

Utilization of minimally invasive breast biopsy for the evaluation of suspicious breast lesions

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Abstract

BACKGROUND: Percutaneous needle biopsy, also known as minimally invasive breast biopsy (MIBB), has become the gold standard for the initial assessment of suspicious breast lesions. The purpose of this study is to determine modern rates of MIBB and open breast biopsy.

METHODS: The Florida Agency for Health Care Administration outpatient surgery and procedure database was queried for patients undergoing open surgical biopsy and MIBB between 2003 and 2008.

RESULTS: Although there was an increase in the use of MIBB, the overall rate of open surgical biopsy remained high (~30%). A reduction in the open biopsy rate from 30% to 10% could be associated with a charge reduction of >\$37.2 million per year.

CONCLUSIONS: The current rate of open surgical breast biopsy remains high. Interventions and quality initiatives are warranted, which could lead to a reduction in unnecessary operations for women, improved patient care, and a reduction in breast health care costs.

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Given the widespread use of mammographic screening programs, many breast cancers in the modern era are detected by imaging modalities, including mammography, ultrasound, and magnetic resonance imaging. Suspicious lesions detected on breast imaging require tissue diagnosis. Tissue diagnosis of suspicious lesions may be obtained by using image-guided minimally invasive techniques such as stereotactic biopsy, ultrasound-guided core needle biopsy,

or surgical approaches (needle-localized excision or excisional or incisional biopsy).¹

Previous^{2,3} and current¹ consensus statements on the management of image-detected breast cancer strongly endorse the application of needle biopsy for suspicious breast lesions for optimal management. It has been suggested that minimally invasive breast biopsy (MIBB) is associated with numerous benefits, including fewer operations, fewer reoperations, less scarring, less morbidity, and facilitation of preoperative multidisciplinary treatment planning.^{4–6} Furthermore, for most patients with benign lesions determined by MIBB, the need for an operation is eliminated.

Several small series have suggested that the rate of use of surgical procedures for the diagnosis of suspicious breast lesions is high.^{5,7} In the present study, we hypothesized that despite the advantages of MIBB, open surgical biopsy con-

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Table 1 Current Procedural Terminology (CPT) code definitions and associated charges

CPT Code	Definition	Charge*
19100	Biopsy of breast; percutaneous, needle core, not using imaging guidance	\$5,405
19101	Biopsy of breast; open, incisional	\$10,271
19102	Biopsy of breast; percutaneous, needle core, using imaging guidance	\$4,720
19103	Biopsy of breast; percutaneous, automated vacuum assisted or rotating biopsy device, using imaging guidance	\$6,041
19125	Excision of breast lesion identified by preoperative placement of radiological marker, open; single lesion	\$11,355

*Charges calculated from fourth quarter 2007 to third quarter 2008 AHCA data (not including associated professional fees).

tinues to be widely and excessively used for the initial management of suspicious breast lesions in Florida. To test the hypothesis, we evaluated trends in patterns of care over a recent 5-year period in Florida and calculated the excess charges associated with the overuse of surgical biopsies for the evaluation of suspicious breast lesions. The findings have significant implications on the quality and cost of

breast care in both the state of Florida and the nation and further suggest the need for efforts to educate and modify current practice patterns.

Methods

This study was a population-based retrospective cohort study based on administrative data from the Florida Agency for Health Care Administration (AHCA) statewide outpatient surgery and procedure database. The AHCA data set was queried for all patients undergoing open surgical breast biopsy and MIBB over the most recent 5-year period (2003–2008) available for analysis. AHCA⁸ oversees the licensure of 36,000 health care facilities, health clinics, hospitals, imaging facilities, and outpatient surgical centers in Florida. AHCA collects data on ambulatory operations and outpatient medical procedures⁹ and shares health care data through the Florida Center for Health Information and Policy Analysis. Data sets are available to the public for a fee.¹⁰

Variations in the use of these procedures were analyzed by hospital over time. Procedures were identified by *Current Procedural Terminology* codes (Tables 1 and 2). Comparisons of multiple categories were tested with 1-way analysis of variance for parametric data. *P* values <.05 were considered significant.

Table 2 Number and type of breast biopsies performed in Florida from fourth quarter 2003 to third quarter 2008

Year (Quarter)	Current Procedural Terminology Code									
	19100		19101		19102		19103		19125	
	n	%	n	%	n	%	n	%	n	%
2003 (4)	266	3.0	680	7.7	1,960	22.1	2,638	29.8	3,313	37.4
2004 (1)	239	2.5	583	6.1	2,248	23.4	2,927	30.4	3,628	37.7
2004 (2)	239	2.5	613	6.4	1,972	20.7	3,211	33.7	3,485	36.6
2004 (3)	178	2.2	555	6.8	1,648	20.3	2,826	34.8	2,913	35.9
2004 (4)	172	2.0	438	5.1	1,771	20.8	3,025	35.5	3,109	36.5
2004	828	2.3	2,189	6.1	7,639	21.3	11,989	33.5	13,135	36.7
2005 (1)	164	1.8	366	4.1	1,888	21.0	3,221	35.8	3,353	37.3
2005 (2)	170	1.9	427	4.8	2,012	22.8	3,029	34.4	3,175	36.0
2005 (3)	117	1.4	364	4.5	1,801	22.0	2,940	36.0	2,946	36.1
2005 (4)	84	1.1	399	5.0	1,624	20.4	3,001	37.7	2,858	35.9
2005	535	1.6	1,556	4.6	7,325	21.6	12,191	35.9	12,332	36.3
2006 (1)	80	.9	379	4.2	1,883	20.9	3,649	40.4	3,035	33.6
2006 (2)	76	.9	423	4.8	1,919	22.0	3,657	41.9	2,648	30.4
2006 (3)	50	.6	382	4.3	2,086	23.3	3,861	43.1	2,579	28.8
2006 (4)	75	.9	422	4.9	2,001	23.2	3,702	43.0	2,409	28.0
2006	281	.8	1,606	4.5	7,889	22.3	14,869	42.1	10,671	30.2
2007 (1)	109	1.3	372	4.3	1,951	22.7	3,711	43.1	2,469	28.7
2007 (2)	85	1.0	346	4.2	2,018	24.6	3,496	42.6	2,254	27.5
2007 (3)	73	.9	348	4.4	1,651	21.1	3,651	46.7	2,103	26.9
2007 (4)	71	.9	351	4.5	1,726	21.9	3,593	45.7	2,129	27.1
2007	338	1.0	1,417	4.4	7,346	22.6	14,451	44.5	8,955	27.5
2008 (1)	50	.6	280	3.1	1,981	22.2	4,241	47.6	2,352	26.4
2008 (2)	43	.5	298	3.5	1,792	20.8	4,301	49.9	2,180	25.3
2008 (3)	58	.7	327	3.9	1,577	18.7	4,335	51.5	2,128	25.3

In this study, we hypothesized that MIBB was more commonly performed at academic medical centers compared with nonacademic institutions. Univariate and multivariate logistic regressions were used to compare the relationship between biopsy techniques among academic versus nonacademic centers. Multivariate logistic regressions were used to determine the association between academic center designation and biopsy type. Covariates were added to the logistic regression to adjust for confounding factors. For multivariate regression, the groups were matched and adjusted for age, race, gender, and payer status. The Cochran-Armitage test for trend was used to determine the significance of practice trends over time.¹¹ If the hospital participates in graduate medical education and is colocated with a medical school in Florida, it was included as an “academic institution” for the purposes of this study. For the purposes of this study, academic centers in Florida included Shands Hospital–University of Florida, Moffitt Cancer Center, Jackson Memorial Hospital, and Tampa General Hospital. Charge estimates associated using the various biopsy procedures were analyzed using charges available from the AHCA database. All data were analyzed using SAS version 9.1 (SAS Institute Inc, Cary, NC).

Results

During the 5-year examination period, 172,342 breast biopsy procedures were performed in Florida and were available for analysis. Sociodemographic data for the patients are outlined in Table 3. The total number of biopsies performed per year is shown in Figure 1. There was no significant change in the total number of biopsies performed per year over the period of study.

Over the period of study, there was a significant change noted in the use of various biopsy procedures ($P < .0001$). Although there was a significant increase in the percentage of patients having MIBB over the period of study, the rate of open surgical biopsy remained very high (approximately 30%; Fig. 2). This finding suggests that open biopsy is being overused in Florida. In 2008, \$246.8 million was charged to the performance of breast biopsy, \$112.7 million for open surgical biopsy, and \$134 million for MIBB.

The use of MIBB was more common at academic centers compared with nonacademic centers. The unadjusted odds ratio was 1.82 (95% confidence interval, 1.74–1.91) for academic centers, suggesting significantly higher rates of MIBB at academic centers. When patients were matched and adjusted for age, race, gender, and payer status, this odds ratio remained significant at 1.49 (95% confidence interval, 1.42–1.56).

Comments

It has been estimated that 1.6 million breast biopsies are performed annually in the United States.⁶ Optimizing care

for patients undergoing these 1.6 million procedures is important for oncologic, cosmetic, and financial concerns.¹ Advantages of MIBB have been clearly outlined and include less scarring, less postprocedural morbidity, and reduced costs.^{4–6} The rate of hematoma requiring treatment has been estimated to be 20 to 100 times more common in patients undergoing open surgical biopsy.¹² Furthermore, infection rates have been estimated to be 38 to 63 times more common in patients undergoing open surgical biopsy.¹² In addition, patients with diagnoses of cancer on MIBB are less likely to require second operations for margin management and/or sentinel node biopsy.^{1,4,6,13} Finally, MIBB before surgical management of cancerous lesions may also allow for multidisciplinary planning and a discussion of eligibility for clinical trial enrollment.¹

Several consensus conferences have firmly recommended the use of MIBB for evaluating breast lesions when possible.² Despite this, our data suggest that open surgical biopsy still accounts for nearly one-third of the biopsy procedures performed in Florida in 2008. Although the use of open surgical biopsy decreased over the study period, the 30% rate seen in 2008 is significantly above what many have suggested to be an appropriate rate of open biopsy (5%–10%).^{1,6}

Most lesions determined to be suspicious are amenable to MIBB. There are reasons why MIBB may not be safely performed, including an unfavorable position of the lesion in the breast (eg, near the chest wall, near an implant),¹⁴ small breast size, active use anticoagulants for other medical conditions, patient refusal, or the lesion not being seen on any imaging studies.⁵ These situations occur uncommonly but do account for up to 5% to 10% of surgical biopsies.⁶

MIBB is highly accurate,^{4,12} and in most circumstances, a benign needle biopsy result can prevent the need for an open surgical procedure.¹ Uncommonly, situations of discordance between needle biopsy results and imaging characteristics prompt performance of open surgical biopsy for diagnosis of suspicious breast lesions.^{4,5} A prior MIBB is not associated with higher rates of surgical site infection in patients subsequently requiring open biopsy or lumpectomy.¹⁵

Friese et al¹³ recently reported a high historical rate of open surgical biopsy. In analyzing only cancer patients in the Surveillance Epidemiology and End Results database from 1991 to 1999, they reported a MIBB rate of only 24.3%. This low observed rate of MIBB likely corresponds to the limited availability of MIBB technology in the early and mid-1990s. A small study of a historical cohort of 6,282 women (1997–2002) who presented with early-stage breast cancer to a member institution of the National Comprehensive Cancer Network demonstrated a 57% rate of MIBB for diagnosis.⁷ This suggested that the practice of open surgical biopsy was prevalent even among breast cancer focused surgeons who practiced at specialized cancer centers in the 1990s through 2002. It is unclear if the practice has changed in more recent years at these specialized institutions or

Table 3 Sociodemographic data from breast biopsy patients in Florida (2003–2008)

Variable	Current Procedural Terminology Code				
	19100 (n = 2,399)	19101 (n = 8,353)	19102 (n = 37,509)	19103 (n = 69,015)	19125 (n = 55,066)
Age (y)					
≤20	30	152	454	294	170
21–30	96	345	1,682	1,229	834
31–40	321	872	4,925	6,612	4,655
41–50	636	1,974	10,737	18,155	13,424
51–60	562	1,809	8,414	16,757	13,410
61–70	414	1,580	5,958	13,618	11,645
71–80	257	1,186	3,824	9,188	8,284
>80	83	435	1,515	3,162	2,644
Gender					
Male	40	286	373	270	164
Female	2,359	8,067	37,136	68,745	54,901
Not known	0	0	0	0	1
Race					
American Indian/Eskimo/Aleut	2	9	77	83	53
Asian or Pacific islander	21	65	477	613	510
Black	376	988	5,414	8,721	5,438
White	1,086	5,582	25,882	47,758	42,187
White Hispanic	766	1,354	3,656	7,504	4,985
Black Hispanic	15	23	106	184	76
Other (if none of the above)	68	218	1,038	2,600	1,179
No response (data not available)	65	114	859	1,552	638
Payer					
Medicare	404	2,035	6,933	15,086	14,424
Medicare HMO	149	567	1,799	4,726	3,646
Medicaid	122	303	894	1,120	988
Medicaid HMO	59	129	492	817	586
Commercial insurance (includes self-insured and Blue Cross Blue Shield)	166	743	1,765	3,866	4,529
Commercial HMO (includes point-of-service HMOs)	548	1,857	11,638	21,086	14,019
Commercial PPO (review provider ID card to identify PPO network)	411	1,946	9,907	16,713	13,781
Workers' compensation	0	2	15	15	15
Champus	30	150	736	1,086	859
VA	11	10	60	73	45
Other state/local government	62	123	500	925	605
Self pay/underinsured (no third-party coverage or <30% estimated coverage)	65	295	1,178	1,599	916
Other	7	31	228	306	149
Charity	364	159	1,348	1,570	493
Kidcare (Healthy Kids, Medikids, and Children's Medical Services)	1	3	16	27	11
Total charges, fourth quarter 2007 to third quarter 2008 (millions) (\$246.8 million)	\$1.2	\$12.9	\$33.4	\$99.5	\$99.8

HMO = health maintenance organization; PPO = preferred provider organization; VA = US Department of Veterans Affairs.

nonspecialized institutions because of consensus recommendations supporting the use of MIBB. Clarke-Pearson et al⁵ have recently reported that 36% of 465 biopsies performed at a single institution were done using the open technique. These authors also suggested that open surgical biopsy rates were higher among nonspecialist breast surgeons compared with breast focused surgeons.⁵

The present study is the largest to date and the first to estimate the extent of open surgical breast biopsy use for breast lesion evaluation on a large population of unselected

patients with and without cancer. The present modern study differs from other large series that have focused on breast cancer patients treated in the 1990s. The present study included all patients undergoing breast biopsy (benign and malignant) captured in the AHCA outpatient database during the most recent period available for analysis. This is important because most breast biopsies are done for lesions ultimately determined to be benign and to not require an operation. The rate of open surgical biopsy in Florida in 2003 was 45%, similar to that in the National Comprehen-

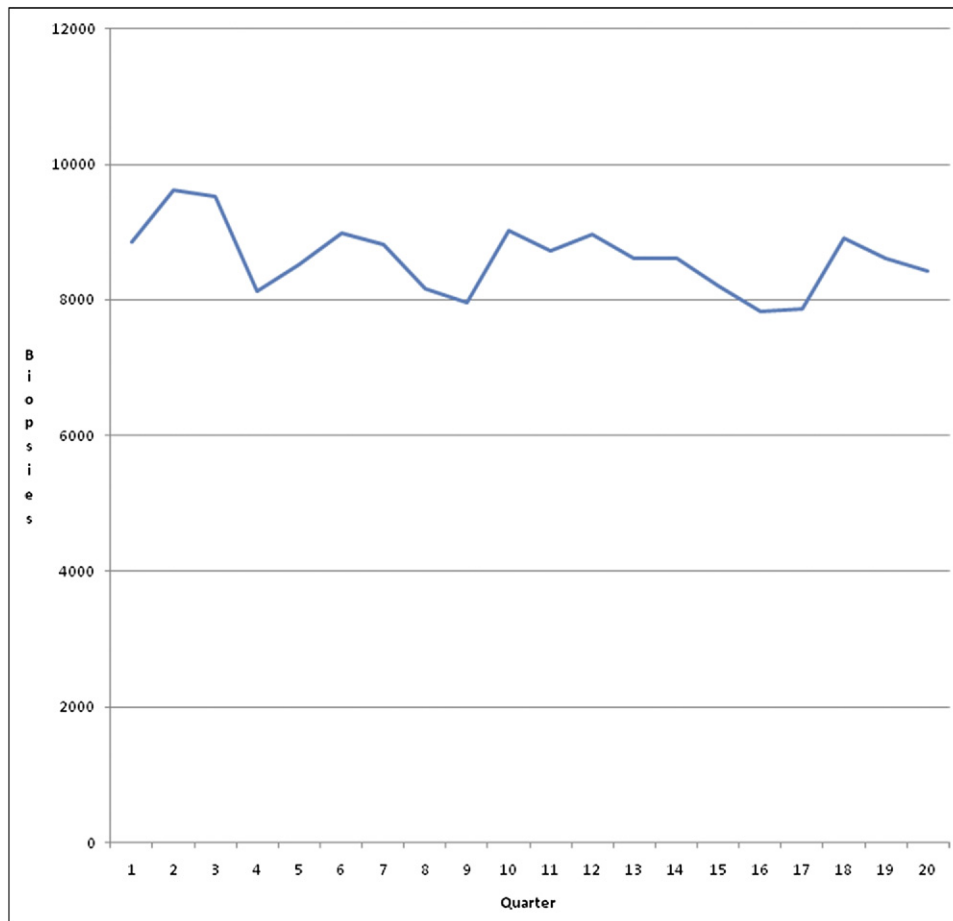


Figure 1 Total number of biopsies performed in Florida by quarter (fourth quarter 2003 to third quarter 2008).

sive Cancer Network study of patients in the late 1990s.⁷ The present study suggests that some improvement in the reduction of the rate of open surgical biopsy has been achieved over the past 5 years (Fig. 2). However, the rate of open surgical biopsy remains unacceptably high. Furthermore, the use of open surgical biopsy is significantly higher at nonacademic centers compared with academic centers. Reasons for persistently high rates of utilization of open biopsy may be related to the lack of access to resources for performing MIBB, a lack of education among practitioners about the value of MIBB, or financial factors associated with the performance of open biopsy. This is an area clearly worthy of further investigation.

This is the first study to elucidate the significant elevation in charges associated with the persistent overuse of open surgical breast biopsy. Open surgical biopsy is associated with higher charges compared with MIBB (Table 1). Consequently, more widespread use of MIBB would be associated with significantly less resource use.⁵ In 2008, reducing the open surgical biopsy rate by 20% would result in a charge reduction of \$37.2 million in Florida (on the basis of average charge data obtained from the AHCA database). On a national level (assuming similar practice patterns in other states), we estimate that reducing the use of open surgical biopsy could be associated with a charge reduction into the hundreds of millions of dollars per year. These charge esti-

mates are conservative, as they only reflect facility fees and do not include the expenses related to professional fees, postsurgical complications, and time lost from work often associated with recovery from unnecessary surgical procedures.

A strength of this study is the fact that the AHCA database is comprehensive, and reporting is required by Florida law for all hospitals and outpatient facilities.¹⁰ This requirement allows an accurate estimation of the rate of unnecessary surgical breast biopsy procedures being performed on women in Florida over the time period of the review. It is not clear if the present results observed in Florida are able to be generalized to other states, but there is no specific reason to believe that the practice patterns in Florida differ from those in other states. The present findings suggest the importance of performing similar analyses in other states. We analyzed only charges that are accurately recorded in the AHCA database. Exact costs associated with the overuse of open breast biopsy cannot accurately be determined but likely are substantial given the charge estimates.

Conclusions

The present study has identified the persistent overuse of open surgical breast biopsy procedures on a statewide level

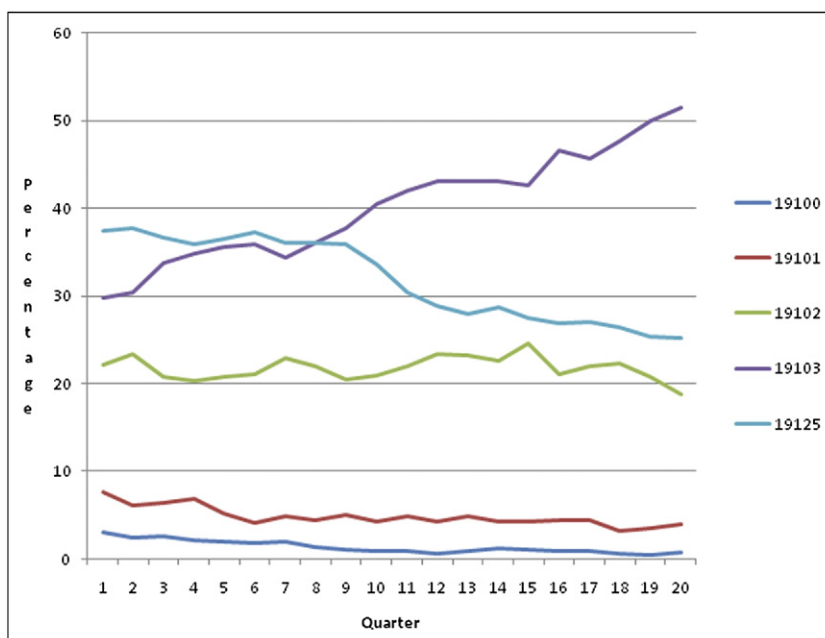


Figure 2 The percentage use of breast biopsy procedures in Florida by quarter (fourth quarter 2003 to third quarter 2008). *Current Procedural Terminology* code 19100 = needle biopsy (MIBB); code 19101 = incisional biopsy (open surgical biopsy); code 19102 = needle biopsy with image guidance (MIBB); code 19103 = vacuum-assisted biopsy with image guidance (MIBB); code 19125 = needle-localized biopsy (open surgical biopsy).

and the associated charges with this practice. The present study is important because it provides a clear demonstration of the potential to improve quality and reduce charges in modern health care through modification of practice patterns. These findings suggest the need for further efforts to educate practitioners and patients about the numerous advantages of MIBB for the evaluation of suspicious image detected breast lesions. Achieving a reduction in the rate of open surgical biopsy should remain a priority in health care delivery, which could eliminate many unnecessary operations in women.

References

1. Silverstein MJ, Recht A, Lagios MD, et al. Special report: consensus conference III. Image-detected breast cancer: state-of-the-art diagnosis and treatment. *J Am Coll Surg* 2009;209:504–20.
2. Silverstein MJ, Lagios MD, Recht A, et al. Image-detected breast cancer: state of the art diagnosis and treatment. *J Am Coll Surg* 2005;201:586–97.
3. American Society of Breast Surgeons. Official consensus statement of percutaneous needle biopsy for image detected breast abnormalities. Available at: <http://www.breastsurgeons.org>. Accessed December 5, 2006.
4. Lind DS, Minter R, Steinbach B, et al. Stereotactic core biopsy reduces the reexcision rate and the cost of mammographically detected cancer. *J Surg Res* 1998;78:23–6.
5. Clarke-Pearson EM, Jacobson AF, Boolbol SK, et al. Quality assurance initiative at one institution for minimally invasive breast biopsy as the initial diagnostic technique. *J Am Coll Surg* 2009;208:75–8.
6. Silverstein M. Where's the outrage? *J Am Coll Surg* 2009;208:78–9.
7. Edge SB, Ottesen RA, Lepisto EM, et al. Surgical biopsy to diagnose breast cancer adversely affects outcomes of breast cancer care: finding from the National Comprehensive Cancer Network. Presented at: San Antonio Breast Cancer Symposium; San Antonio, TX; 2005.
8. Florida Agency for Health Care Administration. Home page. Available at: <http://ahca.myflorida.com/#>. Accessed February 23, 2010.
9. Florida Agency for Health Care Administration. Available at: <http://www.floridahealthfinder.gov/researchers/researchers.aspx>. Accessed February 23, 2010.
10. Witmer MT, Margo CE. Analysis of ophthalmology workforce and delivery of emergency department eye care in Florida. *Arch Ophthalmol* 2009;127:1522–7.
11. Armitage P. Tests for linear trends in proportions and frequencies. *Biometrics* 1955;11:375–86.
12. Bruening W, Schoelles K, Treadwell J, et al. Comparative effectiveness of core-needle biopsies and open surgical biopsy for the diagnosis of breast lesions. Rockville, MD: Agency for Healthcare Research and Quality; 2009.
13. Friese CR, Neville BA, Edge SB, et al. Breast biopsy patterns and outcomes in Surveillance, Epidemiology, and End Results-Medicare data. *Cancer* 2009;115:716–24.
14. Silverstein M, Levine GM. Reply to: “Minimally invasive breast biopsy.” *J Am Coll Surg* 2009;209:289.
15. Paajanen H, Hermunen H. Does preoperative core needle biopsy increase surgical site infections in breast cancer surgery? Randomized study of antibiotic prophylaxis. *Surg Infect (Larchmt)* 2009;10:317–21.