Synoptic Reporting in Tumor Pathology

Advantages of a Web-Based System

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Abstract

The American College of Surgeons Commission on Cancer (ACS-CoC) mandates that pathology reports at ACS-CoC–approved cancer programs include all scientifically validated data elements for each site and tumor specimen. The College of American Pathologists (CAP) has produced cancer checklists in static text formats to assist reporting. To be inclusive, the CAP checklists are pages long, requiring extensive text editing and multiple intermediate steps. We created a set of dynamic tumor-reporting templates, using Microsoft Active Server Page (ASP .NET), with drop-down list and data-compile features, and added a reminder function to indicate missing information. Users can access this system on the Internet, prepare the tumor report by selecting relevant data from drop-down lists with an embedded tumor staging scheme, and directly transfer the final report into a laboratory information system by using the copy-and-paste function. By minimizing extensive text editing and eliminating intermediate steps, this system can reduce reporting errors, improve work efficiency, and increase compliance.

Historically, surgical pathologists had confined their reporting of malignant neoplasms to the identification of tumor type (diagnosis) and nodal involvement. However, recognizing that a plethora of morphologic attributes have significant predictive value for biologic behavior and therapeutic response of the malignant tumors, the Association of Directors of Anatomic and Surgical Pathology (ADASP) issued its official recommendation in 1992 also to include important morphologic attributes in surgical pathology reports.1

Because of the large number of tumors encountered in surgical pathology practice and because the amount of information required in pathology reports is often extensive, pathologists usually cannot consistently remember all of the information required for each tumor and each tumor site.2,3 As a result, important information is often omitted in pathology tumor reports. Based on a landmark study of 15,940 pathology reports of colorectal cancer from 332 laboratories, Zarbo et al4 reported in 1991 that essential elements such as gross tumor size, depth of tumor invasion, status of resection margins, and tumor grades were omitted in a significant portion of surgical pathology reports. Recently, Gomez and Tamboli,5 in an abstract, reported that 27% of referral and internal pathology reports in a highly specialized cancer treatment center failed to include at least 1 element with great clinical significance, such as the status of vascular lymphatic invasion.

In addition, diversity in terms, individual styles, and amount of information obtained constitutes another layer of confusion and obstacle for communication.2,6 The overwhelming diagnostic information and diverse styles, formats, and terminology have been the major sources of inconsistency and lack of uniformity in pathology tumor reporting. To address this issue, in 1993, Rosai,7 in a proposal to standardize
reporting of surgical pathology diagnoses of major tumor types, formulated the checklist format in an attempt to make the reporting process more efficient, uniform, and complete. In 1992, Zarbo also reported that the single practice that was significantly associated with increased likelihood of providing information on gross and microscopic features surveyed was the use of standardized report forms or checklists. In the ensuing years, the College of American Pathologists (CAP) and the American Society for Clinical Pathology have made persistent efforts to establish guidelines for reporting the most commonly encountered human malignant neoplasms.9-17

Effective implementation of these recommendations gained momentum with the mandate by the American College of Surgeons Commission on Cancer (ACS-CoC), which accredits more than 1,400 cancer treatment centers in the United States, that pathologists at its approved cancer programs include all scientifically validated or regularly used data elements in their reports for each site and specimen.18 In accordance, the CAP has developed more than 40 site-specific cancer protocols and checklists as a resource for pathologists for effectively providing this information.19 To be inclusive, the CAP checklists are pages long, often containing too detailed information. Despite being checklists, extensive text editing is inevitable. In practice, extensive deletion and typing (eg, measurements) are usually necessary to ensure that only pertinent text or code data are retained for the cancer registry. Because the checklists or templates are in static text formats (ie, Microsoft Word [Microsoft, Redmond, WA] and portable document format [PDF]), multiple intermediate steps usually have to take place before the reporting information can be incorporated into the final pathology report in the laboratory information system (LIS).

Because the collected data must be incorporated into the main LIS, the reporting process comprises at least 2 major segments: data collection from specimen examination by pathologists and data transfer into the main LIS, most often now by transcriptionists. Currently, the workflow of tumor reporting using CAP checklists or other institutional static templates usually takes a tortuous route that includes downloading and printing the checklist or template, list checking and filling out during data collection by a pathologist, extensive text editing and transferring into the LIS by a transcriptionist, and final review and additional editing by the pathologist before the report is released. There are variations in the order of the process, but extensive editing and multiple steps inevitably take place.

Extensive text editing and multiple intermediate steps involving at least 2 entities (pathologists and transcriptionists) have several weak links for potential reporting errors. Typographic errors are unavoidable. Because the generic CAP checklist or an institutional static template is not an integral part of the pathology report and is without patient demographic information, the resulting typographic separation of the tumor report, albeit transiently, from the rest of the pathology report creates another vulnerable link. The most dangerous is mismatch of the tumor report to the pathology report of the wrong patient. Conventional designation of data collection and data entry into the LIS to different entities (ie, pathologists and office staff) has always been a third weak link unless the final report is transferred into the LIS by electronic copying and pasting by pathologists. Although uniformity in the content is desired, inclusive information in a rigid format has been viewed by many of our users as a major drawback of CAP checklists.

In this report, we introduce a simple template-based tumor reporting system that minimizes exhaustive list checking and extensive text editing, thereby markedly simplifying the process of routine reporting of tumor pathology.

Materials and Methods

A set of tumor-reporting templates on commonly encountered tumors was created with reference to samples collected from several academic institutions. These templates were converted to hypertext markup language (HTML), and tool controls such as drop-down menus, text boxes, and function buttons were created for dynamic presentation (ie, page display in response to inputs by users via a Web browser) on the World Wide Web. The static text was converted into Microsoft Active Server Page (ASP.NET) files. A Microsoft Access database table was created to store and organize the specific morphologic attributes from the templates by the file name and the name of specific organ sites. The stored information could be retrieved as the content of a drop-down list on the Web page for users to select. Specific command source codes were programmed in ASP.NET to implement the dynamic presentation. The completed files with the dynamic functionality were then uploaded and implemented on our institutional server and were accessible to all Internet users.

The specific organ sites are first presented in a drop-down list on the initial Web page. The programmed ASP.NET codes, on selection of an organ site on the drop-down list by the user on the Internet, bring the corresponding HTML rendering of the ASP.NET page of the report form with multiple drop-down lists in categories, each containing specific attributes to be selected. When the final selections are submitted, the ASP.NET codes collate the selections and other text entries and format them into HTML text output on the Web page. This HTML output can be copied and pasted to text-editing buffers on any LIS system. The resultant Web page content (collated tumor report data) is cleared when the client browser is closed.
Results

The synoptic reporting system can be accessed on the World Wide Web by all Internet users at http://dpalm.uth.tmc.edu/cap/webform1.aspx or http://www.urmc.rochester.edu/path/zqu/cap/Webform1.aspx. Along with brief background information and specific instructions on how to use the synoptic reporting system, the entry page provides a drop-down list of specific organ sites for which synoptic report forms are available [Image 1].

Users can select an organ to bring up the complete synoptic report form. In each form, in addition to general information (e.g., surgical accession number, specimen type, and surgical procedure), specific histopathologic attributes are provided in drop-down lists to choose or marked as a blank field to be filled out. A pathology staging scheme for each tumor is also embedded in each form for reference. At the end of each form, a free-text comment field is provided for adding additional information or unique attributes not provided in the standard forms.

On completion of the form, users can compile all selections and entries into a short, concise tumor synoptic report containing only the selected attributes. The system also simultaneously generates and appends to the final report a list of the attributes that have not been selected or included in the final pathology report [Image 1], serving as a reminder of the information missing from the report. If changes to the tumor synoptic report should be made, users can navigate in the browser back to the form and make any changes before compiling the final report. The final tumor synoptic report in the Internet browser window can then be copied and pasted into text-editing buffers in various LISs that accept plain text data. After the final pathology report is transferred into the LIS, all information in the tumor synoptic report on the Internet browser will be permanently purged when the browser is closed. Although the final synoptic pathology report can also be printed on regular paper and submitted for transcription, most users understandably prefer the direct copy-and-paste mode of information transfer to the LIS system.

The tumor synoptic reporting system is compatible with all common Internet browsers such as Microsoft Internet Explorer (Microsoft), FireFox (Mozilla, Mountain View, CA), and Netscape (Netscape Communications, Mountain View, [Image 1]).

[Image 1] Front page and site-specific form. The front page provides a drop-down list of specific organ sites to select (left). When a specific site or organ is selected, a corresponding form appears that contains site-specific reporting information in a drop-down list and staging scheme as a reference (right). In this image, the liver is selected as an example.
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The plain text transfer function with these browsers is compatible with all LISs, allowing final report transfer into the LIS by using the copy-and-paste function. The synoptic reports, of course, can be transferred electronically via e-mail or saved in a secured server for future retrieval.

Discussion

In this report, we introduced a simple Web-based tumor synoptic reporting system with several practical features: drop-down list, reminder function, and convenient Web interface. Because users can directly access this reporting system on the Web, enter reporting data by selecting from drop-down lists, eliminate irrelevant information, and directly transfer the final report into an LIS by simple copying and pasting, this system offers several practical benefits. First and foremost, it reduces the typographic efforts and errors by minimizing extensive text editing. Second, it greatly simplifies the reporting process. The direct copy-and-paste mode of data transfer into LIS by pathologists eliminates multiple error-prone intermediate steps by bypassing the tortuous route of the paper copy of the CAP checklist from the pathologist to the transcriptionist and, after extensive editing, to the LIS, and then back to the pathologist. The pathologist, by this time, may not have the original paper copy of the checklist and, thus, may be unable to ascertain accurate transcription. In addition, the added reminder function helps avoid a common reporting defect, ie, missing required information.

These features effectively counteract the inherent drawbacks of static checklists and templates considered to be the most serious potential risk in standardizing pathology reports by using the checklist model. The drop-down list feature not only provides a reporting advantage but is also consistent with specific recommendation by Centers for Disease Control and Prevention National Program of Cancer Registries. Moreover, the system is made available on the Web. It adopts the modes of navigation and data input commonly encountered...
on the Web and, thus, is familiar to most Internet users. Users do not need training to use this tumor synoptic reporting system. The simplified process and its user-friendliness can help increase work efficiency and compliance.

This system helps collect and summarize diagnostic information independent of any LIS, yet it is compatible with most, if not all, LISs in terms of reported data transfer (entry into the standard LIS system). The independence of this reporting system from existing LISs has 2 key advantages. First, it can be used in conjunction with a wide variety of existing LISs. This is particularly useful for laboratories or institutions that use more than one LIS for different clinical clients. Second, implementation of this system requires no modification of most existing LISs. Incorporation of a complex tumor reporting system in any existing LIS is usually technically demanding because it may affect the underlying software architecture of the existing LIS. The incorporation and subsequent maintenance can also be costly. In contrast, update or modification of this independent tumor synoptic reporting system is easily amendable because the changes are not limited by the complexity of the main LIS and will not affect the underlying architecture of the main systems.

This proposed system, however, has its drawbacks. The data generated by this reporting system are input en bloc into existing LISs, technically in a single field of the underlying database. This will make future data retrieval by single attribute for a retrospective study difficult. However, if the format of the form is consistent, specific data can still be retrieved by more sophisticated search modalities, although certain computer programming (such as a parsing application) will be needed.

Ideally, the tumor reporting function should be embedded in the LIS as an integral component and should have features such as drop-down lists, error reminders, and other relevant functions. The task is expected largely, however, to be that of main commercial LIS vendors. Because the need exists, it is reasonable to believe that LISs in the future will incorporate this capability.

An existing alternative is a hybrid of these two, a reporting system with drop-down lists and other features that can collect report data and disperse the data into specific fields in the main LIS, using some sort of middleware. Generally, such smooth data transfer into LIS is at the expense of independence of the reporting system because this functionality depends on mutual compatibility. Implementation of the system with an individual LIS requires technical expertise and specific modification of either or both systems. As a result, any changes or updates of either system will potentially create an impediment to the functionality of this tumor reporting system. Most third-party reporting systems are also commercial products, and the cost is a significant consideration not in its favor.

Although ACS-CoC–accredited cancer treatment centers are required to include all scientifically validated data elements for each site and tumor specimen, the ACS-CoC imposes no restriction on the format of the pathology report or requirement of variables for which the clinical importance and prognostic value have not been well established. To most users (practicing pathologists), concise tumor-reporting templates with scientifically validated data elements and clinically important information are highly desirable and more manageable than exhaustive, long checklists. Although it is not our intention to judge the adequacy of existing tumor report formats or contents or to take a stance on which reporting system or method should be used, we thought it would greatly increase compliance and reduce clerical error if a user-friendly, simple, and flexible reporting system or method could be made available.

Ideally, the tumor reporting system should be standard and uniform and also institution-specific. In practice, this balance is difficult to achieve, if even possible, at the multi-institutional level. However, this is a real need and should be addressed. The best way, we believe, is to allow users to modify the proposed system to meet their needs. We, therefore, have kept the HTML code an open source for users to copy and modify, although some programming (mainly HTML) knowledge, though quite rudimentary, is needed for this task. As described in the “Materials and Methods” section, a close collaboration between the pathologists and LIS staff is necessary to create or modify such a Web-based reporting system.

At the time of this report, at least 1 major LIS vendor provides an added module with this capability. However, a significant lag time is expected before it is widely adopted owing to the additional cost and compatibility with existing LISs. Although a new generation of LISs with tumor reporting functions in compliance with ACS-CoC requirements will be widely available eventually, the length of the lag time is difficult to predict. Given the facts that the ACS-CoC accredits more than 1,400 cancer treatment centers in the United States and that there are approximately 450,000 new cancer cases each year in the United States and that there are approximately 450,000 new cancer cases each year in the United States, development of simple and easily accessible systems to efficiently and accurately provide the scientifically validated data, such as the one described in this article, will have significant impacts on cancer registries, at least during this transition period. It is reasonable to believe that a simple and user-friendly reporting system will also increase voluntary compliance with the ACS-CoC mandate by many small non–ACS-CoC–accredited hospitals and improve the overall standard of tumor reporting.

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