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**ORIGINAL ARTICLE**

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## **Clinical Radiological Conferences Outside the Radiology Department: Can This be Done Better?**

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### **ABSTRACT**

**Objective:** To improve the workflow of clinical radiological conferences held outside radiology department, where a radiology workstation is unavailable.

**Methods:** Instead of printing out hardcopy of the representative images or saving them into mobile storage device, we used our department's notebook computer to connect to the hospital intranet by wireless networking and browsed the images stored in an advanced image server with pre-processing and remote accessing functions. For examinations performed in other hospitals, we used the electronic patient record system.

**Results:** Improvement in efficiency and cost reduction were achieved as there was no need to process the images and print out hardcopy. Patient privacy protection was enhanced as mobile storage device was not involved. Security was ensured as only computers previously registered and approved by the information technology department were enabled to connect to the hospital intranet and authentication was still required for connecting to the intranet and logging into the server. Real-time advanced post-processing functions, such as 3D volume-rendering and multiplanar reformatting, were available and could facilitate clinical decision making (such as preoperative planning). Discussion on imaging performed in other hospitals before patient transfer to our hospital was also facilitated.

**Conclusion:** Adopting the electronic network-based workflow for clinical radiological conferences held outside the radiology department can save money and time, enhance patient privacy protection, and improve user satisfaction compared to traditional means. It does not entail storing captured images into mobile storage device or printing hardcopy.

**Key Words:** Computer communication networks; Medical informatics

## **中文摘要**

### **於放射部門以外的場地舉行臨床影像研討會：有改善空間嗎？**

**陳嘉智、朱昭穎、朱卓文**

**目的：**於放射部門以外沒有影像工作站的場地舉行臨床影像研討會的情況下，探討如何改善工作流程。

**方法：**我們不再把代表性圖像打印或存放在流動存儲設備中。取而代之，我們使用本部門的手提電腦，通過無線網絡接駁醫院內聯網，然後通過有前處理及遙距接駁功能的圖像伺服器瀏覽圖像。如

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果檢查在其他醫院完成，則使用電子病歷紀錄系統。

**結果：**由於無須處理圖像及打印圖像，因此可提高效率及減省成本。病人的私隱亦因為未有牽涉流動存儲設備而受到保障。只有預先經資訊科技部門登記以及認可的電腦才可接駁醫院內聯網，而登入醫院內聯網及圖像伺服器亦需要密碼認證及識別，此舉可保障病人資料安全。另外有實時後處理功能，如立體影像及多平面影像重建，從而加快了臨床決策（如術前規劃）。討論病人轉介到本院之前已在其他醫院完成的影像檢查，亦變得更便利。

**結論：**在放射部門以外的場地舉行臨床影像研討會，與傳統的方法比較，採用電子網絡的工作流程可以提高效率及減省成本，保障病人的私隱，並提高使用者的滿意度。這方法無須把圖像存放到流動存儲設備並避免打印片子。

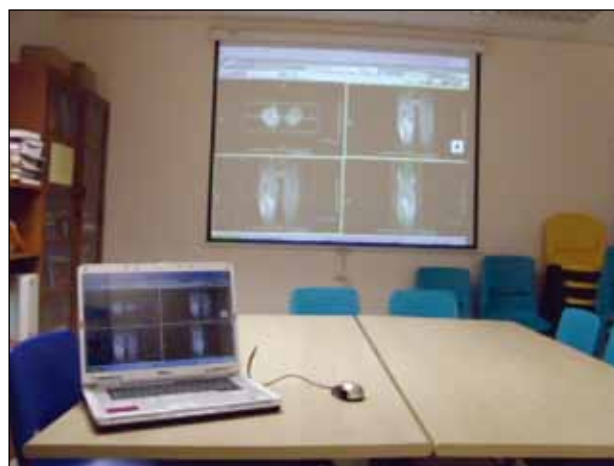
## INTRODUCTION

Multidisciplinary team meetings are becoming more and more important in modern patient care. Members of the team come from various clinical specialties, including clinicians from the primary specialty of the patient, clinical oncologists, pathologists, and last but not the least, clinical radiologists. Discussion on radiology findings has become one of the most important components, if not the single most important one in such meetings. Holding such meetings in the conference room of the radiology department is an ideal option as radiologists are familiar with their own settings. Radiologists can make use of the Radiology Information System and picture archiving and communication system (PACS) workstations to demonstrate the images to other members of the team. Due to lack of time slots and venue for discussion, sometimes, it is not feasible or practical to hold such meetings in the radiology department. Occasionally therefore, some multidisciplinary meetings have to be held outside the radiology department, usually in the premises of the primary specialty of the patient. However, workstations for viewing radiology images such as PACS or Clinical Management System are lacking in these venues and there is no network socket for connection of a computer to the intranet of the hospital. Multidisciplinary Paediatric Oncology Meeting held in meeting room of The Lady Pao Children's Cancer Centre provided one such example (Figure 1). Before the adoption of new workflow, radiologists needed to select and manipulate the representative images into the required windowing, magnification, reformatted planes and layout, and print out on films or papers. Alternatively, they could save them into mobile storage devices such as USB (universal serial bus thumb drive) and display the stored images using a computer in the destined venue. Both methods were time-consuming. Currently, fewer and fewer films were being printed under the newly implemented

filmless project in our hospital. Printing films entailed extra expenditure as images were not routinely printed on films unless requested on an individual basis. Carrying mobile storage devices runs the risk of losing them and leaking confidential patient privacy to an unauthorised third party leading to attendant legal consequences. To increase efficiency, reduce the cost and time spent on preparation of the multidisciplinary team meeting and enhance patient privacy, we used the existing network connections and computer equipment to transform the workflow of the meeting.

## METHODS

Wireless local area network (WLAN) function was available in the notebook computer owned by our radiology department. We first applied for authorisation for this computer to connect to the intranet of Hong Kong Hospital Authority (HKHA) by WLAN, through the Information Technology Department of our hospital. Prior to the meeting, we sent the Digital Imaging and Communications in Medicine (DICOM) data of the



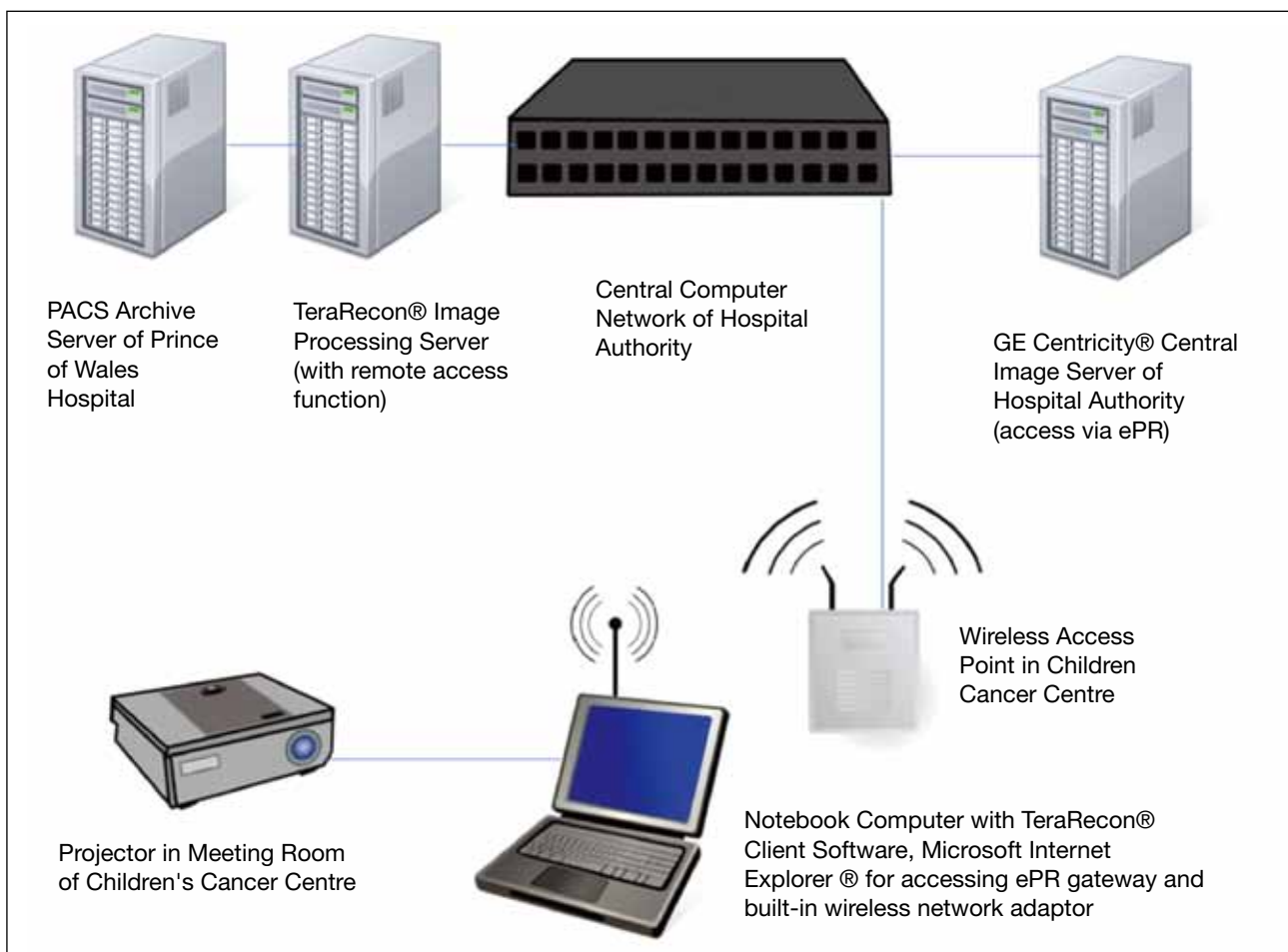
**Figure 1.** Setup of the electronic network-based clinical radiological conferences in the meeting room of The Lady Pao Children's Cancer Centre.

radiological studies to be discussed from the PACS storage server via the network to TeraRecon® Server, an advanced image pre-processing server allowing remote access. Only the client software bundled to the server was installed in the notebook computer and no patient data were stored in its hard drive. We brought along the department notebook computer to the conference venue and established the wireless network connection between this computer and the intranet of HKHA. We launched the client viewing software and logged into the server to browse the stored images. For those patients having preliminary radiological studies before transferred to us from other hospitals for further management, we made use of the Centricity Viewer (by GE Healthcare®), which was the universal image viewer among different hospitals under the HKHA. This enabled us to show the images through the electronic patient record system, which could be accessed by Microsoft Internet Explorer® (Figure 2). Film digitisation was performed for some radiology

examinations (e.g. films of computed tomography scans performed in private clinics / hospitals) to improve display quality, the digitised data were uploaded to the image server prior to the conference.

## RESULTS

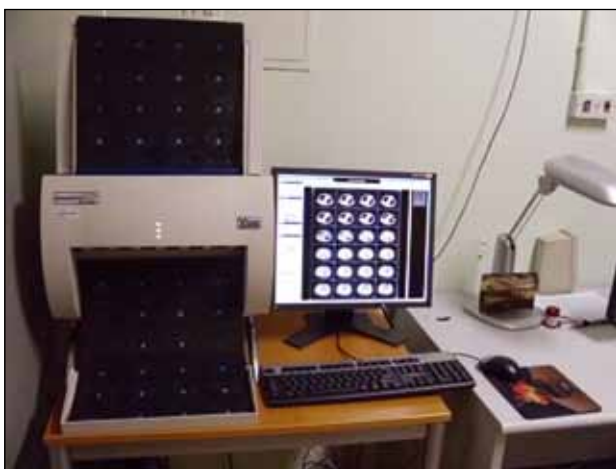
By adopting the new workflow, radiologists no longer needed to select and process the images into the required presentation and print them on films or papers. Time and money were saved. The new workflow also eliminated the need to carry mobile storage devices containing patient data and risk of losing them. Patient privacy protection was enhanced. Moreover, radiologists did not need to spend extra effort anonymising the patient identities (a requirement of the HKHA if patient information was to be stored in mobile personal storage device). Only authorised personnel could connect the computer to the hospital intranet and image server thus ensuring security. This was because only computers owned by the hospital and



**Figure 2.** Workflow of electronic network-based clinical radiological conference.  
Abbreviations: PACS = picture archiving and communication system; ePR = electronic patient record.



**Figure 3.** Screen captures of TeraRecon® Client showing volume-rendered and multiplanar reformatted images of a multislice computed tomographic scan.



**Figure 4.** Film digitiser for digitising films before conference.

previously registered and approved by the information technology department were allowed to connect to the hospital intranet, whilst authentication was still

required before connecting. Real-time advanced post-processing functions such as three-dimensional volume-rendering, multiplanar reformatting (Figure 3) and positron emission tomography–computed tomography fusion were possible, which could facilitate clinical decision making. Discussion of imaging performed in other hospitals before patient transfer to our hospital was also facilitated, as the need to request, trace, and transfer hardcopy radiological films was eliminated. For patients who had previous imaging in private hospitals or imaging centres, we used our film digitiser (Figure 4) to scan the films after obtaining the due consent. The digitised electronic images were sent to our image server. At the time of the conference, we could show the digitised images of such previous scans as well as the images obtained in our own radiology department by using the DICOM format (Figure 5). The display quality of the digitised images was also superior to that produced by a visualiser. Furthermore, the attending radiologist only needed to bring the notebook computer



**Figure 5.** Screen captures of TeraRecon® Client showing side-by-side comparison of digitised image of previous private imaging and post-treatment follow-up imaging in Digital Imaging and Communications in Medicine (DICOM) format done in our hospital.



**Figure 6.** Wireless Access Point in The Lady Pao Children's Cancer Centre.

to the conference venue rather than carrying heavy film packets involving multiple imaging modalities and multiple patients.

## DISCUSSION

It is a tradition for clinical radiologists to use film visualisers to project images on film to a screen, in order to discuss radiological findings in a multidisciplinary team meeting. With the introduction of PACS, filmless workflow, and the increase in availability of computer workstations in radiology departments of modern hospitals, more and more hospitals are shifting to electronic format. This facilitates presentation of radiological images in multidisciplinary team meetings. However, it can be difficult and expensive to setup such computer workstations and associated equipment outside radiology department. Therefore, holding multidisciplinary meetings becomes a great challenge

if it is not conducted in conference room within the radiology department. Adopting the traditional film visualiser is one option but the pre-selected images are of fixed presentation and real-time manipulation of the images is not possible. Moreover, such methods of presentation may not meet the needs of the clinical users in this era of modern medicine. With the development of new technology, browsing radiological studies is no longer restricted to dedicated viewing workstations with high specifications. It is now possible for users to use any ordinary computer connected to a network to display and manipulate high-quality radiological images with advanced post-processing functions. In such system, the data have been pre-processed in a remote server according to instructions of the users and only the results of the post-processed data instead of the whole volume of the DICOM data are transferred to the local viewing computer.<sup>1</sup> If network socket is not available for connection of the concerned computer in the conference venue, any WLAN can be adopted if the venue is within range (Figure 6).<sup>2</sup> As a result, without the need to invest additional resources to install expensive dedicated radiology workstations and laying the required network cables, holding interactive multidisciplinary team meetings outside radiology department becomes feasible. This workflow was adopted from November 2010 to December 2010, and we perceive the quality of conference with the above setup is comparable to that held in the conference room of the radiology department. However, in order to provide a more spacious and comfortable discussion environment, we made arrangements with the involved clinical specialties to reschedule the meeting to the conference room of our radiology department. At the same time, radiologists can illustrate imaging studies by PACS which they are familiar with.

In conclusion, after adopting the electronic network-based workflow for clinical radiological conferences held outside the radiology department, money and time were saved, patient privacy protection was enhanced and user satisfaction improved when compared to traditional means of storing captured images into mobile storage device or printing out films.

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