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Sudden Death in a Male with Severe Coronary Artery Disease and Multiple Kidney Stones

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Abstract

Post-mortem examination is crucial in examining sudden unexpected deaths. Coronary atherosclerotic disease (CAD) is a cardiac entity associated with sudden death. A severe CAD could trigger a fatal arrhythmia or myocardial infarction. This report explores the coexistence of coronary artery disease and kidney stones and highlights the intricate relationship between cardiovascular and renal morbidities. This is a case of a 57-year-old man who died suddenly and had autopsy findings of CAD, cardiomegaly, hypertensive nephrosclerosis, and multiple kidney stones. It is expedient to exclude cardiac or metabolic diseases in individuals with kidney stones and initiate lifestyle changes geared towards preventing coronary atherosclerotic heart disease and sudden death.

Subject Areas

Nephrology

Keywords

Nephrolithiasis, Cardiovascular Disease, Atherosclerosis, Autopsy, Metabolic Syndrome

1. Introduction

Kidney stones can cause marked discomfort and morbidity [1]. Renal calculi are formed mainly from calcium oxalate, although stones can also arise from calcium phosphate [1]. Various factors contribute to stone formation, including dehydration, dietary habits (high intake of oxalate-rich foods), family history, certain medical conditions (such as hyperparathyroidism), and metabolic disorders affecting citrate and calcium. Some authors have explored the role of calcifying nanopeptides in the etiology of renal calculi [2]. These nanopeptides have been implicated in other diseases, including polycystic kidney disease, atheros-

clerosis and cardiovascular calcification [2]. The pathogenesis of nephrolithiasis includes Randall's hypothesis that proposes that the nidus of stone formation starts as interstitial apatite deposits of calcium phosphate [1] [2].

Kidney stone symptoms include pain, often referred to as renal colic, in the back, abdomen, or flank. Hematuria is also a common symptom in patients with kidney stones. Individuals may experience a frequent urge to urinate, accompanied by discomfort. This painful urological condition has shown increasing prevalence over the years [1].

Chronic kidney diseases and nephrolithiasis have been associated with more life-threatening cardiovascular diseases [3] [4]. Coronary artery disease (CAD) is a major global cause of morbidity and mortality. CAD is also a leading cause of mortality, and it is currently on the rise in the developing world due to lifestyle changes [5].

The clinical spectrum of CAD varies widely, encompassing asymptomatic atherosclerosis to acute coronary syndromes [5]. Stable angina, unstable angina, and myocardial infarction represent distinct manifestations, with its characteristic clinical features. The presentation nuances understanding aids in timely diagnosis and intervention. Myocardial infarction, or heart attack, is a severe and life-threatening manifestation of CAD [5] [6]. We report an autopsy case of a 57-year-old man who died suddenly and had both kidney stones and severe coronary artery disease to demonstrate the association of kidney stones and CAD.

2. Case Report

2.1. Clinical Summary

A 57-year-old man who was not known to the hospital and had no established medical records was brought to the emergency room after being found unconscious at home and was certified dead, on arrival at the hospital. The relatives provided a history of having recurrent abdominal and waist pain. He is said to manage the pains with over-the-counter analgesics and he was also a chronic smoker. He complained of worsening waist and abdominal pains hours before demise and indicated interest in visiting a health facility because of the pain intensity.

2.2. Autopsy Findings

At post mortem, examinations showed a lean older looking man measuring 172 cm in length. The cardiac examination revealed an enlarged heart weighing 490 g (reference range [RR]: 300 - 350 g), with biventricular hypertrophy. The tricuspid valve was normal and measured 11.5 cm (RR: 10 - 12 cm), and the mitral valve measured 9 cm (RR: 8 - 10.5 cm). Both the pulmonary and aortic valves are also within normal ranges. The right ventricular wall measured 1.0 cm (RR: 0.2 - 0.5), while the left was markedly hypertrophied with ventricular wall thickness measuring 3.0 cm (RR: 1 - 1.5 cm). Histological examination of the heart revealed myocyte hypertrophy accompanied by significant interstitial fibrosis. There are foci showing wavy myocardial fibers and some capillary congestion. We

would have benefited from the use of Immunohistochemistry to demonstrate evidence of early myocardial death.

There is 75% occlusive atheroma of the left anterior descending artery while the left circumflex had about 40% occlusion. The right coronary arteries were fully patent. There was significant atherosclerosis of the thoracic aorta, abdominal aorta, left and right common iliac arteries. The histology of the branches of the left coronary artery show narrowing of the lumen with atheromatous plaque having dystrophic calcifications within the lipid core (**Figure 1**).

The right and left kidneys had grossly surface irregularity. After easy striping both capsules a granular subcapsular surface with multiple cortical cysts were found. The cortical surface of the right kidneys was irregular with bulging areas and areas of severe congestion. The largest cyst on the right kidney measures 2.5 cm in diameter. Cut sections show good corticomedullary differentiation of both kidneys while the right kidney contains multiple greyish-brown stones within cystic dilated calyces. The stones vary in size ranging from 0.5 cm × 0.5 cm × 1 cm to 4 cm × 3 cm × 2.5 cm. There is also a huge obstructing stone on the right renal pelvis extending into the ureter measuring 5.5 cm in the widest diameter (**Figure 2(A)**). The renal histology showed some glomeruli with periglomerular fibrosis with a few globally sclerosed and vascular features consistent with hypertensive nephropathy (**Figure 2(B)**).

The histology of the lungs was consistent with respiratory bronchiolitis. The lungs section shows marked intra-alveolar and interstitial infiltration by pigmented macrophages. There was subpleural, peribronchial interstitial and alveolar septal fibrosis, and emphysematous changes.

The cause of death based on autopsy findings was hypertensive heart disease with significant coronary atherosclerotic heart disease on a background of nephrolithiasis.

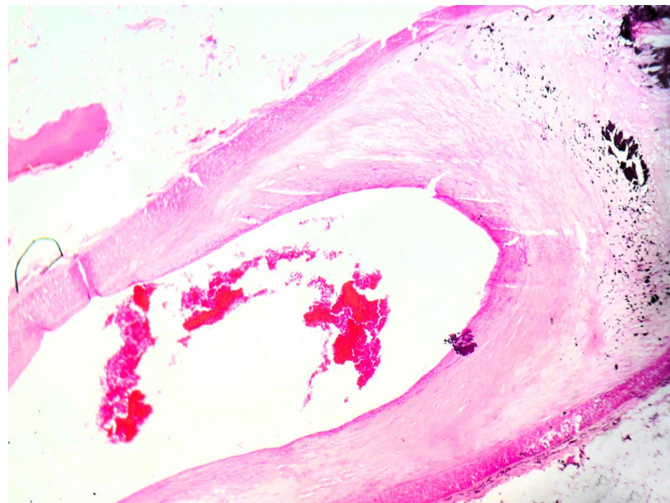

Figure 1. Section of the left anterior descending branch of the left coronary artery with circumferential atheroma and narrowing of the lumen. The lumen contains some thrombus and there is calcification within the core of the atheroma (H&E, 200×).

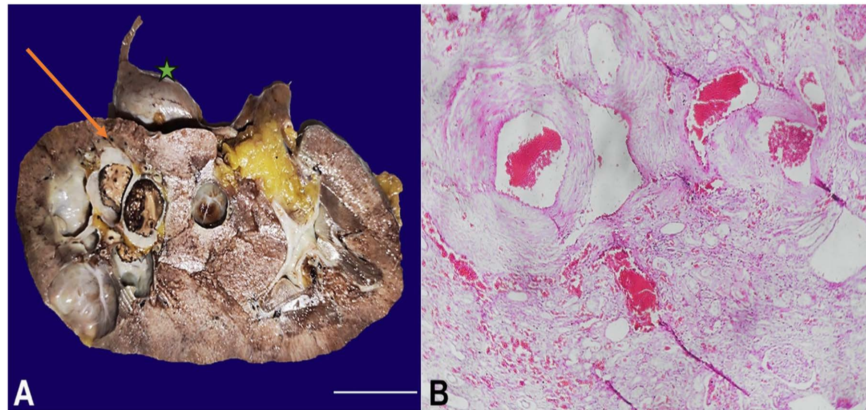

Figure 2. Gross view of the transverse section of the right kidney showing cystically dilated calyces containing stones (orange arrow). The ureter at the hilum is distended with an obstructing stone (green star). Scale bar = 13.5 cm); B-Photomicrograph of the kidney showing focal glomerulosclerosis and hyaline atherosclerosis consistent with hypertensive nephrosclerosis (H&E, 200×).

3. Discussion

The human body is an intricate network where various organs interact. Much interest has been directed to the intriguing association, which is the potential link between kidney stones and CAD [2] [7] [8]. There is variation in the prevalence of kidney stones worldwide, with figures from Saudi Arabia higher than in Europe and with some rarity in African countries [9] [10]. Patients with nephrolithiasis also have a high incidence of recurrence after treatment [9]. This is most likely because the individual is repeatedly exposed to the factors that promote stone formation.

The multifactorial nature of CAD involves a complex interplay of genetic, environmental, and lifestyle factors. Established risk factors include hypertension, hyperlipidemia, diabetes mellitus, smoking, metabolic syndrome, and a family history of cardiovascular disease [4] [11]. CAD evolves from atherosclerosis, a progressive inflammatory condition affecting the coronary arteries in this instance [6] [12]. The accumulation of lipids, inflammatory cells, and fibrous tissue within the arterial walls leads to atherosclerotic plaques. Plaque rupture or erosion can trigger thrombus formation, resulting in partial or complete coronary artery occlusion and subsequent myocardial ischemia [6]. Sudden death can also happen in CAD when the stable plaque narrows the vessel circumference by greater than 75%, which was present in this index report [6].

Wong *et al.* [9] demonstrate that the rising incidence of urolithiasis is similar to the increasing incidence of metabolic syndrome. Kidney stones are associated with the development of diabetes mellitus, cardiovascular diseases, hypertension and dyslipidaemia [9]. A study by Alexander *et al.* [3] demonstrated that nephrolithiasis and atherosclerosis share some common risk factors; it also established that individuals with kidney stones tend to have a higher risk of subsequent acute myocardial infarction. Glover Lashaunta [7] demonstrated a strong association between kidney stones and morbidities such as CAD independent of

race and ethnicity. Individuals with hypertension, cancers, diabetes mellitus, and albuminuria who have kidney stones have been shown by a study to have significantly higher incidence of acute myocardial infarction [4]. While some studies have shown strong association between females with kidney stones and an increased risk of CAD compared to the male sex, [13] [14] this report is of a male patient who had kidney stones with the subsequent fatal cardiovascular event. Conversely, in support of this report, Xu Min *et al.* [4] argued that kidney stones are more common in men epidemiologically and also that CAD is more prevalent in men. Thus, it can be deduced that males are more likely to be exposed to unknown factors that increase both cardiovascular and kidney stone formation risk [4]. Such risk factors possibly induce oxidative stress, which is a key factor in the development of endothelial dysfunction and litho genesis [15].

Another mechanism that explains the association between kidney stones and CAD is the fact that severe kidney dysfunction, sometimes observed in individuals with recurrent kidney stones, can impact electrolyte balance and blood pressure, potentially increasing the risk of cardiovascular complications [16]. Chronic kidney disease (CKD) patients are at high risk for cardiovascular diseases, including CAD [16]. Myocardial infarction and sudden cardiac death are some of the top causes of death in patients with CKD [16]. As renal function deteriorates, the serum levels of CRP become elevated, and high CRP correlates with the inflammatory state of atherosclerosis, which is the underlying pathology of CAD [16]. In instances where coronary artery calcification is evident, as illustrated in the case we have presented, a clear correlation exists between myocardial infarction and sudden cardiac death [16]. It is essential to note that atherosclerotic calcifications occur frequently in CKD, and these calcifications can also happen within the coronary arteries, as seen in this case [16]. We did not obtain a history of hypertension or metabolic syndrome in this patient. Still, autopsy findings demonstrated features consistent with systemic hypertension, such as small vessel vasculopathy in the systemic circulation.

Clinically, systolic dysfunction is the most important predictor of sudden cardiac death, and obstructive coronary artery disease, as seen in this case, is the most common cause of sudden cardiac death [17].

4. Conclusion

Kidney stones are associated with the development of cardiovascular diseases, inclusive of CAD, and both conditions are intricately intertwined. Coronary artery disease can lead to sudden cardiac death. Kidney stones in patients should be considered as a pointer to either the concomitant or future development of CAD to allow for early lifestyle modification and subsequently improve cardiac health.

Ethics Statement

A duly signed consent was obtained from the next of kin to include the pictures

for education purposes. A waiver from the institutional ethics committee was secured for this report.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Coe, F.L., Worcester, E.M. and Evan, A.P. (2016) Idiopathic Hypercalciuria and Formation of Calcium Renal Stones. *Nature Reviews Nephrology*, **12**, 519-533. https://doi.org/10.1038/nrneph.2016.101

[2] Bagga, H.S., Chi, T., Miller, J. and Stoller, M.L. (2013) New Insights into the Pathogenesis of Renal Calculi. *Urologic Clinics of North America*, **40**, 1-12. https://doi.org/10.1016/j.ucl.2012.09.006

[3] Alexander, R.T., Hemmelgarn, B.R., Wiebe, N., Bello, A., Samuel, S., Klarenbach, S.W., *et al.* (2014) Kidney Stones and Cardiovascular Events. *Clinical Journal of the American Society of Nephrology*, **9**, 506-512. https://doi.org/10.2215/cjn.04960513

[4] Xu, M., Zhao, Z., Shen, F., Hu, R., Lu, J., Xu, Y., *et al.* (2022) Modification Effect of Changes in Cardiometabolic Traits in Association between Kidney Stones and Cardiovascular Events. *Frontiers in Cardiovascular Medicine*, **9**. https://doi.org/10.3389/fcvm.2022.923981

[5] Okrainec, K., Banerjee, D.K. and Eisenberg, M.J. (2004) Coronary Artery Disease in the Developing World. *American Heart Journal*, **148**, 7-15. https://doi.org/10.1016/j.ahj.2003.11.027

[6] Jinnouchi, H., Kolodgie, F.D., Romero, M., Virmani, R. and Finn, A.V. (2020) Pathophysiology of Coronary Artery Disease. *Vessel Based Imaging Techniques*, Springer International Publishing, 211-227. https://link.springer.com/chapter/10.1007/978-3-030-25249-6_11 https://doi.org/10.1007/978-3-030-25249-6_11

[7] Glover, L.M. (2015) Association of Kidney Stones with Chronic Disease among Association of Kidney Stones with Chronic Disease among Adults in the United States: Considerations by Race-Ethnicity Adults in the United States: Considerations by Race-Ethnicity. 1033. https://egrove.olemiss.edu/etd/1033

[8] Cappuccio, F.P., Strazzullo, P. and Mancini, M. (1990) Kidney Stones and Hypertension: Population Based Study of an Independent Clinical Association. *BMJ*, **300**, 1234-1236. https://doi.org/10.1136/bmj.300.6734.1234

[9] Wong, Y.V., Cook, P. and Somani, B.K. (2015) The Association of Metabolic Syndrome and Urolithiasis. *International Journal of Endocrinology*, 1-9. https://doi.org/10.1155/2015/570674

[10] Rodgers, A. (2006) The Riddle of Kidney Stone Disease: Lessons from Africa. *Urological Research*, **34**, 92-95. https://doi.org/10.1007/s00240-005-0017-1

[11] Reddan, D.N., Szczech, L.A., Tuttle, R.H., Shaw, L.K., Jones, R.H., Schwab, S.J., *et al.* (2003) Chronic Kidney Disease, Mortality, and Treatment Strategies among Patients with Clinically Significant Coronary Artery Disease. *Journal of the American Society of Nephrology*, **14**, 2373-2380. https://doi.org/10.1097/01.asn.0000083900.92829.f5

[12] Seidman, M.A., Mitchell, R.N. and Stone, J.R. (2014) Pathophysiology of Atherosclerosis. *Cellular and Molecular Pathobiology of Cardiovascular Disease*, 221-237. https://doi.org/10.1016/B978-0-12-405206-2.00012-0

[13] Cheungpasitporn, W., Mao, M., O'Corragain, O., Edmonds, P., Erickson, S. and Thongprayoon, C. (2014) The Risk of Coronary Heart Disease in Patients with Kidney Stones: A Systematic Review and Meta-Analysis. *North American Journal of Medical Sciences*, **6**, 580. https://doi.org/10.4103/1947-2714.145477

[14] Ferraro, P.M., Taylor, E.N., Eisner, B.H., Gambaro, G., Rimm, E.B., Mukamal, K.J., *et al*. (2013) History of Kidney Stones and the Risk of Coronary Heart Disease. *JAMA*, **310**, 408-415. https://doi.org/10.1001/jama.2013.8780

[15] Saenz-Medina, J., Muñoz, M., Rodriguez, C., Sanchez, A., Contreras, C., Carballido-Rodríguez, J., *et al*. (2022) Endothelial Dysfunction: An Intermediate Clinical Feature between Urolithiasis and Cardiovascular Diseases. *International Journal of Molecular Sciences*, **23**, 912. https://doi.org/10.3390/ijms23020912

[16] Hage, F.G., Venkataraman, R., Zoghbi, G.J., Perry, G.J., DeMattos, A.M. and Iskandrian, A.E. (2009) The Scope of Coronary Heart Disease in Patients with Chronic Kidney Disease. *Journal of the American College of Cardiology*, **53**, 2129-2140. https://doi.org/10.1016/j.jacc.2009.02.047

[17] Wang, A.Y.-M., Lam, C.W.-K., Chan, I.H.-S., Wang, M., Lui, S.-F. and Sanderson, J.E. (2010) Sudden Cardiac Death in End-Stage Renal Disease Patients. *Hypertension*, **56**, 210-216. https://doi.org/10.1161/hypertensionaha.110.151167