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A quality initiative of postoperative radiographic imaging performed on mastectomy specimens to reduce histology cost and pathology report turnaround time

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ABSTRACT

Breast pathology relies on gross dissection for accurate diagnostic work, but challenges can necessitate submission of high tissue volumes resulting in excess labor, laboratory costs, and delays. To address these issues, a quality initiative was created through implementation of the Faxitron PathVision specimen radiography system as part of the breast gross dissection protocol; this report documents its impact on workflow and clinical care. Retrospective data from 459 patients who underwent simple or modified radical mastectomy at our institution between May 2012 and December 2014 were collected. Comparison was made between the mastectomy specimen control group before radiography use (233 patients, 340 breasts) and Faxitron group that underwent postoperative radiography (226 patients, 338 breasts). We observed a statistically significant decrease in mean number of blocks between control and Faxitron groups (47.0 vs 39.7 blocks; $P < .0001$), for calculated cost savings of US $146 per mastectomy. A statistically significant decrease in pathology report turnaround time was also observed (4.2 vs 3.8 days; $P = .038$). Postoperative mastectomy specimen radiography has increased workflow efficiency and decreased histology costs and pathology report turnaround time. These findings may underestimate actual benefits and highlight the importance of quality improvement projects in anatomical pathology.

1. Introduction

Gross dissection of postoperative breast specimens is of critical importance for accurate tumor grading, staging, and chemotherapeutic regimen selection in mammary carcinoma. At our institution, breast dissection is performed as part of an integrated model of clinical care, whereby clinical, surgical, and radiologic data are used to inform both dissection and the final pathology report.

However, breast dissection presents unique challenges. Most malignant mastectomy specimens at our institution have T1 or T2 lesions, and small lesions can be exceedingly difficult to locate within heterogeneous breast parenchyma. Coexistence of multiple simultaneous lesions can further complicate lesion mapping, but lesion locations and distances to margins must be meticulously tracked, as well as tissue status between lesions. Mastectomy specimens after neoadjuvant chemotherapy may exhibit a complete or near complete pathologic response, in which case lesions are difficult to grossly identify. The physical extent of ductal carcinoma in situ (DCIS) can be difficult to measure, even when associated with microcalcifications.

Given these challenges, breast pathology at our institution relies on a 3-dimensional approach to gross dissection and lesion mapping and careful correlation with radiographic reports. Emphasis is placed on documentation and recovery of both microclips and microcalcifications. Microclips, small metal objects placed by an operator at the site of the lesion during core needle biopsy, are tracked by radiologists in subsequent mammographies and by pathologists during tissue selection for cassette submission. Microcalcifications, small dystrophic mineral deposits often associated with invasive and/or in situ carcinoma, are neither grossly visible nor palpable during tissue dissection. Correlation of microcalcification presence between mammography and histologic sections is important because in situ carcinoma is often grossly undetectable and, therefore, best seen in association with clinical imaging.

Although both microclips and microcalcifications are invaluable for accurate diagnosis, they can be very difficult to detect within breast specimens during dissection. Recovery of a microclip within a large mastectomy specimen has been compared to “finding a needle in a haystack” and is further complicated by the potential for microclips to shift position in vivo and by the presence of multiple microclips in breasts with multifocal lesions. Microcalcifications are similarly not always present in histologic sections, even from a well-sampled area of breast correlated correctly with radiology reports. Together, these factors often necessitate reexamination of the gross specimen and submission

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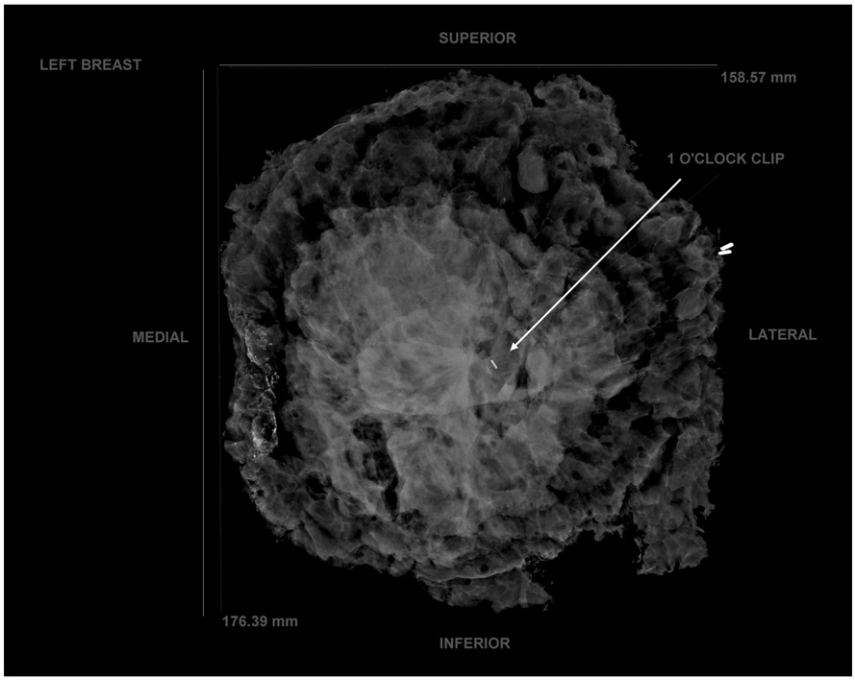

Fig. 1. Example of radiographic image taken before gross dissection using the Faxitron PathVision system and annotated with direction labels, dimensions, and an arrow denoting a microclip.

of additional cassettes for review. This process causes increased labor and laboratory costs as well as delays in reporting results.

Intraoperative specimen radiography has been used successfully in margin assessment in breast-conserving surgery [1,2] as well as in other clinical and research applications [3,4]. We sought to apply this technique postoperatively to improve routine mastectomy dissection and processing by an anatomical pathology service. Specifically, this quality initiative assessed the value of such a system in terms of the number of blocks per breast, cost of processing breast specimens, and pathology report turnaround time.

2. Materials and methods

This project has received institutional review board approval. Retrospective data from 459 patients who underwent simple or modified radical mastectomy at our institution between May 2012 and December 2014 were collected from pathology records. Only simple and modified radical mastectomy specimens were included in the analysis, to directly compare specimens dissected using the same protocol. The following specimen types were excluded: lumpectomies, partial mastectomies, wire-localized excisions, core needle biopsies, reexcisions for margins, capsulectomies, mammoplasties, specimens grossed at outside facilities and sent for consultation, fine needle aspiration/cytology cases, and axillary tail dissections alone. Additional exclusions were made for breasts with the sole diagnosis of invasive lobular carcinoma and for mastectomies done immediately after neoadjuvant chemotherapy because these are dissected using a different grossing protocol in which lesion mapping is performed by submitting sequential sections from all tissue levels.

Mastectomies were performed for surgical treatment of a biopsy-proven malignancy or by patient choice for prophylactic treatment of benign breasts due to a genetic condition and/or contralateral malignancy.

Specimens accessioned on or before September 17, 2013, before acquisition of the Faxitron PathVision system (Faxitron Bioptics, Tucson, AZ) were grossed according to the UCLA breast mastectomy protocol [5]. The specimens were measured in 3 dimensions and weighed in grams, and the margins inked in 6 colors, with the nipple-adjacent region in nipple/skin-sparing mastectomy specimens in a seventh color. Shave margins were taken from all 6 margins as well as from the nipple-adjacent area if present. The specimens were serially sectioned from longest axis (usually medial to lateral) into multiple levels less than or equal to 1 cm in thickness, and lesions compared to the preoperative radiology report (size of lesion, quadrant/clock position, and distance from nipple). All lesions were sampled with a minimum of 1 to 2 sections, unless microclip recovery was impossible, in which case possible lesions were submitted entirely for histologic analysis. All levels were sampled with 1 or 2 representative sections of fibrous areas, including prior biopsy sites when present. Sections were also taken from tissue between multifocal lesions. Cassettes from each

Table 1
Mastectomy characteristics included in radiographic imaging study.

Measurements	Control	Faxitron	*P*
No. of patients	233	226	N/A
No. of breasts			
Benign cases	173	177	.700
Malignant cases	167	161	
All cases	340	338	N/A
Average no. of tumors	0.79	0.81	.887
Average size of tumors (cm)	2.30	1.97	.246
Average weight of breast (g)	795.8	781.7	.790

Table 2
Univariable analysis with the Student *t* tests showing that radiographic imaging is associated with statistically significant decrease in mean number of blocks created in all mastectomies ($P < .0001$) and malignant mastectomies ($P = .015$), but not in benign mastectomies ($P = .25$).

No. of blocks created	Control (n = 233)	Faxitron (n = 226)	*P*
All mastectomies			<.0001
Mean (SD)	41.2 (18.4)	34.3 (16.6)	
Range	11-117	8-105	
Benign mastectomies			.25
Mean (SD)	32.7 (16.9)	29.7 (16.9)	
Range	11-86	8-90	
Malignant mastectomies			.015
Mean (SD)	41.4 (18.1)	34.9 (17.9)	
Range	19-117	10-105	