transmission in this setting is low.

Intraoperatively, the surgeon and assistants should strictly adhere to the general set of guidelines mentioned in the introduction. There are two other recommendations set by the CDC that deserve reinforcement when performing invasive procedures: 1) no health care worker who has exudative lesions or weeping dermatitis should perform or assist in invasive procedures. 2) all those who perform or assist in operative procedures must be educated regarding the epidemiology, modes of transmission, and prevention of HTLV-III infection and the need for routine use of appropriate barrier precautions (15).

If a member of the operative team has a parenteral or mucous membrane exposure to blood (splash to the eye or mouth), the source patient should be assessed clinically and epidemiologically to determine likelihood of AIDS. If assessment suggests the possibility of infection, the patient should be informed of the incident and requested to give consent to serologic testing for evidence of HTLV-III infection. If the source patient tests positive for AIDS or refuses to consent to testing, the victim should be evaluated clinically and serologically for evidence of HTLV infection as soon as possible. If the worker is seronegative, he/she should be retested after six weeks, and on a periodic basis thereafter (i.e. 3, 6, and 12 months following exposure) (16). In contrast to Hepatitis, there is no vaccine yet available for the prophylaxis of AIDS.

Summary

When considering the low risk of transmission, the patient having or suspected of having AIDS or AIDS related conditions can be approached in a more confident manner by the surgeon. However, due to the devastating results of infectivity strict perioperative precautions should be adhered to by all health care personnel involved with the patient.

Hepatitis

Contrary to AIDS, the contraction of viral hepatitis intraoperatively is a documented complication. The disease can affect the surgeon's health and career as well.

The acute form of hepatitis is generally a self-limiting uncomplicated disease and is many times asymptomatic. A sudden onset of nausea, vomiting, anorexia, malaise, and a low grade fever constitute the symptomatic prodromal

phase of the disease. A distaste for cigarettes, various arthralgias, and urticarial eruptions are also prevalent during this phase. An icteric phase begins three to ten days later. There is an appearance of dark colored urine and clay colored stools followed by a systemic jaundice. The jaundice remains for one to four weeks. However, the constitutional symptoms prevalent in the prodromal phase diminish and the patient's condition improves.

Hepatitis is considered chronic if the patient is symptomatic for a six month period. There are various types of chronic hepatitis which vary according to the severity. Chronic hepatitis in general often leads to cirrhosis, liver cancer, and extrahepatic syndromes such as poly arteritis nodosa, glomerulonephitis, "essential" mixed cryoglobulinemia, polymyalgia rheumatica, and Gianotti crosti syndrome. A relatively low number of deaths in the United States are associated with viral hepatitis, approximately 2500 per year (17).

Traditionally the common infectious agents for hepatitis were the hepatitis A virus (HAV) and the hepatitis B virus (HBV). A third virus known as Non A Non B hepatitis virus has been suspected for many years yet the viral components have not been isolated. The patient has a similar clinical course to that of HBV. Recently a fourth virus has been documented known as the Delta virus. This virus is usually associated with a hepatitis B viral infection and tends to increase the morbidity of the patient. It is thought to have been part of the Non A Non B hepatitis group.

Hepatitis A virus causes an "infectious" hepatitis. It is highly contagious and is present primarily in children. The virus is transmitted through the fecal-oral route and has a short incubation period, 2 weeks to 2 months. The virus is rarely transmitted parenterally. There is usually a very short period of viremia which markedly decreases the likelihood of parenteral transfer. Therefore the contraction of HAV during a surgical procedure is not a significant threat.

Hepatitis B virus causes a "serum" hepatitis. In contrast to HAV there is an extended period of viremia. The virus is primarily transmitted by the parenteral route. It is rarely transferred via the fecal oral route.

The hepatitis B virus is the most common hepatitis virus transferral parenterally and poses the greatest threat to medical personnel. There have been a number of reports documenting the prevalence of HBV in hospital settings (18). Medical personnel having direct exposure to blood or other body secretions have a high risk of exposure to the virus. A nationwide study in 1978 reported that 28% of surgeons in the American Medical Association have a marker (antigen or antibody) for HBV in their blood stream (19). It is important to note that this study was performed before hepatitis vaccines were available. Direct innoculation with a contaminated needle or surgical instrument is a common cause. However, any improper handling of blood or blood products can result in the transfer of the virus.

There is an increased vulnerability to acquiring the hepatitis B virus due to the long period of incubation and to the frequency of asymptomatic carriers of the diseases. There are three antigen-antibody systems associated with the HBV which help to identify infection and the infectivity state of the HBV. The hepatitis B surface antigen (HBsAg) is present on the viral coating and is the first antigen identifying an HBV infection. The antigen can usually be identified one to six weeks before the onset of clinical symptoms. The antibody for HBsAg (anti-HBsAg) is usually identified several weeks to months later and is generally present for life.

The hepatitis B Core Antigen (HBcAg) is located on the inner core of the virus. It is usually not present in the serum. The antibody associated with HBcAg (anti-HBcAg) is present in the serum shortly before the clinical symptoms are elicited. The antibody titer gradually diminishes throughout the clinical course of the disease. The antibody is also prevalent in the serum of the chronic hepatitis carrier.

The hepatitis B envelope (HBeAg) antigen is located outside the viral core and is a serum marker for increased infectivity of the virus. HBeAg positive patients have a prevalence to develop the chronic form of the disease. Identification of the antibody for HBeAg (anti-HBeAg) in the serum indicates a lesser degree of infectivity and the disease is generally self limiting.

The Non A Non B virus does not seem to pose a significant problem intraoperatively. The principal mode of transfer is parenteral, yet there is still a great deal unknown about this viral group. It has been transferred primarily by transfusions. The virus can cause a chronic form of hepatitis including a chronic carrier state. Theoretically the virus can be transferred intraoperatively. However, this has not been significantly documented.

Hepatitis B Virus: The Risk to the Surgical Practice

The transfer of HBV poses the greatest threat intraoperatively and thus should be of principal concern. We have briefly discussed the clinical symptoms and the possible sequela of hepatitis which all are at risk of acquiring. However, at a potentially greater risk are those engaged in surgical practice. Becoming a chronic hepatitis B carrier can essentially undermine a surgeon's practice. Six to ten percent of those who acquire HBV become a chronic carrier of HBsAg. An HBV carrier is defined as a person who is serum positive for HBsAg on at least two separate occasions six months apart (17). A person who is serum positive for HBsAg is potentially infectious. A person who was asymptomatic to HBV and becomes a carrier would essentially be unaware of his/her infectious state. A surgeon who is a chronic carrier of HBV is potentially infectious to all patients. Several surgeons in various specialities have lost their surgical practices after becoming chronic carriers of the virus. This has

been well documented in the dental, obstetric/gynecological, and cardiac surgical professions (20-23).

Certain precautions against doctor to patient transfer of the virus must legally be taken by the surgeon who is a chronic carrier. Double gloving on all surgical cases and avoiding inadvertent self injury from surgical instruments must be practiced. All patients must sign a consent to surgery stating the recognition of risk of contracting HBV from the surgeon and the sequela involved. An ongoing surveillance of postoperative patients must be instituted to identify further hepatitis B transmission (21). Most surgeons who are chronic HBV carriers are financially forced to reduce their surgical practice to minor procedures or eliminate the practice altogether. It is thus essential that the chances for intraoperative transfer of the hepatitis B virus be reduced.

Prevention of Intraoperative Transfer of Hepatitis B Virus

Clinical and laboratory evaluation, general surgical precautions, and appropriate HBV prophylaxis are critical in preventing intraoperative transfer of the virus.

Clinical evaluation including a patient history is the first step in identifying a possible HBV risk. Homosexuals, IV drug abusers, post-transfusion patients, and patients with a previous history of HBV infection have the greatest chance of carrying the HBsAg. Patients who have an Asian or East African background are at risk because the HBV is highly endemic in those areas. In addition precautions should be made for patients with early clinical symptoms of hepatitis B. The clinical symptoms have been previously mentioned.

Laboratory evaluation should be performed on any patient who has a potential risk of HBV infectivity. Routine liver studies show an increase in certain liver enzymes. Aspartate transferase (AST or SGOT) and alanine transferase (ALT or SGPT) peak early in the prodromal phase. However there is no correlation between the degree of the rise of these enzymes and the severity of the disease. There is a mild lymphopenia and neutrapenia and an increase in atypical lymphocytes. The atypical lymphocytes are indistinguishable from those associated with infectious mononucleosis. An increase in the prothrombin time indicates severe hepatic necrosis.

A serological hepatitis profile should be performed on high risk patients. The profile can give a definitive diagnosis of an acute or chronic carrier of the HBV. Depending on the lab, the hepatitis profile includes tests for the three antigen-antibody systems previously mentioned. The most diagnostic test for HBV is for the HBsAg. A negative test however does not exclude a hepatitis B infection. A low titer of HBsAg can occasionally be undetected. Anti-HBcAg is the most sensitive of the serological tests and indicates definitive infectivity of HBV. The antibody however is not serologically evident until the clinical symptoms have been manifested. A positive test for HBeAg indicates a highly infectious stage of HBV.

After identification of either a high risk patient or a patient who is a chronic carrier of HBV general surgical precautions should be emphasized. Please refer to the precautions outlined in the beginning of this paper.

Intraoperative exposure to the hepatitis B virus, such as an inadvertent needle stick, must be addressed as soon as possible or within seven days for appropriate steps to be effective. A combination of passive and active immunization is recommended hepatitis B immunoglobulin (HBIG) will give a passive immunity to HBV. The immunoglobin is pooled from individuals who have high titers of the antibody to HBsAg. HBIG is injected intramuscularly and although the half life of the immunoglobulin is twenty-five days, titers are detectable for up to three months. Post exposure prophylaxis usually consists of two injections one month apart.

Heptavax-B and Recombovax-HV are vaccines which stimulate active immunity to HBV. The vaccines are indicated for those who are at a high risk of acquiring HBV (i.e. surgeons) and for those in need of post-exposure prophylaxis.

Heptavax is a suspension of inactivated HBsAg particles taken from the serum of a largely homosexual population. As was previously mentioned, the homosexual population has a high propensity for hepatitis B markers in their serum. The antigens are inactivated by a biochemical and a biophysical process which has shown to inactivate all known viruses. The Heptavox vaccine is given in a three dose regimen. All doses include twenty microliters of the HBsAg particles. The initial dose is given followed by a second dose one month later and a third dose six months after the first. The protection from the vaccine lasts approximately five years and 85-95% or the recipients seroconvert. A booster injection is recommended after five years. Since the vaccine has been prepared from a largely homosexual pool of donors there is a fear that the AIDS virus could be transferred through HBV vaccination. In the five years that Heptavox has been marketed this has yet to be reported (24, 25). The Recombovax vaccine has been produced in the wake of this fear. Recombovax is a genetically engineered vaccine. The HBsAg is produced by baker's yeast (Saccharmyces Cervisae). The vaccine has been marketed for a year and a half and has a 90% seroconversion rate. The same three dose regimen is recommended. The protection from the Recombovax vaccine should last as long as that of the Heptavax vaccine. There is no difference in the price of Heptavax and Recombovax. It is recommended that all three doses be given with the same vaccine. Studies have not yet been completed using a combination of the vaccines.

Summary

There is a significant risk of acquiring the hepatitis B virus

intraoperatively. Clinical and laboratory evaluation, general surgical precautions, and HBV prophylactic measures should be implemented to protect the surgeons health and surgical practice.

References

1. Centers for Disease Control: Recommendations for prevention of HIV transmission in health-care settings. *JAMA* 258:1293, 199-1300, 1305, 1987.
2. Allen JR: Epidemiology of the acquired immune deficiency syndrome (AIDS) in the United States. *Semin Oncol* 11:4, 1984.
3. Scott GB, Fischi MA, Klimas N, et al: Mothers of infants with acquired immunodeficiency syndrome. *JAMA* 253;363, 1985.
4. Weiss A, Hollander H, Stobo J: Acquired immunodeficiency syndrome: epidemiology, virology, and immunology. *Annu Rev Med* 36:545, 1985.
5. Feorine PM, Jaffe HW, Palmer E, et al: Transfusion associated acquired immunodeficiency syndrome. *New Engl J Med* 312:1293, 1985.
6. Geddes AM: Hepatitis B and HTLV-3 infection in injured patients. *Injury: British Journal Accident Surgery* 17:293-294, 1986.
7. Lifson AR, Castro KG, McCray E, Jaffe HW: National surveillance of AIDS in health care workers. *JAMA* 256:3231-3234, 1986.
8. Gerberding JL, Bryant-LeBlanc CE, Nelson K, Moss AR, Osmond D, Chambers HF, Carlson JR, Drew WL, Levy JA, Sande MA: Risk of transmitting the human immunodeficiency virus, cytomegalovirus, and hepatitis B virus to health care workers exposed to patients with AIDS and AIDS-related conditions. *J Infect Dis* 156:1-8, 1987.
9. Weiss SH, Saxinger WC, Rechtman O, Grieco MH, Nadler J, Homman S, Ginzburg HM, Groopman JE, Goedert JJ, Markham PD, Gallo RC, Blattner WA: HTLV-III infection among health care workers. Association with needlestick injuries. *JAMA* 254:2089-2093, 1985.
10. Hirsch MS, Wormser GP, Schooley RT, Ho DD, Felsenstein D, Hopkins CC, Joline C, Duncanson F, Sarngadharan MG, Saxinger C, Gallo RC: Risk of nosocomial infection with human T-cell lymphotropic virus-III (HTLV-III). *New Engl J Med* 312:1-4, 1985.
11. Henderson DK, Saah AJ, Zak BJ, Laslow RA, Lane CH, Folks T, Blackwelder WC, Schmitt J, LaCamera DJ, Masur H, Fauci AS: Risk of nosocomial infection with human T-cell lymphotropic Virus Type III/lymphadenopathy-associated virus in a large cohort of intensively exposed health care workers. *Annals Int Med* 104:644-647, 1986.
12. Conant MA, Friedland GH, Jaffe HW: Confronting AIDS in primary care. *Patient Care* 21:18-38, June 1987.
13. Center for Disease Control: Revision of the CDC surveillance case definition for acquired immunodeficiency syndrome. *Morbidity Mortality Weekly Report* 36:1-15, 1987.
14. Center for Disease Control: Public service guidelines for counseling and antibody testing to prevent HIV infection and AIDS. *Morbidity Mortality Weekly Report* 36:509-514, 1987.
15. Center for Disease Control: REcommendations for preventing transmission of infection with HTLV-III/LAV during invasive procedures. *Morbidity Mortality Weekly Report* 35:221-222, 1986.
16. Center for Disease Control: Summary: recommendations for preventing transmission of infection with human T-Lymphotrophic virus Type III/Lymphodenopathy-associated virus in the work place. *Morbidity Mortality Weekly Report* 34:681, 1985.
17. Department of Health and Human Services, Center of Disease Control: Inactivated hepatitis B vaccine: recommendation of the immunization practices advisory committee. *Annals Internal Medicine* 97:379-383, 1984.
18. Partelick E, Steere A, Lewis H, Millder D: Hepatitis B infection in hospital personnel during an eight-year period. Policies for screening and pregnancy in high risk areas. *Am J Med* 70:924-927, 1981.
19. Denes A, Smith J, Maynard J, Doto I, Berquist K, Finkel A: Hepatitis B infection in physicians: results of a nationwide seroepidemic survey. *JAMA* 239:210-212, 1978.
20. Rimland D, Parkin W, Miller G, Schrack WD: Hepatitis B outbreak traced to an oral surgeon. *New Engl J Med* 296:953-958, 1977.
21. Lettau L, Smith D, Williams D, Cruz F, Sikes K, Hadler S: Transmission of hepatitis B with resultant restriction of surgical practice. *JAMA* 255:934-937, 1986.
22. Coritinko R: Hepatitis B from doctors. *Lancet* 1:346-346, 1982.
23. Center for Disease Control: Hepatitis B among dental patient-Indiana. *Morbidity Mortality Weekly Report* 34:73-74, 1985.
24. Dienstag J: Absence of antibodies to HTLV-III in health workers after hepatitis B vaccination. *JAMA* 254:1064-1066, 1985.
25. Sachs H: Should the risk of acquired immunodeficiency syndrome deter hepatitis B vaccination?:A decision analysis. *JAMA* 252:3375-3377, 1984.

Additional References

Berkow R (ed): *The Merck Manual of Diagnosis and Therapy*, 14th edition. Merck Sharp and Dohme Research Laboratories, Rahway, NJ, 1982, pp 837-843.

Center for Disease Control: Safety of therapeutic immune globulin preparation with respect to transmission of human T-lymphatropic virus type III/Lymphadenopathy-associated virus infection. *Morbidity Mortality Weekly Report* 35:231-233, 1986.

Center for Disease Control: Hepatitis B vaccine: evidence confirming lack of AIDS transmission. *Morbidity Mortality Weekly Report* 33:685-686, 1984.

Center for Disease Control: Recommendation of the Immunization Practices Advisory Committee: Recommendations for protection against viral hepatitis. *Morbidity Mortality Weekly Report* 34:313-334, 1985.

Center of Disease Control: Recommendation of Immunization Practices Advisory Committee: Postexposure prophylaxis of hepatitis B. *Morbidity Mortality Weekly Report*33:285-289, 1984.

Division of Hepatitis and Viral Entities, Center for Infection Diseases, CDC, Immunization Practices Advisory Committee: The safety of hepatitis B virus vaccine. 32:134-136, 1983.

Hamilton J: Hepatitis B virus vaccine: an analysis of its potential use in medical workers. *JAMA* 250:2145-2150, 1983.

Hoofnagle J, Gerety R, Tabor E, Feinstone S, Barker L, Purcell R: Transmission of non A non B hepatitis. *Ann Int Med* 87:14-20, 1977.

Jilg W, Schmidt M, Zovlek G, Lorbeer B, Wilske B, Deinhardt F: Clinical evaluation of a recombinant hepatitis B vaccine. *Lancet* 1174-1175, 1984.

Petersdorf R, Adams R, Brounwald E, Isselbacher K, Martin J, Wilson J: *Harrison's Principles of Internal Medicine*, 10th edition. McGraw Hill, New York, 1983, pp 1789-1798, 1801-1804.

Seeff LB: Type B hepatitis after needle stick exposure: prevention with hepatitis B immune globulin: final report of Veterans Administration Cooperative Study. *Ann Int Med* 88:285-293, 1978.

Szmuness W, Oleszko W, Stevens C, Goodman A: Parsine-active immunization against hepatitis B:immunogenicity studies in adult Americans. *Lancet* 575-577, 1981.