

## Araştırma Makalesi

### THE COURSE OF THE INTERVENTRICULAR CORONARY ARTERIES AND MYOCARDIAL BRIDGES IN ONE-HUMPED CAMEL

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#### Devede Koroner Arterlerin Interventriculer Dallarının Seyri ve Kalp Kas Köprüleri

**Özet:** Develerde kalp kas köprülerinin morfolojik özelliklerini tanımlamak amacıyla yapılan bu çalışmada 17 adet erkek tek hörgüçlü güreş devesi kalbi kullanıldı. Kalpler, koroner arterlerin interventriküler dallarının seyri ve kalp kas köprülerinin şekillenışı arasındaki ilişkiye göre üç grup altında incelendi. Kalplerden birinin sağ yüzünde (% 5,88) ve beşinin sol yüzünde (% 29,41) olmak üzere, toplam altı kalpte (% 35,29) kalp kas köprüsü oluşumu tespit edildi. Mikrometrik kumpas ile ölçülen kalp kas köprüsü genişliklerinin 7-15 mm arasında olduğu belirlendi. Elde edilen bulgular, devede hem koroner arterlerin subperikardiyal ve intramiyokardiyal seyirleri bakımından hem de kalp kas köprülerinin varlığı ve yerleşim yerleri bakımından bireysel farklılıklar bulunduğunu gösterdi.

**Anahtar Kelimeler:** kalp kas köprüleri- koroner arter- deve

**Summary:** The aim of the study was to describe the morphology of the myocardial bridges (MCB) in one-humped camels. Hearts of 17 male wrestler one-humped camels were grouped into three according to the relationship between the course of the interventricular branches of the coronary arteries and MCB formations. MCBs were found in six hearts (35.29 %) and were on the right and left side in one (5.88 %) and five hearts (29.41%), respectively. The MCB widths were measured by micrometric calibre and the values were found was between 7-15 mm. These results show that both the course of the interventricular branches of the coronary arteries and the localization and existence of MCBs were varying from one specimen to another in the camel.

**Key Words:** myocardial bridges-coronary artery-camel

#### Introduction

The coronary arteries of the heart which are subepicardial in position may be bridged by thin strips of myocardial fibres called the myocardial bridges (MCB) (10). These bridges have been the subject of consideration in both human and veterinary

medicine. The studies are focused on the clinical importance and on the classification of MCB in human and veterinary medicine, respectively (1,3,4,7,8,14,16).

In human, an association between the MCB and some pathological conditions such as sudden death syndrome (3,8), myocardial ischemia (1), infarction (4,7) and angina pectoris (7) has been shown, while the pathologic considerations of MCB in animals are less studied (14,16).

In veterinary medicine, the morphology of MCB is well documented in dog (12, 15,16), as the dog's heart is the best animal model for anatomical and physiological studies (12,14). Studies about the muscular bridges have also been performed in domestic animals such as pig (6,14), sheep and ox (5,6,14), goat (5,13,14), water buffalo (5), cat (6), dog (5,12,14-16) and camel (11). According to the literature, there are two speculations with regard to the formation of MCBs, animal size and phylogenetic aspect. Polaček (9) has stated that the MCB is a transitional type of the course of the coronary artery between small and large animals, while it is described as a phylogenetic problem by Berg (2) and Hadžiselimović et al. (6).

Morphological studies of the MCB in different animals will be useful to determine the importance of both clinical and formation aspects of this structure. In this study, it was aimed to describe the morphology of the myocardial bridges in male wrestler one-humped camel.

#### Materials and Methods

Hearts of 17 male wrestler one-humped camel (*Camellus dromedarius*) were used in this study. Immediately following slaughter, the hearts were flushed out with 0.9 % physiological saline and injected with coloured latex through the cannulated right and left coronary arteries. After a few days of fixation in 10% formalin, these were dissected for determining the course of the interventricular coronary arteries branches and the situation of myocardial bridges. The existence of myocardial bridges was established to depend on the course of the interventricular branches of the coronary arteries. The MCB width was measured by micrometric calliper when they existed. The 17 examined samples were allocated into three groups according to the relationship between the course of the interventricular branches of the coronary arteries and MCB formations. *Type I:* the course of the interventricular arteries was entirely subepicardial and no myocardial bridge was observed (Figs. 1A and 1D); *Type II:* the interventricular arteries run subepicardially in the proximal half of the left and right interventricular grooves and predominantly myocardially in the distal half of these grooves (Figs. 1B and 1E). *Type III:* the interventricular arteries run subepicardially and there were one or two typical myocardial bridges on them (Figs. 1C and 1F).

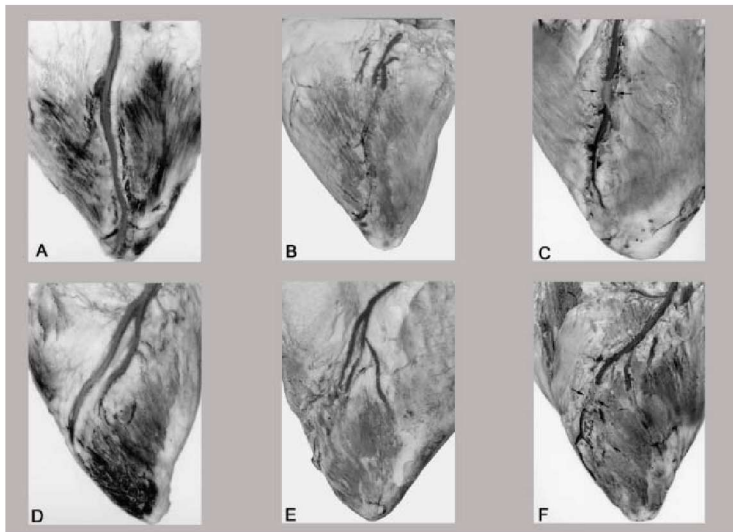
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**Table 1.** Types of the course of the interventricular arteries in each study sample. Interventricular paraconal groove (Left side – L), interventricular subsinusal groove (Right side – R).

**Tablo 1.** Çalışılan kalplerdeki interventriküler arterlerin dağılımının tipleri. Sulcus interventricularis paraconalis (Sol yüz – L), sulcus interventricularis subsinuosus (Sağ yüz – R)

|          |   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | %     |
|----------|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|-------|
| Type I   | L |   |   |   | • |   |   | • | • |   |    |    | •  | •  |    | •  | •  | •  | 47.06 |
|          | R |   |   |   |   |   |   |   |   | • |    |    |    |    |    | •  |    |    | 17.65 |
| Type II  | L |   |   |   |   | • |   |   |   |   | •  | •  |    |    | •  |    |    |    | 23.53 |
|          | R | • | • | • |   | • | • |   | • |   | •  | •  | •  | •  | •  |    | •  | •  | 76.47 |
| Type III | L | • | • | • |   |   | • |   |   | • |    |    |    |    |    |    |    |    | 29.41 |
|          | R |   |   |   | • |   |   |   |   |   |    |    |    |    |    |    |    |    | 5.88  |

To take attention to the MCB, the tone and contours of interventricular arteries were sharpened in figure by using Adobe Photoshop 5.0.



**Figure 1.** The course of the interventricular branches of the coronary arteries in both right (upper) and left (lower) grooves. Type I (A and D), type II (B and E), type III (C and F) and myocardial bridges (arrows).

**Şekil 1.** Koroner arterlerin interventriküler dallarının dağılımı. Sulcus interventricularis subsinuosus (yukarıda) ve sulcus interventricularis paraconalis (aşağıda). Tip I (A ve D), Tip II (B ve E), tip III (C ve F) ve miyocardial köprüler (oklar).

### Results

The types of the course of the interventricular arteries in each examined sample are shown in Table 1.

It was seen that almost half of the cases (47.06%) was type I on the left side, but most of the cases (76.47%) was type II on the right side. Type I and II were observed in both sides of the heart in 11.76 % and 23.53% of all cases, respectively.

Myocardial bridges were found in six hearts (35.29 %) and were on the right and left side in 1 (5.88 %) and 5 hearts (29.41%), respectively. In two hearts (11.76 %), two myocardial bridges were observed on the interventricular paraconal branch. Myocardial bridges were between 7-15 mm in width and were determined to be located at the level of middle third of the interventricular grooves (Table 2).

**Table 2.** Widths of the determined myocardial bridges in each study sample. Left side (L), Right side (R).

**Tablo 2.** Çalışılan kalplerde tespit edilen kalp kas köprülerinin genişliği. Sol yüz (L), sağ yüz (R).

| No of cases |          | L    | R   |
|-------------|----------|------|-----|
| 1           | Proximal | 15mm | -   |
|             | Distal   | 8mm  | -   |
| 2           |          | 15mm | -   |
| 3           |          | 10mm | -   |
| 4           |          | -    | 7mm |
| 6           | Proximal | 10mm | -   |
|             | Distal   | 10mm | -   |
| 9           |          | 15mm | -   |

### Discussion

Polaček (9) considered the behaviour of the coronary arteries in relation to the myocardium to depend not so much on biological affinity as on the size of the animal. There was an intramyocardial course in small animals as Rodentia and Insectivora and a purely subepicardial course in large animals as Artiodactyla. The transitional type was represented by muscular bridges in mammals owing to their sizes (sheep, goat, cat, dog) (5,12,13). Contrary to this, it was reported that the behaviour of coronary arteries is a phylogenetic problem and the arterial course does not depend on the animal size (2, 6). Our findings showed that the behaviour of coronary arteries does not depend on animal size. We observed three types of intramural course of the branches of the coronary arteries in camels, as entirely subepicardial, predominantly intramyocardial, and subepicardial and there was one or two typical myocardial bridges on the arteries.

In the fox, wild boar, pig, sheep, ox, domestic cat (6), dog (12) and goat (13) the myocardial bridges are found on the left interventricular branch. Nevertheless, Dursun et al. (5) reported that muscular bridges were observed on the right and left interventricular branches in Akkaraman sheep, Angora goat, cattle, water buffalo and dog. Van Nie and Vincent (14) examined the MCB in monkey, calf, sheep, goat, pig, dog and seal and their results showed that most of the bridges are observed on the right side. According to Taha and Abel-Magied (11) in the camel, the muscular bridges were seen on the right interventricular branches in all cases and on the left interventricular branches three hearts out of the ten. In the present study, MCBs were found in six hearts

out of the seventeen dissected (35.29 %). These muscular formations were on the right or left side in one (5.88 %) and five hearts (29.41 %), respectively. In two hearts (11.76 %), two MCBs were observed on the interventricular paraconal branch. These variations may depend on breed or individual differences.

Van Nie and Vincent (14) investigated that the myocardial bridge width in different animals including monkey, calf, sheep, goat, pig, dog and seal, and found that 11.11 % of them was < 5 mm, 6-15 mm 55.56 % and 33.33 % was > 15 mm. These authors stated also that bridge widths were dependent on the size of the heart. In this study the MCB widths of 17 camels were between 7 and 15 mm.

In conclusion, these results show that the localization or existence of MCBs may be independent from animal or heart size and are formed individually. Further studies are required in a great number of different animal breeds, to determine whether the MCB is related to the pathological conditions or not as in humans.

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