

# Morphometric Analysis of Accessory Vessel Grooves (AVG) in the Skulls of the Ancient Spradon Population: An Anthropological Approach

**Análisis Morfométrico de los Surcos de Vasos Sanguíneos Accesorios (SVA) en los Cráneos de la Antigua Población de Spradon: Un Enfoque Antropológico**

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**SUMMARY:** Accessory vessel grooves (AVG), or accessory vessel sulcus, is the name given to grooves seen in the frontal region of the skull. In studies conducted by anthropologists on antiquity skeletons, it is seen that some variations are confused with traumas due to the unknown skeletal morphology. This situation leads to an incorrect evaluation of the socio-economic or health structure of the population. In this study, an accessory vessel grooves research was carried out on the skeletons of the late Roman-early Byzantine population. Studies were conducted on 69 adult human skeletons of known age and sex, and 3 human skeletal skulls whose sex could not be determined. Accessory vessel grooves rate was calculated as 10.54 % in the Spradon ancient population. While there is 10.52 % AVG in female individuals in the population, lower AVG levels have been detected in males compared to females with 9.67 %. There is no significant difference between male and female individuals in terms of AVG. Although the lengths of AVG differ in the right and left frontal, it can be said that there is no difference in direction. Although the relation of AVG variation with high blood pressure is included in the literature, the intense appearance of this structure in the Spradon Population, especially in young individuals, weakens this hypothesis. The literature on the existence of AVG will expand further with the studies to be carried out on ancient Anatolian populations in the following years.

**KEY WORDS:** Accessory vessel grooves (AVG); Morphology; Ancient Anatolian population; Skull.

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## INTRODUCTION

While conducting anthropological studies on the skeletons of ancient populations, it can be confused whether some structures in the skeletons are morphology or a pathology. In this case, it is necessary to know the skeletal morphology well and to master the variations and pathologies that may occur in the skeletons. Whether the thin grooves seen in the skull are pathology or an anatomical structure is one of the frequently confused issues. Because many ancient populations have grooves similar to some incision marks on the skeletons. Therefore, the detection of these structures, which anthropologists often confuse with trauma traces in their research on ancient populations, is important in understanding the health status of the population correctly.

The venae emissaria opens into the sinus durae matrix, located in the spaces between the two leaves of the outer membrane of the dura mater of the brain, by piercing the cranium. The holes they create while passing through

the Venae emissaria Cranium are called emissary vein holes. Vv. Emissariae connects the diploic veins inside the skull bone to the sinus durae matrix together with the veins of the scalp (Standring, 2008).

These veins pass through the holes in the cranium wall and provide the connection between the sinuses inside the cranium and the veins outside (Gray, 1918). These veins have an important function in balancing intracranial pressure and during cerebral occlusion or v. They can act as safety valves in patients with head or neck lesions such as narrowing of the jugularis interna (Louis Jr. *et al.*, 2009). Since there are no valves in the emissary veins, the blood flow is bidirectional. Under normal conditions, blood flow in these veins is slow. However, in cases where intracranial pressure increases, these veins become important blood evacuation routes. Emissary veins also play an important role in adjusting the heat balance in the skull, as they allow cooler

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blood to pass from the head surface to the brain. (Irmak *et al.*, 2004). The fact that the 2 grooves in the skull end with the emissary vein hole, it is formed as a result of the enlargement of the emissary veins with 2-way flow due to a trauma, infection or pathology that may cause an increase in intracranial pressure in these individuals, which may belong to Vena Emissaria parietalis. It is thought to be.

## MATERIAL AND METHOD

The skulls with Accessory Vessel Grooves (AVG) subject to the study were extracted in Avcılar District of Istanbul Province. Spradon Ancient City was dated to the Late Roman-early Byzantine period (1st and 2nd century AD). 58 graves were found in the excavation area and skeletons of 90 individuals in total were found among these tombs. 38 Female and 31 Male individuals were determined after the determination of age and sex. The sex of 3 adults could not be determined (Table I) (Sarbak *et al.*, 2017).

Table I. Sex distribution in Spradon population (Sarbak *et al.*, 2017).

<i>Sex Distribution</i>	<i>(N)</i>	<i>(%)</i>
<i>Fetus</i>	1	1.11
<i>Infant</i>	8	8.9
<i>Juvenile</i>	7	7.78
<i>Adolescent</i>	2	2.22
<i>Female</i>	38	42.22
<i>Male</i>	31	34.44
<i>Indefinite</i>	3	3.33
<b>Total</b>	<b>90</b>	<b>100</b>

Accessory vessel grooves (AVG) research was conducted in a total of 72 adult individuals and the sizes of Accessory Vessel Grooves were carefully measured and recorded several times with digital calipers.

## RESULTS

Table II. Accessory vessel grooves measurements in ancient Spradon population.

Grave Number	Sex	Age	Right (mm)		Left (mm)	
			Medial / Lateral	Not	Medial / Lateral	Not
M46-3	<i>Female</i>	Young Adult	Not	Not	54,82	26,55
M 35	<i>Female</i>	Middle Adult	18,47	37,41	5,97	36,58
M36-4	<i>Male</i>	Middle Adult	36,2	Not	Not	Not
M 44-3	<i>Female</i>	Young Adult	27,92	Not	16,11	78,09
M 44-1	<i>Male</i>	Young Adult	14	26,78	9,21	21,06
M35-4	<i>Male</i>	Young Adult	Not	30,53	Not	Not
Indefinite	<i>Female</i>	Elderly Adult	Not	Not	19,45	Not

Spradon late Roman Early Byzantine Population investigated morphological structures called accessory vessel grooves or accessory vessel sulcus on the skulls of adult individuals. In this context, accessory vessel grooves structure was found in 7 individuals in the Spradon community without any coherence of direction. While 4 of these were found in Female individuals, 3 of them were found in Male individuals. 4 of individuals with AVG are seen in Young Adult individuals, 2 in Medium Adult and 1 in Advanced Adult individuals. Of these individuals, there are 2 Young Adult Individuals for Female and Male, 1 for Middle Adult Female and Male, and 1 for Advanced Adult Female (Table II).

M46-3 young adult Female individual had no AVG in the medial and lateral sides of the frontal, while 2 AVGs were detected in the medial of the left frontal, 54.82 mm and 26.55 mm in the lateral (Fig. 1).

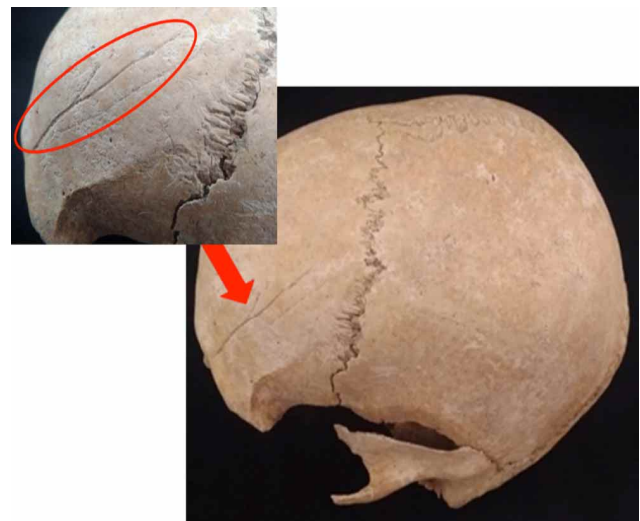


Fig. 1. M46-3 young adult female individual.

M35 Middle adult female individual has AVG in the right frontal medial and lateral and left frontal medial and lateral. While there is a sulcus of 18.47 mm in the medial part of the right frontal, right next to it, there is the second

sulcus with 37.41 mm, which is almost 2 times its length in the lateral. There are 2 sulcus in the left frontal of the individual. While there is a sulcus with a length of 5.97 mm in the medial of the left frontal, the other sulcus with a length of 36.58 mm is located laterally (Figs. 2 and 3).



Fig. 2. M35 female individual.



Fig. 3. M35 female individual's side view

M36-4 middle adult Male individual only has a 36.2 mm long sulcus in the right frontal medial (Fig. 4).



Fig. 4. M36-4 middle adult male individual.

M 44-3 young adult female individual has 3 AVG structures. While there is a sulcus of 27.92 mm in the medial part of the right frontal, this structure is not present in the lateral. While there was 16.11 mm sulcus in the medial of the left frontal, its length of 78.09 mm in the lateral was measured as the longest AVG in the Spradon population. The individual also has metopic suture (Fig. 5).

M 44-1 young adult male individual has 4 AVGs. There is a sulcus of 14 mm in the medial part of the right frontal, 26, 78 mm in the lateral part, 9.21 mm in the medial of the left frontal and a 21.06 mm long AVG in the lateral part. A 30.53 mm long AVG structure was detected only lateral to the right frontal of a M 35-4 young adult Male. There is only 1 AVG in an uncertain advanced adult female. A sulcus with a length of 19.45 mm was detected in the medial part of the left frontal.



Fig. 5. M 44-3 young adult female.

## DISCUSSION

While conducting archaeological and anthropological studies, it is very important to interpret human remains correctly in order to enlighten past populations. Anthropological materials give a lot about the health structures of past populations and their socio-economic situation (Açıkgöz *et al.*, 2020) Having good skeletal morphology knowledge of anthropologists contributes to revealing valuable information from human remains. While conducting anthropological studies, the relationship between the environment and human of the ancient populations constitutes an important subject of research. Evaluations can be made on the skeletons about the daily lives of the population and it is possible to compare them with socio-economic data. In ancient Anatolian populations, revealing whether they were exposed to accidents that occurred as a result of both external factors and daily life is important in terms of reconstruction of the lives of ancient people (Fig. 6). In cases where skeletal morphology is not mastered, it is possible to confuse an anatomical structure in the skeletons with pathology.

Whether some anatomical structures are pathology or morphological features can be confused by forensic scientists, anthropologists, archaeologists, anatomists, neurosurgeons. Forensic scientists and anthropologists who do not have sufficient knowledge about the formation of accessory vessel grooves can define this structure as a traumatic lesion. Although it is an anatomical structure, Accessory Vessel Grooves, which are confused by archaeologists and anthropologists and have the appearance

of an incision scar, are the most important of these anatomical structures. This anatomical feature, which often gives the impression that it was created by a cutting tool on the frontal bone, may cause scientists to misjudge it because it is not a common epigenetic character. In cases where Emitter Veins become prominent, these structures are called Accessory Vessel Grooves. And it is considered a nonmetric feature, not just any pathology. Usually supra-orbital foramen, supra-orbital Veins originating from the orbital notch or frontal foramen form a sulcus on the skull.

There is no exact information about the age of occurrence of accessory vessel grooves. However, Dixon (1904) mentions that a 4-year-old boy found prominent grooves for the supra-orbital nerves in the frontal region. He also states that these grooves are more common in individuals between the ages of 15-30 because the development of the frontal part of the skull is faster in these years. He says that these scars deepen in individuals aged 40-80 (Dixon).

Accessory vessel grooves have been identified in 7 individuals in the Spradon Ancient City community. The rate of AVG in the population is 10.14 %. Accessory Vessel Grooves were observed in 4 out of 38 female individuals and 3 out of 31 Male individuals cared for in the Ancient Spradon Population. While the rate of AVG is 10.52 % in female individuals, it is 9.67 % in male individuals. There is no significant difference between the sexes. In terms of age distribution, it was found to be 18.18 % in young adults,

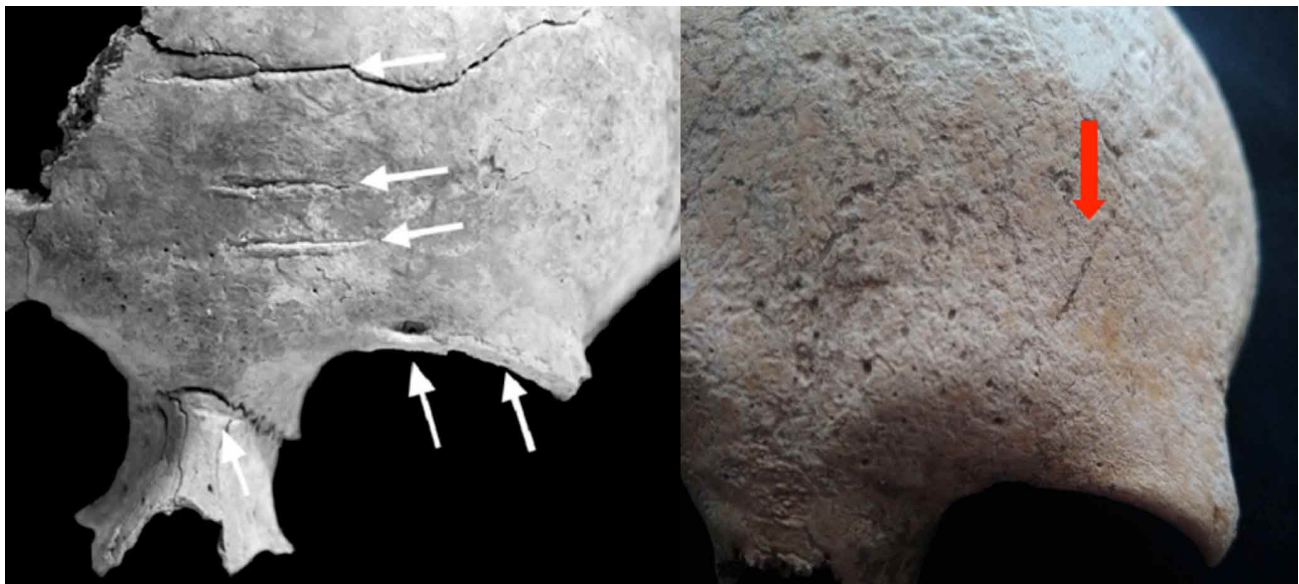


Fig. 6. Sharp force perimortem injuries (Slaus *et al.*, 2010) and AVG.

6.25 % in middle adults and 12.5 % in advanced adults. A higher rate of AVG was detected in the left frontal region compared to the right. Again, a significant difference was found in the measurements taken from the left side compared to the right. In some studies, it is emphasized that AVG can be associated with high blood pressure (Cabanac & Brinnel, 1985). However, the fact that some of the individuals with AVG seen in the Ancient Spradon population are at a very young age is a definite result of the fact that it is not a structure that develops due to high blood pressure. The presence of such a large number of AVGs in the Spradon population can be explained by genetic reasons, although it is not covered much in the literature. Because, in another study, the variational characteristics of the population were investigated and it was observed that kinship relations were determined intensely in this population (Sarbak *et al.*). This research conducted on the late Roman-early Byzantine Spradon population will also be a source for future skeletal morphology studies.

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**RESUMEN:** Surcos de los vasos accesorios (SVA), o canales de vasos accesorios, es el nombre que se les da a los surcos que se ven en la región frontal del cráneo. En los estudios realizados por antropólogos sobre esqueletos de la antigüedad, algunas variaciones se pueden confundir con traumas debido a la morfología esquelética desconocida. Esta situación conduce a una valoración incorrecta de la estructura socioeconómica o sanitaria de la población. En este estudio, se llevó a cabo una investigación de surcos de vasos sanguíneos accesorios en los esqueletos de la población romana tardía y bizantina temprana. Se realizaron estudios en 69 esqueletos humanos adultos de edad y sexo conocidos, y 3 cráneos esqueléticos humanos cuyo sexo no se pudo determinar. La tasa de surcos de vasos accesorios se calculó como 10,54 % en la población antigua de Spradon. Si bien hay un 10,52 % de SVA en las mujeres de la población, se han detectado niveles más bajos de SVA en los hombres en comparación con las mujeres en un 9,67 %. No existe una diferencia significativa entre hombres y mujeres en términos de SVA. Aunque la relación de la variación de SVA con la hipertensión arterial está incluida en la literatura, la importante advertencia de esta estructura en la población de Spradon, particularmente en sujetos jóvenes, debilita esta hipótesis. La literatura sobre la existencia de SVA se ampliará aún más con los estudios que se llevarán a cabo en las antiguas poblaciones de Anatolia en el futuro.

**PALABRAS CLAVE:** Ranuras para vasos accesorios (AVG); Morfología; Población de Anatolia antigua; Cráneo.

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