4-27-1999

A computer assisted study guide for viral hepatitis, April, 1999

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A Computer Assisted Study Guide

For Viral Hepatitis

April, 1999

by
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A Thesis

Submitted in partial fulfillment of the requirements of the
Master of Arts Degree in the Graduate Division
Of Rowan University
May, 1999

Approved by

Date Approved April 27, 1999

Abstract

Diana Hullihen — A Computer Assisted Study Guide For Viral Hepatitis, April, 1999. Thesis Advisor: Richard Meagher, PhD., Biological Sciences.

The purpose of this project was to design a computer assisted program that would enhance the effectiveness of instruction in a clinical laboratory science program. Computer assisted instruction has been proven to be a beneficial and effective method of meeting educational objectives.

The topic of viral hepatitis is a complex and difficult one to teach. The instructor decided to supplement traditional lecture using computer assisted instruction. The goals and objectives of the lesson would be reinforced through this method as well as help the student to master the subject content.

The computer assisted study guide was designed to enhance the presentation of the viral hepatitis lesson. The program was planned to reinforce the content of the lesson as well as promote student competency with the subject. The development stages of the program included subject content, visual aids that supported the written text and questions that provided immediate corrective feedback to the student. Direct interaction with the program was

necessary to maintain the student's interest. Feedback from the program needed to allow for an increase in the student's ability to perform better.

The clinical laboratory science students were taught the topic of viral hepatitis in traditional lecture form. After reviewing the computer assisted study guide, the students took a written examination. The scores of the examination taken after the students reviewed the computer program were compared to the scores of the past three clinical laboratory science classes that did not have the opportunity to use the computer-based study guide. The scores of the class that used the study guide were higher. The students evaluated the computer program and believed that the study guide enhanced their knowledge of the subject of viral hepatitis and helped them prepare for the written examination. Using a computer assisted study guide as a supplement to traditional lecture proved to be an effective means of meeting educational objectives.

Mini-Abstract

Diana Hullihen

A Computer Assisted Study Guide For Viral Hepatitis, April, 1999. Thesis Advisor: Richard Meagher, PhD., Biological Sciences.

The purpose of this project was to design a computer assisted study guide for viral hepatitis to improve the effectiveness of instruction in a clinical laboratory science lesson.

Based on the results of the written examination and student evaluation of the study guide, it was determined that the computer program promoted student competency, enhanced classroom lecture and proved to be an effective instructional method.

ACKNOWLEDGEMENTS

The writer wishes to express her gratitude to the following persons:

Dr. Richard Meagher, for his interest and guidance during the design and implementation of this project.

Thomas Kirk, for his technical expertise and suggestions for the development and the design of this project.

My husband, Richard, for all his love, support and encouragement during my graduate studies.

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INTRODUCTION

Medical Virology is a scientific discipline that is continually changing as more information is gathered at the molecular level. Due to its breadth and importance to the medical environment, Medical Virology is a topic that needs to be addressed in all microbiology and molecular biology courses. Because the field is so dynamic, it is difficult for instructors to use textbooks as reference tools. Most clinical virology textbooks are outdated within a few years as more information about viruses is discovered through molecular-based laboratory techniques. A better method of instruction is required to teach our science students all aspects of Medical Virology to stay current and on the "cutting edge" of technology.

A possible solution to this educational dilemma may be to develop instructional programs using computer-based technology. Students can use this information as an adjunct to didactic instruction. Computer-based instruction, also known as computer assisted instruction or computer assisted learning, is becoming more common as personal computers are becoming easier to use and software programs are less expensive to purchase. Some advantages to computer assisted instruction include: cost effectiveness, accuracy of content, beneficial learning techniques and ability to

effectively assess the learning of the student. (Educational Software Concepts, Inc., 1995)

The cost effectiveness of computer-based technology can be realized through many aspects. This mode of teaching is an excellent supplement to traditional lecture and will not take more of the instructor's time. Computer assisted instruction is available twenty-four hours a day and seven days a week. This teaching aid allows review of difficult subject matter or problem areas. Finally, the ability of this technology to enhance training and development programs at a relatively inexpensive cost allows this instructional mode to be financially practical. (ESC, 1995)

Learning techniques are also enhanced through computer assisted instruction. It allows for learners to move at their own pace, something that is difficult to do when teaching to a number of students at one time. Instruction using a computer promotes student competency and enhances classroom lecture as well as clinical experiences. Computer-based learning also provides consistent instruction to each student, which is often a challenge to the instructor when teaching different classes. (ESC, 1995)

Computer assisted instruction also offers the benefit of current and accurate subject matter content. The momentum of scientific technological advances is such that paper resources such as textbooks are quickly becoming

obsolete as soon as they are printed. Computer-based learning allows for ease in updating information to reflect the current scope of practice. (ESC, 1995)

Assessment of learning is a necessary tool in any educational process. Computer assisted instruction provides the mechanism by which the learner can assess their mastery of the subject matter or their skill level through self-assessment. This technology can provide the student with self-test scores and analysis of test questions immediately. The instructor can assess the students' progress by obtaining this data from the computer program. (ESC, 1995)

Computer assisted instruction can provide both the teacher and the student definitive data as to the progress of the student and the effectiveness of instruction. This mode of instruction is a definite advantage to the contemporary educator. (ESC, 1995).

STATEMENT OF THE PROBLEM

Teaching the topic of Viral Hepatitis is a major endeavor for the biology instructor. This discipline is a complex and difficult one to teach to the science student. The term "hepatitis" is defined as "inflammation of the liver" and generally describes multiple infections that have different degrees of severity. (Taber's Cylopedic Medical Dictionary, 1997) These infections can be caused by a variety of agents, however the most common cause is one of the five hepatitis viruses. These viral agents are classified in alphabetical terms and differ in their modes of transmission. Viral hepatitis can be caused by Hepatitis A (HAV), Hepatitis B (HBV), Hepatitis C (HCV), Hepatitis D (HDV) and Hepatitis E (HEV). (HepTeach(c) 1997) For the student, the topic of Viral Hepatitis is complicated and difficult to conceptualize. For the instructor, teaching students the complex nature of these five agents and their clinical intricacies is a difficult responsibility. Using computer assisted instruction as a supplement to traditional lecture would be an excellent way for the instructor to reinforce the goals and objectives of the course and help the student to understand and apply the information learned.

PURPOSE OF THE STUDY

The Medical Virology course at The Cooper Health System's School of Medical Technology is taught purely through lecture. All information is given by the instructor and a textbook is not required. The instructor approaches the topic of Viral Hepatitis through classification based on viral genome, mode of transmission, clinical presentation and laboratory detection. The five viral agents are summarized in chart formation at the end of the lecture. Historically, the clinical laboratory science student has difficulty understanding and visualizing the concept. The instructor would like to use computer assisted instruction as an adjunct to lecture. A goal of the course would be to use computer-based technology to enhance the learning process and allow the student to reach the higher levels of the cognitive domain, that of application, analysis and synthesis. Specifically, the instructor would like to design a supplemental study guide to the five hepatitis viruses that would allow the realization of this course goal. After the program is designed, the instructor will use it as an extension to the didactic lecture. The students will be required to complete the study guide before taking the comprehensive examination. Scores on the examination will be compared to past scores of former clinical laboratory science students that did not have the

opportunity to use the computer study guide as a supplement to the lecture. Results will confirm whether computer assisted instruction is beneficial or not to the student learning the topic of Viral Hepatitis.

REVIEW OF THE LITERATURE

Designing Computer Assisted Instruction

Guidelines for Design. Any educational program must address four essential components as it is being designed to be an effective instructional experience. Basing design plans on these four components assures a more purposeful instructional program. The first element must address the purpose or problem. Essentially, it must answer the question, "why are you doing it?" The second component must clarify the achievement of the learners. It establishes goals and objectives of the course which will measure the successful outcome of instruction. The third concept answers the question, "how are you going to use it?" or which approaches will be used to teach the information. The last component addresses the assessment of the instruction. It answers the question, "how will you know the success of the instructional task?" (Hord, 1984)

The most important variable affecting learner achievement is completeness of the instructional model. (Alessi, 1984) By addressing the basic components and thoroughly answering the posed questions, a complete and effective instructional program can be achieved. The purpose of the instruction must be presented as information or skill modeling. The achievement of the goals and objectives will be attained by guiding the student in the

beginning understanding of the material and then providing practice for the student to enhance proficiency and the retention of skills. The evaluation of success will come from the assessment of achievement. (Alessi, 1984)

These basic components of instructional design can be achieved through different types of computer based programs. The methodologies used can include tutorials, drills, simulations, games or tests. It is important to note that a program will be more successful if it is based upon a combination of these methodologies. (Alessi, 1984)

Clarifying Educational Objectives. Educators designing the Computer Assisted Instruction (CAI) application must first clarify their objectives. Clear educational objectives is the most crucial issue affecting the successful implementation of CAI into the course of study. Following an educational model will dictate where the computer software will fit into the lesson (s). (Brothen, 1992)

Brothen states that there are many types of software that can elucidate the educational objectives of a course. Projects concerned with data gathering can help reinforce course content, allow students to handle and interpret data and help motivate the students to learn more. Activities involving assessment can help students pace their studying, increase their skills at finding main points within the text

and improve homework habits. Matching exercises can also be used to reinforce major concepts, enhance student comprehension skills and motivate the students to learn basic facts. A fourth activity that can be addressed with computer programs is one which involves examination through weekly quizzes and a final examination. The weekly quizzes allow the students to pace their studying and they also give the students an idea of how well their studying skills are working. Using quizzes and examinations are good diagnostic tools. These tools allow the students to practice their study skills, motivate them to prepare for the exams and help sharpen their comprehension and summarization skills. (Brothen, 1992)

Sponder and Hilgenfeld (1994) also agree that CAI activities should be based on solid educational objectives. These objectives help provide the guidance needed for both designing and implementing computer programs. The National Institute of Education (NIE) has determined that the Information Age has caused a shift in the fundamentals of education. The traditional "three R's" have been replaced with the "two C's", that of comprehension and communication. CAI is aimed at teaching and reinforcing these emerging basics of learning. The NIE offers a course in developing computer assisted instruction. The course goal is to train teachers how to design interactive multimedia activities

using objectives as a means of access to program development and student assessment. (Sponder and Hilgenfeld, 1994) These objectives, described through Bloom's taxonomy of learning, must fulfill the six levels of the cognitive domain which include knowledge, comprehension, application, analysis, synthesis and evaluation. The educational strategy that the NIE uses is referred to as "Cognitively-based Instructional Design (CBID)". This method is used to make software development meaningful as well as creative. The integration of the traditional theories of learning with the unique features of multimedia technology should support a finished program that will appeal to the students' cognitive as well as aesthetic perceptions. (Sponder and Hilgenfeld, 1994)

The importance of cognitively-based instructional design is two-fold. It allows the instructor to focus on his cognitive goals and objectives rather than the sophistication of the computer technology. Cognitively-based instructional design also facilitates activities that help students become proficient in the comprehension and communication skills relevant to today's technological pedagogy. As Sponder and Hilgenfeld state," ... the process of cognitively-based instructional design is an extension of what teachers do best, that is helping students to learn and understand the curriculum while facilitating their

development as intelligent and effective communicators." (1994)

Design Considerations. When developing and designing CAI, many issues need to be considered to ensure a viable outcome. There are both developmental and design considerations to contemplate. The developmental stages should include the topic selection, the content and the audience, the hardware and the software. The topic should be one in which the theory and the technology are well established. The audience needs to be well defined as this will guide the application of the program. Meeting the needs of a greater number of users will allow for better utility of the CAI program. Due to rapid changes in the computer technology, it is best to be aware of upcoming capabilities of hardware systems. Designing a program capable of working on current equipment as well as upgraded equipment will be advantageous. Choosing the software system to help design or "author" programs is an important consideration for CAI development. Features to consider in authorship software include; programmability, efficiency of the production process, availability of customer support services, Web site user support groups, prewritten script commands, supplemental software and interfaces with other software platforms. (Higgins and Thorne, 1998)

When designing the instructional model, reviewing the literature and constructing a content outline are important considerations. The literature will give current information regarding the topic and the outline will provide a model and flow of the instructions. The authors recommend some definite design "Do's and Don'ts". Text should be limited and the number of concepts per screen should not be greater than six. A consistent color contrast, navigation tools and complementary visuals all add to the user-friendliness of the program. Most importantly, presentation should be paced so that it allows for the user to do something every 15 to 20 seconds. This pace will maintain interest and leave little room for distraction to the user. (Higgens and Thorne, 1998)

Once these issues of development and design are decided, actual design can begin. All programs must have a flow that should be examined and followed. The design of the program can be one or a mixture of three configurations, sequence, choice and repetition. The sequence structure represents a linear progression through several steps. The choice structure allows the user to choose from several options displayed on the screen. The repetition structure will repeat a given operation if certain predetermined criteria are met. (Hord, 1984)

A visual representation of the program's flow needs to be prepared after all considerations of development and design are decided. Two forms of visualizing the program can be used, flowcharting or screen mapping. A flowchart describes the steps of the program in a graphic manner. There is a beginning, a process and an end. The process can include choices and procedures that lead to the end. If a repetition configuration is used, certain criteria must be met before the flowchart moves to the end of the process. (Hord, 1984)

Screen mapping is the process used to design each screen of the program. The best way to prepare a screen map is to use index cards. Each screen is represented by an individual card. Therefore, each screen can be updated, added or deleted without rearranging the entire program. Once the screen map is prepared, arranging them on a flat surface and going through the actual process will create a flowchart. The flowchart can be simple or intricate depending on the number of screens previously prepared. The author advises that the more information given to the user on how the program is supposed to work the better chance for a successful outcome. (Hord, 1984)

Another benefit of CAI is that it also may be combined with other instructional activities. Tutorials, drills, simulations, games and tests are all ways in which to

integrate CAI into the instructional design of the lesson. Tutorials are excellent tools to enhance presentation of information and guide the student into the lesson content. There are six basic components of a lesson addressed in a tutorial. Tutorials begin with an introductory section that includes the educational objectives and directions for use. Information is presented to the user, followed by interaction of the user regarding the information, usually in the form of a question and answer. The response of the interaction is judged by the program and feedback follows. The feedback can be corrective or it can identify that remediation is necessary. A closing option completes the cycle. The closing can be temporary with the expectation that the student will return to the program at another time. The closing may be permanent when all the material has been covered. At this point the program should inform the student that the lesson has been completed successfully. (Alessi, 1984)

There are other important aspects of the tutorial that should be included for a successful program. There should be frequent student interaction and involvement. The questions asked should reach the higher cognitive levels of comprehension and application. Feedback from responses should allow for an increase in the student's ability to do better. The lessons should be enjoyable and include both

text and graphics to furnish information, ask questions and provide feedback. Alessi (1984) suggests that students learn better when visual stimuli are used in combination with written text.

Validation of the CAI application is also important when designing and implementing computer-based education. A lesson must be assessed to determine where it is effective and where it is weak. Weaknesses should be corrected through revision and the lesson should be tested again. Alessi (1984) suggests that evaluation of CAI should occur in three progressive steps. The lesson should be reviewed for programming errors, quality of questions and accuracy of content. Pilot testing of the program should occur with a few students using the lesson. The students should be questioned on the factors of whether the lesson was enjoyable, interesting and informative. Field testing should be done by real teachers in real educational environments. Student achievement as well as student attitudes should be assessed in this final evaluation step. Alessi (1984) concludes that "... the designer must begin with a complete model of the instructional process, must apply good pedagogical principles and must evaluate and revise the materials until they are satisfactory."

Hypermedia Applications. Sponder and Hilgenfeld (1994) suggest that educators in any field can use multimedia

applications to create customized CAI lessons for any topic. These applications, also known as "hypermedia", have audio and visual capabilities that are sophisticated yet easy to use. Lessons created with hypermedia technology can combine audio, video, animation, text and graphics. This combination helps hone the comprehension and communication skills necessary for interaction in today's "high-tech" world.

Many educational software products provide the tools necessary to create, publish and administer computer based teaching courses. Most of today's educational software companies do not expect the authors to be able to program a computer. Educational software companies are designing their programs for use by anyone with the ability to "press any key". More educators are finding it easier to convert their knowledge into computer - based teaching programs to share their experience, knowledge and skills with others. As the software designers develop the programs to be used by instructors, they are in effect, putting the power of multimedia in the hands of the instructors. The presentations created by the instructors will motivate their students to new levels of creativity. The consistent learning environment created by computer-based technology will result in more effective learning as the students

explore subjects in far greater depth than traditional instruction.

Summary

Computer assisted instruction is not intended to replace traditional methods of teaching, but rather enhance instructional activities. It offers the capability of presenting facts and concepts through the use of animation, sound, video and simulations. CAI supports interactive learning and allows for the development of problem solving skills. CAI gives instructors the ability to standardize material, present new material and reinforce previously learned concepts. It can provide corrective feedback and offer immediate remediation when subject matter has not been mastered. Simulations can be used to expose students to situations not frequently encountered in real life situations. Tutorials and drills can allow practice of skills and lead to mastery of educational objectives. CAI can evaluate and assess students' learning outcomes in a cost- and time-efficient manner. CAI is a beneficial and effective method of meeting educational objectives in any academic setting.

MATERIALS AND METHODS

Viral Hepatitis Lesson

The topic of Viral Hepatitis is presented to the students at The Cooper Health System's School of Medical Technology through traditional lecture. The written goals and objectives of the lesson are given to the students before the lesson begins. These goals and objectives exist as a "contract" between the instructor and the student to explain exactly what the student is to learn from the material. The rationale of the lesson is to provide the clinical laboratory science student with a basic knowledge of Viral Hepatitis and its application in the clinical laboratory.

The learning objectives are measurable and attainable. At the completion of the lesson, the clinical laboratory science student will be able to:

1) identify the five agents that cause viral hepatitis.
2) interpret a summary chart of the clinical and epidemiological features of viral hepatitis agents.
3) describe and discuss the characteristics, mode of transmission and serological profile of Hepatitis A, B, C, D, and E.

4) assess the clinical situation and evaluate the information given to determine the causative agent of the viral hepatitis.

The lesson is divided into the five agents causing viral hepatitis: Hepatitis A, Hepatitis B, Hepatitis C, Hepatitis D and Hepatitis E. The instructor classifies each of the five agents according to their characteristics, epidemiology, mode of transmission, clinical manifestations, laboratory diagnosis and treatment or prevention measures. Viral Hepatitis can not be isolated in any growth medium; therefore, most diagnostic methods of detection rely on the presence or absence of antibody against the infecting virus. The lesson includes graphs depicting the antibody response to each virus. The lesson also includes a comprehensive summary of the clinical and epidemiological features of the five viral hepatitis agents. A copy of the syllabus including references is included in Appendix A.

Hepatitis A

The lesson begins with a discussion of Hepatitis A virus. This virus is from the Family Picornaviridae. It can be characterized as a non-enveloped, single-stranded RNA virus with icosahedral symmetry. It is very stable and is resistant to drying, low pH, organic solvents and detergents. There is only one known serotype.

Hepatitis A can be found throughout the world. It is endemic in developing countries with more than ninety percent of the adult population exhibiting antibodies to the virus. The prevalence of antibodies to the virus reflects standards of hygiene and sanitation. Hepatitis A is transmitted via a fecal-oral route through contaminated food or water. Infected individuals are infectious two to three weeks before the onset of symptoms and up to eight days after symptoms begin. The incubation period averages about one month. Virus can be found in the blood seven to ten days before the onset of jaundice. A high concentration of virus (10^8 infectious units per milliliter) is excreted in the stool two weeks before to one week after the onset of jaundice. The virus infects the liver and replicates in the hepatocytes and Kupffer cells, thus affecting the ability of these cells.

Hepatitis A can present as asymptommatic to mild in children and has a duration of ten to fourteen days. Fifty percent (50%) of infected adults present with malaise, nausea, fever, vomiting and diarrhea. Another twenty to thirty percent (20% - 30%) may present with joint pain and abdominal pain. Ten percent (10%) of infected children and seventy-five percent (75%) of infected adults will present with jaundice. There is no chronic carrier state or chronic liver disease associated with Hepatitis A virus.

The best way to diagnose Hepatitis A is through serology. Diagnosis is made when an infected individual demonstrates the presence of IgM antibodies to Hepatitis A. This type of antibody is present at the onset of symptoms and reaches its highest titer four weeks later. IgG antibodies to Hepatitis A are detectable by laboratory methods two weeks after the onset of symptoms and persist for life.

A Hepatitis A vaccine is available to provide short-term protection against infection. It is highly recommended for anyone traveling to endemic countries.

Hepatitis B

Hepatitis B is a double-stranded, circular DNA virus that consists of a central core containing the core antigen and a surrounding envelope containing the surface antigen. The core region of the virus produces a protein that is secreted by the infected liver cells into the serum. The presence of this envelope protein correlates with viral replication in the liver and infectivity of the virus.

Hepatitis B is found throughout the world infecting about 300 million people. Fifty percent (50%) of the population in Africa and Southeast Asia are infected. In the United States, the incidence is much less, with only one to 1.25 million chronic infections diagnosed.

Hepatitis B can be transmitted percutaneously, perinatally, through sexual contact or transfusion. Percutaneous transmission includes needlestick, intravenous drug use or dialysis. Eighty to ninety percent (80% - 90%) of infants born in the United States to mothers positive for Hepatitis B surface antigen become infected. Ninety percent (90%) of infected infants become chronic carriers of the virus. Sexual contact is the single most important mode of transmission. Risk for infection by this means has decreased markedly due to education and modifications in sexual behavior. Infection of Hepatitis B due to transfusion has the lowest incidence rate due to the routine screening of blood donors for the virus since 1984.

Hepatitis B has an incubation period of approximately 120 days. Acute symptoms can include jaundice, anorexia, malaise, nausea, vomiting and abdominal pain. A chronic infection can occur with infected individuals presenting with the Hepatitis B surface antigen for six months or more. About 25% of carriers develop chronic active hepatitis that can progress to cirrhosis and primary liver carcinoma.

Hepatitis B is diagnosed in the laboratory through serology or nucleic acid detection. Serological assays are routinely available to detect a variety of Hepatitis B proteins. Hybridization assays and polymerase chain

reaction are also available to quantitate the amount of virus in the infected individual.

Vaccination is available to prevent infection with Hepatitis B. It is safe and highly efficacious and has proven to provide long-term protection in most vaccinated individuals.

Hepatitis C

Hepatitis C is a small, enveloped, single-stranded RNA virus of the Family Flaviviridae. The virus has never been isolated, but its genome has been cloned to develop immunoassays for the detection of virus in infected patients. It accounts for a substantial proportion of acute and chronic liver disease in the United States.

Hepatitis C can be transmitted through transfusion, parenteral drug abuse, sexual contact or perinatally. More than forty percent (40%) of Hepatitis C cases have undefined causes. Many infected individuals remain asymptommatic. Seventy-five percent (75%) of acute infections progress to chronic infection, with twenty-five percent of chronic carriers developing liver cirrhosis.

Most infected individuals produce antibodies within two to six months after infection. The presence of antibodies to Hepatitis C can be detected in the laboratory through serological methods. Qualitative and quantitative nucleic

acid assays are also available to monitor infected patients' viral load.

Hepatitis D

Hepatitis D is a defective RNA agent that requires Hepatitis B for replication and expression. It is endemic in Mediterranean countries, Africa and South America. It is spread through intimate contact or percutaneously and may coinfect with Hepatitis B or superinfect chronic Hepatitis B carriers. Hepatitis D is associated with more severe forms of Hepatitis B infection and presents with a rapid and severe onset of acute hepatitis. There is a thirty percent (30%) mortality rate of chronic Hepatitis B patients superinfected with Hepatitis D.

Hepatitis D is diagnosed in the laboratory by serological methods. A low titer of antibody is detected in Hepatitis D coinfection with Hepatitis B and a high titer of Hepatitis D antibody is associated in a superinfection with Hepatitis B.

Hepatitis E

Hepatitis E is a single-stranded RNA virus from the Family Calciviridae. It is responsible for waterborne epidemics in Southeast Asia, West Africa, South America and Mexico. It is transmitted through a fecal-oral route. Hepatitis E is a self-limiting disease and there is no

evidence of chronic or carrier states. Hepatitis E usually presents with nonspecific symptoms of anorexia, abdominal pain, malaise and arthralgia. In the laboratory, Hepatitis E is diagnosed through serological methods however, antibody to Hepatitis E is not long lasting.

Thus it can be seen that the many differences between the clinical and epidemiological features of these viral hepatitis agents make it a difficult topic for the student to conceptualize. The instructor felt the need for a better way to reinforce the content of the lesson and decided to investigate computer assisted technology.

Choosing the Right Software

The use of computer assisted instruction is on the rise throughout the medical educational system. Numerous programs are available to enhance learning of many topics. Because of the specific nature of Viral Hepatitis, the instructor decided to attempt to design a program that would reinforce the contents of the lesson, rather than replace it. A search of the Internet revealed many educational software companies and a plethora of products. The instructor established guidelines to research these educational software products. The program to be designed would be simple and easy to use. The program would need to support visual aids, such as, graphs, charts, maps and photographs. The program would serve as a supplement to the

lecture and reflect the same content. The basic goal of the program would result in more effective learning on the part of the student.

Educational software product literature was reviewed to ascertain which type of program could support the guidelines listed above. Cost and ease of use were also major considerations. After reviewing some software samples and speaking with technical experts, it was decided that a "Web Page" type program would be used to design the instructional supplement on Viral Hepatitis. Web pages are very easy to design and many people either subscribe to the Internet or have used it in some capacity. Most college students of today have used the Internet to research topics for papers and projects. The availability of Web Page design and a Web Browser in most software packages were the deciding factors in the choice of program to use to design the Hepatitis instructional supplement.

Hepatitis Instructional Supplement

The goal of the computer assisted instruction (CAI) for Viral Hepatitis is to increase the effectiveness of learning. The CAI is meant to be a broad overview of the topics discussed in the lecture and to reinforce the basic concepts. The viral agents are categorized in the same way, using the categories of Characteristics, Epidemiology, Laboratory Diagnosis, Clinical Manifestations, Transmission

and Treatment and Prevention. In addition, information on the pathology of the liver was added to the supplement to give a more comprehensive overview of viral hepatitis. The program allows the student to choose different topics and visual aids to further describe the content. Pictures of the viruses were graphically displayed and serological profiles were included for each virus. As the student reads through each topic he or she is given the option for further description of a point by clicking text that has been "hyperlinked" to another page. These hyperlinks are a word or group of words within the text or a picture that serves as a link to another page of the program. The hyperlinks allow the Web browser that runs the program to go to the linked item. This item may be more text, a picture or graphic, an animation or audio sound. The student has the option of going back to the first page of the program, called the "home" page, or back to the topic that he or she was originally reviewing. The student can continue through the program, or focus specifically on one topic. This computer-based instruction allows the student to interact with the program. It also is self-paced, as there is no limitation on the time that the program runs.

Design of the Program

To begin to design the program, the instructor wrote text that included main points on each virus from the

lecture. The same six categories of characteristics, epidemiology, transmission, clinical manifestation, laboratory diagnosis and treatment and prevention were used. Any of the text that would serve as a link to another page was underlined. Once all the text was written it was formatted into the program using Microsoft "FrontPage Editor", a component of the software program FrontPage 98. This software allows the creation of Web pages without the use of pre-designed templates. Using this program is very similar to producing word processor documents. FrontPage Editor lets the author format documents and add graphics and multimedia applications, without the need to know programming. Like a word processor, FrontPage Editor permits the author to see the results of his or her work rather than the codes and tags that the program uses to implement the results. FrontPage Editor makes it easier to set the color and format of the pages using dialog boxes. This helps standardize the way the Web pages will look to its users. FrontPage Editor also offers wizards that help build more complex elements such as forms, frames and database linkages. (Jones and Randall, 1997)

The text was written in a plain text file and imported into the pages using the FrontPage Editor program. Stylistic changes were made to the text once it was part of the Web page design. Each page has a separate title that

helps the user know where he or she is in the program. Hyperlinks were set up to effectively lead the user to another destination within the program. Hyperlinks are a key element to Web Page technology and its most powerful tool. Hyperlinks are advantageous in that they make it unnecessary to produce large pages of information. Shorter pages are easier to maintain and most users can lose their way if they must scroll through screen after screen of information.

The pictures and graphics to be used in the program were first scanned into the computer using a program called Adobe Photoshop 5.0 and held in a separate file. The images were then inserted into the corresponding page as each page was designed. Each new page of the program presents a graphic image representing the content of that page. Hyperlinks within the text on each page were designed to link to a glossary page that held other images more specific to the hyperlinked text. When the user clicks the cursor on a hyperlink, the program goes to the glossary page and the linked image appears in the center of the screen. All graphics and pictures are defined in this glossary as well. The user can then go back to the page that they were reviewing by clicking the cursor on the "Back" button. Some text was described in the glossary to help further clarify the content. This text was also hyperlinked to the glossary

and the appropriate definition appears in the center of the screen when chosen.

A review section was included to ascertain whether the student had effectively learned the topics. This was not intended to be a formal evaluation of the student's learning, however it gave the student a sense of which concepts were mastered and which ones needed more review. Two questions for each virus was asked for a total of ten questions. These questions corresponded to the information given in the program. The student read the question and clicked on an answer choice. If the answer was correct, a screen appeared that informed the student of the right choice. If the answer was incorrect, the program revealed the correct answer along with a brief explanation of the answer. Therefore this review let the student know which concepts were comprehended and which concepts needed more study. A printed copy of the entire program is included in Appendix B.

RESULTS

The Viral Hepatitis lesson was taught to the clinical laboratory students at The Cooper Health System through the traditional lecture form. Within a week of the didactic lecture, each student was given the opportunity to review the computer-based Hepatitis Study Guide. After each student reviewed the program, three days were given to study for a written examination. This evaluation tool has been used for the last three clinical laboratory science classes at The Cooper Health System. The questions reflect the written goals and objectives of the Viral Hepatitis lesson. The examination consists of multiple choice questions which reflect the student's ability to recall facts. An application of knowledge question asks the student to match antibody status with disease state. The examination also includes three case studies which test the student's ability to analyze laboratory data and determine the causative agent of the viral hepatitis.

The average score on the examination taken after review of the computer-based study guide was a 93.9, with individual scores of 88.3, 93.3 and 100. The past three classes that took the examination without the computer module averaged scores of 87.8, 86.4 and 81.6 respectively.

CONCLUSION

The scores on the examination taken after review of the computer assisted Hepatitis Study Guide were higher than those obtained on the examination after traditional lecture only. The higher scores revealed that the computer program was an advantage to the students and helped them conceptualize the contents of the lesson better. The students had the opportunity to review the concepts of the lesson as well as interact with the program through its Web-page design. The use of charts and graphics enhanced the learning of the subject by the clinical laboratory science students while appealing to both their cognitive and aesthetic observations.

Interaction with the computer program maintained the student's interest and kept distraction down to a minimum. The self-paced environment of the program allowed the student to spend as much time as needed on the material. The program offered a consistent learning environment in that the information provided was constant and instantly available through a "click" of the mouse.

The program reinforced the previous subject matter of the lesson given through traditional lecture. The content reflected the same concepts and was introduced in a similar format. The quiz at the end of the program presented immediate corrective feedback, something that traditional

lecture methods usually do not provide. The quiz also revealed which of the lesson concepts were mastered by the student. The student could then focus on the subject matter that was more difficult to understand when preparing for the written examination.

The students were asked to evaluate the computer study guide after they had taken the written examination. Each student believed that the computer program was helpful in preparation for the written examination. They enjoyed the interactivity of the program and the charts and graphics were excellent visual aids to the written text. The capability of the program to allow active involvement with the lesson and to use other types of learning tools was an advantage to the students.

Using computer assisted instruction as a supplement to traditional lecture is an excellent method to reinforce the goals and objectives of a lesson and to help students understand and apply the information learned. The computer assisted Hepatitis Study Guide promoted student competency, enhanced classroom lecture, presented current and accurate subject matter and allowed the instructor to assess student mastery of the lesson content. The results of this project confirmed that computer assisted instruction is an effective tool in teaching clinical laboratory science students the topic of Viral Hepatitis.

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APPENDIX A

The Cooper Health System
Center for Allied Health Education
School of Medical Technology

Lecture Topic: Medical Virology

Instructor: Diana Hullihen, B.S. , MT(ASCP)
Training and Development Specialist
Program Coordinator, School of Medical Technology

References:

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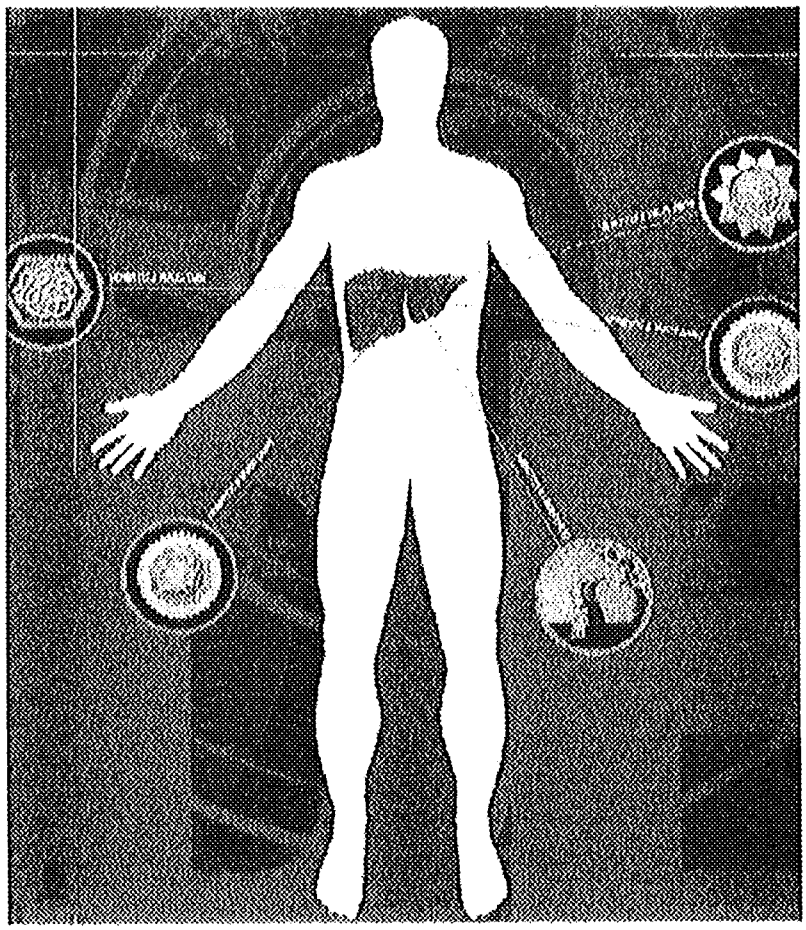
Evaluation: Three written quizzes will be given covering the five lectures. Quiz 1 will include information from Lecture 1 and Lecture 2. Quiz 2 will include information from Lecture 3 and Lecture 4. The final quiz will cover Lecture 5. These quizzes will be averaged together and the final grade will be worth 10% of the final Microbiology Didactic grade.

Lecture Rationale: To provide clinical laboratory science students with a basic knowledge of medical virology and its application to the clinical laboratory. General virology concepts and terminology will be discussed as well as newer methodologies utilized in the laboratory setting.

APPENDIX B

The World of Hepatitis



Pathology of the Liver

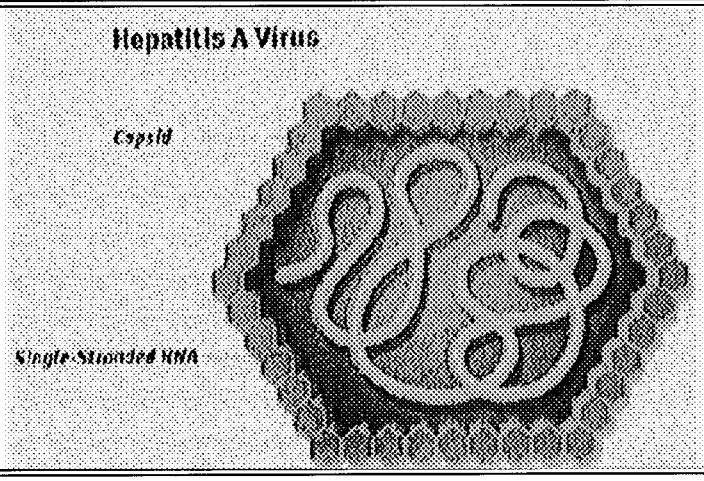
The liver is a powerhouse for the body. It functions as a storage of glycogen, iron and vitamins. It also disposes of metabolic wastes such as urea and bile. The liver metabolizes fat, sugar and proteins. The circulating proteins of the blood clotting system and the plasma proteins that regulate the blood pressure are produced in the liver as well.

When the liver is infected by a viral agent, the following symptoms may occur: fatigue, joint and muscle pain, loss of appetite, nausea, vomiting , diarrhea and fever. As viral hepatitis progresses, the liver becomes enlarged and tender and the infected individual may experience chills, weight loss and dark urine.

As the liver's ability to dispose of metabolic wastes becomes further impaired, bilirubin accumulates in the blood. High levels of bilirubin in the blood can cause the skin and the whites of the eyes to turn yellow, a condition called jaundice. Symptoms can vary from individual to individual, making it impossible to distinguish the causes of Hepatitis by clinical symptoms alone.

In the clinical laboratory there are 3 tools utilized in the measurement of liver function. Elevated test results of some or all are the first indication of liver inflammation. The three tests used by physicians in the diagnosis of hepatitis are as bilirubin, alanine amino-transferase (ALT), aspartate amino-transferase (AST)

Hepatitis A



Characteristics

Hepatitis A is a non-enveloped, ssRNA virus in the Family Picornaviridae. There is one known serotype. Hepatitis A is very stable; it has been known to survive up to one month outside the host under ambient conditions.

Epidemiology

Hepatitis A is found throughout the world. It is endemic in developing countries with >90% of adults presenting with antibodies to the virus. The prevalence of HAV antibodies reflects standards of hygiene and sanitation in the population. Hepatitis A vaccine is recommended for those traveling to areas of high infection rates.

Laboratory Diagnosis

Diagnosis of Hepatitis A is made serologically by demonstration of HAV IgM. These antibodies present at the onset of symptoms and peak 4 weeks later. HAV IgG antibodies are detectable 2 weeks after the onset of symptoms and persist for life.

Clinical Manifestations

The clinical manifestations of infection can include: malaise, nausea, fever, vomiting and diarrhea. Some infected individuals have joint pain and abdominal pain.

Transmission

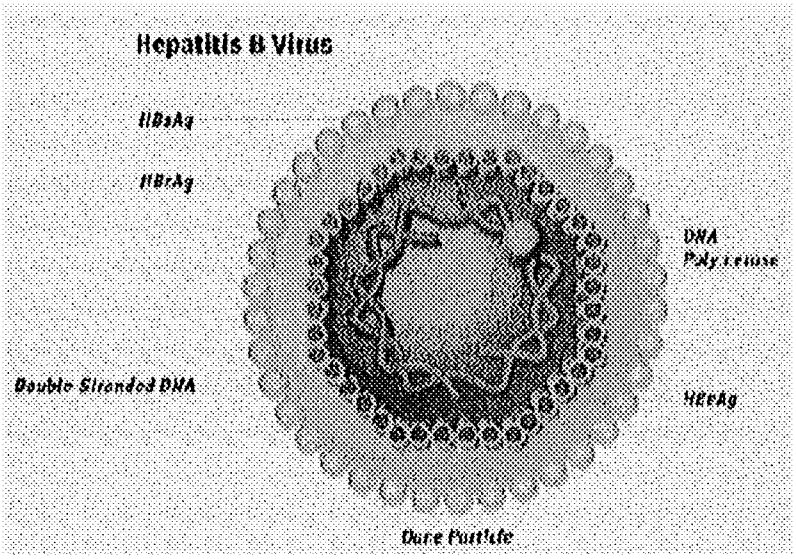
Hepatitis A is transmitted via a fecal-oral route. It is found in contaminated water or food. Infected individuals are infectious 2 - 3 weeks before onset of symptoms and approximately 8 days thereafter. The disease has an incubation period of 10 - 50 days with an average of 1 month. A high concentration of virus is excreted in stool 2 weeks before to one week after the onset of

jaundice. The virus infects the liver and replicates in the hepatocytes. Most adults present with jaundice, however most children are asymptomatic or have a mild disease. Hepatitis A is not associated with chronic liver disease or a chronic carrier state.

Treatment and Prevention

Hepatitis A can be prevented through passive and active immunization. Passive immunization involves the use of pooled immunoglobulin. If administered prior to exposure, it can reduce the incidence of Hepatitis A up to 90%. If administered within 2 weeks of exposure, immunoglobulin can prevent or reduce severity of disease. Active immunization through vaccination with inactivated virus is safe and highly immunogenic.

Hepatitis B



Characteristics
Hepatitis B is a double-stranded circular DNA virus in the Family Hepadnaviridae. The virus consists of a central core containing the core antigen (HBcAg) and a surrounding envelope containing the surface antigen (HBsAg). The core region also produces a protein (HBeAg) during viral replication which correlates with infectivity.

Epidemiology
Hepatitis B is distributed throughout the world. 5 % of the world's population is infected. It is endemic in Africa and Southeast Asia, infecting about 50% of that population. In the U.S. 1 - 1.25 million people are chronically infected.

Laboratory Diagnosis
Hepatitis B infection is diagnosed serologically through a variety of markers. HBsAg is the first serologic marker to appear following infection. The presence of HBsAg in serum indicates active infection. The presence of HBeAg indicates active viral replication and high infectivity. Anti-HBc, appearing 1-4 weeks after HBsAg, indicates current or previous HBV infection. Anti-HBe appears when HBeAg levels disappear and indicates resolution of infection. Finally, antibody to HBsAg (anti-HBs) appears after

HBsAg disappears and serves as the major protective antibody against HBV. Physicians can use an acute hepatitis profile to discern active, acute infection from a chronic carrier state.

Clinical Manifestations

The incubation period for Hepatitis B ranges from 60-180 days. Acute symptoms may present as jaundice, anorexia, malaise, vomiting and abdominal pain. Approximately 30% - 90% of young children and 2% - 10% of adults who are infected with HBV develop chronic infection. 25% of these carriers go on to develop cirrhosis or liver cancer.

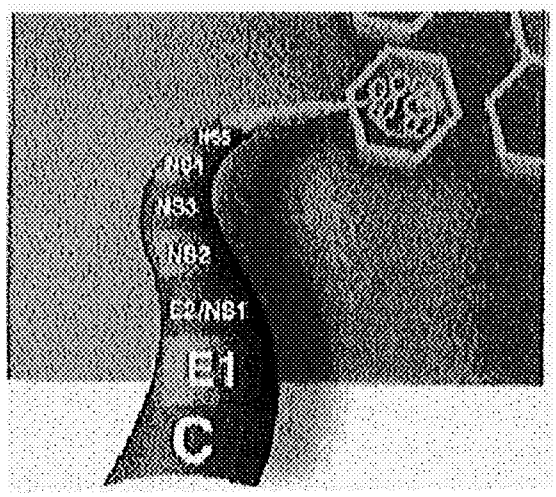
Transmission

Hepatitis B can be transmitted percutaneously, perinatally, through sexual contact or by transfusion. The highest concentrations of virus are in blood or serum; lower concentrations are found in semen, vaginal fluid and saliva.

Treatment and Prevention

Hepatitis B can be treated passively with Anti-HBs immunoglobulin or actively with vaccination. Immunomodulatory agents such as interferon and interleukin-2 can stimulate immune-mediated recognition and suppress immune-mediated liver damage. Antiviral agents have proven effective. These nucleosides serve to inhibit viral DNA and viral protein synthesis.

Hepatitis C



Characteristics
Hepatitis C is a small, enveloped, ssRNA virus in the Family Flavivirus. The virus has never been isolated in culture, however its genome is known and has been cloned to develop immunoassays.

Epidemiology
Hepatitis C accounts for a substantial proportion of liver disease in the U.S. It is a relatively common virus. Most persons infected with HCV develop chronic infection.

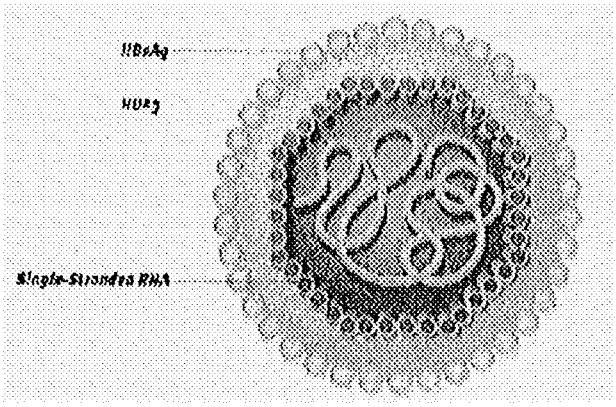
Laboratory Diagnosis
Hepatitis C is routinely diagnosed in the laboratory through serology. The presence of anti-HCV emerges in serum several weeks after onset of symptoms. Hepatitis may also be diagnosed through nucleic acid techniques, such as PCR. This technology is a good method to monitor the patient's viral load during anti-viral therapy. Vaccination is not yet available.

Clinical Manifestations
Clinically, Hepatitis C can present asymptomatically to mild. 75% of those infected progress to chronic HCV, leading to further complications in the liver. Antibody to HCV becomes detectable 2-6 months after exposure. The antibody generally persists, but may become undetectable after recovery. Some patients remain infectious, some do not.

Transmission
Hepatitis C can be transmitted through blood transfusion, parenteral drug use and other factors, including: sexual, perinatal and intrafamilial. More than 40% of HCV cases remain undefined.

Treatment and Prevention
Interferon alpha has been approved for treatment of compensated chronic HCV. There is no specific therapy approved for acute HCV infections.

Hepatitis D



Characteristics
Hepatitis D is a defective RNA agent that is dependent on co-infection with HBV for replication and expression. Hepatitis D requires HBV for synthesis of envelope protein composed of HBsAg, which is used to encapsulate the HDV genome.

Epidemiology
Hepatitis D is endemic in Mediterranean countries, Africa and South America. In general, the global pattern of HDV infection corresponds to the prevalence of chronic HBV infection.

Laboratory Diagnosis
Hepatitis D is diagnosed serologically. Anti-HDV antibody can be detected in serum; with a low titer in HDV/HBV coinfection and a higher titer in HDV superinfection. Anti-HDV generally declines to subdetectable levels after the infection resolves and there is no serologic marker that persists to indicate that the patient was ever infected with HDV. Most patients do not develop chronic infection.

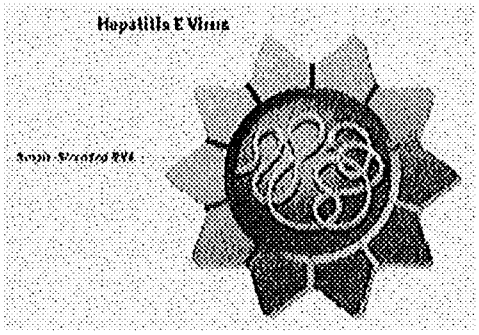
Clinical Manifestations
Hepatitis D is associated with more severe forms of HBV infection. It can be acquired either as a coinfection with HBV or as a superinfection of patients with chronic HBV infection. When HDV coinfects with HBV, the patient has a higher risk of fulminant hepatitis. During superinfection of HDV with HBV, hepatitis is usually fulminant and most patients develop chronic liver diseases with cirrhosis.

Transmission
Hepatitis D is spread by intimate contact or percutaneously. It may

coinfect with HBV or superinfect chronic HBV carriers. Sexual transmission of HDV is less efficient than Hepatitis B. Perinatal HDV transmission is rare. The incubation period ranges from 3 - 13 weeks.

Treatment and Prevention
Interferon has shown good results in clinical trials as a treatment for Hepatitis D. HBV/HDV coinfection can be prevented with either pre- or postexposure prophylaxis with HBV Ig. Prevention of superinfection with HDV depends primarily on the reduction of risk behaviors.

Hepatitis E



Characteristics
Hepatitis E is a ssRNA virus in the Family Calciviridae. Formerly known as "enterically-transmitted non-A, non-B hepatitis", it is responsible for waterborne epidemics in Southeast Asia, Western Africa, South America and Mexico. The highest rates of clinically evident disease have been in young to middle age adults.

Epidemiology
Outbreaks of Hepatitis E occur primarily in developing countries with inadequate environmental sanitation. Although Hepatitis E usually occurs in large outbreaks, HEV infection can account for more than 50% of acute sporadic hepatitis in both children and adults in high endemic areas. All cases of acute Hepatitis E in the United States have been among travelers returning from high HEV-endemic areas.

Laboratory Diagnosis
Hepatitis E is diagnosed by the presence of HEV IgM and IgG antibody. The titer of anti-HEV IgM declines rapidly during convalescence. Anti-HEV IgG persists and appears to provide limited short-term protection against reinfection. No serologic tests are currently commercially available in the US. Several diagnostic tests at the research level include, enzyme immunoassays to detect anti-HEV IgM and IgG and PCR to detect HEV in stool and serum.

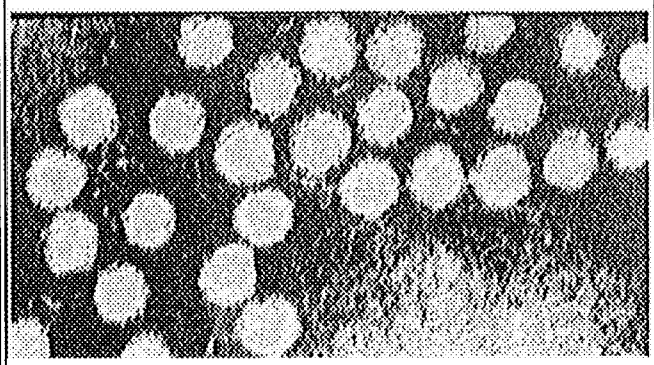
Clinical Manifestations
The incubation period following exposure to HEV averages 40

days with a range from 15 to 60 days. The disease is associated with nonspecific signs and symptoms such as; anorexia, abdominal pain, malaise and arthralgia. It is a self-limited disease with no evidence of a chronic or carrier state. There is evidence of a high mortality rate (10-20%) in infected pregnant woman due to liver failure.

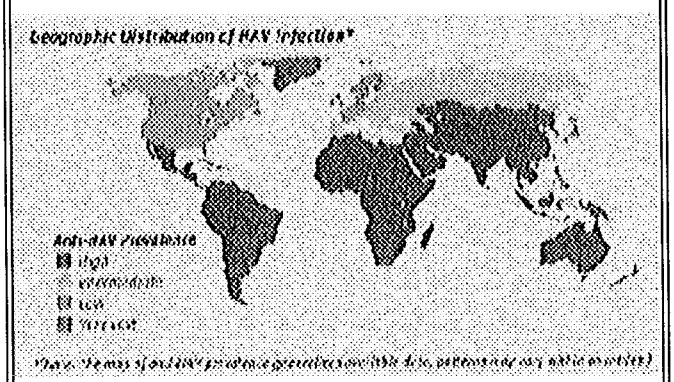
Transmission
Hepatitis E is transmitted primarily by the fecal-oral route and fecally contaminated drinking water is the most documented vehicle of transmission. In non-endemic areas, where outbreaks of Hepatitis E have not been documented to occur, a low prevalence of anti-HEV (<2%) has been found in healthy populations. The source of infection for these persons is unknown.

Treatment and Prevention
There are no clinical studies or approved drugs for treatment of Hepatitis E. Prevention of HEV relies primarily on the provision of good hygiene and clean water supplies.

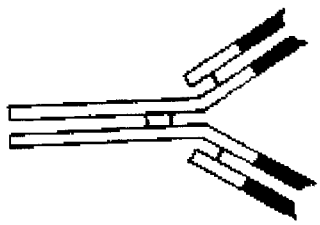
Appendix



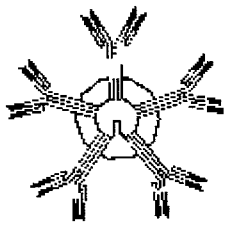
A color enhanced transmission electron micrograph of Hepatitis A particles that appear as spheres (25-28 nm in diameter).



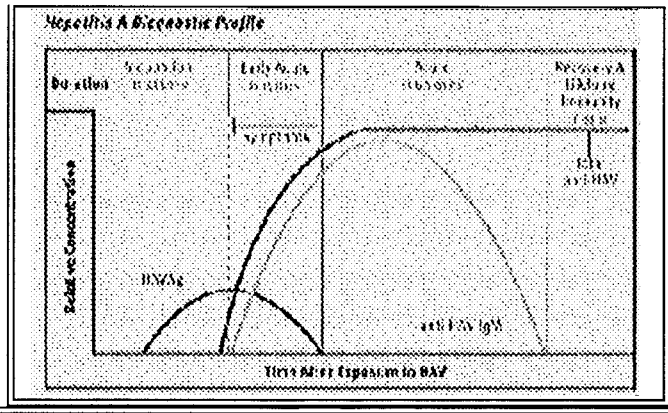
A map showing the geographic distribution of Hepatitis A Virus



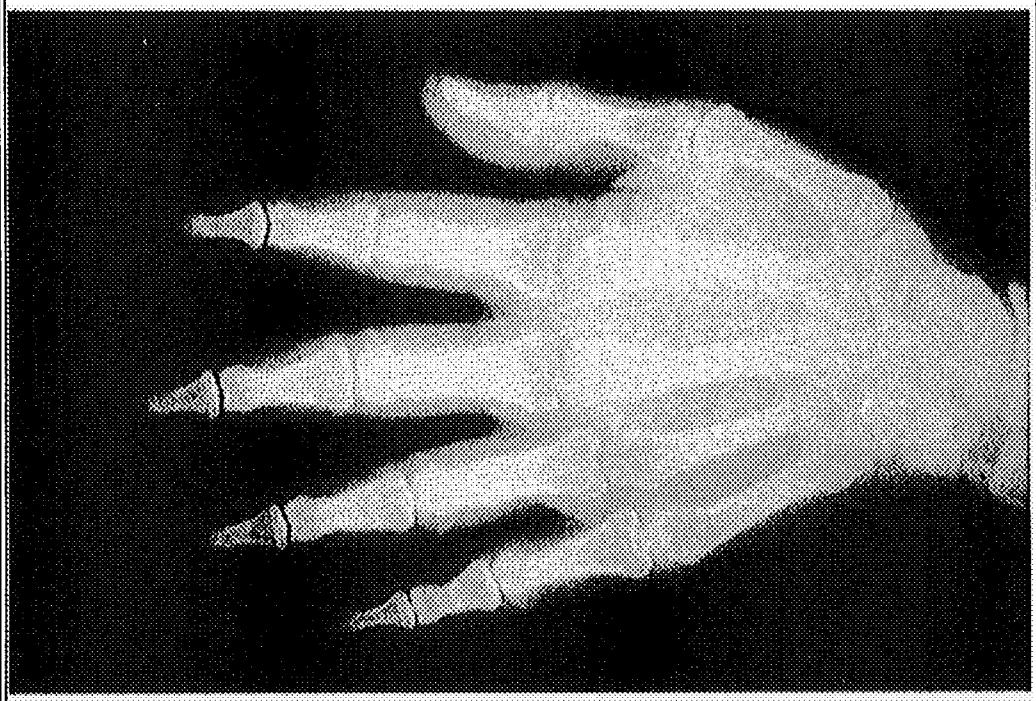
A schematic representation of an IgG molecule



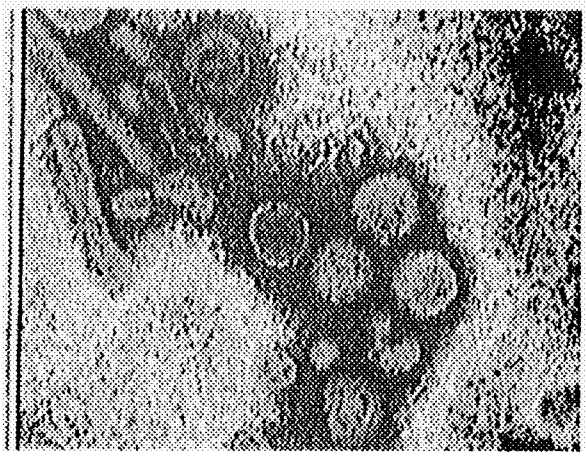
A schematic representation of an IgM molecule

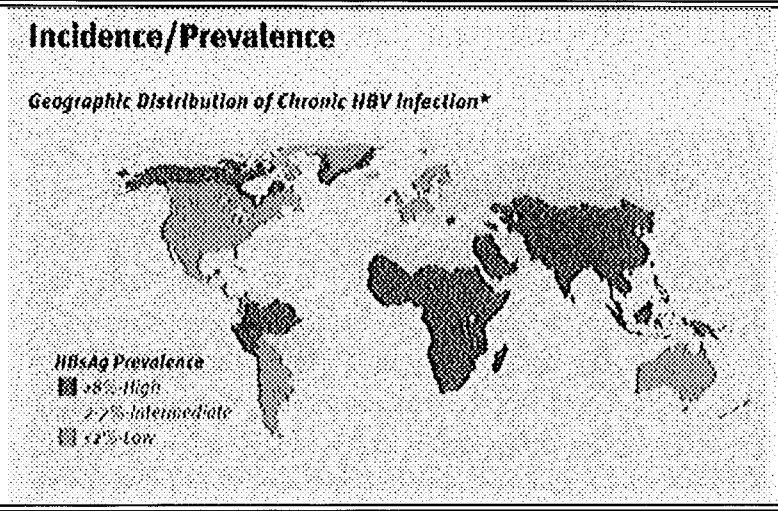


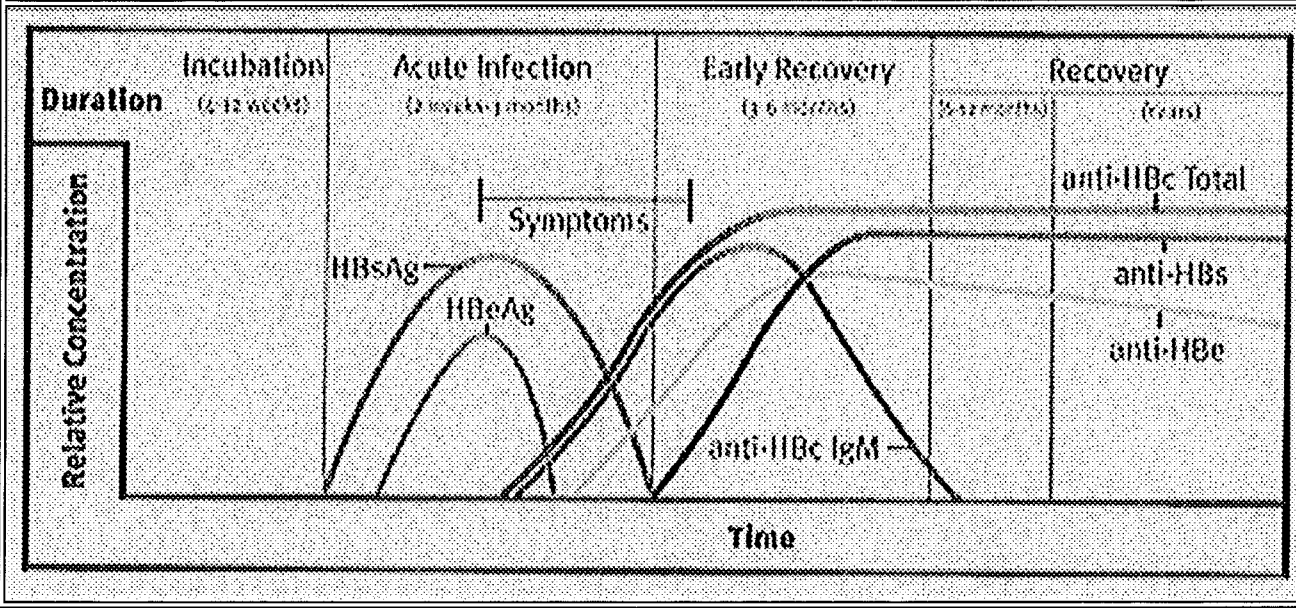
The diagnostic profile of Hepatitis A

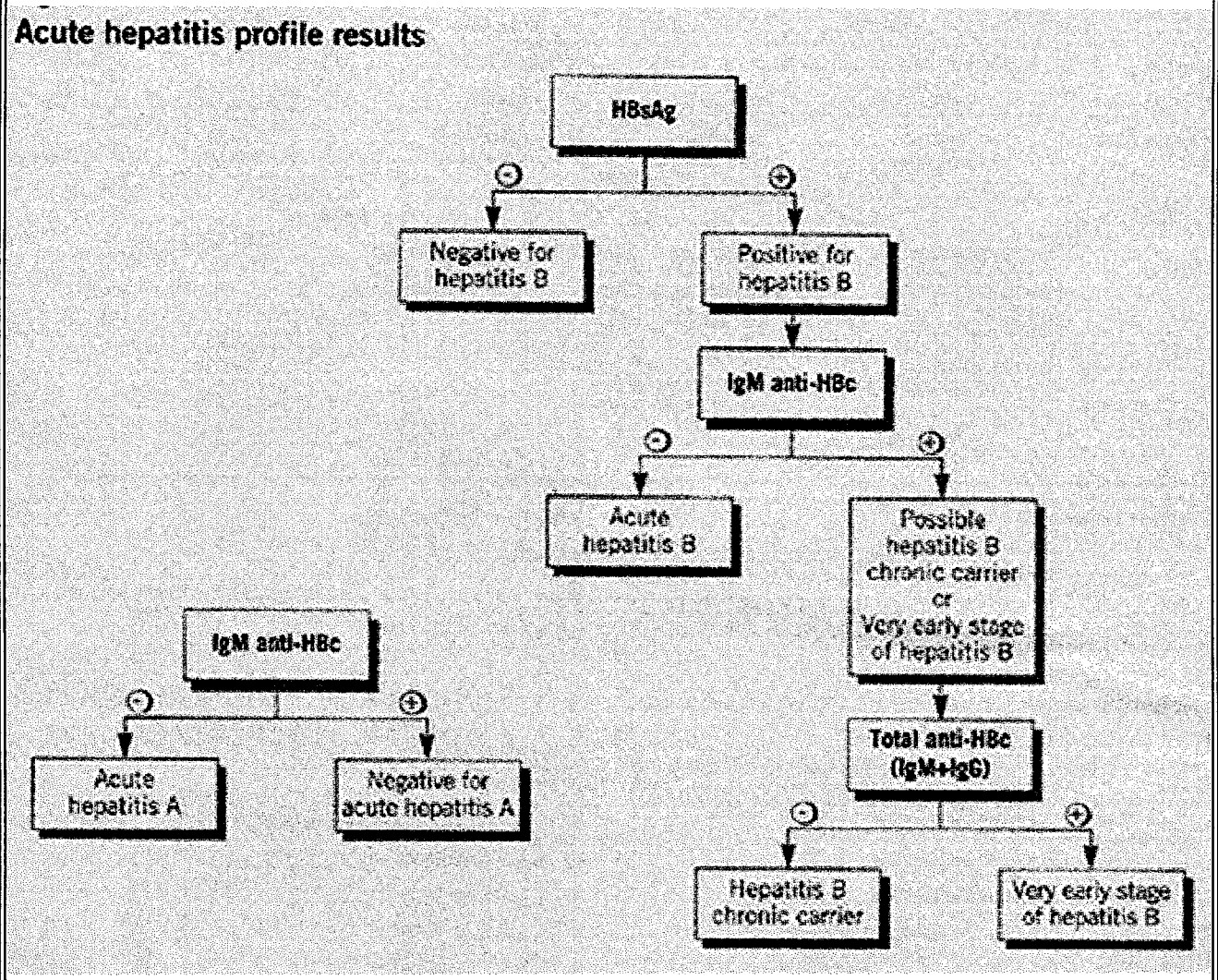


A radiograph of th showing phalange



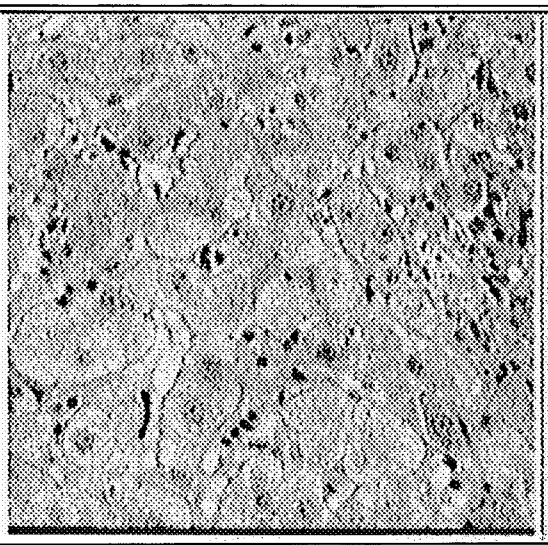
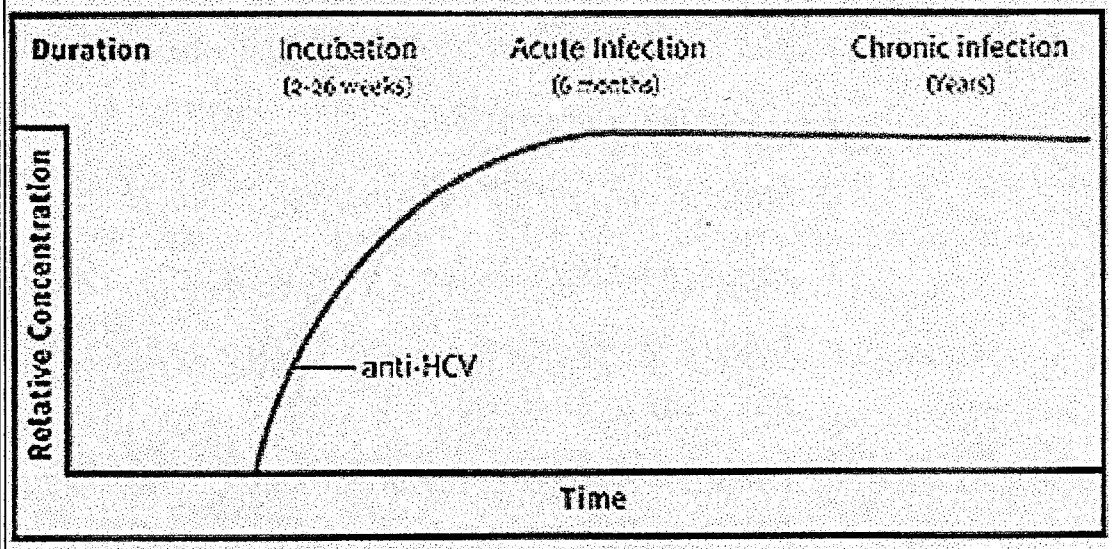
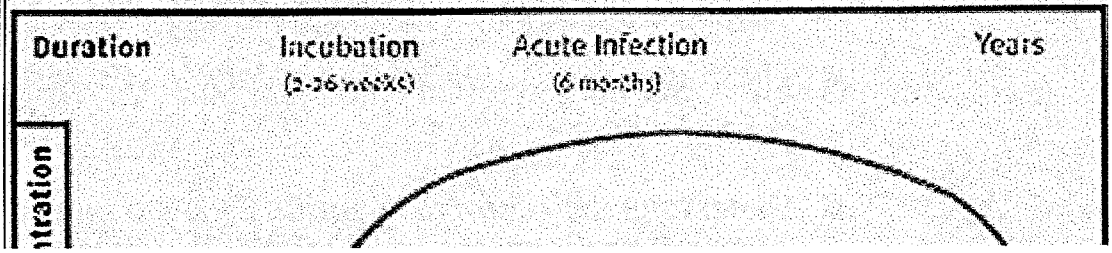

Incidence/Prevalence
Geographic Distribution of Chronic HBV Infection*
HBsAg Prevalence
>8% High
2-7% Intermediate
<2% Low

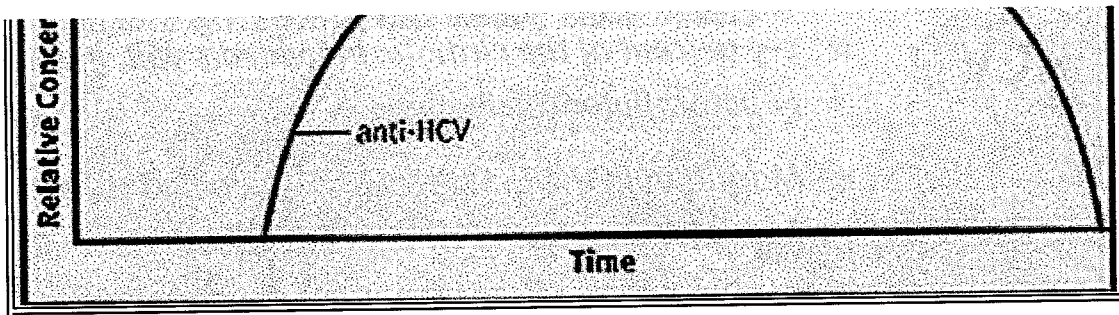

Duration
Incubation
Acute Infection
Early Recovery
Recovery
Relative Concentration
Symptoms
HBsAg
HBeAg
anti-HBc Total
anti-HBs
anti-HBe
anti-HBc IgM
Time



Percutaneously =	Effected through the skin. Applying a medicated ointment by friction, or removal or injection by needle

Perinatally =	Concerning the period beginning after the 28th week of pregnancy through 28 days following birth

Family Flavivirus=	A Family of including th encephalit i
	A photo-mic section of a H
Serological Profile in Majority of Patients With Type C Hepatitis  ***Serological Profile In Some Patients With Type C Hepatitis*** 	Hepatitis C



PCR=

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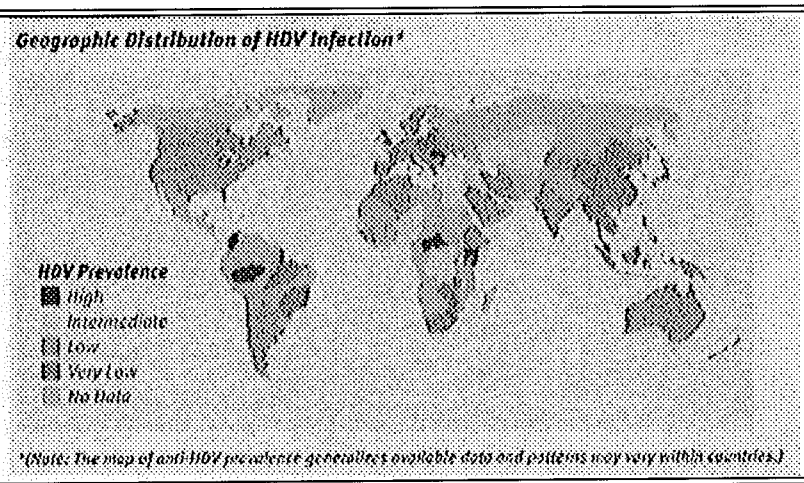
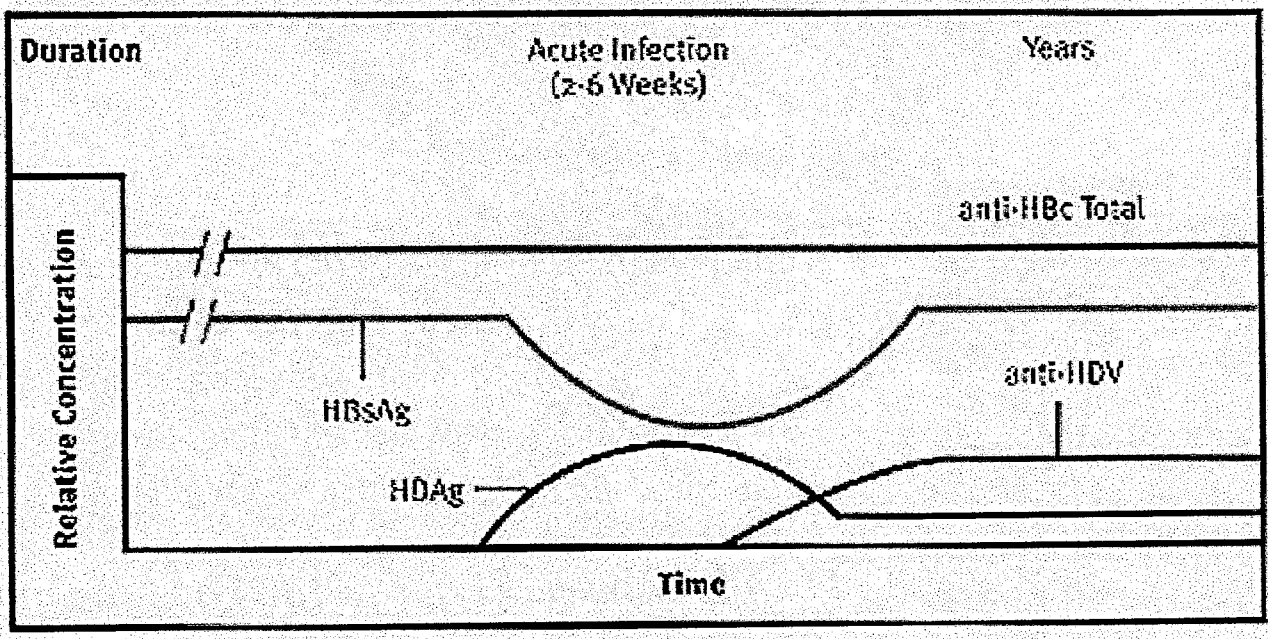
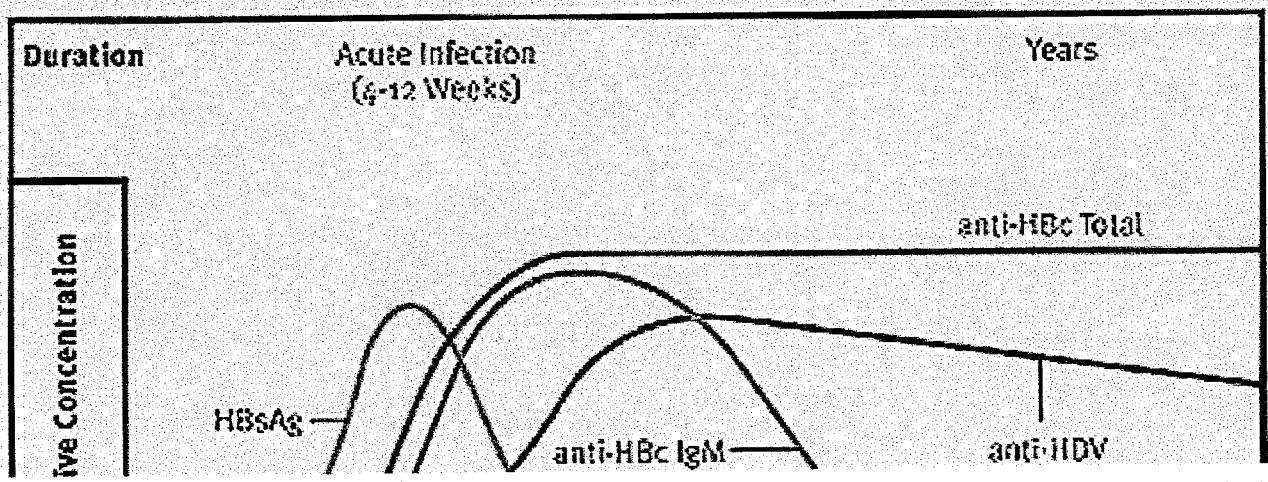
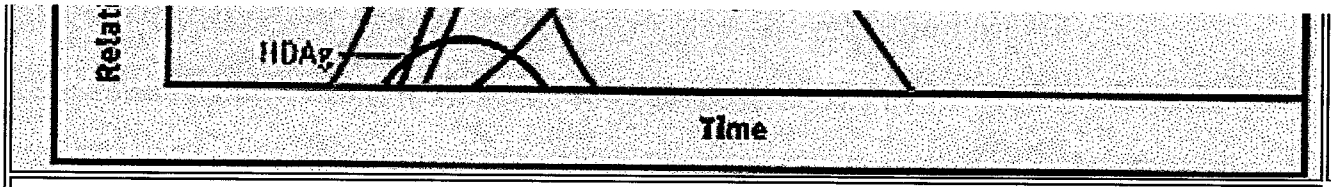


Hepatitis D Superinfection of a Chronic HBV Carrier



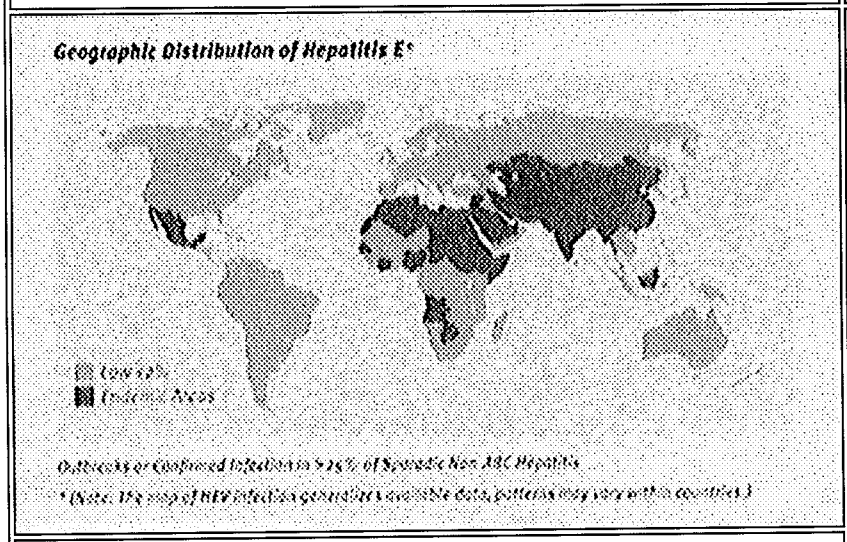
Hepatitis D Coinfection





HBV Ig = Hepatitis B Virus Immunoglobulin

Individuals at risk of HBV are IV drug abusers, hemophiliacs, hemodialysis patients, those engaging in homosexual activities, and non-monogamous individuals

Family Calciviridae=	A family of small RNA viruses including Norwalk, Picornavirus, and Parvovirus.
	A map showing the geographic distribution of Hepatitis E Virus
	Clean Water!!!

1. Which of the following is the mode of transmission for Hepatitis A?

   a. percutaneous

   b. congenital

   c. transfusion

   d. fecal-oral

2. Which of the following describe a clinical course associated with Hepatitis A?

   a. chronic infection

   b. abrupt onset

   c. presence of Hepatitis B surface antigen in serum

   d. transmitted sexually

3. What percentage of the world's population is infected with Hepatitis B?

   a. 25%

   b. 10%

   c. 5%

   d. 50%

4. Which of the following is NOT a mode of transmission for Hepatitis B virus?

   a. needlestick

   b. sexual contact

   c. transfusion of platelets

   d. contaminated water

5. What percentage of infected individuals will go on to chronic infection

with Hepatitis C?

a. 75%

b. 100%

c. 25%

d. 50%

6. Which of the following statements regarding Hepatitis C is TRUE?

a. Hepatitis C is an enveloped ssRNA virus

b. Hepatitis C can be transmitted through blood transfusion

c. Hepatitis C is routinely diagnosed by serological methods

d. All of the above

7. Hepatitis D can be acquired as

a. a coinfection with Hepatitis B

b. a superinfection with Hepatitis B

c. both a and b

d. neither a nor b

8. Hepatitis D is

a. a defective RNA agent requiring Hepatitis B

b. transmitted via fecal-oral route

c. associated with mild infection

d. a member of the Family Flavivirus

9. Hepatitis E is

a. transmitted via fecal-oral route

b. can account for more than 50% of hepatitis in high endemic areas

c. both a and b

d. neither a nor b

10. The normal incubation period for Hepatitis E averages

a. 15 days

b. 40 days

c. 60 days

d. 90 days

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This web was created using Microsoft FrontPage 98.

It is best viewed using Microsoft Internet Explorer 4.0 or Netscape Navigator 4.0.

c. April 1999

General concepts and graphics were used from the following sources:

1. Abbott Diagnostics Educational Services. Hepatitis Learning Guide, 1998.

2. Centers for Disease Control and Prevention. "Epidemiology and Prevention of Viral Hepatitis A to E: An Overview", 1998.

3. Schwartz, J. and Stellato, K. "A Lesson in the ABC's of Hepatitis", MLO, January, 1997.