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Simple Renal Cyst: An Independent Risk Factor of Hypertension

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Abstract
Objective/Aim: *The detection of asymptomatic renal cysts is increasing with advancement of imagining techniques and availability. The aim of our study was to evaluate the presence of simple cysts with prehypertension and hypertension in our population.*
Material and Methods: *All consecutive adult patients aged > 25 years who attended the medicine OPD of FHMC and Hospital were enrolled in study. Detailed medical history and physician examination was done in all the patients. Abdominal ultrasonography and biochemical parameters were done. All patients who had history or evidence of structural or functional kidney disease were excluded.*
Results: *A total of 5000 patients were included in study and divided into three groups: normotension (2810), prehypertension (1488) and hypertension (702) groups. There were significant difference in age, sex, family history of hypertension, regular exercise, smoking habits, BMI, systolic and diastolic blood pressure, fasting plasma glucose, total Cholestrol, HDL Cholestrol, Cretinine, estimated GFR in all three groups. Both number (> 2) and size (>2) of SRCs were associated with prehypertension and hypertension indenpendently.*
Conclusion: *The presence of SRCs is independent risk factor and SRCs size >2 cm and number > are significant determinations if prehypertension and hypertension.*

Introduction

Simple renal cysts are discrete lesions within kidney that are typically cortical, extending outside the parenchyma. They are oval or circular in shape and have a distinct outline with enclosed liquid or semisolid fluid structures in kidney, originating secondary to genetic or acquired processes. They are quite common space occupying lesions of the kidney. Polycystic kidney disease is well known entity associated with hypertension, hematuria, flank pain and recurrent urinary tract infections with ultimate renal function impairment.[9] Simple renal cysts (SRCs) are more common and considered acquired and benign. They are generally unilateral, solitary and asymptomatic except when complications occur due to infection, hemorrhage or rupture leading to formation of complex cyst.[2,3,14]. Imaging modalities such as ultra sound, CT Scan and Magnetic resonance Imaging (MRI) are quite frequently used in the evaluation of abdominal ailments. This has led to detection of

asymptomatic renal cysts that may passed unnoticed from eyes of clinicians. Initially simple renal cysts were overlooked but now clinical importance has grown. There are no clinical data or reports are available on relation with simple renal cysts and hypertension or prehypertension in our population. The objective of our study was to evaluate the patients of SRCs and its association with hypertension and prehypertension.

Material and Methods

In a cross section study 5000 adults patients aged more than 25 years were enrolled in F.H. Medical College and Hospital, Firozabad (India), Medicine OPD between July 2015 to Dec 2016. Patients with history or family history of polycystic kidney disease, Medullary sponge kidney, renal disease (congenital or acquired) diabetes mellitus and pregnancy were excluded. A written and informed consent were taken from all patients which were included in this study and approved by institutional ethics committee.

Detailed medical history, family history of chronic disease and personal history were taken. Smoking status was defined as one pack of cigarette per day and patients were divided into current, past and non smokers. Regular exercise was defined as >30 minutes for at least thrice a week. Anthropometric parameters were measured. Blood pressure was recorded by mercury sphygmomanometer. Two readings of both systolic and diastolic pressure at 15 minutes interval were taken at right arm supine position. Average of two readings were classified as normotensive (<120/80 mmHg); prehypertensive (blood pressure 120-139/80-89 mmHg) and hypertensive (Blood pressure 130/90 mmHg) according to seventh Joint National Committee(JNC VII) criteria[16]. Abdominal ultrasound examination was done after 8 hour overnight fast by experienced ultrasonologist. The diagnostic criteria for simple renal cysts were echolucent, round or oval shape, thin wall, well defined sharply demarcated possession wall without calcification and Doppler signals from within the cyst as well as sound wave amplification behind the cystic renal mass which was not suggestive of malignancy.[11] Fasting blood glucose, serum creatinine and lipid profile were measured in each patient. Glomerular filtration rate (EGFR) was estimated using the abbreviated equation from the modification of diet in Renal Disease Study.[10]

Statistical Anylysis

Data analysis was carried out using an SPSS software version 15 (SPSS, Chicago, 1L). The X^2 test was used for comparison of categorical variables among groups. Multiple linear regression was used to test effect of SRCs on systolic and diastolic pressure respectively.

Result

A total of 5000 patients were enrolled and divided into three groups: normotensive (n=2810) Prehypertensive (n=1488) and hypertension (n=702) groups. It was observed that there was significant difference in clinical parameters like age, sex, body mass index, family history of hypertension, regular exercise, smoking habit, systolic and diastolic blood pressure (Table 1) among three groups. The biochemical parameters like fasting plasma glucose, total cholesterol, triglyceride, HDL Cholesterol, creatinine and estimated glomerular filtration rate also shows significant difference among three groups (Table 2). Similarly number and size of renal cysts also significant difference among all three groups. (Table 3). Adjusted odds ratio (OR) and 95% confidence interval of clinical variables for the risk of prehypertension and hypertension were shown in table 4 and they are already considered as independently associated factors of prehypertension and hypertension. Renal cyst size >2 cm and number >2 were also significantly associated with both prehypertension and hypertensive groups.(Table 5)

Table – 1 Clinical parameters among patients with normotension, prehypertension and hypertension

S. No.	Variable	Normotension (n = 2810)	Prehyperetension (n = 1488)	Hypertension (n= 702)	P Value
1	Age(Years)	44.6 + 10.2	50.8 + 11.6	57.2 + 11.8	0.011
2	Male Gender	1516 (54%)	893 (60%)	435 (62%)	0.002
3	Body Mass Index (>23 kg/m^2)	843 (30%)	759 (51%)	386 (55%)	0.01
4	Family history of hypertension	135 (5%)	198 (14%)	168 (24%)	0.015
5	Regular exercise	218 (9.2%)	97 (6.5%)	43 (6.1%)	0.05
6	Smoking	275 (9.8%)	187 (12.6%)	99 (14.2%)	0.02
7	Systolic Blood Pressure (mmHg)	112 + 9.0	127 + 7	158 + 15	0.01
8	Diastolic Blood Pressure (mmHg)	72 + 7	78 + 8	94 + 12	0.01

Table – 2 Biochemical parameters among patients with normotension, prehypertension and hypertension

S. No.	**Variable**	**Normotension (n = 2810)**	**Prehyperetension (n = 1488)**	**Hypertension (n= 702)**	**P Value**
1	Fasting Plasma glucose (mg/dl)	88.4 + 9.4	90.6 + 10.2	94.2 + 10.4	0.02
2	Total Cholesterol (mg/dl)	128 + 32.4	206 + 37.4	209 + 38.6	0.04
3	Triglyceride (mg/dl)	94 + 18	112 + 31	128 + 37	0.02
4	HDL Cholesterol (mg/dl)	52 + 12.4	46 + 12.7	40.8. + 11.6	.016
5.	eGFR (ml/minute/ 1.73m^2)	98 + 17.6	92.6 + 15.4	86.2 + 21.2	.001
6	Creatinine (mg/dl)	0.80 + 0.08	0.86 + 0.18	1.2 + 0.72	.02

eGFR – estimated glomerular Filtration rate, HDL – High Density Lipoprotein

Table – 3 Simple Renal Cysts among patients with normotension, prehypertension and hypertension

S. No.	**Variable**	**Normotension (n = 2810)**	**Prehyperetension (n = 1488)**	**Hypertension (n= 702)**	**P Value**
1	Presence of SRCs	167 (6%)	296 (16%)	168 (24%)	.016
2	Number >2 <2	 42 (1.5%) 126 (4.5%)	 111 (6%) 185 (10%)	 70 (10%) 98 (14%)	0.01
3	Size >2 cm <2 cm	 56 (2%) 112 (4%)	 130 (7%) 166 (9%)	 63 (9%) 105 (15%)	0.01

Table – 4 The adjusted odd ratio and 95% confidence interval of clinical variables on the risk of prehypertension and hypertension by multinomial logistic regression analysis

Sl. No.	**Variables**	**Prehypertension Vs Normotension**	**P Value**	**Hypertension Vs Normotension**	**P Value**
1	Age > 60 yrs	4.31 (3.5– 5.71)	0.001	18.62(16.14-24.16)	0.001
2	Male Vs Female	2.22 (1.90-2.43)	0.02	2.16(1.98_2.38)	0.02
3	BMI >23 Kg/m^2	2.67 (2.31-2.96)	0.03	2.76(1.98-2.38)	0.01
4	Family History of Hypertension	1.38 (1.12–1.68)	0.01	1.54(1.25-1.90)	0.022
5	Regular Exercise	1.44 (1.16–1.69)	0.01	1.72(1.52-1.94)	0.01
6	Smoking	1.35 (1.16–1.64)	0.42	1.65(1.25-1.91)	0.03
7	Total Cholesterol (>200 mg/dl)	1.66 (1.39–1.92)	0.038	1.97(1.56-2.25)	0.02
8	Low HDL Cholesterol (mg/dl)	0.91 (0.62–1.13)	0.68	1.04(0.84-1.25)	0.05
9.	eGFR	0.94 (0.90–1.10)	0.55	1.60(1.40-2.10)	0.02

Table – 5 The adjusted odd ratio and 95% confidence interval of simple renal cysts on the risk of prehypertension and hypertension by multinomial logistic regression analysis

Sl. No.	**Variables**	**Prehypertension Vs Normotension**	**P Value**	**Hypertension Vs Normotension**	**P Value**
1	Simple Renal Cyst (Yes or No)	1.41 (1.26– 1.73)	0.02	1.86 (1.68– 2.15)	0..12
2	Simple Renal Cyst Number >2	1.97 (1.77 – 2.27)	0.001	2.33 (2.12 – 2.78)	0.001
3	Simple Renal Cyst Size >2cm	2.06 (1.74 – 2.54)	0.02	2.74 (2.20 – 3.41)	0.01

Discussion

Our study shows that presence of SRCs is independent high risk factor for prehypertension and hypertension irrespective of other metabolic, renal and cardiovascular risk factors. The size of SRCs > 2cm and number >2 also increase the magnitude of risk .Other results also show that the presence of SRCs is associated with raised systolic and diastolic blood pressure both. Pederson JF[12] et al observed significant association between simple renal cysts and arterial blood pressure. Similar observations were also seen in certain cross sectional observational studies.[6,7,8] In our study clinical parameters like age, male gender, obesity, family history of hypertension, smoking and physical activity were significantly associated with prehypertension and hypertension, although they are well known risk actors of atherosclerosis.

The mechanism of increase in blood pressure by SRCs is not yet clear. The possible explanation is that elevation of blood pressure is related to activation of rennin-angiotension-aldosterone system which can be stimulated by SRCs. Cyst expansion many cause renal ischemia leading to increased release of rennin. [4,5,12,13] There are certain studies that have demonstrated decreased plasma rennin activity and normalization of blood pressure after surgical removal or decompression of cysts. This supports the view that SRCs can cause hypertension.[10,15] The possible mechanism may be that even small intraparenchymal cysts can create high internal hydrostatic pressure causing renal ischemia by compressing surrounding renal tissue.[13]

In our study we have observed significant association between SRCs and prehypertension and hypertension. The limitation of our study are that we have no measured plasma renin activity, serum renin level and effect of surgical removal of cysts to support the hypothesis of role of increased renin levels in patients of SRCs. Therefore follow-up in larger population survey are required in future to address these issues.

Conclusion

With the advancement of imaging techniques, the diagnosis of simple cysts is increased. The presence of simple renal cysts (SRCs) should not be overlooked. It is an important and independent determinant of prehypertension and hypertension. SRCs >2 in number or > 2 cm in size are frequently associated with hypertension and prehypertension. Patients with SRCs must be monitored closely for blood pressure in routine clinical practice.

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