

WHAT IS THE ORIGIN OF THE LABYRINTHINE ARTERY AMONG BLACK KENYANS?

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ABSTRACT

Origin of labyrinthine artery is important because it influences the presentation of occlusion of anterior inferior cerebellar and basilar arteries. It shows ethnic and geographical variation, but there is no data from black African populations. This study, therefore examined the pattern of origin of labyrinthine artery in adult black Kenyans. Three hundred and forty six arteries from one hundred and seventy-three formalin fixed brains were examined by dissection at the Department of Human Anatomy University of Nairobi, Kenya. Labyrinthine artery arose from basilar artery in 260 (75.1%); as common trunk with anterior inferior cerebellar artery in 48 (13.9%) and from the latter in 38 (11.0%) of cases. There was no side and gender difference in the pattern of origin. This implies that majority of labyrinthine arteries arise from basilar artery, different from that in oriental, Indo-Asian and Caucasian populations, in which it arises from the anterior inferior cerebellar artery. Preoperative evaluation of basilar artery branching is recommended.

Keywords: labyrinthine artery, origin, Kenyan, Basilar, AICA

INTRODUCTION

The labyrinthine artery (LA), also called internal auditory artery, is an end artery which supplies the inner ear, facial and vestibulocochlear nerves. This artery was classically known to arise from the basilar artery (BA) until Nabeya (1923) and Adachi (1928) reported that it consistently arose from the anterior inferior cerebellar artery (AICA) especially among Japanese (Nager, 1954). Some textbooks still describe it as a branch of BA (Tobias et al., 2001). Generally, however, the variable origin from either BA or AICA is now well entrenched (Gabella, 1999; Sinnatamby, 2001; Sunderland, 1945, 1948; Sakata 2001; Wankhede et al., 2015; Haidera, 2015). Features of its occlusion, namely vertigo, deafness, facial palsy, constituting the so called labyrinthine artery infarction are associated with infarction of brainstem and/or cerebellum especially in the territory of AICA (Lee et al., 2009; Kim and Lee, 2009; Haidara et al., 2015). What is not so well known is that other than BA and AICA, the LA could arise from several other sources (Wende, 1975; Harrigan et al., 2009). Knowledge of variation in origin of this artery is important in order to avoid

inadvertent ligation or sectioning of the arteries during surgical approaches to the posterior cranial fossa and especially cerebello – pontine angle for aneurysms, arteriovenous malformations, tumors, epilepsy surgery, posterior temporal lobectomies and posterior cerebral revascularization (Uchino et al., 2003; Pai et al., 2007; Zador et al., 2010; Haidara et al., 2015). Further, they are also important during diagnostic and interventional neuroradiology in avoiding incorrect diagnosis, explaining unusual presentation of posterior circulatory stroke, possible implications of surgery and interventional procedures (Bulsara et al., 2007; Bykowski et al., 2011). The patterns of origin display ethnic variations (Gillilan et al., 1972). As advances in neurosurgery including for tumors increases in Africa (Qureshi and Oluoch – Olunya, 2010; Uduma et al., 2013), there is need for accurate knowledge on brain vasculature. Such data on LA from black populations are, however, scanty and absent altogether for the Kenyan one. This study therefore investigated the origin of LA in a black Kenyan population.

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MATERIALS AND METHODS

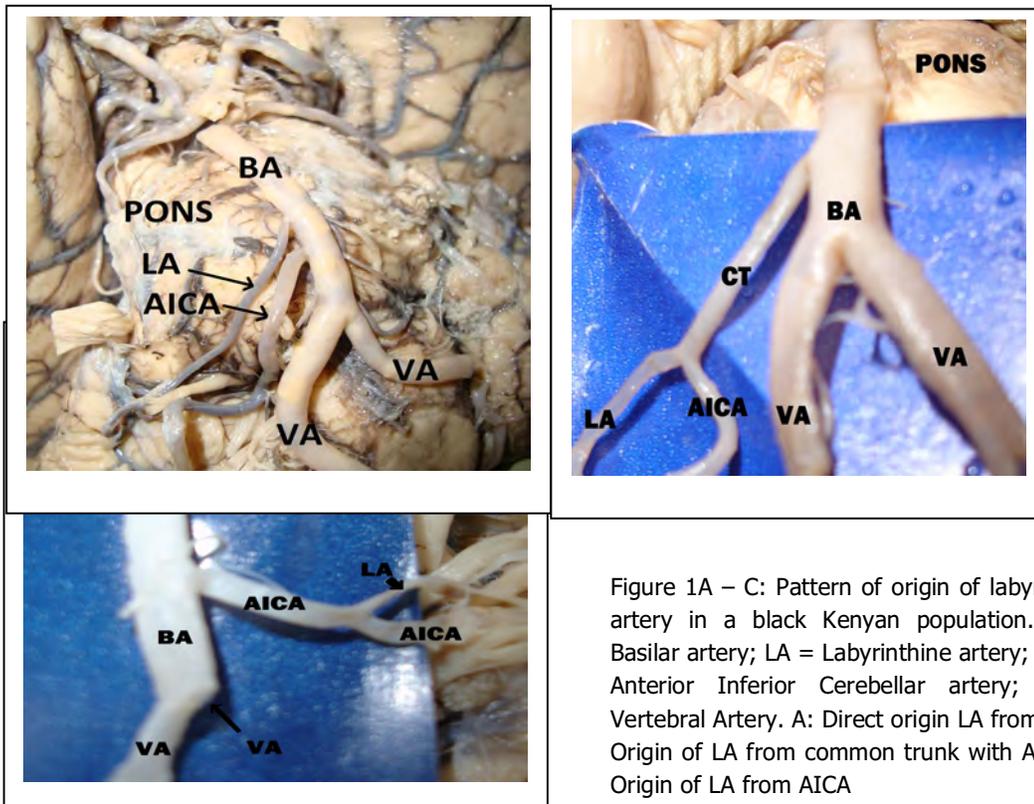
One hundred and seventy-three (99 male, 74 female) brains, that is, 346 arteries were examined. In these, the arachnoid was gently peeled off the base of brain. Labyrinthine artery was identified as that which coursed laterally towards cerebellopontine angle to join the facial and vestibulo cochlea nerves. Arteries were defined as common trunks if their branches were of almost equal diameter on macroscopic examination. Where one branch was smaller, the larger one was considered the parent. Each artery was followed

distally to ascertain its destination. Its site and pattern of origin were then recorded. Photographs of representative patterns were taken using a high resolution digital camera. Respective origins of the arteries were coded and entered the statistical program for Social Scientists version 16.0 for windows. The data were analysed for frequencies. Student t-test was used to calculate statistical difference between left and right and between male and female at 95% confidence interval where p value of ≤ 0.05 was taken to be significant.

RESULTS

The single LA was present in all cases. It arose from the basilar (Fig 1A) in 260 (75.1%) cases. 132 of these were in females, and 128 in males. This difference was not statistically significant ($p = 0.09$). 125 were on the left and 135 on the right ($p = 0.07$).

In 48 (13.9%) cases, it arose as a common trunk with AICA (Fig 1B) and from AICA (Fig 1C) in 38 (11.0%) cases. There was no gender nor side difference in these either.



DISCUSSION

The contemporary view is that LA usually arises from AICA, but may also arise from BA (Gabella, 1999; Sinnatamby, 2001; Zhang et al., 2002; Haidara et al., 2015). Observations of the current study, however, reveal that this artery arose from basilar in (75.1%) of cases, much higher than in prevailing reports where the frequency varied from 7.7% among Koreans (Kim et al., 1990) to 67.7% among Italians (Cavatori, 1908). Although most reports show the predominant origin to be AICA, the frequency varies [Table 1].

Such wide variability is consistent with literature ascertains that this artery may vary even between the two sides of the same individual (Wende, 1975; Boborelu et al., 2012; Wankhede et al., 2015)

In the current study, the origin predominantly from the basilar artery is consistent with reports that acute auditory symptoms from vertebrobasilar

insufficiency are usually associated with multiple brain stem and cerebellar signs (Huang et al., 1993; Lee et al., 2011). This implies that in this study population, posterior circulatory stroke due to vertebrobasilar insufficiency is much more likely to present with vestibulocochlear deficits and should therefore be considered a differential diagnosis in the latter.

Labyrinthine artery arose from AICA or as a common trunk with it in only 25% cases. Origin from a common trunk with AICA though seldom reported, exists in historical accounts (Henle, 1876). Although this association with AICA is much lower than that reported in previous studies (Table 1), it is still clinically significant. Accordingly, vestibulocochlear loss, common in acute ischemic stroke in the distribution of AICA in other populations (Melling and Koos, 1996; Lee, 2014; Kim and Lee, 2017) may occur in only one in four of the Kenyan populations.

Table 1: Pattern of origin of labyrinthine artery in various populations

Author	Population	Origin of labyrinthine artery (%)					
		BA	AICA	SCA	PICA	VA	AICA – LA trunk
Adachi, 1928	Japanese	-	100	-	-	-	-
Cavatori, 1908	Italian	67.7	32.3	-	-	-	-
Haidara et al., 2015	West African	10	90	-	-	-	-
Harrigan et al., 2009	Unspecified	16	45	25	-	-	-
Kim et al., 1990	Korean	7.7	92.3	-	-	-	-
Padmavathi, 2005	Indian	30.6	63.9	-	-	-	-
Sunderland, 1948	Unspecified	17	83	-	-	-	-
Wankhede, 2015	Indian	35	65	-	-	-	-
Wende et al., 1975	German	16	45.4	24.4	5.4	-	-
Zhang et al., 2002	Chinese	12.3	83.6	-	-	-	-
Current study	Kenyan	75.1	11.0	-	-	-	13.9

Key: BA = Basilar Artery; AICA = Anterior Inferior Cerebellar Artery; PICA = Posterior Inferior Cerebellar Artery; VA = Vertebral Artery

Partial ischaemia in the AICA territory could lead to isolated acute auditory syndrome such as hearing loss and tinnitus. Indeed hearing loss and vestibular disorders including vestibular neuritis or Meniere's disease are common signs of AICA infarct (Lee et al., 2002). Accordingly, a detailed neurological examination focusing on additional brainstem and cerebellar signs should be performed on all patients presenting with vertigo (Lee and Cho, 2003).

In conclusion, a majority of the labyrinthine arteries arise from the basilar artery, different from

contemporary reports from Oriental, Indo-Asian and Caucasian populations in which it arises from the anterior inferior cerebellar artery. Patients with audiovestibular symptoms should be examined for brainstem and cerebellar dysfunction.

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