Acta Medica Okayama

Volume 41, *Issue* 4 1987 *Article* 4

AUGUST 1987

Histological and Morphological Observation of the Paravestibular Canalicu-lus

Yu Masuda* Masaaki Fujimoto†

Yoshio Ogura‡ Edward L. Applebaum**

*Okayama University,

†Okayama University,

‡Okayama University,

**University of Illinois,

Copyright ©1999 OKAYAMA UNIVERSITY MEDICAL SCHOOL. All rights reserved.

Histological and Morphological Observation of the Paravestibular Canalicu-lus*

Yu Masuda, Masaaki Fujimoto, Yoshio Ogura, and Edward L. Applebaum

Abstract

The paravestibular canaliculus was studied by light microscopy in serial sections of the temporal bones from otosclerotic patients who underwent fenestration or stapes surgery. In all examined 23 specimens (13 cases), the endolymphatic duct and sac were observed to be normally developed with no pathological findings. The paravestibular canaliculus was found in 14 of the specimens (60.9%). Its course was traced from the proximal to the distal area in 12 specimens, and it appeared to merge into the distal portion of the endolymphatic sac in 7 of them. Twelve of the paravestibular canaliculi contained one vein, and 3 contained several veins. No artery was found. The paravestibular canaliculus was observed to originate from small vascular channels around the vestibule in the otic capsule, lateral to and near the internal aperture of the vestibular aqueduct.

KEYWORDS: temporal bone pathology, paravestibular canaliculus, otosclerosis

*PMID: 3661242 [PubMed - indexed for MEDLINE] Copyright (C) OKAYAMA UNIVERSITY MEDICAL SCHOOL

Acta Med Okayama **41** (4) 173-178 (1987)

Histological and Morphological Observations of the Paravestibular Canaliculus

Yu Masuda, Masaaki Fujimoto, Yoshio Ogura and Edward L. Applebaum*

*Department of Otolaryngology, Okayama University Medical School, Okayama 700, Japan and *Department of Otolaryngology, Maxillofacial Surgery, College of Medicine, University of Illinois, Chicago, Illinois 60612, U. S. A.*

The paravestibular canaliculus was studied by light microscopy in serial sections of the temporal bones from otosclerotic patients who underwent fenestration or stapes surgery. In all examined 23 specimens (13 cases), the endolymphatic duct and sac were observed to be normally developed with no pathological findings. The paravestibular canaliculus was found in 14 of the specimens (60.9%). Its course was traced from the proximal to the distal area in 12 specimens, and it appeared to merge into the distal portion of the endolymphatic sac in 7 of them. Twelve of the paravestibular canaliculi contained one vein, and 3 contained several veins. No artery was found. The paravestibular canaliculus was observed to originate from small vascular channels around the vestibule in the otic capsule, lateral to and near the internal aperture of the vestibular aqueduct.

Key words : temporal bone pathology, paravestibular canaliculus, otosclerosis

Ogura and Clemis (1) clearly demonstrated the paravestibular canaliculus (PVC) by osmium staining. Stahle and Wilbrand (2) confirmed this structure with plastic molding and tomography. Ogura *et al.* also demonstrated it with plastic molding (3). Sando *et al.* (4, 5) investigated it histologically and discussed its importance in microcirculation of the inner ear. Recently, Rask-Anderson (6) and Sando *et al.* (5) confirmed the existence of the PVC in all specimens of human materials they examined.

The present paper describes the histological details of the PVC observed in human temporal bones which had been operated upon because of otosclerosis (7, 8).

Materials and Methods

Thirteen temporal bones removed from otosclerotic patients who underwent fenestration or stapes surgery were used in this study. Two of the patients were male and 11 were female, and the average of age at death was 66.2 years old, ranging from 37 to 86 (Table 1). None of the patients had a history of Meniere's disease. All 23 specimens from the 13 patients belonged to the temporal bone laboratory of the Department of Otolaryngology of Northwestern University. All temporal bones examined were embedded in

Table 1 Cases examined

Case no.	Initials	Sex	Age at death	Cause of death
2	S. D.	F	86	Unknown
3	J. B.	F	37	Unknown
4	I. P.	F	65	Traffic accident
5	C. G.	M	81	Cancer, stomach Pulm. infarct
6	W. P.	M	72	Duodenal ulcer
7	M. M.	F	73	Myocardial infarct
8	O. B.	F	80	Congestive heart failure
9	A. C.	F	49	Cancer, neck
10	M. S.	F	60	Leukemia
11	L. B.	F	65	Leukemia
12	J. N.	F	72	Chr. obstr. lung disease
13	R. T.	F	66	Unknown
14	G. S.	F	55	Cancer, ovaries

celloidin and sectioned horizontally at intervals of 20 μm. Every 10 sections was stained with hematoxylin and eosin solution and observed under a light microscope.

Results

In all of the specimens, the endolymphatic ducts and sacs were observed to be normally developed without pathological findings. The pneumatization was also normal.

The PVC was found in 8 patients (61.5 %) or 14 ears (60.9%) as shown in Table 2. The course of the PVC was traced from the proximal to the distal area along with the vestibular aqueduct (VA) in 12 ears. In 7 of them, the PVC merged into the

Table 2 Histological and morphological findings of the PVC

Case no.	Initials	Side	Observation of the VA, ED or ES	Observations of the PVC		
				Existence	Merging point	Contents
2	S. D.	R	ED, tiny	−		
		L	VA, cut off	?		
3	J. B.	R	Normal	−		
		L	Normal	−		
4	I. P.	R	VA, tiny	Not clear		Vein
		L	VA, tiny	+		Vein
5	C. G.	R	VA, not clear	?		
		L	VA, normal	−		
6	W. P.	R	VA, normal	−		
		L	VA, normal	?		
7	M. H.	R	VA, rather tiny	+		Veins
		L	VA, normal	+	Distal	Veins
8	O. B.	R	Temporal bone, not removed			
		L	VA, normal	−		
9	A. C.	R	VA, normal	+	Distal	Vein
		L	Normal	+	Distal	Vein
10	M. S.	R	VA, cut off	?		
		L	VA, normal	+	Rugose	Vein
11	L. B.	R	VA, normal	+	Distal	Vein
		L	VA, tiny	+	Distal	Vein
12	J. N.	R	VA, normal	+	Distal	Veins
		L	VA, tiny	+	Distal	Vein
13	R. T.	R	VA, normal	+	Distal	Vein
		L	VA, tiny	+	Distal	Vein
14	G. S.	R	VA, normal	+	Distal (dura)	Vein
		L	VA, normal	+	Distal	Vein

Abbreviations: ED, endolymphatic duct; ES, endolymphatic sac; PVC, paravestibular canaliculus; VA, vestibular aqueduct

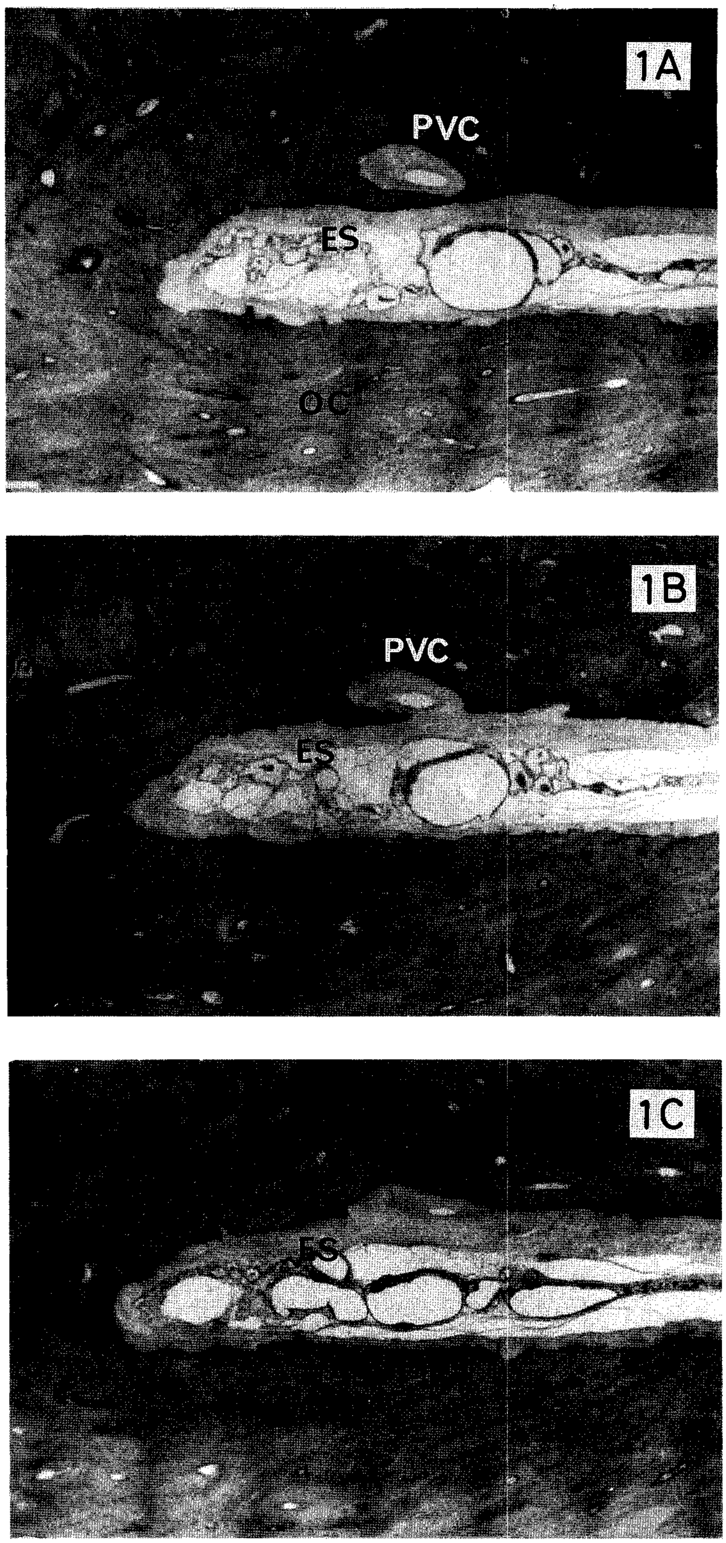

Fig. 1 Merging of the paravestibular canaliculus (PVC) into the distal portion of the endolymphatic sac (A, B, C). Case 9, the left ear ×35. ES, endolymphatic sac; OC, otic capsule.

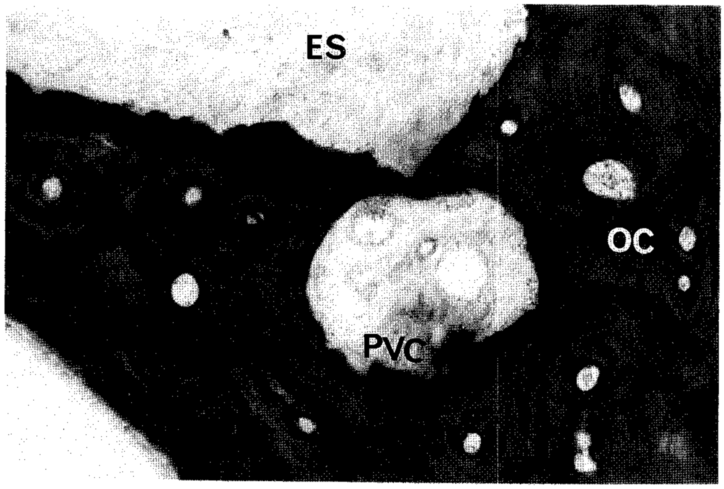

Fig. 2 The paravestibular canaliculus (PVC) attaching to the distal portion of the endolymphatic sac, from the lateral side. Several veins are seen in the PVC. Case 7, the left ear ×100. ES, endolymphatic sac ; OC, otic capsule.

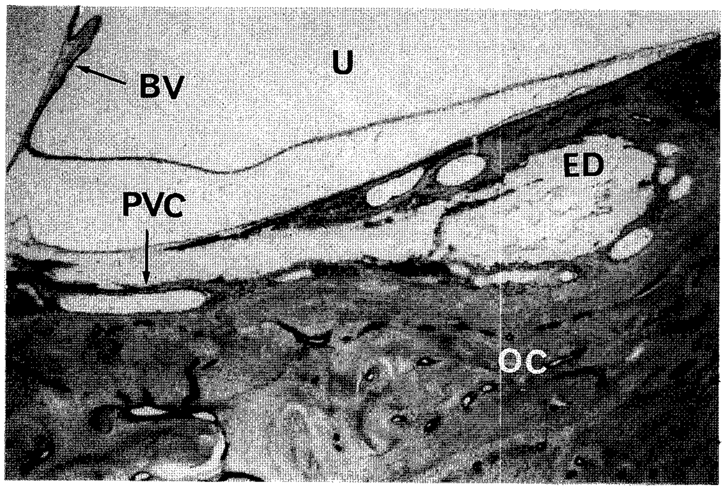

Fig. 3 The beginning of the paravestibular canaliculus (PVC) is seen in the otic capsule as small vascular channels, near the vestibule. Case 14, the left ear ×40. BV, Bast's valve ; ED, endolymphatic duct ; OC, otic capsule ; U, utricle.

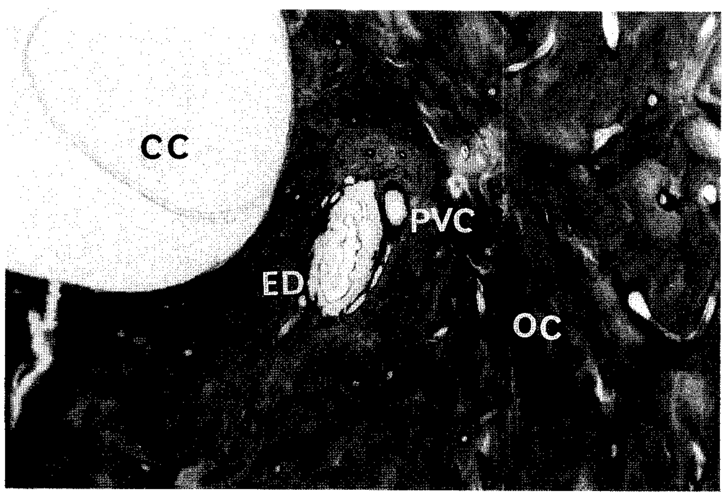

Fig. 4 Some of the paravestibular canaliculus (PVC) appears medial to the isthmus of the vestibular aqueduct. Common crus of the semicircular canals is seen in the left of this photo. Case 7, the right ear ×35. CC, common crus ; ED, endolymphatic duct ; OC, otic capsule.

distal portion of the VA (Fig. 1). In the remaining 5, the PVC appeared to merge into the side of the distal portion of the VA. PVC containing vessels were seen in 12 ears (85.7%), and 3 of the PVC had several veins at the distal portion (Fig. 2). No artery was found in any of the PVC. The beginning of the PVC was observed in the otic capsule near the internal aperture of the VA in the vestibular area in 7 ears. All of these PVC originated around the VA from one or two small vascular channels for veins (Fig. 3). Some of them appeared medial to the isthmus of the VA (Fig. 4).

Discussions

Recently, notice has been taken of the morphology and function of the endolymphatic duct and sac because of their possible clinical significance in Meniere's disease. The clarification of the function of these structures is important, because of the possibility of their role in vestibular circulation.

The small osseous canal "paravestibular canaliculus" (Ogura and Clemis, 1971) was described by Siebenman in 1894, as a canal running along the VA containing veins from the utricle and semicircular canal ends (4). Ogura and Clemis (1) re-discovered this structure in 15 of 23 human temporal bones (65.2%) by means of perilymphatic infusion with 1% osmic acid solution, using a microdissection technique. Later, Stahle and Wilbrand found the PVC in 31% of healthy persons and 11.6% of patients with Meniere's disease by means of tomography. They also demonstrated the PVC using plastic molding at that time. Furthermore, Wilbrand *et al.* (9) found the PVC by the microdissection technique in all human temporal bones in which the PVC was revealed by tomography. Sando and Egami found the PVC in all temporal bones without histological evidence of ear disease (4). All of the reported findings suggest that the PVC is a circulatory passageway to the VA.

Many of the slides of the specimens used in this study were missing, spoiled or partially cut off, so it was not possible to obtain complete histological details of the PVC. Therefore, the incidence of the PVC in our study (60.9%) might be lower than the true value.

Ogura and Clemis reported that the PVC started mediosuperior to the internal aperture of the VA and a lateral to the VA immediately after crossing over the duct in most of the cases they observed. On the other hand, Sando *et al.* (5) investigated the temporal bones by the graphic reconstruction method and found that the PVC begins around the internal aperture of the VA as 2 canaliculi. After joining together, the PVC was found to run inferiorly to the VA, and merge into the VA at the rougose or distal portion of the endolymphatic sac from the lateral side. These findings of Sando's are very similar to ours. Rask-Anderson (6) demonstrated several small vessels from the vestibule to the beginning part of the PVC in plastic molding, also corresponding to Sando's histopathological findings.

Because of incomplete serial sections, it was impossible to confirm the union of 2 or more vascular channels which become the PVC around the vestibule at the internal aperture of the VA in the present study. The authors confirmed, however, that the PVC contains only veins. Sando *et al.* observed a small artery entering from the side of the posterior cranial fossa at the distal portion of the endolymphatic sac in 65% of their specimens and considered it an artery feeding the PVC (5). In 7 ears of 4 patients, the PVC was traced easily from the beginning to the distal end, but we did not find any artery along the entire course. Thus, our results suggest that the PVC is concerned with vascular drainage of the vestibule.

References

1. Ogura Y and Clemis JD: A study of the gross anatomy of the human vestibular aqueduct. Am Otol Rhinol Laryngol (1971) **80**, 813-825.
2. Stahle J and Wilbrand H: The vestibular aqueduct in patients with Meniere's disease. A tomographic and clinical investigation. Acta Otolaryngol (1974) **78**, 36-48.
3. Ogura Y, Masuda Y and Clemis JD: Anatomical note of the paravestibular canaliculus. Proceedings of the Fifth Extraordinary Meeting of the Bárány Society (1976) pp 362-364.
4. Sando I and Egami T: Anatomy of the paravestibular canaliculus. Adv Oto-Rhino-Laryngol (1979) **25**, 34-40.
5. Sando I, Egami T and Harada T: Course and contents of the paravestibular canaliculus. Ann Otol Rhinol Laryngol (1980) **89**, 147-156.
6. Rask-Anderson H: The vascular supply of the endolymphatic sac. Acta Otolaryngol (1979) **83**, 315-327.
7. Masuda Y, Ogura Y and Applebaum EL: Pathological findings of bilateral temporal bones in the cases operated with stapes surgery and fenestration operation. Ear Res Jpn (1980) **11**, 95-98 (in Japanese).
8. Masuda Y, Ogura Y and Applebaum EL: Pathological findings of bilateral temporal bones in the cases operated with fenestration operation. Ear Res Jpn (1981) **12**, 256-259 (in Japanese).
9. Wilbrand HF, Rask-Anderson H and Gilstring D: The vestibular aqueduct and the paravestibular canal. An anatomic and roentgenologic investigation. Acta Radiol (1974) **15**, 337-355.

Received: March 27, 1987
Accepted: June 10, 1987

Correspondence to:
Yu Masuda
Department of Otolaryngology
Okayama University Medical School
2-5-1 Shikatacho
Okayama 700, Japan