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This knowledge-based activity is targeted for all pharmacists and is acceptable for 1.0 hour (0.1 CEU) of continuing education credit. This course requires completion of the program evaluation and at least a 70 percent grade on the program assessment questions.

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Objectives:

After completion of this program, the reader should be able to:

1. Identify the pertinent laboratory values and/or symptomatology required for antiretroviral therapy initiation in treatment-naïve HIV patients.
2. Describe the limitations of early versus deferred treatment for HIV infection.
3. List the factors that limit patient adherence to antiretroviral therapy.
4. Identify the significant changes made to the newest version of the NIH HIV treatment guidelines.

Abstract

Human immunodeficiency virus (HIV) targets CD4+ lymphocytes, a critical component to proper functioning of the human immune system. HIV is a significant public health concern, having resulted in over 27 million deaths since its discovery. Currently, several different treatment options exist, with combination antiretroviral therapy (ART) at the forefront. Despite the success of ART therapy, there are number of problems, including poor patient compliance. Due to this, the appropriate time to initiate therapy in the treatment naïve patient is under continuous scrutiny. Recently, several trials have demonstrated evidence suggesting that initiating ART at high CD4+ counts in the treatment naïve patient is beneficial in preventing outcomes such as progression to AIDS and death due to complications from HIV. This review will discuss two trials influential in the recent change in The National Institute of Health's guidelines on therapy for treatment naïve patients. The trials reviewed here are the North American AIDS Cohort Collaboration on Research Design (NA-ACCORD) and the Antiretroviral Therapy Cohort Collaboration (ART-CC). Despite the success of therapy, it is associated with many negative side effects and high cost, which may affect patient compliance, lead to possible drug resistance and result in treatment failure. Along with the new evidence presented in clinical trials, these factors also must be considered when initiating therapy in the treatment naïve HIV patient.

Background

Human immunodeficiency virus (HIV) infects cells of the immune system and progressively leads to the destruction or deterioration of immune function.[1] HIV normally infects humans by targeting a type of white blood cell known as CD4+ T lymphocytes, which are involved in cell-mediated immunity. Viral particles bind to specific receptors on the cell surface and fuse with the cell. The virus can then enter the host cell and insert its viral DNA into the normal DNA of the host, forcing the newly infected cell to produce additional copies of HIV. These new copies of HIV can go on to infect other cells, leading to a progressive decline in the number and function of CD4+ T lymphocytes and attenuation of the immune system. After causing a significant decline in immune function, HIV can progress into a more serious form known as acquired immune deficiency syndrome (AIDS). AIDS is clinically defined as a CD4+ count of less than 200 cells/mm^3 or a documented AIDS-defining illness. HIV represents one of the world's greatest public health challenges, as it has claimed more than 27 million lives since its discovery. The HIV/AIDS epidemic continues to take nearly 2 million lives each year.[2] More than 33 million people worldwide, including almost 1 million in the United States alone, currently live with HIV/AIDS. HIV can be transmitted via a number of different mechanisms including unprotected sexual intercourse, contaminated blood transfusions, or the sharing of contaminated needles. Infected mothers also can transfer the virus to a child during pregnancy, birth or breastfeeding. Certain patient populations, including men who have sex with men (MSM), African Americans, and Hispanic/Latino Americans are at a disproportionately increased risk for contracting the virus.

As a result of increased patient education on prevention and protection, the spread of HIV has decreased in recent years.[3] However, the total number of infected individuals continues to rise as they are identified earlier and treated with more advanced medication regimens. Antiretroviral therapy (ART) blocks HIV's activity on CD4+ cells by targeting different stages in the HIV lifecycle and decreasing the overall viral load in infected individuals. HIV antiviral therapy includes a combination of the following drug classes: nucleoside reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), protease inhibitors (PIs), fusion inhibitors (FIs), entry inhibitors, and integrase strand transfer inhibitors (INSTIs). ART involves various combinations of the antiviral drug classes. There are three preferred regimens for treatment naïve patients in the current NIH guidelines.[4] The regimens include a 2-NRTI backbone along with either an NNRTI, PI (ritonavir boosted) or INSTI. While the efficacy of antiretroviral therapy in slowing the progression of HIV and maintaining higher CD4+ counts has long been established, there is disagreement about when such therapy should be initiated. Over the past decade, several large-scale clinical trials have studied the risks and benefits of initiating ART at higher CD4+ counts, resulting in changes to the NIH guidelines for antiretroviral therapy in treatment naïve HIV patients.

NA-ACCORD

The North American AIDS Cohort Collaboration on Research and Design (NA-ACCORD) evaluated the rate of death for treatment naïve patients who initiated ART therapy within different thresholds of CD4+ counts.[5] Patients in two different CD4+ count ranges, either 351-500 cells/mm^3 or greater than 500 cells/mm^3, were allowed to initiate or defer ART therapy as a part of their HIV treatment when entering the trial. Patients who initiated ART therapy more than six months after the start of the trial were included in the deferred group. A total of 8,362 patients, were included in the first analysis, [who contributed 23,977 person-years of follow-up], which looked at patients whose baseline CD4+ counts were between 351-500 cells/mm^3. ART therapy was initiated in 25 percent of patients within six months, while the remaining 75 percent deferred therapy. The second analysis included 9,155 patients (who contributed 26,439 person-years of follow-up) whose CD4+ count was greater than 500 cells/mm^3 at the beginning of the trial. In this group, 24 percent of patients initiated therapy early, and 76 percent deferred for greater than six months. The results of this study were significant because they assessed HIV patients with CD4+ counts above the guideline recommendation at that time, which did not recommend initiation of ART until CD4+ count decreased to less than 350 cells/mm^3. Throughout the study, the CD4+ counts and rate of death for patients in each group were assessed. A statistically significant increase in the risk of death for patients who deferred therapy was seen in both patient groups. The relative risk of death was 69 percent higher ($P<0.001$) for patients who deferred therapy with a CD4+ count of 351-500 cells/mm^3 and 94 percent higher in patients who deferred when their CD4+ count was greater than 500 cells/mm^3. The large patient population and significant duration of observation gave this trial strong external validity and allowed death to be used as an endpoint rather than an HIV/AIDS related biomarker. The deferment group in each CD4+ count range essentially served as a control for the study and allowed for an effective analysis of when to initiate ART therapy for patients based on their CD4+ count. No randomization or blinding of study participants was done in this study. However, the use of death as an endpoint limited the risk of bias in the results. Relative risk adjustments for confounding variable such as intravenous drug use and hepatitis C infection were performed, although a sensitivity analysis suggested that due to the size of the trial, confounding would have had to have been unnaturally large to affect the results. These adjusted relative-risk calculations also demonstrated an increased risk of mortality for the deferment group in each of the respective cohorts.

ART-CC

The Antiretroviral Therapy Cohort Collaboration (ART-CC) was an analysis of 12 cohort studies performed in Europe and North America between 1995 and 2003.[6] The study evaluated ART-naïve HIV patients and the progression of their disease once ART was initiated. The trial evaluated five prognostic variables indicative of disease progression, including CD4+ cell count, HIV-1-RNA level, injection drug use (IDU), age, and clinical AIDS. A total of 22,217 patients were included in the cohort database. From the initiation of ART, 20,379 of the patients were analyzed. Due to a lack of CD4+ cell counts between months three and nine during the trial, only 16,167 were included in the analysis from six months after initiation. For each of the variables, a hazard ratio was calculated for patients who progressed to AIDS before death and patients who died prior to the progression to AIDS. After five years, the risk for both endpoints, progression to AIDS followed by death or death alone, ranged from 5.6-77 percent. For example, patients who were less than 30 years old, were infected with HIV via some means other than IDU, had a CD4+ count of less than 350 cells/mm^3 at therapy initiation and had an HIV-RNA level below 5 log copies/ml possessed only a 5.6 percent risk of death over a five-year period. Patients who were 50 years old or older, became infected with HIV via IDU, started ART with clinical AIDS and a CD4+ count of less than 25 cells/mm^3, had an HIV-1-RNA level equal to or greater than 5log copies/ml and whose disease had progressed to AIDS had a 77 percent risk of death over the course of the trial. The results of this study demonstrated the significance of CD4+ cell counts as an indicator of overall survival in HIV patients. The hazard ratios (95 percent CI) ranged from 0.18 for patients with a six-month CD4+ count of greater than 350 cells/mm3 to 0.75 for those with a six-month CD4+ count ranging from 25-49 cells/mm^3. This study demonstrated strong internal validity due to its large size and adjustment in the hazard ratios for confounding variables. A limitation of the study was the lack of cause-specific mortality data for patients in each of the respective cohorts.

Updated Guidelines

Studies such as the NA-ACCORD analysis and ART-CC trial have contributed to the increasing evidence in support of early ART therapy initiation in HIV patients. As a result of these and other similar trials, a panel from the Department of Health and Human Services made significant changes to the current ART therapy guidelines with the goal of providing health care professionals with recommendations for HIV treatment that reflected the findings of the most recent clinical trials. A full version of the new 2010 NIH guidelines can be viewed online at www.aidsinfo.nih.gov.[4] Among the many modifications to the guidelines, the panel made several suggested changes to the timing of ART therapy initiation in treatment naïve patient. Citing evidence of decreased mortality in the NA-ACCORD and ART-CC clinical trials, the panel now recommends initiating therapy in all patients with CD4+ counts 500 cells/mm^3 or less. While the benefits of initiating therapy earlier were clearly demonstrated in the above clinical trials, the panel remained concerned about the long-term impact of side effects on patient adherence and the overall success of treatment. As a result of the NA-ACCORD trial, the panel also made a recommendation for patients with CD4+ counts of greater than 500 cells/mm^3. However, given the lack of supporting evidence from other cohorts or randomized clinical trials, the panel chose to classify initiation of ART therapy in these patients as optional and something to be considered on a case-by-case basis. In all recommendations made by the panel, they stressed the importance of assessing each individual patient's commitment to lifelong ART therapy and adequately explaining the associated benefits and risks before initiating therapy.

Cost

Patients who choose to begin antiretroviral therapy as a part of their HIV treatment are making a lifelong commitment to expensive medications. One argument against initiating such high-priced medications earlier in the course of HIV progression is that the costs of treatment will be unnecessarily increased. A 2001 study on the cost effectiveness of antiretroviral treatment found that patients who initiated combination therapy at 500 cells/mm^3 could expect to live an average of 9.1 years after starting treatment and would incur a lifetime medical cost of $104,100.[7] Patients in the study who chose to defer treatment until their CD4+ counts fell below 200 cells/mm^3 were expected to live an additional 8.51 years at a total treatment cost of $98,000. The results also showed an increase in the number of opportunistic infections experienced by HIV patients who deferred antiretroviral therapy. Over the course of many years of treatment, the costs associated with initiating therapy early are relatively

small compared to the demonstrated increase in life expectancy and decrease in the risk for opportunistic infections.

Patient Adherence and Adverse Events

Patient adherence to ART therapy was not addressed in either study cited by the updated treatment guidelines, but remains a concern for practitioners and patients because it directly correlates with treatment success. Specifically, the most common cause of antiretroviral treatment failure in HIV patients is non-adherence. Pill burden, timing, tolerability, cost and interactions all limit patient adherence. Zidovudine (AZT) was the first antiretroviral medication brought to the market in the 1980s. Patients were required to take AZT five times daily and experienced a number of debilitating side effects. Although newer, more tolerable antiretroviral drug therapies continue to become available, each current class of antiviral medications has general side effects that can affect patient adherence. NRTIs can cause mitochondrial toxicity including lactic acidosis, hepatic steatosis and pancreatitis.[4] NNRTIs can produce rashes and hepatic dysfunction.[4,7] PIs cause gastrointestinal disturbance (nausea, vomiting, diarrhea), bleeding problems, hepatotoxicity and metabolic issues including hyperlipidemia, fat maldistribution and insulin resistance.[4,8] Enfuvirtide, currently the only FI on the market, is administered subcutaneously and can cause injection-site reactions, bacterial pneumonia, insomnia, nausea and diarrhea.[4,9] Hepatotoxicity, fever, rash and upper respiratory tract infection are common side effects seen in maraviroc, an entry inhibitor.[4,10] Raltegravir is an INSTI, the newest class of HIV antiretroviral drugs, and has been associated with an increase in total cholesterol.[11] In addition to tolerability, pill burden also affects patient adherence. The availability of combination antiretroviral drugs has helped curb some of these adherence issues. In addition, drug-drug and drug-food interactions exist and are considered in therapy and monitoring. Pharmacists play an important role in screening for drug interactions, educating patients on side effects and the importance of adherence, as well as screening for other health issues and administering appropriate immunizations. Overall, patient adherence must be managed by all clinicians, including pharmacists, in order to prevent progression of the disease and improve quality of life.

Drug Resistance

Antiretroviral drug resistance is an important consideration in the treatment of HIV patients because it can have a significant impact on the success of ART therapy and lead to increased mortality.[13,14] Opponents of early antiretroviral initiation claim that using these drugs early in the course of HIV progression can increase the risk for resistance and limit future treatment options for patients.[15] Resistance to antiretroviral drugs is caused by mutations in the viral particles that result in different forms of HIV within an individual. Some of these variants of HIV are more resistant to antiretroviral drugs and can lead to a decrease in the effectiveness of treatment. One of the most influential factors in developing resistance to antiretroviral drugs is poor adherence to medication regimens. Patients who choose to initiate therapy and are subsequently poorly adherent expose themselves to antiretroviral drugs but do not fully suppress the replication of the virus. The virus then can continue to replicate in the presence of subtherapeutic drug concentrations, and the risk for mutant strains of the virus developing is increased. The risk of developing resistance to three major classes of antiretroviral drugs, NRTIs, NNRTIs and PIs, has been shown to decrease if treatment is initiated at higher CD4+ counts.[16,17] In order to reduce the risk of drug resistance and maximize the effectiveness of antiretroviral therapy, pharmacists and other clinicians must stress the importance of medication adherence to patients beginning treatment.

Conclusion

The benefits of initiating therapy at CD4+ counts above 350 cells/mm^3 were clearly demonstrated by the NA-ACCORD and ART-CC trials, and the newly refined guidelines reflect these new findings. However, treating HIV patients with ART therapy does have a number of limitations as well. Antiretroviral drug costs in the United States remain high, and regardless of the CD4+ count at which they are initiated, represent a significant financial burden for patients, insurance companies and government programs. Many classes of antiretroviral drugs also have serious potential side effects that can lead to increased morbidity and decreased patient adherence. A patient's adherence to their medication regimen is vital to slowing the progression of HIV and improving life expectancy. Most types of antiretroviral therapy include multiple different classes of drugs, and the resulting pill burden can lead to lower rates of adherence in patients, especially those with higher CD4+ counts that may not be experiencing an AIDS defining illness. Resistance to antiretroviral drugs, commonly the result of poor patient adherence, can limit treatment options for patients as they progress through the disease as well. However, despite these and other concerns, it is important to focus on the consistently improved patient outcomes demonstrated in early initiation groups from the reviewed clinical trials. Across almost all demographic groups, participants who initiated ART therapy earlier in the course of the disease were more likely to live longer and less likely to progress to clinical AIDS. The success of ART in HIV patients is dependent on a variety of different factors, and a careful assessment of the risks and benefits of treatment must be performed for patients considering initiating therapy at any point in the progression of the disease. Pharmacists and other health care professionals must play an active role in discussing the risks and benefits of treatment with patients and assessing the readiness to make a lifelong commitment to antiretroviral therapy. The most recent findings certainly do not signal the end of the debate on ART therapy, and HIV treatment will undoubtedly continue to be the focus of much discussion and research in the future.

References

1. AIDSinfo: A Service of the U.S. Department of Health and Human Services. HIV and Its Treatment: What You Should Know. Health Information for Patients. Updated December 2009. Accessed Dec. 6, 2010.
2. WHO: World Health Organization. 10 facts on HIV/AIDS. www.who.int/features/factfiles/hiv/en/index.html. Updated July 2010. Accessed Dec. 6, 2010.
3. CDC: Centers of Disease Control and Prevention. HIV in the United States: an overview. www.cdc.gov/hiv/topics/surveillance/resources/factsheets/us_overview.htm. Updated July 2010. Accessed Dec. 6, 2010.
4. Aidsinfo: Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the use of antiretroviral agents in HIV-1 infected adults and adolescents. Department of Health and Human Services. Dec. 1, 2009. 1-161. Available at aidsinfo.nih.gov/contentfiles/AdultandAdolescentGL.pdf. Accessed Dec. 6, 2010.
5. Kitahata MM, Gange SJ, Abraham AG, Merriman B, Saag MS, Justice AC, et al. Effect of early versus deferred antiretroviral therapy for HIV on survival. N Engl J Med. 2009;360:1815-1826.
6. Lippincott Williams & Wilkens. Prognosis of HIV-1-infected patients up to 5 years after initiation of HAART: collaborative analysis of prospective studies. AIDS. 2007;21:1185-1197.
7. Viesen K, Dawson J. Anti-retroviral non-nucleoside reverse transcriptase inhibitors. Revised 6 June 2005. Clinical Pharmacology. Gold Standard; 2011.

8. Viesen K, Dawson J. Anti-retroviral protease inhibitors. Revised 6 October 2005. Clinical Pharmacology. Gold Standard; 2011.
9. Enfuvirtide [monograph]. Lexi-Comp online. Lexi-Comp; 2011.
10. Maraviroc [monograph]. Lexi-Comp online. Lexi-Comp; 2011.
11. Raltegravir [monograph]. Lexi-Comp online. Lexi-Comp; 2011.
12. Schackman BR, Goldie SJ, Weinstein MC, Losina E, Zhang H, Freedberg KA. Cost-effectiveness of earlier initiation of antiretroviral therapy for uninsured HIV-infected adults. Am J Public Health. 2001;91:1456-1463.
13. Havlir DV, Marschner IC, Hirsh MS, Collier AC, Tebas P, Bassett RL, et al. Maintenance antiretroviral therapies in HIV-infected subjects with undetectable plasma HIV RNA after triple-drug therapy. N Engl J Med. 1998;339:1261-1268.
14. Richman DD, Morton SC, Wrin T, Hellmann N, Berry S, Shaprio MF, et al. The prevalence of antiretroviral drug resistance in the United States. AIDS 2004;18:1393–1401.
15. Weinstein MC, Goldie SJ, Losina E, Cohen CJ, Baxter JD, Zhang H, et al. Use of genotypic resistance testing to guide HIV therapy: clinical impact and cost-effectiveness. Ann Intern Med. 2001;134:440-450.
16. Phillips AN, Leen C, Wilson A, Anderson J, Dunn D, Schwenk A, et al. Risk of extensive virological failure to the three original antiretroviral drug classes over long-term follow-up from the start of therapy in patients with HIV infection: an observational cohort study. Lancet. 2007;370:1923–1928.
17. Lucas GM. Antiretroviral adherence, drug resistance, viral fitness and HIV disease progression: a tangled web is woven. J Antimicrob Chemother. 2005;55:413–416.

Assessment Questions

1. There are currently _____ people in the United States living with HIV/AIDS:
   a. 500,000
   b. 1 million
   c. 2 million
   d. 5 million

2. All of the following patient populations are at an increased risk of contracting HIV EXCEPT:
   a. Hispanic/Latino Americans
   b. Men who have sex with men (MSM)
   c. African Americans
   d. All of the above

3. Which of the following is NOT considered a preferred antiretroviral treatment regimen for treatment naïve patients:
   a. 2-NRTI + 1 PI (ritonavir boosted)
   b. 2-NRTI + 1 FI
   c. 2-NRTI + 1 NNRTI
   d. 2-NRTI + 1 INSTI

4. Which of the following CD4+ count values is the minimum at which an asymptomatic HIV-positive patient would not be classified as an AIDS patient:
   a. 500 cell/mm3
   b. 200 cells/mm3
   c. 100 cells/mm3
   d. 50 cells/ mm3

5. The 2010 NIH Guidelines state that antiretroviral therapy should be initiated in patients with each of the following CD4+ counts EXCEPT:
   a. 300 cells/mm3
   b. 350 cells/mm3
   c. 400 cells/mm3
   d. 600 cells/mm3

6. Results of a study conducted by Schackman et al published in 2001 suggested that patients initiating ART therapy at 500 cells/mm3 could expect to live an additional _____ years as a result of treatment:
   a. 9.1 years
   b. 7.5 years
   c. 6.3 years
   d. 10.6 years

7. All of the following are considered to be limitations to patient adherence with antiretroviral therapy EXCEPT:
   a. Pill burden
   b. Cost of treatment
   c. Requires inpatient administration
   d. Side effects

8. Protease Inhibitors are associated with which of the following side effects:
   a. Upper respiratory tract infection
   b. Insulin resistance
   c. Insomnia
   d. Renal failure

9. Which of the following is considered a role of the pharmacist in improving patient adherence and limiting adverse effects with antiretroviral drugs?
   a. Administering appropriate immunizations
   b. Screening for drug-drug and drug-food interactions
   c. Educating patients on common side effects of their medications
   d. All of the above

10. One argument against earlier initiation of ART therapy is that poor patient adherence will lead to an increased risk of:
   a. Side effects from current medications
   b. Clinically significant bleeding episodes
   c. Liver transplantation
   d. Resistance to antiretroviral drugs

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Program Content:	Strongly Disagree				Strongly Agree
The program objectives were clear.	1	2	3	4	5
The program met the stated goals & objectives;					
Identify the pertinent laboratory values and/or symptomatology required for antiretroviral therapy initiation in treatment-naïve HIV patients.	1	2	3	4	5
Describe the limitations of early versus deferred treatment for HIV infection.	1	2	3	4	5
List the factors that limit patient adherence to antiretroviral therapy.	1	2	3	4	5
Identify the significant changes made to the newest version of the NIH HIV treatment guidelines.	1	2	3	4	5
The program met your educational needs.	1	2	3	4	5
Content of the program was interesting.	1	2	3	4	5
Material presented was relevant to my practice.	1	2	3	4	5

Comments/Suggestions for future programs:

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Answers to Assessment Questions - Please Circle Your Answer

1. A B C D	**4. A B C D**	**7. A B C D**	**10. A B C D**
2. A B C D	**5. A B C D**	**8. A B C D**	
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