A study on branching pattern of branches of middle meningeal artery based on meningeal grooves present in the cranial cavity in south Indian dry skulls

Running title: Analysing the branching pattern of branches of middle meningeal artery based on meningeal grooves present in the cranial cavity

Abstract:

Aim:

To study the branching pattern of branches of the middle meningeal artery based on meningeal grooves present in the cranial cavity.

Introduction:

Middle meningeal artery is the major human dural artery. It is a neurologically very important artery for treatment and study of various neural health problems. Its origin and course can vary a lot in relation with embryological development. Complex sequences of MMA gives many opportunities for variant anatomy. It is clinically very important.

Materials and methods:

In this study we decided to investigate the anatomical organisation of the MMA, its branching pattern by taking south indian human dry skulls (N=30). It can be easily traced next to foramen spinosum.The statistical analysis was performed using the t-test calculator.

Result:

Most of the skulls had its middle branch of MMA from the anterior branch.There were many variations observed in the branching pattern.

Conclusion;

The branching pattern had many anatomical variations, which differed from one skull to another. The future scope of this study is to analyse skulls of people from different ethnical groups, observe the variations and trace the correlations.

Keywords:

Middle meningeal artery, variant anatomy, dry skull, neurological importance, foramen spinosum.

Introduction:

The knowledge of the anatomical organisation of the middle meningeal artery (MMA) is of great importance in surgery and radiology.(1–4) This artery and its branches have implications in the pathophysiology of migraine by theories suggesting neurogenic information or cranial vasodilation(5,6) (7). Detailed information of MMA helps in surgeries like bypass(8) (9). MMA Originates from maxillary artery, predominantly periosteal, irrigating bone and dura matter(10)(11,12)(13–15).It enters the floor of middle cranial fossa through foramen spinosum, travels latterly through a middle fossa bony ridge and curves anteriorly over upper greater a wing of sphenoid where it divides into frontal and parietal branch.(16,17) Frontal branch is located in a Bonny ? tunnel and is susceptible to tearing during trauma and this can produce many neurological disorders (18,19). Awareness of these anatomic variations become important for surgeons to reduce risk of complication during surgical repair. Rupture of this artery at pterion leads to epidural haematoma(20) (21). The MMA plays some important role in treatment of many diseases and recurrent chronic subdural haematoma (CDSH) (22–25). In this research we will try to find various different anatomical variations in the branching pattern of MMA.

Materials and methods:

The present study analysed 30 adult dry skulls from a private dental College in Chennai. Only skulls that had bony tunnels and grooves formed from the MMA on either side were used. The statistical analysis was performed using the t-test calculator.

Authorization from the Hospital/Department where the study has been carried out

Tracing of the MMA:

The MMA was first traced by finding out the foramen spinosum. From the foramen spinosum the anterior and posterior division of the artery divides, close observation of the traces gives us the arisal origin of the branch of the MMA either from anterior or posterior branch.

Fig 1

Fig 2

Fig 1 & 2: Shows the tracing procedure tracing of the branching pattern of middle meningeal artery

Statistical analysis:

The statistical analysis was performed using the t-test calculator. The comparison between the morphometric organisation of the right and left MMA from each skull were performed using a paired t test. The P value of 0.05 or less was considered significant in all statistical tests performed at 95% confidence interval.

Results:

The present study observed (that by analysing the)30 skulls, the branching pattern of each side was analysed considered and a table with the cumulative data is plotted below (Table 1). From this table the study inferred that the majority of middle branch of MMA has arisen from the anterior branch than the posterior one of it . In which figure 3, 4, 5 represent the exceptions or

the rare anatomical variations among the 30 skulls studied analysed. Figure 3 represents a dry skull with 2 posterior branches on each side and figure 4 represents a dry skull with a very larger artery size than the normal ones. Figure 5 represents a dry skull which has two different branching patterns on either side of it. Figure 6, 7 represents a dry skull where the anterior branch has formed a bonny tunnel. The Paired t-Test applied to the samples confirmed a p value of 0.5 was obtained which showing there is no meaningful difference significance between the differences data observed in the right and left sides for in the 30 dry skulls.

TABLE 1: Shows the number of the middle branches of MMA branching from anterior and posterior branches on each side.

SIDE	ANTERIOR	POSTERIOR
RIGHT	19	11
LEFT	23	7

Fig3: Skull with 2 posterior branches

Fig4: Skull with large groove size

Fig 5:Skull with different branching pattern on both sides

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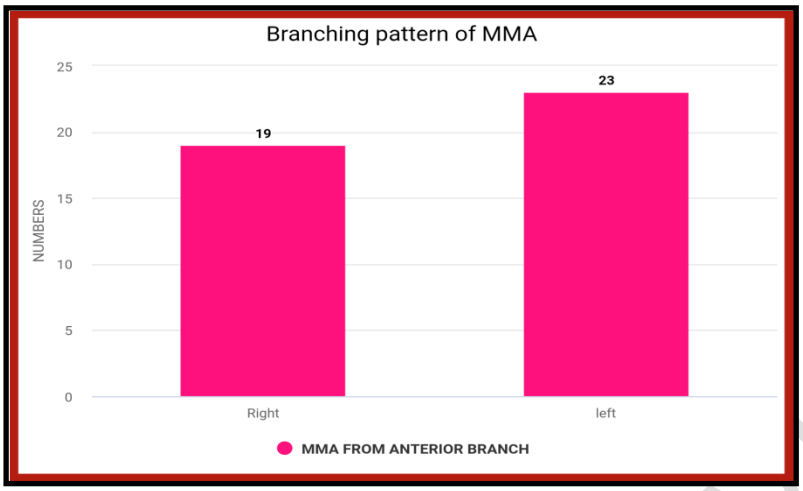
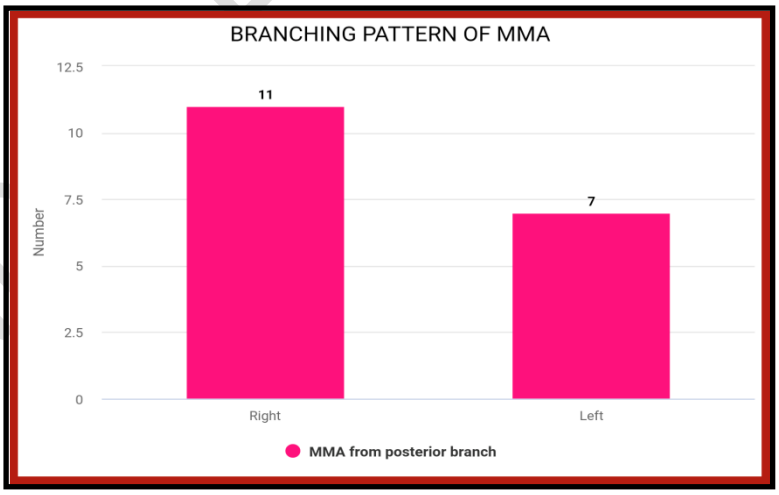
Fig 6:Skull where the anterior branch forms



Graph 1 shows the number of middle branches of MMA arising from the anterior branch on right and left sides. Y axis represents the number of skulls showing the mentioned pattern. X axis shows the respective sides whether left or right.



Graph 2 shows the number of middle branches of MMA arising from the posterior branch on right and left sides. Y axis represents the number of skulls showing the mentioned pattern.X axis shows the respective sides whether left or right.

Discussion:

In the present study we investigated the branching pattern of MMA either from anterior or posterior branch. We found a similar study where morphological and histological features of the bony canal through which the MMA passes was examined (reference 26). The study observed that while the middle meningeal grooves deepen were deepened and they gradually envelop the MMA. The collagen tissues of the outer dural layer continue into the bony canal with the MMA and this is confirmed was seen in the histological study (26). A further analogous similar morphometric analysis of the bony canal in the human skull which measured the lengths of frontal and parietal branches of the bony canal to view the anatomical variations (27)).

One more study of the functional, and morphological pattern of MMA and its embryological differences was carried out were done to observe any anatomical variation (28). The artery which surrounds the middle meningeal artery is the auriculo temporal artery, it is the result of arises from a complex embryological origin warranting its which is the reason for many anatomical variations (29). The importance of MMA in surgical revascularization. MMA can be injured easily if it passes through the bony canal, its morphological and histological features were studied to improve surgical results (26).

Chronic subdural hematoma (cSDH) is caused due to trauma which results in the injury of pterion which is right behind the temple, it is the thinnest part of the skull,where 4four types of bones come in contact.. Underneath this lies the anterior region of MMA, thus it this is the reason why it is often injured leading to cSDH (30). This disease is acknowledged said to be more common among the elderly people. MMA embolization offers the potential for a minimally invasive less morbid treatment in this age group (31). In our study, the frontal branch of the MMA was embedded in the bony canal but this detail is currently omitted both in the literature anatomical nomenclature.,

Besides, in this study we observed the bony canal structure formation just in few of the skulls examined out of the total, the same as what found by (Name not reference)int similar to the study done by (32),. skull Actually They where they studied the incidence and morphometry of the MMA bony canal and grooves on the base.

In the present This study has outlined we obtained the anatomical variations of the MMA and its it's different branching patterns.

However the limitations of the methodology applied of this present study should be acknowledged are the following: the sample is circumscribed to individuals whose first the age, race, gender etc of the 30 dry skulls is unknown.

Because of this ,therefore a correlation of the branching pattern with age, gender etc cannot be done.

The future developing scope of this study is will be to collect dry skulls from different parts of the world, hence from people belonging to different ethnical groups.

This will be the starting point to and also analyse the correlation of the branching pattern with age, gender, descendants, etc.

Conclusion:

The branching pattern of MMA shows variations in the region of branching and point of branching.

thus the study The conclusion that can be drawn is that there is an concludes by saying there is anatomical variation in the branching pattern of MMA from person to person. Thus the present study concluded that studying branching patterns of MMA in the cranial cavity is an important parameter in anatomical studies, anthropometric studies, etc.

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