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What the Temporal Bone has Always Known History, Evidence, and the Quiet Correction of Received Wisdom in Otologic Surgery

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ABSTRACT

Much of what has been taught and practised in chronic otitis media surgery over the past century was not evidence-based. It was consensus-based — a set of received positions transmitted from teacher to trainee with the authority of tradition rather than data. The dry ear prerequisite. The mandatory mastoidectomy. The uncritical preference for one canal wall strategy over another. Each has been challenged by evidence, and each has proved more fragile than its proponents believed. This article argues that this pattern is intrinsic to the history of temporal bone surgery, which has always been conducted at the intersection of what surgeons believed and what the bone eventually demonstrated. The figures who built modern otologic surgery were, at their best, willing to follow the evidence wherever it led — including away from their own most influential work. That disposition is what the current generation of otologic surgeons most needs, and what the history of this discipline most clearly models.

Keywords: Chronic otitis media, Tympanoplasty, Mastoidectomy, Cholesteatoma, Canal wall surgery, Evidence-based otology, Cochlear implantation, History of otolaryngology.

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INTRODUCTION

In 2023, I was invited to deliver the Prof. Dr. S. L. Jaiswal Oration at VENTCON Gondia. The invitation felt like an occasion that called for honesty rather than a review of current technique. The title I chose was: 'The Mistakes We Have Made in Treating Chronic Otitis Media, and the Lessons We Have Learnt.' This article expands that oration within the broader history of temporal bone surgery. The clinical argument and the historical argument are, in this case, the same argument.

The Temporal Bone as Teacher of Humility

Harold Schuknecht of Harvard — who built a collection of over one thousand temporal bones and used it to describe the four types of presbyacusis — once called this structure the most complex cubic centimetre in the human body. He did not say the most difficult. He said the most complex. Complexity invites inquiry; difficulty implies defeat.

The temporal bone has been teaching its lessons since before anaesthesia. Gabriele Fallopio described the bony canal of the facial nerve in 1561 **(Figure 2)**, using no instrument more powerful than a spectacle-maker's lens. Bartolomeo Eustachi described the pharyngotympanic tube in 1563 **(Figure 3)** - but his anatomical atlas was lost for 150 years and only published in 1714. Vesalius named the malleus and incus in 1543 **(Figure 4)**, the same year Copernicus published his heliocentric model. These men had no drills, no suction, no imaging. They had a candle, a scalpel, and a willingness to look at what was actually there.

Figure 1: Andreas Vesalius, De Humani Corporis Fabrica (1543) — Seventh Muscle Table woodcut. Vesalius named the malleus and incus in the same work. The dramatic illustrations set a new standard for anatomical representation. Public domain.

William MacEwen of Glasgow formalised the suprameatal triangle in 1893 as a reproducible landmark for mastoid access. Harvey Cushing wrote candidly about the terror of sigmoid sinus bleeding, noting that the difference between a controlled field and catastrophe was often a single misjudged hammer blow. The history of temporal bone surgery is largely a history of received positions being dismantled by evidence that came too late to prevent their propagation

The Ossicular Chain — Anatomy and the History of Its Naming

Vesalius named the malleus and incus in 1543. The stapes was described by Eustachi shortly after, noting its resemblance to a stirrup **(Figure 5)** — an equestrian metaphor in an age when cavalry still shaped wars. The naming of these three bones by men working without magnification remains one of the most precise pieces of anatomical observation in the history of medicine. The mechanical logic of the ossicular chain — impedance matching between air and fluid, amplification through lever action and area reduction — was not understood for another three hundred years. The names were exactly right from the beginning.

The Dry Ear Prerequisite: A Requirement Without Evidence

For most of the twentieth century, deferring tympanoplasty until the ear was dry was treated as self-evident. The logic was intuitive but untested. Robert Mills and colleagues, reporting in the Laryngoscope in 2013, concluded:[1]

> *"Active discharge at the time of surgery does not have an adverse effect on the outcome of myringoplasty operations and is not a reason to postpone surgery."*

A retrospective analysis from the Gruppo Otologica in Piacenza, examining 323 patients operated between 1983 and 1993 — including ears discharging severely at surgery — showed no statistically significant difference in graft success rates or hearing outcomes. I have been operating on wet ears for a long time and have found no difference in the take-up rate of the graft. Now, before anyone accuses me of false self-belief, my juniors have been doing the same for the past 12 years with the same excellent take-up rates. There is a peculiar advantage in operating on wet ears- the demarcation between healthy and unhealthy portions of the tympanic membrane is very evident, and removal of the diseased portion extensively creates a dry and well-healed ear. Schuknecht famously wrote, "an otologist should not worry about making a small perforation into a big one before grafting". That is evidently very true.

Is Mastoidectomy Necessary? A Question We Stopped Asking

The routine addition of mastoidectomy to tympanoplasty for mucosal COM was performed for years on the basis of a theory — that the mastoid acts as a reservoir of infection. A retrospective review of 484 patients undergoing repair of simple tympanic membrane perforations showed tympanic membrane repair equally effective in both groups at 91%, with comparable

Figure 2: Gabriele Fallopio (1523–1562), from the oil portrait in the Istituto Anatomico, Modena. He described the facial nerve canal, chorda tympani, semicircular canals, and cochlea. He died aged 39. Public domain.

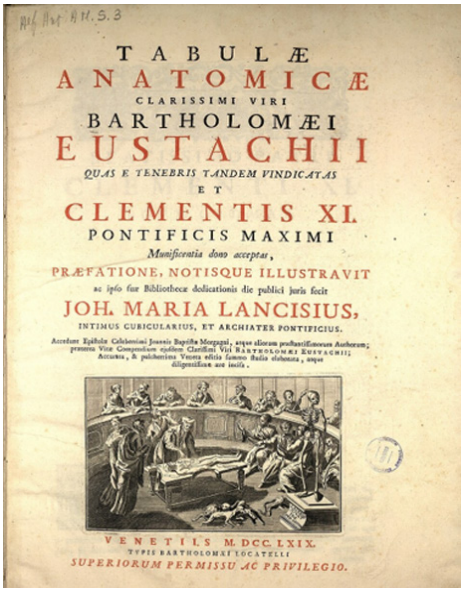

Figure 3: Bartolomeo Eustachi, Tabulae Anatomicae title page, Venice 1769. Subtitle: 'rescued from darkness at last' (Quas e Tenebris Tandem Vindicatas). Written c.1563, lost for 150 years. Public domain. the facial nerve canal, chorda tympani, semicircular canals, and cochlea. He died aged 39. Public domain.

hearing results. Most complications of tympanoplasty occur during the mastoidectomy component. Our own MESIARC data **(Figure 6)** confirmed during the COVID period showed no difference in graft uptake or hearing results when we ceased routine mastoidectomy for mucosal COM. For long, I had believed that mastoidectomy was unnecessary for an increased graft take-up rate, but was following principles taught over the ages, which we were afraid to question. It must be the attitude of every budding otologist, even if today practising only on the temporal bone, to question every belief and make changes if science demands it.

The Stapes and the Human Cost of Progress

Julius Lempert spent the 1930s and 1940s transforming the fenestration operation into a reliable single-stage technique. In 1952, Samuel Rosen was performing a routine manoeuvre during a fenestration when the stapes footplate moved freely beneath his instrument — stapes mobilisation discovered by accident. He taught it widely. Refixation rates were high and the technique did not last. John Shea of Memphis delivered the definitive answer in 1956: stapedectomy with prosthetic reconstruction. The results were transformative and durable.

Shea had trained under Rosen. The student's operation made the teacher's obsolete. Rosen is said to have experienced a genuine despondency as Shea's results accumulated and the surgical community moved decisively away. The man whose serendipitous

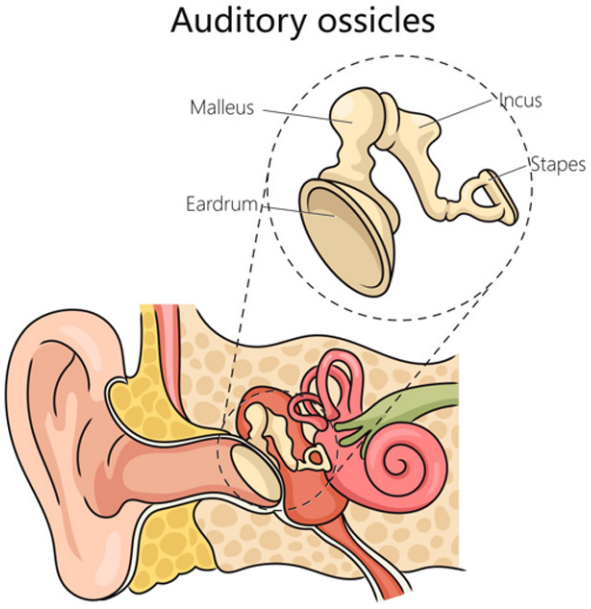

Figure 4: Auditory ossicles with middle ear cross-section — the ossicular chain showing the eardrum, malleus, incus, and stapes in anatomical relationship to the cochlea. © Depositphotos.

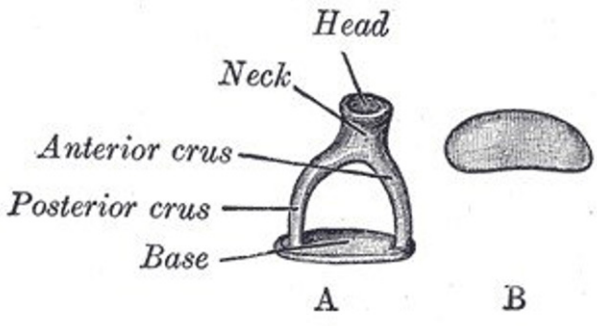

Figure 5: The stapes — head, neck, anterior crus, posterior crus, and base (footplate, B). The smallest bone in the human body, named for its resemblance to a stirrup. Public domain.

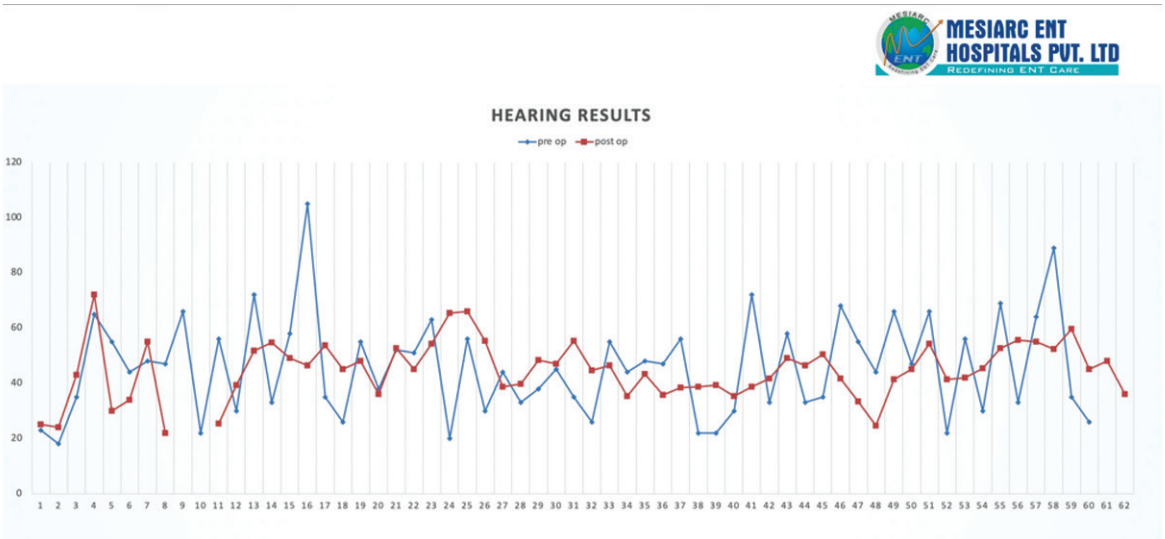

Figure 6: MESIARC hearing results — pre-operative (blue) versus post-operative (red) pure tone averages across 62 consecutive tympanoplasty cases. Consistent post-operative improvement across the series. MESIARC ENT Institute, Kozhikode.

observation opened the door watched his student walk through it further than he ever could. Rodney Perkins of Stanford completed this arc in the 1980s with KTP laser stapedotomy. From Lempert's single-stage fenestration to laser-drilled stapedotomy spans barely forty years. The dominant operation changed three times within a single surgical lifetime.

The Canal Wall Debate: Smyth's Reckoning

Gordon D.L. Smyth of Belfast published 'Combined Approach Tympanoplasty' in the Archives of Otolaryngology in 1969.[2] A monograph followed, circulating widely through postgraduate programmes internationally. Sixteen years later, Smyth published 'Cholesteatoma Surgery: The Influence of the Canal Wall' in the Laryngoscope (January 1985)[3] - a reckoning based on twenty years of his own operative data. His retrospective of 435 intact canal wall cases showed recurrent cholesteatoma in 7% and residual disease in 1.5%. His conclusion was unequivocal: reduction of cholesteatomatous complications necessitates removal of the canal wall.

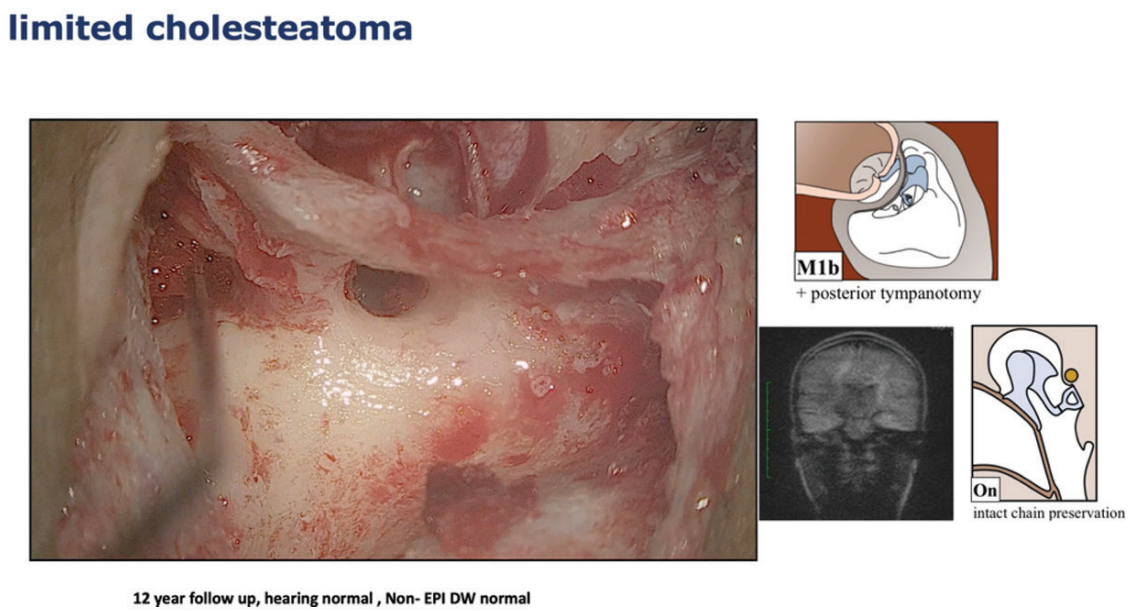

Figure 7: Limited cholesteatoma (M1b staging), intact canal wall procedure with posterior tympanotomy and intact ossicular chain preservation. 12-year follow-up: hearing normal, non-EPI DW MRI normal. The best achievable outcome with canal wall up surgery and maintained surveillance. MESIARC ENT Institute.

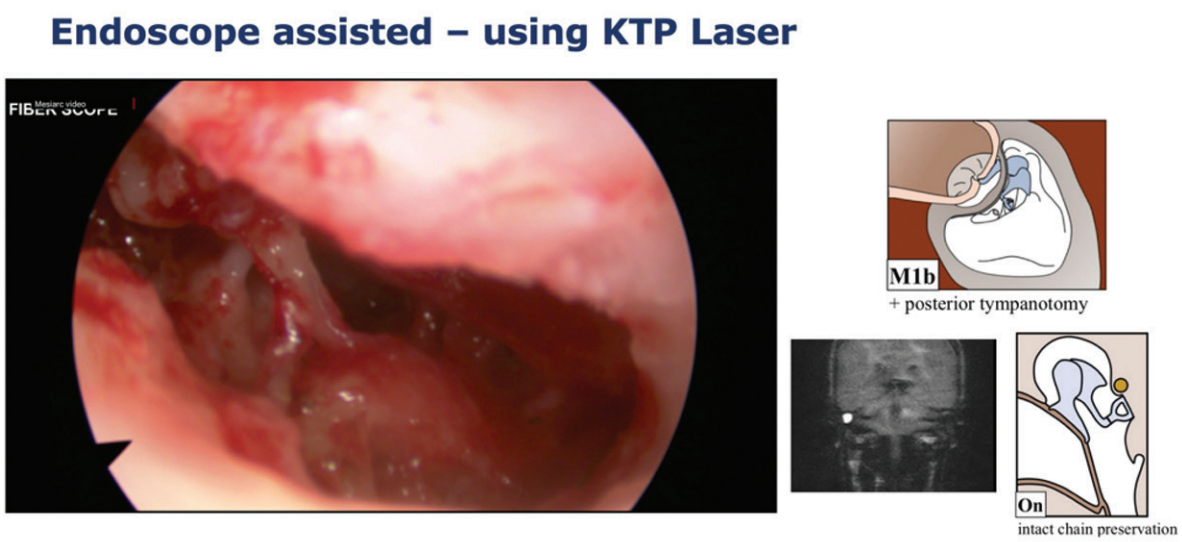

Figure 8: Same disease staging and surgical approach. 13-year follow-up: non-EPI DW MRI demonstrates recidivism — epithelial pearl detected. KTP laser-assisted endoscopic second look performed. The ear appeared entirely normal on otoscopy. 'What looks great may not be good.' MESIARC ENT Institute.

Smyth GDL. Combined approach tympanoplasty. Arch Otolaryngol. 1969;89(2):250-1. Smyth GDL. Cholesteatoma surgery: the influence of the canal wall. Laryngoscope. 1985;95(1).

A surgeon publicly dismantling the position his most widely read work had established, using his own long-term data — that is rare, and it is the correct behaviour. The lesson is not that Smyth was wrong in 1969. The evidence then could not have shown what twenty years of follow-up would reveal. The lesson is what he did when the evidence matured.

The MESIARC Treatment Algorithm for Squamous Disease

The argument that neither canal wall strategy is universally superior demands a structured decision pathway. The algorithm below **(Figure 9)** represents our current institutional protocol, incorporating disease staging, operative approach, post-operative hearing assessment, and the surveillance obligations specific to each pathway.

Case Report: Eleven Years of Follow-Up

Diya S Lal presented at MESIARC at age 5 in 2011 **(Figure 10)** with bilateral disease. She has been followed continuously and returned in May 2022, now aged 17 **(Figure 11).** This case is presented with written parental consent for publication.

The Most Consequential Error the Specialty Made

William House performed the first single-channel cochlear implant in 1961[6] **(Figure 13).** For nearly two decades, the mainstream hearing science community regarded it as dangerous. House was formally censured by the American Otological Society. By the late 1980s, multichannel implants were demonstrating open-set speech recognition and the censure was quietly forgotten. Our programme at MESIARC, initiated in 2002, has now performed over 2,700 paediatric implants **(Figure 12)** and is one of only two Indian member institutions of the HEARRING global consortium. The science that was actively suppressed by the specialty's professional body is now the most rapidly advancing field in rehabilitative otology.

The Trial the Specialty Did Not Want

Lars Thomsen and the Copenhagen group published their randomised controlled trial of endolymphatic sac surgery in the Archives of Otolaryngology in 1981.[4] Patients were randomised to either endolymphatic sac decompression or a sham operation — a cortical mastoidectomy that identified the sac but left it untouched. Both groups improved. There was no statistically significant difference in vertigo control.

Thomsen J et al. Placebo effect in surgery for Ménière's disease: a three-year follow-up study. Arch Otolaryngol. 1981;107(5):271-7.

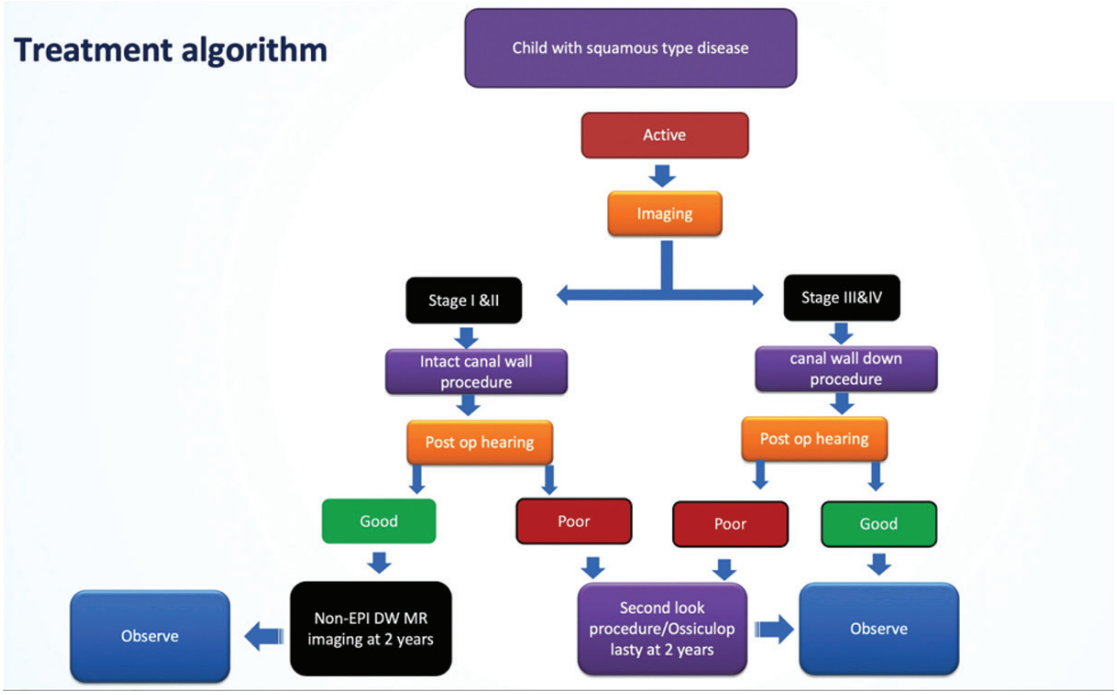

Figure 9: MESIARC treatment algorithm for paediatric squamous disease. Stage I and II: intact canal wall procedure with non-EPI DW MRI at 2 years. Stage III and IV: canal wall down procedure with second-look ossiculoplasty at 2 years if hearing is poor. MESIARC ENT Institute.

The surgical community's response was not gracious. Much of the criticism was the sound of a specialty protecting a procedure it was not prepared to abandon. Endolymphatic sac surgery has never fully recovered its evidence base. The lesson applies equally to the dry ear requirement, the routine mastoidectomy, and the mandatory freshening of perforation edges.

The Surveillance Deficit

If I were to identify the single most consequential ongoing failure in the management of chronic otitis media in this country, it would not be any aspect of operative technique. It would be the inadequacy of post-operative surveillance. Non-EPI DW MRI at two

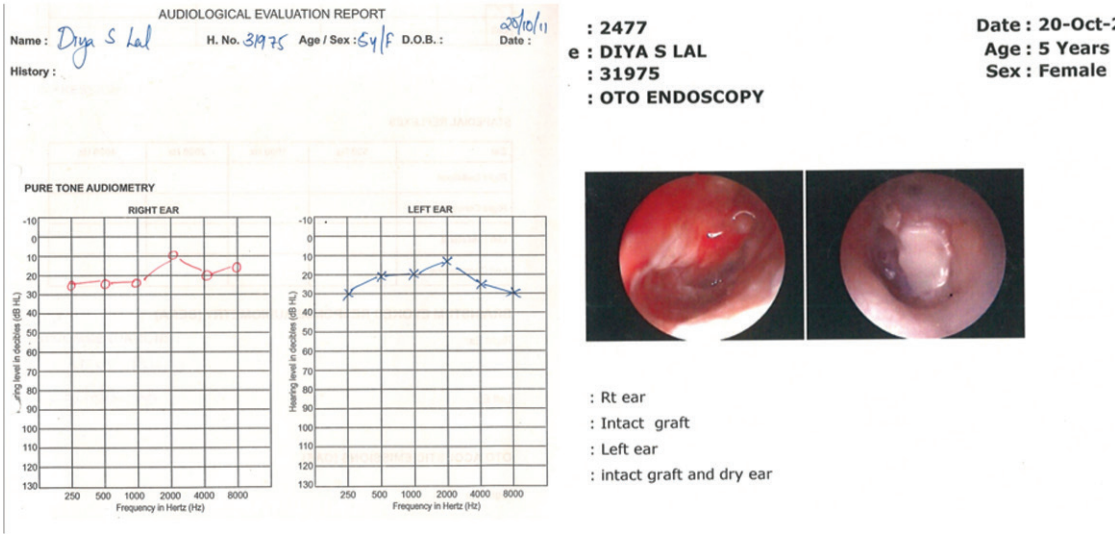

Figure 10: Diya S Lal, aged 5 years, October 2011. Post-operative pure tone audiometry showing near-normal bilateral hearing following bilateral tympanoplasty. Otoendoscopy confirms intact bilateral grafts. MESIARC ENT Institute. Published with written parental consent.

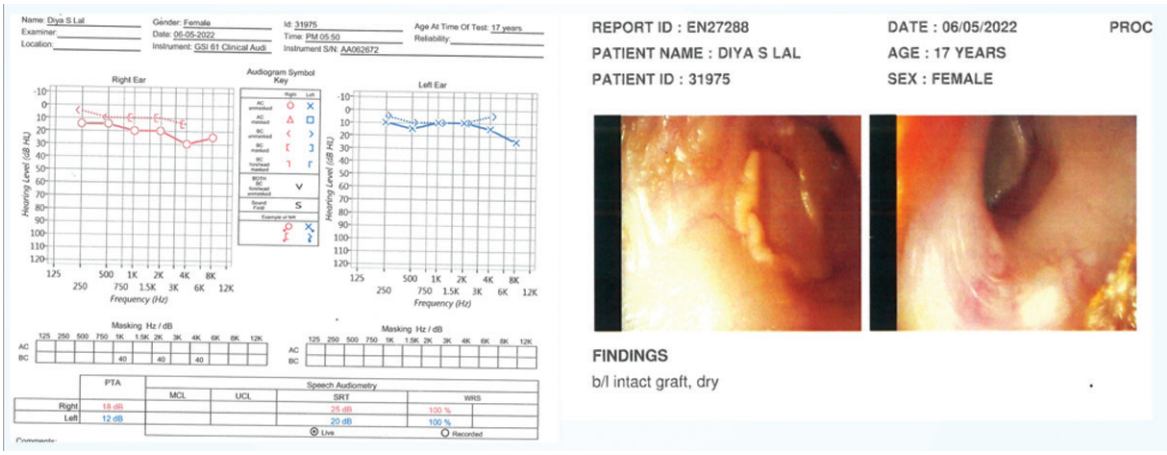

Figure 11: Diya S Lal, aged 17 years, May 2022 — eleven years post-operatively. PTA: right 18 dB, left 12 dB. Bilateral intact grafts, dry. Speech recognition 100% bilaterally. Published with written parental consent.

years following canal wall up surgery is the standard the evidence supports. **Figures 7 and 8** illustrate both faces of this reality — the ear that remained disease-free at twelve years, and the ear that looked identical on otoscopy but harboured an epithelial pearl detectable only on imaging.

Towards Uniform Protocols: What the Evidence Demands

1. A wet ear is not a contraindication for surgery. Active discharge does not adversely affect graft uptake or hearing outcomes in mucosal COM.
2. Routine mastoidectomy does not improve results in mucosal COM. The decision should be based on specific pathological findings in each ear.
3. The role of Eustachian tube function as a determinant of tympanoplasty outcome is less certain than commonly taught. Cartilage tympanoplasty should be considered when chronic negative middle ear pressure is suspected.[7]
4. Canal wall up and canal wall down procedures each have genuine indications. Neither is universally superior. Recidivism rates and Indian follow-up compliance realities must both inform the decision honestly.

Figure 12: Modern cochlear implant external system — sound processor and transmitter coil. © Depositphotos.

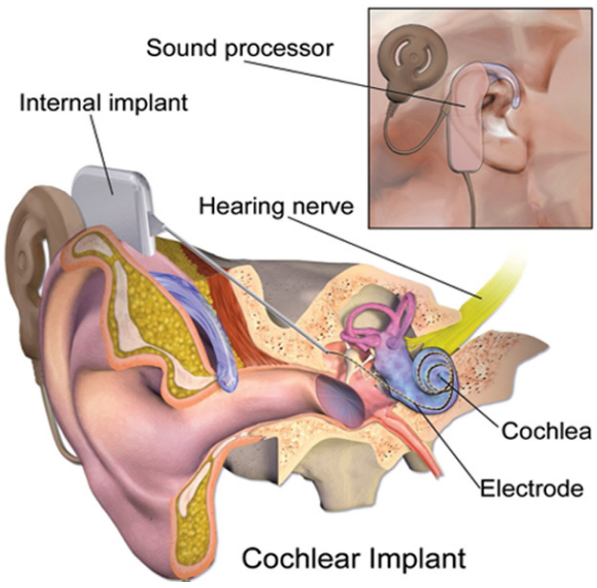

Figure 13: Cochlear implant system — internal implant, electrode array in cochlea, hearing nerve, sound processor, and external coil. CC BY 3.0.

5. Non-EPI DW MRI at two years following canal wall up surgery for cholesteatoma should be standard protocol, not an optional investigation.
6. Prosthesis material in ossiculoplasty is a secondary driver of outcomes.[5] Stapes status, middle ear mucosa, Eustachian tube function, and canal wall status are the primary determinants.

CONCLUSION

The temporal bone has been teaching its lessons for longer than any of us have been listening. What it teaches, beyond anatomy and technique, is a set of intellectual dispositions: the capacity to hold a position with conviction and revise it with honesty; the ability to distinguish between evidence that confirms what we already believe and evidence that requires us to change; the discipline to follow data to their actual conclusions.

Gordon Smyth published his reckoning with his own data sixteen years after the work that established his reputation. Lars Thomsen published a trial that the field did not want to read. William House persisted with cochlear implantation through two decades of censure. Samuel Rosen watched his student make his life's work obsolete and did not pretend otherwise. These are the stories the specialty needs to tell itself.

The case of Diya S Lal, now 17 years old with normal bilateral hearing eleven years after surgery at age five, is the argument for doing this work carefully and following it up faithfully. The bone will continue to teach. The question is whether we are listening.

END NOTE

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