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The Nerve Supply of the Human Auricle

ELMAR T. PEUKER* AND TIMM J. FILLER

Clinical Anatomy Division, Institute of Anatomy, Westfalian Wilhelms-University, Muenster, Germany

Knowledge of the innervation of the outer ear is crucial for surgery in this region. The aim of this study was to describe the system of the auricular nerve supply. On 14 ears of seven cadavers the complete course of the nerve supply was exposed and categorized. A heterogeneous distribution of two cranial branchial nerves and two somatic cervical nerves was found. At the lateral as well as the medial surface the great auricular nerve prevails. No region with triple innervation was found. Clin. Anat. 15:35–37, 2002. © 2002 Wiley-Liss, Inc.

Key words: innervation; external ear; cadaveric study; variation

INTRODUCTION

A detailed knowledge on vascularization and innervation of the outer ear is crucial for reconstructive and plastic surgery in this region. Moreover, the innervation of the auricle is the theoretical basis of different reflex therapies (e.g., ear acupuncture). However, data on the innervation as provided by scientific publications are scarce, incomplete, and inconsistent. The aim of this study is to describe the system of the auricular nerve supply.

MATERIALS AND METHODS

On 14 ears of seven cadavers the complete course of nerve supply was exposed under magnifying glasses. Each branch was defined by identifying its origin. The bodies (both sexes, age between 68 and 84 years) donated to the Institute of Anatomy had been embalmed with a mixture of formaldehyde, chloral hydrate, and sorbitum solution. Ramifications were coated with a water-soluble dye and photographically documented. The results were transferred to a scheme of the external ear and classified.

RESULTS

A heterogeneous distribution of cranial branchial nerves and somatic cervical nerves was found.

At the lateral surface the GAN (great auricular nerve) prevails. In 73% of cases the ABVN (auricular branch of vagus nerve) and in 18% the GAN was found on the antihelix solely, and 9% showed a double innervation. The lobule and the antitragus were supplied by the GAN in all cases. The tragus was innervated by GAN in 45% solely, in 9% by the ATN (auriculotemporal nerve), and in all other cases by both of them. The tail of helix and the scapha were always supplied by the GAN, the spine of helix in 91% by the ATN (9% GAN). The ATN was found in 80% at the crus helicis; in 20% the ABVN branched on this part. In 9% the ABVN provided ramification for the crura antihelices (91% GAN), in 45% of the specimen for the cavity of conchae, and in 100% for the cymba conchae. In 55% two nerves were found on the cavity of conchae (GAN and ABVN). No region with triple innervation was found. For an overview see Table 1 and Figure 1A.

At the medial surface of the auricle the LON (lesser occipital nerve) participated in 55% of the innervation of the upper third (in 37% solely). The GAN participated in 63% (in 27% solely); in 36% double innervation was found. The supply of the middle third was provided in 64% by the GAN (18% solely), in 73% by the ABVN (27% solely), and in 18% by the LON (in no case solely). Double innervation was seen in 55% of the middle third. At the lower third, in 91% of the cases GAN was found (73% solely), and in 27% the ABVN (9% solely). No region with triple innervation was found at the medial surface of the auricle as

*Correspondence to: Dr. Elmar T. Peuker, Institute of Anatomy, Vesaliusweg 2-4, D-48149 Muenster, Germany.
E-mail: peuker@uni-muenster.de

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TABLE 1. Overview of the Innervation Pattern of the Lateral Surface of the Auricle

	ABVN	GAN	ATN
Crus of helix	20%		80%
Spine of helix		9%	91%
Tail of helix		100%	
Scapha		100%	
Crura of anthelix	9%	91%	
Antihelix	73%	9%	18%
Antitragus		100%	
Tragus	45%	46%	9%
Cymba conchae	100%		
Cavity of concha	45%	55%	
Lobule of auricle		100%	

ABVN = auricle branch of the vagus nerve; GAN = great auricular nerve; ATN = auriculotemporal nerve.

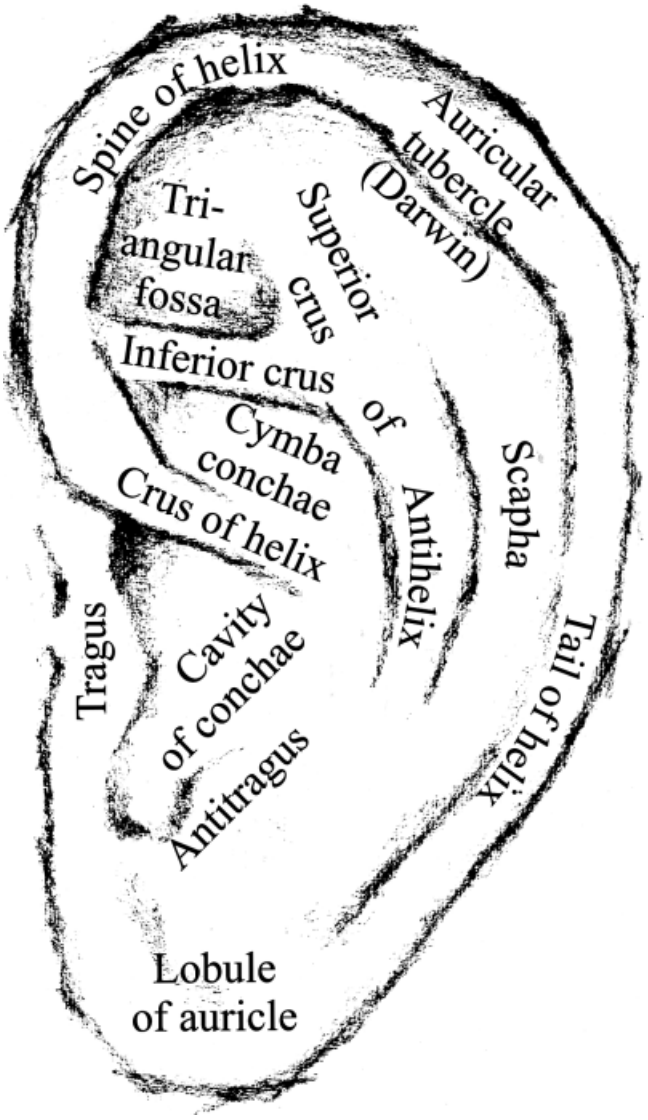

Fig. 1. Scheme of left auricle, lateral aspect.

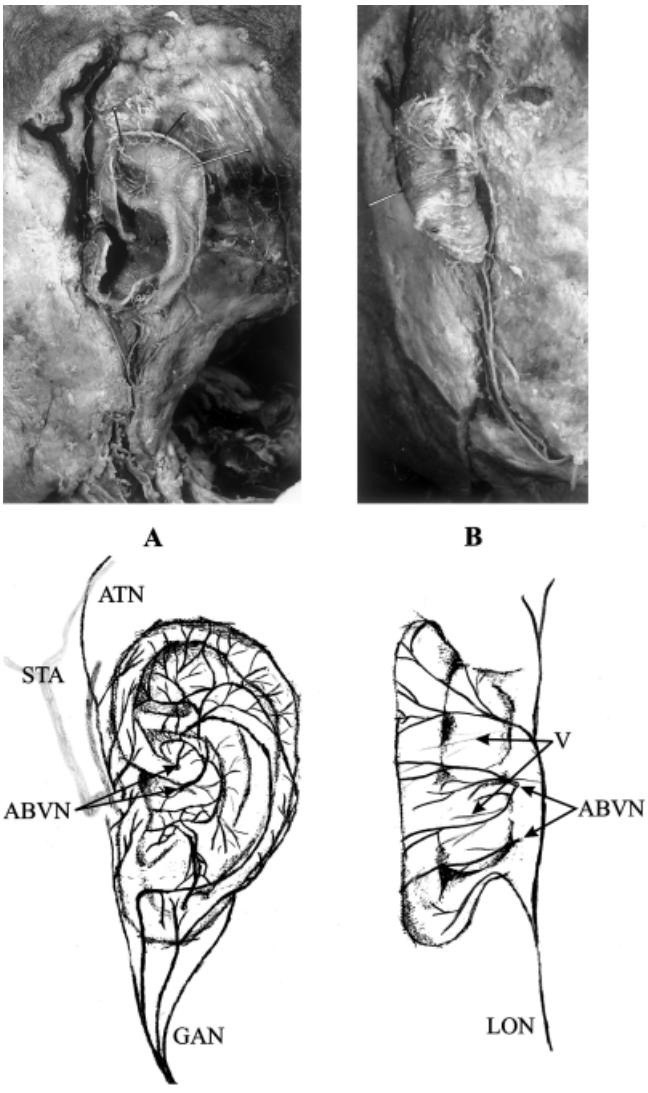

Fig. 2. **A.** Lateral surface of the external ear with corresponding scheme. ABVN = auricular branch of vagus nerve; GAN = great auricular nerve; ATN = auriculotemporal nerve; STA = superficial temporal artery. **B.** Medial surface of the external ear with corresponding scheme. ABVN = auricular branch of vagus nerve; LON = lesser occipital nerve; V = vessels.

well. For details on double innervation see Figures 1B and 2.

DISCUSSION

The external ear appears only in mammals. The density of nerve fibers in the human auricle compared to other regions of the head seems rather high. In addition, four different nerves are distributed to the external ear. They are partly branchiogenic and somatogenic. Concerning the sensory innervation, there is a gap in the origin between the first and third branchiogenic nerves on the upper side and on the

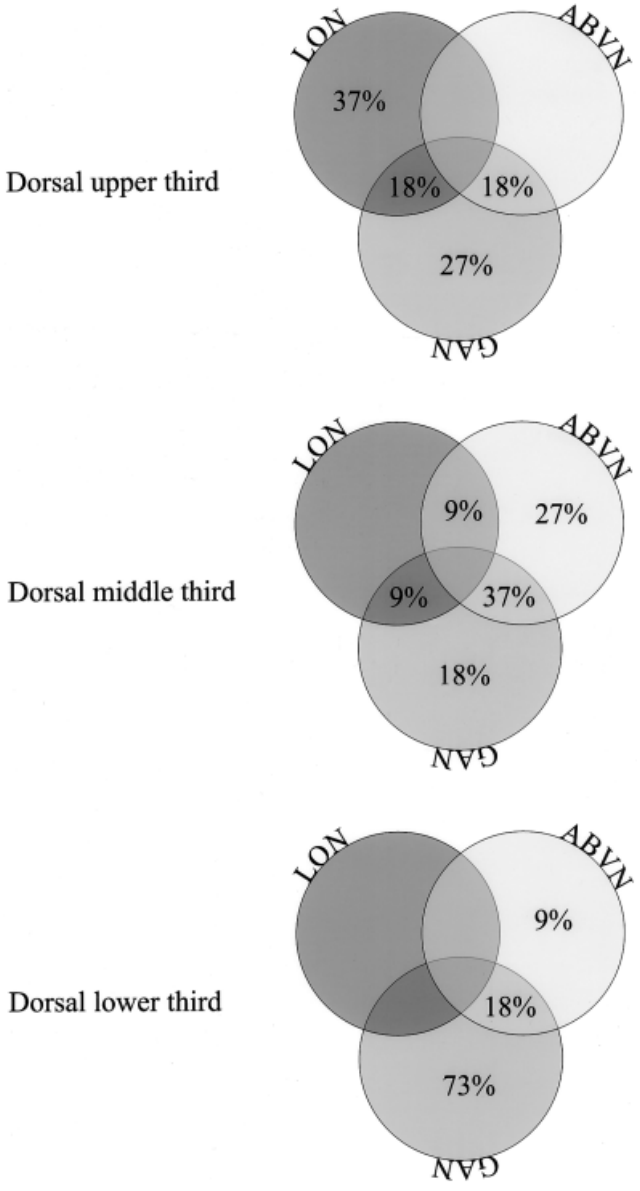

Fig. 3. Scheme of the distribution patterns of the medial surface of the auricle. ABVN = auricular branch of vagus nerve; GAN = great auricular nerve; LON = lesser occipital nerve.

third to fourth spinal nerves from the lower side. No overlapping of the branchial branches was noted, whereas the somatogenic nerves showed double innervation with both origins of the nerves. The overlapping was seen on the lateral site only within the middle third (tragus, inferior concha, and antihelix), whereas the medial surface revealed overlapping in all parts.

Other studies imply that the sensory innervation is provided by the cranial and cervical nerves (Satomi and Takahashi, 1991). Labeling of the central projections shows a remarkable ipsilateral distribution (Nomura and Mizuno, 1984). However, the respective studies have been performed mainly on cat auricles, and no suggestions were made on the function of this extensive innervation. Regulation of temperature might be a possible explanation, control of ear formation could be another. Nonetheless, to our knowledge, there are no related studies available.

Depending on the technique, complications of otoplasty and auricular reconstruction are quite common. Cutaneous problems, residual pain, hypesthesia, sensitivity to cold or touch, and delayed wound healing are mentioned in scientific publications (Calder and Naasan, 1994; Caouette-Laberge et al., 2000; Weerda and Siegert, 1994). Most of the surgical techniques do not consider the innervation pattern (Heppt and Trautmann, 1999). However, disturbances of the nerve supply of the vessels and therefore of the tissue nutrition may be responsible for the considerable postoperative problems.

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