

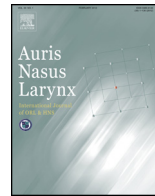


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## Galea-aponeurotic flap for the repair of large scalp defects extending to bone

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### ABSTRACT

**Objective:** Defects of the scalp after surgical resections of skin cancers are common conditions. The purpose of this article is to present a useful technique for the repair of large scalp defects extending to bone using galea-aponeurotic flaps and split-thickness skin grafts.

**Methods and results:** The technique and cosmetic results of this method are displayed and the minimal invasiveness compared to other techniques in the elderly is underlined and discussed.

**Conclusion:** Large defects extending to bone can present a significant challenge to the reconstructive head and neck surgeon because the lack of elasticity of the scalp skin may inhibit direct approximation and the lack of vascularity of the bony wound ground may not support skin grafts. Despite its excellent clinical usefulness, the presented approach has not been highlighted as yet. In conclusion, this surgical technique is a simple, fast, minimal-invasive and reliable approach for the reconstruction of large scalp defects extending to bone. It is of particular benefit in patients with a baldhead and in the elderly and infirm.

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### 1. Introduction

The scalp is the anatomical region that borders anteriorly to the face and posteriorly to the neck. It is composed of five tissue layers: skin, subcutaneous tissue, aponeurosis and muscle, loose areolar tissue and pericranium. The aponeurosis, also referred to as the galea aponeurotica, is responsible for the relative inelasticity of the scalp and is contiguous with the paired frontalis muscles anteriorly, the paired occipitalis muscles posteriorly, and the temporoparietal fascia laterally [1–3]. The skin of the scalp is exposed to high levels of ultraviolet light and is therefore a common location for primary and metastatic skin cancers, such as squamous cell carcinoma, melanoma and basalioma. These tumors and their precursors are most often found in the elderly, frequently in multiple locations of the scalp. The primary therapy for skin cancer of the scalp is surgical excision; therefore defects of the scalp after surgical resections are common conditions. Large defects extending to bone can present a significant challenge to the

reconstructive head and neck surgeon because the lack of elasticity of the scalp skin may inhibit direct approximation and the lack of vascularity of the bony wound ground may not support skin grafts. We here present useful option for the repair of large scalp defects extending to bone using a galea-aponeurotic flaps and split-thickness skin grafts. The excellent cosmetic results of this method are displayed and the minimal invasiveness compared to other techniques in the elderly is highlighted.

### 2. Method and results

The study was performed in accordance with the Declaration of Helsinki. We have successfully treated two patients with large surgical defects of the scalp extending to bone after tumor resection using the galea-aponeurotic flap with split-thickness skin grafts. We here present exemplarily the results of an 83-year-old male with a history of chronic lymphatic leukemia and multilocular squamous cell carcinomas and basaliomas of the scalp and face. The patient was in a reduced general condition, had a significant thrombocytopenia and multiple scars on his baldhead from previous surgical procedures. Surgical resection of two recurrent squamous cell carcinomas on his forehead resulted in two defects of the scalp extending to bone, a smaller one with a diameter of about 4 cm and a bigger one with a diameter of about

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8–9 cm. Until histopathological results confirmed an R0-resection status, the defects were temporarily covered with synthetic skin (Epigard®). Minimal-invasive reconstruction of the scalp defects was subsequently performed with galea-aponeurotic flaps and split-thickness skin grafts from the medial face of the upper arm as described below. Figs. 1 and 2 present the surgical result at 1 day and 3 months postoperatively.

### 2.1. Technique

Galea-aponeurotic flaps combined with split-thickness skin grafts were used to recover the large defects of the scalp extending to bone after oncologic tumor resection. In principle, two to three flaps including the aponeurosis, the underlying loose areolar tissue and the periostum are rotated from the scalp adjacent to the defect from several sides, connected with each other by suturing and covered with one or two split-thickness skin grafts from the arm or leg (Fig. 3a and b). The flaps are won by retracting and lifting the scalp at the edge of the surgical defect, identifying the tissue planes and dissecting at the plane of the galea with scalpel and scissors. The flaps are then rotated leaving a 1–2 cm stem to secure it. To cover the whole defect, two or three flaps are rotated from several sides of the scalp and their free edges are connected with 4-0 fast-absorbing interrupted sutures. The flaps are carefully punctured at multiple points to prevent hematoma and then covered with punctured split-thickness skin grafts. These are fixed with each other and with the edges of the surgical defect using 4-0 or 5-0 non-absorbing interrupted sutures. Finally, a fat-based loose compression bandage is applied. The procedure can be performed in local or in general anesthesia and takes approximately 20–30 min.

### 3. Discussion

The reconstruction of scalp defects extending to bone can present a significant challenge to the head and neck surgeon. These defects most often result from the surgical resection of skin cancers in the elderly after the exposure to high levels of ultraviolet light during their lifetime. Several approaches to the repair of scalp

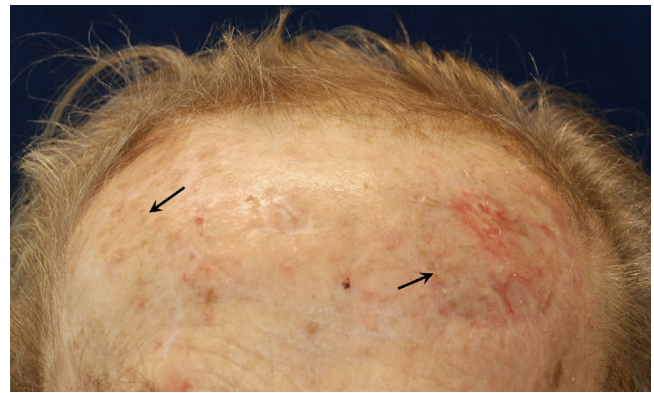


Fig. 2. The postoperative result after 3 months demonstrates a satisfactory cosmetic outcome. The arrows indicate the location of the two healed wounds.

defects extending to bone have been described, but all of them have significant disadvantages, particularly in the elderly or infirm. Primary closure is only an option for small defects and even then very wide undermining in the subgaleal plane needs to be performed and high levels of wound tension frequently cause wound dehiscence and postoperative pain [2–4]. Because of the poor tissue mobility, primary closure of larger defects is usually impossible [4]. Healing by secondary intention is almost always an option but is slow and risks osteomyelitis of the skull devoid of pericranium. Drilling down the outer cortical layer of the skull can accelerate the formation of granulation tissue but needs general anesthesia and even then re-epithelisation of larger defects requires that the patient perform wound care for an extended period of time [3,4]. Split- or full-thickness skin grafting after milling the outer cortical table of the skull has also been described but also needs general anesthesia and is often associated with unstable skin and wound breakdown [2,5]. Local cutaneous flaps are a major method of scalp defect reconstruction but these are complex and time-consuming, require a lengthy operation time and large flaps with extensive incisions and tissue mobilization



Fig. 1. Postoperative status at day one after surgical reconstruction of two scalp defects extending to bone with galea-aponeurotic flaps and split-thickness skin grafting. Note also the poor tissue conditions of the bald forehead's skin including multiple scars from previous surgical interventions.

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