

# Association between renal cysts and abdominal aortic aneurysm: A case-control study

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## SUMMARY

**Objective:** To investigate the positive association between the presence of simple renal cysts (SRCs) and abdominal aortic aneurysm (AAA).

**Method:** In a retrospective case-control study including subjects aged > 50 years, we evaluated the incidence of SRCs on computed tomography (CT) scan. We compared 91 consecutive patients with AAA referred from the Division of Vascular Surgery and 396 patients without AAA, randomly selected after being matched by age and gender from 3,186 consecutive patients who underwent abdominal CT. SRC was defined as a round or oval low-attenuation lesion with a thin wall and size > 4 mm on CT without obvious evidence of radiographic enhancement or septations. Patients were considered as having AAA if the size of aorta was greater than 3.0 cm.

**Results:** Patients with AAA and without AAA were similar in terms of age (67.9±8.41 vs. 68.5±9.13 years) (p=0.889) and gender (71.4 vs. 71.2% of male subjects, respectively) (p=0.999). There was no difference in the prevalence of SRC between case and controls. Among individuals with AAA, 38 (41.8%; [95CI 32.5-52.6]) had renal cysts compared to 148 (37.4%; [95CI 32.7-42.2]) in the control group (p=0.473), with a prevalence ratio (PR) of 1.16 (95CI 0.80-1.68).

**Conclusion:** We found no significant differences in the prevalence of SRCs among patients with AAA and controls. Our findings suggest that the presence of SRCs is not a risk factor or a marker for AAA.

**Keywords:** cystic kidney diseases, abdominal aortic aneurysm, connective tissue.

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## INTRODUCTION

Abdominal aortic aneurysm (AAA) is a serious disease, with significant morbidity and mortality.<sup>1,2</sup> The incidence of AAA has been estimated to be 15-37 per 100,000 patients-year, with an increased prevalence in both males and the elderly.<sup>3</sup> Due to the high mortality rate following AAA rupture, ultrasound screening has been recommended for high-risk patients aged 65-75 years.<sup>4,5</sup> Known risk factors for AAA development include smoking, chronic obstructive pulmonary disease, hypertension, atherosclerosis and familial history.<sup>6,7</sup>

Recently, some publications suggested an association between simple renal cysts (SRCs) and AAA.<sup>8-10</sup> Simple

renal cyst is the most common structural abnormality observed in human kidneys, with prevalence ranging from 5-41%.<sup>11,12</sup> Similarly to what is seen with AAA, the prevalence of SRCs increases with age and in male population.<sup>13</sup> The majority of SRCs are asymptomatic, not harmful and incidentally found by renal imaging, including computed tomography (CT) and ultrasonography. Most SRCs are clinically irrelevant and seldom require treatment.<sup>11,13</sup> Some authors hypothesized that AAA and SRC might share common pathophysiological mechanisms, including possible manifestation of connective tissue weakness.<sup>14</sup> Furthermore, the association between SRCs and AAA

might be of clinical importance for the early recognition of patients at risk for the aortic aneurysmal disease. So, the aim of our study was to investigate a possible positive association between the presence of SRCs and AAA.

## METHOD

This is a retrospective case-control study aimed to establish the prevalence of SRCs in patients with and without AAA based on CT reports, performed in two private clinics specialized in vascular surgery and diagnostic imaging in the city of Feira de Santana, Brazil. Our study was approved by the institutional review board of both clinics, and requirement for informed consent was waived.

Ninety-one (91) consecutive patients with AAA treated in a private clinic specialized in vascular diseases (L.J.C.S) during the years 2008 and 2011 were included in the study group. Diagnosis of AAA was confirmed by CT. Patients were considered as having AAA if the aorta size was greater than 3.0 cm. A control group was identified by searching the database of a private clinic specialized in radiology (M.V.M.S) for all patients aged > 50 years submitted to CT scan in the same period without the diagnosis of AAA. The absence of AAA was confirmed by CT in all patients. Predisposing factors for renal cyst formation (autosomal-dominant polycystic disease, end-stage renal disease, and hydronephrosis) were excluded. Of 3,186 patients initially selected, 396 age- and gender-adjusted controls were selected. Due to specifics of the radiology database, detailed clinical or demographic information were not available for the control subjects.

All imaging studies were performed, read and reported by an experienced radiology attending physician as part of clinical care and without knowledge of this study. A patient was considered to have a SCR if a round or oval low-attenuation lesion with a thin wall and a size > 4 mm was identified on CT without obvious evidence of radiographic enhancement or septations.

Data were expressed as means  $\pm$  SD, medians and interquartile ranges, or absolute values and fractions. Student's t-test or Mann-Whitney U test was used to compare continuous variables while categorical variables were compared using Chi-square or Fisher's exact test. All tests were 2-sided, with  $p < 0.05$  considered statistically significant, and were performed using GraphPad Prism® version 6.02 (GraphPad Software, San Diego, CA, USA).

## RESULTS

Among the 91 patients included in the group with AAA, 65 (71.4%) were male and 26 (28.6%) were female. Mean age of the individuals with AAA was  $67.91 \pm 8.41$  years

(range 51-89 years). In the control group, 282 (71.2%) patients were male and 114 (28.8%) female. Mean age in the control group was  $66.47 \pm 9.13$  (range 51-89 years). The groups were similar according to mean age ( $p = 0.889$ ) and gender distribution ( $p = 0.999$ ).

In the group of patients with AAA, SRCs were observed in 38/91 (41.7%) individuals. There was no significant difference in the prevalence of SRCs between men and women. Twenty-nine (29) out of 65 male patients (44.6%) and nine out of 26 female patients (34.6%) had SRCs ( $p = 0.482$ ).

In the control group, SRCs were found in 148/396 (37.4%) patients. No significant difference was observed in the prevalence of SRCs compared by gender. Simple renal cysts were seen in 108/275 (39.3%) male patients and in 40/121 (33.1%) female patients ( $p = 0.261$ ).

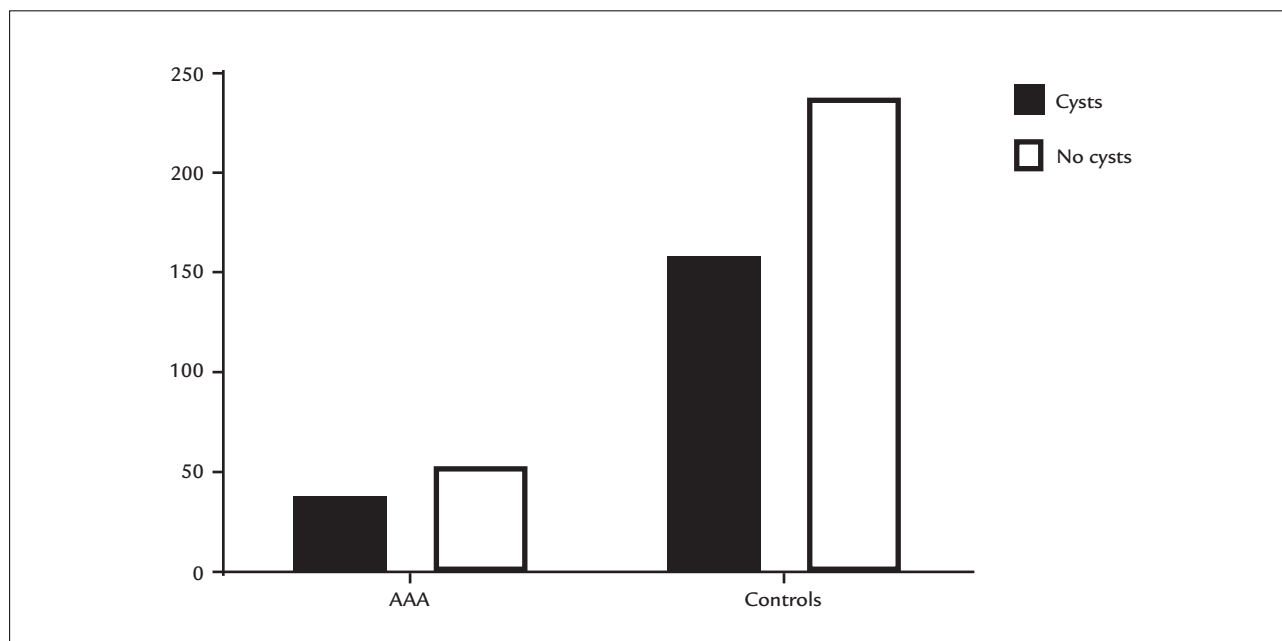
The prevalence of SRCs among patients with AAA (41.7% [95CI 32.5-52.6]) was similar to the prevalence observed in the control group (37.4% [95CI 32.7-42.2]) (OR = 1.08 [95CI 0.68-1.72]),  $p = 0.473$  (Figure 1).

## DISCUSSION

In the present study, there was no statistical difference in the prevalence of SRCs in patients with AAA (41.7%) and in the controls (37.4%). Previous publications demonstrated a statistically significant correlation between SRCs and AAA<sup>6,8-10,14</sup> and put SRCs in line with other clinical markers that have been associated with AAA, including smoking, chronic obstructive pulmonary disease, hypertension, atherosclerosis and familial history.<sup>6,7</sup> However, our data oppose these findings and suggest that SRCs cannot be used as a clinical marker for AAA.

Some authors hypothesized the existence of a common pathogenetic pathway for the development of SRCs and AAA. Speculatively, authors suspected an interrelation in the metabolism of collagen and elastin that may be implicated in both entities.<sup>8,9,14</sup> Our data refutes this common pathophysiological pathway, since the prevalence of SRCs were similar in patients with and without AAA.

The difference observed between our data and those of previous published studies may be explained by several factors, including demographic characteristics and selection or allocation bias. Yaghoubian et al.<sup>9</sup> first reported that patients with AAA have a significantly increased prevalence of SRCs on CT scan compared to patients without AAA.<sup>9</sup> The differences with the present data may be explained by demographic and baseline characteristics. In the study published by Yaghoubian et al.,<sup>9</sup> the mean age was higher than in our series (67 vs. 74 years) and a higher prevalence of men (71 vs. 91%) was observed. As previously demonstrated, male gender and old age are consistent risk factors



**FIGURE 1** Prevalence of simple renal cysts among patients with abdominal aortic aneurysm (AAA) and controls.

for the development of SRCs.<sup>3</sup> These demographic differences may explain the higher prevalence of SRCs observed by Yaghoubian et al.<sup>9</sup> in comparison to our data (54.0 vs. 41.7%). Furthermore, in our data, the prevalence of SRCs in the control group was higher than the prevalence found by Yaghoubian et al.<sup>9</sup> (44.9 vs. 30.0%), which may explain the divergence between the series. The difference may also be explained by an allocation bias. The control group in the Yaghoubian et al.<sup>9</sup> series included patients who underwent a CT scan for traumatic injury. Nevertheless, the inclusion criteria for our control group were age > 50 years old and absence of an AAA on the CT scan. These criteria may allow the inclusion of patients that underwent a CT scan intending to evaluate a cystic renal lesion, increasing the prevalence of SRCs in our control group.

Recently, Ziganshin et al.<sup>15</sup> demonstrated that patients with aortic aneurysm had 2.8 times greater prevalence of renal cyst compared to the control group. Ziganshin et al.<sup>15</sup> demonstrated a prevalence of renal cysts of 15.3% in the control group, compared to the prevalence of 44.9% observed in our control group. This difference may be explained by the average age of our control group, which was significantly higher (63.5 vs. 41.4 years). Our control group was matched by age and gender to the group including patients with AAA, and selection bias may explain the differences observed with our data.

Due to the high mortality rate following AAA rupture, ultrasound screening has been recommended for high-risk

patients aged 65-75 years.<sup>4,5</sup> In 2014, the United States Preventive Task Force recommended one-time ultrasound screening for men 65-75 years of age who have ever smoked.<sup>16</sup> Identifying risk factors in order to select populations with higher risk of presenting an AAA is important for daily clinical practice. Unfortunately, our data refute the hypothesis that SRCs are associated with AAA, and thus cannot be used as a marker of this important vascular disease in our population.

Our study has limitations that must be acknowledged. First, the patients included in the study were not a random sample of the general Brazilian population and our data must be extrapolated carefully. Second, due to specificities of the radiology database and the retrospective nature of our study's design, detailed clinical or demographic information were not available for the control subjects and could not be compared between the groups. However, to the best of our knowledge, this is the first series in a Brazilian population. Furthermore, these are the first data to refute the hypothesis that SRCs is associated to AAA. Future multicenter studies are needed to solve this matter, showing whether or not there is a common genesis for both diseases, or even the possible role of renal cysts as a marker of aortic aneurysms.

## CONCLUSION

Our study found no association between SRCs and AAA. Our data suggest that SRCs cannot be used as a risk factor to select patients that should be screened for an AAA.

## RESUMO

Associação entre cistos renais e aneurismas da aorta abdominal: Um estudo de caso-controle

**Objetivo:** Avaliar uma possível associação entre presença de cistos renais simples (CRS) e aneurisma aórtico abdominal (AAA).

**Método:** Em um estudo de caso *versus* controle com sujeitos com idade > 50 anos, avaliamos a prevalência de CRS detectados por tomografia computadorizada (TC). Comparamos os achados de 91 pacientes consecutivos com AAA oriundos da Divisão de Cirurgia Vascular com 396 pacientes sem AAA, randomicamente selecionados e ajustados por idade e gênero dentre 3.186 pacientes consecutivos que se submeteram a TC abdominal. Cisto simples foi definido como lesão hipodensa oval ou arredondada com paredes finas, maiores do que 4 mm em TC sem realce contrastual ou septação. Pacientes foram considerados com AAA quando o diâmetro da aorta era maior que 3,0 cm.

**Resultados:** Pacientes com AAA e sem AAA eram semelhantes quanto a idade (67,9±8,41 *vs.* 68,5±9,13 anos) (p=0,889) e gênero (71,4 *vs.* 71,2% dos indivíduos masculinos, respectivamente) (p=0,999). Não havia diferença de prevalência de CRS entre casos e controles. Dentre indivíduos com AAA, 38 (41,8%; [IC95% 32,5-52,6]) tinham cistos renais, comparados com 148 (37,4%; [IC95% 32,7-42,2]) no grupo controle (p=0,473), com uma razão de prevalência (RP) de 1,16 (IC95% 0,80-1,68).

**Conclusão:** Não observamos diferenças significativas na prevalência de CRS entre pacientes com AAA e controles. Nossos resultados sugerem que presença de CRS não é fator de risco ou preditor para AAA.

**Palavras-chave:** doenças císticas renais, aneurisma de aorta abdominal, tecido conjuntivo.

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