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ORIGINAL ARTICLE

Cytology cases of the week: an educational tool that improves trainee exposure to cytology

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Cytology cases of the week;
COWs

Introduction The Accreditation Council for Graduate Medical Education requires residents to examine 1500 cytology specimens by the end of residency. Cytology cases of the week (COWs) were instituted in 2010–2011 in an effort to increase trainee exposure to cytology.

Materials and methods Images of 2 to 5 cases with basic clinical information are sent to residents weekly. Residents have 1 week to respond by e-mail; after which, correct answers are e-mailed. Cytology resident in-service examination (RISE) scores were used to assess the effectiveness of COWs. Additionally, a feedback survey was distributed to trainees to determine the perception of COWs as a teaching tool.

Results An unpaired two-sided *t* test showed residents who participated in COWs scored 15.4% higher on the RISE than residents who participated minimally or not at all over the 5-year period ($P < 0.05$). In 2014–2015 and 2015–2016, when COWs were minimally and not at all offered, we saw a significant decrease in average cytology RISE scores compared with prior years when COWs were offered ($P < 0.05$). There was no correlation between percentage of correctly submitted answers for COWs and RISE scores. The vast majority (83%) of trainees reported participating in COWs for self-study, and the majority (86%) felt participation in COWs increased their cytology knowledge. Major reasons for not participating included technical challenges and time limitations.

Conclusions COWs are an effective educational tool that increase resident fund of knowledge in cytology. Residents who participate in COWs perform higher on the RISE, regardless of percentage of correctly submitted answers. Published by Elsevier Inc. on behalf of American Society of Cytopathology.

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Introduction

Cytopathology is a major subspecialty in Anatomic Pathology practice. Topics pertaining to cytopathology account for a significant proportion of questions on the

American Board of Pathology Primary Certifying Examination. The Accreditation Committee for Graduate Medical Education requires residents to examine at least 1500 cytology specimens by the end of their training.¹ The American Society for Cytopathology further recommends a minimum of 3 months dedicated to cytology, preferably interspersed as weeks throughout the entire training period.²

Cytology training for a resident can be widely variable across and even within programs because of the daily variation in the number and quality of cases. Many residency programs are spread across multiple campuses, which also contributes to the variability in cytology training within a program. Additionally, residents may be pulled from their cytology experience for cross-coverage or to take vacation, complicating efforts to offer residents a standardized cytology curriculum. In an attempt to enhance the cytopathology training experience, we started cytology cases of the week (COWs) in the 2010-2011 academic year at the University of California, San Francisco (UCSF).

The resident in-service examination (RISE) administered by the American Society for Clinical Pathology is a well-established method of assessing pathology knowledge, used by 100% of the pathology training programs in the United States.³ Rinder et al found that senior residents with higher RISE scores are more likely to pass the American Board of Pathology (ABP) certifying examination on the first attempt, and, further, “mean scores for the cytopathology and surgical pathology subsections were higher for residents who passed the exam when compared to residents who failed.”³ Here, we use cytology RISE scores to measure the effectiveness of COWs as a teaching tool.

Materials and methods

COWs are offered weekly. Basic clinical information for 2 to 5 cases are sent each week via e-mail to trainees. Images for the cases are stored on the UCSF secure server as well as the password-encoded portion of our intradepartmental Web site. Typically, 1 image is provided per case; occasionally, additional images and/or immunohistochemical stains are included. Examples of how cases are formatted are seen in Figs. 1 and 2.

Cases are selected to demonstrate a wide variety of cases ranging from straightforward classic features of common entities to more challenging or rare cases. Trainees have 1 week to respond by e-mail; after which, answers and a new set of cases are provided. Trainee participation is voluntary. All cases are archived by organ system on the UCSF secure server and available for residents to access for future self-study purposes. COWs were routinely offered in academic years 2010 through 2013. In 2014-2015, very few COWs were offered, approximately 15% of what is typically offered in a year. In 2015-2016, no COWs were offered.

Cytology RISE scores were used to measure the effectiveness of COWs as an educational tool. An unpaired

Figure 1 COW example: 60-year-old man with history of lung carcinoma now with PET-positive parotid mass (FNA). Answer: Warthin tumor.

two-sided *t* test was used to compare average cytology RISE scores during years COWs were routinely offered (2011-2014) and years prior to the initiation of COWs (2005-2010) as well as to the years when COWs were minimally or not at all offered (2015 and 2016). An unpaired two-sided *t* test was also used to compare cytology RISE scores between participants and nonparticipants in COWs. Minimal participation was defined as participating in fewer than 30% of the COWs available for a given year. In addition, multiple linear regression analysis was performed for each individual year from 2011 to 2015 to determine if the percentage of correctly submitted answers for COWs (compared with simply participating) or postgraduate year level influenced RISE cytopathology scores between the participant and nonparticipant groups.

An anonymous feedback survey (Fig. 3) was distributed to trainees using Qualtrics Survey Software to assess perception of COWs as a teaching tool and to obtain feedback on how they could be improved. Postgraduate year and completion or intent to complete cytology fellowship training was recorded. Trainees were queried on how often they participated in COWs, whether or not they submitted answers if they participated, and factors hindering or promoting participation. Trainees were asked to evaluate their current level of cytology knowledge with their pre-training level and comment on COW contributions to any educational growth.

Results

There was a trend toward higher average cytology RISE scores for the residents as a group in the years COWs were routinely offered (2011-2014) compared with prior years (2005-2010), with the difference ranging from 15% to 20%, but this finding did not reach statistical significance ($P = 0.06$). Average cytology RISE scores for 2015 and 2016 (when COWs were minimally or not at all offered)

Figure 2 COW example: 56-year-old woman status post total abdominal hysterectomy and bilateral salpingo-oophorectomy who presents with a right lower lobe lung nodule. A, Papanicolaou stain, 200 $\times$. B, hematoxylin and eosin, 200 $\times$. C, TTF-1, 200 $\times$. D, PAX-8, 200 $\times$. Answer: Metastatic adenocarcinoma of gynecologic origin. The patient had a history of endometrioid adenocarcinoma of the uterus.

were significantly decreased in comparison to the years COWs were routinely offered, with the difference ranging from 15% to 20% ($P < 0.05$), as demonstrated in Fig. 4.

An unpaired two-sided t test showed that residents who participated in COWs scored 15.4% higher on the RISE than residents who participated minimally or not at all ($P < 0.05$) from 2011 to 2015 (Fig. 5). Analysis of the years individually showed that residents who participated in COWs again on average had higher RISE scores than nonparticipants, with the difference ranging from 6.7% to 25.2%. This difference was statistically significant in 3 of 4 years in which COWs was offered regularly ($P < 0.05$), including 2011, 2012, and 2014 (Table 1). Very few COWs were offered in 2015. Multiple linear regression analysis of each individual year from 2011 to 2015 showed no correlation between postgraduate year or for the number of correct answers (compared with simply participating) with RISE cytopathology percentile scores between participants and nonparticipants in COWs.

The survey response rate was 55.3% (26 of 47 trainees). The vast majority (83.3%, $n = 15$) reported participating in COWs for self-study, and 16.7% ($n = 3$) reported participating for board preparation. The majority (86%, $n = 18$) felt participation in COWs increased their cytology knowledge ($n = 14$, markedly increased; $n = 4$, somewhat increased).

Major obstacles to participation included technical challenges and time limitations. As previously mentioned, the images for the cases are stored on our secure server as well as the password-encoded portion of our intradepartmental Web site, which some residents reported as a hindrance to participation and stated that they would be more inclined to participate if the images were attached to the e-mail providing the clinical information.

The timing of distribution of COWs has varied since their initiation and many residents reported they would be more inclined to participate or increase their participation if the cases were e-mailed on a more regular basis (at the same time and on the same day every week). Several residents also stated that they would be more encouraged to participate if the follow-up information on the cases came with more descriptive answers, outlining the major cytologic features seen in the image provided as opposed to merely receiving a diagnosis.

Discussion

Digital pathology has been shown to be a useful tool in pathology and has many uses, including graduate medical education, pathology training, e-learning and virtual

<p>1. What is your current post-graduate year?</p> <ul style="list-style-type: none"> • PGY-1 • PGY-2 • PGY-3 • PGY-4 • PGY-5+ <p>2. Are you currently or have you previously participated in a Cytopathology Fellowship?</p> <ul style="list-style-type: none"> • Yes • No <p>3. What was your level of exposure to cytology prior to entering pathology residency?</p> <ul style="list-style-type: none"> • None • Some • Extensive (i.e. did a cytology rotation, worked in cytology) <p>4. On average, how often do you participate in COWs (even if you don't submit your answers)?</p> <ul style="list-style-type: none"> • Never • Once a month • Twice a month • Three times a month • More than three times a month 	<p>5. What is the major reason you participate?</p> <ul style="list-style-type: none"> • Board preparation • Self-study or self-improvement • Interested in cytopathology fellowship • Other, please specify <p>6. Is there any specific reason you don't participate more?</p> <ul style="list-style-type: none"> • I don't think they're useful • I don't have time • Other, please specify <p>7. How do you feel about your current level of cytology knowledge compared to when you started pathology residency?</p> <ul style="list-style-type: none"> • No change • Somewhat increased • Markedly increased <p>8. How much of this increase in cytology knowledge is attributable to your participation in COWs?</p> <ul style="list-style-type: none"> • All • A moderate amount • A little • None at all • N/A - I do not participate in COWs <p>9. Any additional feedback or comments?</p>
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Figure 3 Survey provided to residents.

workshops, and proficiency testing.⁴ Unlike surgical pathology, where many recuts can be created from 1 paraffin block, cytology smears are limited as they cannot be replicated. Thus, digital pathology is particularly essential in cytology education of pathology residents and cytotechnologists.⁵ Here, we discuss the successful use of still images as a teaching module that increases resident fund of knowledge in cytology. After the introduction of COWs, we saw a significant increase in cytology RISE scores for the trainees as a group and found that residents who participate in COWs perform significantly better on the cytology portion of the RISE than those who participated minimally or not at all, regardless of the number of correctly submitted answers for COWs. In the years that COWs were minimally

or not at all offered, we saw a decrease in RISE scores, which further supports the use of COWs as an effective teaching module.

We recognize that there are trainees who participated in COWs but did not submit their answers; however, there is no way to account for these trainees. Anyone who did not submit answers was counted as a nonparticipant. We also recognize that the RISE is only one way of measuring medical knowledge, but, given the fact that RISE data were available in our program during the years analyzed, we believe it is the best standardized method in assessing

Figure 4 Trend of average cytology RISE scores (percentile), all residents, 2005 to 2016.

Figure 5 Comparison of average cytology RISE scores (percentile) between participants and nonparticipants in COWs, 2011 to 2015. The COWs program was initiated in 2010.

Table 1 Comparison of average cytology RISE scores between participants versus nonparticipants in COWs by individual years.

Year	Participants/ nonparticipants (n)	Difference between participants and nonparticipants in average cytology RISE scores (%)	P
2011	7/16	25.2	0.02 ^a
2012	15/11	22	0.04 ^a
2013	18/17	9.3	0.29
2014	13/17	22.6	0.03 ^a
2015 ^b	15/18	6.7	0.42

^aP < 0.05.
^bMinimal COWs offered in 2015.

resident competency in cytology for this study. The Progressive Evaluation of Competency (PEC) program administered by the American Society for Cytopathology is another standardized method of assessing cytology knowledge among residents and fellows. Although fellow performance on the final PEC exam has been shown to correlate with passing the ABP cytopathology subspecialty certifying exam, this finding has not yet been established for residents taking the primary ABP certifying exam.⁶ Whereas the cytopathology fellows participate in the PEC program at our institution, the residents do not.

COWs can be easily adapted for any program, supplementing the cytology curriculum already in place. In our program, the month-long dedicated cytology rotation also includes study sets and slide quizzes, which residents formally review with attending pathologists. COWs require relatively limited preparation time and can be utilized by the trainees practically anywhere because the format is succinct. This benefits both the person creating the cases and the trainees, who prefer high-yield teaching modules that require little time commitment.⁷ The format is similar to the “practical with images section” of the anatomic pathology board exam, of which 30% is composed of cytology-related images.⁸

COWs can assist in augmenting exposure to cytology for all trainees, particularly in programs where residents rotate through multiple sites or have limited cytology experiences. Additionally, COWs can provide continuous exposure throughout the entire training period even after residents have completed their cytology rotation. By using current cases, we provide trainees with both cases with classic cytologic features and more uncommon cases that might not typically be found in a book. By archiving the currently more than 600 cases, we have created a digital cytology study set for all trainees to access at their leisure. We are currently making modifications to COWs in order to encourage further resident participation. The COWs were pioneered by one of our faculty members (EK), who until recently prepared and distributed all cases; due to increasing

duties, this became quite burdensome and is the reason for the interruption of COWs during almost 2 years. Our solution has been to recruit additional faculty members to create cases on a rotating schedule. We are also looking into software that could help facilitate COWs by e-mailing previously used cases from our bank of 600 unique cases on a scheduled basis. We are reluctant to do so, however, as we would prefer to utilize new current cases rather than recycled ones. Lastly, we are looking into storing the images for the cases on a non–password-encoded portion of our intradepartmental Web site after verifying that this is not a Health Information Privacy Act violation, which initially was a concern and the reason images were being stored securely.

In conclusion, COWs can be implemented with relatively limited resources in order to increase trainee exposure to cytology and provide a more standardized exposure to cytology. In our program, availability and usage of COWs was associated with statistically significant improvement of RISE scores both for the program as a whole and for individuals participating, regardless of number of correct diagnoses. Additional technology could be used to improve ease of use in order to further encourage resident participation.

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Conflict of interest disclosures

The authors have nothing to disclose.

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