

Definitive High-Dose-Rate Surface Mould Brachytherapy for Localized Cutaneous Squamous Cell Carcinoma of the Scalp in an Elderly Patient: A Case Report

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Abstract: ***Background:** Cutaneous squamous cell carcinoma (SCC) frequently develops on chronically sun-exposed head-and-neck skin. Surgery is standard for most localized tumours, but definitive radiotherapy is appropriate when resection is contraindicated, declined, or expected to cause substantial morbidity. For selected superficial lesions on curved or irregular surfaces, high-dose-rate (HDR) surface mould brachytherapy permits conformal dose delivery with rapid dose fall-off beyond the target. **Case presentation:** A 78-year-old woman with an Eastern Cooperative Oncology Group performance status of 2 presented with a six-month history of a progressively enlarging ulceroproliferative lesion over the left frontoparietal scalp. Punch biopsy confirmed squamous cell carcinoma. Contrast-enhanced magnetic resonance imaging demonstrated a well-defined exophytic scalp lesion measuring approximately 22 × 14 mm, without extension into the outer table of the skull, abnormal meningeal enhancement, or intracranial parenchymal involvement. In view of her age, performance status, superficial localized disease, and anticipated surgical morbidity, definitive surface mould brachytherapy was selected. She received 52 Gy in 13 fractions of 4 Gy, delivered twice daily between 11 and 18 May 2026. Treatment was completed without a major interruption. At one month, marked regression with a small residual granulating area was observed. At three months, the site was completely epithelialized, with no clinically evident residual exophytic tumour and only localized hypopigmentation. **Conclusion:** This case supports definitive HDR surface mould brachytherapy as a focused, non-surgical option for carefully selected superficial scalp cSCC without calvarial involvement. Longer clinical and radiological follow-up is required before durable local control can be concluded.*

Keywords: cutaneous squamous cell carcinoma; scalp carcinoma; surface mould brachytherapy; high-dose-rate brachytherapy; definitive radiotherapy; elderly patient.

1. Background

Cutaneous squamous cell carcinoma is the second most common keratinocyte carcinoma and occurs predominantly on chronically sun-exposed skin. Head-and-neck lesions merit particular attention because local progression may involve functionally or cosmetically important structures, and SCC has a greater propensity for nodal and distant spread than basal cell carcinoma. The scalp is a clinically challenging site: wider excision may create a substantial defect requiring grafting or flap reconstruction, while deep invasion may involve the calvarium and preclude a purely superficial treatment approach.^{1,2}

Surgical excision, including Mohs micrographic surgery where appropriate, remains the preferred treatment for most localized SCC. Definitive radiotherapy is recommended when surgery is not feasible, is declined, or would produce unacceptable functional or cosmetic morbidity.³ In elderly or frail patients, treatment selection should incorporate performance status, comorbidity, tumour size and depth, anatomical site, anticipated treatment burden, and patient preference rather than chronological age alone.

Surface mould brachytherapy is particularly suited to superficial tumours on curved or irregular surfaces. A customized catheter-bearing mould maintains a reproducible source-to-surface relationship, and image-based planning can achieve conformal target coverage with steep dose fall-off into deeper tissues. GEC-ESTRO recommendations emphasize careful selection according to lesion depth, geometry, and treatment technique.⁴ We report an elderly woman with biopsy-proven localized scalp cSCC, without radiological calvarial involvement, treated definitively with surface mould brachytherapy.

2. Case Presentation

A 78-year-old postmenopausal woman presented to the outpatient department with a gradually progressive swelling over the left side of the scalp for approximately six months. The lesion had persisted and increased in size. No significant previous oncological history was documented. Her ECOG performance status was 2.

Clinical examination showed a localized ulceroproliferative lesion over the left frontoparietal scalp, measuring approximately 2 × 3 cm (Figure 1(a&b)). A punch biopsy obtained on 29 April 2026 confirmed squamous cell

carcinoma. Histological grade, measured tumour thickness, perineural invasion, lymphovascular invasion, and formal

pathological risk classification were not available in the supplied record.



Figure 1

3. Diagnostic Assessment

Contrast-enhanced MRI of the brain, performed on 28 April 2026, demonstrated a well-defined exophytic lesion arising from the left frontoparietal scalp and measuring approximately 22×14 mm. There was no extension into the outer table of the skull, and no abnormal meningeal or intracranial parenchymal enhancement. These findings supported localization of disease to the scalp and were central to selection of a surface technique. Incidental cerebral atrophy and bilateral periventricular white-matter signal changes consistent with chronic ischemic/demyelinating change were noted.

On the available clinical, histopathological, and radiological information, the working diagnosis was localized cSCC of the left frontoparietal scalp without radiologically evident calvarial or intracranial extension. Formal TNM staging was not assigned because the source record did not document all required clinical and pathological risk features or comprehensive nodal assessment.

Management was individualized considering the patient's advanced age, ECOG performance status of 2, limited

superficial disease, and the potential morbidity of surgical excision and reconstruction. Following clinical assessment, definitive high-dose-rate surface mould brachytherapy was selected.

A customized surface mould was fabricated from a 0.5-cm-thick wax bolus shaped to conform to the tumour and surrounding scalp. Four treatment catheters were incorporated into the mould at approximately 1-cm intervals. The applicator was positioned and secured over the left frontoparietal scalp to ensure close surface contact and reproducible treatment geometry (Figure 2).

Planning CT images were acquired with the applicator in situ at a slice thickness of 1.25 mm, and treatment planning was performed using a Varian brachytherapy treatment-planning system. The prescribed dose was 52 Gy in 13 fractions of 4 Gy, delivered twice daily each dose 12 hour apart. The target D 90% was 4.6 Gy per fraction, and V100 was 99.7%. The planning images demonstrated the spatial distribution of the 90%, 95%, and 100% prescription isodose levels across the superficial target, with dose fall-off toward the underlying skull and brain. (Figure 3)

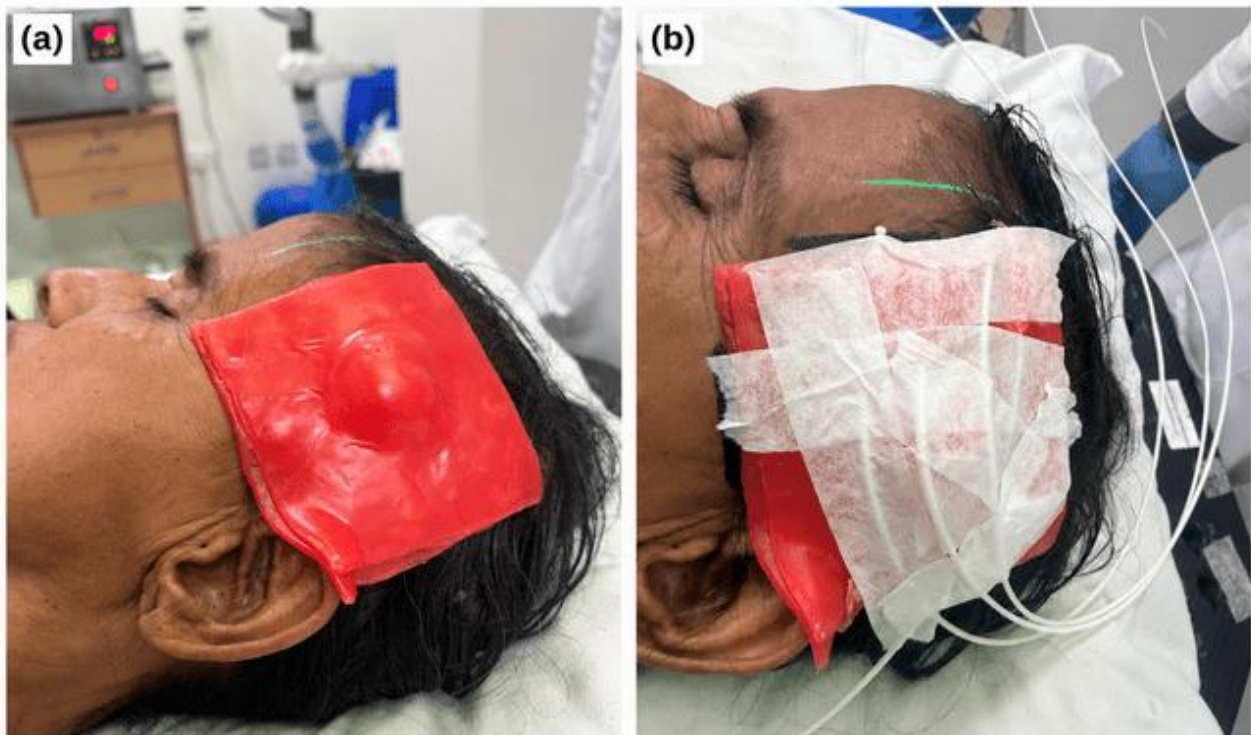
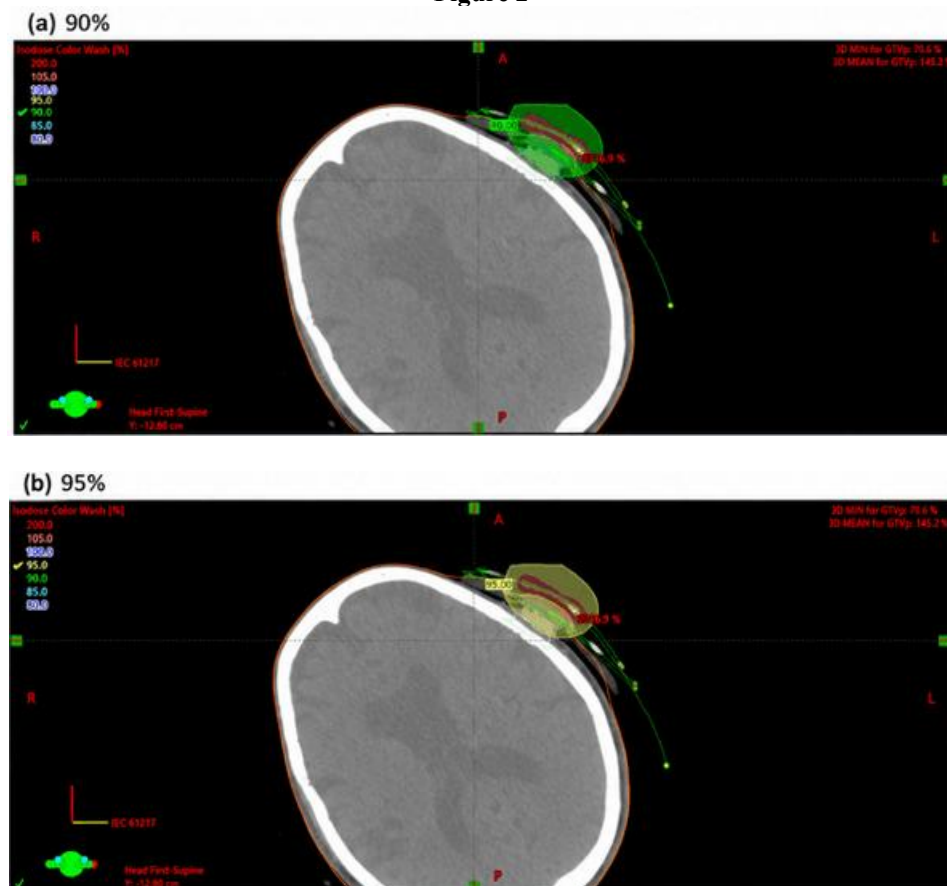


Figure. Surface mould fabrication and catheter placement for brachytherapy: (a) fabrication and fitting of the surface mould; (b) placement and fixation of brachytherapy catheters on the mould.

Figure 2



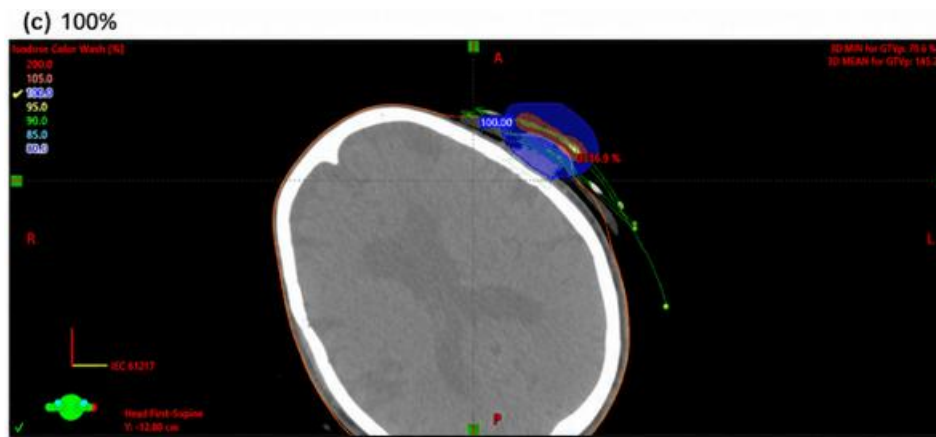


Figure. Axial CT-based surface mould brachytherapy planning images showing colour-wash distributions of the (a) 90%, (b) 95%, and (c) 100% prescription isodose levels over the growth.

Figure 3: Axial CT-based surface mould brachytherapy plan showing conformal coverage of the superficial scalp target and dose fall-off toward deeper structures.

Table 1: Documented treatment parameters from the supplied case record

Treatment parameter	Documented value
Intent	Definitive
Technique	Surface mould brachytherapy
Total dose	52 Gy
Dose per fraction	4 Gy
Number of fractions	13
Schedule	Twice daily, as documented
Treatment period	11-18 May 2026

Toxicity, Follow-Up, and Outcome

The patient completed the prescribed course on 18 May 2026 without a documented major treatment interruption. At completion, there was marked regression of the exophytic component with residual ulceration/crusting and localized treatment-related skin change (Figure 4). Her clinical condition and vital parameters were stable, and she was discharged with follow-up advice. A formal CTCAE toxicity grade was documented but didn't undergo any acute toxicity whereas patient developed Grade 1 dermatitis at the month of conclusion which recovered on subsequent month of follow up.



Figure. One month after brachytherapy: (a) left oblique and (b) left lateral views showing grade 1 dermatitis of the surrounding skin and healing granulation tissue over the growth.

Figure 4

At one month, there was marked clinical regression, with a small residual ulcerated/granulating area and surrounding post-radiotherapy skin changes. At three months, the treated site had completely epithelialized, the previously visible ulceroproliferative lesion had disappeared, and no clinically evident residual exophytic disease was present. Localized

hypopigmentation remained, with a satisfactory early cosmetic result (Figure 5). No major late toxicity was apparent at this early assessment; however, three months is insufficient to characterize durable tumour control or late effects.



Figure. Three-month follow-up after brachytherapy. (a–c) Different views showing complete clinical remission, with a hypopigmented patch over the scar area and no residual dermatitis.

Figure 5

4. Discussion

This case demonstrates the feasibility of definitive HDR surface-mould brachytherapy for localized superficial scalp cSCC in an elderly patient. Although surgery remains the standard treatment for most localized SCC, scalp excision may result in a substantial defect requiring graft or flap reconstruction. In the present 78-year-old patient with ECOG 2, superficial localized disease and no MRI evidence of calvarial or intracranial extension, definitive brachytherapy offered a reasonable non-surgical approach while avoiding the morbidity of excision and reconstruction.¹⁻³

Surface-mould brachytherapy is particularly suitable for superficial lesions on curved or irregular surfaces such as the scalp. Customized moulds provide close and reproducible catheter positioning, while CT-based planning allows conformal target coverage with rapid dose fall-off toward the skull and brain. However, accurate mould construction, minimal air gaps, stable fixation, appropriate catheter spacing and correct assessment of lesion depth remain essential for reliable treatment delivery.⁴⁻⁶

Guix et al. reported a five-year actuarial local-control rate of 98% in 136 facial skin carcinomas treated with custom HDR surface moulds, supporting the effectiveness of this technique for superficial skin malignancies. Although their series predominantly involved facial lesions, our scalp SCC similarly demonstrated an early complete clinical response; however, longer follow-up is required before comparable durable control can be claimed.⁷

Zaorsky et al., in a meta-analysis involving 9,729 BCC/SCC lesions, demonstrated generally favourable cosmetic outcomes with hypofractionated radiotherapy while highlighting the potential impact of higher biologically effective doses on late cosmesis. This is relevant to our patient, who received 52 Gy in 13 fractions and showed satisfactory early healing with localized hypopigmentation, although longer follow-up is required to assess late effects.⁸

Indian experience further supports this approach. Budrukkar et al. reported excellent local control with HDR surface-mould brachytherapy for head-and-neck skin malignancies, whereas Sen et al. demonstrated comparable target coverage

with greater conformity and organ sparing than electron therapy in postoperative non-melanoma skin cancers. Unlike the postoperative patients in the latter study, our patient received surface-mould brachytherapy as the sole definitive local treatment, avoiding surgery and reconstruction.^{9,10}

Yadavalli et al. reported a 90% complete-response rate among definitively treated skin-cancer patients using CT-planned Iridium-192 surface-mould brachytherapy, with no Grade III-V toxicity during short follow-up. Our patient's complete clinical response at three months and satisfactory early toxicity profile are consistent with these findings, although the present report specifically concerns definitive treatment of a scalp SCC.¹¹

Bandyopadhyay et al. reported long-term Indian outcomes in 28 patients with scalp or facial non-melanoma skin cancers, with no recurrence at a median follow-up of 54 months. They also identified skin dose, dose homogeneity and catheter-to-surface distance as predictors of late toxicity and cosmetic outcome. Their findings provide important long-term support for CT-based customized mould brachytherapy, although their cohort included different histologies and both definitive and adjuvant treatments.¹²

More disease-specific evidence is provided by Kalaghchi et al., who reported a 95.2% complete clinical response at three months among definitively treated head-and-neck NMSC patients receiving 30-52 Gy in 10-13 fractions, with good/excellent cosmesis in 96.2% at two years. Our schedule of 52 Gy in 13 fractions lies at the upper end of their reported range, and our patient's complete epithelialization at three months is consistent with their early response.¹³

Esmati et al. provide one of the closest comparisons, reporting 22 head-and-neck NMSC patients, including eight SCCs and three scalp SCCs, with a two-year local-control rate of 87.5% for SCC. Similarly, Laliscia et al. reported a two-year local-control rate of 90% without Grade 3 or greater toxicity in a tailored-mould series of 40 lesions, 40% of which were located on the scalp. These studies directly support the feasibility of surface-mould brachytherapy for scalp lesions, although our three-month follow-up remains too short for meaningful long-term comparison.^{14,15}

The present regimen of 52 Gy in 13 fractions of 4 Gy, delivered twice daily, represents a relatively intensive definitive schedule and corresponds to a tumour BED10 of approximately 72.8 Gy (EQD2 approximately 60.7 Gy). The favourable early response is encouraging; however, late effects such as hypopigmentation, telangiectasia, alopecia, fibrosis, ulceration or necrosis require continued surveillance, particularly because the exact minimum interfraction interval was not documented.8,13

The main limitations are the single-patient design, short three-month follow-up, absence of histopathological confirmation of response, incomplete documentation of pathological risk features. Therefore, the present outcome should be regarded as an early complete clinical response rather than durable cure. Nevertheless, this case adds to the relatively limited literature specifically addressing definitive surface-mould brachytherapy for scalp SCC, demonstrating complete epithelialization and preservation of the scalp contour without surgical excision in an elderly patient.

5. Conclusion

Definitive surface mould brachytherapy provided an early complete clinical response with satisfactory epithelialization and limited early cosmetic change in this 78-year-old woman with superficial left frontoparietal scalp SCC. The technique can be considered for carefully selected elderly or medically vulnerable patients when surgery is undesirable, provided lesion depth is adequately assessed and applicator geometry and dosimetry are rigorously verified. Longer follow-up is essential to establish durable local control and late toxicity.

Patient Consent and Ethics

Written informed consent was obtained from the patient for the publication of clinical details and accompanying clinical images. The patient's identity has been protected to maintain confidentiality. Ethics committee approval was not required for this single-patient case report in accordance with institutional policy.

Declaration of Conflicting Interests

We declare that we have no financial or non-financial conflicts of interest relevant to the publication of this case report.

Funding

No specific funding was received for this case report.

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