Voice Recognition Technology Implementation in Surgical Pathology

Advantages and Limitations

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• ***Context.*—Voice recognition technology (VRT) has been in use for medical transcription outside of laboratories for many years, and in recent years it has evolved to a level where it merits consideration by surgical pathologists.**

***Objective.*—To determine the feasibility and impact of making a transition from a transcriptionist-based service to VRT in surgical pathology.**

***Design.*—We have evaluated VRT in a phased manner for sign out of general and subspecialty surgical pathology cases after conducting a pilot study. We evaluated the effect on turnaround time, workflow, staffing, typographical error rates, and the overall ability of VRT to be adapted for use in surgical pathology.**

***Results.*—The stepwise implementation of VRT has resulted in real-time sign out of cases and improvement in average turnaround time from 4 to 3 days. The percentage of cases signed out in 1 day improved from 22% to 37%. Amendment rates for typographical errors have decreased. Use of templates and synoptic reports has been facilitated. The transcription staff has been reassigned to other duties and is successfully assisting in other areas. Resident involvement and exposure to complete case sign out has been achieved resulting in a positive impact on resident education.**

***Conclusions.*—Voice recognition technology allows for a seamless workflow in surgical pathology, with improvements in turnaround time and a positive impact on competency-based resident education. Individual practices may assess the value of VRT and decide to implement it, potentially with gains in many aspects of their practice.**

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Voice recognition technology (VRT) geared for medical transcription has been available since the 1980s,[1] although it was not adapted for widespread use by physicians until more recently. Voice recognition technology has been successfully used in many specialties, particularly in radiology. There have been some studies that compared VRT with human transcriptionists in different medical practices and specialties, with varied results regarding turnaround time (TAT).[2–7]

However, there have been only a few studies comparing the use of voice recognition software with transcription services for surgical pathology. A study from the Cleveland Clinic[8] (Cleveland, Ohio) in 2002 reported the potential financial benefits and its experience with the implementation of VRT into surgical pathology. In 2003, a group in Ontario[1] reported that VRT had a lower accuracy and required more editing time than use of their human transcription service. A recent study at University of Pittsburgh[9] (Pittsburgh, Pennsylvania) demonstrated benefits regarding TAT and error reduction when using VRT for gross descriptions and final surgical pathology reports. As there have been ongoing improvements in software and hardware, it is reasonable to assume that previous studies may underestimate the current value of using VRT.

We have evaluated and completed phased implementation of VRT for use by pathologists' assistants, residents, and attending pathologists on our general and subspecialty surgical pathology services. The aims of this study were to evaluate the impact of VRT on TAT, to determine the feasibility of incorporation of VRT into our surgical pathology practice, and to analyze the advantages and limitations of this technology as it applies to surgical pathology.

MATERIALS AND METHODS

The pathology department at Stony Brook University Medical Center (Stony Brook, New York) accessions approximately 20 000 ± 2000 surgical pathology specimens annually, ranging from biopsies to complex resections. The cases are divided among surgical pathologists covering the general pathology service and various subspecialty areas. Voice recognition technology was introduced into the surgical pathology service in phases during the course of 3 years from July 2006 to June 2009.

Specifications

The minimum computer specifications for implementing VTR are a 2.8 GHz processor, 2 GB of RAM, and a headset or upright microphone (Figure 1). All of the computers use Windows XP

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Figure 1. *Photograph depicting the compact and ergonomic setup used for voice recognition technology for surgical pathology case sign out.*

Professional Service Pack 3 (Microsoft Corporation, Redmond, Washington) as an operating system. The VRT software used is VoiceOver (version 4.1, VoiceBrook, Lake Success, New York), which uses Dragon Naturally Speaking Software (version 10, Nuance Communications, Burlington, Massachusetts) as a speech recognition engine. This has been integrated with our laboratory information system, CoPath (version 2.5, Sunquest Information Systems, Tucson, Arizona), and Microsoft Word 2003 (Microsoft Corporation, Redmond, Washington) as a word processor. Templates were created for use in most gross descriptions (Figure 2) and are used, when feasible, in final reports, including those for cancer resections.

Phase 0 (Before July 2006)

Prior to the use of VRT, our department used an outside service to transcribe gross pathology descriptions overnight and 4 full-time in-house transcriptionists for the transcription of surgical pathology final reports during regular business hours.

Phase 1 (July 2006 to May 2009)

Initially, VRT was implemented for use by the residents and the pathologists' assistant exclusively for gross descriptions. The software used at this time was Dragon Naturally Speaking version 8.

Phase 2 (Pilot Study of VRT Use for Full Reports, June 2009)

A pilot study was conducted with the aim of comparing the difference in TAT for creating final reports using VRT versus in-house manual transcription. The pathologists conducting the pilot study (M.S., T.P.) used VRT to generate surgical pathology reports for cases of varying levels of complexity. A second group of similar cases was submitted for routine transcription using handwritten diagnoses. The time that passed between the completion of slide review and the final electronic verification of cases by both methods was recorded for 62 total cases.

Phase 3 (Implementation of VRT for Complete Surgical Pathology Reports Starting in June 2009)

After reviewing data from the pilot study, troubleshooting, and customizing the software for our laboratory information system, VRT was implemented for use by residents and attending pathologists in the generation of the entire surgical pathology report. On-site training was provided to all individuals concerned in June 2009. New users first initialized their profiles, which required dictating text for 5 minutes while following commands on the computer screen. Subsequently, they had individual 30-minute training sessions with support staff from the vendor, mainly to learn the commands to navigate through the system. Templates were built in Microsoft Word and then transferred into the VRT program. Initially, TAT data were compared for the month prior to the pilot study (May 2009) and for the 2 months following the implementation of VRT (July and August 2009).

Phase 4 (Follow-Up Assessment, July 2009 to December 2010)

To further evaluate the impact of VRT on workflow, TAT data was collected and compared for two 8-month periods. During the

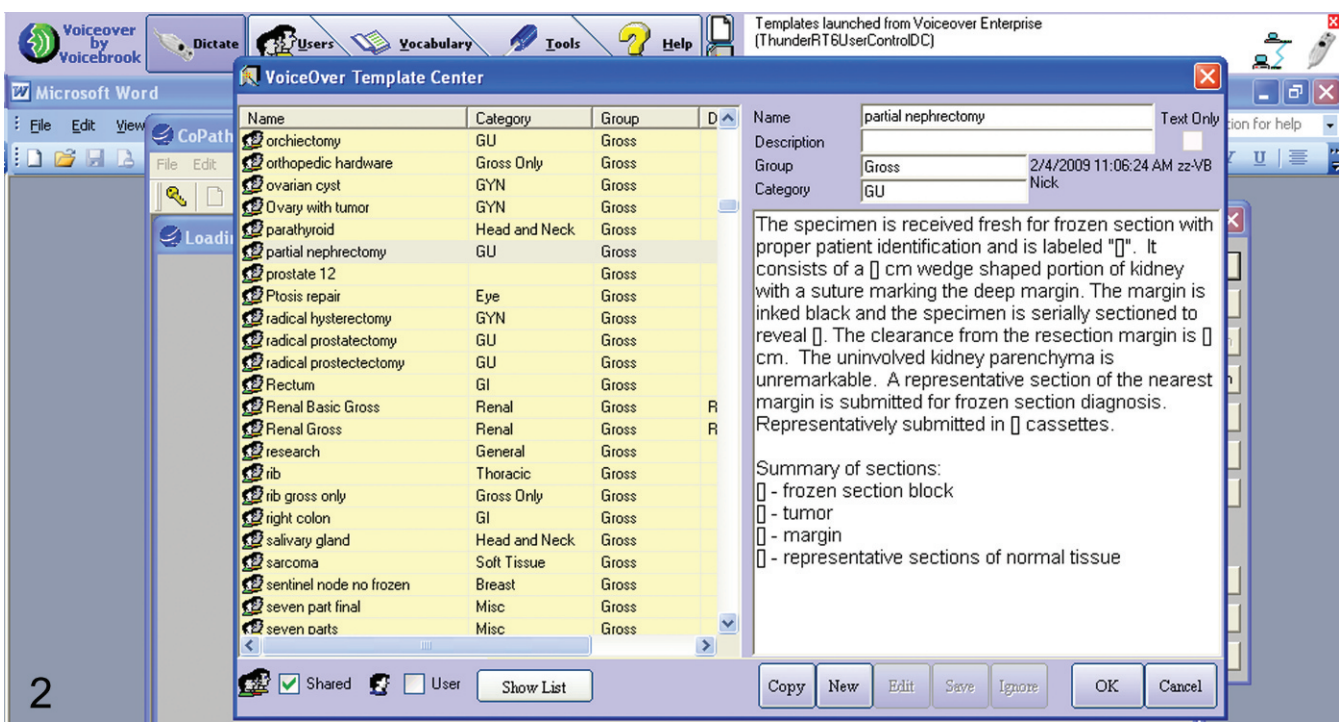

Figure 2. *A screen snapshot depicting a sample template for insertion into surgical pathology reports using voice recognition technology.*

Table 1. A Composite Summary of Surgical Pathology Turnaround Time (TAT) Throughout the Implementation of Voice Recognition Technology (VRT)

	Phase 0: Before VRT	Phase 1: VRT—Gross Descriptions Only	Phases 2–4: VRT—for Both Gross and Final Diagnosis
Average TAT, d	4	4	3
% of cases signed out in 1 day	22	24	36
% of cases signed out in 2 days or less	54	60	67

first 8-month period (June 1, 2008 to February 28, 2009), VRT was used only for gross description. For the second 8-month period (June 1, 2009 to February 28, 2010), VRT was implemented for all portions of the surgical pathology report. The same months were used to account for annual fluctuations that may occur in a teaching hospital. The quantity and distribution of cases was unchanged during this time. The impact of these changes on transcriptionists' workload was evaluated by comparing total lines typed before and after VRT. For each 8-month period, the number of amendments generated for typographical errors was compared. Continuous troubleshooting was performed by follow-up communications between the laboratory informatics department and the pathologists and residents to resolve any issues related to VRT (hardware and software). These data were evaluated by the medical director (M.S.) and have since been incorporated as a component of the anatomic pathology quality assurance program.

RESULTS

Phase 0

For all cases in surgical pathology, in the 3 years prior to VRT use, the average TAT was 4 days, with 22% of cases signed out in 1 day and 54% in 2 days or less (Table 1).

Phase 1

For all cases in the 35 months during which VRT was used only for gross descriptions, the average TAT was 4 days, with 24% of cases signed out in 1 day and 60% in 2 days or less (Table 1).

Phase 2

In the pilot phase, a significant TAT benefit was observed with use of VRT for the entire surgical pathology report in comparison to use of VRT for gross descriptions combined with transcription for final diagnosis. Using transcriptionists resulted in a mean time of 747 minutes and a median time of 495 minutes between the completion of slide review and electronic sign out of the case. In comparison, when using VRT there was a mean time of 1.6 minutes and a median time of 2 minutes. The additional advantages observed were that VRT reports became available in the hospital information system within minutes of viewing the slides of a given case. Voice recognition technology misinterpretations were uncommon and were corrected in real-time by pathologists before electronic release of the report. Errors related to handwriting with transcription were avoided. A seamless workflow from viewing the slides, dictation, and case sign out was achieved. The surgical pathologists did not have to review any slides a second time when using VRT. Cases could be completed while avoiding issues with transcriptionist scheduling and workload. Based on this experience, we decided to implement VRT for complete surgical pathology reports.

Phase 3

The 2 months after training and implementation of VRT showed an improvement in case TAT from 3 days to 2 days. The percent of cases signed out in 1 day (24-hour period excluding weekends) increased from 31% in May 2009 to an average of 41% in July and August 2009 (Table 2).

Phase 4

During the period in which VRT was in more uniform use for case sign out, a 68% reduction in the number of lines typed by transcriptionists occurred. Comparison of the two 8-month intervals showed a relatively similar number of specimen accessions while the total number of lines typed decreased from 83 216 to 26 733. For reasons unique to our practice, transcriptionists continue to assist in generating the final reports for our high volume of placenta cases, which are template based. At present, 97% of the nonplacenta cases are completed fully using VRT. The exceptions include amendments and results of special studies.

The average percent of cases signed out in 1 day improved from 27% to 37% since generalized VRT implementation during the 8-month periods (Figure 3). Applying VRT to case sign out resulted in a reduction in the average case TAT from 4 to 3 days during the same 8-month periods. Extending the analysis to 19 months (June 2009 to December 2010) with full report VRT use revealed that gains in TAT have continued with an average TAT of 3 days (Table 1). The average TAT remains at 3 days with or without placenta cases in the analysis.

The workflow (Figure 4) has improved with the use of VRT and residents are now involved in all aspects of generation of complete surgical pathology reports.

Amendments for Typographical Errors

We compared the number of amendments issued for typographical errors in 3 different months spread across the year before and after VRT implementation. There was a reduction in the number of amendments in the post-VRT

Table 2. Analysis of Turnaround Time (TAT) in the Initial Transition Period (Phase 3)

	Total Number of Cases	Voice Recognition Cases, No. (%)	Transcriptionist Assisted Cases, No. (%)	Average TAT, d	Percentage of Cases Signed Out in 1 Day
May 2009	1686	0 (0)	1686 (100)	3	31
June 2009			Implementation and training		
July 2009	1744	1004 (58)	740 (42)	2	41
August 2009	1551	930 (60)	621 (40)	2	43

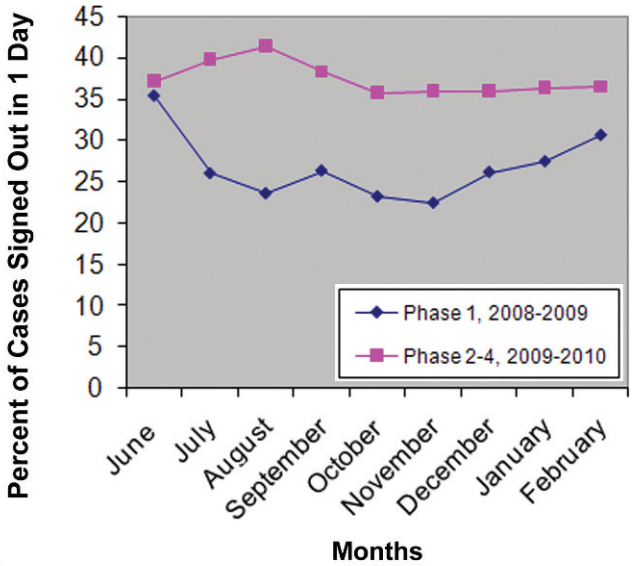

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Figure 3. *Percent cases signed out in 1 day while using voice recognition technology for gross only (phase 1) versus complete surgical pathology reports (phase 2–4) on a monthly basis.*

use months from 18 to 8 (October 2008 versus 2009) and from 13 to 9 (January 2009 versus 2010). In the transition month, the number of amendments rose to 22 compared with 10 in the previous year (June 2009 versus 2008). This was not surprising as all the pathologists and residents were trained during this month.

Troubleshooting and Information Technology Support

Technical support for VRT is provided on-site by the laboratory information systems staff. If issues are unable to be resolved, VoiceBrook staff is contacted and they recommend solutions or remotely log in to troubleshoot. A log is maintained to document problems and their resolution. Some of the issues encountered include corrupt user profiles and inadvertent profile locking. We have follow-up data on a weekly basis for 28 weeks (March 2009 to September 2010). There are 27 total users at any given time, including 14 attending pathologists, 12 residents, and 1 pathologists' assistant. Many users have no issues to report in a given week; however, all users have had at least 1 issue to report and all have been resolved satisfactorily. Voice recognition technology data are now a quality assurance monitor for our anatomic pathology division.

COMMENT

Surgical pathology reports incorporate complex histologic terminology that conventionally has been viewed as best typed by in-house transcriptionists, followed by some use of off-site transcription. However, VRT and the latest software have the potential of being customized and used for surgical pathology reports. We have been able to show improvements in TAT, workflow, a reduction in wording errors, and a positive impact on resident education after implementing VRT in a phased manner in our surgical pathology practice.

Voice recognition technology has been successfully implemented in other medical fields and has the potential to be similarly effective in surgical pathology. Turnaround time is an important quality measure for surgical pathology and impacts timely delivery of appropriate patient care as well as clinician satisfaction with surgical pathology services. In-house transcriptionists are often not available beyond regular business hours, and, even when available, a bottleneck can be created when several pathologists and residents submit cases to the transcriptionists at the same time either using dictation tapes or handwritten notes, resulting in varying time lags before the cases can be finalized. With VRT, cases can be dictated and signed out at any time by any number of pathologists in a group. Also, the case can be completed immediately on evaluation of the slides before progressing to review the next case.

Through the use of templates, completion of gross descriptions and final reports can be accelerated. A common use of templates is synoptic reports for cancer resection specimens. These templates include all of the scientifically validated data elements that are approved by the College of American Pathologists and the American College of Surgeons Commission on Cancer.[10] Templates can be useful in the gross room as they can list all of the critical measurements, descriptive items, and sections needed for grossing a particular specimen.

One reservation that pathologists may have about using VRT is the possible impact of individual accents on word recognition accuracy. The current software has modules for different accents and adapts to each user after a training session of approximately 1 hour. Accents have not proven to be a barrier in our experience, as the software adapts to each user. Effective implementation of VRT requires motivation on behalf of pathologists to modify their practice of signing out cases. Users must be willing to exert the effort required to adapt to this new technology, as is true for any new modality a physician encounters. The inherent benefits for pathologists to be able to sign out cases in real-time without waiting for transcription to be completed became apparent early on to our group and most of our surgical pathologists are now able to use VRT. Some pathologists may be able to achieve more significant gains in TAT following the implementation of VRT compared with others, depending on their current workflow and transcription services. Individuals who sign out infrequently may not develop the ease of using VRT. Cue cards at the individual work stations were helpful in the transition for our pathologists and residents.

The ability of the information technology staff to provide timely technical support has been beneficial in ensuring continued use of VRT. In groups without dedicated information technology staff, support from the vendor is available and is important for both the implementation phase and any troubleshooting thereafter.

It is difficult to select just one measure to compare the accuracy of the 2 methods, and previous studies have used different strategies.[1,9] However, with both options, the pathologist must proofread the report before it is finalized. One main difference is that with VRT, typographical errors are corrected in real-time while progressing through the dictation, but with a transcriptionist, errors are corrected during a review of the report after transcription and prior to finalizing the case. With either method, there should ideally be no typographical errors in the final report. In comparing amendments for typographical errors to evaluate whether there has been

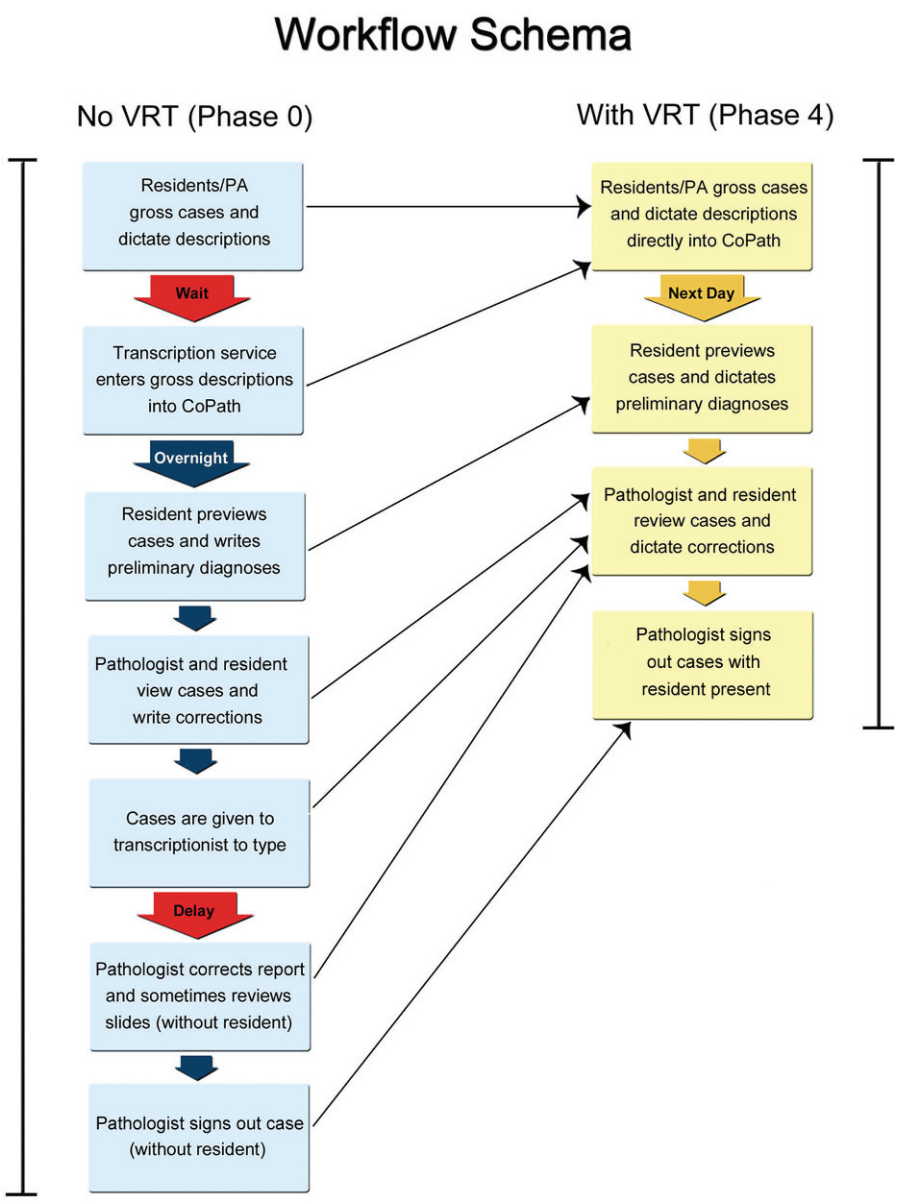

Figure 4. *Workflow schema in surgical pathology before and after implementation of voice recognition technology (VRT). Each case can now be signed out in real-time by the pathologist immediately on review of a case under the microscope. Abbreviation: PA, pathologists' assistant.*

a change in the ability of pathologists to detect such errors since VRT was initiated, we showed a reduction in the number of amendments for typographical errors, suggesting that VRT use has strengths in this area as well.

One possible reason for any errors in voice recognition escaping detection before a case is signed out is that words are always spelled correctly by the program and may look similar to the desired words. For example, if a person intends to say the word ''ascending'' the word ''descending'' may unintentionally appear in the text. Users also must mute the microphone if an interruption occurs to avoid the insertion of extraneous text. As with manual transcription, VRT also requires thorough review of the dictated text to prevent this type of error from appearing in final reports. For errors that occur repeatedly, the system independently ''learns'' from corrections made and also allows the user to train specific words or commands to output in the desired manner. Handwriting related errors and tape dictation related errors are avoided with VRT. In 2003, a report of VRT showed a low accuracy rate of the software for generating pathology reports,[1] but a more recent study published in 2010 showed a reduction in errors following VRT implementation, compatible with our results.[9] This could be indicative of improvements in the VRT hardware and software during this timeframe.

Voice recognition technology has a significant impact on resident training. Using VRT, residents are able to dictate the preliminary diagnoses for all of their cases prior to final review with the pathologist. The residents are present while the descriptions are corrected and the case is signed out. This timely feedback is essential in reinforcing the important elements of a complete surgical pathology report and allows residents to improve their medical knowledge, as well as other competencies. Additionally, the pathologists will not need to review slides of cases a second time. The workflow is equally hassle free for cases grossed in by the pathologists'

assistant that go directly to the pathologist without a resident being involved.

Implementation of VRT raises concerns regarding the necessity of retaining a full staff of transcriptionists. If the transcription staff is hired through the department of pathology, the transcriptionists may be cross-trained to perform other duties, provided they are amenable to additional training. At our institution, the transcription staff members were trained to function in other capacities. Currently, these staff members work to streamline work flow in the histology laboratory, which has expedited case assembly and delivery to attending pathologists and residents. Other departments that switched to using VRT were similarly able to train their employees to perform other tasks.[6]

The implementation of VRT has been met with variable levels of enthusiasm, as the members of our department were accustomed to a transcriptionist based system. Although some users anticipated increased time and effort would be required to complete cases using VRT, the data from our pilot study suggested otherwise. In addition, resolution of system related issues in the period prior to generalized implementation of VRT facilitated its introduction. The overall impact of implementation was an improvement in TAT in surgical pathology.

Some groups have unique characteristics for which VRT is not easily adapted. At our institution, most placentas are sent fresh to pathology for examination. Many cases receive only a gross examination. The single attending pathologist responsible for most placenta cases found it more efficient to continue her well-established routine of grossing multiple cases in succession and then having the template-based gross description inserted into the report by the transcription staff. Because most of the placenta reports use only templates for gross and final diagnoses, it was decided that VRT would not be incorporated into this service at the present time. All other surgical pathology services are now using VRT.

The benefits of improved TAT are not limited to improved quality measures for laboratories alone. They have a wider impact including shorter hospital stays, earlier triaging of cases, and earlier implementation of specific therapies. Consequently, one anticipates better patient outcomes, improved marketability of a pathology practice, and potential savings to the department and the hospital in cost per report generated. Others have also commented on potential institutional savings due to shorter hospital stays for patients.[6]

Voice recognition technology may be valuable not only in academic settings but also in the competitive environment of private practice where a shorter TAT may factor into a clinician's decision to use one pathology practice over another. We cannot determine if VRT is ideal for everyone. Surgical pathologists who can improve their efficiency from the streamlined workflow and use of templates may be able to finish their daily case load in a more efficient manner. Resources that were originally used for transcription can be reallocated. In addition, the same software can be used for the generation of manuscripts, reference letters, standard operating procedure manuals, grants, lectures, and even for lengthy practice related e-mails.

Continuous feedback from faculty and residents has helped us respond to issues that develop at the level of the individual user and to also detect any systemic issues at an early stage. Monitoring these data in the quality assurance program permits us to have a broad view of the impact of this technology on our practice.

In summary, VRT tailored for surgical pathology is a potentially valuable tool that can help improve TAT. A seamless flow from examining the slides under the microscope, dictating the case, and signing it out in real-time before moving on to the next case can be obtained. Cases can be completed independently by the pathologist without the need for manual transcription, at a time and pace that suits the pathologist. For surgical pathologists who are seeking to move away from a transcription based workflow, VRT is a worthwhile consideration.

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