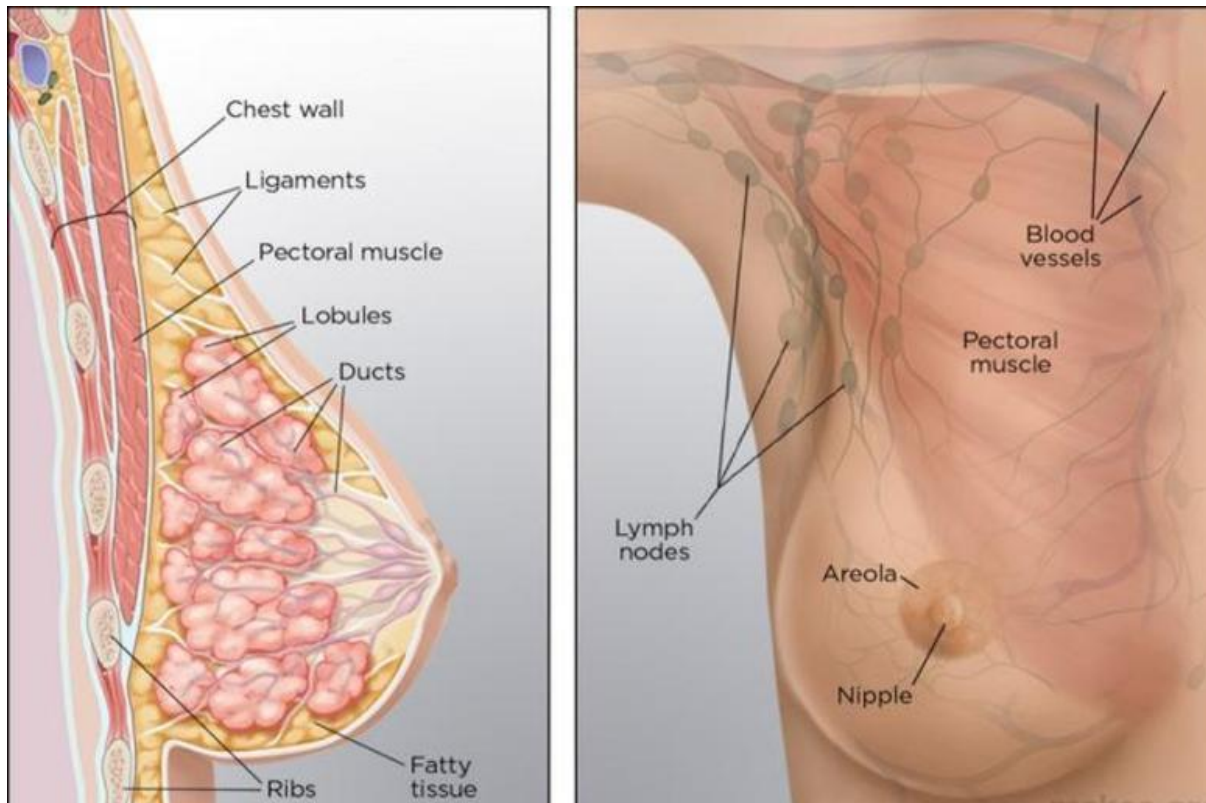


Mastectomy and Reconstruction: An overview.

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Introduction

The anatomy of the breast and its boundaries include the clavicle superiorly, the sternum medially, the inframammary fold inferiorly, and the latissimus along the pectoralis major fascia laterally. (fig 1)



In 1882, William Halsted documented the first interventions he carried out, establishing guidelines in radical cancer surgery and using new anaesthesia, aseptic and antiseptic techniques for the first time. Results in terms of survival and local recurrence reduction were exceptional, thus making the Halsted operation, described in the 19th century, be performed on more than 90% of the patients with breast cancer in the US until the 1970s of the 20th century.

Halsted's radical mastectomy involved large incisions and extensive tissue ablation. The mammary gland, both pectoral muscles, and the entire axillary lymphatic tissue, up to its tip, were excised. The extent of resection also led to

an important associated morbidity (paraesthesia, lymphoedema of the arm, rib cartilage damage, or pneumothorax by the perforation of the intercostal space).

The current standard mastectomy (also known as a Modified Radicle Mastectomy) was established by John Madden in 1972. His contribution to the technique was the preservation of both Pectoral muscles (Pectoralis Major and Minor). The breast tissue including the nipple areolar complex, excess skin and the axillary content are removed to leave a flat chest wall.

After the implementation of the Madden modified radical mastectomy, along with advances made in adjuvant therapy and radiotherapy, conservative axillary treatment was adopted because, it was shown that that it achieved similar results. Sentinel node technique favored the limitation of unnecessary interventions regarding axillary clearance for node negative patients, and, in this way, the rate of postoperative complications (lymphedema, paresthesia, upper limb mobility limitation) was decreased considerably.

The combination of plastic surgery principles in cancer surgery gave birth to oncoplastic surgery that brought a great contribution regarding the obtaining of an optimal aesthetic result, with techniques such as nipple areola sparing mastectomy or skin- sparing mastectomy, to facilitate breast reconstruction.

Indication for Mastectomy:

Prior radiation therapy to the breast or chest wall (eg previous breast conserving surgery, Mantle Zone radiotherapy for Lymphoma)

Inflammatory breast cancer (After Neo-adjuvant Chemotherapy).

Diffuse malignant microcalcifications (DCIS)

Widespread Invasive disease that is multicentric, located in more than one quadrant, and cannot be removed through a single incision with negative margins. (but remember Neo-adjuvant chemo)

A positive pathologic margin after repeat re-excision and suboptimal cosmetic outcome

Small breast size with a large volume of disease.

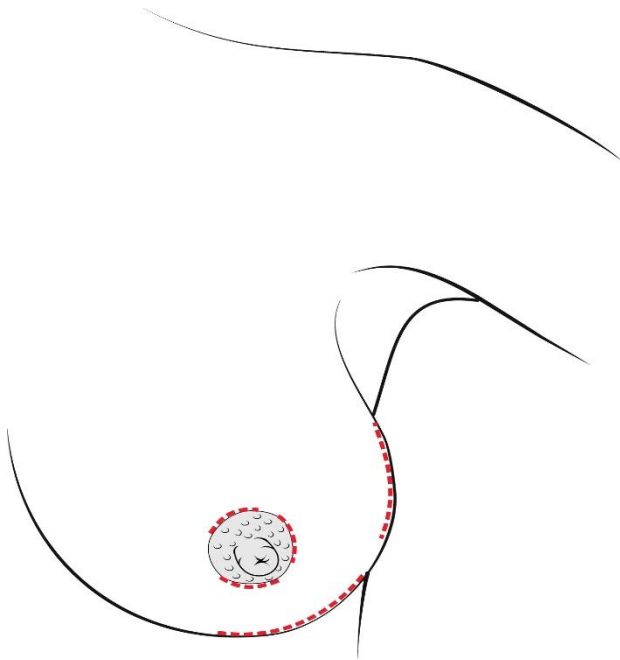
Risk reducing Surgery eg BRCA1 gene carrier.

Patient choice (Avoiding radiotherapy with breast preservation)

Patients who undergo a mastectomy have the option for immediate or delayed reconstruction using autologous tissue or implants. Prior to the mastectomy, patients should be seen by an Oncoplastic surgeon. The decision for immediate or delayed reconstruction is made based on the need for other adjuvant treatments such as post-mastectomy radiation.

For those patients who do not want reconstruction, **a simple mastectomy** removing the breast mound and skin to leave a flat chest is performed, and a soft prosthesis worn in an adapted bra will maintain the external appearance of a breast mound under clothing. Today more than 75% of women do not have a Surgical reconstruction of the breast following mastectomy.

For women who wish to have an immediate reconstruction, a **Skin Sparing mastectomy is performed.**



Incisions for skin sparing Mastectomy.

i) Peri-areolar ii) Infra mammary iii) Lateral Anterior chest wall.

The Breast tissue is removed through an incision into the skin envelope, but no skin is removed, unless it is directly involved with cancer. The nipple -areolar complex is also preserved unless there is disease within 2cm of the nipple or DCIS in the subareolar ducts.

The Choice of reconstruction techniques include.

Prosthetic implant:- Saline or Silicone.

Autologous Tissue such as a myo-cutaneous or adipo-cutaneous flaps

Eg Lattismus Dorsi Flap, TRAM or DIEP flap.

Reconstruction using an Implant

Historically after a mastectomy, a Surgeon would place a tissue expander under the pectoralis muscle. The muscle pocket was not big enough to allow the full volume of the breast to be inserted, so a balloon like expander was used. Once the wound had healed the balloon could be inflated by injecting saline through the expander port in out-patients to increase the volume.

At a later date a second operation was performed to exchange the expander for a permanent silicone implant once the final volume of expansion had been achieved.

Acellular dermal matrix (ADM) has been used as a soft tissue replacement since its introduction in 1994. ADMs are soft tissue matrix grafts created by a process that results in decellularization but leaves the extracellular matrix intact. This matrix provides a scaffold upon and within which the patient's own cells can repopulate and revascularize the implanted tissue. Its utility has been demonstrated in various reconstructive techniques, particularly in abdominal wall, and breast reconstruction. The first use of ADM in the breast reconstruction in Europe was performed by Rick Linforth in Bradford in July 2008.

Most ADMs are made from animal skin eg Pig skin (Strattice, Artia, Fortiva) others from Bovine (Surgimend) There are also some synthetic meshes such as Tiloop.

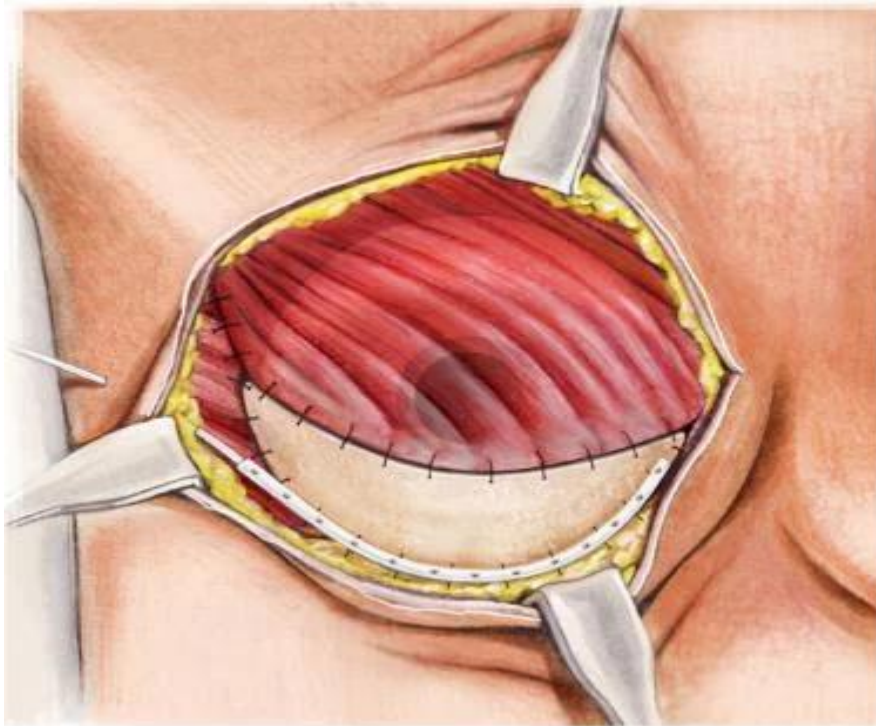
Skin incisions can be made in the infra-mammary fold, Lateral breast crease, or Peri areolar and vertical scar. A Wise pattern skin reducing incision for an autologus dermal flap can also be used.

The pectoralis major is first disconnected at the inferior origin along the inframammary fold, then separated from the rectus and serratus fascia, allowing a submuscular pocket to be created.

A thick 6 × 16 cm piece of acellular dermis is sutured to the ensuing inferior defect in the pectoralis major to create a hammock in which the implant can sit.

The implant or tissue expander is placed under the Pectoralis Major muscle above and covered by the ADM below.

The Muscle and ADM are then sutured together totally enclosing the implant.



Expander implant placed under the Pectoralis Major Superiorly and the ADM sutured in the lower pole to the Inframammary fold and free boarder of Pectoralis.

Using this technique has allowed Surgeons to go direct to implant with the final silicone implant placed at the first operation provided the breast volume is less than 500cc's (eg 34A-C/ 36 B). For larger breasts, an expander may still be used

or a Skin Reducing Wise pattern mastectomy performed where the skin envelope is reduced, to create a smaller breast than the patients current breast.

This is like performing a breast reduction, but all the breast tissue is removed, and the redundant skin in the lower pole used for a dermal sling.



Left Skin sparing mastectomy and immediate reconstruction 12 months post op using direct to implant and Strattice reconstruction .

Since 2015 Surgeons have now been performing Total ADM cover reconstruction. In this procedure the Pectoralis Muscle is left completely undisturbed and a large sheet of ADM is used to cover the implant.

This reduces pain, muscle animation and improves recovery. It is best performed in patients who have some fat below the skin to allow cover of the implant to prevent implant folds being visible so best avoided in low BMI patients. This new technique is rapidly becoming the procedure of choice for implant-based reconstruction in the UK.

The operation takes around 1.5 to 2 hours to perform, has no other wounds on the body and usually just one night in hospital followed by 4-6 weeks recovery at home. A drain is often placed under the skin to remove tissue fluid or seroma for 3-5 days.

Risks associated with ADM's and implants.

The most important aspect of immediate reconstruction is to ensure good blood flow to the skin flaps of the breast envelope. Skin necrosis occurs in 6-10% of mastectomies and can lead to wound break down, infection and implant loss.

This is much more likely in smokers, prior radiotherapy, obese patients and diabetics. Skin necrosis in these groups can be 4 to 5 times higher.

In addition to skin necrosis, implant loss can occur because of infection and most surgeons will give an intraoperative and a 5-7 day course of antibiotics such as Flucloxacillin.

Other complications relate to the implant including Capsular contracture, implant rupture, rippling and ridges palpable on the implant and very rarely Breast implant associated Anaplastic large cell lymphoma. (BIA-ALCL).

Chronic pain after mastectomy is also common affecting 40% of women although most is usually controlled with simple pain relief.

Autologous Reconstruction.

Instead of using ADM and implants, some patients prefer to use their own tissue for reconstruction. This involves the same mastectomy, but harvest tissue from:

Lattissimus dorsi muscle swung through the axilla on to the chest wall (pedicled flap) used with or without an implant depending on the amount of fat which can be taken above the muscle (extended LD flap)

Trans rectus abdominal muscle flap (TRAM) usually a free flap taking the lower abdominal skin, fat and small area of muscle.

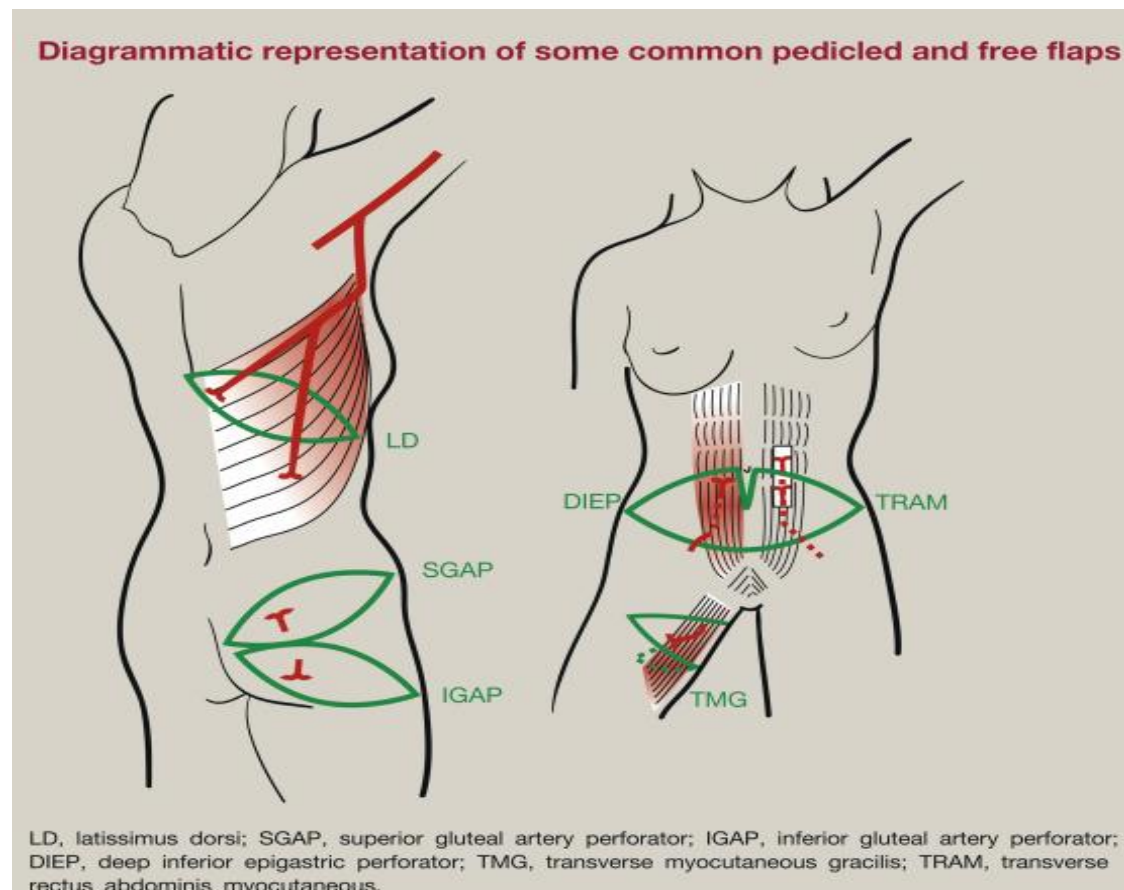
Deep Inferior Epigastric Flap (DIEP) a muscle sparing perforator flap taking just skin and fat from the lower abdomen.

These autologous procedures are performed by Plastic Surgeons and take from 4-8 hours, hospital stay of 4-7 days and 6-8 weeks to recover. They have the advantages of a warm, softer more natural feeling breast and can be used for bigger breast volumes (D/E cup). They avoid the issues relating to silicone. The abdominal flap also has the effect of an abdominoplasty which can be appealing for some women.

They are longer operations, so are not suitable for patients with co-morbidities such as Ischaemic heart disease, smokers, grossly obese. The major complication is a lack of blood flow or venous congestion at the microvascular anastomosis leading to flap necrosis seen in 1-3 % of flaps. Skin necrosis also occurs at a slightly lower rate than with implants. The longer term complications include abdominal hernia, fat necrosis and donor site pain especially with the latissimus dorsi flap.

There is also a National shortage of surgeons who can perform the DIEP flap which is limiting its availability for use as a reconstructive procedure.

Autologous reconstruction can also bring in new skin with the muscle to facilitate delayed reconstruction and is especially useful in patients who have had chest wall radiotherapy after their mastectomy.

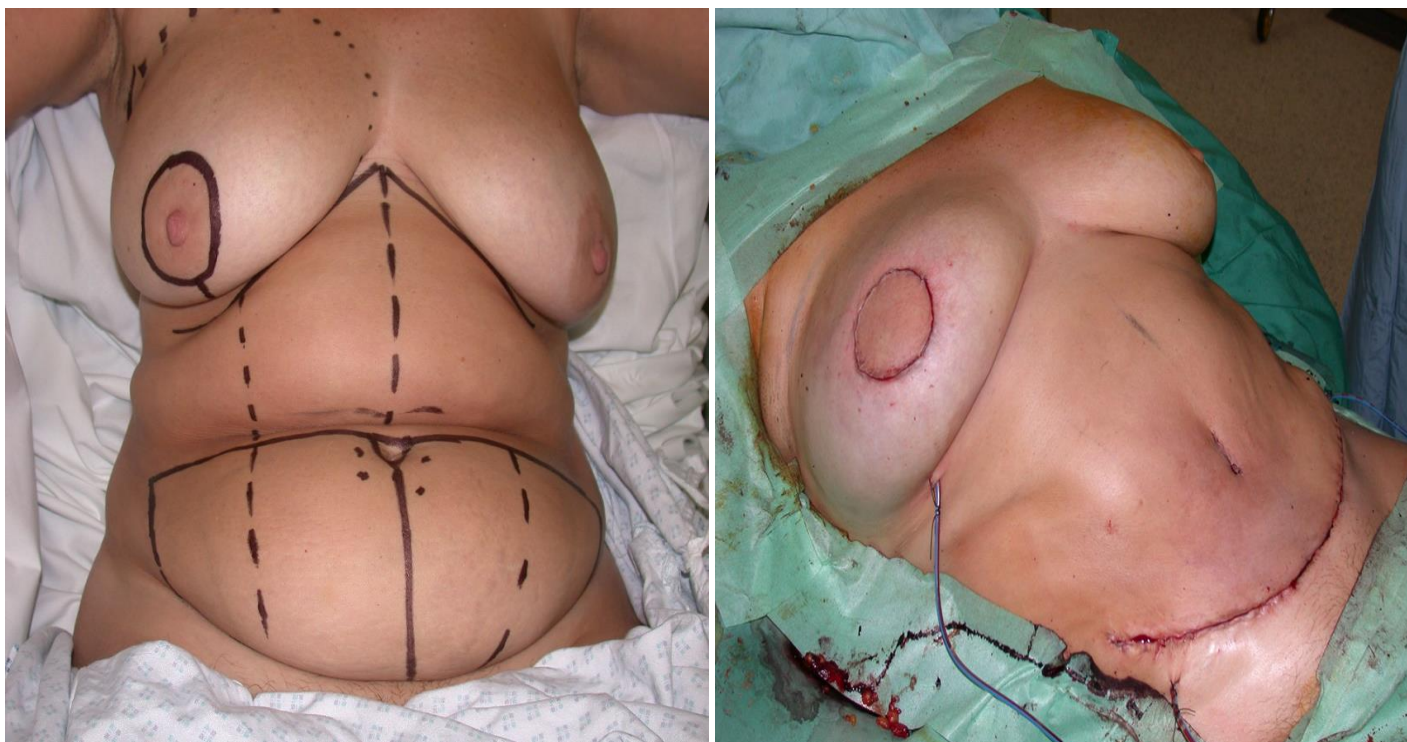


Latissimus dorsi flaps (the LD fla) is a robust flap with a low (<1%) loss rate. It is a musculo-cutaneous pedicled flap that is typically harvested through a bra-line incision in the lateral position, along relaxed skin tension lines.

A simultaneous mastectomy can be performed with a second surgeon in the context of immediate reconstruction, thereby reducing operating time. The flap is harvested in the Scarpa's fascial plane, preserving the subdermal plexus to the back skin. While an LD flap can be inset over an implant, an autologous 'extended' LD (ALD) flap avoids the use of implants by gaining extra flap volume with dissection of adjoining fatty areas. The flap is then passed through an axillary tunnel into the mastectomy pocket.

Abdominal free flap reconstruction requires microvascular expertise and is most safely performed in high-volume, specialized units who can demonstrate flap loss rates as low as 1-2%.

A transverse ellipse of fat with overlying skin is harvested from the lower abdomen, leaving a long, low transverse scar. The umbilicus is repositioned at abdominal closure. Flap design is based on the deep inferior epigastric vessels (DIEP), which are usually the dominant circuit supplying the anterior abdominal wall. An abdominal free flap is either performed as a deep inferior epigastric perforator flap (DIEP) or as a transverse rectus abdominis musculocutaneous flap (TRAM). While the DIEP is the gold standard technique it requires the presence of a single (or a few, in proximity), good quality and calibre perforating artery and vein to be safely isolated without sacrificing the muscle. The TRAM flap, while sacrificing a degree of muscle (the full width of one of the Rectus Abdominus muscle), harvests multiple small perforators within a cuff of muscle which then converge in a larger calibre vessel downstream. A muscle-sparing TRAM (msTRAM) can be raised if a lateral portion of the rectus with its innervating nerves is preserved and kept in continuity. A preoperative CT angiogram can map out the vascular anatomy and greatly aid surgical planning.



Pre and post op Immediate Abdominal DIEP Flap Reconstruction.

There are multiple other free flap options including superior gluteal artery perforator (SGAP), inferior gluteal artery perforator (IGAP), transverse musculocutaneous gracilis (TUG) and greater omentum flap.

Further Reading:

An 8-Year Experience of Direct-to-Implant Immediate Breast Reconstruction Using Human Acellular Dermal Matrix (AlloDerm)

C. Andrew Salzberg; Andrew Y. Ashikari; R. Michael Koch; Elizabeth Chabner-Thompson;

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Skin-reducing mastectomy with breast reconstruction and sub-pectoral implants.

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