

Final Report

**Digitizing radiology films using flat-bed scanner
and produce a multimedia digital teaching file
in musculoskeletal radiology**

Digital Radiology Teaching File – case study in musculoskeletal radiology

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Abstract

Digital images have been long established in radiology department. Despite this, most radiology teaching films has been film-based. The drawback of this conventional system is that it consumed space, only one user can use at any one time and expensive. Analogue radiology films were digitized using flatbed scanner with transparency adaptor and digital camera. Digital-based teaching files using personal computer (PC) should be encouraged as this will reduce space for storing, can be distributed without much cost, inexpensive, many users can use at the same time and others can use even though at different place using the internet. The teaching file was prepared using HyperText Mark-up Language (HTML) as this can be used using any web browser. It is now available in University Sains Malaysia, Kelantan Campus Branch (USMKCK) intranet.

Keywords: Digital, teaching file, radiology, internet

Introduction

Conventional film-based has been used for long as a form of teaching radiology. With the explosion of information technology and availability of radiology images already in digital form, people are reevaluating the format. Mainly the academic departments

originally used internet. However, with the availability of World-Wide-Web (WWW), the interest of using this format in the public has gained momentum. This is further evidenced by our country aggressively pushing information technology (IT) as a national agenda with the setting up of Multimedia Super Corridor. The documents can contain text, images, audio or video and can be displayed on any computer anywhere in the world with an internet connection.

Our campus branch recently has installed networking with many terminal points and is called USMKCK intranet. The ability using the browser as part of radiology education has great potential. Some pioneers in this setup are University of Washington Webserver, USA and Visible Human Project, National Library of Medicine, USA. The aim of this paper is to share the experience how radiology images are digitized cheaply and the development of digital teaching file using musculoskeletal radiology as a case study.

Methods and result

Hardware

The analogue radiology images are scanned using either flatbed scanner Mustek MFS-6000CX with transparency adaptor or Canon Powershot 600 digital camera. A Wearnes 80486-microprocessor-based PCs with 28 MB RAM was used and all images were viewed on a 14-inch VGA digital colour monitor with a dot size of 0.28 inch of 640 by 480 pixels.

Software

Gray images of 256 shades were manipulated using Adobe Photoshop 3.0 after the images are scanned using a Picture Publisher or Photo impact software's with the

flatbed scanner and digital camera respectively. The images range between 150 to 100 dpi resolution. The resolution was acceptable viewing purposes. These images are equal and if not better than the images in books, journals or other media. The size of each image range from 50 to 100 kilobytes and saved in JPEG lossy compression format. This format was chosen as it can be saved in very small size. The cases are written using HTML Assistant Pro - Freeware in the following format:

a) 10 unknown cases are listed on the first page (fig. 1)

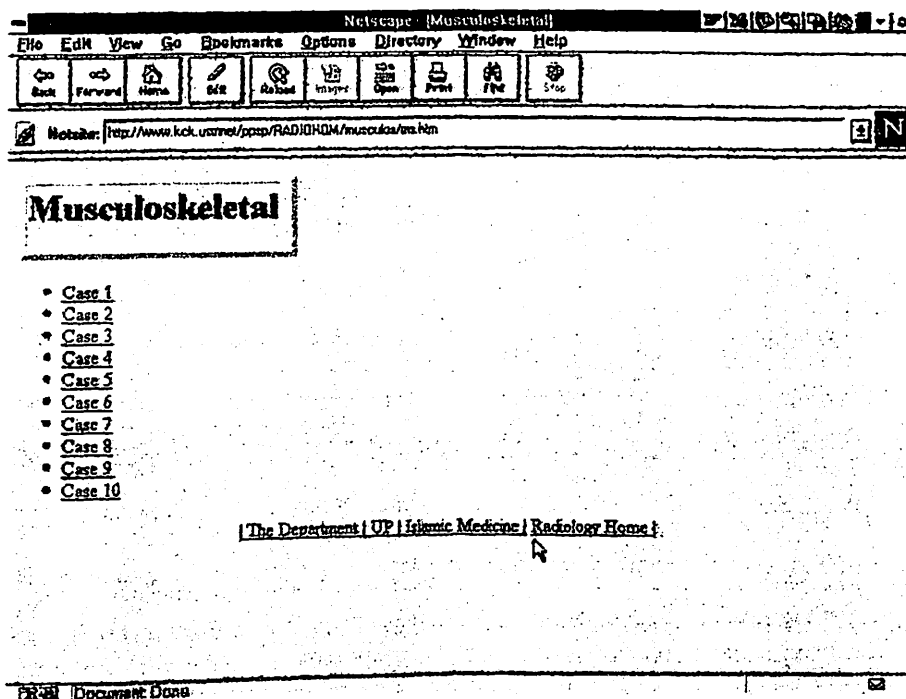


Figure 1: This page of the teaching file lists the ten cases and each named as case number

b) Image of each case are shown with a short clinical summary (fig.2)

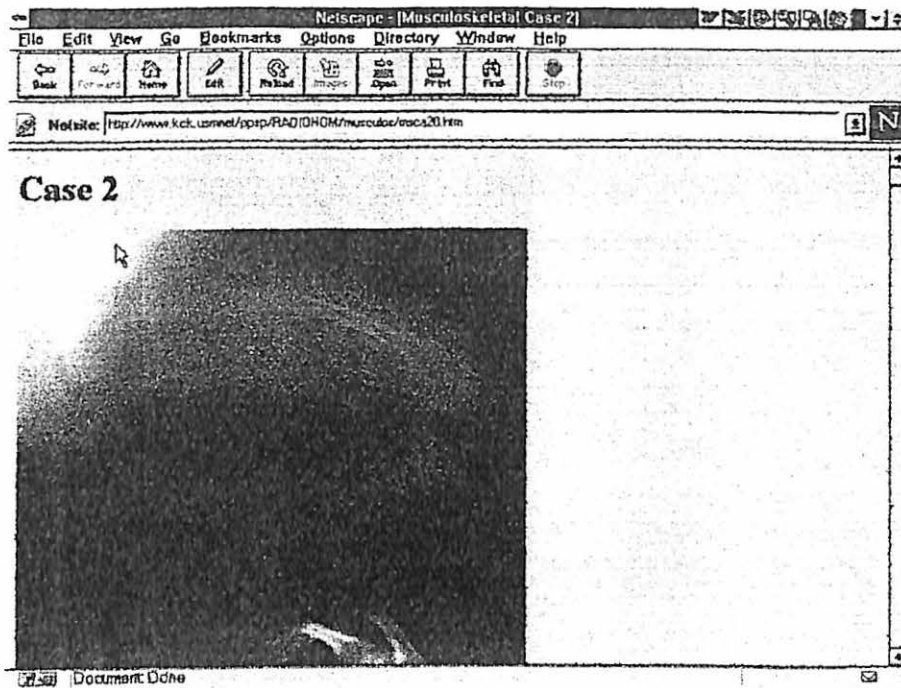


Figure 2: This page of the teaching file shows the radiology image

c) Answers are given with description of the image and diagnosis given (fig.3)

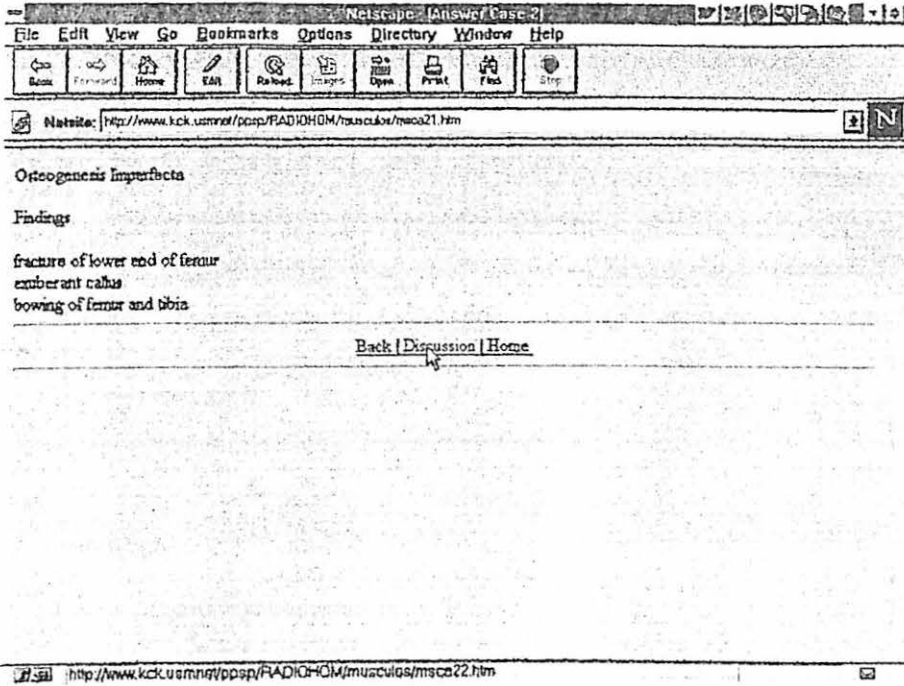


Figure 3: This page of the teaching file gives the findings and the answer of the image

d) A detail discussion is given about each case and many more images can be looked at in other pages (fig. 4)

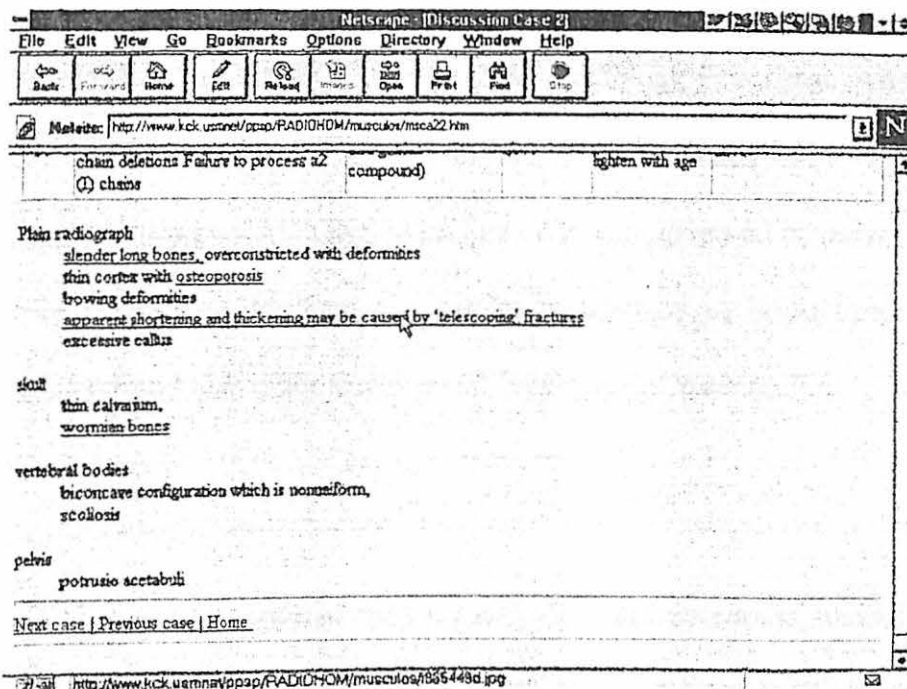


Figure 4: This page of the teaching file gives a detail description of the disease and relevant images can be looked at

Ten diseases of musculoskeletal system were chosen. A total of 85 cases were obtained who were admitted in Hospital USM from 1 January 1990 to 31 December 1995. The most tedious part is pulling out the radiology films from the film library of the Department of Radiology and selecting the relevant films from the envelopes. The source of the data was conventional analogue films so all images have to be scanned with a total number 256. The film formats and densities varied, so the scanning parameters had to be optimized to obtain images of high quality. This is important to make it suitable to musculoskeletal radiology. The images are then cropped to show

the pertinent signs and scaled down or magnified accordingly. Brightness, contrast and gamma had to be adjusted to demonstrate the findings.

This teaching file can be read using any browser in the market irrespective of what platform they are. Examples in the market are Netscape 4.0 or Internet Explorer 4.0. It can be browsed in USMKCK net in USM Radiology Homepage with the following address of Uniform Resource Locator (URL):<http://10.5.10.10/ppsp/RADIOHOM/ms.htm>. We were given an abundant disk space in this server and the teaching file can be updated by us at anytime. Our postgraduate students and also other teaching staff now use the teaching file.

Discussion

The images are kept in PC neatly in the hard disk. It could be copied, shared and distributed easily. The images are of good quality for viewing and of equal and sometimes better than that seen in textbook or journal. However it is not advised to use it for diagnosis in the above format as higher resolution is required. Expensive dedicated radiology films digitizer is available in the market with very good resolution. However the cost is very expensive of about RM 150,000. The flatbed scanner and digital camera were bought at only RM 3,000 each.

File compression protocols that return the exact original file upon decompression are often referred to as lossless compression because there is no loss in the data file. Examples of this are PCX, IMG, GIF, TIF, BMP and MSP. However it can only compress an image file by a factor less than two. 'Lossy' compression protocols use procedures that compress an image file by a factor of 10 or more and then decompress the file back to a form that is close to the original, but not identical to original. Although some data loss has taken place, the restored image is practically

visually indistinguishable from the original (1). Example is in JPEG format. Size is important, as it is a major factor in image transmission.

Softwares used were all available free in the internet or as part of the bundle with the hardwares bought. Using HTML Assistant Pro - Freeware editor was quite a task initially as knowledge using HTML tags was required. Presently there are many HTML editor programs that don't require the user to be proficient in HTML. There are referred to as WYSIWYG (What You See Is What You Get) editors. Examples are Microsoft FrontPage and Netscape Gold 3.0 but of course with a price tag.

Education in medicine has evolved a lot since the introduction of PC and WWW. The advantages are it being simple and fast method of information and image distribution and available around the world at minimal cost. Our teaching file is an example and now being used for undergraduates, postgraduates and other staff in our campus branch. These are used as education and also for interest. It has the advantage over conventional film library as it is interactive, cheap, can be looked at any time and occupy little space. All cases have followed our postgraduate examination format, presenting a short clinical summary with the images before revealing the answers and discussion. More sophisticated format interaction is possible but this requires a high degree of programming (2).

Any computers connected to the server can access the teaching file using local area network (LAN). At the moment it cannot be accessible from internet. It is hope this can be done in the near future. When this happen, any students can access the teaching file using the WWW.

Conclusion

We hope with explosion of using IT in MSC and the rest of the country, more and more education materials will be developed in digital form so that it is more accessible throughout the institution, country and globally.

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