Implementation of a Dynamic Teaching File Using the Software Application Microsoft OneNote in an Academic Neuroradiology Division

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Abstract

Background: As a neuroradiology section it came to our attention that each member of our group was independently saving cases encountered during daily practice in their own personal manner. This wealth of information was essentially being underutilized as it was not readily available among the other members of the team. The need for a teaching file to collectively archive all these cases brought on the idea of developing a teaching file using Microsoft OneNote.

Methods: Microsoft OneNote is a note-taking program that provides access using an online portal or free-to-download mobile application. The program allows the user to create unlimited folders and subfolders that can be subclassified at the group's discretion. In our case we have organized it according to etiology of the condition, i.e. infectious, congenital, etc. We propose the development of a template for the purposes of maintaining uniformity. The template includes space for demographic information, symptoms, four illustrative images, imaging findings, differential diagnoses, pearls and pitfalls, and embedded multimedia.

Results: Ultimately, a dynamic, customizable, and continually- expanding teaching file was created to suit the specific needs and objectives of our department. As part of their neuroradiology rotation, medical students and visiting trainees are encouraged to contribute to the file.

Conclusion: The potential applications of the Microsoft OneNote program as a teaching file, as well as its design flexibility and the ability to access the file from virtually any mobile device represent a truly innovative take on radiologic teaching files. The format, classification and customization options can adapt to the department's individual needs.

Keywords: TEACHING FILES, RADIOLOGY, MOBILE APPLICATIONS, ARCHIVING

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Introduction

As a neuroradiology section in a high-volume, high-complexity academic institution, it came to our attention that each member of our group was independently saving illustrative or interesting cases encountered during daily practice in their own personal manner, be it within a Microsoft PowerPoint presentation or harbored within an individualized subfolder in the radiology picture archiving and communication system (PACS). However, this wealth of information was essentially being underutilized as it was not readily available to the other members of the team, radiology trainees or the medical students rotating in our division. The need for a teaching file to collectively archive all these cases brought on a search for the new frontier in image storing and sharing. The requirements for a robust teaching file that meets the demands of an imaging department with a substantial teaching commitment include ease of use, straightforward submission process, ability to

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support several users, searching capabilities to access cases and no added costs (1).

Several groups have explored the integration of teaching files to their native PACS (1-3). Many of the newer radiology PACS offer options to directly transfer cases into personal folders for the purposes of building an individualized teaching file within the system. The attraction of such a process lies particularly in the ease of case submission. However, while convenient, this effort was ultimately lost if an individual transferred out of the institution or if the PACS system was changed or updated. Also, it was not immediately available to the medical students or to a variety of trainees outside the reading room without granted access to PACS. Furthermore, this modality lacks compatibility across handheld devices and different platforms (4). Rojas, et al. explored the use of OsiriX imaging software for the creation of a teaching file of interstitial lung disease cases (3). The process included handpicking illustrative thoracic imaging studies and then anonymizing and exporting the exams, via a removable medium such as an external hard drive, to the teaching file server within OsiriX (5). Additionally, relevant clinical information and pulmonary function tests had to be extracted from the electronic medical record, saved as a Microsoft Word or Microsoft Paint document and then transferred along with the images. Microsoft Paint was then used to remove any additional patient identifiers from the exam. At this point the Microsoft Word documents required conversion to iWork Pages (Apple Computer) documents in order to be compatible with the hyperlink function that would ultimately join the case in OsiriX with the corresponding clinical information (5). While relatively labor intensive, the end result is a very complete and robust teaching file. A particular advantage of such a technique includes the ability to transfer entire CT examinations, which ultimately translates into the ability to scroll through the whole exam rather than choosing key illustrative images. Similar attempts to streamline the transfer of images from PACS to a Digital Imaging and Communications in Medicine (DICOM) format were also explored (6). This setup also had the advantage of transferring entire exams, much like those that implemented OsiriX. This is especially valuable as it more closely resembles daily practice at the workstation. However, the extensive steps taken to enter a case made it cumbersome to include the process in daily practice and to recruit the visiting medical students and trainees to participate in the expansion of the file which was a key objective of ours.

The Radiologic Society of North America (RSNA) offers a free open source software named the Medical Imaging Resource Center (MIRC) to create and share teaching files among the imaging community (7). After appropriately downloading and configuring the software on the computer, MIRC can serve as a repository for cases with a quick image transfer process. In addition, MIRC automatically uploads the data from the Digital Imaging and Communications in Medicine (DICOM) header to extract patient age, sex, clinical history, diagnosis, imaging modality and organ system into each corresponding case (7). Unfortunately, as is the case with numerous institutions, our particular institution does not allow for the downloading of software to the radiology workstations and we were not able to utilize the teaching file system (TFS) developed under the RSNA MIRC project due to these limitations. Furthermore, MIRC required that the PACS have the capacity and authorization to transmit DICOM images to other DICOM storage service class providers. Furthermore, to be able to later use the images in Microsoft PowerPoint, an additional tool such as RadPix or RadXtreme is required to convert the MIRC documents (7).

After exploring several internet-based and offline options, the idea of developing a teaching file using Microsoft OneNote arose. The purpose of this article is to demonstrate the potential applications of the software application, Microsoft OneNote, as a dynamic

teaching file that serves as an archiving method, as well as a tool for radiology training. A simplified, step-by-step approach to the construction and expansion of this teaching file is described and the advantages of this software over other file archiving and sharing methods are illustrated. We will describe how we have devised this archive within our section and how we have structured the teaching file to accommodate to our needs. Also, we will explore the uses of the teaching file as an archiving system, as a way to involve the medical students into the expansion of the file and as a repository for cases to be used later for publications or presentations.

Methods

Microsoft OneNote, originally advertised as a "digital note-taking" application, allows for the creation of a file with unlimited folders and subfolders. The notes within these folders can harbor embedded text, images, links, and clips from the web. Microsoft OneNote can be accessed online or can be downloaded, free of charge, as an application to a computer or mobile device. The file can be shared with or without editing privileges, and changes made to the file synchronize between all devices. A free initial storage capacity of 15 GB is available upon opening a Microsoft account, and additional storage can be purchased later on if insufficient. The actual use, implementation and sharing of the file carries no charge.

The interface is aesthetically pleasing, user-friendly and intuitive. A case can be entered in approximately 15 minutes or less, depending on the user's expertise and familiarity with the program. A Microsoft or Outlook account is required to develop a file using Microsoft OneNote. We suggest creating a general department or section account, as to avoid personal identifiers.

The first step in developing a teaching file using Microsoft OneNote is deciding on how to classify the cases. Once a user opens a file, folders can be named and subfolders can be created within the general categories. In our personal teaching file, a general layout and categorization of the folders was constructed to divide cases according to the etiology of the condition. Currently, the folders included into the teaching file are: infectious, traumatic, congenital, neoplastic, vascular, and miscellaneous. Under each broad category a "note" is created for each case using the principle diagnosis as the title.

In an attempt to preserve uniformity and facilitate navigation within the file we developed a template using a form-type format. The use of templates has been widely implemented in other web-based and offline teaching files because of the way it facilitates standardization and searching capabilities (8). The template is available under a separate, easy-to-access, independent folder. The intention of creating the template was for it to be copied and filled out when entering each new case to the teaching file. Currently the template includes space for entering age and

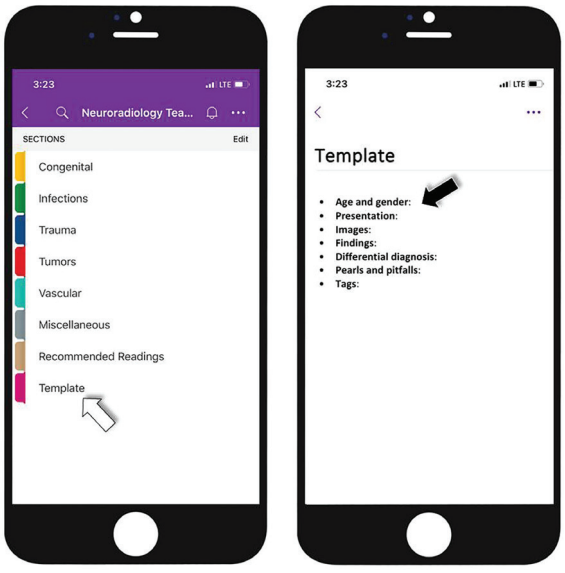

Figure 1: Screenshots of the mobile version of Microsoft OneNote. We recommend making a separate tab for a template. When the user begins the process of entering a new case the first step is to select the "template" tab (white arrow) and copy and paste the predesigned template into the appropriate subsection. This serves as a form where the user can fill in each of the fields (black arrow). The advantage is all cases have a uniform appearance and include basic demographic, clinical and imaging information.

gender, presentation, images, imaging findings, differential diagnosis, pearls and pitfalls, and tags. This way, all cases have the same layout and include the same information. (Figure 1) The demographics of the patient and clinical presentation are entered into the corresponding fields. Under the images portion of the template an average of four representative images are inserted into the note for each case. The number of images can be more or less depending on the preferences of the user. HIPAA compliance is maintained by eliminating patient identifiers when uploading cases.

The imaging findings field includes a brief description of the inserted images, a few differential diagnoses are proposed and a concise description of the pearls and pitfalls of the case are entered. (Figure 2) In the latter sections we have sometimes opted to insert links to recommended articles on the particular topic. Users that browse the case can immediately click on the link and are redirected to the webpage or article if they care to read more about the subject. (Figure 3) The integrated search capability makes finding specific diagnoses and/or imaging signs quick and simple. In our particular file, by adding a section titled "tags" to our template, the contributor adds key words to the case that a future user might potentially enter to search for that particular case. By doing so, searches performed by other users can offer more accurate results. Any word embedded into any of the notes within the file can be found when entered in the search field. The search function generates a listing of pertinent results and subdivides them into the section in which the word was found, for example, folder name, note title, note body, etc. This way, the browser can quickly review whether the word was found as the final diagnosis of the case, or as a differential diagnosis.

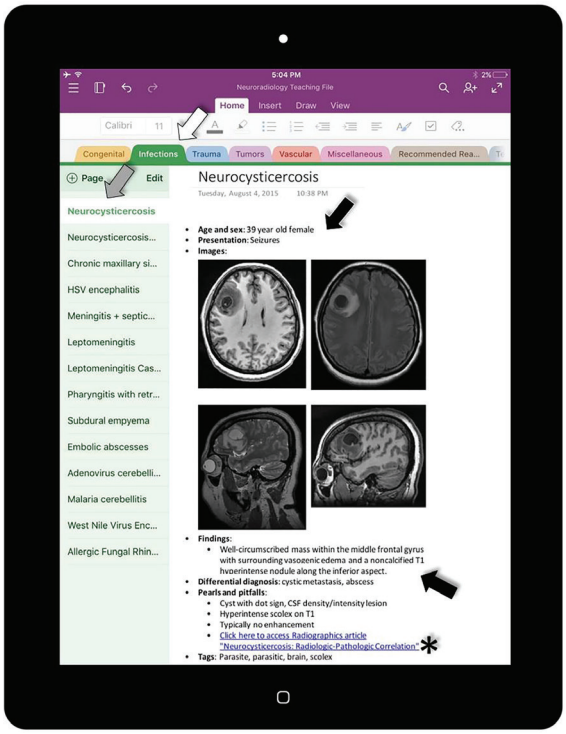

Figure 2: Screenshot of the tablet version of the application shows the example layout with the colored tabs at the top representing the different categories (white arrow). The left hand column shows the cases found under that folder (gray arrow). The main diagnosis is entered as the title of the subfolder. The template is pasted into a subfolder under the appropriate category and filled out with the relevant information (black arrows). Approximately four representative images are selected and copied to the case. Links to further reading may be embedded (asterisk).

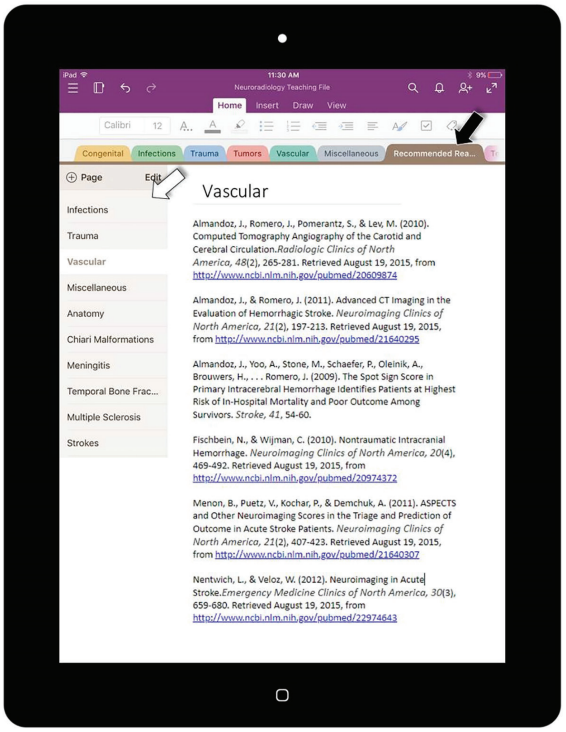

Figure 3: Screenshot of the tablet version of the application shows how a tab can be created for recommended reading (black arrow) with references organized by subject (white arrow) for the user to consult.

After the construction of the foundation of the teaching file was complete, sample cases were entered, and an easy-to-follow instruction manual was created. (Appendix A) At this point other members of the department were invited to participate by entering cases of their own. As part of their neuroradiology rotation, medical students and visiting trainees are encouraged to contribute to the file. A form is provided to them at the beginning of their rotation, which includes blank spaces with the information pertaining to the case that is required to fill out the OneNote case template. (Appendix B) During daily case reading, others in the reading room can guide students as to which cases may be included and can aid them in filling out the form. By following the instruction manual and referring to the information form, students continue to expand the teaching file, while at the same time review important findings related to the diagnosis.

Results

Ultimately, a dynamic, customizable, and continually- expanding teaching file was created to suit the specific needs and objectives of our department. Authorized users are able to quickly upload images from interesting or illustrative cases encountered during daily work. Pertinent clinical information is added for easy reference. Also, concise imaging pearls and pitfalls, as well as recommended reading, can be included in the case to be readily available to anyone accessing the file. Furthermore, files, links and figures can be attached and integrated into a case to further illustrate important teaching points.

The Microsoft OneNote teaching file can be used to obtain images for presentations or publications. Moreover, the file can be accessed for viewing both online and offline. Users can add or search for cases using their mobile devices anywhere from the reading room to their living room. A major advantage of OneNote is the fact that the program is operated by Microsoft and therefore is constantly updated, and has integrated functions with other Microsoft Office programs which are widely available.

Further applications are limited only by one's creativity and imagination. The file can be subdivided into folders according to topic or to level of training to be reviewed during different rotations. Cases can be copied to a separate folder, with the diagnosis hidden, to be presented in a case conference setting. Also, a folder with a weekly or monthly "mystery case" can be created to challenge members of the department with difficult diagnoses.

The flexibility of the application allows for modification of the file to mold to the dynamics of the user's environment. Members of the department can easily search for companion cases that may serve in illustrating key points or differential diagnoses for cases encountered during daily workflow. At the beginning of a rotation, the resident, fellow or trainee can be referred to the teaching file to access recommended reading material pertaining to their level of training or to a specific subject.

Many other ways of organizing the teaching file can be employed depending on preferences of the user. Classification can be done according to anatomic location and then subdividing the folders into etiology of the condition within each anatomic region. Other options include creating a file for each etiology and subdiving into folders according to etiology. Applying ICD-10 coding or other existing classification systems can serve as a guide to creating a pre-established form of organizing the file.

Potentially, the teaching file can be shared on a greater scale for people to access as a reference tool all over the country and the world. By making the non-editing privileges link available to others, anyone can view and search the teaching file without compromising the integrity of the format. On the other hand, collaborations can be made between institutions to expand the teaching file using editing- privilege sharing.

Discussion

The potential applications of the Microsoft

OneNote program as tool to create a teaching file, as well as its design flexibility and the ability to access the file from virtually any mobile device represent a truly innovative take on radiologic teaching files. The format, classification and customization options can adapt to the department's individual needs. On-the-go access to the archive can prove to be a valuable tool both for the education of trainees and for the overall academic improvement of the department both in and out of the reading room. Multimedia capabilities allow for the integration of cases, articles, videos, and other files and webpage clips, which further enhance the learning experience.

Future projections of this initiative include expanding its accessibility to other users outside our section, possibly initially to other sections in our department and then progressively to other institutions and the general public. As more people become involved, ideas for the potential uses and applications of the teaching file will grow and evolve. Undoubtedly, the strength of this project lies in the brainpower provided by all the users that contribute to it.

The obstacles or limitations to the widespread implementation of Microsoft OneNote as a teaching file include the protections in place at each institution. In an institution that has the ability to snip or copy paste images from PACS directly into the website or downloaded version of the program, the entering of cases can be done simultaneously at the time of study interpretation without significant delays. However, if the protections in place at the place of practice do not allow for users to copy and paste images from PACS, this could represent a hindrance to the growth and expansion of the file.

Conclusion

In conclusion, with this initial experience of implementing Microsoft OneNote as a dynamic teaching file in our section, we believe that others can easily apply this general layout to their groups and benefit from it in the way we have.

Conflict of Interest: None Declared.

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