Surgical Reconstruction following Wide Local Excision of Malignant Melanoma of the Scalp

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INTRODUCTION

The standard surgery treatment for primary cutaneous melanoma has, as an oncological objective, to prevent local recurrence. Current guidelines suggest excision with wide margins down to the underlying deep fascia that can be included or not.1 In the head and neck district, excision with wide margins generally require planning a reconstructive procedure to avoid a poor functional and/or aesthetic outcome; therefore, size and composition of the tissue resected must be considered. In particular for the scalp, a unique tissue lacking a proper donor site, preservation of patient’s hairlines, a high-tension-free wound closure, and a careful use of the electrocautery to avoid damage to the follicles are the basis for achieving an aesthetically acceptable result. Scalp localization is associated with Breslow thickness, independent of histopathological subtype,2 and worse prognosis compared with other localizations.3 Although the pathophysiology of this difference remains unclear, frequent amelanotic and nodular subtypes, especially in elderly bald male patients, lead to the consideration that chronic solar damage has an important role in their onset. Moreover, regional lymphatic and vascular anatomy and difficulty in self-examination4,5 could contribute to the rapid growth and progression of the disease.6 Because of its aggressive malignancy, researchers tend to consider scalp localization as a distinct subcategory of melanomas, such as acral lentiginous and mucosal melanoma, requiring special clinical consideration.7 The higher frequency of locally advanced conditions (ie, satellite metastases) that require wider excisions (including the possibility to remove the pericranium)8 and the high propensity for locoregional localizations, particularly in those patients with stage III disease, make reconstructive procedures particularly complex. A surgical algorithm for general scalp reconstruction is present in the literature9,10; however, as far as we know, a specific guide for reconstructive

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surgery in case of wide excision for scalp melanoma does not exist. A planned resection area is at the basis of reconstruction algorithm; however, the histopathology of the tumor should be taken into account. Compared to nonmelanoma skin cancers, in fact, radiotherapy is usually not included in the therapeutic process of the primary tumor.11 This review aims to analyze the reconstructive techniques present in the literature to establish if a specific surgical algorithm for the management of the melanoma of the scalp may be deduced.

METHODS

Search Criteria

A thorough literature search was conducted in April 2020 across the following databases: PubMed MEDLINE, Scopus, and Cochrane Library. No date limits were set. The search terms used were “scalp reconstruction AND melanoma.” These broad search terms together with related articles of the resulting primary search were used to identify all citations reporting reconstructive strategies for scalp defects after scalp melanoma excision. Results were analyzed, and double references were excluded. Two different authors independently examined the titles and abstracts of citations and generated a list of articles for review. Additional articles were included by reviewing the reference list of the relevant abstract. This study was conducted according to PRISMA guidelines for systematic reviews.

Selection Criteria

Inclusion and exclusion criteria were defined before searching to avoid selection bias.

Inclusion Criteria

• Adult human subject;
• English language;
• Diagnosis of melanoma of the scalp region;
• Size of the scalp defect in cm² (including if expressed on average) and reference to the anatomical depth of the defect;
• Studies that include different diagnoses for which it is possible to attribute a surgical reconstructive strategy (eg, a case series of a different diagnosis but with the same reconstructive strategy) and a relative outcome to melanoma patients.

Exclusion Criteria

• Studies that include different diagnoses for which it is not possible to attribute a surgical reconstructive strategy to melanoma patients.

RESULTS

A total of 121 citations from PubMed, 551 from Scopus, and 5 citations from Cochrane Library were initially identified. After a title and abstract review, analyzed by 2 different reviewers, 48 records were considered relevant. Full-text examination excluded further 31 articles. Seventeen articles of the initial research, published from

Fig. 1. PRISMA guidelines.
| Reference                  | Year | Type               | Patient Selection                                                                 | Sample (Patients) | Surgery                                                                 | Surface Area | Follow-up, Outcome and Complications                                                                 |
|----------------------------|------|--------------------|----------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------|
| Ni et al12                 | 2020 | Case series        | 16 craniofacial malignant tumors                                                  | 4 melanomas       | WLE: Periosteum and 1–2 mm of skull external lamina were removed. Rapid pathological examination to determine whether cutting edge and tumor base were tumor-negative. Reconstruction: Pedicled flap (scalp-fascia-vascular) with parietal branch of STA + skin graft donor site | 6.25–80 cm²  | From 6 mo to 3 y. All the flaps survived well. Venous congestion occurred in 1 case of fascia-vascular pedicle STA parietal branch flap. No recurrence of tumors was observed, and the appearance of flaps was satisfying, but flap donor sites suffered from a relatively poor appearance or alopecia deformity. |
| Altınkaya et al13          | 2018 | Retrospective case series | All patients with extensive scalp defects that were reconstructed with free anterolateral thigh flaps from November 2007 to April 2015. Age ranged from 23 to 65 y (mean age 44 y); 6 men and 5 women | 4 melanomas of the scalp | WLE: Extremely large or near-total scalp defects including the periosteum. Reconstruction: Anterolateral thigh flaps for scalp reconstruction with primary closure of the donor site. The sizes of the flaps were 10–54 cm in length and 7–17 cm in width. Anastomoses: superior thyroid artery and a branch of the internal jugular vein (2 patients); superficial temporal vessels (1 patient); facial vessels (1 patient) | 65–276 cm²   | The mean follow-up was 36 mo. No complications                                                        |
| Komorowska-Timek et al14   | 2004 | Case series        | Patients (n = 7) undergone a scalp reconstruction between October 2000 and June 2003, with the use of artificial dermis (Integra Template, Johnson & Johnson Wound Management, Somerville, N.J.) | 4 melanomas of the scalp | WLE: Tumor removal and wound debridement. If the pericranium was absent, the outer table of the calvaria was burred down to bleeding bone (2 patients had pericranium, left; 1 patient had bone, left; 1 patient had galea, left) Reconstruction: Application of the skin substitute. The average length of hospital stay was 6–150 cm² (97 ± 58 cm). | 6–150 cm²    | Mean follow-up of 14 ± 13 mo (range, 2–29 mo)                                                      |

(Continued)
Wilensky et al\textsuperscript{15} 2005 Case series Series of 24 elderly patients with full-thickness defects of the scalp, resulting in exposed cranium 13 melanomas of the scalp (primary or recurrences) Average age: 71 ± 16.8 y WLE: Radical (full-thickness) resection of the scalp tumor with adequate margins resulting in exposed pericranium All patients had clear surgical margins before skin grafting Reconstruction: The bovine collagen was fenestrated using the Integra mesher before use After 30 d, patients were returned to the operating room for split-thickness skin grafting under monitored anesthesia supplemented by a local anesthetic infiltrated into the scalp. This procedure was performed on an outpatient basis Average time to skin grafting: 27.7 ± 18.1 d Follow-up not indicated. 3 patients required at least 1 additional replacement of their bovine collagen construct related to persistent exposed skull from microabscesses beneath the construct. All healed (infection prolonged healing >6 wk).

Frodel et al\textsuperscript{16} 2004 Retrospective series 4 patients with scalp defect 1 melanoma of the scalp, 32-year-old woman WLE: Resection with 2-cm margins was performed, including periosteum Reconstruction: 3-flap Orticochea-type 56 cm\textsuperscript{2} (7 × 8 cm\textsuperscript{2}) No complication Follow-up: 18 mo

Beasley et al\textsuperscript{17} 2004 Case series 26 consecutive patients undergoing free tissue transfers for large scalp and forehead defects between July 1, 1992, and June 30, 2001 19 men, 7 women; median age: 69 y (range 31–85 y) A 69-year-old man presented with small recurrences of a previously resected scalp melanoma WLE: A wide area of scalp was resected with the superficial lobe of the parotid and the upper neck dissected (levels I, II, and III). Bone exposure Reconstruction: A free latissimus dorsi muscle-only flap was used to repair the defect A split-thickness skin graft taken from the anterolateral thigh was then used to cover the muscle The defect was estimated at 300 cm\textsuperscript{2} preoperatively He had a satisfactory cosmetic result 6 mo postoperatively, but died of distant metastases 12 mo postoperatively

Table 1. (Continued)
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| Reference | Year | Type | Patient Selection | Sample (patients) | Surgery | Surface Area | Follow-up, Outcome and Complications |
|-----------|------|------|-------------------|-------------------|---------|--------------|--------------------------------------|
| Lipa et al<sup>10</sup> | 2004 | Case series | All free latissimus dorsi muscle flap reconstructions of the scalp performed by the same surgeon over a 2-y period (June 1999–July 2001) | 1 melanoma of the scalp | WLE: Calvarial bone excision and reconstruction was required | 81 cm² | Donor site seroma, Died 18 mo postoperatively. Local recurrence (brain) and metastasis (lungs and bone) |
| Koenen et al<sup>19</sup> | 2008 | Case series | 78-year-old man, melanoma patient | WLE: Complete local resection of the tumor under local anesthesia and histologic examination of the cut edges for tumor cells. The exposed bone was then treated with a high-speed drill to partially remove the outer table of the skull until petechial bleedings from the diploic space occurred on the whole wound bed | 67 cm² | Follow-up: 6 mo. |
| Souza<sup>20</sup> | 2012 | Case series | 1 retroauricular melanoma, Stage III | WLE: Preservation of the pericranium. Partial skin graft | 61.6 cm² (8.8 × 7 cm²) | Follow-up: not clearly described. Alive without disease. No complications. |
| Richardson et al<sup>21</sup> | 2016 | Case series | 10 patients underwent reconstruction of large scalp defects using the application of the Integra bilayer wound matrix followed by delayed split-thickness skin grafting from January 1, 2008 to December 31, 2014 | 2 melanoma patients: (1) 60-year-old man (2) 83-year-old man | WLE: Frozen sections for margin control or the Mohs micrographic technique. Full-thickness scalp resection, including peristomeum overlying the outer table of the skull | Defect size: (1) 63 cm² (2) 28 cm² | Follow-up: (1) 570 d (2) 95 d |
| | | | | | | No complications. | |
| | | | | | | Percent skin graft take (1) 100% (2) 95–100% | |
| | | | | | | Patient 1 did not show any breakdown of the graft after IMRT and tolerated the treatment without any major toxic effects | |
Table 1. (Continued)

| Reference          | Year | Type       | Patient Selection                          | Sample (patients)                       | Surgery                                                                 | Surface Area | Follow-up, Outcome and Complications |
|--------------------|------|------------|--------------------------------------------|----------------------------------------|------------------------------------------------------------------------|--------------|--------------------------------------|
| Vithlani et al²²    | 2017 | Case report| 87-year-old man (poor general conditions)  | Melanoma of the left postauricular region | WLE: The extent and required margins meant that the lesions became confluent, and the calvaria was burrned to the bleeding bone | 96.7 cm²     | Follow-up: 14 mo                      |
|                    |      |            |                                            |                                        | Reconstruction: Integra without subsequent epidermal autografting because of an unforeseen deterioration in the patient's condition, and the wound reepithelialized over a period of 6 mo |             | Acceptable aesthetic and functional outcome |
|                    |      |            |                                            |                                        |                                                                         |              | Localized infection resolved with minimum debridement 1 wk postoperatively |
| Kwee et al²³        | 2012 | Case report| 83-year-old man                            | Soft tissue deficit and osteomyelitis of the calvaria of the entire scalp result of wide local excision, local transposition flap, and skin grafting for a desmoplastic melanoma on the midscalp, followed by adjuvant radiotherapy | WLE: Excision of all the involved scalp skin and subcutis and full thickness excision of the osteoradionecrotic bone. Reconstruction: Calvarial reconstruction with titanium mesh and coverage achieved with polymethylmethacrylate impregnated with tobramycin. Soft tissue reconstruction with bilateral ALT flaps, the left measuring 17 × 38 cm² and the right 12 × 25 cm². Recipient vessels: the superficial temporal vessels bilaterally, with a single artery and vein used on each side, and a vein between the 2 flaps (in the midline) was anastomosed, linking the vasculature of the entire reconstructed scalp. Both ALT donor sites were skin grafted | 743 cm²      | Follow-up not indicated (discharged 3 wk after surgery) |
| Dang et al²⁴        | 2000 | Case report| 73-year-old man                            | Excision of SSM (0.9 mm Breslow, stage I, Level III) of the vertex | WLE: Round wide and deep excision to the galea Reconstruction: Local flaps variation of Y plasty stellate-shaped closure | Diameter: 3 cm Area: 7.07 cm² | Follow-up: 2 wk |
|                    |      |            |                                            |                                        |                                                                         |              | No complications                      |
Table 1. (Continued)

| Reference          | Year | Type      | Patient Selection                               | Sample (patients) | Surgery                                                                 | Surface Area       | Follow-up, Outcome and Complications                                                                 |
|--------------------|------|-----------|-------------------------------------------------|-------------------|-------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|
| Badhey et al²⁵     | 2016 | Case report | 61-year-old man | Melanoma with depth of invasion of at least 0.9 mm, and mitotic index of 1 (preliminary tumor stage of at least T1b; PET/CT was positive only for uptake at the primary site) | WLE: Wide local excision of the primary lesion down to the calvaria along with a sentinel lymph node biopsy Reconstruction: Orticochea flap with required galeotomies and extensive back-cuts | Cutaneous scalp defect down to the calvaria: 100 cm² | During the postoperative follow-up period, the patient did well without any evidence of complication, including wound breakdown, recurrence, or flap necrosis |
| García del Campo et al²⁶ | 2008 | Case report | 82-year-old man | Ulcerated polypoid nodular frontoparietal melanoma (Level III Clark, Breslow:12 mm) that immediately recurred with satellitosis, 20 d after primary excision | WLE: Radical resection including the pericranium (under general anesthesia) Reconstruction: A local transverse posterior transpositioning scalp flap with preservation of the pericranium in the region of the flap was used to repair the defect Following repositioning of the flap, a free partial thickness skin graft from the right thigh was used to cover the donor zone 1.5 mo after the operation, a flap scar plasty was performed, removing the “dog ear” left after surgery | 102 cm² (12 × 8.5 cm²) | The aesthetic outcome was satisfactory. Follow-up: 5 yr after the last oncological operation (no evidence of local or regional disease recurrence is observed) |
| Varnalidis et al²⁷ | 2019 | Case report | 74-year-old man | Stage IIIA nodular melanoma | WLE: Subperiosteal scalp melanoma resection (full-thickness scalp resection to the level of calvaria) Reconstruction: Pinwheel flap, 4-L shaped (a rotational flap can be considered as a variation of the rhomboid or Limberg flap) | 59.16 cm² (6.8 × 8.7 cm²) Oral defect | Follow-up: 1 y The recovery was uneventful. Excellent cosmetic results with minimal scarring |
| Halpern et al²⁸     | 2009 | Case report | 63-year-old woman | Melanoma in situ | WLE: Excision extending to bone. Reconstruction: Placement of bilateral galeal hinge flaps followed by full-thickness skin grafts (A distal area of the galea is incised, and a partial-thickness layer of galea is dissected off of its base and transposed into a position to cover the exposed periosteum of an adjacent defect) | 29.7 cm² (5.5 × 5.4 cm²) | Follow-up: not described. 100% graft survival. No complications |

IMRT, intensity-modulated radiotherapy.
8

2000 to 2020, fulfilled the inclusion criteria and were included in the systematic review (Fig. 1).

All the 17 selected studies (Table 1) involved a retrospective analysis: 10 were case series and 7 were case reports. In particular, among case series, only patients who met the inclusion criteria were considered and included in our review.

A total of 39 patients were included in the studies on scalp defect reconstruction after wide local excision of melanoma with different surgical techniques. The sample

| Depth of the Defect                           | Width of the Defect                           | Reconstruction                                                                 | Complications                                      |
|-----------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------|
| Epicranial tissues or perioristum preserved   | 7.07 cm² (round shaped, 3 cm diameter)         | n = 1 Local flaps variation of Y plasty (stellate-shaped closure)               | No complications                                   |
|                                               | 9.9–93.5 cm² (51.7 ± 41.8)                    | n = 13 Fenestrated bovine collagen + split-thickness skin graft (2 stages)     | Infection (prolonged healing)                      |
|                                               | 61.6 cm² (8.8 × 7)                            | n = 1 Partial retroauricular skin graft                                        | No complications                                   |
|                                               | 6–150 cm² (97 ± 58)                           | n = 3 Skin substitute + split-thickness skin graft (2 stages)                  | No complications                                   |
|                                               | 6.25–80 cm²                                   | n = 4 Pedicled flap with parietal branch of STA + skin graft donor site         | No complications                                   |
|                                               | 29.7 cm² (5.5 × 5.4)                          | n = 1 Bilateral galeal hinge flaps + full-thickness skin grafts                | Venous congestion                                  |
|                                               | 1.63 cm²                                      | n = 2 Dermal regeneration template + split-thickness skin graft (2 stages)     | <5% skin graft loss                                |
|                                               | 56 cm² (7 × 8)                                | n = 1 3-flap Orticochea-type                                                   | No complications                                   |
|                                               | 59.16 cm² (6.8 × 8.7)                         | n = 1 Pinwheel flap, 4L shaped                                                 | No complications                                   |
|                                               | 67 cm²                                        | n = 1 Drilling of the exposed bone + dermal regeneration template + ultrathin skin graft (2 stages) | No complications                                   |
|                                               | 96.7 cm²                                      | n = 1 Integra without subsequent skin autografting                            | No complications                                   |
|                                               | 100 cm²                                       | n = 1 Orticochea flap with required galeotomies and extensive back-cuts        | No complications                                   |
|                                               | 102 cm² (12 × 8.5)                            | n = 1 Local transverse posterior transpositioning scalp flap with preservation of the pericranium + partial thickness skin graft of the donor area | No complications                                   |
|                                               | 6–150 cm² (97 ± 58 cm²)                       | n = 1 Calvaria burred down to bleeding bone + skin substitute + split-thickness skin graft (2 stages) | No complications                                   |
|                                               | 65–276 cm²                                    | n = 4 Anterolateral thigh flaps for scalp reconstruction with primary closure of donor site | No complications                                   |
|                                               | 210 cm²                                       | n = 1 Free latissimus dorsi muscle flap. Postoperative radiotherapy            | Donor site seroma. Died 18 mo postoperatively. Local recurrence (brain) and metastasis (lungs and bone) |
|                                               | 300 cm²                                       | n = 1 Free latissimus dorsi muscle—only flap + split-thickness skin graft      | No complications                                   |
|                                               | 743 cm² (previous radiotherapy + reconstruction of the calvaria) | n = 1 Free bilateral ALT flaps + skin grafts of the donor site | No complications                                   |
size of each study ranged from 1 to 13 melanoma patients. Demographic characteristics of the population taken into examination were age, reported as mean and/or as range in case series, and sex, not for all items, with a prevalence of men (n = 14). Depth of the WLE, size of the defect in cm², type of reconstruction, follow-up, and surgical outcomes were considered.

**PATIENT SELECTION**

Primary melanoma excision was the main diagnosis, including 20 patients, while 5 were surgeries secondary to complications or recurrences; 13 were not individually specified. Stages ranged from 0 (melanoma in situ) to IV (distal metastases). The size of scalp surgical defect after wide local excision (WLE) ranged from 6 to 743 cm². Regarding the depth of excision, 18 patients had the epicranial and/or pericranial tissues preserved, while 14 patients had only calvaria; the skull external lamina was removed in 5 excisions and a full-thickness defect of the calvaria was present in 2 patients (Table 2).

**RECONSTRUCTION STRATEGIES**

The reconstruction methods described in the selected articles ranged from skin grafting, whether14,15,19,21,22 or not preceded by a bovine collagen construct, to local flaps (associated26–28 or not26,24,25 with skin grafting), local pedicle flaps (with skin graft of the donor area),32 and free flaps.15,17,19,25 In 1 patient, the one with the largest defect described, bilateral free ALT flaps were harvested.23

Reconstructive techniques, based on the depth and width of the scalp defect, are summarized in Table 3. When epicranial tissues and/or periosteum were preserved during WLE, skin grafting was preceded (or not) by dermal regeneration templates and various types of local flaps were used. Otherwise, local or pedicle flaps with or without skin grafting of the donor site, dermal regeneration templates onto drilled/buried down bone with subsequent skin graft, free flaps, with primary closure or skin grafts of the donor site, were required.

Follow-up ranged from few weeks to 5 years. Complications were not frequent localized infections, which led to prolonged healing of dermal regeneration templates, venous congestion in pedicle flaps, and donor site seroma when free flaps were used. There were no recurrences, but 2 patients died because of distant metastasis, respectively, 12 and 18 months after surgery.

**DISCUSSION**

Scalp reconstruction seeks functional and cosmetic goals. Although the protection of the bone tissue to avoid infections of the calvaria (or alloplastic implants replacing the bone) plays a fundamental role in the reconstructive process, obtaining an acceptable aesthetic result is particularly demanding due to the intrinsic characteristics of the scalp itself. Its low elasticity due to the presence of the galea makes it difficult to directly close small defects, especially in the vertex area, where the galea is fully formed and the skin is tight and inelastic.29–31 Moreover, its complexity, due to the presence of the hairline and the different orientation of the hair follicles,32 often makes it impossible to replace defects with tissues that cannot be distinguished from the original. Scalp reconstruction after melanoma excision deserves further important considerations. In our review, the age of patients ranged from 24 to 87 years, which leads us to consider several variables: for example, the importance of obtaining an aesthetically acceptable result and the complexity of the surgical procedure that the patients can handle. Young patients generally demand reconstructions that provide for the presence of hair and that can quickly help them recover a normal social life. Elderly patients often present comorbidities that contraindicate very demanding reconstructive interventions. Local scalp flaps such as multiple flap Orticochea-type forms or pinwheel flaps seem to be useful both for debilitated high-risk patients, who can tolerate limited anesthesia, and for patients who request immediate closure of the defect with hair-bearing tissues. Even though random pattern flaps may produce distortion of important anatomical structures such as anterior or temporal hairline, they are characterized by speed of execution, frequent single surgical procedure, and fast healing,33 being adequate both in the presence and in the absence of the periosteum. However, clear-of-tumor defect margins are
mandatory because of their movement from the original position. An alternative, not present in our review, may be represented by a primary reconstruction with skin grafting followed by delayed, subgaleal or external, scalp expansion in case of wide defects, whereas they need association with skin grafts in case of wider wounds. Another easy and oncologically safe option is represented by skin-grafted local galeal flaps. Skin graft management, however, can benefit from delayed serial scalp reductions through elastic sutures, scalp extenders, galeal flaps, and galeotomies, to avoid considerable temporary deformity due to expander positioning and inflating.

Kwee et al. in their case report, described one of the most extreme cases present in the literature: a total scalp reconstruction, including bony defect, with bilateral free anterolateral thigh flaps in an 83-year-old man who had undergone WLE and failed various procedures of reconstruction due to adjuvant radiotherapy for a desmoplastic melanoma on the midscalp. Such cases are a rare occurrence because radiotherapy is rarely used to treat primary melanoma, except when patients are not good candidates for surgery or refuse surgical treatments. However, the recent positive experience obtained with the use of synthetic dermal substitutes permits the surgeon to easily reconstruct even large defects with a simple and safe technique. Moreover, many of the articles selected for this review confirmed the effectiveness of this method to convert an exposed skull bone defect into a wound that can be skin grafted. Doubtless, when full-thickness calvarial resection (that results in dural exposure) is included in the WLE, coverage with well-vascularized tissue is required. Although free flaps are able to provide a solid and long-lasting reconstruction, they have some limitations. In addition to their surgical complexities and lengths, free-flap harvesting foresees the presence of specialized teams in the global management of the patients, from preoperative investigations to discharge. Moreover, despite in non-hair-bearing scalp reconstruction, they can...
provide for a superior aesthetic result, thanks to the use of the latissimus dorsi with a split-thickness skin graft, when aesthetic reconstruction of the hair-bearing scalp is required, their use is not recommended. When a defect is localized in the anterior scalp and/or in the forehead regions, original orientation of the hair should be preserved. The superficial temporal fascia V-Y advancement island flap is useful for small- to medium-sized defects, while for larger ones, delayed scalp expansion should be considered.

Although overall survival shows a progressive increase over the years, patients with scalp melanoma have poor disease-free and overall survival rates when compared with those with cutaneous melanoma of other body sites. Our data show the presence of patients with local recurrences or advanced stages of the disease, up to patients who died a few months after surgery due to distant metastasis. Therefore, especially in the case of particular histopathological aggression, the surgeon should take into account the possibility of temporizing for the definitive reconstruction while the area affected by the primitive localization is monitored for recurrence.

Cost analysis must also be taken into consideration. Dermal substitutes are known to have high costs compared to autografts. However, when compared with pedicle and free flaps, no significant difference exists for the overall cost (hospitalization, surgery, outpatients), even being more convenient with a higher lesion size.

Application of a reconstruction algorithm based on the size and depth of the defect, the overall health of the patients, and expectations for an aesthetic result could be helpful in planning the most suitable reconstructive procedure (Fig. 2). Despite the expanding clinical and research work on scalp grafts, in most cases, the use of cutaneous flaps is still the best option available. Local tissues should be preferred in case of small- to medium-sized defects, especially when a hair-bearing scalp reconstruction is needed. Larger defects should require delayed scalp expansion. Skin grafting, alone or preceded by a dermal substitute, is suitable for large defects, particularly in bald patients. When dealing with very large defects, full-thickness bone involvement, previous radiotherapy treatment in the area, or its post-operative planning, using free flaps represent the safest option.

CONCLUSIONS

All scalp defects require immediate coverage of the skull to preserve it from infection. Although the reconstructive techniques described are superimposable to those used for the non-melanoma-derived defects, the high propensity for locoregional recurrences, the age of patients (which is lower on average compared to non-melanoma skin cancer), and the reduced need for radiotherapy treatment could contribute to making different reconstructive choices. A specific algorithm should take into account the considerable variability in terms of the presence of systemic disease and social needs of younger patients with scalp melanoma.

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