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One-stage vs. two-stage approach for partial breast reconstruction with lateral chest wall perforator flaps

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ABSTRACT

Background: The lateral chest wall perforator flaps offer an excellent option for partial breast reconstruction (PBR) in women undergoing breast conservation surgery (BCS) for laterally placed tumours in small to moderate non-ptotic breasts.
Methods: We have performed 40 PBR, including LICAP (Lateral intercostal artery perforator) and LTAP (Lateral thoracic artery perforator) flaps over a three-year period. 29 were performed as one-stage whilst 11 were performed as two-stage approach. The latter approach was undertaken for patients with high tumour to breast ratio in an attempt to extend the indication for breast conservation.
Results: Out of 40 patients, 27 were symptomatic and 13 were screen-detected with a mean age of 49 years. The overall median tumour size on pre-op imaging was 35 mm and was 47 mm for the ones selected for two-stage approach. 11 patients underwent neo-adjuvant chemotherapy and additional 14 had adjuvant chemotherapy. All but one patient had adjuvant radiotherapy to the breast. 4 patients (10%) required further surgery to the breast due to incomplete cancer excision; 2 underwent successful re-excision and 2 (5%) were recommended completion mastectomy. A high satisfaction scores were reported both by the patients and surgical team with regards to the aesthetic outcome. There were no significant differences observed in complications, aesthetic outcome or patient satisfaction levels with the two approaches. Patients undergoing two-stage approach had an extra periareolar scar (in majority of the cases), which faded well with radiotherapy.
Conclusion: We recommend considering two-stage approach in women with high tumour to breast size ratio to ensure successful BCS prior to PBR.

1. Introduction

The history of use of lateral chest wall flaps for breast reconstruction dates back to 1986. Holmstrom and Lossing et al. described Lateral thoracodorsal flap, a random pattern local fascio-cutaneous flap used to assist implant reconstruction after mastectomy for breast cancer [8]. The concept of Oncoplastic Breast Surgery has led to emergence of techniques to facilitate partial breast reconstruction; lateral chest wall perforator flaps being one of them. These flaps extend the indications for breast conservation surgery and are associated with minimal procedure related morbidity resulting in quick recovery and excellent aesthetic outcomes.

The lateral chest wall flaps are pedicled perforator flaps that could be based on either Lateral intercostal artery perforators (LICAP) or branch of Lateral thoracic artery (LTAP) [11]. The other vessels that could be used are anteromedial perforators of intercostal vessels and thoracodorsal artery perforator flap (TDAP) [6]. These flaps have been used for partial breast reconstruction predominantly for lateral defects after cancer resection [5] and for autologous breast augmentation after massive weight loss [10,1,3].

The flap is designed on the lateral chest wall by pinching redundant roll of fat with variable extension around the back depending on the tissue needed to fill the defect. The flap is oriented parallel to the skin tension lines with the tip curving up posteriorly parallel to the underlying ribs and following the angiosome description [12]. The perforators are preferably marked pre-operatively with a hand-held Doppler with the patient lying down simulating the intra-operative position and the flap design can be moved to ensure the inclusion of more than one perforators.

In this article, we are sharing our experience with the lateral thoracic wall perforator flaps for partial breast reconstruction (PBR) to facilitate breast conservation surgery in women with breast cancer. This is a single-center, single surgeon series with prospective data collection. Three-quarter cases were done using one-stage approach and a quarter with two-stage approach.

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2. Methods

This study was performed at Oxford University Hospital, UK. This is a prospective single surgeon series of partial breast reconstruction with lateral chest wall perforator flaps over a three-year period between 2011–2014.

The data was collected prospectively and updated regularly by collating from histological records, radiological reports for any imaging performed, operative notes for weight of the specimen and type of flap and letters from the oncologists with regards to the treatment received after surgery. The same surgical team followed up the patients regularly in order to keep an eye any complications or significant events.

The primary outcomes studied were a) need for further breast surgery due to incomplete cancer excision b) rate of complications after PBR and c) aesthetic outcomes as assessed by the surgical team and the patients. The study was carried out as a part of routine clinical care with approval to audit the outcomes. The hospital ethical and clinical guidelines were adhered to and patients' permission was obtained to use their anonymised photographs for educational and publication purposes.

The questionnaire used to assess the patient reported outcomes was Body Image Scale (Appendix A) that has been validated for use in women undergoing surgery for breast cancer [9]. The scores were added for all the questions, total could range from 10–40, 10 being the best and 40, worst. The anonymised questionnaires were sent out by a member of the surgical team between 4–6 months after the completion of radiotherapy. As this questionnaire is a validated tool, it did not require local ethics approval. Two surgeons (one trainee and one senior surgeon) reviewed pre-operative, and 12-months post-op photographs (2 views, frontal and oblique) for each patient, the aesthetic outcomes were marked subjectively using Harris scale (poor, fair, good or excellent).

The data were statistically described in terms of mean median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables (tumour size) between the study groups was done using 2-tailed Student *t* test.

3. Results

40 cases were carried out from year 2011–2014 with a median follow-up of 27 months (12–49 months). The mean age was 49 years (range from 42–69 years) and 4 patients were active smokers at presentation. All patients were diagnosed pre-operatively with biopsy proven DCIS or invasive breast cancer. The patients were offered the choice of breast conservation surgery or mastectomy and were counseled with regards to the pros and cons of the two options. All these patients had tumour to breast volume ratio of greater than 20% so simple lumpectomy would have resulted in significant breast distortion after radiotherapy. Majority of the patients were not candidates for mammoplasty because of either small size of the breasts or non-ptotic breasts, however, small number of patients preferred PBR to mammaplasty in order to keep their breast size and prevent scars on the contralateral breast. Table 1 gives the distribution of the breast-cup size prior to surgery and corresponding tumour size suggested on pre-operative imaging. All tumours were located in the outer half of the breast.

Table 1
Details of the median tumour size in relation to the bra cup.

Breast size	Number of patients (%)	Median tumour size on imaging (pre-op)
A	3 (7.5%)	21
B	7 (17.5%)	41
C	16 (40%)	35
D	14 (35%)	43

Table 2
Distribution of the clinic-pathological and treatment parameters in our series.

Tumour characteristics and treatment	Number of patients (%) (total:40)
Symptomatic presentation	27 (67%)
Screen detected cancers	13 (33%)
Invasive Cancers	35 (87%)
DCIS only	5 (13%)
Tumour size (on histology) excluding NAC:	29 (72%)
1–2 cm	6
2–5 cm	15
> 5 cm	3
Multifocal	5
Post Neo-adjuvant chemotherapy	11 (28%)
pCR	3
T1	1
T2	4
T3	2
*Tumour grade (invasive cancer only)	
Gr 1	5 (14%)
Gr 2	16 (46%)
Gr 3	14 (40%)
*Node positive at diagnosis	7 (20%)
*Axillary Nodes positive (total)	21 (60%)
*Triple negative cancers	6 (17%)
*ER positive cancers	27 (77%)
*Her-2 positive cancers	6 (17%)
*Neo-adjuvant chemotherapy (NAC)	11 (31%)
*Chemotherapy (adjuvant and NAC)	25 (71%)
Adjuvant radiotherapy	39 (1 declined)
*Adjuvant endocrine therapy	26 (74%)

NAC: Neoadjuvant chemotherapy.
pCR: pathological complete response.
* This information applies to invasive cancers (35 in total).

All patients were assessed by 2-view digital mammogram and ultrasound of the affected breast and axilla. MRI was limited to fewer (19) patients, the indications being tumour size discrepancy, invasive lobular cancer and patients undergoing neoadjuvant chemotherapy. 21 patients had positive lymph nodes; 7 at presentation (proven by ultrasound guided nodal biopsy) and rest after sentinel lymph node biopsy. 11 patients underwent neoadjuvant chemotherapy including all 7 patients with positive nodes at presentation and others were either triple negative or with a large primary cancer.

3.1. Patient characteristics (Table 2)

27 patients presented with symptoms and 13 were screen-detected cancers. 35 had invasive cancer and 5 had DCIS only. The overall median tumour size judged on pre-op imaging was 35 mm and mean tumour size was 33 mm (ranging from 15–75 mm). The procedure was performed as one-stage procedure (Fig. 1) in 29 patients and as 2-stage procedure (Fig. 2) for 11 patients. The latter approach was adopted in women with high tumour to breast ratio, thus bordering on to recommendation for mastectomy. These women preferred breast conservation surgery, therefore wide local excision was performed first and the cavity was maintained patent with normal saline in order to ensure clear margins prior to committing to partial breast reconstruction. The pathology was fast-tracked and once margin clearance was ensured, patients was brought back for surgery within 2–4 weeks of initial surgery for

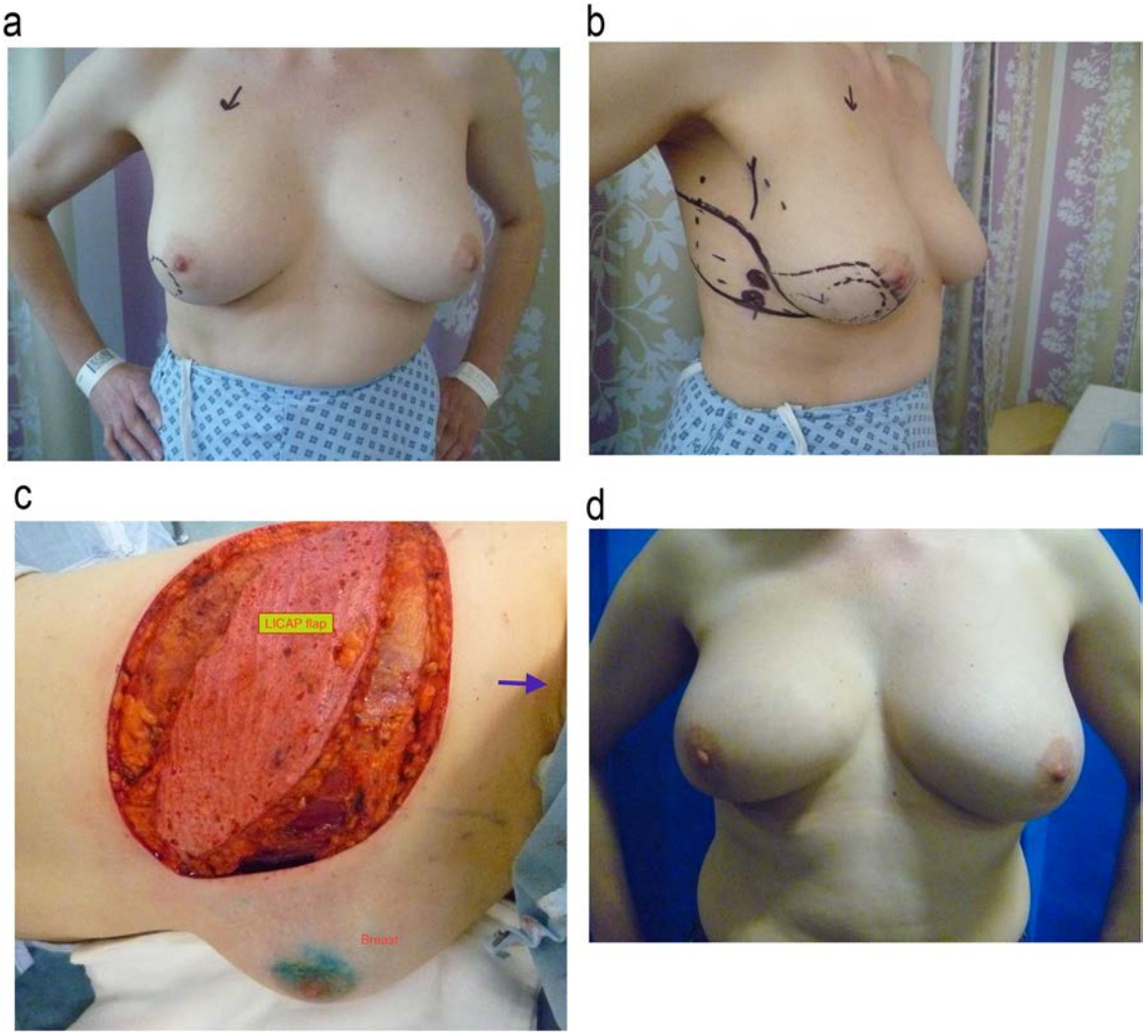

Fig. 1. One-stage LICAP flap reconstruction. 1a: 47-year old with 40 mm cancer in the lower outer quadrant of the right breast (pre-operative). 1b: Pre-op marking for LICAP flap. 1c: Intra-operative picture showing the flap dissected (arrow points towards head with patient in lateral position). 1d: 2 years after radiotherapy on right side. Patient had chemotherapy after surgery.

partial breast reconstruction to reconstruct the defect. The median size on pre-op imaging for women undergoing two-stage approach was 47 mm, with mean tumour size of 45 mm (ranging from 24–75 mm); this was significantly higher than the mean tumour size observed in the one-stage group ($p=0.009$, student t-test). The tumour characteristics for patients undergoing two different approaches are detailed in Table 3.

The median tumour size on final histology was 35 mm (14–140 mm) in unifocal cancers undergoing primary surgery (total of 23 cases). 6 were multifocal (2 or more foci) cancers confined to the same quadrant of the breast and 11 patients had neoadjuvant chemotherapy with varying degree of response seen on excision. The median weight of the specimen excised for tumour excision was 96 g (ranges from 35–193 g). The median size of radial excision margins was 10 mm (ranges from 4–15 mm). Out of 40 patients, 4 required further surgery due to inadequate radial margins, as assessed on histology. 2 underwent successful re-excision and 2 were recommended mastectomy due to a) extensive DCIS (this patient declined further treatment including surgery and /or radiotherapy) b) multifocal unexpected invasive lobular cancer (this patient underwent mastectomy with direct to implant reconstruction).

There were two patients during this time period, who were selected for two-stage approach but required completion mastectomy during the second operation.

3.2. Complications

The complications encountered in this cohort of patients include:

1. Immediate re-operation for complications (2)
   a. Bleeding and hematoma: this resulted in partial flap loss due to delay in return to theatre thus resulting in volume deficiency and inferior aesthetic outcome.
   b. Pain and Inflammatory oedema post-op: the patient underwent exploration to rule out flap/fat necrosis. No obvious cause for found for inflammation and washout lead to resolution of symptoms.

2. Superficial skin necrosis (1): a small area of skin necrosis was observed overlying the flap that was managed conservatively however resulted in significant scarring and distortion.

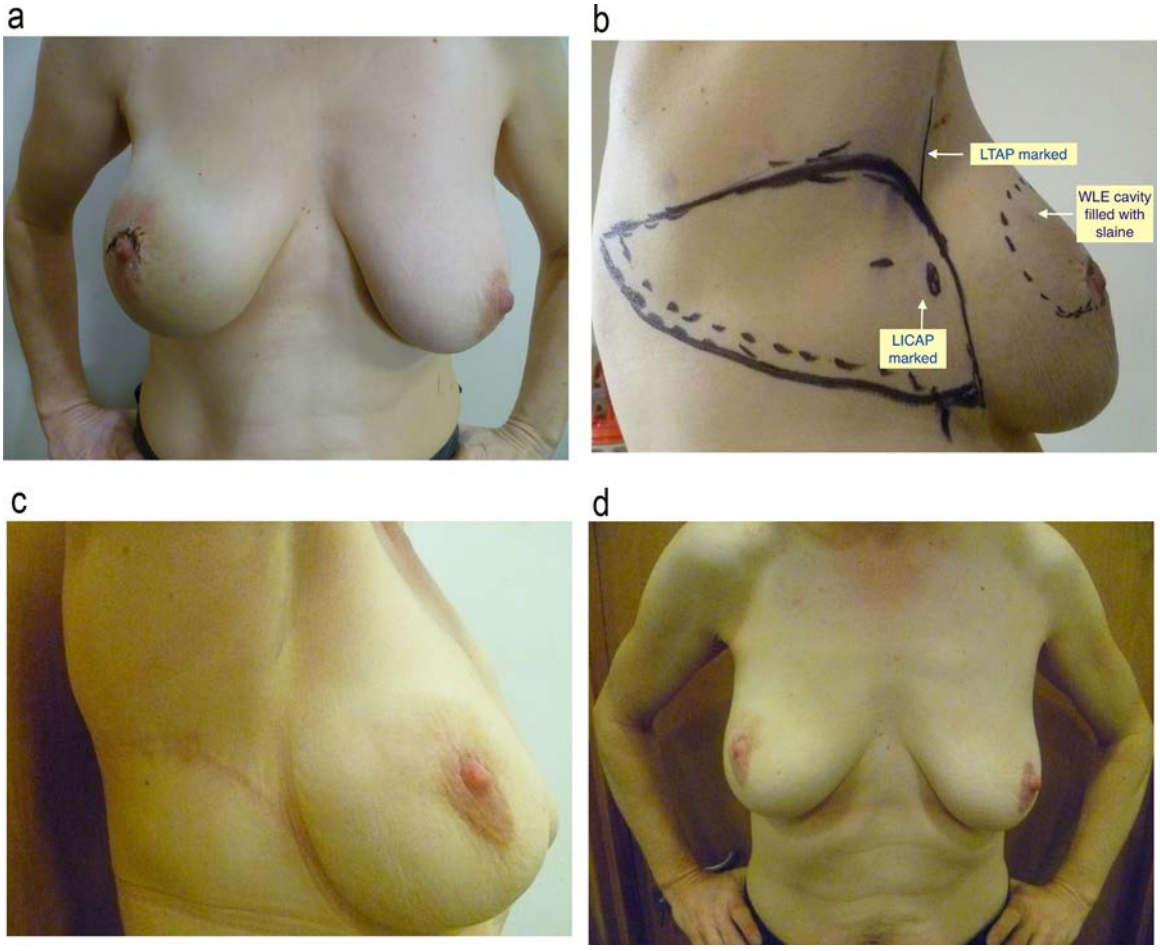

Fig. 2. 2-stage LTAP flap reconstruction. 2a: Post-op picture after wide local excision (WLE) with saline fill of the cavity and SLNB (1st Stage) for 45 mm cancer in the upper outer quadrant of Right breast in a 41-year-old lady. The WLE was performed via per-areolar incision. 2b: Pre-op marking of flap, both perforators (LTAP and LICAP) were marked pre-operatively using hand-held Doppler. 2c: Appearance of scar 1-year after radiotherapy. 2d: 2 years after radiotherapy.

Table 3
Tumour characteristic of patients undergoing one-stage and two-stage approach.

	One-stage	Two-stage	*p* value
Mean Tumour size (mm) (on pre-op imaging)	33	45	0.009
Total number of patients	29	11	
DCIS only	3	2	
Invasive cancers	26	9	
Neo-adjuvant chemotherapy	7 (27%)	4 (44%)	
Chemotherapy (adjuvant and NAC)	18 (69%)	7 (77%)	
Her-2 positive cancers	4 (15%)	2 (22%)	
Node positive cancers	15 (51%)	6 (66%)	

Table 4
Patient and clinician reported aesthetic outcomes.

PROM scores (BIS)	**10–20**	**21–30**	**31–40**
Number of patients (out of 30 responders)	**24 (80%)**	**6**	**0**
Clinician scores (Harris scale)	**Good to excellent**	**Fair**	**Poor**
Number of patients (out of 39 evaluated) *	**32 (82%)**	**5**	**2**

* 39 patients' photographs were evaluated as 1 patient underwent completion mastectomy.

3. Fat necrosis (2): both the patients presented with a lump 6–12 months after radiotherapy and fat necrosis was proven on biopsy (thus ruling out recurrence). Both patients underwent surgical excision of fat necrosis to ally anxiety.
4. Minor complications:

   a. Small hematoma
   b. Seroma

These were managed with conservative management, with no significant impact on the further therapy or aesthetic outcome.

5. Breast lymphoedema (2): both these patients had axillary treatment for positive nodes, which was assumed as the potential cause for breast lymphoedema and were managed by manual lymphatic drainage.

3.3. Follow-up

The patients are being followed up as per local policy with annual clinical examination and bilateral mammograms. There was no problems reported by the radiologist with regards to mammographic follow-up and patients did not require additional imaging except the ones with fat necrosis. All patients have been followed up for at least 1 year, longest being 4 years. There have been no cases of local recurrence to date. One patient presented with visceral metastases 18 months after surgery. This patient had triple negative cancer and had neoadjuvant chemotherapy followed by surgery and radiotherapy.

50% of cancers in this study were node positive; 6 were Her-2 positive and 6 patients had triple negative cancer suggesting a significant proportion of high risk cases in the case-mix and thus relevance of short term follow-up.

3.4. Patient and clinician reported outcome (Table 4)

The overall aesthetic outcome as judged by patients and the surgical team using Harris scale [7] has been good to excellent in 82% patients. 2 patients had sub-optimal results, one after skin necrosis and second due to post-op bleeding. No patient required contralateral symmetrization surgery. The patient reported outcome questionnaires with Body Image scale [9] were sent out to patients at about 6 months after completion of in-hospital treatment (radiotherapy). Three-quarters (30) responded and 80% reported high satisfaction scores (less than 20). The scores varied form 10 to 29 and the median score was 13.

4. Discussion

The lateral chest wall perforator flaps allows partial breast reconstruction in women with small to moderate sized non-ptotic breasts, with a diagnosis of breast cancer and result in excellent aesthetic outcome with minimal morbidity. This technique could obviate the need for mastectomy in selected group of women, who wish to pursue breast conservation surgery.

The LICAP flap is pivoted at its junction with the vessels therefore has limited mobility making it suitable essentially for the lateral breast defects. However the pure LTAP flaps have slightly better mobility due to the superior placed vessel, which is often of good caliber and allows the flap to hinge superiorly thus permitting rotation and better volume fill of the defect in the breast.

LICAP/LTAP flaps are good options for one stage partial breast reconstruction in small to moderate sized non-ptotic breasts. However it is important to take in account the fall back options for reconstruction in case patient needs mastectomy due to extensive disease or positive margin. LD remains an option after LICAP has been harvested, however there are a few limitations. First extent of soft tissue harvest with LD flap is likely to be limited, so for patients with autologous LD as a reconstructive option (if mastectomy is needed), it is worth considering doing LICAP as two-stage approach after ensuring margin negativity of the wide local excision. Second, it is prudent not to extensively undermine the caudal skin flaps after LICAP harvest as that could potentially devascularise the upper half of skin paddle if LD flap is then needed.

The 2-stage approach has an important role in women where breast conservation option is being considered to potentially avoid mastectomy. This involves lumpectomy (with axillary procedure, as indicated) and the cavity is filled with saline. The patient is brought back for flap reconstruction within 2–3 weeks (ideally), once the histology has confirmed negative margins. This approach has following advantages a) ensures that the procedure is performed without the anxiety of potentially interfering with reconstruction options should mastectomy be recommended, particularly, in borderline cases b) helps to combine further axillary procedure during second procedure, if needed, for positive nodes c) helps with team working with skill-mix so that breast conservation surgery could be performed by the wider team preventing delay in the index procedure d) this approach is preferred if patient would be a candidate for autologous LD flap reconstruction should she need mastectomy. The disadvantages are a) potentially more scars as WLE is often performed through periareolar approach and b) logistics of two-operations with limitation on the permissible time period between two operations due to implications of saline absorption.

Patient selection is crucial when deciding to adopt one-stage or two-stage approach. Women with higher tumour to breast size ratio and wishing to conserve their breast are good candidates for two-stage approach to ensure complete cancer excision before undertaking breast reconstruction. This is overall a cost-effective approach as it avoids unnecessary perforator flap surgery should the patient requires completion mastectomy after an attempt at breast conservation surgery. This also extends the indications for breast conserving surgery in women, who are otherwise recommended mastectomy. There were no differences observed in complications, aesthetic outcome or patient satisfaction levels with the two approaches. Patients undergoing two-stage approach had an extra scar (periareolar scar in majority of the cases), which faded well with time after radiotherapy.

There is published data establishing the oncological safety of oncoplastic procedures [2,4] and the PBR approach provide an option to extend the BCS for women with small to moderate breasts with good aesthetic outcome. Our series has a modest median follow-up of 2 years (ranging from 12–48 months) and there was no episode of local recurrence.

None of the patients required contralateral symmetrization and the aesthetic results have been stable with no significant evidence of breast and/or flap atrophy, post radiotherapy. The limitation of this study is the short-term follow-up. A long-term study is needed to establish the stability of the aesthetic outcome and the symmetry of breasts with time.

5. Conclusion

Lateral chest wall redundant fold offer an excellent option for partial breast reconstruction to reconstitute the defect after breast conservation surgery in carefully selected patients. This includes women with small to moderate non-ptotic breasts with laterally placed tumours and a redundant fold on the lateral chest wall to facilitate PBR. We would recommend considering two-stage approach as an option in women with tumour size bordering onto mastectomy and wishing to pursue breast conservation surgery. This helps to ensure successful breast conservation surgery prior to performing partial breast reconstruction. Our series have shown excellent outcome with high patient and surgeon satisfaction scores, irrespective of the approach adopted. We would like to acknowledge that the short follow-up is a limitation in our study and therefore subject to interpretation in different clinical settings.

Disclaimer

No conflict of interest.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.ctarc.2016.06.003.

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