

# Measuring the extent of DCIS in breast excision specimens: A comparison of four methods



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## ABSTRACT

**Background:** Measuring the extent of non-palpable DCIS in a breast specimen is challenging. Several methods for estimating the extent of DCIS have been employed, but none have been validated. The aim of this study was to compare the extent of DCIS using various methods of estimation.

**Design:** 78 primary breast excisions with DCIS and an accompanying sliced specimen radiograph were retrospectively reviewed. All specimens had been sampled using the serial sequential (SSS) method, which involved mapping the location of each block on the sliced specimen radiograph and calculating extent through 3-D reconstruction. This method was considered the gold standard. The other methods included; 1) calculating the extent based on sampling only areas of calcification (calcification method); 2) recording the number of blocks involved by DCIS and multiplying this by 0.3 cm (blocks method); 3) measuring the largest extent of DCIS on a single slide (single slide method). Data was analysed by characterizing the under- and over estimation relative to the SSS method, and by calculating the percentage correctly classified into size categories.

**Results:** All three alternative methods tended to underestimate the DCIS, with median underestimates of zero when extent (according to the SSS method) was <0.5cm, increasing to 1.2cm, 1.6cm, and 3.7cm for the calcification, blocks and single slide methods when extent was >4cm. The percentage of cases estimated to within 1cm of the SSS method were 81%, 72% and 50% respectively for the calcification, blocks and single slide methods; differences of more than 2cm were seen in 9%, 8% and 30% of cases.

**Conclusions:** When DCIS is <0.5cm, all methods of measuring extent are equivalent. For sizes >0.5cm the alternative methods tended to underestimate the DCIS extent relative to the SSS method with the underestimation becoming more pronounced as size increased. These size discrepancies are of clinical relevance.

## BACKGROUND

Measuring the extent of non-palpable DCIS in a breast specimen is challenging as most cases are detected mammographically and are grossly invisible. The size of DCIS has been shown to correlate with local recurrence, the risk of a compromised margin and residual disease. As this measure is important for clinical management, the best possible estimate of size should be reported. Although there is no standardized method for estimating the extent of DCIS, sequential sampling with mammographic correlation is considered to be the most thorough method. The goal of this study was to compare the size of DCIS obtained using various methods and to compare these estimations with the size determined using the sequential sampling method.

## MATERIALS & METHODS

157 breast excision specimens with DCIS and without microinvasion during the period of January 2001-July 2007 were identified. Inclusion criteria: 1) all slides available for review, 2) sliced specimen radiograph and section diagram available, 3) if not submitted in toto, had negative flanking sections at the limits of DCIS. Re-excision lumpectomies were excluded. 78 cases formed the study group.

### Specimen Processing

Specimen measured in 3 dimensions. All margins painted with silver nitrate; superior-anterior re-painted with blue ink and inferior-anterior with green ink. Following fixation in 10% formalin, specimen serially sectioned into thin slices and radiographed in pathology department. Location of blocks mapped on Xray.

### Extent Calculation

- Serial sequential sampling method (SSS):**  
Average slice thickness = size in plane of sectioning ÷ # of slices.  
Extent in plane of sectioning = # slices involved x average slice thickness  
Extent in other 2 planes measured on glass slides, with reconstruction using section diagram.
- Calcification method:**  
Location of calcifications mapped on sliced specimen xray. Extent calculated as SSS method, using only theoretical sampling of areas of calcification.
- Blocks method:**  
Number of positive blocks x 3mm (presumed average thickness of tissue section)
- Single slide method:**  
Largest extent measured on one single slide.

### Statistical Analysis

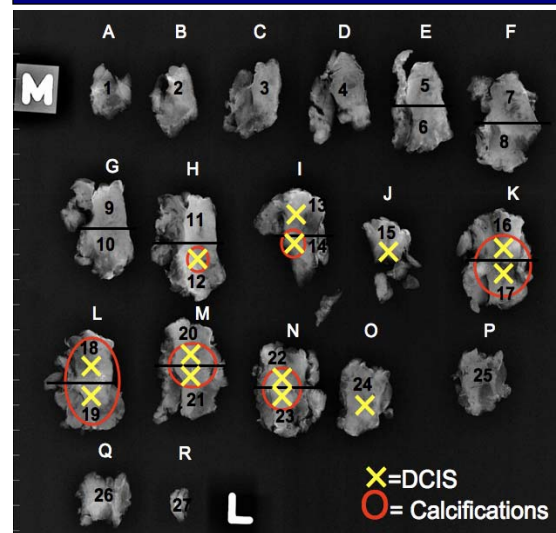
Graphical displays were employed as the main method of comparing the alternative methods to the SSS method. Statistical calculations were performed using S-PLUS 6.2 for Windows.

Case Parameters	
Grade I	4 (5.1%)
II	40 (51.3%)
III	34 (43.6%)
Comedo necrosis	47 (60.3%)
Mean number of blocks (range)	26.7 (8-66)
Mean slice thickness cm (SD)	0.5 (0.1)
Mean number of positive slices (range)	4.8 (1-14)
Mean number of positive blocks (range)	7.5 (1-54)
Largest dimension by the SSS method	
In plane of sectioning	57 (73%)
On a single glass slide	13 (17%)
Reconstruction across 2-3 slides	8 (10%)

### Number (percentage) of cases classified into the same size category as the SSS method

Size by SSS method	Calcification method	Blocks method	Single slide method
< 0.5 cm	4/4 (100)	4/4 (100)	4/4 (100)
0.5-2 cm	28/34 (82.4)	28/34 (82.4)	28/34 (82.4)
> 2-4 cm	19/26 (73.1)	14/26 (53.8)	1/26 (3.8)
> 4cm	9/14 (64.3)	8/14 (57.1)	0/14 (0)
Total	65/78 (78)	54/78 (69)	33/78 (42)

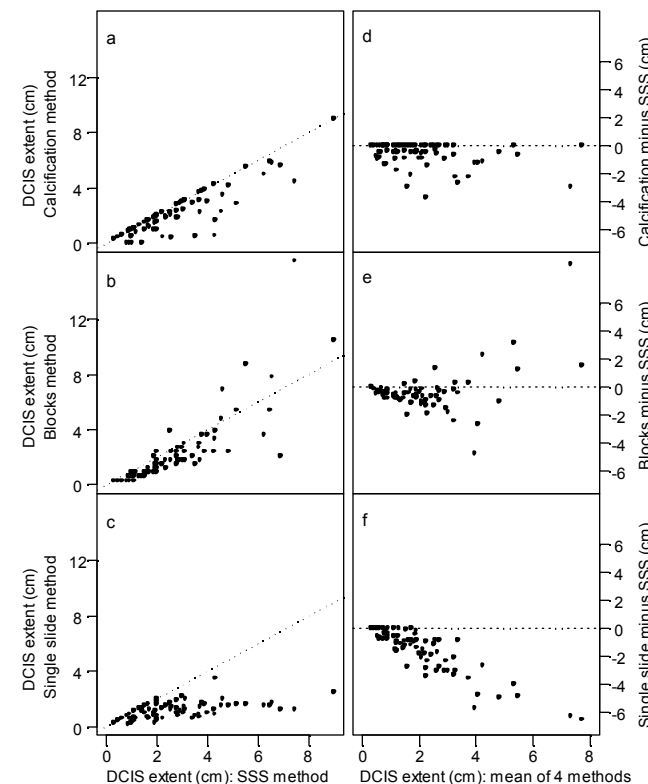
### DCIS extent calculation example



Specimen serially sectioned into 18 slices (A to R) in medial-lateral plane. Submitted in toto in 27 blocks  
SSS method = 2.4cm  
Specimen ML size 5.7cm ÷ 18 slices - 0.3cm average slice thickness. ML size DCIS = 0.3cm x 8 slices involved (2.4cm)  
Calcification method = 2.1cm (0.3cm x 7 slices involved)  
Blocks method = 3.9cm (13 positive blocks x 0.3cm)  
Single slide method = 1.7cm

## RESULTS

### DCIS extent as measured by the calcification, blocks and single slide methods compared to the SSS method



**Panels a, b and c:** Extent of DCIS as measured by the *calcification, blocks and single slide* methods versus the serial sequential sampling (SSS) method. The dotted line indicates where the alternative method gives identical results to the SSS method.

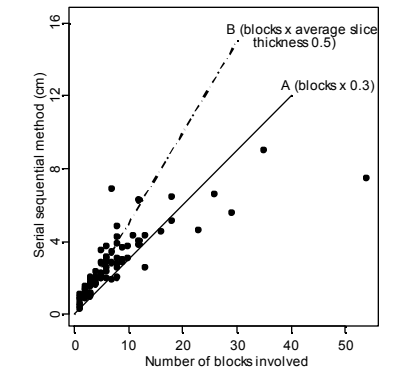
**Panels d, e and f:** The differences between each alternative method and the SSS method versus the mean of all four methods. The dotted line indicates where the differences are zero.

### Size discrepancy between the calcification, blocks and single slide methods from the SSS method

	Size of discrepancy from SSS method			
	≤ 0.5cm	0.5 to 1cm	1 to 2cm	>2cm
All cases (n=78)				
Calcification method	64.1%	16.7%	10.3%	9.0%
Blocks method	42.3%	29.5%	20.5%	7.7%
# blocks x 0.5cm	57.7%	12.8%	14.1%	15.4%
Single slide method	26.9%	23.1%	20.5%	29.5%
Cases with DCIS <2cm* (n=45)				
Calcification method	75.6%	11.1%	8.9%	4.4%
Blocks method	53.3%	40.0%	6.7%	0.0%
# blocks x 0.5cm	80.0%	11.1%	8.9%	0.0%
Single slide method	46.9%	31.1%	20.0%	2.2%
Cases with DCIS 2 to 4cm* (n=26)				
Calcification method	53.8%	23.1%	7.7%	15.4%
Blocks method	34.6%	19.2%	38.5%	7.7%
# blocks x 0.5cm	30.8%	19.2%	26.9%	23.1%
Single slide method	0.0%	15.4%	26.9%	57.7%
Cases with DCIS >4cm (n=7)				
Calcification method	28.6%	28.6%	28.6%	14.3%
Blocks method	0.0%	0.0%	42.9%	57.1%
# blocks x 0.5cm	14.3%	0.0%	0.0%	85.7%
Single slide method	0.0%	0.0%	0.0%	100.0%

\* As determined from DCIS size calculated as average of four methods

### Relationship between the number of blocks involved and the extent of DCIS by the SSS method



Line A - # blocks x 0.3cm (blocks method); Line B - # blocks x 0.5cm (average slice thickness)

- When data points >9 blocks are eliminated, the best fit multiplier is 0.45cm; if >10 blocks eliminated the best multiplier is 0.44cm.
- A 'two step formula' is required when all data points are taken into consideration, in order to adjust for the curved relationship.

## COMMENTS & CONCLUSIONS

### Calcifications method:

- This method either equaled or underestimated extent compared to SSS method; there were no overestimations by design. Overall, estimations by the *calcification* method were closest to the SSS method (64% of cases ≤0.5cm discrepancy).
- Underestimations show that DCIS extends beyond the limits of calcifications. The presence of comedo necrosis did not improve correlation with SSS method.

### Blocks method:

- Number of blocks correlates with size when the number of blocks is less than approximately 8-10, but large discrepancies occur for cases greater than 4cm.
- The presumed section thickness of 0.3cm is smaller than our average slice thickness of 0.5cm. Smaller size discrepancies occur when 0.5cm is used as the multiplier.
- From our data, a multiplier of 0.45cm could be used when the number of positive blocks is less than 10, but validation with other data sets is required prior to its routine use.

### Single slide method:

- Performed poorly and should only be used when DCIS is limited to a single slide

### Serial sequential sampling method:

- Is a thorough method of measuring DCIS and was considered the 'gold standard' in this study.
- In our experience, this method requires little additional time and resources, particularly when imaging can be done in the pathology department.