Skin-Sparing Mastectomy: An Alternative to Conventional Mastectomy in Breast Cancer

Manuel Ramos Boyero
Departamento de Cirugía, Unidad de Patología Mamaria, Hospital Universitario de Salamanca, Salamanca, Spain

Abstract

Women who require or desire mastectomy for breast cancer one option should be immediate breast reconstruction. Skin-sparing mastectomy (SSM) describes the surgery that maximises breast skin and infra-mammary fold preservation, significantly improves the symmetry and natural appearance and a more satisfied patient. In multiple studies, SSM seems to be oncologically safe in patients undergoing mastectomy for invasive T1-T2 tumours, multicentric tumours, ductal carcinoma in situ, or risk-reduction. However, the technique should be avoided in patients with inflammatory breast cancer or in those with extensive tumour involvement of the skin. SSM with nipple areola complex preservation appears to be oncologically safe, providing that the tumour is not close to the nipple and the retro-areolar tissue is free of tumour. Though adjuvant radiotherapy is not an absolute contraindication to SSM, it should be used with caution since it decreases the final cosmetic result.

Key words: Skin-sparing mastectomy. Immediate breast reconstruction. Breast cancer. Local recurrence.

Introduction

Surgery remains of great importance in the first-line treatment of breast cancer. In the past 30 years, breast cancer surgery has been less aggressive and disfiguring. Surgical strategies have changed significantly and the objective of modern breast cancer surgery is to maintain oncological efficacy while reducing the number of radical procedures, with the goal of reducing patients’ physical and psychological trauma. Modified radical mastectomy, the conservative approach,¹,² and selective lymphadenectomy, according to sentinel lymph node biopsy, are examples of this progressive evolution.

Since the introduction of conservative breast surgery and neoadjuvant chemotherapy, the incidence of mastectomies has been declining, but they are still inevitable in patients with tumours that are disproportionate to the size of the breast or are multicentric, in those with high familial or personal risk, when there has been a contraindication to...
postoperative radiation therapy or if the patient prefers a mastectomy from the start.

Because it appears to reduce psychological morbidity and achieves good aesthetic results, immediate breast reconstruction has increased in recent years with the goal of providing a better quality of life to patients who undergo a mastectomy. Immediate breast reconstruction (IBR) has also been shown to improve the cost-effectiveness ratio when compared to delayed reconstruction since it only requires a single operation and hospital admission, and it reduces lost work due to disease. However, it should be noted that there is little data on the impact of IBR on survival rates, early diagnosis of recurrence, and its influence on adjuvant treatment, as well as on the number of complications and the aesthetic results, and patient satisfaction.

As with other types of surgical treatment, the improvement in aesthetic results has been important and, in part, has been due to patient demand. The skin-sparing mastectomy (SSM), where the majority of the patient’s natural skin is preserved with the goal of performing an IBR, is the result of these tendencies. In this type of mastectomy, the aim is to preserve skin from the surrounding area and the inframammary fold as much as possible which facilitates reconstruction of the breast in a more natural way with little change in the colour of the skin and symmetry, thereby achieving a more desirable aesthetic result. Breast reconstruction has evolved from being a process of shaping a breast to a process of refilling a breast.

**Surgical Considerations**

Since the introduction of SSM by Toth et al., there have been few variations on the technique, but we must keep in mind that SSM requires technical experience since complications such as epidermolysis or full-thickness skin loss may compromise the final result and delay initiation of adjuvant treatment. As noted earlier, SSM includes resection of the areola-nipple complex, any scar from a previous biopsy, and complete extirpation of the breast gland which allows for later refilling of the glandular cavity using autologous tissue, an implant, or both. The primary difference from the standard mastectomy is that SSM limits extirpation of the skin as much as possible, which facilitates immediate adequate reconstruction and achieves better symmetry with the contralateral breast, thereby avoiding additional surgeries. Sentinel lymph node biopsy can be done prior to or simultaneous with SSM with lymphadenectomy is needed.

**Types of Incisions**

The type of incision chosen should facilitate complete extirpation of the breast tumour and of scars from previous biopsies. Incisions will vary according to the size and shape of the affected and contralateral breast, the tumour size and location, the location of the previous biopsy and the surgeon’s preference, and should be planned with immediate breast reconstruction in mind.

The most widely used incisions are the periareolar (circular), periareolar with lateral extension (tennis racket), periareolar with lateral and medial extensions, periareolar elliptical, and the reduction mammoplasty or mastopexy-type incision (Figure 1). In the periareolar incision, a circular incision is made 1 mm from the areolar border; when the areola is small, a tennis racket incision with a lateral extension is required in order to facilitate extirpation of the gland. The periareolar elliptical is a miniature version of the classic, non-skin-sparing mastectomy incision. The reduction mammoplasty incision is made according to the typical Wise-pattern incision where, in addition to the periareolar incision, there is a vertical extension made towards the inframammary fold with a lateral and medial extension over the fold. Other authors prefer a vertical mammoplasty pattern (Lejour) to avoid skin necrosis at the union of the T in the Wise-pattern.

Carlson categorised SSM into 4 types according to the incision and the amount of extirpated tissue. In type-I, only the areola-nipple complex is removed. This is used in prophylactic mastectomies in cancers that are diagnosed by needle biopsy. The incision can be extended laterally to facilitate axillary access. The type-II SSM, where the areola-nipple complex and the skin over the tumour or previous biopsy is removed, is used when the tumour or biopsy scar is close to the areola. In type-III, the areola-nipple complex is removed and, due to the distance from the areola, the skin over the tumour or previous biopsy is removed via a separate incision. The type-IV SSM is used in sagging breasts when simultaneous or delayed bilateral reduction is planned.

A sentinel lymph node biopsy (SLNB) or axillary lymphadenectomy can be performed through these incisions.
when necessary, though many authors prefer a separate transverse incision which facilitates axillary lymphadenectomy and doesn’t damage the skin preserved during mastectomy.\textsuperscript{9,12,17} This incision is not very visible and it is very useful in dissection of the vascular pedicle of the \emph{latissimus dorsi} when used for breast reconstruction. SLNB can be performed during the same surgery using an intraoperative cyto-histological study or by performing it one week prior to mastectomy, thereby knowing the axillary status prior to surgery, which can avoid rescue axillary lymphadenectomy in patients with immediate breast reconstruction.\textsuperscript{12} Nevertheless, the lower the risk of axillary lymph node metastasis and the greater the sensitivity of the intraoperative sentinel lymph node study, the more feasible it is to perform SLNB in the same surgery with SSM and reconstruction.\textsuperscript{14}

\textbf{Technical Aspects of the Skin-Sparing Mastectomy}

Dissection of the skin flaps is performed in a manner that is similar to standard mastectomy by following the subcutaneous aponeurosis and freeing the gland from the \emph{pectoralis major} muscle. However, this type of mastectomy requires a meticulous technique and careful handling of the tissue in order to prevent skin flap ischemia. Dissection of the gland should be made above the fascia that surrounds the breast in order to achieve the most complete removal of mammary tissue possible (Figure 2) and should reach the anatomical limits of the breast: the anterior border of the \emph{latissimus dorsi} muscle, the inframammary fold, the sternal border, and the superior pole of the breast, which is generally located at the level of the second rib. Dissection of the sternal border of the flap must be performed carefully in order to avoid injuring the dermal branches of the internal mammary artery perforators that vascularise the medial skin flaps.

Skin necrosis complications do not occur more frequently than in the standard mastectomy. In one published study,\textsuperscript{11} epidermolysis and skin necrosis that required debridement occurred in 10.7\% of SSM and in 11.2\% of other mastectomies. This type of complication was more frequent in type-IV SSM incisions. Retractors with illumination or fibre-optic lighting provide illumination centered on the surgical field which facilitates a good plane of dissection and good haemostasis which, when performed with bipolar or argon electrocoagulation, is more selective and has less side effects. Viability of skin flaps is determined by clinical assessment, though more sophisticated methods have been used that have not achieved broad application such as fluorescent dyes, thermography, photoplethysmography, and Doppler-flow studies.

\textbf{Types of Delayed Reconstruction}

The ultimate objective of SSM is to perform IBR that can be achieved using transferred autologous tissue (Figure 3), implants (Figure 4), or both.\textsuperscript{18} The 2 main types of autologous tissue available come from the inferior abdomen (TRAM, DIEP, SIEA) and from the \emph{latissimus dorsi} muscle. When implants are used, these may be definitive prosthetics, Becker-type expansion prosthesis or subpectoral expanders. Use of one technique or another depends of each institution or the surgeon’s preference since there is no absolute contraindication for any of them, though avoidance of reconstruction with prosthesis is recommended if postoperative radiation therapy is anticipated. In large SSM studies,\textsuperscript{13} use of each of these reconstructive modalities, both autologous tissue and implants, are approximately evenly distributed.

\textbf{Preservation of the Areola-Nipple Complex}

Although SSM with IBR offers significant cosmetic benefits over standard mastectomy, removal of the areola-nipple complex (ANC) significantly impacts the final result, though patients can be offered delayed reconstruction of the nipple and a tattoo or prosthesis. The ANC is removed because it is believed that the adjacent lactiferous ducts can contain tumour cells that have spread to the ducts from the primary tumour. Preservation of the ANC means changing the SSM to a subcutaneous mastectomy that has different oncological implications. Nevertheless, it should be mentioned that recent studies have shown that the risk of ANC tumour involvement has been overestimated.\textsuperscript{19,20} Several publications\textsuperscript{21-23} have shown that ANC involvement (10.6\%) is related to the proximity of the tumour to the areola (<2 cm), multi-centricty, tumour size, and axillary involvement. Gerber et al\textsuperscript{22} demonstrated that when the ANC is preserved in tumours located more than 2 cm from the areola and the intraoperative histology study of the sub-areolar tissue was negative for tumour extension, local recurrence was very rare (1.6\%) and much better aesthetic results were achieved. Another problem with ANC preservation is partial or total necrosis (6\%-7\% of patients) and will depend primarily on the surgical technique.\textsuperscript{24,25} If only the nipple of the ANC is removed, it has been shown that the preserved areola was affected in 0.9\% of cases and that tumours were more than 5 cm in diameter and in a retroareolar location.\textsuperscript{20,23}
Oncology Considerations. Local Recurrence

The main oncological problem with SSM is related to the possibility of leaving residual tumour tissue in the surrounding skin which will later manifest as a local recurrence. The initial paradigms in the treatment of breast cancer emphasised radical resections, but the success of conservative breast surgery has created doubt on the need for removal of skin that is not affected by the tumour. It should also be pointed out that when a standard mastectomy is performed, a wide ellipse of the skin that includes the areola, the skin, and the previous biopsy is removed, but the rest of the skin that covers the breast is preserved and is freed like sliding flaps that allow for good approximation and flat adherence of the skin to the thoracic wall.

In the past, the different amounts of skin to remove in order to avoid local recurrence following mastectomy has been discussed. Despite the different types of mastectomies performed, local recurrence has remained constant over the years. In other words, the increase in skin resection has not achieved better local follow-up. Recurrence is influenced by several factors other than the size of the skin resection. Due to the fact that local recurrence is more a component of tumour biology than of failure of the surgical technique, expanding the areas of resected skin does not appear to offer a logical therapeutic alternative since, in order to perform IBR, skin with autologous tissue from other parts of the body must be moved in a quantity similar to the amount removed, and by having a different colour and texture, it reduces the aesthetic result.

With regards to local recurrence, SSM has been reported to be a safe treatment in early stage cancer, but the majority of the studies published have a short clinical follow-up, few are prospective and the majority are based on the experiences of a single hospital (Table). Carlson et al28 published a broader study with 539 cases in stages 0-4 with an average follow-up of 65 months, and they observed a 5.5% rate of local recurrences, but with the proviso that 30.6% of cases correspond to non-invasive tumours. When the stage 0-2 tumours were analyzed, local recurrence was 4.8%; other authors have obtained similar results29-32 in ductal carcinoma in situ (DCIS) after SSM and IBR. In 2 series of T1 and T2 tumours, incidences of 6.2% and 7% respectively were achieved, and in one of them,32 the local recurrence with conventional mastectomies was similar to SSM. Medina-Franco et al33 found incidences of recurrence of 4.5% after SSM with IBR after 73 months of follow-up. Although Meretoja et al34 did not find a relationship between local recurrence and the clinical staging, Carlson et al35 observed a higher rate of skin recurrence with higher clinical staging.

If the rate of local recurrence in conventional or standard mastectomy is analysed, with or without reconstruction, it can be observed that the number of local recurrences is similar to SSM, for both invasive and non-invasive tumours. In one recent meta-analysis, a 6.3%
rate of local recurrence was reported at 5 years of follow-up following conventional mastectomy with lymphadenectomy without radiation therapy and 5.8% in positive axillary nodes with radiation therapy, which points out that local recurrence is influenced more by tumour biology and staging of the disease at the time of surgery than by surgical technique used for the mastectomy,26,27 but this assertion is not confirmed by prospective randomised studies that compare conventional mastectomy to SSM. Furthermore, comparisons between different publications are difficult because they include patients in different clinical states and the chemotherapy and radiation therapy protocols may differ between different countries. Also, it has been proved that radiation therapy substantially reduces local recurrence regardless of the tumour characteristics.40

SSM follow-up with immediate reconstruction is based, as with all protocols, on periodic clinical examination every 4-6 months for the first 2 years, but there are variations in the timing of mammograms, ultrasounds, or MRIs. Treatment of local recurrence depends on early diagnosis that makes less invasive surgery and later adjuvant treatments possible. Local recurrence after mastectomy has generally been seen as a sign of a poor prognosis. When recurrence after SSM or IBR is analysed, approximately 70% of patients with local recurrence develop distant metastases.26-28,31,32,34,38

### Indications and Contraindications

SSM is indicated in patients with DCIS when conservative surgery cannot be performed and when adequate margins are obtained while removing the tissue from the quadrant where the tumour is located. It appears to be as effective as standard mastectomy since a 98% rate of local control is achieved without postoperative radiation therapy.26-28,31,32,34,38

In the cases of initial infiltrating carcinoma where the tumour is located, it appears to be as effective as standard mastectomy since a 98% rate of local control is achieved without postoperative radiation therapy.26-28,31,32,34,38

In addition to these 2 clinical situations, detailed studies with good results have been published; however, they need to be backed by a greater number of patients in order to broaden the indications. In the case of locally advanced disease after neoadjuvant chemotherapy, SSM has also been used in patients with local recurrence following conservative surgery with good local control of the disease and good aesthetic results.41 Also, in patients with large or pendulous breasts, a reduction-mastectomy type SSM can be performed according to the Wise-pattern in order to achieve a final reconstruction of smaller and less sagging breasts, which is normally accompanied by an immediate contralateral reduction mammoplasty in order to achieve symmetry.14,15 Conversely, in patients with breast augmentation who present with early-stage carcinoma, there are authors44 who perform SSM followed by reconstruction.

Logically, SSM is clearly contraindicated in patients who have tumour involvement of the underlying skin. It is also not indicated in situations in which the risk of skin necrosis and infection is increased, as in cases of previous radiation therapy, obesity, and diabetes, and in heavy smokers.35 Additionally, the use of SSM with IBR will be influenced by other factors such as the information the patient has received, age, race, psychosocial factors, geographic region, and the type of hospital.36,45

### Influence of Adjuvant Treatments

**Skin-Sparing Mastectomy and Chemotherapy**

In most of patients with breast cancer, chemotherapy (CT) is indicated because it improves survival rates and reduces regional recurrence. IBR may influence CT, and vice versa; the former may delay CT due to immediate surgical complications and the latter may increase complications of reconstruction. These have not been measured statistically in the studies performed, which may indicate that IBR does not influence the timing of mammograms, ultrasounds, or MRIs. Treatment of local recurrence depends on early diagnosis that makes less invasive surgery and later adjuvant treatments possible. Local recurrence after mastectomy has generally been seen as a sign of a poor prognosis. When recurrence after SSM or IBR is analysed, approximately 70% of patients with local recurrence develop distant metastases.26-28,31,32,34,38

### Table: Local Recurrence After Skin-Sparing Mastectomy in Breast Cancer

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>SSM, No.</th>
<th>LR, %</th>
<th>Follow-up, Months</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slavin et al26</td>
<td>1998</td>
<td>51</td>
<td>2</td>
<td>45</td>
<td>26 cases of DCIS</td>
</tr>
<tr>
<td>Newman et al21</td>
<td>1998</td>
<td>372</td>
<td>6.2</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Simmons et al21</td>
<td>1999</td>
<td>77</td>
<td>3.9</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Toth et al27</td>
<td>1999</td>
<td>50</td>
<td>0</td>
<td>51.5</td>
<td></td>
</tr>
<tr>
<td>Kroll et al32</td>
<td>1999</td>
<td>114</td>
<td>7</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Rivadeneira et al36</td>
<td>2000</td>
<td>71</td>
<td>5.1</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Rubio et al33</td>
<td>2000</td>
<td>95</td>
<td>3</td>
<td>44</td>
<td>DCIS</td>
</tr>
<tr>
<td>Foster et al22</td>
<td>2002</td>
<td>25</td>
<td>4</td>
<td>49</td>
<td>LABC</td>
</tr>
<tr>
<td>Medina-Franco et al33</td>
<td>2002</td>
<td>176</td>
<td>4.5</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Spiegel et al30</td>
<td>2003</td>
<td>177</td>
<td>5.6</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Carlson et al28</td>
<td>2003</td>
<td>539</td>
<td>5.5</td>
<td>65</td>
<td>DCIS, 30.6%</td>
</tr>
<tr>
<td>Gerber et al31</td>
<td>2003</td>
<td>112</td>
<td>5.4</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Downes et al34</td>
<td>2005</td>
<td>38</td>
<td>2.6</td>
<td>53</td>
<td>“High risk” tumours</td>
</tr>
<tr>
<td>Greenway et al38</td>
<td>2005</td>
<td>225</td>
<td>1.7</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Salhab et al34</td>
<td>2006</td>
<td>25</td>
<td>0</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>Vaughan et al39</td>
<td>2007</td>
<td>210</td>
<td>5.3</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Meretoja et al36</td>
<td>2007</td>
<td>196</td>
<td>5.1</td>
<td>70</td>
<td>T0/T3</td>
</tr>
</tbody>
</table>

*DCIS indicates ductal carcinoma in situ; LABC, locally advanced breast cancer; LR, local recurrence; SS, skin-sparing mastectomy.*
not interfere in the initiation or effects of adjuvant or neoadjuvant CT.\textsuperscript{46-48}

Skin-Sparing Mastectomy and Radiation Therapy

The indications for radiation therapy (RT) after an SSM with IBR are the same as after a standard mastectomy, that is, in large-sized cancers (T3-T4) and/or with 4 or more metastatic axillary lymph nodes; in fact, it has been shown to reduce regional recurrence and may increase survival. IBR after a standard mastectomy may be relatively contraindicated in this type of patient since RT may worsen the aesthetic result by increasing local complications. The most frequent complications are infection, difficult expansion, and capsular contraction when prosthesis or expanders are used\textsuperscript{49,50} and the increase in fat necrosis or loss of volume when the reconstruction is performed with autologous tissues.\textsuperscript{42} Nevertheless, Hazard et al.\textsuperscript{51} in retrospective studies, do not contraindicate IBR in patients with adjuvant RT since it does not lower survival or increase local recurrence, and it has acceptable aesthetic results.

When the influence of RT on patients with SSM and IBR is analysed, it can be observed that there are few prospective studies.\textsuperscript{52} One of the most interesting is the study by Cordeiro et al.\textsuperscript{53} where, despite finding a higher number of complications following RT, they do not contraindicate IBR due to the aesthetic results and patient satisfaction. These same authors recommend a rapid expansion in the immediate postoperative period to change the expander for a definitive prosthesis at 3-4 weeks after finishing chemotherapy and to begin RT at 3-4 weeks after the change. Kronowitz et al.,\textsuperscript{54} with the goal of avoiding problems and RT and not losing the advantages of SSM, performed SSM and IBR with an expander that was maintained throughout CT; they deflated prior to RT and then re-inflated after RT. Later, they performed a definitive reconstruction using TRAM or a lattissimus dorsi/prosthesis.

There are similar discussions with respect to RT in SSM with IBR using autologous tissues. Authors such as Tran et al.\textsuperscript{55} contraindicate IBR due to the complications produced by RT. Others, such as Soong et al.\textsuperscript{56} do not find an increase in complications in SSM with TRAM reconstruction.

For the purpose of avoiding SSM with IBR in patients who are candidates for postoperative RT, SLNB and ultrasound-guided biopsies of suspicious axillary adenopathies may help us know the patient's axillary status prior to or during surgery.\textsuperscript{17} However, one must keep in mind that in half of all patients with a positive SLN, this will be the only positive lymph node and, therefore, we cannot completely rule out SSM and IBR in this group of patients since they will not receive radiation therapy.

References

Ramos Boyero M. Skin-Sparing Mastectomy: An Alternative to Conventional Mastectomy in Breast Cancer


