Facial injection of botulinum toxin type A does not improve headache symptoms.

**Classic Article Review**

**Background:** Migraine headaches are a very common disorder that affect approximately one fifth of women and occur less commonly in men. Several medical therapies have been shown to be beneficial in migraine, including several oral medications as well as avoidance of dietary trigger factors. There have been several studies of botulinum toxin type A (BoNTA) for prophylaxis against migraine, but dosages used, muscles injected, and results have been variable. Interpretation is often made difficult by a placebo effect, which is thought to be about 30% for episodic migraine medication trials.

**Objective:** To evaluate the efficacy of BoNTA in treating migraine.

**Design:** Double-blind, randomized placebo-controlled study.

**Participants:** 232 patients with migraine headaches as defined by International Headache Society criteria. Patients were aged 18 to 65 years, with a diagnosis of migraine prior to age 50 years, and had a previous response to acute migraine therapy.

**Methods:** Patients were randomized into 1 of 5 treatment groups: (1) frontal with 10 units of botulinum, (2) temporal with 6 units, (3) glabellar with 9 units, (4) all 3 areas with a total dose of 25 units, or (5) a placebo injection into all 3 areas. It should be mentioned that the groups that had a single area injected had placebo injections in the other areas. Both patients and physicians were blinded to treatment. Patients kept diaries to record the frequency and severity of their migraine headaches from 30 days prior to 60 days after injection. Other standard quality-of-life measures were also used, including headache- and migraine-specific instruments as well as SF-36.

**Results:** No statistically significant differences in migraine frequency or severity were observed in any treatment group. The BoNTA did not demonstrate a significant improvement over placebo in any secondary outcomes including severity, medication use, nausea, or photophobia. Only minor adverse events such as muscle weakness were reported, and the incidence of this was similar in all treatment groups.

**Conclusions:** BoNTA was of no benefit in treating migraine headache in this study.

**Reviewer’s Comments:** Prior studies of botulinum and migraine after had had variable results, with some controlled trials demonstrating significant effects and others not. In the past, botulinum has been more effective in cases where the population of headache patients was less well controlled. Studies such as this current one have attempted to use a better-delineated population of headache patients in hopes of finding a population where this treatment is most effective. The current study failed to find a significant effect of BoNTA on migraine; it may be that this study failed to find a result due to poor choice of injection sites or dosages, but most likely, the role of BoNTA in migraine treatment is likely to be minimal. (Reviewer-Benjamin T. Crane, MD).
The transcochlear and transotic surgical approaches provide good skull-base exposure but at the expense of hearing and substantial risk to facial nerve function when it is rerouted.

**Background:** The transcochlear approach was popularized by House and Hitzelberger in the 1970s in an attempt to address lesions anterior to the internal auditory canal, many of which were previously considered inoperable. The sacrifice of any remaining hearing on the operated canal is the major disadvantage to this approach. Since this approach was developed, there have been many advances in image-guided, endovascular, and endoscopic surgery that have permitted surgery in relatively inaccessible areas using minimal exposure. The transcochlear approach involves rerouting the facial nerve posteriorly, while in the transotic approach, the facial nerve is left in place.

**Objective:** To describe indications, risks, and benefits of the transcochlear and transotic approaches.

**Design:** Retrospective review.

**Participants:** 40 patients who underwent either the transcochlear approach (n=15) or the transotic approach (n=25). Mean age at time of surgery was 45 years, and patients were nearly equal between genders. There was a range of tumors: meningioma, cochlear neuroma, acoustic neuroma, cholesteroloma, and others. Six patients had serviceable hearing prior to surgery.

**Methods:** Patients had surgery between 1995 and 2007. Follow-up after surgery ranged from 1 month to 10 years, with a mean of 2 years.

**Results:** Patients undergoing the transcochlear approach had tumors of average size (4.4 cm), which were significantly larger than those (2.4 cm) of patients who underwent the transotic approach. Of patients, 93% had complete removal of gross tumor. Preoperative facial nerve function was normal in 67% of transcochlear patients and in 80% of transotic patients. A total of 14% of patients had complete paralysis. Intraoperative nerve re-anastomosis was performed in 8 patients. Immediately after surgery, 53% had facial weakness and 36% had total paralysis. At the last visit, 2 of 8 transcochlear patients had facial nerve function of House-Brackmann grade III or better. In transotic patients, 16 of 24 had normal facial nerve function at their most recent follow-up. Postoperative cerebrospinal fluid leak occurred in 3 patients, 2 of whom required operative closure. Other complications included diplopia, dysphagia, imbalance, and death.

**Conclusions:** Transcochlear and transotic approaches provide good skull-base exposure with minimal brain retraction. Disadvantages include complete hearing loss and potential facial nerve weakness.

**Reviewer’s Comments:** It is difficult to argue with the exposure that these procedures allow, and most tumors discussed in this paper would probably not have been resectable through a less-invasive approach. One of the points I take away from this paper is that facial nerve function after the transcochlear approach tends to be poor and usually does not improve with time. This probably occurs due to loss of blood supply during rerouting of the nerve. Based on these data, I would do everything possible to avoid rerouting the facial nerve when operating on a tumor in this region. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Meningioma, Petrous Apex, Clivus, Hearing Loss, Facial Nerve, Transcochlear Approach

Print Tag: Refer to original journal article
Intratympanic gentamicin has a significant benefit for relief of aural fullness and vertigo in patients with Ménière's disease.

**Background:** Intratympanic gentamicin is now considered a standard therapy for Ménière's disease. There have been several large case series and at least 2 major meta-analyses that demonstrate a benefit for vertigo control. Historically, treatments of Ménière's disease have been difficult to evaluate because a significant fraction of Ménière's disease-related vertigo--probably about two thirds--improves without therapy. It is, therefore, important that Ménière's treatments be evaluated in a prospective placebo-controlled manner.

**Objective:** To evaluate the effectiveness of intratympanic gentamicin in control of Ménière's symptoms.

**Design:** Prospective, double-blind, randomized placebo-controlled trial.

**Participants:** 28 patients who met the 1995 American Academy of Otolaryngology—Head and Neck Surgery criteria for definite Ménière's disease participated in this study. All patients had a primary complaint of vertigo, had a caloric response, and had failed conservative medical therapy. Patients were excluded if the affected ear was the only hearing ear or the better hearing ear. Twelve patients were given placebo, and 16 were given gentamicin.

**Methods:** All patients had a middle ear ventilation tube placed 4 weeks prior to starting therapy. Over a 4-week period, 0.4 mL of gentamicin concentrated to 30 mg/mL was injected into the middle ear on a once-weekly basis. At each visit, patients had an audiogram, and vertigo, tinnitus, and aural fullness complaints were scored. After treatment, patients were followed up at 6 weeks, 6 months, and 1 year.

**Results:** During the study period, patients who received gentamicin had a hearing decrease of 8 dB, compared to no change in the placebo group. Tinnitus scores were similar in both groups and did not change over the treatment period. Both groups had similar aural fullness scores at the start of the trial. The placebo group had no decrease in aural fullness, but the gentamicin group did have significantly less aural fullness. Vertigo complaints did not change in the placebo group but did significantly decrease in the gentamicin group, with more than half the patients no longer experiencing any vertigo symptoms.

**Conclusions:** Gentamicin demonstrated a significant decrease in aural fullness and vertigo in patients with Ménière's disease.

**Reviewer's Comments:** This study demonstrated a significant decrease in aural fullness and vertigo with gentamicin treatment. However, hearing was slightly worse in gentamicin-treated patients. This study confirms the findings of an earlier smaller, randomized placebo-controlled trial of gentamicin for vertigo control in Ménière's, and it extended these results to aural fullness, although this is usually not a major complaint in this patient population. This study of Ménière's treatment was somewhat unusual because it did not find a placebo effect. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Ménière's Disease, Hearing Loss, Vertigo, Aural Fullness, Gentamicin

Print Tag: Refer to original journal article
Labyrinthectomy and translabyrinthine vestibular nerve section have similar rates of vertigo control and postoperative imbalance.

**Classic Article Review**

**Background:** Labyrinthectomy typically has a very high success rate at controlling vertigo in Ménière's disease patients. This procedure is also sometimes combined with a vestibular nerve section. William House popularized the translabyrinthine vestibular nerve section (TLVNS) in the 1950s as the gold standard for vestibular ablation surgery. The labyrinthectomy is a slightly simpler procedure that may leave residual vestibular tissue around Scarpa's ganglion, which may form a source of neuroma formation or persistent vertigo.

**Objective:** To determine if TLVNS and labyrinthectomy offer similar outcomes.

**Design:** Patient survey.

**Participants:** 135 patients underwent either a labyrinthectomy or TLVNS surgery for vertigo between 1990 and 2005 and were sent a survey; 42 responded.

**Methods:** The questionnaire asked patients to rate their symptoms using the American Academy of Otolaryngology–Head and Neck Surgery criteria. Questions covered frequency, severity, and degree of interference with everyday activities. The same rating scales were used for current symptoms and symptoms prior to surgery. Patients were also asked if they had any subsequent surgery for vertigo control.

**Results:** Patients who underwent labyrinthectomy were significantly older at the time of surgery, with a mean age of 59 years versus 45 years in TLVNS patients. Follow-up was 4.5 years for labyrinthectomy and 7.8 years for TLVNS. About 64% of patients had a Ménière's diagnosis. Other diagnoses included fistula, vestibular hydrops, vestibular neuronitis, sudden sensorineural hearing loss, or posttraumatic vertigo. Both groups had a similar number of reported vertigo spells prior to surgery. Both groups reported vertigo, and disability scores were improved from preoperative levels. In both groups, 24% said they continued to experience vertigo. More than 80% of both groups indicated that they continued to experience imbalance; however, in the labyrinthectomy group, 46% indicated their balance had improved after surgery compared with 81% in the TLVNS group. Vertigo was minor or resolved in about 80% of both groups, and a single digit percentage of both groups rated their current vertigo symptoms as severe.

**Conclusions:** Labyrinthectomy and TLVNS offer similar success rates for vertigo control.

**Reviewer's Comments:** Interestingly, only 64% of patients had a Ménière's diagnosis. Other diagnoses such as sudden sensorineural hearing loss do not seem an appropriate indication for a labyrinthectomy. There is a significant amount of clinical information missing in these patients that may have contributed to their vertigo and imbalance. Patients were asked to rate their preoperative symptoms several years after surgery, so significant recall bias is possible. The main significant difference was that patients undergoing TLVNS had a greater decrease in imbalance after surgery than did labyrinthectomy patients. This is difficult to interpret because these groups were not similar; labyrinthectomy patients were 14 years older at surgery and had a shorter follow-up. (Reviewer-Benjamin T. Crane, MD).
Giving gentamicin and vestibular rehabilitation exercises prior to pontine angle surgery may improve the postoperative recovery period.

**Classic Review Article**

**Background:** After acoustic neuroma surgery, patients often wake up with severe vertigo, nystagmus, and vomiting caused by an acute unilateral loss of vestibular function. Recovery from a unilateral loss such as this can often take weeks. Recovery can be delayed in elderly patients and those who have had trauma to the cerebellum during surgery.

**Objective:** To propose a “prehab” protocol to improve vertigo symptoms that can occur after cerebellar-pontine angle surgery.

**Design:** Case series.

**Participants:** 12 patients aged 21 to 72 years (mean, 50 years) with pontine angle tumors. Ten of these patients had vestibular schwannomas, and the remaining 2 had meningiomas. All patients had a gadolinium-enhanced MRI prior to surgery that demonstrated a tumor between 4.5 and 25.0 mm. Patients also had caloric testing prior to surgery, and only those with normal or near-normal function were offered this therapy.

**Methods:** Patients selected for inclusion were instructed to execute a home-based vestibular training program. This consisted of 14 days of training after which gentamicin was given as 4 transtympanic injections. Patients continued training for 6 weeks after gentamicin, which the authors found sufficient for vestibular compensation.

**Results:** After gentamicin injections, but prior to surgery, a total or near-total vestibular loss was found in all 12 patients. Two patients also had a deterioration in hearing. After surgery, these patients recovered quickly, and the authors report they had no balance problems after surgery and were ambulating on the first postoperative day.

**Conclusions:** Preoperative gentamicin combined with vestibular exercises offers the possibility to improve postoperative recovery, but it carries a significant risk of hearing loss.

**Reviewer’s Comments:** In this paper, the authors propose the new and radical idea of “prehabilitation.” Essentially, they ablate the vestibular system prior to surgery so that patients may recover from the vestibular lesion and have an easier postoperative course. The argument for doing this is that patients are better equipped for rehabilitation in the preoperative period. A major criticism of this technique is that it puts patients at risk for hearing loss. However, it is not clear if using a lower gentamicin dose would minimize this risk. There is also no control group, and the improvement in recovery with this technique is poorly documented. Also at issue is that some of these patients might have maintained some vestibular function on the operated side had they not been given gentamicin. They might have needed more time to recover after surgery, but they might have had more vestibular function after this recovery. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Vertigo, Acoustic Neuroma, Vestibular Schwannoma, Hearing Loss, Gentamicin, Rehabilitation

Print Tag: Refer to original journal article
A series of 12 patients with posterior semicircular canal dehiscence is described in which most patients have conductive hearing loss.

**Background:** Because of the superior canal dehiscence syndrome, CT and vestibular evoked myogenic potential (VEMP) testing are now part of the standard workup in patients with dizziness symptoms. As part of this workup, other conditions that can cause dizziness symptoms and decreased VEMP thresholds are occasionally discovered, such as the enlarged vestibular aqueduct syndrome.

**Objective:** To report the first series of patients with posterior semicircular canal dehiscence (PCD).

**Design:** Retrospective chart review.

**Participants:** The study included 12 patients ranging in age from 2 to 67 years (including 7 pediatric patients). Patients were found to have PCD on CT scan and reduced VEMP thresholds and increased amplitude.

**Methods:** CT scans were performed with 1-mm slices and standard axial and coronal reconstructions. Audiometry was also performed in all but 1 individual. Cervical VEMPs were performed in post-PCD patients.

**Results:** 1 patient was found to have bilateral PCD. One patient had an iatrogenic dehiscence caused by surgery. Seven patients were aged <8 years, making their symptoms difficult to assess. However, all adult patients had aural fullness. Only 1 patient had vertigo with sound, and 4 reported dysequilibrium. Most patients had a mixed hearing loss, with negative bone conduction thresholds present in 2. In 70% of noniatrogenic cases, the dehiscence was identified into a high-riding jugular bulb on the caudal portion of the posterior canal. In the remaining 3 cases, the dehiscence was into the posterior cranial fossa. Two patients also had evidence of superior canal dehiscence. It is interesting that all but 1 of the noniatrogenic cases occurred on the right side. This may be due to the right dominant jugular vein drainage in most people.

**Conclusions:** This is the largest series of PCD to date. Most patients had conductive hearing loss. Noniatrogenic dehiscences tended to open into the jugular bulb.

**Reviewer's Comments:** This paper represents a significant advance in the understanding of PCD, but it will not likely be the last word on the subject. One issue with a diagnosis of superior canal dehiscence is that CT can be misleading by over-diagnosing dehiscence. Although most cases were confirmed by VEMP and low-frequency conductive hearing loss, stronger evidence of the posterior origin would have been nystagmus in the posterior canal plane caused by stimulation of the affected ear with noise or pressure. Furthermore, none of the PCDs were directly observed or treated. It is unclear if treating this problem would address patient symptoms. More than half of these PCD cases occurred in children, in contrast to superior canal dehiscence, which is almost always acquired in adulthood. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Conductive Hearing Loss, Jugular Bulb, Dizziness, Vertigo, CT Scan, Surgical Complications

Print Tag: Refer to original journal article
People who have dizziness and vestibular dysfunction on testing have a 12-fold increase in the risk of falling.

**Background:** Dysfunction of the vestibular system is a disorder that we, as otolaryngologists, commonly encounter. Vestibular dysfunction can be the underlying cause of falls, which is a considerable source of morbidity in the elderly population. Sequelae from these events are a common cause of death in this population. The exact magnitude of this problem has been difficult to estimate, and the relationship between vestibular dysfunction and falls in the general population has previously been difficult to determine.

**Objective:** To analyze the National Health and Nutrition Examination Survey (NHANES) to determine the relationship between falls and vestibular dysfunction.

**Design:** Analysis of cross-sectional survey results.

**Participants:** 5086 American adults aged ≥40 years who participated in the NHANES survey were included. Individuals were excluded for conditions such as severe visual impairment, inability to stand, or weight >275 pounds.

**Methods:** Patients were given a balance questionnaire that asked about dizziness, balance, and history of falls. The balance testing consisted of a modified Romberg Test of standing on firm and compliant surfaces. Subjects were asked to stand unassisted using 4 test conditions. The 4th condition was designed to assess the vestibular system—standing on a foam pad with eyes closed. The test was scored on a pass-fail basis. Failing occurred if subjects opened their eyes, moved their arms or feet to maintain stability, or began to fall.

**Results:** As determined by failure of test condition 4, 35.4% of subjects had vestibular dysfunction. The rate of dysfunction was higher with advancing age, less than a high school education, greater smoking history, and a history of hypertension, diabetes, and falls. Because there was a significant association between vestibular dysfunction and several other variables, the association between vestibular dysfunction and falls was reanalyzed after adjusting for age, gender, race, and cardiovascular risk factors. Subjects who had dizziness and vestibular dysfunction on testing had a 12-fold increase in the risk of falling.

**Conclusions:** This survey estimates the risk of vestibular dysfunction as 35%, higher than in most previously reported series.

**Reviewer's Comments:** The Romberg test for vestibular dysfunction used by this study is not one that is typically used and may identify a number of cases of subclinical vestibular function not detected with other methods. Part of the reason might be that the Romberg Test does not identify the origin of vestibular dysfunction and will likely include both peripheral and central disease. (Reviewer-Benjamin T. Crane, MD).
Sicca symptoms and positive serology may predict positive pathology, and these Sjögren's patients may not need lip biopsies

**Background:** As otolaryngologists, we are consulted for lip biopsies for patients with suspected Sjögren's disease. However, these procedures are not without complications and morbidities, and many clean biopsies can yield nondiagnostic results.

**Objective:** To address the issue of clinical utility of lip biopsies in patients with Sjögren's syndrome.

**Design:** Retrospective review of records of patients who underwent full rheumatologic evaluations, a panel of appropriate serology testing, and labial lip biopsies at a single tertiary academic institution from 2002 to 2004. Pathological evaluations were graded appropriately.

**Methods:** Patients were grouped according to lip biopsy results, which were correlated with various clinical and serological findings.

**Results:** 49 patients were initially screened with the American Medical Association Current Procedural Terminology code, and 46 patients were included in the study. Specimens were categorized into 2 groups: those with high grade 3 and 4 pathology, and those with grades <3. Positive pathologies were those with grade 3 or 4. Statistically, no clear associations were found between groups and any clinical presentation and/or serology. There were some notable trends that did not meet statistical significance. Joint pain, salivary gland swelling, and bladder involvement were associated with high-grade pathology. Antinuclear antibody serology was similar in both groups, but anti-Sjögren's syndrome B tended to be associated with higher grade. When data were examined to look for predictors of positive biopsy, those with sicca symptoms and positive serologies were more likely to have grade 4 pathology ($P=0.017$).

**Reviewer's Comments:** The strength of this report is the clear lack of statistical correlation between positive lip biopsy and clinical presentation. This underscores the fact that there are no clear exams or tests that can reliably provide the diagnosis, and that clinical judgment should be the overriding deciding factor in the management of this syndrome. Given the small N value in this study, therefore, the authors’ analysis of positive-predictive value of clinical correlates should be evaluated with caution. Only 12 patients in this analysis had both sicca syndrome and positive serology, and of these, 9 had high-grade pathology. (Reviewer-Young J. Kim, MD).

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Keywords: Sjögren's Disease, Lip Biopsy

Print Tag: Refer to original journal article
A 1:200,000 epinephrine injection in sinus surgery may not be associated with cardiovascular changes without any sacrificing hemostasis.

Background/Objective: Use of local vasoconstrictors prior to endoscopic sinus surgery is widespread for improved visualization. However, its safety has been questioned. In order to determine the optimal dose of epinephrine use in sinus surgeries, the authors use a randomized, clinical trial method to answer this question.

Design: Double-blind, truly randomized clinical trial performed in a single tertiary center.

Participants: 140 patients undergoing surgery for chronic sinusitis, polyposis, and recurrent sinusitis without any cardiovascular, hypertension, and bleeding disorder history.

Methods: Before surgery, all patients received 1:1000 epinephrine topically. One group received 2% lidocaine with 1:100,000 epinephrine injected submucosally, and the second group received 2% lidocaine with 1:200,000 epinephrine. Cardiovascular data were collected for 5 minutes at 1-minute intervals during and after injection. Blood loss and subjective surgical visualization data were obtained from the 2 surgeons.

Results: The group that received a higher concentration of epinephrine had significantly higher hemodynamic changes, including higher heart rate, blood pressure (both systolic and diastolic), and mean arterial pressure when the drug was injected. However, the group that received 1:200,000 epinephrine did not have significant changes in these parameters after injection of the epinephrine. In terms of bleeding, no differences were noted as judged by the frequency of suctioning during surgery.

Conclusions: The lower concentration of epinephrine of 1:200,000 for submucosal injection prior to endoscopic sinus surgery may be a safer concentration for hemostatic effect during surgery without sacrificing visualization.

Reviewer's Comments: The authors should be lauded for using a randomized trial method to answer their question, but there are some design limitations. One is that the patient population chosen is somewhat heterogeneous. The other issue is use of topical epinephrine for both groups. This would not invalidate the degree of hemodynamic changes noted in the 2 groups, but it would raise the question of whether the hemostatic effect was from the topical or the submucosal injection of epinephrine. This is particularly true for sinus surgeries that tend to be short with minimal dissections. Overall, however, the authors provide some evidence that epinephrine injections may be lowered to 1:200,000 without significantly sacrificing hemostasis for optimal sinus surgery. The degree of hemodynamic changes, however, between the 2 concentrations of epinephrine is small, and routine use of 1:200,000 epinephrine for healthy patients may still not be warranted from this report. However, for patients with cardiovascular history, the lower concentration of epinephrine should be considered. (Reviewer-Young J. Kim, MD).

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Keywords: Endoscopic Sinus Surgery, Epinephrine Injection, Hemostasis

Print Tag: Refer to original journal article
Bevacizumab may reduce the tumor burden in neurofibromatosis type 2 patients with vestibular schwannomas and improve hearing in some patients.

**Background:** Unlike treatment for sporadic vestibular schwannoma, surgical and radiotherapy treatments for vestibular schwannoma among patients with neurofibromatosis type 2 (NF2) do not compare well to the sporadic types. Pathologically, schwannoma is not technically a vascular lesion, but angiogenesis has been noted to be important for its growth.

**Objective:** To determine if bevacizumab, a monoclonal antibody that specifically antagonizes vascular endothelial growth factor (VEGF) pathway, can be used to treat vestibular schwannomas.

**Design/Methods:** Retrospective study of records of 10 patients with NF2 with vestibular schwannomas who were treated with bevacizumab. Prior to this, the authors presented their study of immunostaining of vestibular schwannomas from NF2 patients. They looked at expression of VEGF and other factors that are important in the VEGF signaling pathway. Patients were followed up radiographically with MRI as well as audiograms. Included in the study were those with NF2 with progressive disease who were not amenable to surgery or radiotherapy. Patients were followed up clinically with MRI and serial audiograms before and after use of bevacizumab. Toxicity profiles were also followed. Responses were defined as >20% reduction in tumor volume as dictated by MRI. Hearing responses were defined as improvements in word recognitions score compared to baseline.

**Results:** In terms of immunostaining, VEGF was expressed in 100% of specimens. Moreover, one of the receptors for VEGF, VEGFR-2, was expressed in 32% of the tumor vasculature. In terms of the clinical trial, 9 of 10 patients showed radiographic evidence of tumor shrinkage. Of 10 patients, 7 were eligible for audiological studies after treatment; 4 of these patients had a hearing response according to word recognition scores. In terms of side effects, bevacizumab treatment resulted in 21 adverse events of grade 1 or 2.

**Conclusions:** Bevacizumab can modestly reduce the volume of the tumor in most patients with NF2. In some patients, there are improvements of hearing with sustained improvement for up to 16 months.

**Reviewer’s Comments:** This was an interesting study for several reasons. One is the finding that hearing loss can be reversed in some patients treated with bevacizumab. All patients with improvements in hearing or stable hearing had volume reduction of tumor. The authors posit that the hearing improvement is likely correlated with intraneural edema and tumor shrinkage, but not all patients who had volumetric response had hearing improvements. This suggests that there may a window of opportunity to reverse the hearing loss due to schwannomas. The other interesting finding, of course, is that these schwannoma lesions can be treated with biological reagents that target VEGF pathways. (Reviewer-Young J. Kim, MD).

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Keywords: Acoustic Neuroma, Vestibular Schwannoma, Neurofibromatosis, Vascular Endothelial Growth Factor, Bevacizumab

Print Tag: Refer to original journal article
There is a learning curve in stapes surgery, and it probably takes 60 to 70 cases to be proficient.

**Classic Review Article**

**– Background:** The number of patients now having stapes surgery has been decreasing for the past 20 years. Reasons for this are not clear but may be due to better hearing aid options, less frequent otosclerosis due to fluoride in the water supply, and more widespread vaccinations in childhood. As a result, otolaryngologists are now doing less stapes surgery, and trainees are not getting as much experience with the procedure. Stapes surgery is thought to be a good model for understanding the learning curve of surgical training because it is technically difficult, and the outcome can be easily measured.

**Objective:** To determine the learning curve for stapes surgery by studying 2 otolaryngologists shortly out of training in the United Kingdom.

**Design:** Retrospective review.

**Participants:** The first 100 primary stapes operations done by each author were reviewed.

**Methods:** A survey was sent to otolaryngologists in Britain to inquire about the number of stapes operations performed in 2001. A total of 518 surveys were sent (43% responded). The first author performed stapedotomy under local anesthesia and began using a laser after the first 30 cases. The second author performed stapedotomy with a vein graft under general anesthesia using a laser. Hearing results were analyzed using the mean over 15 consecutive operations.

**Results:** Of surveys returned, 43% of those surveyed had performed at least 1 stapes in the past year. Eight surgeons performed ≥25 stapes surgeries in a year, but only half of these were involved in training residents. One author took 10 years to accumulate his first 70 cases, and the other took 6. Both authors had a dead ear in their first 15 cases. Three other patients had lost >20 dB of bone conduction. One author had a trend toward decreasing air-bone gap with experience, but the other did not. The end point of the learning curve is not clear from this study, but it is likely in the range of 60 to 70 cases.

**Conclusions:** This study demonstrates that the learning curve for stapes surgery requires many more cases to get to the end point most otolaryngologists will do in training. The authors recommend that stapes training be focused on individuals who will become career otologists.

**Reviewer’s Comments:** The study points out a difficult problem of surgical training and attempts to answer the question, “How many cases is enough?” It is not clear to me that stapes surgery takes as long to master as the authors suggest. Even experienced surgeons report a dead ear rate near 1%, and in these series, it may have happened to come early in the operative experience. Because of the moving average method used, a rare adverse outcome can introduce a bias over a range of cases. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Hearing Loss, Otosclerosis, Surgery Teaching

Print Tag: Refer to original journal article
Surgical treatment is curative in most jugular foramen tumors.

**Background:** Jugular foramen tumors are relatively rare and often present with non-specific symptoms, which make early diagnosis difficult. Although these tumors are usually benign, their potential involvement with vascular structures, including the jugular bulb and carotid artery, as well as cranial nerves, often makes treatment of these tumors risky. Glomus jugulare tumors are the most common tumor of this region, but meningiomas and schwannomas are less frequently encountered. Common presenting symptoms include conductive hearing loss and pulsatile tinnitus, although advanced tumors can present with cranial nerve palsy.

**Objective:** To describe current diagnosis, management, and treatment outcome for jugular foramen tumors.

**Design:** Retrospective chart review.

**Participants:** 83 patients presenting with jugular foramen tumors between 1997 and 2008.

**Methods:** Data for each case were tabulated, including symptoms, exam findings, treatment modality, tumor size, and histology.

**Results:** Women comprised 80% of patients, and 2 patients had bilateral tumors. Only 1 tumor was malignant. Glomus jugulare was the most frequent jugular foramen tumor (87%); other tumors included schwannoma and meningioma. Mean tumor size was 2.8 cm. Tumors presented with pulsatile tinnitus (84%), conductive hearing loss (76%), and hoarseness (35%). A retrotympanic mass was visualized in 91% of glomus jugulare patients. The tumor extended intracranially in 18%, and 40% of tumors encased the carotid artery. Nearly 75% of patients underwent surgical treatment, and in three fourths of these patients, the infratemporal fossa approach was used. In 81% of surgical patients, total tumor removal was achieved. Radiation was the primary therapy in 18%, and the remaining 8% were observed. Facial nerve function was House-Brackmann grade I or II in 71% immediately postoperatively and 88% at the last follow-up. Complications included cerebrospinal fluid leak occurring in 7%. Recurrence occurred in 30% of surgical patients at a mean follow-up of 26 months.

**Conclusions:** Total resection of glomus tumors can be curative. However, tumors in this area are almost always benign, so subtotal resection should be considered when necessary to preserve cranial nerves and vascular or central nervous system structures.

**Reviewer’s Comments:** This is a recent large series of tumors that are relatively rarely encountered by most otolaryngologists. This series makes the point that good facial nerve function can be maintained in almost all cases. It also brings up the point that most of these tumors are visible on physical examination, and recurrences are relatively common. Radiation therapy remains controversial in these tumors, and I would have liked to see more data about long-term effects of radiation in these patients. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Dysphagia, Skull-Base Tumor, Glomus Jugulare, Lower Cranial Nerve Schwannoma, Facial Weakness

Print Tag: Refer to original journal article
The authors of this study found that presence of stapes superstructure, malleus handle, healthy mucosa, stapes mobility, and local anesthesia lead to better hearing results after ossiculoplasty.

**Background:** Ossiculoplasty is a commonly performed procedure to improve conductive hearing loss. Prior studies have found several factors that predict better outcomes. These factors include nonsmoking, malleus handle present, intact stapes superstructure, and preservation of an aerated middle ear space.

**Objective:** To use a multivariate analysis to determine prognostic factors for short-term hearing outcomes in the authors' patients.

**Design:** Retrospective case review.

**Participants:** 720 patients who underwent ossiculoplasty between 1989 and 2006 at the authors' institution in Japan and were followed up for at least 1 year were evaluated. These patients included 64% cholesteatoma, 18% chronic otitis media, and 5% atelectasis cases.

**Methods:** The authors used autologous material for ossiculoplasty in almost all patients in this series. This included autologous ossicles, auricular cartilage, or cortical bone. Cartilage was the most frequent and was used in 72% of patients. Audiometry was performed before and after surgery. Logistic regression was used to predict success versus failure. Factors examined included: gender, age, presence of cholesteatoma, 1- or 2-stage surgery, presence of stapes superstructure, malleus handle, primary or revision surgery, general or local anesthesia, mobility of the foot plate, and status of the mucosa.

**Results:** Significant factors that predicted better outcomes included stapes superstructure present, malleus handle present, normal mucosa, stapes mobility, and local anesthesia. Age, gender, graft material, and number of stages did not change the prognosis. Some factors previously known to predict worse hearing outcomes such as tobacco smoke exposure and canal wall down mastoidectomy were not examined in this study.

**Conclusions:** Intact stapes superstructure, present malleus handle, normal mucosa, stapes mobility, and local anesthesia predicted better outcomes after ossiculoplasty.

**Reviewer's Comments:** This study points out some important prognostic factors to consider when performing ossiculoplasty; however, these factors have been reported in prior series, and some known factors such as tobacco smoking history and canal wall status were not considered. What is very unusual about this series is that almost all ossiculoplasties were performed using autologous material, which in most cases was cartilage. It is also important to note that long-term (>1 year) results are not reported. One of the disadvantages of autologous materials in this setting is that they may not have the longevity of synthetic materials, which are now used in most ossiculoplasties. It would be interesting to know the longer-term results in these patients, and how these results compared with ossiculoplasty using titanium or hydroxyapatite prostheses. (Reviewer-Benjamin T. Crane, MD).

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**Keywords:** Hearing, Cholesteatoma, Ossiculoplasty

**Print Tag:** Refer to original journal article
Most of the conductive hearing loss eliminated by stapes surgery remains stable over a long period.

**Classic Article Review**

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**Background:** Patients very frequently ask us about long-term results of stapedotomy. Although there have been a large number of studies examining the outcome of stapes surgery, very few have followed patients more than a few years.

**Objective:** To provide long-term results of stapes surgery.

**Design:** Retrospective review, with re-examination of prior patients.

**Participants:** From 1965 to 1975, 322 patients were identified who underwent stapes surgery at the authors' institution. Postoperative examination was performed in 2001 and 2002 of 58 patients who had undergone 68 stapes surgeries during this period. Patients had surgery at a mean age of 38 years, and mean age at follow-up was 71 years.

**Methods:** The follow-up examination included audiometry and physical exam. Patients had had audiograms prior to surgery and 6 to 12 months postoperatively. Stapedoplasty was performed using the posterior crus of the stapes in most patients. Other techniques included polyethylene prosthesis, wire, and Teflon.

**Results:** At the follow-up visit 6 to 12 months postoperatively, the air-bone gap (measured over 500 to 2000 Hz) was <20 dB in 82% of patients. After a mean of 32 years, the gap was <20 dB in 75% of patients. If a <10-dB criterion was used, the percentage was 38.6% at 6 to 12 months and 36.8% at 32 years.

**Conclusions:** Most conductive hearing loss eliminated by stapes surgery remains stable over a long period.

**Reviewer's Comments:** In this study, the authors report that most patients get air-bone gap closure to 20 dB, but much fewer get closer to 10 dB. In many modern series, the closure of the gap to 10 dB is considered the standard for a good result. The worse results in this series may be due to the fact that the prosthesis used was the posterior crus of the stapes in most cases. Few centers use this procedure today. However, there have been very few studies on long-term results of stapes surgery. John Shea, who has been doing stapes surgery for 50 years, reported a large series with long-term follow-up about a decade ago. In this series, he observed an air-bone gap <10 dB in 63%, much higher than the percentage reported here. (Reviewer-Benjamin T. Crane, MD).

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Keywords: Stapes, Stapedotomy, Conductive Hearing Loss

Print Tag: Refer to original journal article
Is LPR Associated With Increased Risk of Vocal Fold Polyps?

The Significance of Laryngopharyngeal Reflux in Benign Vocal Mucosal Lesions.

Chung JH, Tae K, et al:

Otolaryngol Head Neck Surg 2009; 141 (September): 369-373

In this study, laryngopharyngeal reflux was associated with an increased risk of Reinke's edema, but no increased risk of developing vocal fold polyps or nodules.

**Background:** Recent studies have associated laryngopharyngeal reflux (LPR) with subglottic stenosis and vocal process granuloma. Other conditions such as chronic cough, vocal fold dysplasia, and even sinusitis are speculated to be associated with increased acid reflux. Few studies have evaluated LPR's association with benign vocal fold lesions.

**Objective:** To determine the association of LPR with benign vocal fold lesions.

**Design:** Case-controlled study.

**Participants:** 110 patients with benign vocal fold lesions were compared to 200 patients with LPR symptoms. Of 110 patients in the study group, 50 had vocal nodules, 40 had vocal polyps, and 20 had Reinke’s edema.

**Methods:** Patients underwent 24-hour double-probe pH monitor. Identification of pathologic LPR, total reflux number, fraction time of pH <4, and DeMeester scores were recorded. An LPR event was defined as a pH level <4.0 at the proximal probe immediately following distal probe acid exposure without eating or swallowing. Pathologic LPR was defined as the occurrence of >3 episodes of LPR. Reflux symptom index (RSI) and reflux finding score (RFS) were compared.

**Results:** Pathologic LPR was seen in 65% of the control group, 66% of the vocal nodule group, 75% of the vocal polyp group, and 90% of the Reinke’s edema group. Mean RSI ($P = 0.015$) and RFS scores ($P = 0.014$) in Reinke’s edema cohort and mean RFS in the vocal polyp group ($P = 0.023$) were significantly higher than in controls. Total reflux number and DeMeester scores in the Reinke’s edema group and fraction time of pH <4 in the vocal polyp group were significantly higher versus the control group.

**Conclusions:** LPR was associated ($P = 0.016$) with an increased risk of Reinke’s edema (odds ratio, 4.85; 95% CI, 1.093 to 21.492) compared to the control group. While RFS scores were significantly higher in the vocal polyp group, LPR was not associated with an increased risk of developing vocal fold polyps or nodules.

**Reviewer’s Comments:** The authors present a good retrospective case-controlled analysis incorporating a pH-probe study, the gold standard for diagnosis of LPR. Nevertheless, this study has a participation bias toward patients willing to undergo 24-hour pH-probe study and does not control for key variables such as smoking and muscle tension dysphonia (MTD). MTD is commonly associated with vocal fold nodules, while smoking is closely associated with Reinke's edema. With regard to LPR’s association with an increased risk of Reinke's edema reported in this study, LPR may not be causal of Reinke's edema, but rather symptomatic of smoking. Smoking cessation, treatment of LPR, and voice therapy represent key medical interventions for benign laryngeal lesions and should be recommended by all otolaryngologists who treat these diseases. (Reviewer-Alexander Hillel, MD).

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Keywords: Benign Vocal Fold Lesions, Laryngopharyngeal Reflux

Print Tag: Refer to original journal article
RT Plus EPO as Adjuvant Tx Does Not Improve Survival Outcomes

Extracts From The Cochrane Library: Erythropoietin as an Adjuvant Treatment With (Chemo) Radiation Therapy for Head and Neck Cancer.

Burton MJ, Deschler DG, Rosenfeld RM:

Otolaryngol Head Neck Surg 2009; 141 (October): 438-441

Erythropoietin should not be administered as adjuvant therapy with radiotherapy for head and neck cancer for the purposes of improving survival outcomes.

**Background:** The Cochrane Library systematically reviews the effects of health care interventions to provide evidence for health care decisions. The journal, Otolaryngology – Head and Neck Surgery, has a quarterly section highlighting Cochrane systematic reviews relevant to otolaryngology – head and neck surgery. Aside from human papillomavirus-related oropharyngeal tumors, cure rates for advanced head and neck cancers have not improved over the last 40 years. Modifications to treatment regimens are attempted to improve treatment effect and hopefully increase survival. The theory behind erythropoietin's (EPOs) potential treatment effect begins with tumor hypoxia resulting in increased tumor invasiveness. Hypoxic tumors, in turn, are associated with severely anemic individuals. Correction of anemia by increasing hemoglobin levels with EPO could potentially increase tumor oxygenation and reduce invasiveness.

**Objective:** To compare combined treatment of radiation therapy and erythropoietin (RT+EPO) with radiotherapy (RT) alone in the treatment of head and neck cancer.

**Design:** Summary of Issue 3, 2009, in the Cochrane Central Register of Controlled Trials. **Materials:** Meta-analysis of randomized controlled trials that treated head and neck cancer of any stage or type using RT with and without EPO.

**Methods:** At least 2 review authors screened search results. Overall survival, local regional tumor control, and local regional progression-free survival were compared. Studies using supplemental iron in the RT+EPO cohort, but not in the RT alone group, were included.

**Interventions:** RT+EPO or RT alone to treat head and neck cancer.

**Results:** 5 randomized controlled trials, with a total of 1397 patients, met inclusion criteria. Pooled data demonstrated the RT+EPO group had significantly worse overall survival ($P = 0.005$; odds ratio [OR], 0.73; 95% CI, 0.58 to 0.91) and local regional progression-free survival ($P = 0.0002$; OR, 0.63; 95% CI, 0.49 to 0.80) than did the RT group. There was no significant difference in local regional tumor control between groups.

**Conclusions:** RT+EPO has worse survival and local regional progression-free survival than RT alone. EPO should not be administered as adjuvant therapy with radiation therapy for head and neck cancer for purposes of improving survival outcomes.

**Reviewer’s Comments:** The evidence does not support use of EPO to improve survival in patients with head and neck cancer. Furthermore, pooled data demonstrated a significant negative effect on survival with RT+EPO compared to RT alone. These conclusions support the position that EPO should not be given with an intention to improve survival in head and neck cancer patients. Further research suggests that the reduced overall survival may be due to stimulation of EPO receptor-positive head and neck tumors. In other studies, EPO has been shown to have a negative survival effect in breast, non–small-cell lung, lymphoid, and cervical cancer cohorts; however, it demonstrated a positive survival effect on patients with esophageal cancer. (Reviewer-Alexander Hillel, MD).

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Keywords: Adjuvant Therapy, Head & Neck Cancer, Radiation, Erythropoietin

Print Tag: Refer to original journal article
Full-thickness defects and smoking are associated with an increased risk of forehead flap complications.

**Objectives:** To identify clinical characteristics associated with forehead flap failures in patients undergoing reconstruction for nasal defects.

**Design/Participants:** Retrospective chart review on all patients (n=205) who underwent forehead flap reconstruction for nasal defects by the senior author over a 13-year period.

**Methods:** A minimum of 4 months of follow-up was an inclusion criterion. Presence or absence of diabetes, smoking, and vascular disease was documented. The incidence of major complications, including any evidence of flap necrosis, nasal obstruction, or alar notching, was tracked.

**Results:** Median age of the group was 66 years. A total of 33 patients (16.1%) developed some type of major complication during the postoperative period. Eleven patients (5.4%) experienced some degree of flap necrosis, while 10 (4.9%) experienced significant postoperative nasal obstruction, and 20 (9.8%) had alar notching. Full-thickness defects were associated with higher risk of major complications (odds ratio [OR], 4.62; \( P < 0.01 \)), particularly flap necrosis (OR, 4.31; \( P = 0.02 \)) and alar notching (OR, 6.48; \( P < 0.01 \)). Smokers were noted to have higher odds of developing flap necrosis (OR, 4.34; \( P = 0.02 \)). Complication risks were not significantly increased in patients with diabetes, increased age, or vascular disease.

**Conclusions:** Full-thickness defects and smoking are associated with increased risk of forehead flap complications. In contrast, presence of diabetes, vascular disease, and older age were not associated with an increased risk of complications.

**Reviewer's Comments:** This study focuses on examining clinical characteristics associated with forehead flap failure in facial reconstruction. The 16% major complication rate is also a reflection of the numerous comorbidities present in the study population. Not surprisingly, full-thickness defects and smoking status were significant clinical predictors of forehead flap complications, underscoring the importance of smoking cessation in these patients. Interestingly, factors such as diabetes and vascular disease were statistically significant clinical predictors. Although, as the authors pointed out, presence of diabetes showed a trend toward significance with flap necrosis. (Reviewer-Tang Ho, MD).

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Keywords: Forehead Flaps, Nasal Reconstruction

Print Tag: Refer to original journal article
Use of crushed autologous cartilage combined with Tutoplast-processed fascia lata offers another viable technique in achieving nasal dorsum augmentation in appropriate candidates.

**Background:** Autologous cartilage is considered the ideal material for nasal dorsum augmentation, given its unsurpassed biocompatibility and ease to carve. However, limited cartilage availability, donor-site morbidity, and concern for visible cartilage graft contour secondary to warping are all potential concerns.

**Objective:** To examine the outcome of dorsal augmentation with crushed cartilage layered with Tutoplast-processed fascia lata (TPFL).

**Design/Participants:** Retrospective chart review conducted on a series of 113 patients who underwent dorsal augmentation with crushed cartilage combined with TPFL.

**Methods:** The crushed cartilage was placed underneath 2 to 3 layers of TPFL, which was placed underneath the soft tissue envelope. Outcome measures included subjective evaluation of patient satisfaction and documented incidence of complications. The follow-up period ranged from 8 to 38 months, with a mean follow-up of 27 months.

**Results:** Various types of grafts were used in combination with TPFL in the study, including septal cartilage, costal cartilage, conchal cartilage, and ethmoid bone. Among 101 patients who responded to the questionnaire, 85% were reported to be satisfied with the esthetic outcome. A 3.5% complication rate is reported in the study, including over-augmentation of the nasal dorsum, graft resorption, and complaint of dorsal irregularity. Revision rhinoplasty was performed in 8 patients (7.1%) for nasal tip revision, graft resorption, and over-augmentation of the nasal dorsum.

**Conclusions:** Crushed autologous cartilage cushioned with TPFL offers a viable alternative nasal dorsum augmentation and contouring in appropriate candidates.

**Reviewer's Comments:** The search for the most suitable dorsal augmentation material continues. While autologous cartilage material has been widely considered to be the gold standard, limitations, such as associated donor-site morbidity and amount of graft available, need to be considered. Use of TPFL combined with crushed cartilage offers another viable method for augmenting the nasal dorsum, such as the Turkish delight (diced cartilage wrapped in Surgicel). However, as the authors pointed out, use of this technique has its limitations, including the cost of TPFL and unpredictable resorption. Again, appropriate selection of appropriate candidates is critical. (Reviewer-Tang Ho, MD).

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Keywords: Dorsal Augmentation, Processed Fascia Lata, Autologous Cartilage

Print Tag: Refer to original journal article
Chemical Peel Still Plays Significant Role in Tx of Facial Aging

Combination Jessner's Solution and Trichloroacetic Acid Chemical Peel: Technique and Outcomes.
Herbig K, Trussler AP, et al:

Plast Reconstr Surg 2009; 124 (September): 955-964

Use of Jessner’s solution combined with trichloroacetic acid can be a safe and effective means of treating moderate facial rhytids.

Background: Trichloroacetic acid (TCA) is commonly used in facial chemical peel for treatment of facial aging as well as for actinic keratoses. Jessner’s solution can be used to aid TCA penetration because of its keratolytic properties.

Objective: To review the clinical outcome of patients treated with a combination of TCA and Jessner’s solution for facial rhytids.

Design/Participants: Retrospective analysis of 105 patients who underwent a total of 115 chemical peels over a period of 7 years with a combination Jessner's solution and 35% TCA.

Methods: Outcome measures included patient demographics, concomitant surgical procedures, and complications.

Results: All subjects were females with a mean age of 54 years. Most peels (90%) were done in conjunction with other surgical procedures including face/neck lifts. The most common complication was posttreatment fungal infections (7.8%). All patients were successfully treated with an oral and topical antifungal regimen. Hyperpigmentation was observed in 2 cases (1.7%). All patients had Fitzpatrick I to II skin tone, and no hypopigmentation or hypertrophic scarring was observed in this series.

Conclusions: Use of 35% TCA combined with Jessner’s solution can be a safe and effective means of treating moderate facial rhytids in properly selected patients.

Reviewer’s Comments: A variety of treatment options are available for facial rhytids. Minimally invasive means, such as chemical peels, require minimal capital investment on the part of the practitioner, and when used in the properly selected patient, it can be very effective. Use of Jessner's solution in combination with TCA allows for a much more effective and even peel process. Histologically, chemical peels have been shown to result in an increase in collagen, elastin, and glycosaminoglycans within the regenerated skin. This increase in dermal ground substance translates into the more youthful appearance after chemical peel. However, patient counseling prior to treatment as well as careful monitoring of the posttreatment progress is critical to ensure treatment success. (Reviewer-Tang Ho, MD).

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Keywords: Chemical Peel, Trichloroacetic Acid

Print Tag: Refer to original journal article
Autogenous cartilage grafts are successfully developed from cultured human chondrocytes for the purpose of microtia reconstruction in this pilot clinical study.

**Background:** Surgical reconstruction of microtia has involved use of autogenous costal cartilage versus synthetic implants. Use of costal cartilage is advantageous, but donor site morbidity can be significant, and the amount of available cartilage is limited.

**Objective:** To examine a tissue-engineering technique for generating autogenous cartilage material from chondrocytes.

**Methods:** A multilayer chondrocyte culture system was developed. Four microtia patients were enrolled in this Japanese study and underwent a 2-stage implantation technique. Autologous chondrocytes were prepared from harvested microtia auricular cartilage remnant. Chondrocytes were cultured for 4 weeks in a chondroid matrix and then injected into a subcutaneous pocket of the lower abdomen of the patient. A solid newly formed cartilage block was formed subcutaneously 6 months later and harvested surgically. The cartilage was carved and implanted subcutaneously for correction of microtia deformity.

**Results:** The neocartilage block had sufficient mechanical strength and elasticity for carving into a new auricular cartilage framework. Immunohistochemical studies confirmed presence of type II collagen and normal differentiation as well as histological characteristics of elastic cartilage. Follow-up ranged from 2 to 5 years, and no significant cartilage absorption was seen clinically.

**Conclusions:** In a small series of 4 patients, autologous auricular chondrocytes were successfully cultured and used for microtia reconstruction in a 2-stage implantation process.

**Reviewer's Comments:** Despite great expectations, practical clinical applications of tissue engineering have been slow to develop. In this pilot study, the authors circumvented the challenge of forming a usable cartilage block in vitro by culturing autologous chondrocytes within the milieu of the donor human body in a relatively accessible location for surgical harvest. The newly formed cartilage possesses all advantages of traditional autogenous costal cartilage graft without the significant donor-site morbidity. However, it is a 2-stage process, and additional studies, including longer follow-ups, are necessary to assess the stability of the cartilage graft. (Reviewer-Tang Ho, MD).

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Keywords: Microtia, Cartilage Grafts, Tissue Engineering

Print Tag: Refer to original journal article