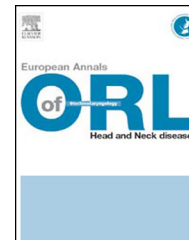




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TECHNICAL NOTE

BAHA implant: Implantation technique and complications

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KEYWORDS

BAHA;
Hypertrophic scar;
Skin complications;
Surgical technique;
Skin graft;
Skin flap

Summary

Objectives: BAHA implants have been shown to be effective in certain forms of conductive hearing loss, but the presence of the titanium abutment is responsible for sometimes severe skin reactions. The objective of this study was to compare two operative techniques: skin flap, and full-thickness skin graft.

Material and methods: Between January 2004 and January 2011, 72 patients were treated by BAHA implant and 32 of these patients (total of 41 implants) were included in the study. Two surgical techniques were used: full-thickness skin graft ($n=21$) and skin flap ($n=20$).

Results: Four types of skin complications were observed: necrosis, inflammation/infection, hypertrophic scar, and fixture loss due to inadequate osseointegration. Complications requiring surgical revision were observed in 20% of cases with the skin flap method and 38% of cases with the skin graft technique, with no significant difference between the two groups ($P=0.31$).

Conclusion: The skin graft technique appears to be associated with a higher rate of major complications. The most common complication is hypertrophic scar. The apparently high complication rate in this series can be explained by a selection bias (exclusion of a large number of complication-free patients).

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Introduction

Bone-anchored hearing aids (BAHA) are indicated in patients with conductive or mixed hearing loss unsuitable for conventional air conduction hearing aids and ineligible for surgical rehabilitation. The indications for BAHA have been more recently extended to unilateral sensorineural hearing loss, as several studies have demonstrated improved speech understanding in noise and improved hearing comfort

related to attenuation of the “screen” effect of the head in these patients, under certain conditions.

These hearing aids, initially developed by Tjellström and Carlsson (Göteborg) in 1977, are based on the concept of osseointegration described by Branemark several years previously. Branemark demonstrated, in animals and then in man, perfect integration of titanium prostheses implanted in the maxilla and mandible.

Due to the presence of a foreign body in contact with the scalp, skin reactions are commonly observed and can sometimes lead to severe complications [1]: skin necrosis, infection, hypertrophic scar, and defective osseointegration possibly responsible for fixture loss. Holgers et al. proposed a 5-stage classification of increasing severity of implant (from

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grade 0: no reaction, to grade 4: infection requiring removal of the implant).

The BAHA surgical implantation procedure is simple, but requires compliance with certain basic principles to minimize the postoperative complication rate. Many surgical variants concerning the skin incision have been described, all designed to reduce these complications. However, no technique has been clearly demonstrated to be superior and the technique used essentially depends on the team's usual practice.

Our team in Strasbourg has been implanting BAHAs since 1992. The technique initially used consisted of creating an anterior- or superior-based U-shaped skin flap, but this technique appeared to be associated with a high postoperative skin complication rate. Since 2005, we have simplified our technique by performing a thinned circular full-thickness skin graft raised directly at the site of implantation. The objective of this study was to compare these two techniques in terms of complications and to compare our results with those of the various published series.

Material and methods

Patients

The study design consisted of retrospective review of the medical charts of 72 patients included on the basis of the following criteria: unilateral or bilateral BAHA implant placement, patients of all ages, operated between January 2004 and January 2011. Forty cases were excluded from this study (22 skin grafts and 18 skin flaps) because of missing data in the medical charts or the most recently operated patients with less than 1 year of postoperative follow-up. Thirty two patients satisfying all of these criteria were therefore included in the study. Twenty-nine of these 32 patients presented unilateral/bilateral conductive or mixed hearing loss and three presented unilateral cophosis. Several BAHAs were implanted in six patients because of skin complications. Two patients received bilateral BAHA implants: this series therefore comprised a total of 41 BAHA implants.

Twenty one of the 41 implants were implanted according to the skin graft technique and 20 were implanted according to the skin flap technique. In the first group, the mean age at the time of implantation was 35.3 years and the sex ratio was 0.48. In the second group, the mean age at the time of implantation was 36.3 years and the sex ratio was 0.55. Both groups comprised a similar proportion of children under the age of 16 years: eight on 21 in the skin graft group, and seven on 20 in the skin flap group ($P=1$). Comorbidities likely to affect healing were investigated (diabetes, long-term corticosteroid therapy, obesity, smoking, atopy). These risk factors were identified in 29% (6/21) of patients of the skin graft group and 15% (3/20) of patients of the skin flap group, with no significant difference between the two groups ($P=0.45$). Mean follow-up was 4 years (range: 1–11 years).

Surgical technique

Four senior surgeons perform BAHA implantation in our institution. The skin flap technique was gradually abandoned from 2005 onwards. Only the skin graft technique is used at

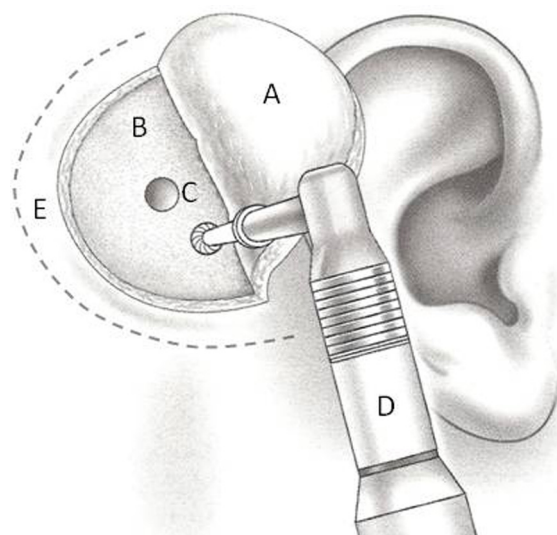


Figure 1 Anterior-based skin flap technique. A. Anterior-based flap. B. Periosteum. C. Countersink. D. 2 or 3 mm long cutting drill. E. Zone of thinning of the subcutaneous tissue around the implant.

Portmann M, Manuel pratique de chirurgie otologique, Elsevier Masson, 1997.

the present time. No bias related to learning of a new surgical technique was observed, as this is a simple procedure used in other indications. Two techniques were therefore used: anterior-based U-shaped skin flap and, more recently, the circular full-thickness skin graft raised from the implantation site.

Both techniques are performed under local or general anaesthesia. The procedure starts with identification of the implantation site, which must be extensively shaved, situated posteriorly and slightly superiorly to the external ear, generally 5.5 cm from the external auditory canal. Implantation may be facilitated by using a phantom implant, which must not be in contact with the ear. After antisepsis and placement of sterile drapes on the operative field, the subcutaneous tissue is infiltrated with local anaesthetic, preferably with adrenaline.

In the skin flap technique, a 3 to 4 cm rectangular or semicircular incision centered on the implant position is performed (Fig. 1). The scalpel is not placed perpendicular to cortical bone, but at an angle in order to harvest a maximum of subcutaneous tissue present underneath the edges of the skin around the implant. The flap is then reclined anteriorly, sparing the periosteum which must be simply perforated over the site of implantation of the screw. The fixture is then inserted according to the principles described by Branemark: a countersink, 3 or 4 mm long depending on the thickness of the bone, is drilled using a high speed cutting drill. This countersink is then enlarged with a bone rasp to the shape and diameter of the implant. Finally, a 3 or 4 mm self-tapping fixture is screwed at low speed perpendicularly to the bone. All these procedures must be performed under abundant irrigation to prevent heating of the bone that can interfere with osseointegration. The skin flap is subsequently thinned with a scalpel blade, in a subdermal plane removing the hair follicles: the flap must be hairless

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