Systematic cavity shaves reduces close margins and re-excision rates in breast conserving surgery

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Summary The role of cavity shaves in reducing re-excision rates in breast conserving surgery (BCS) remains unclear. We compared rates of close margins and re-excision following cavity shaves based on either intraoperative radiology or systematic cavity shaves. Data was recorded prospectively from 1999 to 2003 for 217 patients undergoing BCS. For the first 106 cases, cavity shaves were performed when intraoperative radiological margins appeared close (<10 mm). The remaining 111 cases had systematic superior and inferior cavity shaves (SSICS). Close margins and re-excision rates were compared between groups. The median weight of excised tissue was less in group two: 82.8 g versus 100.5 g, \( P = 0.001 \). SSICS reduced close margins by 83% (18/106 versus 8/111), OR 0.17, 95% CI 0.08–0.48, \( P = 0.001 \). Multivariate analysis showed SSICS also reduced re-excision rates (15 versus 8 cases), OR 0.26, 95% CI 0.09–0.74, \( P = 0.012 \). SSICS reduces close margins and re-excision rates. This approach has additional cosmetic benefits because less tissue is excised.

Introduction

Breast conserving surgery (BCS) has become the standard treatment for most breast tumours, with evidence from large prospective trials demonstrating equivalent survival to that obtained after mastectomy. Breast conserving surgery (BCS) is to perform a cosmetically acceptable operation, whilst minimising the chance of local recurrence. The most important risk factor for developing local recurrence following BCS is residual disease at the resection margin, which occurs in 17–51% of cases.

Various strategies of margin analysis have been employed in an effort to reduce close margins and the need for further surgery, including taking shave...
biopsies from the resulting cavity. However, whether cavity shaves reduce the re-excision rate remains controversial—although some argue it produces good rates of local control, others conclude it is a poor predictor of completeness of excision. These differences probably reflect variation in groups studied, cavity shave technique, or in criteria defining close margins.

The aim of this study was to establish whether a policy of systematic cavity shaves would reduce close margins and re-excision rates following BCS, compared to cavity shaves only performed when intraoperative radiology (IOR) or palpation suggested close margins.

Methods

Data was recorded prospectively from 1999 to 2003 for 217 patients undergoing wide local excision of biopsy proven breast cancer. Following triple assessment, patients with suitable biopsy proven tumours underwent BCS. These lesions were predominantly asymmetric spiculate densities. Patients with multifocal tumours or radiological evidence of multifocal microcalcification were offered mastectomy. Patients suitable for BCS with multifocal tumours or radiological evidence of multifocal microcalcification were offered mastectomy. Patients suitable for BCS who preferred mastectomy were excluded from the study.

During BCS, excised whole specimens were orientated with marker sutures before IOR, using a long suture laterally and a short suture on the superior edge. Excised specimens were then transported in formalin for IOR, to assess tumour content within the excised specimen and tumour proximity to the specimen margins. Excised tumours not visible using IOR were excluded from the study. We used two-view specimen IOR, with a 1:1 ratio. Anteroposterior and cranio-caudal views were used to determine tumour proximity to resection margins. IOR was performed whilst axillary dissection took place, so that the process did not extend operating time.

Following IOR, all specimens were transported for histological analysis, and IOR images were immediately sent to operating surgeon. One observer (BI) recorded six measurements from the IOR radiograph: superior, inferior, medial, lateral, deep and superficial margins. An IOR image margin of 10 mm was considered inadequate, and cavity shaves of the inadequate margin were then performed. We aimed to shave 5–10 g of tissue from the relevant margin. Including haemostasis, this process took approximately 2 min.

If there was a discrete mass palpable within otherwise normal breast tissue, and there was clinical suspicion that the malignant process involved the resection margin, additional shaves were taken, even if the corresponding IOR margin was >10 mm. Cavity shaves were orientated with a suture on the cavity side, to aid pathological interpretation. Histological analysis of the main specimen and shaved margins took place after the operation.

In addition to IOR margins, a standardised proforma was used to record tumour location, macroscopic and microscopic tumour histology, further surgery (if needed) and adjuvant treatment. Tumour margins were measured macroscopically. Margins less than 5 mm were considered inadequate/closed, except for the deep or superficial margin. Patients with inadequate margins were offered further surgery.

From 1999–2001, cavity shaves were only performed when IOR margins were less than 10 mm, or intraoperative palpation suggested a close margin. An audit of the first 106 cases (1999–2001, group one) showed the superior/inferior resection margin accounted for 90.2% of positive margins. No further data analysis was performed until the end of the study. Consequently, systematic superior and inferior cavity shaves (SSICS) were performed on all subsequent patients (2001–2003, 111 patients, group two). In group two, medial and lateral shaves were also performed if IOR margins were <10 mm, or intraoperative palpation suggested close margins.

Patient demographics, tumour histology, positive margins and re-excision rates were compared between groups one and two. Categorical data were compared using the $\chi^2$ test, and the Mann–Whitney test was used to compare medians of non-normally distributed continuous variables, with data variation expressed as interquartile range (IQR). Odds ratios (OR) are expressed with 95% confidence intervals (CI), $P<0.05$ was considered significant throughout. Data was analysed using the Statistical Package for the Social Sciences version 10 (SPSS 10).

Results

Group one (1999–2001) had 106 patients, and group two (2001–2003) had 111 patients. The groups did not differ in median tumour size (19 mm), grade (2), or Nottingham prognostic index (3.4 versus 3.6, $P = 0.38$), Table 1. There was no statistically significant difference in tumour histology between groups one and two. However, the median weight of excised tissue was less in the group two: 82.8 g
(IQR 57.1–110.3) versus 100.5 g (IQR 75–147.6), P = 0.001, Table 1.

Before cavity shaves, 39 patients in group one (36.8%) and 57 patients in group two (51.4%) had tumour beds with close margins, OR 0.54 (95% CI 0.3–0.97), P = 0.026. Of the close margins, 90.2% in group one and 83.1% in group two were either the superior or inferior margin (Table 2).

All shaves were performed without complication. In group one, 61 cavity shaves were performed in 49 patients because radiological margins were <10 mm or intraoperative palpation suggested close margins. Of these shaves, 26 were in patients with close margins (53.1%), of which five failed to produce a new histologically clear margin (10.2%). The remaining 23 shaves were in patients with clear margins (46.9%). A similar proportion of patients in group two required additional shaves (56 additional shaves in 41 patients), χ² = 1.1, P = 0.29. Thus the total number of shaves in group two was 278 (56 additional shaves and 222 SSICS). The median weight of cavity shaves reduced from 6.8 g (IQR 3.8–12) in group one to 4 g (IQR 2.5–6.4) in group two, P = 0.01. Multivariate analysis controlling for lymph node status, tumour grade and the higher initial rate of tumour bed positivity in group two showed SSICS reduced close margins by 83% (18/106–8/111), OR 0.17, 95% CI 0.08–0.48, P = 0.001.

Further surgery

Of 18 patients in group one with close margins, four patients declined further surgery. All eight patients in group two with close margins had further surgery. Overall, 15 patients had completion mastectomy and seven had wider excisions of the affected margin. Histological analysis of the re-excised tissue showed only four patients (18%) had evidence of residual disease.

In group two, SSICS was associated with a reduced re-excision rate (14 versus 8 cases), OR 0.26, 95% CI 0.09–0.74, P = 0.012. Histological examination of the resected specimens showed residual cancer in three specimens (two in group one and one in group two).

Discussion

In this prospective study, we have demonstrated a significant decrease in both close margins and subsequent re-excision rates by the introduction of systematic SSICS. The groups had well-matched baseline characteristics and histopathology, enabling valid comparisons to be made.

The reduction in close margins in group two occurred despite the initial resection specimen being more likely to have close margins in group two than group one (51% versus 37%). This difference in initial margin status may have arisen

| Table 1 | Tumour macroscopic and microscopic histopathology for groups one and two. |
|---------------------------------|------------------|------------------|----------------|
| Variable                        | Group one, n = 106 | Group two, n = 111 | Probability, P |
| Median age                      | 62               | 59               | 0.23           |
| Ductal carcinoma                | 85               | 91               | 0.74           |
| DCIS                            | 4                | 1                | 0.20           |
| Lobular/ductal                  | 1                | 7                | 0.07           |
| Lobular                         | 7                | 7                | 0.93           |
| Mucinous/papillary/tubular      | 9                | 5                | 0.23           |
| Coexisting DCIS                 | 46               | 49               | 0.91           |
| Specimen volume (IQR), cm³      | 236.5 (141–357.5) | 162 (110–249.5)  | <0.001         |
| Total specimen weight, g        | 100.5 (75–147.6)  | 82.8 (57.1–110.3) | 0.001          |
| Tumour size, mm                 | 19 (15–23)       | 19 (13–25.8)     | 0.55           |
| Nottingham prognostic index    | 3.4 (3.2–4.4)    | 3.6 (3.2–4.6)    | 0.38           |
| Tumour grade                    | 2 (1–3)          | 2 (2–3)          | 0.12           |

| Table 2 | Distribution of close histological margins (<5 mm) in groups one and two. |
|------------------|------------------|------------------|----------------|
| Close margin     | Group one | Group two | Probability, P |
| Number of patients | 39 | 57 | 0.026 |
| Superior         | 20       | 35       | 0.48           |
| Inferior         | 17       | 34       | 0.95           |
| Medial           | 3        | 10       | 0.54           |
| Lateral          | 1        | 4        | 0.46           |
| Total            | 41       | 83       | NR             |
because group two excisions were performed after an audit of the first 106 cases (group one) showed that superior and inferior margins were most likely to be close, hence the resection medially and laterally may have been minimised. This may also explain the reduction in weight of tissue excised in group two, and suggests a less radical excision was performed once it was known the superior and inferior margins were most likely to be close.

In addition, the weight of cavity shave was lower in group two than group one. Prior knowledge of the margins most likely to be close and that these margins will undergo subsequent shaves may account for this reduction in excised tissue weight. An alternative explanation is that increasing expertise and experience in identifying cancer from the surrounding inflammatory tissue may have contributed to the reduced shave weight in group two.

The number of additional shaves performed in group two (due to suspicion following palpation or close IOR margins) was similar to that in group one. This effectively controlled for any reduction in close margins which may have occurred in group one due to additional shaves, and gives further support to the argument that SSICS was responsible for the reduction in close margins and re-excision rates in group two.

Although almost half the additional shaves in group one were in patients with clear margins, the remaining 53% of shaves in group one occurred in patients with margins <5 mm. As the volume of excised tissue was small, we feel that additional shaves were a useful method of minimising the need for further surgery, whilst maintaining a cosmetically acceptable outcome. Our re-excision rate (7%) following SSICS compares favourably with other published series, which report re-excision rates of 15–20% following BCS with shaves6,10 and 51% without.5

Although BCS offers a cosmetically superior outcome to mastectomy, there is a lifelong risk of local recurrence: of those with negative pathological margins, 97% are free from recurrence after 6 years, whereas only 86% of patients with positive margins are recurrence free during the same follow-up.7 Consequently, excising breast cancer with negative margins has become increasingly important, with much research aimed at identifying accurate methods of margin analysis. Other methods of margin assessment, including intraoperative macroscopic assessment10 or cavity lavage11 are either time consuming or have low sensitivity. Whole cavity excision removes substantial volumes of breast tissue, impacting on the cosmetic outcome of surgery.12 Frozen section analysis may not be appropriate for small tumours, and is a costly procedure potentially limited by freezing artefact.13 We have shown SSICS is a simple, accurate, technically straightforward and reproducible method of determining margin status. Whether this approach reduces local recurrence in the longer term remains to be seen—further follow-up studies of this patient group may be needed.

A potential limitation of this study is patients were not randomly assigned to group one or two. However, the study was initially an audit to determine best practice, and as our groups were historical cohorts, with analysis of group one showing 84% of close margins occurred superior or inferiorly, it could be argued that it would be unethical to randomise patients to a group that would not undergo SSICS.

Although we excluded tumours not visible on IOR, this number is small hence the results are still generalisable. We used close margins as our main indicator for further surgery. Although there appears to be consensus that close margins strongly predict local recurrence, the issue remains controversial.4,14 However, negative margins may be a less useful predictor of residual disease, as 37–43% of specimens with negative margins are ultimately found to have residual foci of invasive tumour.4,9 Rather than incomplete excision, this probably reflects either discontinuous primary tumour growth14 or insufficient histological analysis of the margin.4 By orientating our specimens with marker sutures, we feel confident that histological analysis was focused on the required margins, and that negative margins were a good predictor of residual disease: only two patients had involved shaves adjacent to a clear margin. Both of these shaves contained DCIS, which has a tendency to be multifocal.15

One surgeon (BI) performed the majority of operations in this series (>90%). The same surgeon directly supervised the remaining cases, thus maintaining consistency in the method of cavity shave. Recent data has shown identical local recurrence rates during 7 years of follow-up whether BCS was performed by a consultant or trainee surgeon.16

Conclusions

In this series, the majority of close margins occurred at the superior and inferior resection margin. Systematic cavity shaves of these margins are a reliable method of determining margin status, reducing close margins, and reducing re-excision...
rates. This approach has additional cosmetic benefits as it allows less tissue to be excised.

References


