



Improving quality of breast conservative surgery for lower quadrants cancer in small and medium sized breasts: Crescent technique versus J mammoplasty

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Background: For medium/small size breast, breast conserving surgery (BCS) is usually associated to poor cosmetic results. The objective of the study is to evaluate oncological safety and cosmetic results comparing the “Crescent” and the “J” mammoplasty technique and to develop an algorithm for the treatment of breast cancer located in lower quadrants in medium/small breast.

Methods: We retrospectively analysed all consecutive patients who underwent a “J” mammoplasty or a “Crescent” technique at AUSL IRCCS Reggio Emilia between 2016 and 2021. Fifty-eight patients were enrolled, the first group including 29 “Crescent” technique procedures and the second one including 29 patients who underwent the “J” mammoplasty technique. Oncological safety and surgical minor and major complications were evaluated. Aesthetic results were evaluated by two senior breast surgeons, independently, at least 6 months after radiotherapy (RT).

Results: At follow-up of 36 months, no recurrences and no major complications were observed in both groups. Minor complications were observed in two (6.9%) “J” group cases and in six (20.7%) “Crescent” ones ($P < 0.05$). The 96.6% of “Crescent” and the 73.5% of “J” cases were judged excellent/good. One (3.4%) “Crescent” was judged fair versus six (20.7%) “J” mammoplasty. Two (6.9%) “J” cases were judged poor, requiring ipsilateral re-operation.

Conclusions: When a favourable ratio between tumor size and breast volume is present, BCS can be performed for tumors located in the lower quadrants. Evaluating patients’ anthropometric characteristics, skin involvement and tumor features is the key to select the right technique and to obtain both great cosmetic result and low rate of complications.

Keywords: Breast conservative surgery (BCS); oncoplastic; Crescent technique; J-mammoplasty technique; aesthetic outcome

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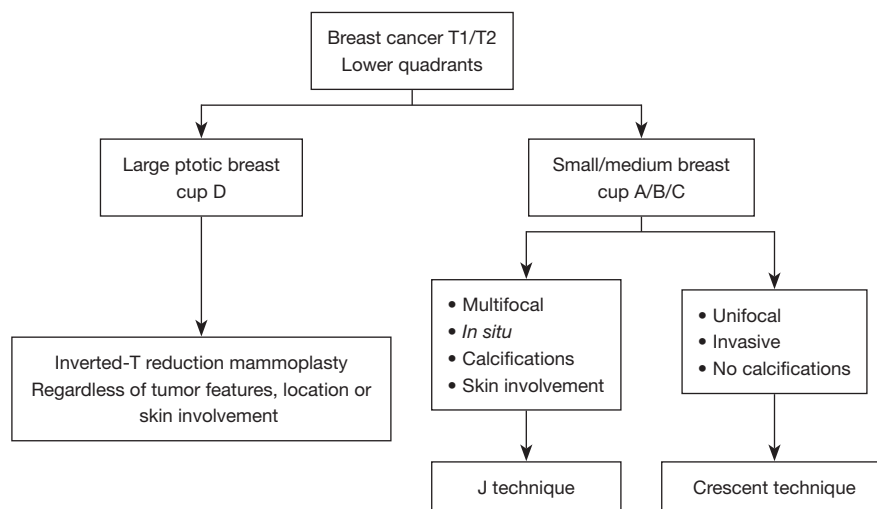


Figure 1 Simplified algorithm for decision making in lower quadrant conservative surgery.

Introduction

Breast conservative surgery (BCS) remains the gold standard in the management of early breast cancer (BC) (1). Several randomized trials have confirmed that BCS followed by radiotherapy (RT) allows equivalent survival rates when compared to mastectomy (2-4) with good cosmetic results. Cancer in the lower pole of the breast represents a major challenge for the surgeon in achieving a good aesthetic outcome. In large/medium size ptotic breasts, tumors can be easily resected with large safety margins with an inverted T superior pedicle reduction mammoplasty avoiding important cosmetic defects. In case of medium/small

size breasts, BCS is usually associated to poor aesthetic results, which are often worsened by post-operative RT (5-9). A correct previous planning, as shown in *Figure 1*, is mandatory to prevent deformities in medium/small size breasts also when less than 30% of glandular tissue must be removed. The purposes of this paper are the evaluation of both safety and cosmetic results in “Crescent” and “J” mammoplasty techniques and the development of an algorithm for the treatment of BC located in lower central quadrant (LQ), lower inner quadrant (LIQ) and lower outer quadrant (LOQ) in medium/small-sized breasts. We present this article in accordance with the STROBE reporting checklist (available at <https://gs.amegroups.com/article/view/10.21037/gs-24-74/rc>).

Highlight box

Key findings

- Both the Crescent and the J-mammoplasty technique provide oncological safety and good aesthetic outcome in breast cancer of the lower pole.

What is known and what is new?

- Conservative breast surgery of the lower pole is challenging in small/medium sized breasts.
- Two different surgical techniques which can be safely taken into account during the surgical decision process.

What is the implication, and what should change now?

- Evaluating patients’ anthropometric characteristics, skin involvement and tumor features is the key to select the right technique and to obtain both great cosmetic result and low rate of complications.

Methods

Study cohort and data sources

All consecutive patients who underwent a traditional “J” mammoplasty or a “Crescent” technique at AUSL IRCCS Reggio Emilia between July 2016 and December 2021 were analyzed for this retrospective study with a level IV of evidence. Given the retrospective nature of the study, the small sample of anonymous patients who did not have surgery that deviated from normal clinical practice, the ethical committee approval was not required as per AUSL IRCCS Reggio Emilia’s internal policy. Informed consent was obtained from all of the involved patients. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Data were collected from

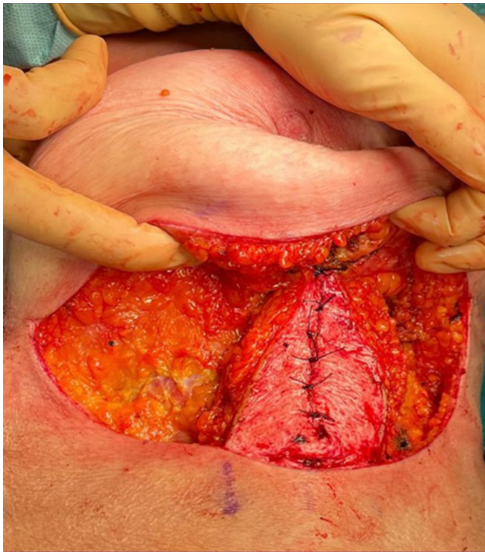


Figure 2 “Crescent” fasciocutaneous flap wrapping.

computerized patient’s records. The inclusion criteria for both techniques were: patients with early BC (T1) of LQ, LIQ and LOQ requiring a BCS. Feasibility for T2 BC were evaluated individually according to favourable tumor size/breast size ratio; small (cup A/B) or medium (cup C) -sized breast. The exclusion criteria for both techniques were: multicentricity and unfavourable tumor size/breast size ratio. The exclusion criteria for “Crescent” technique were: tumours located less than 0.5 cm from the skin, skin retraction, calcifications, in situ Tumor (Tis) and multifocality. In particular, tumour located less than 0.5 cm from the skin is an exclusion criterium because the technique involves sparing the skin of the lower quadrants to obtain a better cosmetic result. Moreover, in case of skin involvement, it is possible to use a patch of the skin with the Crescent technique, but the purpose of the technique we described in the paper is to avoid scars in the lower quadrants. Finally, Tis was excluded from the Crescent technique because of the pattern of ductal extension of Tis tumour, which can sometimes be bigger than expected. In order to avoid a second surgery for margin involvements, that could be not easy after the Crescent technique, we preferred to exclude Tis from the criteria. Fifty-eight patients were enrolled in the study and divided into two groups: 29 patients underwent the “Crescent” technique and 29 underwent the “J” mammoplasty technique. The study focused on oncological safety and surgical complications, which were divided into minor and major complications.

Minor complications included: wound infection which only required antibiotic therapy, marginal skin necrosis/partial nipple areola complex (NAC) necrosis managed without further surgery, fat necrosis, ecchymosis and seromas. Major complications involved: complete and partial NAC necrosis which required surgery, wound dehiscence and haematoma. Furthermore, aesthetic results were evaluated at least 6 months after RT. Cosmetic outcomes were assessed by two senior breast surgeons, independently, evaluating the following criteria: volume symmetry, breast shape, nipple-areola complex symmetry, scars and overall appearance of the breast and NAC (excellent, good, fair, poor, bad) as described by Clough *et al.* (10). In conclusion, we developed an algorithm to allow an effective pre-operative surgical strategy for the treatment of lower BC in medium/small-sized breasts.

Surgical technique

The Crescent technique described by Renouvel *et al.* (11) is characterized by a fasciocutaneous flap taken from the fatty area below the inframammary fold. The “Crescent” flap is designed by drawing the following two lines: the first one is situated 0.5 cm above the inframammary fold and the second one 1 cm below it, corresponding to the width of the flap. The skin and the subcutaneous tissue are incised along the upper line with electrocautery up to the pectoralis major muscle. Breast parenchyma is raised from the muscle following the pectoralis fascia to allow a wide resection of the tumor. Subsequently de-epithelialization of the skin area situated between the incision and the inferior line below the inframammary fold is performed. In order to realize the “Crescent” fasciocutaneous flap, the inferior line is incised laterally and medially to a central zone which is left attached to the thoracic wall. No preset flap thickness was used. After checking the flap volume and its perfusion, the two edges of the “Crescent” flap are stitched together and pulled up to fill the breast defect, as shown in *Figure 2*. In case of lateral or medial defect, a hemiflap can be easily raised through the incision of the inferior line only in the lateral or medial part of the attached area realizing the so called “Emicrescent” technique. The lower quadrants J mammoplasty technique is performed to resect tumors situated into inferior quadrants, with a predilection for those located in the LOQ. It allows the excision of a larger portion of breast parenchyma when compared to both “Crescent” and “Emicrescent” techniques. The tumor, the overlying skin and the adjacent glandular tissue are removed thanks to a wide incision shaped like a “J” starting

from the NAC and descending down to the inframammary fold inward or outward depending on the tumor location. The NAC is subsequently recentralized through the de-epithelialization of an upper outer/inner periareolar skin crescent directly opposite from the initial tumor position. This technique leaves a “J” scar formed by the radial, inframammary and periareolar incisions.

Statistical analysis

Quantitative variables were analyzed using the Student’s *t*-test to detect differences between the two groups. Categorical variables were analyzed using the Chi-squared test and the Fisher’s exact test. A *P* value of 0.05 or less was considered statistically significant. All the analyses were performed using SPSS 22 software package (SPSS, Inc., Chicago, IL, USA).

Results

Median age was 52 years (range, 31–75 years) in the “Crescent” technique group and 58 years (range, 40–87 years) in the “J” mammoplasty group. A higher body mass index was found in the “J” technique group than in the “Crescent” one (26.5 *vs.* 25.2 kg/m²), without a significant statistical difference. No differences were found between the two groups also regarding age, tobacco and common comorbidities as hypertension and diabetes. Crescent technique was used for 13 lesions located in the LQ, 8 located in the LOQ and 8 in the LIQ. Moreover, in the “Crescent” technique group, BCS was required for radial scar in 1 case, for infiltrative ductal carcinoma in 25 cases and for infiltrative lobular carcinoma in 3 cases; *in situ* ductal carcinoma was found associated to infiltrative carcinoma in 17 cases. The “J” mammoplasty group consisted of 29 patients, 9 lesions were located in the LQ, 15 in the LOQ and 5 in the LIQ. Six *in situ* ductal carcinoma, 18 infiltrative ductal carcinoma, 3 infiltrative lobular carcinoma and 2 atypical ductal hyperplasia underwent “J” BCS technique. No significant statistical differences in terms of histological and biological features were observed between the two groups, as summarized in *Table 1*. Despite a larger surgical specimen in the “J” technique group (17.10±10.7 mm) compared to the “Crescent” one (13.48±8.3 mm), no statistically meaningful differences were detected between the two groups (*P*=0.14). A statistical significant difference was found in the histological size of the lesions (*P*=0.003), which was higher in the “J” group (15.52±10.1 mm)

compared to “Crescent” one (13.00±5.1 mm) and in the volume of tissue removed (*P*=0.046) which was higher in the “J” technique group (132.04±97 cm³) compared to the “Crescent” one (63.86±57 cm³). No recurrences were observed during a mean follow-up of 36 months. Complications: one patient who underwent BCS with the “J” technique (3.4%) developed a marginal skin necrosis, which did not require surgery. No skin necrosis was observed in the “Crescent” technique group. Six lumpectomies (20.7%) in the “Crescent” technique group and only one (3.4%) in the “J” mammoplasty one developed seroma, showing the only complication-related significant statistical difference (*P*=0.048) between the two groups. Cosmetic outcomes: cosmetic outcomes were evaluated 6 months after adjuvant RT, independently by two senior plastic surgeons. Clough *et al.* (10) designed a cosmetic sequelae classification to assist the breast surgeon in analysing aesthetic outcomes. A five-point scale is used to rate cosmetic outcome, focusing on the breast form, the NAC position and the action required to correct the defect, as showed in *Table 2*.

All breasts were available for evaluation. Ninety-six-point-six percent of the “Crescent” technique cases and 73.5% of the “J” mammoplasty technique cases were judged excellent/good. Interestingly, only 1 (3.4%) “Crescent” techniques was judged fair due to a minimal retraction of inframammary fold not requiring contralateral symmetrisation; whereas 6 (20.7%) of the patients who underwent “J” mammoplasty technique were judged fair due to volume asymmetry and deviation of NAC requiring an ideal ipsilateral re-operation mainly with lipofilling. Two (6.9%) “J” techniques cases were judged poor in the overall appearance of the breast because of NAC deformation and deviation requiring ipsilateral re-operation.

Discussion

Patients with favourable ratio between tumor size and breast volume undergo BCS. Observational data suggest that BCS might even confer a survival advantage, maintaining oncologic safety and resulting in fewer surgeries and complications, with improved survivorship (satisfaction, function, and health-related quality of life) over mastectomy (12). The choice of the technique depends exclusively on the breast surgeon experience as if no guidelines have been developed to optimize oncological and cosmetic results. In women with large and/or ptotic breast an inverted T reduction mammoplasty allows both good aesthetic result and oncological safety and represents

Table 1 Patient and tumor features

Patient demographics and pre-operative parameters	Total	J technique	Crescent technique	P value
Age (years)	60 [31–87]	58 [40–87]	52 [31–75]	0.24
BMI (kg/m ²)	25.9 [17.2–45]	26.5 [23.6–29.0]	25.2 [23.3–28.9]	0.43
Hypertension	24 (41.4)	13 (54.2)	11 (45.8)	0.59
Smoking	12 (20.7)	7 (58.3)	5 (41.7)	0.51
Diabetes	3 (5.2)	1 (33.3)	2 (66.7)	0.55
Neo-adjuvant chemotherapy	2 (3.4)	1 (50.0)	1 (50.0)	>0.99
Tumor histology				0.16
IDC	18 (31.0)	8 (44.4)	10 (55.6)	
IDC + DCIS	24 (41.4)	10 (41.7)	14 (58.3)	
DCIS	6 (10.3)	6 (100.0)	0	
ILC + LCIS	6 (10.3)	3 (50.0)	3 (50.0)	
Other	1 (1.7)	0	1 (100.0)	
ADH	2 (3.4)	2 (100.0)	0	
RS	1 (1.7)	0	1 (100.0)	
Tumor location				0.053
LQ	22 (37.9)	9 (40.9)	13 (59.1)	
LIQ	13 (22.4)	5 (38.5)	8 (61.5)	
LOQ	23 (39.7)	15 (65.2)	8 (34.8)	
Tumor subtype				–
Luminal-A	31 (53.4)	17 (58.6)	14 (48.3)	
Luminal-B	9 (15.5)	4 (13.8)	5 (17.2)	
Luminal-B, HER2 ⁺	10 (17.2)	3 (10.3)	7 (24.1)	
HER2 ⁺	4 (6.9)	4 (13.8)	0	
Triple negative	4 (6.9)	1 (3.4)	3 (10.3)	
Radiological size (mm)	15.29 [3–50]	17.10±10.7	13.48±8.3	0.14
Histological size (mm)	14.26 [4–50]	15.52±10.1	13.00±5.1	0.003
Specimen volume (cm ³)	97.9 [15–504]	132.04±97	63.86±57	0.046

Data are expressed as median [range], mean ± standard deviation or n (%). BMI, body mass index; IDC, invasive ductal carcinoma; DCIS, in situ ductal carcinoma; ILC, invasive lobular carcinoma; LCIS, in situ lobular carcinoma; ADH, atypical ductal hyperplasia; RS, radial scar; LQ, lower central quadrant; LIQ, lower inner quadrant; LOQ, lower outer quadrant.

the best possible choice. In women with medium/small-sized breasts oncoplastic techniques give the chance to offer BCS. When the BC is located in the inferior quadrants the aesthetical outcome can be challenging for the surgeon. There are several volume displacement techniques which could be used, still with no international approved

guidelines. Usually, when the defect is around 30% of the breast volume, pedicled perforator flaps should be the first choice (13). Indeed, chest wall perforator flaps, especially the lateral intercostal artery perforator (LICAP) for BC in the outer quadrants and the anterior intercostal artery perforator (AICAP) flaps for BC in the lower quadrants, are

Table 2 Five-point scale used to rate cosmetic outcome

Scores	Overall aesthetic results	Breast forms	NAC positions	Action required
5	Excellent	No detectable asymmetry	Perfect position	No further action
4	Good	Perfect breast form with minimal asymmetry	Good position	No further action
3	Fair	Minimal retraction in the operated quadrant/asymmetry of volume	Minimal deviation of NAC toward the operated quadrant	ASCT type 1 requiring contralateral symmetrization
2	Poor	Deformation of operated breast	Deviation of NAC	ASCT type 2 requiring ipsilateral reoperation
1	Bad	Major deformation of operated breast	Distortion of NAC	ASCT type 3 mastectomy

NAC, nipple-areola-complex; ASCT, aesthetic sequelae of conservative treatment.

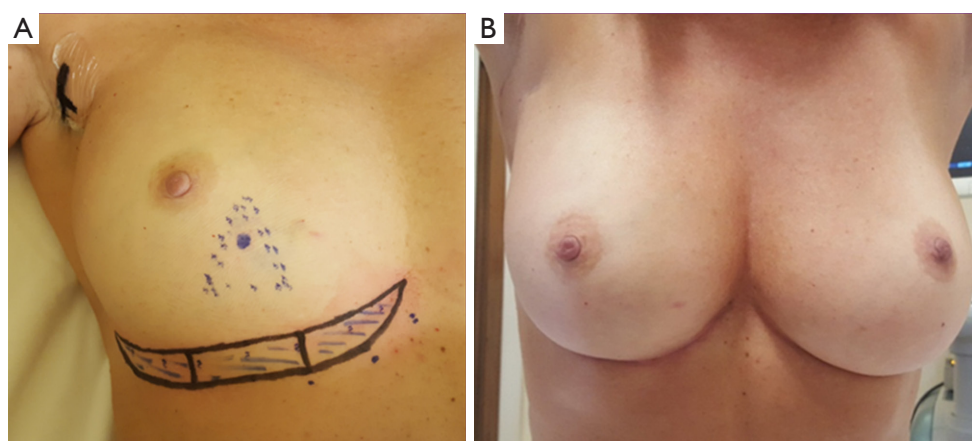


Figure 3 9-mm ductal invasive cancer located in the lower-inner quadrant of the right breast in a 58-year-old patient who underwent BCS with Crescent technique. (A) Pre-operative picture; (B) 90 days post-operative picture. BCS, breast conserving surgery.

gaining wider popularity since they permit larger volume resections and good aesthetical outcomes (14). On the other hand, the main limitation in using a perforator flap is the difficult pedicle dissection, with a potentially increased surgical timing and complication rate. Therefore, we decided to focus our attention on the “Crescent” and the “J” technique because they both represent good options the surgeon could rely on when performing BCS of small BC (<30%) of the lower quadrants. In our series, we evaluated 58 consecutive patients who underwent a “Crescent” or a “J” technique for tumors located in lower quadrants in small/medium breasts. No differences in oncological safety were found; indeed, no recurrences were identified in both groups at a mean follow-up of 36 months. However, we observed a statistically significant difference in the volume of breast tissue removed and histological size of the lesions

which were both higher in the “J” technique compared with the “Crescent” technique. Despite the higher volume of breast tissue excised with the “J” mammoplasty, an increased complication rate has been found for the “Crescent” technique mainly due to seroma formation following fat necrosis. These results are slightly higher than those shown by Aljarrah *et al.* (15) (6/54, 11% *vs.* 6/28, 21.4%), probably related to the ultrasound examination to which all our patients were subjected and not only those clinically evaluable. Aesthetic results, in particular concerning the “Crescent” technique, are better compared with those observed in literature by Aljarrah (96.6% of the procedures were judged excellent/good *vs.* 73.5%), as shown in *Figures 3,4*. We believe that our results depend on different factors. First of all, an accurate selection of the patients is mandatory to obtain excellent results. We

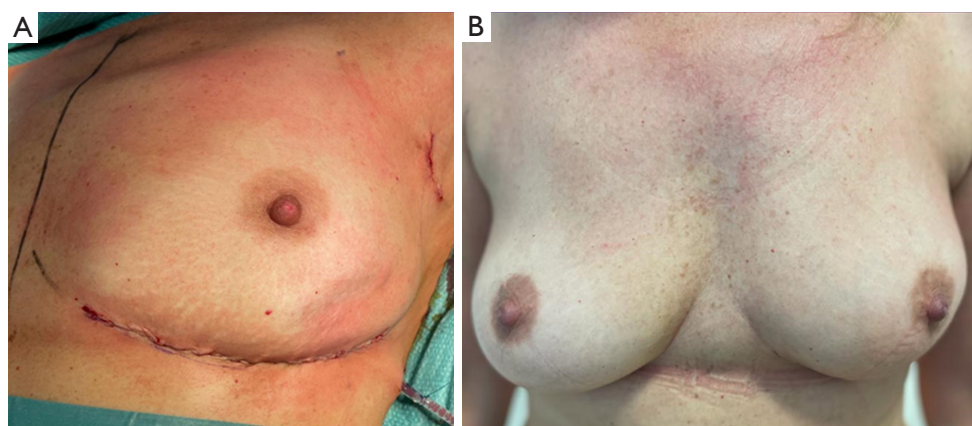


Figure 4 15-mm ductal invasive cancer located in the lower-outer quadrant of the left breast in a 60-year-old patient who underwent BCS with Crescent technique. (A) Pre-operative picture; (B) 100 days post-radiotherapy picture. BCS, breast conserving surgery.

also consider antibiotic therapy a crucial factor to avoid infection that can cause breast deformity. Moreover, placing the patient in a sitting position at the end of the surgical procedure can strongly improve the aesthetic final result, as it shows defects not detectable with the patients lying down, allowing an easy repair of the defect by modifying the way in which the fasciocutaneous flap is stitched in the cavity.

Conclusions

We offer conservative surgery in all patients affected by BC located in the LIQ, LQ and LOQ when a favourable ratio between tumor size and breast volume are present. We suggest to assess patients' anthropometric characteristics (breast volume, cup A, B, C), tumor location (LOQ, LQ, LIQ), skin involvement and tumor features (calcifications/mass, *in situ*/invasive, lobular/ductal) as shown in *Figure 1* when choosing the most suitable surgical technique. Large and ptotic breast (cup D) can be easily treated with an inverted T reduction mammoplasty regardless of tumor features and skin involvement. Small (cup A), medium size (cup B, C), without ptosis or with moderate ptosis must be served by crescent or J techniques.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://gs.amegroups.com/article/view/10.21037/gS-24-74/rc>

Data Sharing Statement: Available at <https://gs.amegroups.com/article/view/10.21037/gS-24-74/dss>

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://gs.amegroups.com/article/view/10.21037/gS-24-74/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Given the retrospective nature of the study, the small sample of anonymous patients who did not have surgery that deviated from normal clinical practice, the Ethical Committee approval was not required as per AUSL IRCCS Reggio Emilia's internal policy. Informed consent was obtained from all the involved patients. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

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