



# Scalp and Forehead Cancer

Michael F. Klaassen and Ian Burton

## Core Messages

- The scalp layer is relatively inelastic but has a robust blood supply to all layers (skin, dense connective tissue, galea/occipitofrontalis muscle and pericranium).
- Local flaps based on the superficial temporal and occipital vascular pedicles should be designed large to cover the convex contour of the cranium.
- Skin grafts to the secondary defects are sometimes necessary but can be revised with tissue-expanded scalp flaps as elective final stages in the scalp reconstruction.

## 1 Introduction

The scalp is regularly exposed to the sunlight, and invasive cancer is common particularly in balding elderly men with chronic actinic-damage. Scalp skin cancer may include squamous cell, basal cell and malignant melanoma in decreasing frequency. Other rare cancers of the adnexal structures in the dermis may also be seen [1]. Squamous cell cancer is the most common malignancy seen in the lead author's surgical practice here in New Zealand over the past 30 years. Mostly this is due to the damaging cumulative effects of ultraviolet ionizing radiation in fair-skinned, outdoor-working individuals like farmers, fishermen and forestry workers. Squamous cell cancer may also arise in previously scarred or damaged scalp skin, such as at the sites of burns and chronic ulcers. Local extension is the usual mode of growth of most scalp SCCs which may involve surrounding scalp areas as well as the deeper scalp layers and eventually the calvarium itself. Intracranial extension is rare but may present in recurrent cases, particularly after adjuvant radiotherapy. SCCs may metastasize to loco-regional nodal basins in the parotid,

occipital and cervical regions, and this is also the mode of spread for the rarer malignant melanomas.

Clinical diagnosis, staging and histopathological confirmation are all important aspects of the initial workup. For the most challenging scalp malignancies, the multidisciplinary team approach is favoured. *Diagnose before you treat* is the most important initial principle defined by Gillies. The standard reconstructive ladder or pyramid is the toolbox that all plastic surgeons are raised on. The goal is to achieve Complete Local Excision and Aesthetic Reconstruction (CLEAR) in as few stages as possible to save the patient unnecessary suffering. The options for repair include secondary intention, skin grafts (split and full thickness), local or loco-regional flaps (with or without pre-surgical expansion) and distant flaps including free tissue transfer.

When the clinical scenario is unusual or atypical, the guidance of an experienced histopathologist is mandatory. The lead author has always relied on questioning the pathology when the clinical situation seems unusual. The very rare case of a relatively innocuous scalp basal cell carcinoma de-differentiating into a poorly differentiated squamous cell carcinoma with local and regional nodal metastases is a case in point (see later).

## 2 Management/Technique

A number of clinical cases managed by the lead author are described with principles of reconstruction and challenges encountered along the way.

## 3 Squamous Cell Cancer

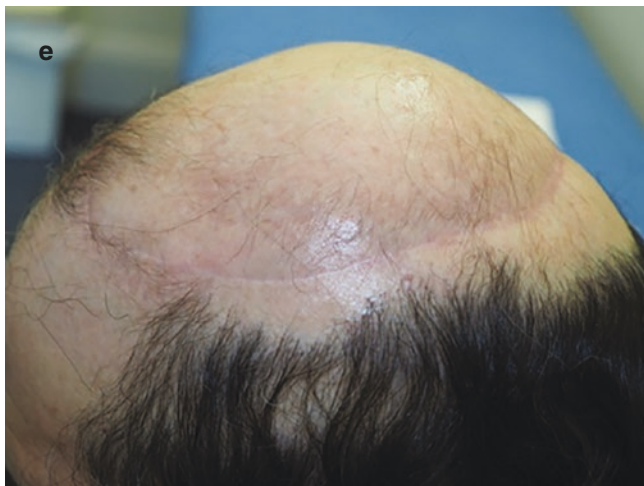
This 65-year-old man (Fig. 1) was referred with a pT2 well-differentiated SCC arising at the site on his frontal scalp where a chronic sinus had formed from the use of a hairpiece fixed with a metal clip. He had worn the hairpiece for >20 years to disguise his significant alopecia. The 5 cm

M. F. Klaassen (✉)  
Private Practice, Auckland, New Zealand

I. Burton  
Private Practice, Gisborne, New Zealand



**Fig. 1** (a–c) A 65-year-old man with frontal scalp SCC caused by toupee hair piece clip (a: pre-surgical plan, b: immediate large scalp rotation flap, c: day 1, d and e: 5 months post-surgery)



**Fig. 1** (continued)

diameter scalp tumour was widely excised down to and including the frontal periosteum. Immediate repair was achieved with a large scalp rotation flap raised on the right superficial temporal vascular pedicle and the donor site closed directly over a suction drain. He is shown immediately, day 1 and 5 months post-surgery with the scalp flap well healed.

Another case is the 59-year-old man (Fig. 2) referred with a rapidly growing T4 lesion of his left frontal scalp, which had been biopsied and reported as a keratoacanthoma. Although the tumour was mobile on the pericranium, there were associated subdermal nodules in the draining lymphatic distribution of the left temple and parotid regions. A wide excision incontinuity with a left superficial parotidectomy and selective neck dissection was performed preserving the facial nerve branches. A rotation scalp flap repaired the defect, but a split skin graft was required for the posterior scalp secondary defect. Final histology revealed a well-

differentiated SCC with reactive hyperplasia in the pre-parotid lymph nodes. His result at 7 years post-surgery is shown, with no sign of recurrence.

This 73-year-old man (Fig. 3) presented with a large (40 mm) ulcerated poorly differentiated SCC of the vertex. The duration of growth was 2 years, and associated palpable right occipital lymph nodes were also widely excised. Histologically these showed reactive hyperplasia only. Large rotation scalp flaps were planned anteriorly and posteriorly. However, after wide excision down to calvarium, it was decided that a large posterior rotation flap based on the left occipital vascular pedicle, raised at the suboccipitalis-galea plane and scored to increase elasticity would close the defect. A drain was placed under the flap, and the secondary posterior defect repaired with a split skin graft. Post-surgery the patient underwent adjuvant radiotherapy. Figure 3f shows the almost healed secondary defect, skin grafted and prior to commencement of adjuvant radiation therapy.

Sometimes the local scalp skin has such extensive actinic damage that local flap repair is contraindicated. This is where skin grafts can be a good reconstructive choice. The 86-year-old man (Fig. 4) with extensive scalp sun damage and previously treated scalp melanoma was referred with multiple actinic lesions including a moderately differentiated SCC of his left frontal region and other neighbouring lesions which proved to be SCC in situ. He had multiple wide excisions and repair with full-thickness skin grafts from a supraclavicular donor site. Aged 90 years he returned with another SCC on his right frontal region, which was widely excised and repaired with a full-thickness skin graft, this time from his submental donor site. Note the colour match of the grafts from the supraclavicular and submental donors, compared to the pale graft to the dorsum of his nose, which came from his medial arm donor site.



**Fig. 2** (a–e) A 59-year-old man with SCC left frontal scalp and associated left parotid lymphadenopathy. Wide excision incontinuity with a superficial parotidectomy, selective neck dissection and repair with

large rotation local scalp flap. Skin graft to secondary defect required and late result at 7 years



**Fig. 2** (continued)



**Fig. 3** (a–f) A 73-year-old man with longstanding SCC vertex scalp widely excised down to calvarium and repaired with a large rotation local flap, with split skin graft to the secondary defect. Image f shows delayed healing of graft margins, prior to adjuvant radiation therapy



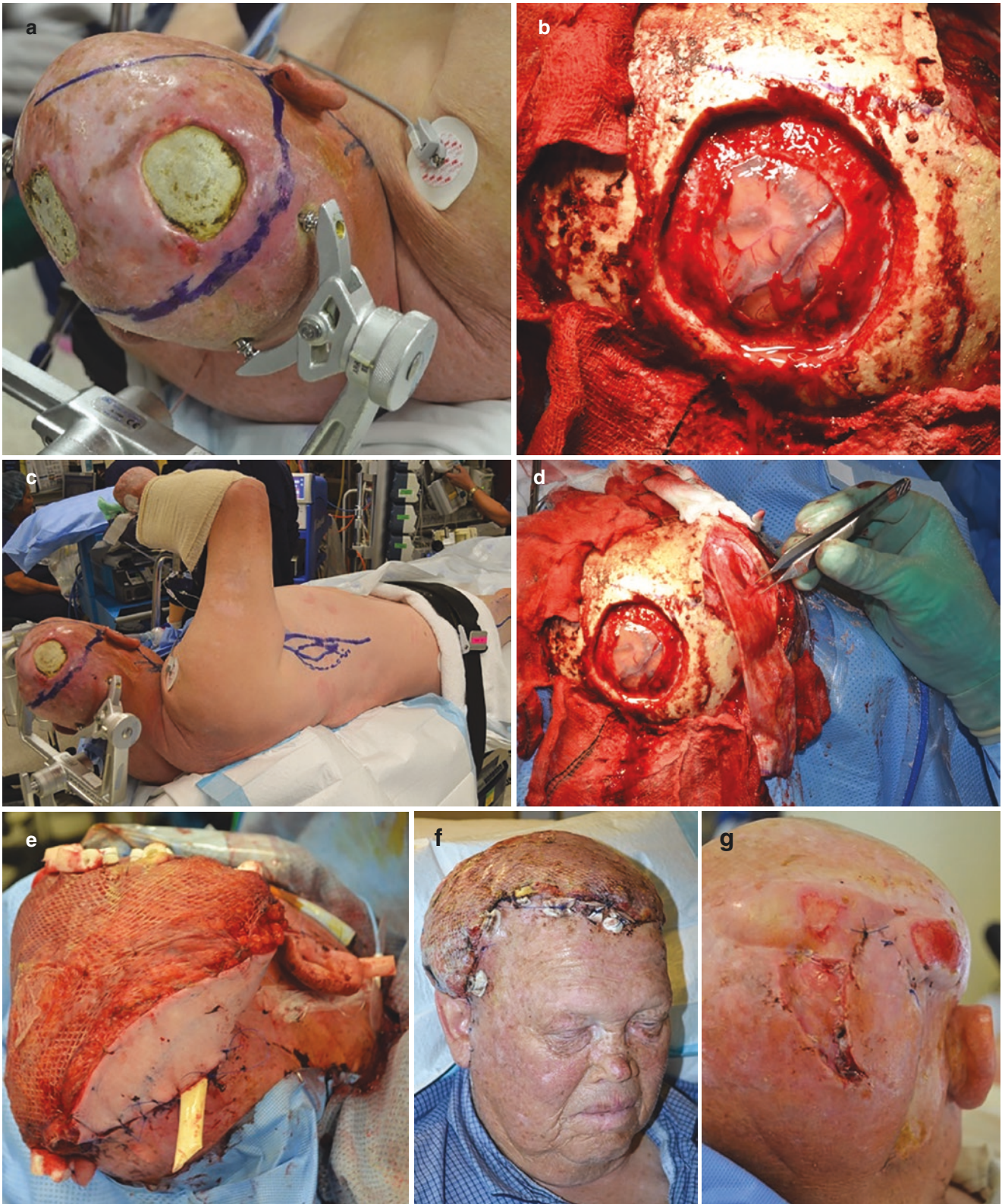
**Fig. 4** (a–f) A 90-year-old gentleman with multiple scalp SCCs treated by wide excision and repair with full-thickness skin grafts

#### **4 Recurrent SCC Post-surgery and Radiation**

This is a particularly challenging oncological and reconstructive problem as seen in the 70-year-old man (Fig. 5) who was born with congenital ectodermal dysplasia and had multiple previous operations for BCCs and SCCs of his scalp. Several years before an incomplete margin had been treated with high-dose radiotherapy. He was referred with two large areas of exposed calvarium with obvious osteoradionecrosis. CT and MRI scan showed full-thickness skull bone necrosis and thickening of the underlying dura mater. A

combined neurosurgical/plastic surgical craniectomy of the necrotic skull was performed preserving the sagittal sinus but resecting the underlying dura and finding local recurrence on the brain surface. Immediate reconstruction was performed with a free fascia lata graft for dural repair and a large free latissimus dorsi myocutaneous flap for scalp cover. Further radiotherapy was given and also protective head gear with future plans to replace the resected calvarium later when there was no risk of infection. This major surgery was in reality palliative because 2 years later an intracranial recurrence led to his untimely death.





**Fig. 5** (a–g) A 70-year-old farmer with congenital ectodermal dysplasia and recurrent SCC in irradiated scalp and calvarium, requiring a cranial resection and free flap reconstruction

## 5 Melanoma

This 50-year-old man (Fig. 6) was referred with a Breslow thickness 2 mm nodular melanoma of his hair-bearing frontal scalp, despite a benign biopsy 1 year earlier. With a 2 cm wide margin, a full-thickness scalp excision was performed. A large scalp rotation flap based on the left superficial temporal vascular pedicle easily repaired the defect once galeal scoring had been performed to increase the flap elasticity.

Unfortunately as part of his radiological workup for the pT2aN0M1 nodular melanoma, a CT scan confirmed

metastases in his brain, lungs, chest wall and liver. Despite radiotherapy and immunotherapy with a BRAF inhibitor + pembrolizumab (Keytruda), he did not survive his melanoma and succumbed to his disease within 12 months.

Another patient in his 80s (Fig. 7) presented with local multiple cutaneous scalp metastases. These were confirmed as recurrent melanoma despite wide excision of the primary some years before. The lesions were widely excised from his left forehead and frontal scalp, down to the pericranium, and repaired with a split skin graft.



**Fig. 6** (a–d) A 50-year-old man with frontal scalp 2 mm thick nodular melanoma, widely excised and the defect repaired with a large rotation scalp flap



**Fig. 7** (a and b) An 80-year-old gentleman with cutaneous scalp malignant melanoma metastases, widely excised and defect repaired with split skin graft

## 6 Basal Cell Cancer

Although BCCs may arise on the scalp, the lead author's long experience has been that they are more common on the forehead and the rest of the face. These BCCs range from nodulocystic well-demarcated local cancers to the widely infiltrating morphoeic/sclerosing subtypes and also multifocal BCCs.

For the larger BCCs, local flap repair is a good option for the CLEAR principle, and the double advancement local flap H-plasty is ideal.

This 39-year-old woman (Fig. 8) presented with a large infiltrating BCC of her right upper forehead near the anterior hairline. It had desmoplastic features on diagnostic punch biopsy. A wide excision was performed, and immediate reconstruction achieved with a large H-plasty local flap design.

The bilateral advancement is designed to be at the sub-frontalis plane and Burow's triangles at either lateral end of each advancement flap improve the closure, by reducing tension.

A similar but more caudally located large infiltrating BCC of the lower central forehead/forehead region is shown in this 74-year-old woman (Fig. 9). This had been biopsied 18 months previously and revealed only an actinic keratosis. Clearly de-differentiation into a malignant cancer had occurred. Wide excision and repair with a large H-plasty flap making up half the width of the forehead was designed to be camouflaged in the relaxed skin tension lines of the mid-forehead and supra-orbital margins. Like the previous case, surgery was performed under local anaesthetic with intravenous sedation as a day case. The four lateral Burow's triangles are more clearly marked in the flap design.

The potentially most difficult BCCs of the scalp are the very rare de-differentiating subtypes which recur despite initial complete excision and transform into more aggressive malignancies with metastases. This subtype also known as basosquamous is reported as occurring in the ratio of 1:10,000 standard BCCs [2].

This 63-year-old gentleman (Fig. 10) was referred with a 40 × 35 cm nodular infiltrating BCC of his right fronto-parietal scalp, partially hidden in his hair. Initial wide excision and repair with an inferiorly based temporal scalp rotation flap were performed under general anaesthetic as a day case. Within 6 months a local recurrence again reported as an ulcerated nodular BCC was narrowly excised just caudal to the original primary in the right temporal scalp. A year following the original scalp BCC, he returned with an infiltrating poorly differentiated SCC on his right sideburn region, caudal to the previous nodular BCC recurrence. It was infiltrating downwards into the preauricular tissues.

Wide excision and a further local flap + split skin graft proved unsatisfactory as the SCC had invaded subcutaneous tissue and superficial temporal fascia with perineural invasion. CT scans revealed right parotid and cervical lymph node metastases, so he was referred for wide excision of all previous tumour sites, superficial parotidectomy, neck dissection and a free radial forearm flap repair. There was confirmed nodal and extranodal disease. A large 'beaver tail' of forearm fat was designed to reconstitute the parotid contour over the ramus and angle of the mandible. The radical surgery and reconstruction were followed by chemo-radiation therapy, and he remains well and disease-free at 24 months after completing 18 cycles of immunotherapy pembrolizumab (Keytruda).



**Fig. 8** (a–d) A 39-year-old female with infiltrating BCC showing desmoplastic growth pattern before, immediate, 3 weeks and 1 year post reconstruction with H-plasty advancement local flaps

**Fig. 9** (a–d) A 74-year-old female with infiltrating BCC glabellar forehead region, widely excised and reconstructed with H-plasty local flap. Micropore taping at 1 month and result at 4 months





**Fig. 10** (a–f) Frontal scalp nodular BCC which de-differentiated into a poorly differentiated SCC with perineural invasion and regional nodal metastases to parotid and cervical nodes, when it recurred at 12 months



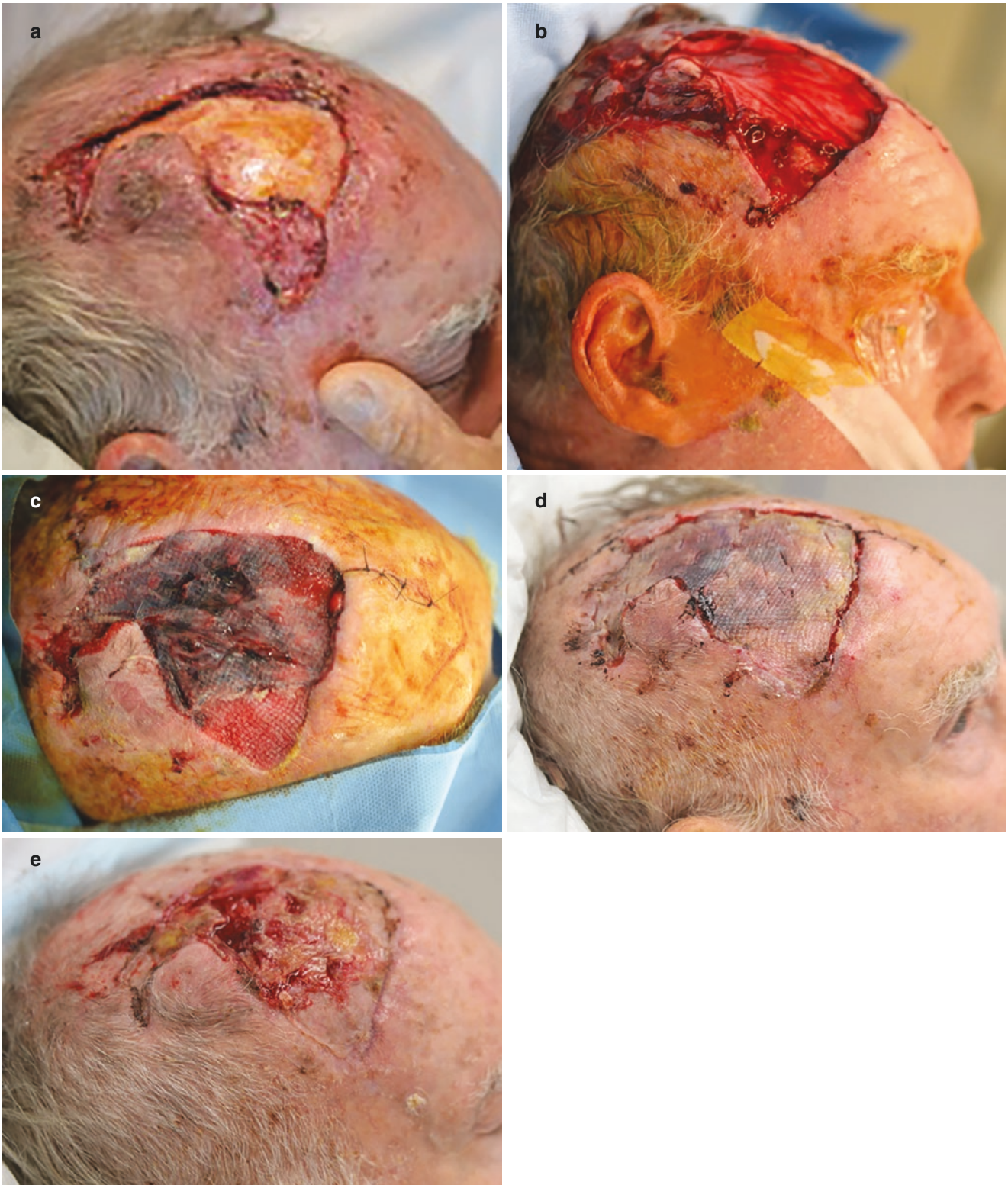
## 7 Complication Management

The plastic surgeon must always have a lifeboat when plan A fails [3]. These lifeboats are required for unplanned failures as well as those that make their way eventually for reconstructive salvage. One of MK's surgical mentors once said 'Plastic surgery is the common pathway for lost causes' and was a timely reminder of what reality and time will serve up.

The elderly man (Fig. 11) in his late 70s presented with an infected wound and exposed right parietal calvarium after attempted resection of a recurrent SCC of his scalp by his general practitioner. The failed rotation flap attempt was widely debrided under general anaesthetic and a pericranial flap based on the supraorbital pedicles transposed to cover the exposed skull. After a period of negative pressure wound

dressings as an inpatient, the granulating pericranial flap was covered with a split skin graft, and satisfactory healing achieved.

This 78-year-old man (Fig. 12) was referred by a district nurse with exposed right frontal calvarium and a chronic wound. Three years previously a dermatologist had incompletely excised an SCC from his scalp and repaired the defect with a skin graft. Subsequently radiation therapy for the incomplete SCC excision led to graft failure over the frontal bone. A second dermatologist then attempted reconstruction with an 'S-flap'. My recommendation was for wide excision, removal of osteo-necrotic outer table of skull and repair with a large scalp rotation flap based on the right superficial temporal pedicle, with a skin graft to the posterior secondary defect. He was lost to follow-up.



**Fig. 11** (a) Post-debridement of original attempted repair, (b) pericranial local flap, (c) after VAC dressing removed from pericranial flap, (d and e) early appearance of split skin graft (partial take)



**Fig. 12** (a and b) Complications of incomplete excision, adjuvant radiotherapy, devascularisation and local flap failure, leading to exposed calvarium

## 8 Controversies

The most significant controversy in recent years is the trend for non-surgeons (GPs and dermatologists) to attempt scalp cancer excision and repair beyond their surgical skill set. This has been documented in Australia/New Zealand and continues to challenge the reconstructive services.

## 9 Conclusion and Summary

Skin cancer of the scalp and forehead is considered as a combined anatomical and reconstructive challenge. The many and varied options for repairing a cutaneous defect can be a challenging decision pathway for the novice surgeon, dermatologist or GP. For the experienced plastic surgeon with decades of reconstructive practice, the choices are often simply automatic. This is based on many cases, of trial and error, of success and failure, of restoring ana-

tomical repair initially and then refining this into aesthetic reconstruction. The plastic surgical tool kit offers a vast array of options, and ‘to flap or to graft?’ is often the rhetorical question.

Extreme scalp and forehead cancers require a team effort and a multidisciplinary setting. The consequences of mismanagement are considerable both in terms of morbidity and potential mortality. The highest standards of oncological and reconstructive management are only just good enough.

## References

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