

Concentrated Growth Factor enhances Epithelialization after Mastoid Obliteration in Endoscopic Transcanal Canal Wall Down Mastoidectomy

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ABSTRACT

Background: Chronic otitis media with cholesteatoma often requires canal wall down mastoidectomy, even though effective in disease clearance, results in an open mastoid cavity prone to delayed epithelialization and persistent discharge. Mastoid obliteration has been employed to reduce cavity-related complications; however, optimal healing remains a challenge. Concentrated growth factors, an autologous platelet concentrate rich in growth factors, have shown potential in enhancing tissue regeneration and wound healing. **Objective:** To evaluate the efficacy of Concentrated Growth Factor (CGF) combined with Hydroxyapatite (HA) versus HA alone in mastoid cavity obliteration following Canal Wall Down (CWD) mastoidectomy, specifically focusing on the rate and quality of epithelialization. **Methods:** A total of 60 patients undergoing primary CWD mastoidectomy were enrolled and divided into two groups: those receiving HA alone (n=31) and those receiving a combination of HA and CGF (n=29). Postoperative healing was assessed using otoendoscopy. **Results:** The postoperative complications, such as ear discharge, graft swelling, and signs of poor vascularisation, were more frequent in the HA group than the CGF/HA group. A significantly higher proportion of patients in the CGF/HA group achieved complete epithelialization within 60 days. **Conclusion:** The addition of CGF into mastoid cavity obliteration significantly accelerates epithelialization and shortens the recovery period following CWD mastoidectomy. These findings suggest that CGF is a highly effective biological adjunct in otologic surgery. **Keywords:** Cholesteatoma, Concentrated growth factor, Canal wall down mastoidectomy, Mastoid obliteration

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INTRODUCTION

The surgical management of cholesteatoma mainly involves either Canal Wall Up (CWU) or Canal Wall Down (CWD) Mastoidectomy. While CWU preserves anatomical integrity, it is associated with higher recurrence rates. In contrast, CWD Mastoidectomy effectively reduces recurrence but results in a large mastoid cavity with several postoperative challenges. These include delayed epithelialization, granulation tissue formation, persistent otorrhea, increased susceptibility to infection, the need for long-term cavity care, and complications related to the fitting of traditional hearing aids [1].

Mastoid obliteration has increasingly been employed to handle these issues by reducing cavity size using biological or synthetic materials [2].

The transcanal otoendoscopic approach to mastoidectomy limits the availability of autogenous materials such as cartilage or pedicled periosteal flaps for cavity obliteration. Therefore, artificial substitutes like Hydroxyapatite (HA), bioactive glass S53P4, and their derivatives have become increasingly common in Canal Wall Down (CWD) procedures [3-8]. However, without adequate coverage, synthetic particles are prone to displacement from the mastoid cavity, and a persistent risk of infection remains [5,6].

To reduce these issues, this study utilises Concentrated Growth Factor (CGF), the latest generation of blood-

derived platelet concentrate. Unlike Platelet-Rich Plasma (PRP), CGF contains a varied array of growth factors that effectively promote cell proliferation, migration, differentiation, angiogenesis, and osteogenesis [9].

While CGF has been successfully applied in oral, maxillofacial, and nasal surgeries to treat defects and enhance healing, its application in otologic surgery is still evolving [10].

This study intends to evaluate the role of CGF in improving epithelialization following mastoid obliteration in CWD Mastoidectomy.

MATERIALS AND METHODS

This is a prospective study including 60 adult patients who underwent primary Canal Wall Down (CWD) Mastoidectomy for middle ear cholesteatoma between December 2019 and October 2025. The study was conducted at a tertiary care centre. Informed consent was obtained from all participating patients. Patients requiring revision surgery, those with malignancy, or those with systemic infections were excluded.

Patients underwent otoendoscopic examination to assess for retraction pockets and accumulation of keratin debris on the tympanic membrane. Pure-tone audiometry and computed tomography (CT) of the temporal bone were performed. Patients were randomly allocated to one of two groups: those receiving HA alone (n=31) and

those receiving a combination of HA and CGF (n=29). All patients were followed up for at least six months postoperatively.

CGF Preparation:

Autologous venous blood (9 mL) was centrifuged using a variable-speed protocol to obtain CGF. The fibrin layer was isolated and compressed to form a membrane.

Mastoid Obliteration:

Following disease clearance via CWD Mastoidectomy, for the HA group, the cavity was filled with HA and covered with cartilage; for the CGF/HA group, HA was covered with CGF membrane before cartilage placement, as shown in Figure 1.

Follow-up:

Patients were followed up on postoperative day 20, with subsequent visits every two weeks until the surgical cavity achieved complete epithelialization.

Evaluation of Complete Epithelialization:

Complete epithelialization was defined as the total coverage of the mastoid cavity and incision site with healthy, vascularized epithelium, in the absence of granulation tissue, moisture, oedema, infection, or HA particle shedding.

Scoring System:

A score of 3 was assigned for complete epithelialization achieved within 30 days; scores of 2, 1, and 0 were assigned for durations of 30–60 days, 60–90 days, and more than 90 days, respectively.

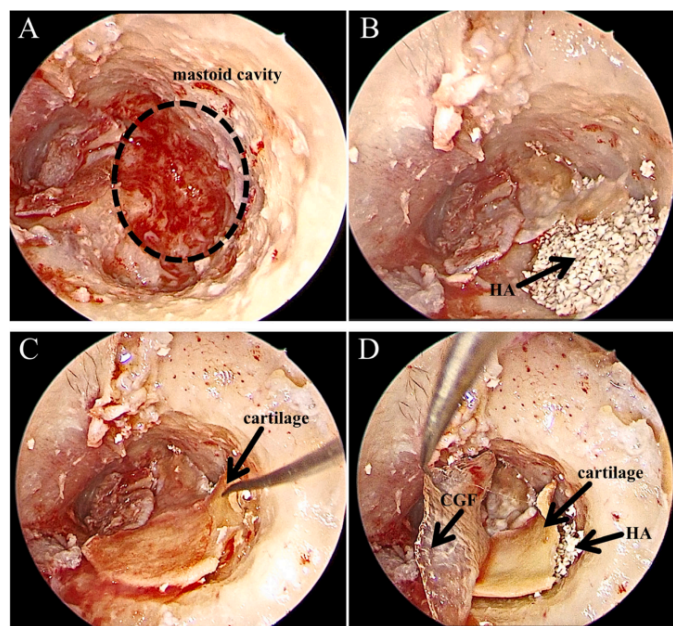


Figure 1. (A) Cavity created following CWD Mastoidectomy. (B) Cavity packed with HA. (C) The HA-filled mastoid cavity is covered with tragal cartilage. (D) A CGF membrane is applied over the HA and tragal cartilage as a covering layer.

RESULTS

The median age of patients was 40 years; demographic distribution was comparable between groups.

Under otoscopy evaluation of postoperative healing, granulation tissue was frequently observed at the incision sites and within the central mastoid cavity in the HA group, with two cases exhibiting ear discharge and a moist cavity. Conversely, the CGF/HA group displayed superior healing; the mastoid cavities remained clear and were rapidly lined with healthy, vascularized epithelium.

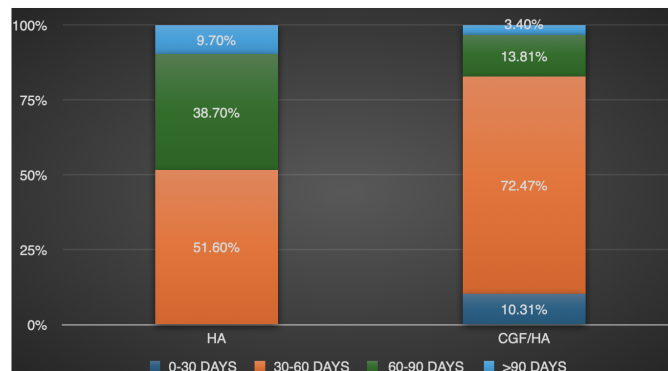


Figure 2. Proportion of patients according to postoperative epithelialization time in the HA-treated group versus the CGF/HA group (* $p < 0.05$).

In the CGF/HA group, 10.3% of patients achieved complete healing within 30 days, 72.4% within 30–60 days, 13.8% within 60–90 days, and 3.4% required more than 90 days. In contrast, no patients in the HA group achieved complete epithelialization within the first 30 days, and only 51.6% reached completion within 30–60 days, 38.7% in 60–90 days, and 9.7% required more than 90 days. Statistical analysis showed significantly higher early epithelialization in the CGF/HA group ($p < 0.05$) (Figure 2).

The modified scoring system showed that the CGF/HA group had significantly higher median scores, indicating faster healing, than the HA group ($p < 0.05$).

The results strongly support the efficacy of CGF as a biological adjunct in promoting rapid and stable wound healing following CWD Mastoidectomy.

DISCUSSION

In our study, CGF considerably enhances epithelialization following mastoid obliteration. Patients receiving CGF showed faster healing, reduced complications, and improved cavity status.

The main mechanism by which CGF promotes epithelialization resides in its specialised fibrin matrix. The CGF membrane provides a stable three-dimensional scaffold that facilitates the adhesion and proliferation of leukocytes and platelets, while guaranteeing the continuous release of essential growth factors [12,13,14].

Its autogenous nature eliminates the risk of tissue rejection or histocompatibility issues. The clinical efficacy of Concentrated Growth Factor (CGF) combined with Hydroxyapatite (HA) amounts to a significant advancement over standard techniques. Liu et al. demonstrated that this combination significantly accelerates mucosal healing, achieving superior epithelialization within 60 days post-surgery compared with HA alone ($p = 0.032$) [11]. This biological synergy addresses a common limitation of purely synthetic materials; for instance, while Sun et al. noted that bioceramic scaffolds like HA provide excellent structural durability and success rates exceeding 90%, they frequently lack the intrinsic regenerative signals to drive rapid mucosal coverage [15].

Compared with traditional autologous materials, Mishra et al. found that bioactive glass and bone dust can achieve a high "dry ear" success rate of 95.59%. Yet, the healing process is often protracted [16]. This is further supported by Harun et al., who reported a mean time to achieve a dry mastoid bowl of 18.6 weeks when using standard obliteration protocols [17]. By contrast, the

inclusion of CGF as described by Liu et al. shifts the healing trajectory closer to the 8-week mark. Furthermore, Lindeboom et al. reported that while HA is superior to bone pate in terms of lower infection rates and lowered resorption, it is the addition of autologous growth factors that provides the necessary "bio-activation" to optimise early-stage surgical outcomes [18].

The present study is limited by its relatively smaller sample size. Although complete cavity healing was observed in all patients during follow-up, these outcomes should be interpreted cautiously, as delayed healing can occur. They may be more apparent in bigger cohorts. Further multicenter studies with longer follow-up are necessary to validate the reproducibility and generalizability of these outcomes.

CONCLUSION

The application of CGF in mastoid cavity obliteration significantly improves epithelialization rates and reduces postoperative morbidity following CWD Mastoidectomy. CGF is a safe, effective, and easily accessible biological adjunct that improves surgical outcomes.

Further prospective, randomised studies should be conducted to validate these findings and assess long-term advantages.

REPORTING, DATA & REGISTRATION

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Clinical trial registration

Clinical trial registration is not applicable: this manuscript does not report a prospectively registered clinical trial.

DECLARATIONS

Conflict of Interest

The authors declare that they have no conflict of interest relevant to the content of this article.

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Ethical Clearance

This article does not contain any studies with human participants or animals performed by any of the authors; therefore, ethical clearance is not applicable. Written informed consent was obtained from all individual participants (or their legal guardians) included in the study.

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