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Arterial Smooth Muscle Fibre of Coronary Circulation Has Twice More Pulsatory Power Than That of Systemic or Pulmonary Circulation

Anatomy

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ABSTRACT

Pulsatory power of human ascending aorta, pulmonary trunk, femoral artery right coronary artery and left coronary artery was divided by the total number of smooth muscle fibres present in tunica media of their 10mm long arterial segments to calculate the pulsatory power of single arterial smooth muscle fibre.

It was observed that pulsatory power of single arterial smooth muscle fibre present in ascending aorta, pulmonary trunk and femoral artery was 3.33 Joule per heart beat while the pulsatory power of single arterial smooth muscle fibre present in right coronary artery and left coronary artery was 6.66 Joule per heart beat.

It was concluded that pulsatory power of single smooth muscle fibre present in coronary arterial circulation was twice more than the pulsatory power of single smooth muscle fibre present in systemic/pulmonary arterial circulation because blood enters the lumen of coronary arteries during diastole of heart when pressure as well as velocity of blood flow are less than that during systole of heart and to compensate it coronary arterial smooth muscle fibre has to work twice more to propel the blood forwards.

INTRODUCTION

Pulsatory power of human arteries was calculated and laws of arterial pulsation were created by Keshaw Kumar (1993, 2015) [1,2]. Arterial wall area was calculated describing the microstructure of human arteries creating the laws of arterial elasticity or muscularity by Keshaw Kumar (1998, 2001, 2015) [3,4,5]. Effect of tangential pressure of pulsation on tunica media of human arteries was observed and theory of arterial pulsation was created by Keshaw Kumar (2002, 2015) [6,7]. Anatomy of human coronary arterial pulsation was studied showing the coronary arterial pulse pressure in right and left coronary arterial dominance maintaining that deviation/ alteration of "Keshaw Constants" in coronary arteries is the exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance by Keshaw Kumar (2003, 2009, 2015)[8,9,11] Later on Keshaw Kumar (2011)[10] reported pulsatory power of human arterial smooth muscle fibre.

Present study was conducted in order to compare pulsatory power of single arterial smooth muscle fibre present in coronary circulation with pulsatory power of single arterial smooth muscle fibre present in systemic/pulmonary circulation because unlike the arteries of systemic/pulmonary circulation blood enters the lumen of coronary arteries during diastole of heart therefore, pulsatory power of an arterial smooth muscle fibre present in coronary circulation must differ from pulsatory power of an arterial smooth muscle fibre present in systemic/pulmonary circulation.

MATERIAL AND METHODS

Pulsatory power of 10 mm long arterial segments of human ascending aorta, pulmonary trunk, femoral artery, right coronary artery and left coronary artery was divided by total number of smooth muscle fibres present in arterial wall area of their tunica media to obtain the pulsatory power of single arterial smooth muscle fibre.

Pulsatory power and total number of smooth muscle fibres present in arterial wall area of 10mm long arterial segments of human ascending aorta, pulmonary trunk and femoral artery were obtained from the literature as reported by Keshaw Kumar (1993, 2015, 2002, 2015)[1,2,6,7]. Pulsatory power of these arteries was divided by the total number of smooth muscle fibres of these arteries to obtain the pulsatory power of their single smooth muscle fibre.

Pulsatory power, wall thickness and lumen circumference of 10mm long arterial segments of human right and left coronary arteries were obtained from literature as reported by Keshaw Kumar (2003, 2009, 2015)[8,9,11] and arterial wall area was calculated by multiplying the length, tunica media thickness and lumen circumference of the arterial segment with one another (Keshaw Kumar 1998)[3]. Tunica medial densities of smooth muscle fibres per magnified field in coronary arteries obtained from the literature as reported by Keshaw Kumar (2001,2015)[4,5] were multiplied by arterial wall area of each coronary artery to obtain total number of smooth muscle fibres present in arterial wall area of the tunica media of right as well as left coronary arteries. Pulsatory power of single coronary arterial smooth muscle fibre was obtained by dividing the coronary arterial pulsatory power by total number of coronary arterial smooth muscle fibres.

OBSERVATIONS

Pulsatory power of human ascending aorta was 3000 Joule per heart beat while pulsatory power of human pulmonary trunk and femoral artery was 1000 Joule per heart beat (Keshaw Kumar 1993, 2015)[1,2]. Total number of smooth muscle fibres present in arterial wall area of 10mm long arterial segments of human ascending aorta, pulmonary trunk and femoral artery was 900+, 300+ and 300+ respectively (Keshaw Kumar 2002, 2015)[6,7]. Pulsatory power of single arterial smooth muscle fibre of above mentioned arteries was 3.33 Joule per heart beat which was obtained after dividing their pulsatory power by their total number of smooth muscle fibres present in arterial wall area:

TABLE – I

(Pulsatory Power of Single Smooth Muscle Fibre Present in Systemic/Pulmonary Arterial Circulation)

Arteries	Pulsatory power	Number of smooth muscle fibres present in arterial wall area	Pulsatory power of single arterial smooth muscle fibre
Ascending aorta	3000 Joule per heart beat	900+	3.33 Joule per heart beat
Pulmonary trunk	1000 Joule per heart beat	300+	3.33 Joule per heart beat
Femoral artery	1000 Joule per heart beat	300+	3.33 Joule per heart beat

Tunica media thickness of right and left human coronary arteries was 0.1mm and 0.3 mm respectively while lumen circumference of right as well as left human coronary artery was 10mm (Keshaw Kumar, 2003, 2009, 2015)[8,9,11]. After multiplying the length, lumen circumference and tu-

nica media thickness of 10mm long arterial segments of coronary arteries with one another the arterial wall area obtained in case of left coronary artery was 30 cubic mm while in case of right coronary artery it was 10 cubic mm.

TABLE – II
(Arterial Wall Area of Human Coronary Arteries)

Arteries	Length	Tunica media thickness	Lumen circumference	Arterial wall area
Right coronary artery	10mm	0.1mm	10mm	10 cubic mm
Left coronary artery	10mm	0.3 mm	10mm	30 cubic mm

Tunica medial density of human coronary arterial smooth muscle fibres per magnified field was +++ (Keshaw Kumar 2001,2015)[4,5]. After multiplying coronary arterial wall area by tunica medial density of human coronary arterial smooth muscle fibres per magnified field the total number of tunica medial smooth muscle fibres obtained in left coronary artery was 90+ while in case of right coronary artery it was 30+.

TABLE – III
(Total Number of Smooth Muscle Fibres Present in Arterial wall area of Human coronary arteries)

Arteries	Arterial wall area	Tunica medial density of smooth muscle Fibres	Number of smooth muscle fibres present in arterial wall area
Right coronary artery	10 Cubic mm	3+	30+
Left coronary artery	30 Cubic mm	3+	90+

Pulsatory power of left coronary artery was 600 Joule per heart beat while right coronary arterial pulsatory power was 200 Joule per heart beat (Keshaw Kumar 2003, 2009, 2015)[8,9,11] pulsatory power of single coronary arterial smooth muscle fibre was 6.66 Joule per heart beat which was obtained after dividing the coronary arterial pulsatory power by total number of coronary arterial smooth muscle fibres present in arterial wall area.

TABLE – IV
(Pulsatory Power of Single Smooth Muscle Fibre Present in Coronary Arterial Circulation)

Arteries	Pulsatory power	Number of smooth muscle fibres present in arterial wall area	Pulsatory power of single smooth muscle fibre
Right coronary artery	200 Joule per heart beat	30+	6.66 Joule per heart beat
Left coronary artery	600 Joule per heart beat	90+	6.66 Joule per heart beat

Therefore pulsatory power of single smooth muscle fibre present in coronary arterial circulation was twice more than the pulsatory power of single smooth muscle fibre present in systemic/pulmonary arterial circulation.

DISCUSSION

Findings of present study resemble with the findings reported by Keshaw Kumar (2011)[10]. Pulsatory power of an artery effects only the number of smooth muscle fibres present in its tunica media and the arterial segments having equal length and equal pulsatory power have equal number of smooth muscle fibres in their tunica media. (Keshaw Kumar, 2002, 2015) [6,7]. Therefore pulsatory power of an arterial smooth muscle fibre can be obtained by dividing the pulsatory power of that arterial segment by total number of smooth muscle fibres present in its tunica media.

Pulsatory power of 10mm long arterial segments of human ascending aorta, pulmonary trunk and femoral artery is 3000, 1000 and 1000 Joule per heart beat respectively (Keshaw Kumar, 1993, 2015)[1,2] while total number of smooth muscle fibres present in their tunica media are 900+, 300+ and 300+ respectively (Keshaw Kumar, 2002, 2015)[6,7]. Therefore pulsatory power of single smooth muscle fibre present in tunica media of these arteries will be 3.33 Joule per heart beat.

Pulsatory power of 10mm long arterial segments of human left and right coronary arteries is 600 and 200 Joule per heart beat respectively (Keshaw Kumar 2003,2009.2015)[8,9,11] while total number of smooth muscle fibres present in their tunica media are 90+ and 30+ respectively (Keshaw Kumar 2001, 2009)[4,9]. Therefore pulsatory power of a single smooth muscle fibre present in tunica media of these arteries will be 6.66 Joule per heart beat.

Blood reaches in lumen of arteries belonging to systemic/pulmonary arterial circulation during systole of heart, while in the lumen of arteries belonging to coronary arterial circulation blood reaches during diastole of heart. Therefore pulsatory power of single smooth muscle fibre of coronary arterial circulation is twice more than the pulsatory power of single smooth muscle fibre of systemic/pulmonary arterial circulation to compensate the force and velocity of blood flow in lumen of coronary arteries.

REFERENCES

1. Keshaw Kumar. Pulsatory power of human arteries. Vijnana Parishad Anusandhan Patrika. (1993) vol. 36 (2) : 115-120.
2. Keshaw Kumar. Laws of arterial pulsation International Journal of Scientific Research (2015) vol. 4 (1) : 65-66.
3. Keshaw Kumar. Area of arterial wall. Vijnana Parishad Anusandhan Patrika. (1998) vol. 41 (3) : 211-215.
4. Keshaw Kumar. Microstructure of human arteries. Journal of Anatomical Society of India (2001) vol. 50 (2) : 137-140.
5. Keshaw Kumar. Laws of Arterial elasticity or muscularity. International Journal of Scientific Research (2015) vol. 4 (4) : 19-21.
6. Keshaw Kumar. Effect of tangential pressure of pulsation on tunica media of human arteries. Journal of Anatomical Society of India. (2002) Vol. 51 (1) : 35-38.
7. Keshaw Kumar. Arterial segments having equal length and equal pulsatory power have equal number of smooth muscle fibres in their tunica media-Theory of arterial pulsation. International Journal of Scientific Research (2015) Vol. 4 (7) : 70-72.
8. Keshaw Kumar. Anatomy of human coronary arterial pulsation. Journal of Anatomical Society of India (2003) Vol. 52 (1) : 24-27.
9. Keshaw Kumar. Coronary arterial pulse pressure in right and left coronary arterial dominance. Anatomica Karnataka (2009) Vol. 3 (3) : 17-23.
10. Keshaw Kumar. Pulsatory power of human arterial smooth muscle fibre. Vijnana Parishad Anusandhan Patrika. (2011) vol. 54 (1) : 33-36.
11. Keshaw Kumar. Deviation/alteration of "Keshaw Constants" in coronary arteries is the exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance. International Journal of Scientific Research (2015) Vol. 4 (8) : 13-16.