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Abstract

Objective: The primary goal of this study was to assess computerized tomography (CT) scan evidence of new bone formation following cartilage cap resurfacing of dehiscent superior semicircular canals.

Study Design: Blinded, controlled, retrospective review.

Methods: High resolution CT scans of 20 patients were reviewed by two neuroradiologists. Of these 20 patients, 5 had undergone transmastoid cartilage cap resurfacing surgery for a dehiscent superior canal, with both preop and postop scans. 15 patients had undergone high resolution CT scans served as controls. All scans were deidentified, cropped, and the neuroradiologists were blinded to the previous interpretation as well as each others interpretation. The outcome metric was the presence or absence of a dehiscence.

Results: There were 4 patients with a dehiscent superior canal preoperatively who had new bone formation postoperatively. One patient who had surgery had evidence of new bone formation adjacent to the dehiscence. There was agreement in all cases, including controls, of the presence or absence of bone formation and dehiscence or no dehiscence. The time interval between surgery and the bone formation on CT scan ranged from 20 - 38 months, average of 30 months.

Conclusions: There is CT evidence of new bone formation covering a previous superior canal dehiscence following transmastoid cartilage cap resurfacing. The average time interval between surgery and bone formation on CT scan averaged 30 months.

Introduction

Dehiscence of the superior semicircular canal is a common entity, but not commonly recognized. Patients with debilitating symptoms, such as chronic dysequilibrium, sound induced vertigo, autophony, are potential candidates for surgery.¹ Surgery for a superior canal dehiscence (SCD) is either plugging or resurfacing of the dehiscence.^{2,3} The 'success' rate of each procedure is difficult to determine, as most results are based on subjective patient symptom changes. Plugging of the superior canal inevitably results in loss of function of that canal, and not infrequently other ipsilateral canals.⁴⁻⁶ Cartilage cap resurfacing was introduced to avoid plugging of the canal and maintain its anatomic integrity, as well as function.² The fate of the cartilage (conchal or tragal) is largely unknown. However, recently we have observed new bone formation at the site of the cartilage, with CT evidence of closure of the dehiscence. Once this was discovered, we undertook this study to assure accurate reading of the CT scans.

Methods and Materials

CT scans of 5 patients (Table 1) with SCD whom had undergone cartilage cap resurfacing surgery in which new bone formation was suspected on postoperative CT scans were compared with CT scans of 15 patients without SCD.

De-identified images of bilateral otic capsules, in Poschl and Stenver views, were cropped using Analyze 12.0 software to eliminate evidence of prior surgery or other pathology. Two neuroradiologists, blinded to each other's interpretation, independently reviewed all sets of images. They were instructed to draw conclusions as normally would, and indicate if there was a dehiscence or no dehiscence. Interpretations were then compared for inter-observer agreement.

Table 1. Patient demographics

Age / Sex	Side	Post op Interval	Cartilage Source
54 / Female	Right	35 months	Tragal
69 / Female	Right	34 months	Tragal
79 / Male	Right	23 months	Tragal
38 / Female	Left	20 months	Conchal
63 / Male	Left	38 months	Conchal
		Avg – 30 months	

Results

For the 5 patients who had undergone cartilage cap resurfacing, there was complete inter-observer agreement. 4/5 had new bony growth and closure of the dehiscence (Fig 1 & 2). 1/5 had ectopic bone growth adjacent to the dehiscence.

For the 15 controls – complete inter-observer agreement occurred in all cases.

A postoperative MRI confirmed patency of the superior canal (Fig 3).



Figure 1. Preop CT

Figure 2. Postop CT

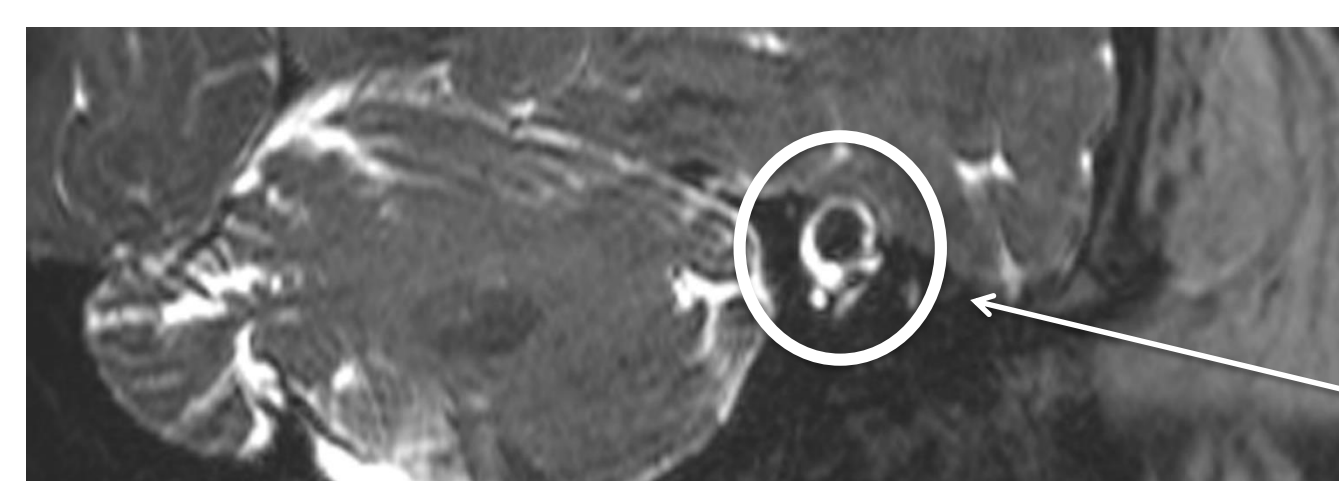


Figure 3. Postop MRI

Patent superior canal

Discussion

The initial finding of new bone formation and closure of the dehiscence was incidentally discovered on a CT scan assessing the unoperated side. As new bone formation was unexpected, this blinded study format was undertaken to assure this finding was verified.

The incidence of new bone formation with cartilage cap resurfacing is unknown, as it seems to take years to develop, and long term patient follow-up with imaging is challenging.

Surgically, care is taken to leave perichondrium on the cartilage for resurfacing. The mechanism for new bone growth over, or from, the otic capsule is speculative. Possible mechanisms include idiopathic, post-traumatic⁷, mesenchymal cell differentiation and/or migration^{8,9}, or otic capsule remodeling.^{10,11}

Since the original study was undertaken, an additional 5 cases have been identified and confirmed, now a total of 10 cases. The potential of closure of a previously dehiscent superior canal has important implications for treatment.

A weakness of this study is its lack of prospective design. Also, the incidence of bone formation after cartilage cap resurfacing is unknown, and no factors have yet been identified to predict its occurrence.

Conclusions

Currently, 10 patients have been identified with postoperative bone formation and closure of the dehiscent superior canal following cartilage cap resurfacing. The average time interval between surgery and identification is 30 months. This finding has potentially important implications for surgical management of SCD.

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