Breast Sentinel Lymph Node Frozen Section Practice

An Enterprise Audit as a Guide for Moving Forward

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• **Context.**—In recent years, there has been a shift to less aggressive surgical management of the axilla in breast cancer. Consequently, sentinel lymph node evaluation by frozen section (FS) has declined. Additionally, there has been an impetus to decrease efforts in identifying small sentinel lymph node metastases.

• **Objectives.**—To critically evaluate our enterprise performance in evaluating axillary sentinel lymph nodes submitted for FS prior to considering changes in processing.

• **Design.**—A retrospective review (August 1, 2017–July 31, 2019) was conducted to identify sentinel and non-sentinel lymph nodes from 1 academic institution and 2 community sites. Cases were evaluated for grossing technique and discordance between FS and permanent section (PS) due to sampling and/or interpretive error. Clinicopathologic features were assessed.

• **Results.**—Lymph nodes from 426 patients with 432 neoplasms were sent for FS. Serial sectioning at 2-mm intervals was adhered to in 338 of 432 (78.2%). Serial sectioning was significantly lower at the community sites (14 of 60; 23.3%) versus at the academic institution (324 of 372; 87.1%; χ² < .001). Discordant cases were all false negatives (21 of 432; 4.8%). A total of 7 of 21 false negatives (33.3%) had macrometastatic (>2 mm) disease; of these, 3 were post–neoadjuvant chemotherapy, 3 were neither serially sectioned nor posttherapy, and 1 was a small (<0.3-cm) focus. A total of 15 of 16 false negatives due to sampling error were detected on the first permanent section level.

• **Conclusions.**—Standard serial sectioning of sentinel lymph nodes at 2-mm intervals resulted in infrequent false negatives due to macrometastatic disease. A single additional permanent section level is reasonable, given adherence to serial sectioning.

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In the evaluation of breast cancer, sentinel lymph node (SLN) status provides vital prognostic information used to establish next steps in treatment.\(^1^,2\) Detecting positive SLNs allows the surgeon to consider performance of axillary lymph node dissection (ALND). Sentinel lymph node frozen section (FS) evaluation has been used to avoid delaying ALND. However, SLN FS can increase operative time and introduce artifactual distortion, and it may result in loss of diagnostic tissue.\(^3\) Additionally, SLN FS has variable sensitivity and is made more difficult with smaller metastatic foci, with prior therapy, and in cases of invasive lobular carcinoma.\(^3^,4\)

Clinical trials have found that ALND provides limited benefit in patients with micrometastastic disease (≤2 mm)\(^5\) and for those undergoing breast-conserving therapy with low tumor stage (pT1–pT2) and low-volume macrometastatic disease (>2 mm, 1–2 positive SLNs).\(^6\) However, ALND is still performed in patients with greater axillary disease burden and remains the mainstay of treatment for patients with persistent SLN metastatic disease following neoadjuvant chemotherapy (NAC).\(^7^,8\) Axillary lymph node dissection may also be performed in patients with low-volume SLN macrometastatic disease in the setting of mastectomy, although this is becoming less frequent with recent publication of trial data.\(^9^,10\) Outside of the NAC setting, the main goal of SLN FS examination is identification of macrometastatic disease, which has an improved sensitivity (94%) compared with micrometastastic disease (40%).\(^3^,11\) As such, many surgical practices find merit in sending SLNs for FS evaluation in a subset of cases.

Processing of SLNs is crucial, and the College of American Pathologists (CAP)\(^14\) and the Royal College of Pathologists (RCPath)\(^15\) have established guidelines on sectioning. Per CAP and RCPath guidelines, each SLN should be sectioned at 2-mm intervals, while nonadjacent cut surfaces are placed face up for evaluation. Slicing in this way allows for the maximum surface area to be appreciated within the space permitted, with an ideal cross-section of lymph node showing the capsule and subcapsular sinus.

CAP protocol further states that at least 1 representative hematoxylin–eosin (H&E) level must be examined. However, it does not explicitly say how many, if any, additional H&E levels and/or immunohistochemical (IHC) studies are

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best practice. Although these methods find occult metastases, this results in minimally worse 5-year overall survival and disease-free survival that does not justify ALND. Thus, some experts have advocated that only 1 H&E level be used because additional slides have little to no clinical impact because they typically only help in the detection of micrometastatic or smaller metastases. However, performing a single level may result in nodal downstaging, which has prognostic implications.

Our institutional SLN practice, like many others, included cutting multiple H&E levels with variable use of IHC, regardless if FS was requested, generating multiple slides per block. The goal of this study was to critically evaluate our SLN practice, with a focus on more challenging SLN FS cases, in order to consider making changes in our institutional protocol to safely reduce slide production.

**MATERIALS AND METHODS**

**Case Selection and Review**

We conducted a retrospective (August 1, 2017–July 31, 2019) database search of our laboratory information system using the key words “sentinel” and “intraoperative” for all breast procedures for which lymph nodes, sentinel and nonsentinel, were sent for FS diagnosis within our enterprise. During this time, our enterprise included 3 sites: 1 academic institution (AI) and 2 community sites (CS).

All cases with 1 or more SLNs sent for FS were included. Additional axillary lymph nodes that were “clipped,” or previously biopsied with placement of a biopsy marker, as well as palpable non-SLN sent for FS, were included in data analysis as they, per protocol, were to be processed in the same fashion as SLNs. “Clipped” lymph nodes were included as SLNs. However, palpable non-SLNs were recorded separately.

All patients had a diagnosis of ductal or pleomorphic lobular carcinoma in situ or invasive carcinoma. Diagnosis was made via preoperative core biopsy for all apart from 1 patient who underwent mastectomy who was high risk (BRCA-1 positive) and had suspicious findings on breast magnetic resonance imaging, but who lacked diagnostic biopsy.

Clinicopathologic features were assessed via laboratory information system and chart review. Reports and all archived FS and PS slides for all included cases were reviewed to evaluate grossing technique and discordance between FS and PS.

**Pathologic Evaluation of Lymph Nodes**

During the study time period, the protocol within our enterprise was to section all SLNs at 2-mm intervals perpendicular to the long axis and submit all nodal tissue for FS unless there were large metastatic deposits identified on gross exam, in which case a single representative cross-section could be submitted for FS rather than the entire lymph node. Frozen section tissue sections were embedded and frozen within optimal cutting tissue media and cut on a standard (−20°C) cryostat, creating 6- to 7-μm-thick sections. A minimum of 2 intraoperative FS slides (levels 1 and 2) were cut. Six additional slides were cut after routine processing, with 3 H&E-stained PS slides provided from levels 3, 5, and 7, and 3 unstained slides corresponding to levels 4, 6, and 8 were retained for possible later use for H&E or IHC staining. Cytokeratin or other IHC was not routinely ordered but later added if deemed necessary for diagnosis at the discretion of the signing pathologist. All PS levels (levels 3 through 8) were cut at 200-μm intervals.

The pN stage was classified as outlined by the American Joint Committee on Cancer staging manual as follows: pN0 if no nodal metastasis or isolated tumor cells (i.e., ≤0.2 mm), pN1mi for micrometastasis (>0.2 mm to 2 mm), pN1a for metastasis in 1 to 3, pN2a in 4 to 9; or pN3a in 10 or more axillary lymph nodes with at least 1 deposit greater than 2 mm.

**FS-PS Correlation**

Cases were classified as concordant if FS and PS agreed, being either true positive or true negative. Cases were classified as discordant if false negative (FN), or when 1 or more SLNs was called negative and later deemed positive, either on review of FS slides due to interpretive error or only on deeper FS slides due to sampling error (SE). In cases with SE, the first FS level in which metastasis was detected was recorded. There were no false-positive cases, or those in which a SLN FS was called positive and later deemed to be negative.

**Statistical Analysis**

Clinicopathologic features were compared between groups with and without discordance using means, medians, and frequencies. Characteristics were compared using $x^2$ tests of independence or Fisher exact test for categoric variables and 2-sample $t$ tests or Wilcoxon rank sum tests for continuous variables. Factors associated with discordance by univariable analysis were analyzed using multivariable logistic regression. Fisher exact test investigated the relationship between enterprise site (AI versus CS) and serial sectioning of lymph nodes. A $P$ value of <.05 was considered significant. All data analysis was performed using SAS Proprietary software 9.4 (Cary, North Carolina).

**RESULTS**

**Patients**

Lymph nodes sent for FS came from 426 patients with 432 neoplasms, with 6 patients having bilateral breast cancer. Most patients were female (423 of 426; 99.3%) with a mean age of 57 years. Most cases were from the AI (372 of 432; 86.1%), whereas the remainder were from the CS (60 of 432; 13.9%; Table). Invasive ductal carcinoma was the most common (292 of 432; 67.6%) breast cancer subtype, and the most frequent pathologic T and N stage was pT1 (223 of 432; 51.6%) and pN0 (350 of 432; 81%), respectively. A subset (151 of 426; 35.4%) had undergone NAC. Of those undergoing NAC, 49 (11.5%) had a known prior positive lymph node, 13 (3.1%) of which were enrolled in the Alliance A011202 randomized clinical trial in which patients were intraoperatively randomized to ALND or no ALND if FS showed persistent positive axillary lymph node metastases (>0.2 mm) in 1 to 6 lymph nodes.

**Adherence to Sectioning Protocol**

Serial sectioning at 2-mm intervals was performed for all FS in 338 of 432 cases (78.2%). Nonadherence to this protocol was significantly associated with performance at CS, in which only 14 of 60 (23.3%) were appropriately sectioned compared with 324 of 372 (87.1%) at the AI ($P < .001$). When nonadherent, large lymph nodes were submitted either whole or bisected.

We additionally followed grossing technique in the 6 months after the study and found that serial sectioning at 2-mm intervals was performed for all SLN FS in 72 of 76 cases (94.7%) done at the AI and 15 of 21 cases (71.4%) at CS.

**FS-PS Concordance**

Most cases were concordant, with true negative comprising 339 of 432 (78.5%) and true positive comprising 72 of 432 (16.7%). Discordance, or cases with 1 or more FN SLN FS, was seen in 21 of 432 (4.8%; Figure 1).

**Discordant (FN) Cases**

Of 21 FN cases, 15 (71.4%) were due to SE, 5 (23.8%) were due to interpretive error, and 1 (4.8%) had both an FN
## Clinicopathologic Features With Comparison of Concordant (n = 411) and Discordant (n = 21) Sentinel Lymph Node (SLN) Frozen Section (FS) Cases

| Characteristic                                      | Total, N = 432 | Concordant, n = 411 | Discordant, n = 21 | P Value |
|-----------------------------------------------------|----------------|---------------------|-------------------|---------|
| Sex, No. (%) (N = 426)                              |                |                     |                   | >.99ab  |
| Female                                              | 423 (99.3)     | 402 (99.3)          | 21 (100)          |         |
| Male                                                | 3 (0.7)        | 3 (0.7)             | 0 (0)             |         |
| Age at diagnosis, y, mean ± SD (N = 426)            | 56.8 ± 12.7    | 56.8 ± 12.6         | 56.5 ± 13.9       | .85c    |
| Enterprise site, No. (%)                            |                |                     |                   | >.99ab  |
| Academic institution                                | 372 (86.1)     | 354 (86.1)          | 18 (85.7)         |         |
| Community sites                                     | 60 (13.9)      | 57 (13.9)           | 3 (14.3)          |         |
| Tumor subtype, No. (%)                             |                |                     |                   | .13ab   |
| DCIS/pLCIS                                          | 80 (18.5)      | 80 (19.5)           | 0 (0)             |         |
| IDC                                                | 292 (67.6)     | 274 (66.7)          | 18 (85.7)         |         |
| ILC                                                | 47 (10.9)      | 45 (10.9)           | 2 (9.5)           |         |
| Other invasive                                      | 13 (3)         | 12 (2.9)            | 1 (4.8)           |         |
| Mean tumor size, cm                                 | 0.9 ± 0.7      | 0.9 ± 0.7           | 1.4 ± 0.6         | <.001c  |
| pT stage, No. (%)                                   |                |                     |                   | .008ab  |
| pT0 or pTis                                         | 130 (30.1)     | 129 (31.4)          | 1 (4.8)           |         |
| ypT0 or ypTis subset                                | 59 (13.6)      | 58 (14.1)           | 1 (4.8)           |         |
| pT1                                                | 223 (51.6)     | 213 (51.8)          | 10 (47.6)         |         |
| ypT1 subset                                         | 63 (14.6)      | 59 (14.3)           | 4 (19)            |         |
| pT2                                                | 72 (16.7)      | 62 (15.1)           | 10 (47.6)         |         |
| ypT2 subset                                         | 25 (5.8)       | 20 (4.9)            | 5 (23.8)          |         |
| pT3                                                | 5 (1.2)        | 5 (1.2)             | 0 (0)             |         |
| ypT3 subset                                         | 2 (0.5)        | 2 (0.5)             | 0 (0)             |         |
| ypTX                                               | 2 (0.5)        | 2 (0.5)             | 0 (0)             |         |
| pN stage, No. (%)                                   |                |                     |                   | <.001ab |
| pN0                                                | 350 (81)       | 350 (85.2)          | 0 (0)             |         |
| ypN0 subset                                         | 109 (25.2)     | 109 (26.5)          | 0 (0)             |         |
| pN1mi                                              | 15 (3.5)       | 7 (1.7)             | 8 (38.1)          |         |
| ypN1mi subset                                       | 4 (1)          | 2 (0.5)             | 2 (9.5)           |         |
| pN1a                                               | 44 (10.2)      | 37 (9)              | 7 (33.3)          |         |
| ypN1a subset                                       | 23 (5.3)       | 19 (4.6)            | 4 (19)            |         |
| pN2a                                               | 15 (3.5)       | 10 (2.4)            | 5 (23.8)          |         |
| ypN2a subset                                       | 9 (2.1)        | 6 (1.5)             | 3 (14.3)          |         |
| pN3a                                               | 7 (1.6)        | 6 (1.5)             | 1 (4.8)           |         |
| ypN3a subset                                       | 5 (1.2)        | 4 (1.0)             | 1 (4.8)           |         |
| ypNX                                               | 1 (0.2)        | 1 (0.2)             | 0 (0)             |         |
| M stage, No. (%)                                    |                |                     |                   | .18ab   |
| MX                                                 | 428 (99.1)     | 408 (99.3)          | 20 (95.2)         |         |
| M1                                                 | 4 (0.9)        | 3 (0.7)             | 1 (4.8)           |         |
| Neoadjuvant chemotherapy, No. (%)                  | 131 (35)       | 141 (34.3)          | 10 (47.6)         | .21b    |
| Prior positive lymph node biopsy                    | 49 (11.3)      | 43 (10.5)           | 6 (28.6)          | .02ab   |
| Alliance A011202                                    | 13 (3)         | 11 (2.7)            | 2 (9.5)           | .13ab   |
| Median SLNs for FS, No. (range)                    | 2 (1–12)       | 2 (1–12)            | 3 (1–8)           | <.001a  |
| Median non-SLNs for FS, No. (range)                | 0 (0–3)        | 0 (0–3)             | 0 (0–3)           | .02a    |
| Median positive FS, No. (range)                    | 0 (0–5)        | 0 (0–5)             | 1 (0–4)           | <.001a  |
| Serially sectioned, No. (%)                        | 338 (78.2)     | 322 (78.3)          | 16 (76.2)         | >.99ab  |
| Cytokeratin IHC, No, (%)                            | 97 (22.5)      | 87 (21.2)           | 10 (47.6)         | .008ab  |
| Axillary lymph node dissection, No, (%)             | 56 (13)        | 47 (11.4)           | 9 (42.9)          | <.001ab |
| Axillary radiation, No. (%)                         | 50 (11)        | 40 (9.7)            | 10 (47.6)         | <.001ab |

Abbreviations: DCIS, ductal carcinoma in situ; IDC, invasive ductal carcinoma; IHC, immunohistochemistry; ILC, invasive lobular carcinoma; NAC, neoadjuvant chemotherapy; pLCIS, pleomorphic lobular carcinoma in situ.

a Exact test.
b Chi-square test.
c Wilcoxon rank-sum test.
d Other invasive carcinomas included: metaplastic (7), mucinous (2), apocrine (1), tubular (1), and tubulolobular (1).
e Invasive mucinous carcinoma (1).
f TX was due to the presence of lymphatic involvement only after NAC.
g pNX was due to the presence of metastasis in contralateral SLN only (ipsilateral not assessed); this represents 1 of 3 patients with M1 status.
due to SE and 1 due to interpretive error (Figure 2). A total of 14 (66.7%) had micrometastatic and 7 (33.3%) had macrometastatic disease (examples in Figure 3). The most frequent metastasis size was 1 mm and the median size was 2 mm (range, 0.5–9 mm). Ten patients (47.6%) had undergone NAC, and 2 (9.5%) had invasive lobular subtype.

Multiple clinicopathologic features were associated with discordance by univariate analysis (Table). However, multivariate analysis showed significant association with the following features: (1) increased number of SLNs sent for FS ($P = .04$); (2) higher pT stage ($P = .01$); (3) performance of cytokeratin IHC ($P = .002$), and (4) increased number of total positive lymph nodes (SLN and non-SLN) identified via FS ($P < .001$).

Of the 7 FN cases with macrometastatic disease, 4 were at the AI and 3 at the CS. All 4 AI cases were appropriately serially sectioned; however, 3 were post-NAC with low cellularity, and the other was a small (0.3-cm) macrometastasis. All 3 CS cases were not serially sectioned, nor were they post-NAC.

A total of 15 of 16 FNs (93.8%) due to SE had metastasis identified on the first PS level (level 3). In the other case there was metastasis in a serially sectioned SLN that was first identified on the second PS level (level 5); it was a 1.2-mm micrometastasis without extranodal extension and 3 additional SLNs from this case were negative (Figure 2).

### Outcomes

A total of 7 of 21 patients (33.3%) with FN underwent ALND. However, 3 underwent ALND during the same procedure because other SLNs were found to be positive at the time of intraoperative evaluation (Figure 1).

Two patients who underwent later ALND did not have nodal upstage. One post-NAC patient undergoing mastectomy at the AI had 2 appropriately serially sectioned SLNs and 1 non-SLN sent for FS, all called negative. One SLN FN due to interpretive error had a metastasis that was <2 mm on rereview of FS, but was up to 3 mm on deeper PS. The other SLN showed micrometastasis present only in deeper PS. This patient underwent later ALND, which yielded 12 negative lymph nodes. The other was a CS patient undergoing breast-conserving therapy who had 2 macrometastases and 1 micrometastasis out of 6 SLNs reported at FS. The surgeon intraoperatively discussed options with family and a decision was made to wait for final pathology, which showed 1 additional positive SLN, which was grossly 14 mm and bisected for FS with PS showing a 5-mm macrometastasis not present on rereview of FS slides. Following multidisciplinary discussion, there was recommendation for ALND, which was accepted by the patient and yielded 13 negative lymph nodes.

The other 2 patients who underwent later ALND had nodal upstage. One was a CS patient for whom the grossly 20-mm SLN was not serially sectioned but bisected for FS, and deeper PS levels showed a 6-mm metastasis (Figure 3, A) not identified on rereview of FS slides. With ALND her nodal stage increased from pN1a(sn) to pN2a. The other patient, who also had the largest FN macrometastatic focus (9 mm), had invasive lobular subtype with low cellularity after NAC (Figure 4) and was enrolled in the Alliance Breast SLN FS Practice Audit—Czaja et al

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![Figure 1. Management and outcome of discordant (false-negative) sentinel lymph node frozen section cases. *Of 6 patients with false-negative micrometastases undergoing ALND in the same procedure, 5 had other lymph nodes with macrometastases identified at frozen section, and all were either status post neoadjuvant chemotherapy (5) or neoadjuvant endocrine therapy (1). Abbreviations: AI, academic institution; ALND, axillary lymph node dissection; CS, community site.](image-url)
Figure 2. Classification of sentinel lymph node frozen section false-negative results (n = 21). *One case had both sampling error (SE) and interpretive error (IE).

DISCUSSION

Sentinel lymph node FS discordance due to FN varies in the published literature because of multiple factors. First, studies reflect heterogeneity in which SLNs are processed for FS and how FN is defined. Additionally, variable performance of preoperative axillary ultrasound contributes to varying rates of SLN submission for FS. Cases sent for FS have also changed, resulting overall in less SLN FS requests in recent years.

Specifically, publication of the American College of Surgeons Oncology Group (ACOSOG) Z0011 trial results led to decreased SLN FS because the findings concluded that clinically node-negative pT1 to pT2 breast-conserving therapy patients could safely undergo axillary radiotherapy in lieu of ALND for low-volume (1–2 positive SLNs) macrometastatic disease. After Mapping of the Axilla: Radiotherapy or Surgery? (AMAROS) and NSABP B-32 trials showed similar results in populations that included both breast-conserving therapy and mastectomy patients, resulting in further declines in ALND and need for SLN FS. Thus, SLN FS requests have declined, but those that are sent are becoming more difficult, with higher percentages having previously undergone NAC.

Use of SLN, and thus SLN FS, following NAC has decreased in recent years as clinical trials have supported that patients with biopsy-proven low-stage (cN1) nodal disease who convert to node-negative (ypN0(sn))—given dual-tracer technique and identification of any clipped lymph node and/or 2 or more SLNs—can safely avoid ALND. The Alliance A011202 trial, which uses intraoperative SLN FS for randomization, aims to examine outcomes in those with persistent positive axillary disease following NAC who undergo axillary radiation with or
without ALND.\textsuperscript{30} In the current study, 35.4\% of SLN FS patients received NAC.

Sentinel lymph node FS evaluation following NAC is notably more challenging, largely because of decreased tumor cellularity. Making these cases even more challenging, ALND remains standard of care for any volume of persistent metastatic SLN disease following NAC (outside of trial settings), meaning that it is crucial to detect small metastases at the time of FS to avoid reoperation for ALND.

As noted previously, this is not the scenario for most other (non-NAC) cases, in which only detection of significant macrometastatic (>2 mm) disease has an impact on patient management. Notably, one of the most consistent features associated with SLN FS FN in the literature is small (<2 mm) micrometastasis.\textsuperscript{24–27}

In this study, SLN FS FN was seen in 21 patients, comprising 4.8\% of all cases and 22.5\% of all cases with final positive SLN status. However, most (14 of 21; 66.7\%) were micrometastases, and 4 patients with macrometastases had other intraoperatively identified positive SLNs, 3 of whom underwent ALND during the same procedure and 1 of whom had her intraoperative course dictated by trial protocol. Thus, SLN FS FN only significantly impacted intraoperative care for 3 patients, 2 of whom had SE that would likely have been avoided with proper SLN sectioning at 2-mm intervals rather than bisection of the large lymph nodes.

Although experts agree that SLN should be thinly sectioned at 2-mm (or thinner) intervals there is debate over whether to section parallel or perpendicular to the long axis. Per our policy, SLNs are sectioned perpendicular to the long axis, which is in keeping with the RCPath protocol\textsuperscript{15} and is in contrast with the most recent CAP protocol, which states one should section parallel to the long axis.\textsuperscript{14} The rationale for parallel sectioning is cited to be based on “old anatomic data that suggest afferent lymphatics are more likely to enter the node in this plane.”\textsuperscript{28} Prior CAP protocols did not specify the plane in which to section.\textsuperscript{29} A recent practice survey conducted across academic centers in the United States and Canada showed dichotomy of practice, with 44.4\% (8 of 18) sectioning parallel and 55.6\% (10 of 18) perpendicular to the long axis.\textsuperscript{30} We feel that it is simply easier to achieve thinly sliced sections, and therefore easier to detect small metastases, by cutting SLN perpendicularly, especially for those sent fresh for FS.

There has also been significant debate and heterogeneity in histologic processing of SLN, with many laboratories, like ours, still performing multiple H&E levels, with or without cytokeratin IHC.\textsuperscript{30} However, several trials support only minimal outcome differences when “enhanced methods,” including additional H&E levels and IHC, were used to detect occult metastases not present in the original H&E section.\textsuperscript{3,31,36} Thus, some have suggested that a single PS H&E level is sufficient for diagnosis and staging.

Among 16 SLN FS FNs due to SE in this study, nearly all (15 of 16; 93.8\%) were detected on the first cut PS level. However, performance of a single PS H&E level (following 2 FS levels) would have resulted in 1 patient being staged as pN0(sn) rather than pN1mi(sn). However, arguments in favor of change in protocol to only 1 PS level are that this finding was rare (0.2\% of all cases) and that it would result in a significant reduction in histology laboratory resource use. Specifically, per a prior cost analysis performed at our institution we estimate a laboratory cost reduction alone of $17.08 per block ($4.36 × 2 fewer H&E and $4.18 × 2 fewer unstained slides cut per block). However, this process change is dependent on otherwise treating SLNs per standard of care, namely grossing appropriately by serially sectioning at 2-mm intervals.

We had a much lower than expected adherence to our 2-mm serial sectioning protocol for SLN FS, especially at CS (78.2\% at the AI versus 23.3\% at CS). This posed an opportunity for the education of pathologists on the importance of serial sectioning of breast SLNs for detection of small metastatic foci. Future aims are to examine our SLN cases not sent for FS during this time period as well as to monitor SLN FS cases following education efforts. This will allow us to determine if SLNs not sent for FS have been treated similarly to SLN FS (representing a true education gap) or if practices differed, possibly as a result of a more stressful FS environment, in which, “in the heat of the moment,” policy may be overlooked or ignored because of time constraints and/or other pressures. In the 6 months following education efforts, adherence to 2-mm serial
section increased to 94.7% and 71.4% at the AI and CS, respectively.

**CONCLUSIONS**

This study supports a shift toward more challenging breast SLN FS cases. However, it also highlights the importance for performing standard of care gross sectioning at 2-mm intervals and the need to monitor protocol adherence rather than assuming the policy is uniformly understood and followed. If future monitoring shows continued improved adherence to our sectioning policy, with confirmation of minimal patient care impact, we plan to decrease the number of FS slides created after FS to just 1 additional H&E level and 1 unstained slide for potential future use.

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