Case Report

Hypertension Due To Renal Artery Stenosis

Devi Novriyanti M, Aumas Pabuti, Fitrisia Amelin

Abstrak

Sebagian besar etiologi hipertensi pada anak adalah sekunder dengan kelainan yang mendasari, berbeda dengan dewasa yang biasanya primer. *Renovascular hypertension* (RVH) terjadi lebih sering pada remaja daripada usia dewasa. Stenosis arteri renalis adalah istilah umum yang merujuk pada lesi vaskuler yang menyebabkan penyempitan arteri renalis sehingga mengganggu aliran darah ke ginjal. Proses untuk mengidentifikasi hipertensi sekunder dan mencari penyebabnya selalu menjadi tantangan pada remaja. Dilaporkan kasus hipertensi akibat stenosis arteri renalis pada remaja perempuan, usia 15 tahun 3 bulan yang didiagnosis berdasarkan gejala klinis, USG doppler dan CT angiografi.

Kata kunci: hipertensi, remaja, stenosis arteri renalis

Abstract

The most childhood hypertension is secondary to an underlying disorder. Renovascular hypertension (RVH) disease more common in adolescents than in the adult age group. Renal artery stenosis is a general term that refers to any vascular lesion causing narrowing of the renal artery, thereby impairing blood flow to the kidney. The process to identify secondary hypertension in adolescents and to diagnose the cause is always challenging. The rarity of the case and the complexity make it important to present this case. It was reported a case of 15 years and 3 months old female with hypertension due to renal artery stenosis, diagnosed by clinical manifestation, USG Doppler and CT angiography.

***Keywords**: hypertension, adolescent, renal artery stenosis*

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INTRODUCTION

Hypertension is relatively common, with a prevalence of more than one billion in the world.[1] The incidence of hypertension in children is unknown. One report shows that the prevalence of hypertension in children is 1% and has increased especially in school age. This is probably due to the increasing prevalence of obesity in this group.[2] Hypertension is also a problem in adolescents, because hypertension in adolescents can continue in adulthood and have a higher risk of morbidity and mortality.[3-5] The incidence of hypertension in children and adolescents is estimated between 1– 3% and increases with age, ranging from 15% in young adults to 60% in people older than 65 years.[6] The incidence of hypertension in adolescents is around 9,6% in Jakarta.[7]

Hypertension based on the etiology is divided into primary (essential) and secondary. While most hypertension in adults is primary, secondary hypertension is more common in children and adolescents.[7] Secondary hypertension is an elevated blood pressure that results from an underlying, identifiable, often modifiable cause.[8] Secondary hypertension must be appropriately diagnosed and treated, so patients with a secondary form of hypertension might be cured, or at least show an improvement in blood pressure control and a reduction of cardiovascular risk.[9]

The etiology of secondary hypertension could be one of the diseases that include: renal problem (renal parenchymal disease, renal vascular disease, *etc*), endocrine (hypothyroidism, hyperthyroidism,

Cushing syndrome, etc), drugs and exogenous hormones, neurological causes, obstructive sleep apnea, acute stress related secondary hypertension, diseases of the aorta, pregnancy-induced hypertension, and isolated systolic hypertension due to an increased cardiac output. Renovascular hypertension disease accounts for 5-10 % of all childhood hypertension.[10,11]

Renal Artery Stenosis (RAS) is a frequently encountered problem in clinical practice. The disease encompasses a broad spectrum of pathophysiologies and is associated with three major clinical syndromes: ischemic nephropathy, hypertension, and destabilizing cardiac syndromes. The two most common etiologies are fibromuscular dysplasia and atherosclerotic renal artery disease.[12] The process of identifying secondary hypertension in adolescents and to diagnose the cause is always challenging. The rarity of the case and the complexity make it important to present this case. The aim of this case report is to describe the diagnosis, pathophysiology and management of secondary hypertension due to renal artery stenosis in adolescents.

CASE

Reported 15 years and 3 months old female, admitted to pediatric outpatient clinic Dr. M. Djamil Hospital with chief complain: headache since 2 month ago. Headache was throughout the head, throbbing headache for 5-15 minutes and intermittent. Vomit 2 weeks ago for 2 days, 1-3 times/day, intermittent, containing food and not projectile. No fever, cold, cough, breathlessness and chest pain. No seizure, numb at extremities and loss vision. No history of the bloody, sandy and thick color of urination. No history of head trauma. No history of consumption medicine and herbal. The patient eats 3 times a day, homemade food is not too salty, neither like to eat snacks, vegetables or fruit. She has no history of weight gain, fatigue, weakness, weight loss, hair loss, heat intolerance, tremor, fever, prolonged cough, arthralgia, skin rash. Mixturation dan defecation was normal. Patients had been hospitalized at Solok district hospital 2 months ago for 5 days with headache and hypertension crisis 200/100 mmHg. The patient has never been tested for blood pressure before. The patient controlled regularly to pediatric outpatient clinic in Solok district hospital and had been performed urologic USG with the result: left kidney was shrunk with vascularity of the left kidney seems minimal by using color doppler, suspected renal artery stenosis. The patient got furosemide 2 x 40 mg, proponalol 1x 60 mg, potassium slow-release 2 x 600 mg but the patient's blood pressure still remains high.

On Physical examination, the patient look moderately ill with Glasgow coma scale (GCS): E4M6V5 = 15, blood pressure 150/90 mmHg in all four extremities, (P50:110/65 mmHg, P90: 123/79 mmHg, P95:127/83 mmHg, P 99: 134/91 mmHg), heart rate 84 times per minute, respiratory rate 20 times per minute, body temperature 36,7 ^{0}C, bodyweight 45 kgs, body height 154 cms, weight for age was 86,53%, height for age was 95%, weight for height was 102%, well-nourished. There was no anemic, no icteric, no edema and no cyanotic. The skin was warm. There was no regional lymph enlargement. The head was round and symmetric. Conjunctiva was not anemic, sclera was not icteric, isochoric pupil with diameter 2mm/2mm, light reflex was positive normal. Ears were normal. There was no nasal flare. Mouth's mucous was wet, with no oral trash, no cyanosis. There was no neck rigidity, JVP 5-2 cmH_2O. The chest was symmetric and no retraction, lung: vesicular, no rales, no wheezing. On heart examination, the apex wasn't obvious seen in inspection but palpable at 1 finger medial of left midclavicular line, intercostal space V, heart border was normal and sound was regular rhythm with no murmur. There was no abdominal distension, liver and spleen were not palpable, ballotement negative — no abnormality found in genitalia, puberty state A2M3P2. Extremities were warm with good perfusion, no edema, physiological reflex were positive normal, pathological reflex were negative. Motoric strength and sensory were normal.

Laboratory finding : haemoglobin 13,1 gr/dl, leucocyte 7.550/mm3, differential count 0/2/0/57/38/3, hematocrite 40%, platelets 409.000/mm^3. Urinalisis was in normal limit. Random blood glucose 108 mg/dl, sodium 140 mmol/L, potassium 3,5 mmol/L, calsium 9,6 mmol/L, ureum 28 mg/dl, creatinin 0,7 mg/dl with

glomerular filtration rate (GFR) 125 ml/min/1,73m^2 (N: 96,5-136,8), uric acid 8,2 mg/dl, total cholesterol 179 mg/dl, low density lipoprotein (LDL) cholesterol 106 mg/dl, high density lipoprotein (HDL) cholesterol 66 mg/dl, trigliseride 145 mg/dl, total protein 7,8 gr/dl, albumin 5,1 gr/dl, globulin 2,7 gr/dl.

Consultation result from the ophthalmology department: Currently, there are signs of hypertensive retinopathy KW II ODS. Recommendations: control blood pressure and follow up every 6 months

Urologic USG examination: right kidney was normal shape and size, size 10.2 x 4.16 cm, hyperechoic kidney parenchymal structure, differentiation of cortex and medulla still clear. The pelvicalyceal system does not widen, neither stone or focal lesions. Left kidney: shape and size slightly smaller than the right, hyperechoic renal echo parenchymal structure is the same as liver and spleen echo, cortical and medullary differentiation is still clear. The pelvicalyceal system does not widen. There were no stones or focal lesions. Doppler ultrasound: proximal left renal PSV showed: 151 cm/s, RI 0.91 while right renal artery 54.9 cm/s, RI 0.75 cm. Conclusion: suspected left renal artery stenosis, differential diagnose: renal artery occlusion. Recommendation for CT angiography.

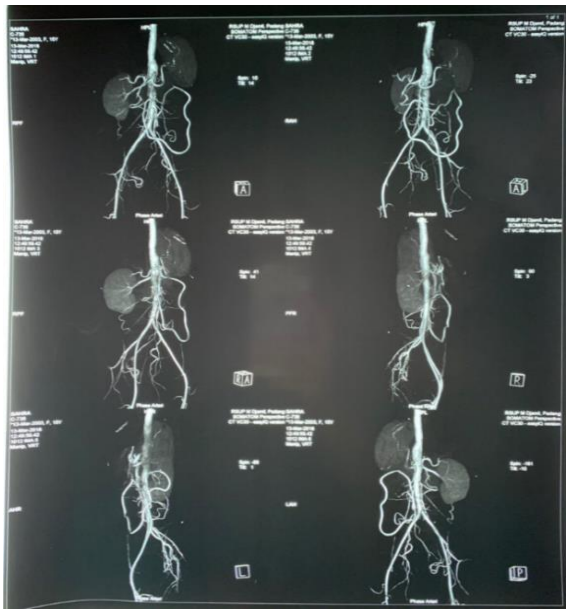

Figure 1. Patient's CT angiography

Expertise CT angiography renal: There was a stenosis in the right renal artery in the proximal part with a diameter of approximately <2.8 mm. No collateral artery, arteriovenous malformation (AVM) or aneurysm were seen. Left renal artery: stenosis appears on the proximal part (almost not visualized) and then the renal artery caliber appears to be smaller. The size of the kidney was shrinking. There was no sign of widening calises and no stones in both kidneys. There was no ascites and pleural effusion. Impression: bilateral renal artery stenosis (especially left renal artery).

ECG show sinus rhythm, rate 84 bpm, axis was normal, P wave was normal, PR interval was 0,14 s, QRS duration was 0,06 s, no ST-T changes. The conclusion was a sinus rhythm with no sign of ventricular hypertrophy.

The patient was diagnosed with bilateral stage II hypertension. The patient was consulted with the Vascular surgery department and suggested to referred to Ciptomangunkusumo hospital to corrective surgery because of a lack of facilities. Hence, the patient and her family didn't agree to referred to Ciptomangunkusumo hospital, so the therapy given is only medication. The patient has consuming anti-hypertension drug captopril 3 x 25 mg, propranolol 1 x 60 mg, amlodipine 1 x 10 mg with minimal improvement of hypertension.

DISCUSSION

Secondary hypertension is the most frequent form of hypertension in children. Renovascular disease accounts for 5-10% of childhood hypertension and should be suspected in the presence of severe hypertension found difficult to manage with medical therapy.[13] We describe the case of 15 years and 3 months old girl with stage II hypertension due to renal artery stenosis. The patient was admitted to the paediatric outpatient clinic in M.Djamil hospital. The patient's blood pressure was measured by about 150/90 with a history of hypertensive crisis of about 200/100 mmHg.

Accurate assessment of blood pressure is essential for the diagnosis and treatment of hypertension. Measurement is especially challenging in young children and infants who can find the procedure uncomfortable and upsetting. Successful measurement of blood pressure in young children is

dependent on several factors: 1) a relaxed environment; 2) well-maintained equipment; 3) availability of various cuff sizes to suit all children, and 4) a rest period of about 5 min before measurement. Inaccurate cuff size and positioning are the most usual causes of overestimation of blood pressure. A cuff with a bladder measurement completely encircling the arm with the center of the bladder positioned over the brachial artery is recommended. A Doppler device to measure systolic blood pressure is very useful in young children and infants.[14]

Blood pressure should be taken in all four limbs at the first assessment. At least two consecutive sitting blood-pressure measurements 1 minute apart are advisable. A diagnosis of hypertension should only be made if blood pressure is consistently raised on repeated visits. Children with difficult to define blood pressure, 24-h ambulatory blood pressure monitoring can be used. This technique has greatly enhanced the diagnosis and management of hypertension in children.[14]

After confirmed hypertension, screening of the etiology of hypertension must be done according to history, physical examination, and laboratory tests. Further investigation into a possible secondary etiology in the absence of suggestive signs and symptoms is indicated in resistant hypertension (defined as elevated blood pressure although the patients have been treated with three antihypertensive agents, including diuretics), onset of hypertension in persons younger than age 20 years or older than age 50 years, a severe or accelerated course of hypertension, worsening of control in previously stable hypertensive patient, significant hypertensive target organ damage, lack of family history of hypertension, or specific drug intolerances.[8,15] In this case, the patient was then treated with two antihypertensive agents with no satisfying improvement. These findings bring us to suspect that the patient had secondary hypertension. Further investigation was done to determine the etiology of hypertension.

The most common cause of secondary hypertension at adolescents is renal disease.[15] Based on anamnesis and physical examination we still can not decide the etiology. Her laboratory examination towards renal function and urinalysis shows a normal level. This leads us to do more investigation about her hypertension.

Some imaging modalities could be done to visualize the renal and renal artery.[11] Both spiral computed tomography (CT) and magnetic resonance imaging (MRI) are being increasingly used to visualize the renal arteries. General agreement exists across the literature that renal angiography is the “gold-standard” for the diagnosis of renal artery stenosis. Similarly, nearly all authorities agree that individuals who have a very high absolute risk of renal artery stenosis or renovascular hypertension should proceed directly to renal angiography.[16]

In this case, imaging modalities help us to make a more definite etiology of secondary hypertension. The noninvasive modality was chosen first by the pediatrician in south Solok district Hospital, USG urology. The result impression was left kidney shrunk with vascularity of the left kidney seems minimal by examination using color doppler, suspected stenosis renalis. We performed CT-scan and showed suspected acute glomerulonephritis (right kidney), dd/ normal variant. Renal angiography was performed later as the gold standard diagnostic tool to confirm the diagnosis. In this case, we performed CT angiography and the result confirmed that the patient suffers bilateral renal artery stenosis.

Renovascular hypertension refers to hypertension induced by renal ischemia or by renal artery stenosis. The diagnosis of renovascular hypertension can be made only retrospectively, unlike the diagnosis of most other cardiovascular and nephrology conditions. Renal artery stenosis is a diagnosis based on anatomic criteria. Classically, renal artery stenosis was diagnosed when the patient had a greater than 75% narrowing of the diameter of a main renal artery or a more than 50% luminal narrowing with a post stenotic dilatation.[16,17]

Pathophysiology of hypertension in renal artery stenosis begins with an increase in plasma renin activity. This increase results in an immediate increase in blood pressure.[16] Subsequent elevation in plasma aldosterone results in an increase in salt and water retention, thereby potentiating the impact on

hypertension. If unilateral RAS occurs, the contralateral normal kidney may compensate for the salt and water effects; however, this compensatory mechanism will not occur in the case of bilateral RAS (BRAS).[18] This case-patient suffered BRAS. The mechanism behind BRAS or unilateral RAS with a solitary kidney is due to extracellular fluid overload secondary to decreased diuresis rather than a renin-mediated mechanism.[18]

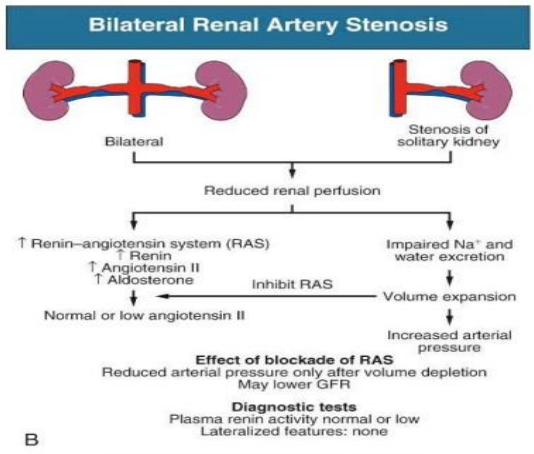

Figure 2. Bilateral renal artery stenosis[18]

In our case, we can conclude that a patient's hypertension was renovascular hypertension because the blood pressure was resistant hypertension. Our suspicion toward renovascular hypertension came because of the onset of hypertension at a young age. No other comorbidities such as diabetes, dyslipidemia, nor tobacco use, were found in our patient that could lead to hypertension and then renal artery stenosis. In this case, the patient is a young adolescent, with no traditional risk factors noticed. From this information, we can exclude atherosclerotic disease as the etiology of renal artery stenosis. According to the ACR criteria for Takayasu's arteritis, the patient only meets 2 of the 6 criteria which are: age at disease onset ≤ 40 years, and the arteriogram arteritis.[19] Another possible cause of renal artery stenosis in this patient is fibromuscular dysplasia (FMD). Fibromuscular dysplasia is more common in younger patients.

The literature reports limitations of renal Doppler ultrasound scanning in diagnosing RVH.[20] In the present case, it provides the diagnostic suspicion of left renal artery stenosis, although without identifying bilateral stenosis. Renal angiography is the most accurate method for assessment of suspected RVH and allows for treatment with renal angioplasty during the same procedure. Measurement of renal vein renin and aldosterone concentrations is also useful to diagnose RVH, especially when the stenosis is bilateral.[20] In this case, we cannot measure renal vein renin and aldosterone concentration.

Pharmacological therapy, ACE inhibitors, and ARB must be carefully used since they provoke efferent glomerular arteriole dilation, thus reducing filtration pressure. Whether the overall effect of ACE inhibitors and ARBs on GFR in renovascular hypertensive patients is beneficial or detrimental has been matter controversy.[16] In cases with bilateral stenosis, they can induce an important decline in GFR with subsequent acute renal failure. Yet, it was the most effective drug. Renal function should be assessed frequently when these drugs are used.[20]

Percutaneous transluminal renal angioplasty (PTRA may be the first-line intervention to treat childhood RVH, with a cure rate between 22% and 59% and improvement in 22–74%.[18] Before the introduction of PTRA with stent, surgical revascularization was the standard treatment of RVHA. Angioplasty results are also less satisfactory in children than in adults, probably due to the smaller diameter of the vessel and the higher response of the immature vasculature to growth factors. Thus, there is a higher risk of restenosis, as occurred in this case. Renal artery stenting in children is controversial and rarely used, since it is associated with non-negligible restenosis, and its long-term results are not completely understood in this age group.[21,22], In this case, the patient refuses to referred to Ciptomangunkusumo hospital, so the therapy given is only medication. Chung *et al* report that the percentage of atrophic kidney became higher in the medication group than in PTRA group.[23]

CONCLUSION

Secondary hypertension must be appropriately diagnosed and treated. Renal artery stenosis is one of the many causes of secondary hypertension.

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