

ATHEROSCLEROTIC PLAQUE OF RENAL VASA RECTA ON CALCIUM STONE PATIENT

¹Sawkar Vijay Pramod, ¹Suwandi Sugandi, ¹Aaron Tigor Sihombing, ²Makmuri

¹Department of Urology, Faculty of Medicine/Padjadjaran University, Hasan Sadikin Hospital, Bandung, Indonesia.

²Department of Pathology Anatomy, Faculty of Medicine/Padjadjaran University, Hasan Sadikin Hospital, Bandung, Indonesia.

ABSTRACT

Objective: We would like to identify whether atherosclerotic plaque inside renal vasa recta correlates with the formation of calcium stone. **Material & Method:** Samples are taken from kidney tissue removed by nephrectomy due to stone and non-stone disease. Histopathological examination with specific staining was performed by a single pathologist to find the atherosclerotic plaques inside the renal vasa recta. The result of each group was compared, and then analyzed using the Chi square test/Fischer exact test (SPSS ver.16.0; $p < 0,05$). **Results:** We found that the risk of calcium lithiasis is two-fold higher in the group with atherosclerotic plaques inside the renal vasa recta. ($PR = 2,15$; $p < 0,05$). **Conclusion:** Calcium stone are more likely to occur on patients with renal vasa recta atherosclerotic plaque, as possible sequelae of vascular injury.

Keywords: Atherosclerotic plaque, vasa recta, calcium renal stone.

ABSTRAK

Tujuan Penelitian: Peneliti ingin mengidentifikasi apakah plak aterosklerosis dalam vasa rekta ginjal berhubungan dengan terbentuknya batu kalsium. **Bahan & Cara:** Sediaan ginjal berasal dari nefrektomi akibat batu dan non-batu. Dilakukan pemeriksaan histopatologi untuk melihat adanya gambaran aterosklerosis plak dalam vasa rekta ginjal oleh seorang ahli patologi dengan pewarnaan khusus. Dilakukan penilaian statistik dengan chi square test/Fischer exact test, menggunakan SPSS ver.16.0. $p < 0,05$ dinyatakan bermakna. **Hasil Penelitian:** Dari hasil penelitian didapatkan risiko terbentuknya batu kalsium 2 kali (prevalence rate = 2,15 dengan $p < 0,05$) lebih besar pada kelompok dengan plak pada vasa rekta ginjal. **Simpulan:** Batu kalsium terjadi 2 kali lebih sering pada pasien dengan plak aterosklerosis dalam vasa rekta.

Kata Kunci: Plak aterosklerosis, vasa rekta, batu kalsium.

Correspondence: Sawkar Vijay Pramod, c/o: Department of Urology, Faculty of Medicine/Padjadjaran University, Hasan Sadikin Hospital, Jl. Pasteur No. 38, Bandung, Indonesia. Phone: +62-22-2039141. Mobile phone: 0811248069. Home Address: H. Kurdi Street no 36, Bandung 40243, Indonesia.

INTRODUCTION

The lifetime prevalence of an individual to suffer from urinary tract stone disease ranges from 1-15% with a few possible causes, including gender, race, age, geographic location, and more. Metabolic and chemical factors - physical (physicochemistry) are important keys in the etiology of urinary tract stones.¹

Chemical-physical processes of stone formation is a complex course, beginning with satu-

ration, nucleation, and crystal growth, aggregation and retention. Currently, some experts suggest another opinion in the formation of urinary tract stones.

Low and Stoller (2004) put forward the hypothesis that stone formation is an intravascular phenomenon, precisely in the vasa recta near the renal papillae. Injury and repair process that occurs in vasa recta may result in atherosclerotic-like reactions, resulting in endothelial calcification, followed by a process of erosion into the papillary

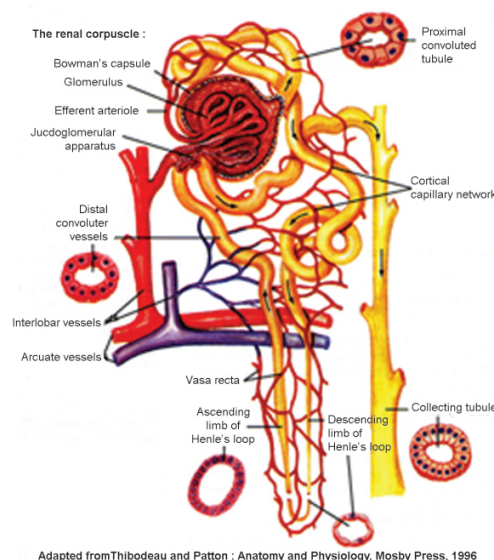
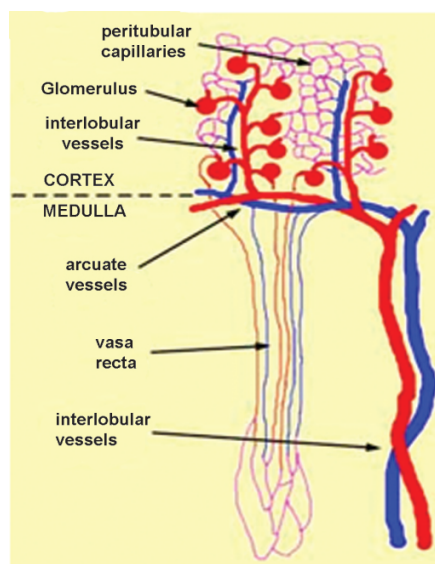


Figure 1. Nephron circulation system.

interstitium and into the tubules, so it can become a nidus for stone formation.^{1,2}

Vasa recta is a part of renal circulation. Located primarily in the cortico-medullary junction area, it vascularizes proximal and distal tubules, and plays a role in maintaining the osmolarity in the interstitial tissue.³

Atherosclerosis is a group of vascular diseases characterized by thickening, reduced elasticity of the walls and plaque deposits (atheroma) containing lipoproteins, leukocytes, and macrophages. Atherosclerosis can affect various circulatory systems in the body with different manifestations. Some risk factors can predispose to atherosclerosis, one of which is age. In the Framingham heart study age of more than 40 years (men) or more than 50 years (women) are included in major risk factors.⁴

OBJECTIVE

To identify relationship between atherosclerotic plaque in renal vasa recta and calcium stone formation.

MATERIAL & METHOD

This study was a cross-sectional study using consecutive sampling method. The study was conducted in Hasan Sadikin Hospital (RSHS), Bandung, West Java, between September 2009 and September 2009.

The number of samples obtained were 20, in which 15 subjects with calcium stones and 5 subjects with no stones. Preparations were derived from nephrectomized kidneys due to non-functionality resulting from calcium stones, and trauma (age > 40 years for men and > 50 years for women). The exclusion criteria in this study were children, infection stones, and pyonephrosis.

The preparations were analyzed histopathologically by a pathologist to assess the presence of atherosclerotic plaque in the vasa recta. Kossa staining method was used to observe the atherosclerotic plaque profile.⁵ Statistical assessment was done with Chi square test/Fischer exact test, using SPSS ver.16.0. $p < 0,05$ was declared as significant.

RESULTS

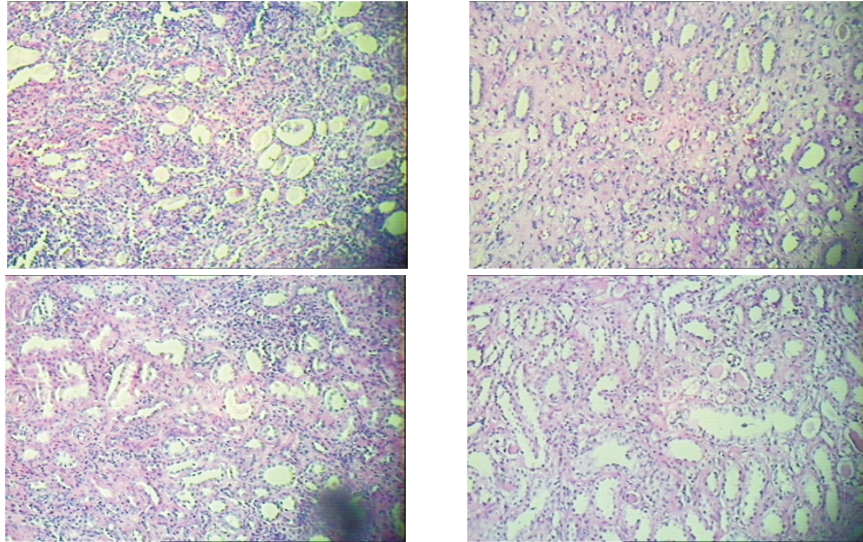


Figure 2. Negative results (no black plaque found with Kossa staining).

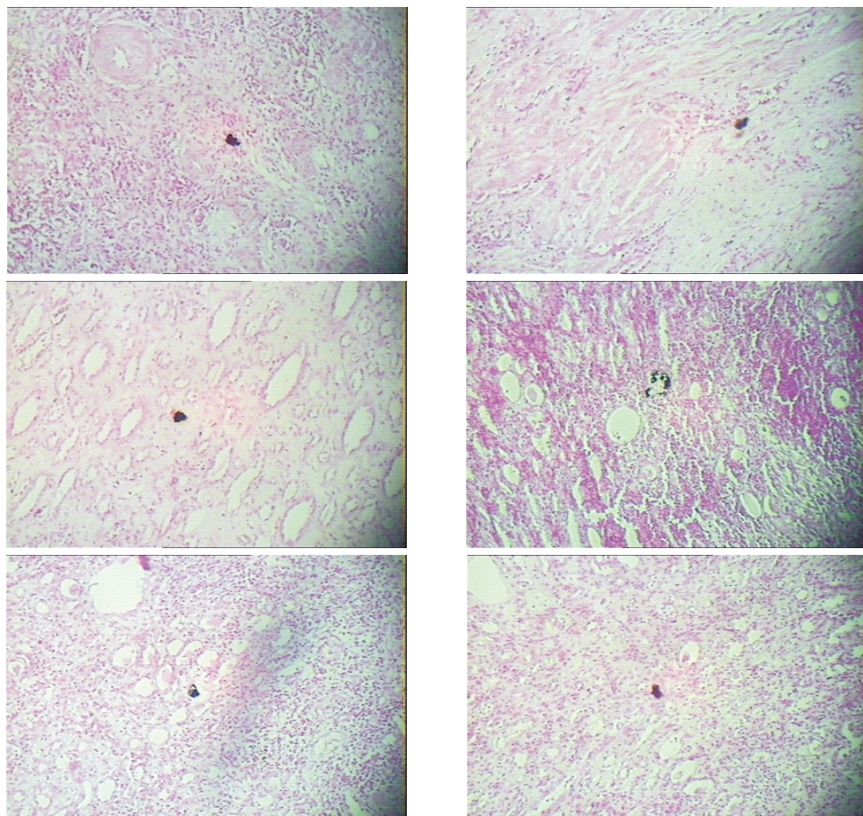


Figure 3. Positive results (black plaque found with Kossa staining).

Table 1. Distribution of research results.

	Stone	Non-Stone	Total
Plaque	12	1	13
Without plaque	3	4	7
Total	15	5	20

p = 0,03 and prevalence rate (PR) = 2,15

DISCUSSION

Atherosclerosis is a systemic disease and, therefore, it rarely arises in only one blood vessel. The process of plaque formation begins with the accumulation of lipoproteins, due to hypercholesterolemic circumstances, in tunica intima. It is followed by adhesion of leukocytes to endothelial lumen and penetration of leukocytes into the intima. Leukocyte accumulates, foam cell formation process occurs due to phagocytosis by mononuclear lipoprotein, and ends with the formation of fibrous capsule with lipid core.^{5,6}

Physical-chemical processes of stone formation is a complex course. Starting with the glomerular filtrate through the nephron and supersaturated urine, precipitation and the formation of crystals and nuclei occur. Crystals can be released simultaneously with the urine, so the stone will not be formed or fixed, through a process of epithelial injury in the tubules within the kidneys, so it becomes a place for growth and aggregation that led to the formation of stones.¹

In this study, from non-stone group there was one subject with atherosclerotic plaque profile. The subject was a man aged 42 years. Presumably in this patient atherosclerotic plaque in vasa recta did not erode into the tubules, so it had not formed a nidus for the formation of urinary tract stones. In stone group there were three subjects without atherosclerotic plaque. All three were female subjects, aged between 40-50 years. Most likely, the patients were still in premenopausal period, in which

the estrogen hormone is still acting as protection against atherosclerotic plaque formation, and stone formation was caused by factors other than atherosclerotic plaque.

The risk of calcium stone formation was found twice ($p < 0,05$) higher in the group with a plaque on the kidney vasa recta. This supports the hypothesis that the occurrence of plaque in the vasa recta is associated with the occurrence of renal calcium stones. The relationship between atherosclerotic plaque with urinary tract stones bring enormous clinical implications. Cardiovascular risk factors should be taken into account in the management of urinary tract stones comprehensively and to prevent recurrence.

Limitations of the study were regarding the sample size and the imbalance between stone and non-stone groups due to the few number of nephrectomy cases with non-stone indication.

CONCLUSION

Calcium stones occur twice more frequently in patients with atherosclerotic plaques in vasa recta.

REFERENCE

1. Pearle S, Margaret. Urinary lithiasis: Etiology, epidemiology, and pathogenesis. Campbell-Walsh Urology. 9th ed. 2007; 42: 1389–90.
2. Miller, Nicole L. Pathogenesis of renal calculi: Intravascular phenomenon. Urology Clinics of North America; 2007. p. 299.
3. Dorland's Illustrated Medical Dictionary. 29th ed. 2000; 140, 166.
4. Chien, Peter C. Lipid disorders: Current Diagnosis & Treatment in Cardiology, 3rd ed. 2008; 2: 18–19.
5. Luna, Lee G. Methods for pigments and minerals: Manual of Histologic Staining Methods. 3rd ed. 1979; 176–7.
6. Libby P. Vascular disease: Pathogenesis of atherosclerosis; Disorders of the cardiovascular system. Harrison's Principle of Internal Medicine. 15th ed. 2001; 241: 1377–8.