



GLOBAL JOURNAL OF MEDICAL RESEARCH
SURGERIES AND CARDIOVASCULAR SYSTEM
Volume 13 Issue 3 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)

Atherosclerosis of Coronary Arteries - An Autopsy Study

By Prabhu.M.H, Siraj Ahmed S & Aftab Begum

Basaveshwara Medical College, India

Abstract - Atherosclerosis is a complex and common disease contributing to increased mortality and morbidity. The exact global incidence of atherosclerosis is beyond calculation. Autopsy studies can provide information about the impact and course of atherosclerosis. Present study is undertaken to study the spectrum and distribution of atherosclerotic lesions in the coronary arteries and the association of age, sex, diet, socio-economic status, smoking and alcohol consuming habits with atherosclerosis.

Methods : Heart specimens were obtained from medicolegal autopsies. Sections from representative areas were studied for gross and microscopic evidence of atherosclerosis.

Results : Among the 50 cases studied 35 were males and 15 were females. Coronary arteries of 24 males (72.72%) and 9 females (27.27%) showed atherosclerosis. Males were affected more than females. Age has a dominant influence on atherosclerosis, it increased with age. 33 (66%) cases showed coronary atherosclerosis. Upper class, obesity, alcohol consumption and cigarette smoking trends have dominant role in acceleration of atherosclerotic lesions. Religion and vegetarianism have lesser affect on atherosclerosis. Among coronaries, left anterior descending artery is most commonly involved.

Keywords : *autopsy, atherosclerosis, coronary arteries.*

GJMR-I Classification : *NLMC Code: WG 410*



Strictly as per the compliance and regulations of:



© 2013. Prabhu.M.H, Siraj Ahmed S & Aftab Begum. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License (<http://creativecommons.org/licenses/by-nc/3.0/>), permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Atherosclerosis of Coronary Arteries - An Autopsy Study

Prabhu.M.H ^α, Siraj Ahmed S ^σ & Aftab Begum ^ρ

Abstract - Atherosclerosis is a complex and common disease contributing to increased mortality and morbidity. The exact global incidence of atherosclerosis is beyond calculation. Autopsy studies can provide information about the impact and course of atherosclerosis. Present study is undertaken to study the spectrum and distribution of atherosclerotic lesions in the coronary arteries and the association of age, sex, diet, socio-economic status, smoking and alcohol consuming habits with atherosclerosis.

Methods : Heart specimens were obtained from medicolegal autopsies. Sections from representative areas were studied for gross and microscopic evidence of atherosclerosis.

Results : Among the 50 cases studied 35 were males and 15 were females. Coronary arteries of 24 males (72.72%) and 9 females (27.27%) showed atherosclerosis. Males were affected more than females. Age has a dominant influence on atherosclerosis, it increased with age. 33 (66%) cases showed coronary atherosclerosis. Upper class, obesity, alcohol consumption and cigarette smoking trends have dominant role in acceleration of atherosclerotic lesions. Religion and vegetarianism have lesser affect on atherosclerosis. Among coronaries, left anterior descending artery is most commonly involved.

Conclusion : Autopsy studies play a vital role in unraveling the spectrum and occurrence of atherosclerosis. Atherosclerosis is a complex and multifactorial disease. Smoking and alcoholism can accelerate the development of atherosclerosis. The incidence of atherosclerosis in developing countries (like India) is same as developed countries.

Keywords : autopsy, atherosclerosis, coronary arteries.

1. Introduction

The disease atherosclerosis has great relevance today. Atherosclerosis is a distinctive form of arteriosclerosis known from ancient times. The terms 'athere' (meaning-porridge) and sclerotic (hardening or fibrosis) derived from Greek terminology, do not represent the complete morphology of disease. Despite our familiarity with this disease,

some of its fundamental characteristics remain poorly recognized and understood. The cause and pathogenesis of atherosclerosis remains subject of lively speculation and controversy.¹

Atherosclerosis is a pathological entity and a multifactorial disease of large and medium sized arteries, characterized by plaque like intimal deposits which contain neutral fats, cholesterol, lipophages, blood elements, at times, other evidence of hemorrhage and calcium deposits. Complications of which are disastrous – ischaemic heart disease, cerebral stroke, peripheral gangrene and so on. It is a pandemic, percentage incidence of morbidity varies from country to country. It is a modern epidemic in U.S.A., Europe, Canada, New Zealand and Australia.²

Among the diseases in the western world, atherosclerosis is overwhelmingly the prime disorder leading to death and serious morbidity. Despite recent reduction in mortality of coronary heart diseases (CHD) about 50% of all deaths in US are still attributable to atherosclerosis related diseases.¹ The developing countries such as India, Singapore, Malaysia and Sri Lanka are catching up and registering a steady increase in the mortality rates due to atherosclerotic heart diseases.³ In India coronary heart disease accounts for 10-15% of all cardiovascular diseases.⁴

The exact global incidence of atherosclerosis is impossible to calculate because it can exist without producing any symptoms or signs. These asymptomatic cases can be diagnosed only if an autopsy is done, in all cases of death due to any cause. However, the magnitude of the problem can be assessed by looking at the mortality rates in different countries due to atherosclerotic heart disease. In a survey conducted in males in the 45 to 54 years age group,⁵ the mortality rates due to atherosclerotic heart disease in different countries are lowest in Japan (8%) and highest in Finland (41%). In U.K., U.S.A., and Canada the average mortality rate is 36%. The disease is increasing in countries undergoing industrialization.⁶

Unfortunately, in India there are no statistics giving the national incidence of this disorder.³ However, Padmavathi and associates,⁷ gave the average incidence of atherosclerotic heart disease in seven different states during 1958-59 as 0.51% per 1,000 population. In another study conducted at All India Institute of Medical sciences, New Delhi, with the help of autopsy studies and taking atherogenic index as an

Author ^α : Assistant Professor, Department of Pathology Basaveshwara Medical College & Hospital, S.J.M.I.T Campus, Chitradurga- Karnataka, India. E-mail : prabhumural@yahoo.com

Author ^σ : Assistant Professor, Department of Anatomy Basaveshwara Medical College & Hospital, S.J.M.I.T Campus, Chitradurga, Karnataka, India. E-mail : drsms70@gmail.com

Author ^ρ : Assistant Professor, Department of Physiology Basaveshwara Medical College & Hospital, S.J.M.I.T Campus, Chitradurga, Karnataka, India. E-mail : drsms70@gmail.com

indicator, the incidence of coronary heart disease is given as 35.5% in males and in females as 14%.⁵

Although global incidence, a wide range of variation in the prevalence and severity of atherosclerosis has been shown to exist in different geographic population. Against this background the present study has been taken in order to determine the severity and distribution of coronary atherosclerosis in the selected autopsies of the deaths occurring in general population Karnataka state, which has good representation of all social classes.

II. METHODOLOGY

a) Materials And Methods

The material for the present study included 50 (fifty) heart specimens obtained from medico legal autopsies performed in the Department of Forensic Medicine, Basaveshwara Medical College and Hospital, Chitradurga and other heart specimens received at the Department of Pathology, Basaveshwara Medical College and Hospital, Chitradurga, sent for histopathological examination to define any suspected cardiovascular pathology. Hearts were obtained by standard procedures from all autopsies.

The age, sex and relevant information including age, sex, socio-economic status, dietary habits of the deceased were obtained from the informant accompanying the deceased.

The methods used for the analysis of the material was as per the procedure recommended by

1. White, Edward and Dry (1950).⁸
2. Gore and Tejada (1957).⁹
3. W.H.O. study group (Technical report series, 1958, 1962, 1964).^{10,11,12}

All autopsies were carried out within four to twenty four hours after death.

All the specimens of right and left coronary arteries blocks were taken at a particular fixed distance at from 1.5 cm and 3 cm from the Ostia, also From the circumflex branch of the left coronary artery, bits were taken at the same distance form the point of branching of the left coronary artery into anterior descending and circumflex branches. Additional bits of tissue were taken from other regions of the vessels which showed stenosis. This stenosis is graded based on the luminal narrowing of the coronaries when examined by hand lens and is graded from grade 0 (no narrowing / normal) to grade IV (complete obliteration).

Grade – 0	:	Normal
Grade – I	:	1-25% stenosis
Grade – II	:	26-50% stenosis
Grade – III	:	51-75% stenosis
Grade – IV	:	76-100% stenosis

The bits of the tissue were fixed in 10% formalin and embedded in paraffin. Sections for histological study were taken from the paraffin blocks and stained

with haematoxylin and eosin. Special stains were also done whenever indicated, namely Verhoeff and Van-Gieson's for demonstration of elastic tissues, smooth muscle and collagen, and Alcain blue for the demonstration of mucopolysaccharide ground substance. All histological sections were studied for microscopic evidence of atherosclerotic lesions.

III. RESULTS

The coronary arteries of fifty specimens of heart were examined in the department of Pathology, Basaveshwara Medical College and Hospital, Chitradurga, observations made from the study are as follows:

The youngest subject was 19 years and the oldest was a male of 80 year age, forming a age range of 19-80 years. The majority of the cases were from 3rd to 4th decades of life forming 58% of total number of cases studied. There were 35 males and 15 females in the ratio of 2.5:1. Among the fifty cases studied 33 cases showed evidence of coronary atherosclerosis.

Table 1: Smoking and Atherosclerosis

Habit of Smoking	No. of cases	Positive cases	
		No. of cases	Percentage
Smokers	24	19	79.16
Non-smokers	26	14	53.84
Total	50	33	-

The above table showed higher incidence in smokers (79.16%). When compared to non-smokers (53.84%).

Graph 1: Smoking and Atherosclerosis

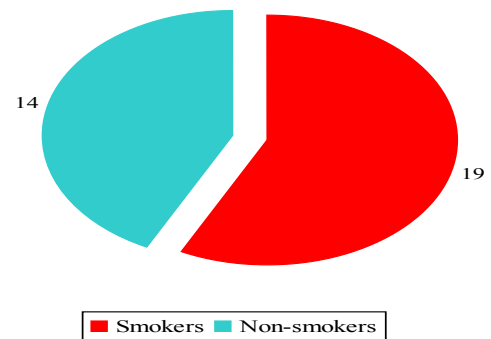


Table 2: Alcoholism and Atherosclerosis

Alcoholism and habit	No. of cases	Positive cases	
		No. of cases	Percentage
Alcoholics	23	18	78.26
Non-alcoholics	27	15	55.55
Total	50	33	-

Incidence of atherosclerosis was greater in alcoholics (78.26%) than in non-alcoholics (55.55%).

Graph 2 : Alcoholism and atherosclerosis

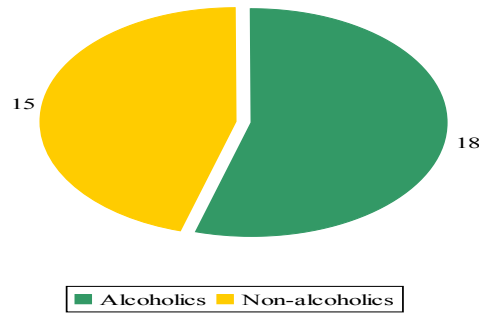
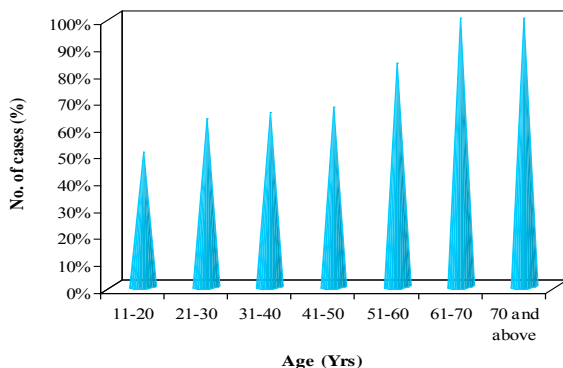


Table 3 : Coronary Atherosclerosis

Age group	Sex	Total No. of cases	No. of positive cases	Total positive	Percentage
11-20	Male	2	2	2/4	50
	Female	2	0		
21-30	Male	6	4	5/8	62.5
	Female	2	1		
31-40	Male	12	7	10/17	64.7
	Female	5	3		
41-50	Male	8	5	8/12	66.66
	Female	4	3		
51-60	Male	5	4	5/6	83.33
	Female	1	1		
61-70	Male	1	1	2/2	100
	Female	1	1		
70 and above	Male	1	1	1/1	100
	Female	0	0		
		50	33	33	66

Of the 50 cases studied 33 cases showed coronary atherosclerosis. This table shows that coronary atherosclerosis will increase with age and it also shows that males are more affected i.e., 24 cases (72.72%) and females are affected in 9 cases (27.27%). The coronary atherosclerosis was much common in males but after 5th decade it takes the same course in both male and female.

Graph 3 : Coronary Atherosclerosis



Of the 50 heart specimens studied 33 showed coronary atherosclerosis with various histological changes such as fibroblastic activity, mucopolysaccharide deposition, degeneration of internal elastic lamina, accumulation of lipid cholesterol crystals, hyalinization, calcification and hemorrhage.

Salient features of atherosclerotic lesions

- i. Fatty streaks.
- ii. Fibrous plaques.
- iii. Atheroma.

Histological examination of representative plaques in the second and third decades showed the presence of fat with little or no cellular reaction. In the 4th and 5th decades, there was generally a fibrous tissue reaction to the presence of fat. By the 5th decade, the fibrous reaction had become more pronounced and was associated with degenerative changes.



Fig. 1: Heart along with coronary arteries and aorta upto its bifurcation

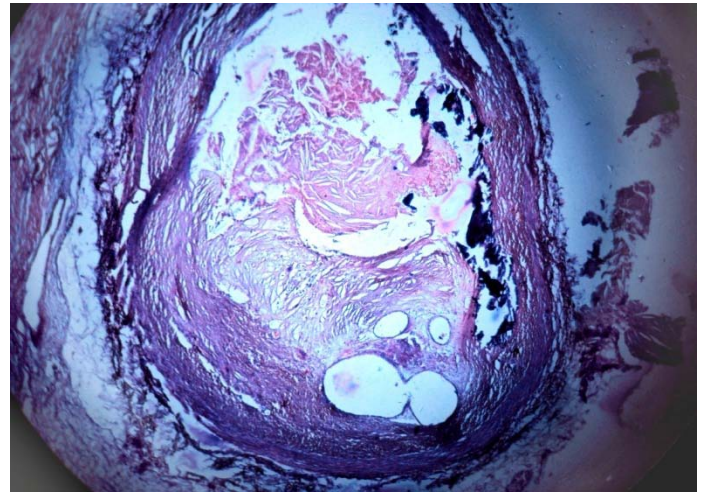


Fig. 4 : Atheromatous plaque with complete obliteration of the lumen (Grade IV stenosis) with cholesterol clefts and calcification (H&E x 50)



Fig. 2 : Coronary artery showing obliteration of the lumen by atheromatous plaque

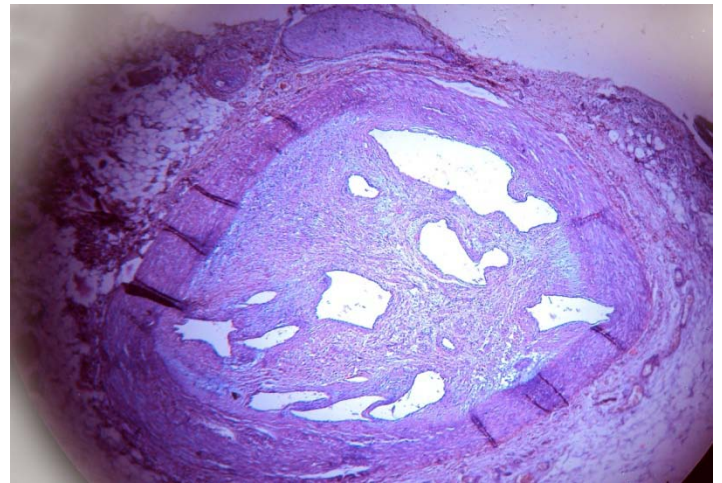


Fig. 5 : Atheromatous plaque which shows recanalisation in coronary artery (H&E x 50)



Fig. 3 : Cut section of coronary artery showing atheromas

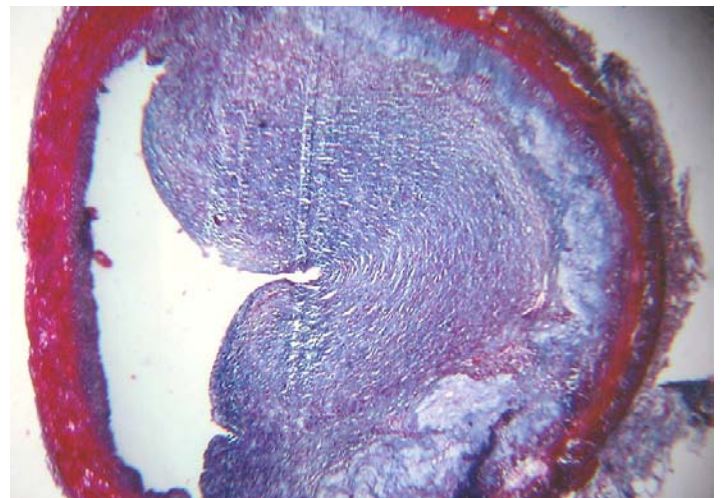


Fig. 6 : Atheromatous plaque with Grade IV stenosis collagen has stained blue and smooth muscle- red colour (Masson's Trichrome stain x 50)

IV. DISCUSSION

The autopsy study provides a means of understanding the basic process which sets a stage for clinically significant atherosclerotic cardiovascular disease. There is no valid method of sampling of living population. It was, therefore, considered that deaths

suspected due to cardiovascular pathology, probably provide the best sample of the living population for studying atherosclerosis. Many epidemiological studies have brought to light a number of factors that are of indisputable importance in the development of atherosclerosis.

Table 4 : Percentage incidence of atherosclerosis in various studies

	Study	Place	Percentage
1.	Wig and associates (1962) ¹³	North India	64
2.	Enos et al., (1953) ¹⁴	Korea	77.3
3.	Subramaniam R. et al., (1964) ¹⁵	Madras	62
4.	Bhargava and Bhargava (1975) ¹⁶	North Karnataka	69.9
5.	Shirani J et al., (1995) ¹⁷	USA	65
6.	Strong J.P. et al., (1999) ¹⁸	USA	60-80
7.	McGill et al., (2000) ¹⁹	USA	58
8.	Present Study	karnataka	66

The percentage incidence of atherosclerosis in various studies ranged from 58% in the study by Mc Gill et al., in United States to 77.3% by Enos et al., among soldiers killed in action in Korea. In present study, the incidence was 66% which was almost comparable to all studies and nearly equal to Wig and Associates, Shirani J et al., studies.

The age group in above studies varied from neonates to 94 years, whereas in the present study, it was 19 to 80 years. The minimal age was almost equal to Enos et al., Strong J.P. et al., and McGill et al. The maximal age was similar to Wig and Associates and Shirani J. et al.

Table 5 : Shows age range in different studies in comparison with the present study

	Study	Age range
1.	Wig and Associates, (1962) ¹³	0-80
2.	Enos et al., (1953) ¹⁴	18-48
3.	Subramaniam R. et al., (1964) ¹⁵	2.5-94
4.	Bhargava and Bhargava, (1975) ¹⁶	0-90
5.	Shirani J. et al., (1995) ¹⁷	71-80
6.	Strong J.P. et al., (1999) ¹⁸	15-36
7.	McGill et al., (2000) ¹⁹	15-34
8.	Present study	19-80

The prevalence and extent of atherosclerosis quite clearly increased with age. The datas of different studies are compared in Table -8.

Table 6 : Comparison of percentage of involvement by atherosclerosis in each decade of life in different studies

Decade	Wig and Associates (1962) ¹³		Bhargava and Bhargava (1975) ¹⁶		Present study	
	No. with lesions	%	No. with lesions	%	No. with lesions	%
< 1 year	-	-	0/13	0	0	0
1 st Decade	2/18	11	2/20	10	-	-
2 nd Decade	7/18	38	2/21	10	2/4	50
3 rd Decade	24/38	63	12/30	40	5/8	62.5
4 th Decade	23/24	95	21/25	84	10/17	64.7
5 th Decade	23/25	92	17/21	80	8/12	66.66
6 th Decade	19/19	100	10.12	83	5/6	83.33
7 th Decade	8/9	88	3/3	100	2/2	100
8 th Decade	-	-	1/1	100	1/1	100

In the present study the cases from the first decade were not included as the disease started in the 2nd decade, as stated by Gore et al (1960).⁹ Wig¹³ and associates observed that atherosclerosis started appearing in teen age itself.

In the 2nd decade, the incidence of atherosclerosis was 50% in the present study which was higher compared to Wig¹³ and Associates Study (38%) and Bhargava's¹⁶ Study (10%). This may be due to small sample survey.

Results of third decade were almost similar to the Wig and Associates, 40% incidence in the Bhargava's Study which was lesser when compared to present study (66%). The increase of incidence in our study may be due to change of life style of people in recent decades.

After fifth decade almost all the cases in the present study showed the evidence of atherosclerosis. The present study was almost comparable to the above studies in the remaining decades.

V. CONCLUSION

The present study concludes that coronary artery atherosclerosis is common in majority of cases. Atherosclerosis is a complex and multifactorial disease. Age has a dominant influence. Males are affected more than females. Smoking and alcoholism can accelerate the development of atherosclerotic lesions, though they are not atherogenic on their own.

All the observation in the present study showed that the incidence of atherosclerosis in the developing countries (like India) is same as developed countries. There is need of life style change in general public as well as cardiologists and treating physicians to think of early treatment, to avoid untoward complications.

REFERENCES RÉFÉRENCES REFERENCIAS

1. Kumar, V. et al. (2004) Robbins and Cotran pathologic basis of disease, 7th ed. Philadelphia: Elsevier Publications, pp. 511-554.
2. Jagannath Reddy, D. (1986) Recent concepts on aetio-pathogenesis and morphology of atherosclerosis. *Circulation*, 4, pp. 491-500.
3. Park, K. (2000). Text book of Preventive and Social Medicine. 16th ed. Jabalpur: Banarasidas Bhanot Publishers, pp. 252-275.
4. Hughes, K. et al. (1990) Cardiovascular diseases in Chinese, Malaysians, Indians and in Singapore differences in mortality. *J Epidemiol Community Health*, 44, pp. 24-28.
5. Nagalotimath, SJ. (1982) Panel discussion on atherosclerosis Part-I. *I J of the Scientific Society*, 9, pp. 125-133.
6. Grundy SM. (1983) Atherosclerosis. Pathology, Pathogenesis and role of risk factors. *Disease-a-Month*, 29, pp. 3.
7. Padmavati S, Gupta S, Pantulu GVA. (1959) Dietary fat serum cholesterol level and incidence of atherosclerosis in Delhi. *Circulation*, 19, pp. 849-855.
8. White, Edward and Dry. (1950) The relationship of the degree of coronary atherosclerosis with age in men. *Circulation*, 1, pp. 645.
9. Tejada, C. Gore, I. (1957) Comparison of atherosclerosis in Gutemala city and New -Orleans. *Am J Path*, 33, pp. 887.
10. W.H.O. (1958) study group on the classification of atherosclerotic lesions. Technical report series No. 143.
11. W.H.O. (1962) Study group on classification of atherosclerotic lesions. Technical report.
12. W.H.O. (1964) Study group on classification of atherosclerotic lesions. Technical report.
13. Wig, KL. Malhotra, RP. Chitkara, NL. et al. (1962) Prevalence of coronary atherosclerosis in Northern India. *Br Med J*, 24, pp. 510-513.
14. Enos, WF. Holmes, RH. Beyer, J. (1953) Coronary disease among united Solders killed in action in Korea. *JAMA*, 152, pp. 1090-1092.
15. Abraham, C. Kulangara. Subramaniam, R. (1964) Autopsy study of atherosclerosis at Madras, South India. *Circulation*, 29, pp. 546-550.
16. Bhargav, MK. Bhargava, SV. (1975) Coronary atherosclerosis in North Karnataka. *Indian J Path Micr*, 18, pp. 65-79.
17. Shirani, J. Youseti, J. Roberts, WC. (1995) Major cardiac findings at necropsy in 366 American octogenarians. *Am J Cardiol*, 75, pp.151-156.
18. Strong, JP. Malcom, GT. McMahan, CA. Tracy, RE. Newman WP 3rd. et al. (1999) Prevalence and extent of atherosclerosis in adolescents and young adults: Implications for prevention from the pathobiological Determinants of Atherosclerosis in Youth Study. *JAMA*, 281(8), pp. 727-35.
19. McGill, HC. Brown, BW. Gorel. et al. (1968) Grading stenosis in the right coronary artery. *Circulation*, 37, pp. 460-468.
20. Glasgow, S. Rowley, DA. Kohut, RI. (1961) Atherosclerosis of human aorta and its coronary and renal arteries. *Arch of Pathol*, 73, pp. 82-95.