



Research Paper

A Local Random Glandular Flap for oncoplastic breast conserving surgery

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ABSTRACT

Background: Oncoplastic breast cancer surgeries involve a combination of oncologic surgery and esthetic techniques, to excise breast malignant tumors with appropriate clear margins, and maintain or create a pleasant breast contour and shape. Various techniques have been presented up to now, and each one has its advantages and disadvantages. We present our Local Random Glandular Flap, which is practical for many tumor locations and sizes; and yields acceptable, almost symmetrical outcomes.

Methods: We collected data of patients who had been operated on between 2014 and 2019 using this technique. Information gathered consisted of tumor characteristics, flap characteristics, and results of surgery regarding oncologic and cosmetic outcomes in a five-point Likert scale.

Results: Data of 25 patients were collected. The mean size of tumors was around 25 mm. There was no involved margin except for one case that had diffuse malignant cells in many foci around the margins in her permanent histologic reviews and underwent mastectomy afterwards. Cosmetic outcomes as rated by the patients were very good and good in about 79% and 21% of the patients, respectively; and very good, good, medium, bad and very bad in around 71%, 16.5%, 8%, 0% and 4%, respectively as rated by the surgeon.

Conclusions: The LRGF technique allows a wide resection of malignant breast tumors with excellent oncologic results, satisfactory cosmetic outcomes and nearly no need for contralateral symmetrization procedures. This procedure has interesting novel features: the scar is minimal, no skin is removed, the shape of the breast is largely conserved so that symmetrization of the contralateral breast is not necessary, and areolar re-centralization is not needed.

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1. Introduction

Breast cancer is a major health problem globally, and the most common female cancer worldwide [1,2]. Treatment of the disease is undergoing improvements and modifications continuously, and the recent two decades have witnessed major reforms in the management options [4,5]. Surgery is no exception, and the standard of care for breast cancer surgery has evolved from the radical mastectomy of Halsted in the 1890s to the breast conserving surgery (BCS) of today [6]. Moreover, excision of margins of normal breast tissue around a large breast mass may involve large volumes of resection, which

cause asymmetry and unsightly cosmetic deformities [7,8]. The solution to this problem has been provided by in-breast tissue relocation to increase cosmetic outcomes of wide breast tissue excision, recognized as oncoplastic techniques and consisting of a combination of esthetic plastic procedures and cancer surgery [9].

In this paper, we present our experience with a novel Local Random Glandular Flap (LRGF) technique which involves curved small incisions and allow for in block excision of the cancer with enough margin, and use of one or two glandular flaps to fill in the cavity of the tumor.

2. Methods

The study was performed in Arash Women's Hospital, Tehran, Iran. All patients consented and signed the agreement for the use and publication of their data for research and scientific purposes at the time of hospitalization. Protected healthcare information was not disclosed, and the study conformed to the Ethical Principles for Medical Research of the Helsinki Declaration.

The study was performed in Arash Women's Hospital, affiliated to Tehran University of Medical Sciences. All patients have consented and signed the agreement for the use and publication of their data for research and scientific purposes at the time of hospitalization.

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We retrospectively reviewed the files of patients who had undergone surgery for invasive or in-situ, non-metastatic, uni- or multifocal breast cancer in any location in the breast, and had been listed under a code including the LRGF technique. As a specific code had not been defined for LRGF, the files registered with a non-specific related code from 2014 to 2019 were examined for the description of technique, and those operated with LRGF were selected. Only patients whose documents were complete, had a well-recorded follow up and had rated the cosmetic result at the 9-month interval of follow up were entered in the study.

The technique had been used for women who were planned to undergo oncoplastic BCS. Contraindications of the technique were the same as BCS overall and included previous radiation to the breast or the chest, multicentric disease, skin disorders like scleroderma or lupus erythematosus which preclude radiation, previous breast surgery for cancer, early pregnancy, diffuse or extended microcalcifications in mammography, multicentric tumor, and high (>30–40%) tumor to breast ratio, in addition to large central breast masses and large masses in the far zone of the upper inner quadrants (UIQ).

In addition to the breast operation, axillary surgery was performed as axillary dissection for patients with positive axillary nodes, and as sentinel node biopsy in women with clinically negative nodes in the pre-operative assessment. For the latter, localization of the sentinel node was done by the dual mode, comprising radionuclide and blue dye injection.

Radiotherapy was performed for every patient, and other treatments including neoadjuvant chemotherapy, adjuvant chemotherapy, anti-HER2 therapy, and hormone therapy were carried out as indicated based on tumor and patient characteristics.

All the procedures have been performed by an oncologic surgeon. After the immediate postoperative period, all patients were visited at 3- and 9-months intervals, whether under adjuvant treatment or not.

The oncologic results were evaluated regarding the result of histologic assessments, and the cosmetic outcome was rated by noting the surgeon opinion and asking patients a simple question: "On a scale from zero to 4, how do you rate the cosmetic result of your breast surgery?"

2.1. Definition of the surgical technique

In this technique, the incision site and length is planned based on the size and location of the tumor, and its distance from the areola, the inframammary fold, and the anterior axillary fold. For tumors in the near zone and many of those in the mid-zone, a periareolar incision; for lumps in the far zone and some in the mid zone in the upper inner quadrant (UIQ) and in the lower inner quadrant (LIQ) or lower outer quadrant (LOQ) in large breasts, an incision on the mass parallel to the areola; for masses in the mid to far zone in the upper outer quadrant (UOQ), an axillary incision; for tumors in the far lowest part of the breast, an incision on the inframammary fold; and for lesions in the mid zone of the lower pole (around 5 to 7 in a clockface pattern), a radial incision was used.

In this technique, we do not excise any skin, except when indicated due to skin retraction or involvement. When the incision is over the tumor, we first undermine the skin as close as possible in order to obtain the largest superficial margin. We then go round the tumor and perform the lumpectomy with a wide margin, which we consider to be grossly more than 1 cm when the breast boundaries allow. For cases where the incision is not over the tumor, we dissect bluntly under the skin leaving a thick flap, to reach the tumor. We then perform the lumpectomy with margins criteria as described above.

All the specimens are oriented by placing sutures on 5 directions according to the orientation of the tumor bed relative to the breast, and the tumor bed is marked with clips. Margins between 1 and 10 mm are considered as close, while margins less than 1 mm are considered positive and dictate further excision.

After ensuring perfect hemostasis, the second stage which consists of the oncoplastic procedure begins. The goal is to fill the 3-dimensional defect in the tumor bed by breast tissue from the same breast without large incisions or pedicled flaps. For this purpose, local glandular tissue near to the defect is used; thus, tissue is mobilized from the same quadrant for small masses in large breasts, and more frequently from one or two adjacent quadrants (Fig. 1). The volume of tissue displacement, the origin of harvest and number of mobilized tissue flaps is determined by the size of the cavity which has to be filled and the location of the defect.

First, the tissue flap is freed from under the skin, leaving a thick skin in all circumstances to circumvent later skin retraction (Fig. 1a). Then the flap is dissected sharply all around except for its deep base on the pectoralis fascia and its attachments with the more distal breast tissue; the latter is omitted if breast skin gets retracted over the distal portions after displacement of tissues, and only the deep base is saved. After being freed, the flap is placed in the defect and fixed to the cavity floor or the peripheral tissue with a few sutures (Fig. 1b). The displacement consists of advancement, rotation, or transposition of tissues. After complete hemostasis, the skin defect is closed with continuous subcuticular sutures, without dermal stitches. Drains are occasionally placed based on the surgeon's estimate.

The study is reported in accordance with STROCSS criteria [10].

The registry and the unique identifying number (UIN) of the study in Researchregistry is 6719.

3. Results

Overall, 25 patients which had been operated from November 2014 to October 2019 were entered in the study. The mean age of the patients was 52 years (27–81 years). Sixteen women (64%) were postmenopausal. The average size of the tumors was 24.7 mm (range 8–48).

All patients underwent sentinel lymph node biopsy (SLNB) with frozen section examination. Intra-operative histologic evaluation of the specimen was positive in 10 patients (40%), and axillary lymph node dissection (ALND) was performed for them. The histologic type, grade, size, axillary nodal status, stage, hormone receptor and HER2 status of all tumors are depicted in Table 1.

3.1. Oncologic surgery results

The margins of the resection were free in all specimens, except for one patient who had diffuse patchy areas of malignant transformation all around the margins, and underwent mastectomy later.

Eight patients had early or late complications. Seroma developed in three patients, these were managed conservatively without aspiration, and all resolved successfully. Mild cellulitis around the incision appeared in three, which responded to short-term oral antibiotic therapy. One patient developed fat necrosis in the tumor bed, which had a suspicious appearance and was confirmed by histologic exam. In one patient, infection and abscess in the lower pole of the breast, inferior to the operation site occurred 2 months after the surgery while she was under chemotherapy. It was treated by incision and drainage and antibiotic therapy.

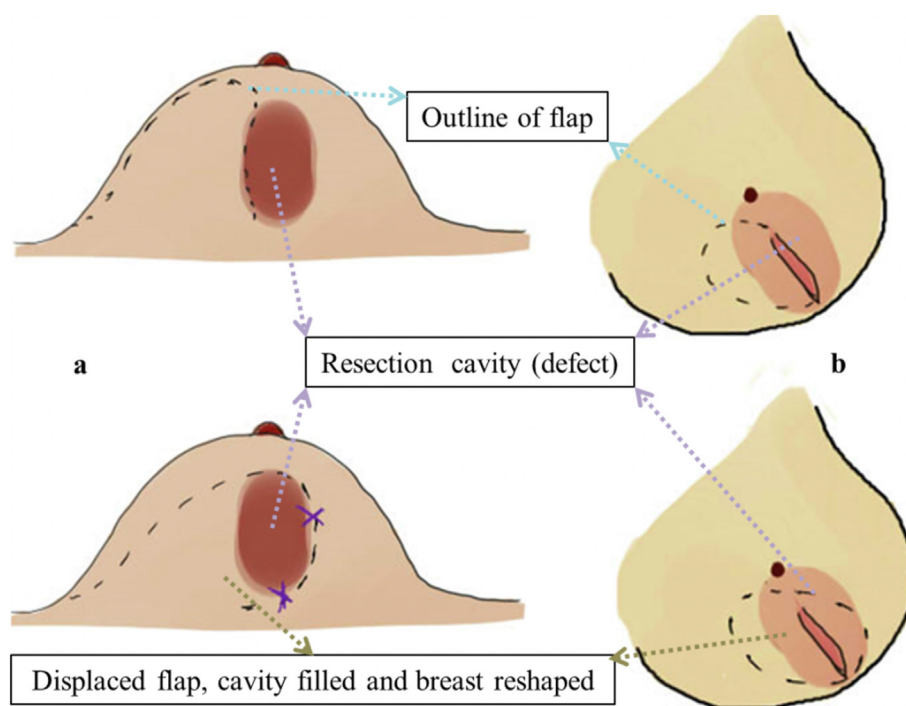


Fig. 1. Defect made by tumor resection in the breast, and displacement of glandular flap for filling it a) transverse cut, superior view b) anterior view.

Table 1
Histologic characteristics and TNM staging of all tumors.

Variables		Number (%)
Histologic type	Invasive ductal	22 (88%)
	DCIS	1 (4%)
	Medullary	1 (4%)
	Metaplastic	1 (4%)
Tumor size	Tis	1 (4%)
	T1	12 (48%)
	T2	12 (48%)
	T3	0
	T4	0
Axillary status	N0	15 (60%)
	N1	10 (40%)
Stage	0	1 (4%)
	1	10 (40%)
	2	13 (52%)
	3	1 (4%)
Grade	1	5 (20%)
	2	15 (60%)
	3	5 (20%)
Hormone receptors	+	21 (87.5%)
	–	4 (16%)
HER 2	+	1 (4%)
	–	23 (95.8%)

DCIS = ductal carcinoma in situ; HER2 = human epidermal growth factor receptor 2.

3.2. Esthetic procedure results and outcomes

In order to fill the lumpectomy defect, one and two local flaps were used in 20 and 5 patients, respectively. The volumes of each resected specimen, location of tumors and flap(s) are demonstrated in Table 2.

Cosmetic results were rated by the surgeon and the patients based on a Likert system of 0–4. Six patients (24%) rated the cosmetic result of their operated breast as 3, and 19 others (76%) rated it as 4. The surgeon's rating results consisted of 4 in 17 (68%), 3 in 4 (16%), 2 in 3 (12%, one of them due to fat necrosis), and 0 in one (4%, the patient with a delayed local abscess).

In regard to symmetry, all operated breasts were grossly symmetric with the contralateral one, although subtle asymmetries could be seen (Fig. 2), or previous asymmetry slightly worsened (Fig. 3). However, one patient whose outcome was symmetric got obese (around 10 kg increase in weight in a woman with a pre-operative normal BMI and a weight of 55 kg), and the opposite breast got much larger while the ipsilateral one did not enlarge due to radiation firmness. She is now losing weight by dieting and exercising and does not wish to undergo contralateral symmetrization.

4. Discussion

In this retrospective study which has been held on patients files operated between 2014 and 2019, 25 cases who had undergone oncoplastic BCS with the LRGF technique have been reviewed. The advantage of this technique includes using short-length incisions, avoiding skin resection, maintenance of breast shape, and evading contralateral symmetrization.

The cosmetic results of breast surgeries depend on patient's age, breast and tumor size, tumor location, need to re-excision in the tumor bed, and the type of breast surgery; the percentage of breast volume excision is the most important. Obtaining clear margins in breast surgery sometimes need resection of large volumes, and oncoplastic breast surgery (OBS) techniques have been developed to encompass the esthetic aspect in line with the oncologic aspects [11].

Two main types of OBS have been defined: volume displacement and volume replacement. Techniques in the first group recruit a local dermo-glandular flap from the adjacent breast tissue to replace the defect. They are not easily used in small breasts, but are associated with fewer complications and are thus an appropriate primary OBS technique. The second type transposes larger volumes of breast tissue from other anatomic areas near the breast to fill larger defects.

Most of these OBS methods excise a large part of breast skin, and although they produce very good cosmetic results, changes in the

Table 2

Volume of resection, tumor and flap site for all cases (in order of their surgery dates).

Case No	Largest diameter (mm) of each tumor	Tumor site	Volume of resection (mm)	Site of flap harvest
1	30	UP	115 × 90 × 65	UOQ
2	17	UIQ	100 × 80 × 30	UOQ
3	15	UOQ	100 × 80 × 40	LOQ
4	15	UIQ	80 × 60 × 30	LIQ
5	21	UP	80 × 60 × 40	UOQ
6	8 ^a	Central	90 × 65 × 30	LOQ
7	27	Central	55 × 55 × 45	UOQ
8	25	LP	80 × 70 × 40	LOQ
9	17	UOQ	85 × 65 × 35	LOQ
10	45	UP	100 × 75 × 50	UOQ
11	20	LIQ	100 × 85 × 35	LOQ
12	7	LP		UIQ
12	20	UOQ	140 × 115 × 35	LOQ
13	15			UIQ
13	25	UP	100 × 70 × 40	UOQ
14	40	LOQ	100 × 80 × 60	UOQ
15	15	UOQ	100 × 70 × 35	UIQ
16	15	LOQ	115 × 80 × 25	UOQ
17	12			
17	35	LIQ	110 × 100 × 20	UIQ
18	20	LOQ	110 × 65 × 45	LOQ
18	15			UOQ
19	1			
19	3			
19	15	UOQ	90 × 70 × 30	LOQ
20	35	LP	85 × 75 × 70	LOQ
21	12			LIQ
21	22	UOQ	55 × 50 × 17	LOQ
22	22	UIQ	75 × 60 × 4.5	UOQ
23	25	LOQ	45 × 45 × 40	UOQ
24	17	UIQ	75 × 65 × 33	UOQ
25	18			
25	6 ^a	LIQ	7 × 4.5 × 3	UIQ

^a Extensive microcalcifications in the mammography around the tumor.

shape of the breast usually impose symmetrization procedures of the contralateral breast.

Indeed, every OBS technique has its limitations. In techniques that use a periareolar approach, the scar is usually very suitable esthetically. However, sometimes large amounts of skin have to be resected and the nipple-areolar complex is displaced, which can lead to unacceptable deformity or mostly, asymmetry.

In 2016, Klinger et al. [12] presented a type of oncoplasty which used two circular incisions, one in the periareolar region and one eccentric or concentric incision placed so that the tumor could be extracted with sufficient margin between these two. Thereafter reshaping was completed via periareolar –three flaps. The major advantage of this technique is the superior cosmetic effect regarding the incision site; however it allows limited access to tumor locations far from the nipple, and also produces decreased fullness in the upper poles of the breast.

In 2017 the Lateral Oncoplastic Breast surgery was introduced by Singh et al. [13] for cancers in the lateral quadrants. The incision in this technique extends from the apex of the axilla on the anterior axillary line to the lateral part of the inframammary fold while the patient is in the lateral position. The tumor is excised by dissecting breast tissue in the superficial plane, and from the pectoralis muscle in the deep aspect, so that the specimen can be palpated manually and a reasonable margin can be excised. As the authors explain, reshaping in this technique is not needed and re-approximation of the tissue is enough. The researchers have used

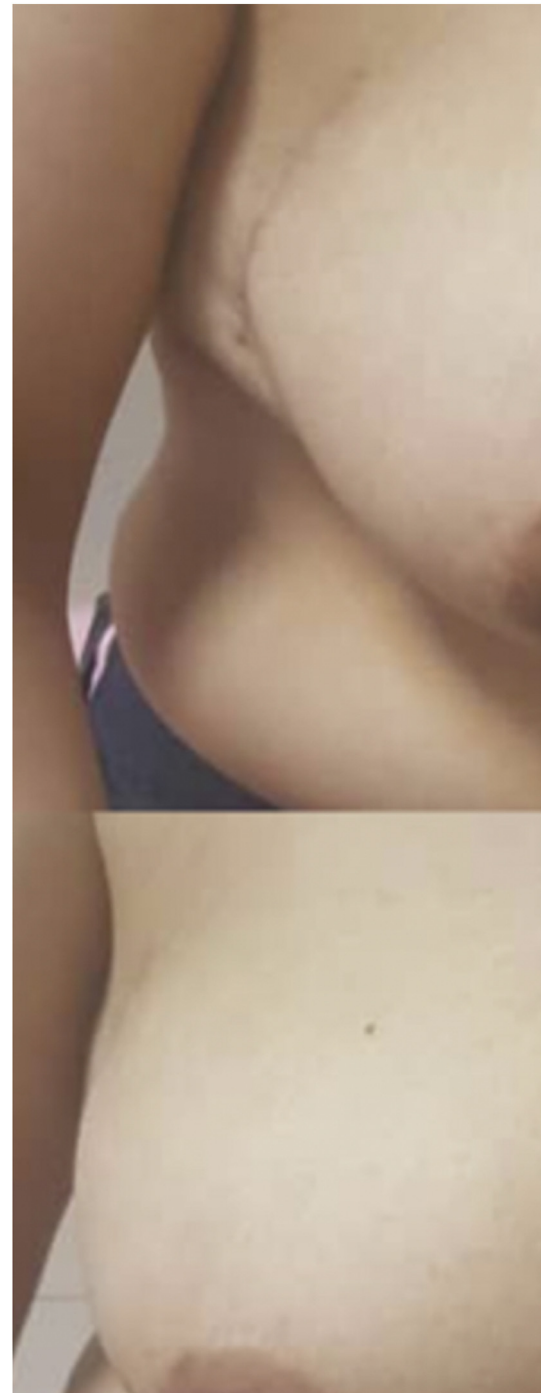


Fig. 2. Fifty-two years old patient with a 25 mm invasive ductal carcinoma in 8 o'clock, mid-zone of right breast; 6 months after surgery, chemotherapy and radiotherapy. A 45 × 45 × 40 mm resection was performed and a flap from the upper outer quadrant had filled the defect. (The patient has consented to have this photo published).

this technique for tumors that are far from the incision by cutting in the breast tissue perpendicular to the incision to access the tumor. In that circumstance, re-approximation of the two tissue flaps around the perpendicular incision closes the defect. Dislocation of the breast position is prevented by suturing back the lateral border of the pectoralis fascia to the muscle.

In a technique presented by Bordoni et al. [14] in 2019 which is carried out via a vertical or inverted-T Wise pattern approach, wide tumor resection is performed after undermining the skin over the

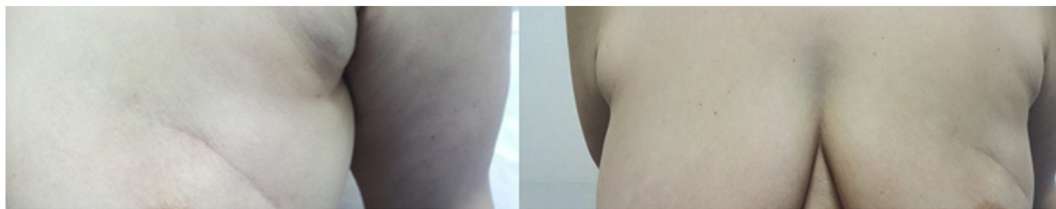


Fig. 3. Forty-six years old patient with a 30 mm invasive ductal carcinoma in upper part of left breast; 5 years after surgery, chemotherapy and radiotherapy. A flap from the upper outer quadrant was used to fill the defect. The left breast was smaller than the right one before surgery, the asymmetry was only slightly aggravated after surgery and a little more after radiotherapy (preoperative photos are not available. The patient has consented to have this photo published).

tumor However, skin undermining is continued in the inferior and medial quadrants, and the breast is separated from the skin. Reshaping is performed by upward rotation of an infero-lateral flap, which is fixed to another flap advanced from the axilla. In this technique, skin removal is always performed and contra-lateral symmetrization is consequently needed.

The cosmetic outcomes of the techniques of Singh and Bordoni are satisfactory, but they are limited by the location of the lumps, since they can only manage tumors in the lateral areas of the breasts.

The “extended glandular flap” technique has been reported by Ogawa et al. [15] from Japan in 2011. They used subclavicular flaps. The technique is used in small breast and has acceptable cosmetic results but is only practical for tumors in the upper parts of the breasts and causes partial deformities in the subclavicular areas.

In well-known oncoplastic techniques like batwing, inverted V-plasty, J-plasty and L-plasty, a larger amount of breast tissue can be resected while the nipple areolar complex stays centralized. However, these cannot be used in small breasts, produce large scars and frequently lead to asymmetric breasts.

In the technique introduced in this study, we first focus on oncologic principles for resection of the tumor. Then, considering esthetic directions, we reshape the breast by using one to two local breast glandular tissue flaps without mobilizing the skin. This can be used in almost any tumor location except for large central tumors or those in the very far zone of the upper inner quadrant. This procedure has interesting novel features both in the technical aspects and the practical cosmetic results. Regarding the technical aspects, the scar is minimal, no skin is removed, and the displaced flap is based on the vascularization it takes from the chest wall where it is still attached while being mobilized. For the results, the shape of the breast is largely conserved so that symmetrization of the contralateral breast is not necessary, and areolar re-centralization is not needed.

4.1. Limitations of the study

Because of defective coding in the files, we could not retrieve the records of all patients who had been operated by the LRGF technique, and the sample size is less than it could have been.

5. Conclusion

The LRGF technique of breast oncoplastic surgery can be effectively used for most breast tumors. It yields excellent oncologic outcomes, small scars, minimum nipple displacement, and subtle breast asymmetry.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964

Helsinki Declaration and its later amendments or comparable ethical standards.

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No funding was secured for this study.

Author contribution

Dr. Sadaf Alipour: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript. Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Zohreh Foroutan: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

Conflict of interest statement

The authors deny any conflict of interest in any terms or by any means during the study.

Guarantor

Sadaf Alipour.

Research registration number

- Name of the registry: Arash Women's Hospital, affiliated to Tehran University of Medical Sciences. Unique Identifying number or registration ID:
- Hyperlink to the registration (must be publicly accessible):

Consent

Not applicable.

Consent to participate

Every patient who is admitted in our hospital, including all the patients in this study, sign an informed consent regarding the possible use of their data for educational and research purposes at the time of admission. Therefore informed consent was obtained from all individual participants included in the study at the time of hospitalization.

Consent for publication

Every patient who is admitted in our hospital, including all the patients in this study, sign an informed consent regarding the possible publication of their anonymous data for educational and

research purposes. Therefore consent for publication was obtained from all individual participants included in the study at the time of hospitalization.

Availability of data and material

The anonymous data can be provided on request from the corresponding author.

Code availability

Not applicable.

Provenance and peer review

Not commissioned, externally peer-reviewed.

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Appendix A. Supplementary data

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