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The middle cardiac vein as a key for "posteroseptal" space — a morphological point of view

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About 25% of accessory pathways (AP) run via "posteroseptal" space (PSS). There are three approaches for ablation of these pathways: from the right atrium, from the left atrium or from the ventricle and coronary sinus (CS). However in some cases AP is too far from all of them. Catheterisation of the middle cardiac vein (MCV) seems to be the only chance for successful ablation. Our aim was to evaluate the topography of the MCV in PSS.

Classical anatomical investigation was carried out on the autopsy material of 98 consecutive human hearts (42 F, 56 M; age 57 ± 21 yrs). It was supported by transverse section performed under coronary sinus. Regions just behind the atrioventricular septum and behind the cavities were respectively classified as "septal", right (RP) and left posterior (LP). Between them right (RPS) and left posteroseptal areas (LPS) were present. At the posterior view of the heart the angle between CS and MCV ranged from 75 to 90° in 62% of hearts, 60–75° in 18%, 30–60° in 10% and 90–130° in 10%. In 16% MCV ran via the "septal" region, 59% — LPS, 10% — RPS, 10% — RP and 5% — LP. At the ostium of 58% MCV a valve was observed, however there was no trouble with insertion of the 6F catheter into it. We concluded that it is possible to insert the 6F catheter into MCV, which makes it possible to perform ablation of epicardial postero-inferior accessory pathways. The origin of MCV is usually located in the left "posteroseptal" region and runs towards the left side of the posterior wall.

key words: accessory pathways, coronary sinus, middle cardiac vein, posteroseptal space, radiofrequency ablation

INTRODUCTION

The posteroseptal „pyramidal" space of Sealy is one of the most sophisticated regions of the heart. It is formed by the posterior a-v groove flanked by atrial tissue on either side and has its apex at the central fibrous body. The roof of this region is the floor of the coronary sinus [2]. This region is very important for electrophysiologists and surgeons, especially those who are involved in treating cardiac arrhythmias, because about 25% of accessory pathways run via this region [9]. There are three approaches for ablation of these pathways: from the right atrium, from the left atrium or from the ventricle and coronary sinus [7, 10]. However, in some cases AP is present too far from all of them — consecutive applications performed from all of these approaches

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are only transiently successful. Catheterisation of the middle cardiac vein seems to be the last chance for successful ablation [7, 10]. Our aim was to evaluate the topography of the middle cardiac vein in posteroseptal space and the structure of its ostium, which may make the ablation procedure easier in patients with postero-inferior accessory pathway or ectopic ventricular arrhythmia in the same region.

MATERIAL AND METHODS

The investigation was carried out on the autopsy material of 98 consecutive human hearts. There were 42 female, 56 male with age 57 ± 21 years. There were no hearts with congenital abnormalities or important valve diseases.

Initially 6F catheter, similar to that used for radiofrequency ablation, was inserted into the coronary sinus and next into the middle cardiac vein. The angles between the coronary sinus and middle cardiac vein were evaluated at the posterior view of the heart (angle A) and at the lateral view of the heart (angle B). Next, posterior wall of the coronary sinus was opened. On the plane transverse to the intramural part of the coronary sinus the angle of vena cordis media inflow was measured (angle G). The lowest part of the circle of the coronary sinus section was estimated as zero, the most right lateral point as 90 (Fig. 1).

After these measurements, transverse section was performed under the coronary sinus. The region just behind the atrioventricular septum was classified as "septal". The more lateral area was classified as right or left posteroseptal. More lateral (behind the cavities) right and left posterior area was present. The course of the middle cardiac vein in posteroseptal space was evaluated.

RESULTS

We observed that in the posteroseptal space the middle cardiac vein was most often localised at the base of the "pyramid" (epicardially) just posterior to the atrioventricular septum (in 43%). The macroscopic view is shown from the top in Figure 2 and from behind in Figure 3. In the remaining hearts it was present more often on the left side than the right side of the septum. Usually (in 85%) it was running towards the left side of the heart but the angle between the middle cardiac vein and the coronary sinus was less than 75 only in 29%. Precise topography of the middle cardiac vein in posteroseptal space is summarised in Table 1. The angles between the middle cardiac vein and the coronary sinus in different planes are presented in Table 2.

At the ostium of the middle cardiac vein a valve was observed in 58 (58%) of examined hearts. Usually it was a small semilunar structure (Fig. 4), rarely a membrane which reduced the lumen of the vein (Fig. 5). However, there was no trouble with insertion of the 6F catheter into the middle cardiac vein.

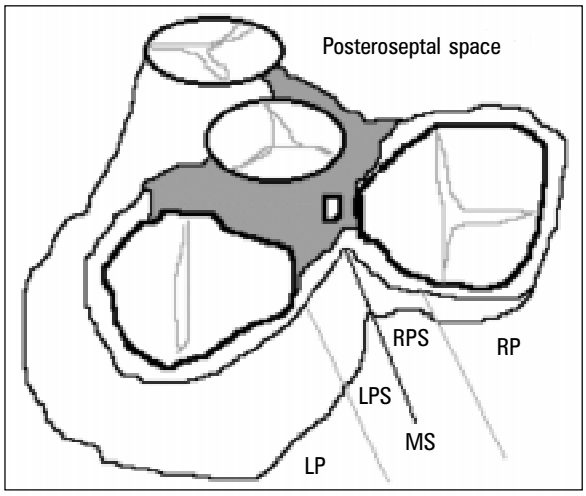

Figure 1. Schematic view on posteroseptal space; MS — true posteroseptal (posterior to the atrioventricular septum), LPS — left posteroseptal, RPS — right posteroseptal, LP — left posterior, RP — right posterior.

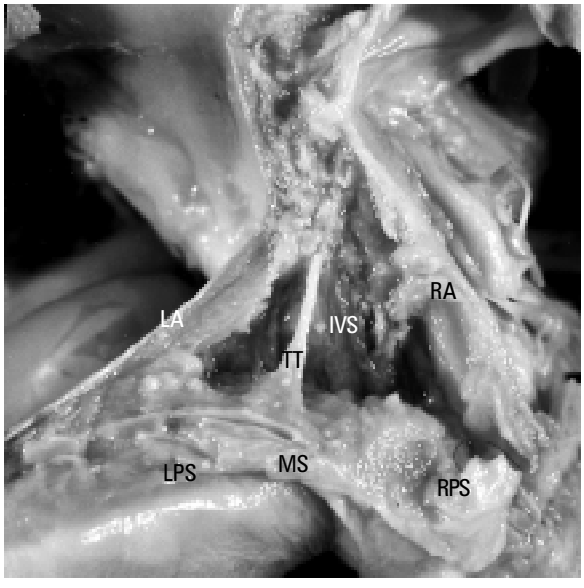

Figure 2. Macroscopic view of the posteroseptal space from the base of the heart; RA — right atrial wall, LA — left atrial wall, TT — tendon of Todaro, IVS — interventricular septum, MS — true posteroseptal space, LPS — left posteroseptal, RPS — right posteroseptal.

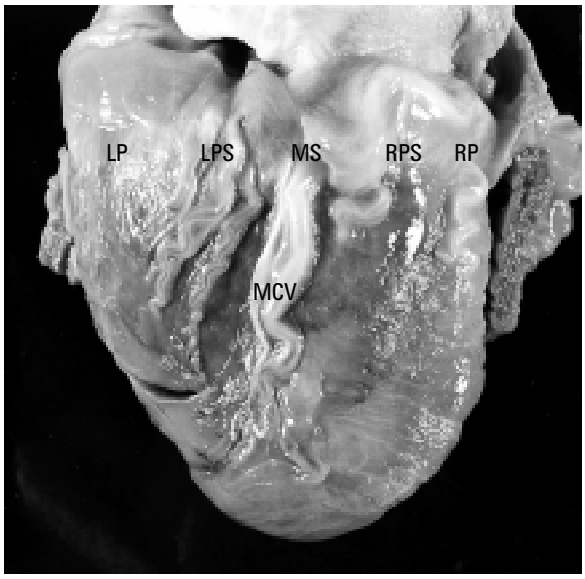

Figure 3. Macroscopic view of the posteroseptal space from the postero-phrenical surface; MCV — middle cardiac vein, MS — true posteroseptal space, LPS — left posteroseptal, RPS — right posteroseptal, LP — left posterior, RP — right posterior.

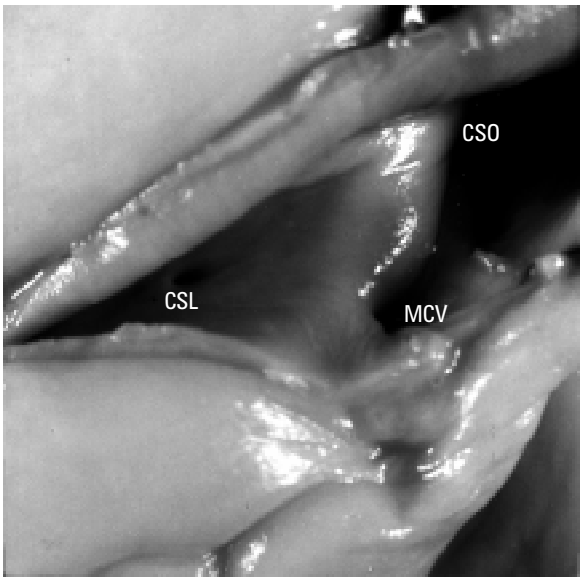

Figure 4. Middle cardiac vein orifice without a value and the quite extensive lumen; MCV — middle cardiac vein ostium, CSO — coronary sinus orifice, CSL — coronary sinus lumen.

Table 1. Topography of the middle cardiac vein in posteroseptal space

Course of MCV in PSS	
MS	43%
LPS	27%
RPS	11%
LP	10%
RP	7%
MS > RPS	1%
LPS > LP	1%

MS — true posteroseptal (posterior to the atrioventricular septum), LPS — left posteroseptal, RPS — right posteroseptal, LP — left posterior, RP — right posterior

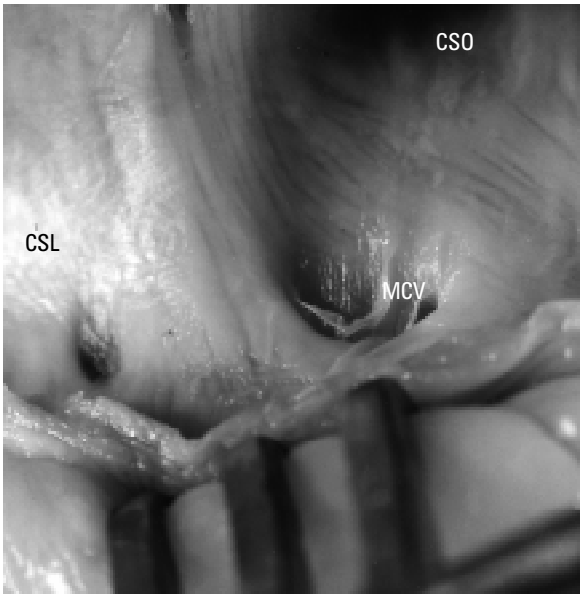

Figure 5. Middle cardiac vein orifice with the valve and the reduced lumen of the vein. Abbreviations as Figure 4.

Table 2. The angle between the middle cardiac vein and the coronary sinus at the posterior view of the heart (angle A), at the lateral view of the heart (angle B) and at the transverse section of the intramural part of the coronary sinus (angle G)

Angle A	Angle B	Angle G
30–60 (9%)	30–45 (13%)	0–15 (3%)
61–75 (20%)	46–60 (24%)	30 (80%)
76–90 (56%)	61–75 (24%)	45 (11%)
91–130 (15%)	76–90 (37%)	60 (6%)

DISCUSSION

In some cases posteroseptal accessory pathway ablation is performed in diverticulum of coronary sinus [6, 8]. Some other authors suggest using the middle cardiac vein for ablation of posteroseptal, subepicardial or postero-inferior accessory pathways which are located too far from heart cavities to be ablated by radiofrequency current from classical

approaches [7, 10]. Jackman et al. [3] observed that about 9% of posteroseptal accessory pathway should be ablated from the middle cardiac vein. Jedynak et al. [4] used this approach in about 3% of patients with accessory pathway ablation.

On the basis of our study we suspect that this approach may be helpful and easy to use in electrophysiological practice, particularly for ablation of left postero-inferior septal accessory pathways. Insertion of the catheter to the left cavities using transaortic or transseptal approach can be thus avoided and success rate in patients with this type of pathways may be increased. In future this approach may be used for mapping of ectopic left ventricular tachycardia and in patients with epicardial site of the arrhythmias origin — for ablation.

Arruda et al. [1] observed that among patients with a negative delta wave in lead II, in more than 50% successful ablation site was in coronary sinus or in the middle cardiac vein. These results were confirmed by Dean et al. [2]. Both studies suggested high similarity of the delta wave polarisation in left posterior accessory pathways and these located near the middle cardiac vein. The reason for this similarity may be the tendency of the middle cardiac vein to left posteroseptal localisation. However, Jedynak et al. [4] observed characterisic electrocardiographic features in 7 pts with successful ablation inside the middle cardiac vein: a deep, negative QS complex in leads III (2.6–2.8 mV) and aVF (1.4–1.8 mV). Probably these pathways are located more inferiorly than typical posteroseptal ones.

We can conclude that the middle cardiac vein is usually located in left posteroseptal region. Most of the examined middle cardiac veins ran towards the left side of the posterior wall. It was possible to insert the 6F catheter into every middle cardiac vein, which made it possible to perform ablation of epicardial accessory pathways in posteroseptal space.

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