Mastoid obliteration with bioactive glass: A comparative analysis of long-term outcomes

Ruwan Kiringoda, M.D.[1] and Larry Lustig, M.D.[2]
[1]Mass Eye and Ear Infirmary / Harvard Medical School, Boston MA
[2]Columbia University Medical Center, New York, NY

ABSTRACT

Objectives: We sought to compare the use of bioactive glass to autogenous materials (fascia, cartilage, periosteum) for cavity obliteration following CWD mastoidectomy.

Study design:
Retrospective review

Methods:
Single surgeon study from 2008 to 2014, 36 patients underwent 37 CWD procedures with bioactive glass cavity obliteration and 32 patients underwent 33 procedures with native material obliteration. Operative reports and all documented postoperative clinical visits were reviewed. Complications and need for reoperation were compared between groups.

Results:
There were no significant differences in rates of postoperative infection or persistent drainage requiring medical intervention (13.5% in the bioactive glass group, versus 12.12% in the native obliteration group). Similarly, there was no significant difference in need for revision mastoidectomy (2.7% with bioactive glass, 6.1% with autogenous material obliteration).

Conclusions:
Bioactive glass, which stimulates osteogenic cells to produce mitogenic growth factors and form trabecular bone, is safe and effective for obliteration of mastoid cavity defects. There is no evidence of increased postoperative infection rate when using bioactive glass, nor is there an increased need for revision mastoidectomy on long-term followup.

CONTACT

Ruwan Kiringoda, M.D.
Mass Eye and Ear Infirmary
Ruwan_KIringoda#@meei.harvard.edu

BACKGROUND

A major goal following canal wall down tympanomastoidectomy is the creation of a dry mastoid cavity that is easy to maintain. Large, open cavities may result in unwanted caloric stimulation, inability to wear a hearing aid, need for permanent water precautions, and painful cleaning.

Mastoid obliteration aims to reduce size of the cavity, promote ease of cleaning, and allow for a long term healthy and functional ear. The choice of obliterative agent includes autologous and synthetic materials.

An ideal obliterative agent is biocompatible, infection resistant, easy to use, and maintains its volume over time.

Bioactive glass is a synthetic bone substitute which stimulates osteogenic cells to produce mitogenic growth factors and form trabecular bone.

Few studies have looked at long term outcomes following bioactive glass obliteration of the mastoid in CWD surgery.

METHODS AND MATERIALS

- Study design: Retrospective, single surgeon study from 2008 to 2014
- All patients undergoing primary or revision CWD mastoidectomy and cavity obliteration with bioactive glass or native materials with a single surgeon (LRL) from 2008 to 2014 were included.
- Exclusion criteria: Patients with less than 1 year of postoperative followup were excluded
- Operative reports and all documented postoperative clinical visits were reviewed. Complications including infection or drainage requiring medication, and need for reoperation were compared between groups

DEMOGRAPHICS

	Bioactive Glass	Non-Bioactive Glass
Number of Procedures	36 patients, 37 procedures	32 patients, 33 procedures
Age	44.1 ± 18.4 years	43.1 ± 14.1 years
Number Female	18 (49%)	17 (52%)
Prior CWU	13 (35%)	11 (33%)
Prior CWD	6 (16%)	6 (18%)
Mean Followup	2.6 ±.8 yrs	2.5 ± 1.6 yrs

Table 1: Patient demographics

RESULTS

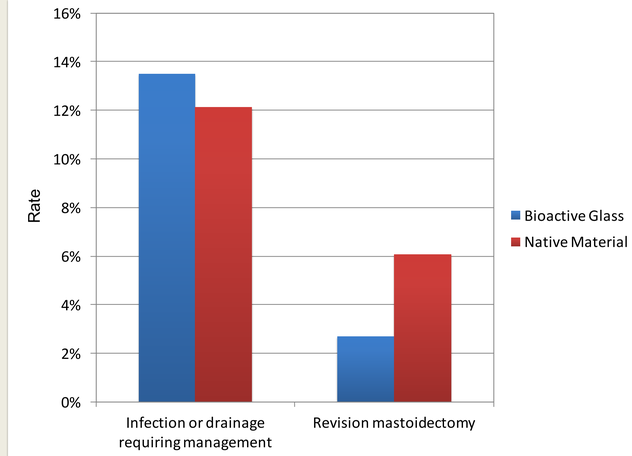

Figure 1: Rates of postoperative infection and need for revision mastoidectomy following mastoid obliteration. There was no significant difference in the rate of postoperative infection or drainage requiring intervention (p=0.86). There was no significant difference in the rate of need for revision mastoidectomy (p=0.48).

Pt	Procedure /Indication	Bioactive Glass?	Duration from surgery	Notes
JV	37y M s/p CWU mastoidectomy for cholesteatoma	Yes	.13 years	Persistent postop pain, elected for removal
LW	54 y woman with prior CWD mastoidectomy with recurrence	No	4.9 years	Recurrent middle ear cholesteatoma and canal stenosis
BC	64y woman w large epi/mesotympanic cholesteatoma	No	4.1 years	Recurrent cholesteatoma

Table 2: Indications for revision mastoidectomy following CWD surgery

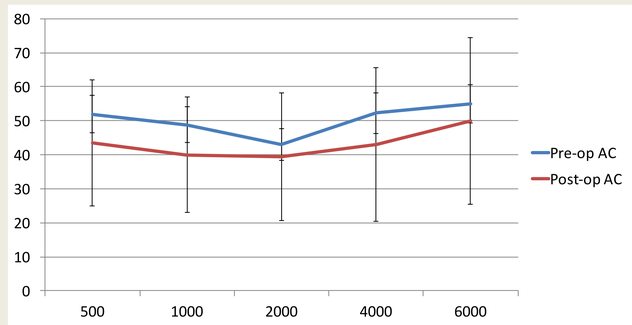

Figure 2: Pre- and post-op air conduction demonstrates improvement in ABG following CWD mastoidectomy with bioactive glass obliteration. There was no significant difference in change in ΔABG between the bioactive glass and non-bioactive glass groups (not pictured).

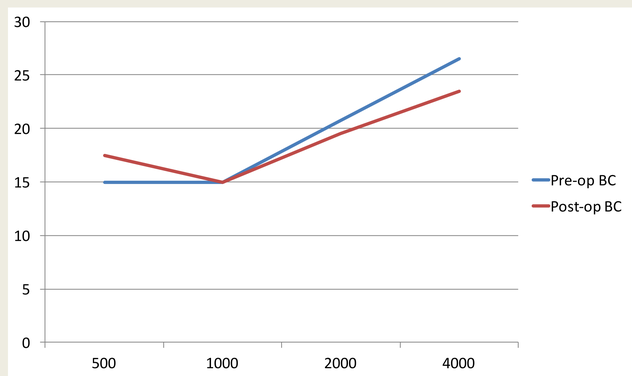

Figure 3: Pre- and post-operative bone conduction thresholds following mastoid obliteration with bioactive glass. No significant postoperative changes in bone conduction thresholds.

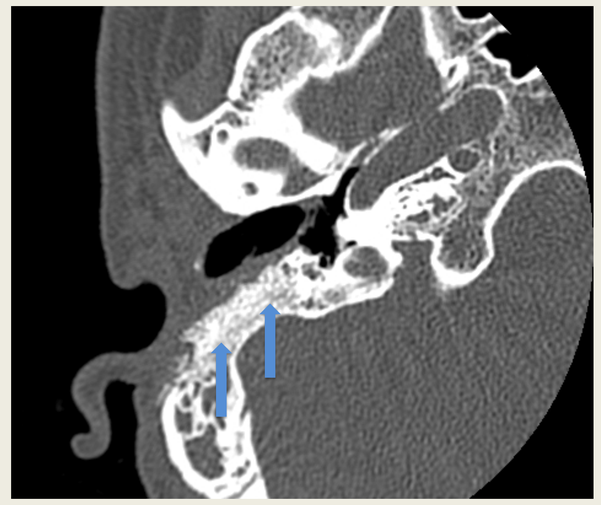

Figure 4: CT scan at 1 year post-op demonstrates osseointegrated appearance of bioactive glass granules (blue arrows) with intact posterior canal wall reconstruction.

DISCUSSION

- There is no evidence of increased postoperative infection rate following mastoid obliteration using bioactive glass, nor is there an increased rate of revision mastoidectomy on long-term followup.
- No instances were noted of granule infection or extrusion requiring removal of the bioactive glass.
- Audiometric outcomes are satisfactory, with no significant differences with different techniques for obliteration.
- No significant changes noted in pre-and post-op bone conduction thresholds following use of bioactive glass, suggests a lack of ototoxicity

CONCLUSIONS

- Overall, bioactive glass is safe and effective for obliteration of mastoid cavity defects following canal wall down surgery
- No adverse short or long term outcomes are apparent, compared to obliteration with native biologic materials.
- Potentially, bioactive glass allows for decreased time spent in the OR harvesting native material, with additional associated cost.
- Additional long-term prospective and cost-benefit analyses are needed to better characterize the role of bioactive glass for mastoid obliteration.

REFERENCES

1. Stoor P, Pulkkinen J, Grenman R. Bioactive glass S53P4 in the filling of cavities in the mastoid cell area in surgery for chronic otitis media. *Ann Otol Rhinol Laryngol.* 2010;119(6):377-382.
2. Silvola JT. Mastoidectomy cavity obliteration with bioactive glass: a pilot study. *Otolaryngol Head Neck Surg.* 2012;147(1):119-126.
3. Bernardeschi D, Nguyen Y, Russo FY, Mosnier I, Ferrary E, Sterkers O. Cutaneous and Labyrinthine Tolerance of Bioactive Glass S53P4 in Mastoid and Epitympanic Obliteration Surgery: Prospective Clinical Study. *Biomed Res Int.* 2015;2015:242319