

‘Popliteal aneurysm rupture in Bali Med Hospital, Indonesia: Case report and literature review

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Popliteal artery aneurysm (PAA) is a rare and difficult disease to learn. Popliteal artery is the most common site involved in peripheral aneurysms where the incidence is 80% of the peripheral aneurysm. Data regarding the PAA in Indonesia as well as a discussion of the PAA could not be found. A man aged 52 years old with a BMI of 24.22 came to the emergency room in a state of *compost mentis* complained of pain behind the knee on the right foot accompanied by swelling and redness pain is increasing when walking in the past three days ago. Edema extends proximally up to ½ to 2/3 distal medial thigh, touching warm, dorsalis pedis artery pulsation and popliteal arteries difficult to evaluate. Vein-artery ultrasound Doppler on right inferior extremity and found v. tibialis anterior-posterior and right dorsalis vein pedis give the impression of normal and lumen collapse when compressed. Examination D-Dimer shows the results of 4028 ng / mL (> 500ng / mL). Patients diagnosed with compartment syndrome accompanied popliteal hematoma with abscess and differential diagnosis of DVT. The incision hematoma, vascular urgent fasciotomy and exploration by opening the fascia was done, there were a visible and profuse bleeding, suspected to be derived from total rupture of the popliteal artery. After patient's conditions was stable Then a repair with open surgical repair in the form of femorotibial bypass surgery using vein graft performed. After the surgical procedure, patients experienced improvement in conditions.

Keywords: Popliteal artery aneurysm, peripheral aneurysms, femorotibial bypass surgery.

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INTRODUCTION

Popliteal artery aneurysm (PAA) is a rare and difficult disease to learn. This disease is 3.2% of the causes of acute ischemia of the lower extremities.¹ Popliteal artery is the most common site involved in peripheral aneurysms where the incidence is 80% of the peripheral aneurysm.² However PAA ruptured is rare cases where a recent study showed the incidence of cases of rupture of the PAA was only 2.2% in the first years.³

Data regarding the PAA in Indonesia as well as a discussion of the PAA could not be found. This case study aims to provide scientific evidence of the case of PAA in Indonesia, especially in Bali and demonstrate PAA's successful management using open surgical repair.

CASE PRESENTATION

A man aged 52 years old with a BMI of 24.22 came to the emergency room in a state of *compost mentis* (GCS 4-5-6) complained of pain behind the knee on the right foot accompanied by

swelling and redness pain is increasing when walking in the past three days ago. Patients admitted to feeling pain when walking for various distance. Based on the assessment scale using the Visual Analog Scale pain, patients admitted on the scale 6. Excavation history of disease found patients had a history of type 2 diabetes mellitus, fatty liver, acute hepatitis and hypertension. The results of physical examination found a warm touching the lesion, blood pressure 150/90, pulse 80 beats per minute regular, respiratory rate of 20 times per minute, and the body temperature of 38°C.

Patients suspected with DVT along with sepsis so the patient was referred to the Cardiovascular and Thoracic Surgery (CVTS) poly two days later. The results of the examination of the CVTS poly showed right popliteal fossa section swollen and cyanotic, palpable hard with non-well defined margin lesion and popliteal arterial pulsation that cannot be evaluated (**Figure 1**).

Edema extends proximally up to ½ to 2/3 distal medial thigh crus from the popliteal fossa to distal thigh, touching warm with the dorsalis pedis artery pulsation and popliteal arteries difficult to evaluate while still normal femoral arterial pulsation. Investigations carried out in the form of vein-artery ultrasound Doppler on right inferior extremity and found v. tibialis anterior-posterior



Figure 1. Edema in right popliteal fossa with cyanotic and hard palpable mass with no well-defined margin.

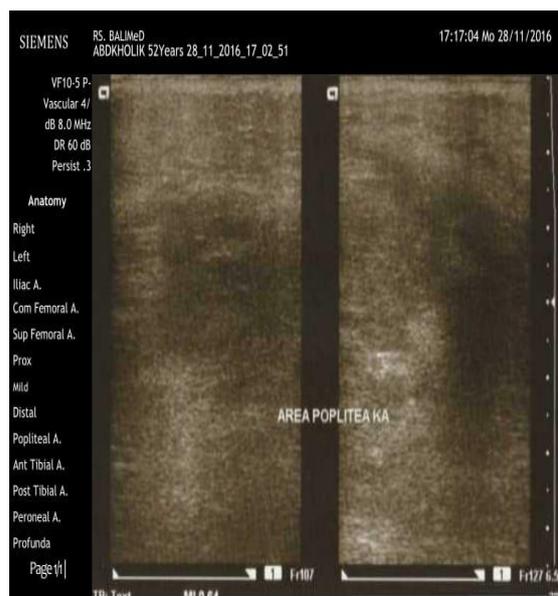


Figure 2. USG result of artery and vein on right popliteal artery area. It showed the edema area that causing the artery and find difficult to identified



Figure 3. Profuse bleeding with pus from a ruptured aneurysm from popliteal artery.



Figure 4. a part of aneurysm ruptured from popliteal artery showed as a thrombus and pus.

and right dorsalis vein pedis give the impression of normal and lumen collapse when compressed; a. femoralis, a. tibialis posterior-anterior, a. dorsalis pedis and a. poplitea dextra relatively well and was not found thickening, sclerotic and thrombus; appears edema in the right popliteal area vein-artery so that the outline is very difficult to identify (**Figure 2**).

We planned for further investigations with CT angiography but patients have elevated levels of serum creatinine (2.0mg / dL) and BUN (33.3 mg / dL) thereby granting the contrast is not indicated for these patients. Examination D-Dimer shows the results of 4028 ng / mL (> 500ng / mL) so that the diagnosis of DVT may be considered although ultrasound was not found DVT (**Table 1**).

Patients diagnosed with compartment syndrome accompanied popliteal hematoma with

abscess and differential diagnosis of DVT. Patients planned to do at the incision hematoma, vascular urgent fasciotomy and exploration in the same day. At the time of surgery performed with regional anesthesia and the prone position, the S-shaped incision is made in the popliteal area dextra then deepened to the fascia.

After opening the fascia there were a visible and profuse bleeding, suspected to be derived from total rupture of the popliteal artery. Hemorrhage mixed with pus from an abscess ruptures. Bleeding was stopped by clamping and pus evacuated. Gastrocnemius muscle appears bluish black color indicates muscle already necrosis. To stop the bleeding for lifesaving, popliteal artery ligation at the proximal end and distal and planned to repair within next week (**Figure 3** and **Figure 4**).

Table 1. Patient's Lab Results Summary

Laboratorium Test	Result	Intepretation	
CBC	WBC	30.6	High
	Hb	10.8	Low
	PLT	296	Normal
Coagulation Profile	PT	12.7 s	Normal
	APTT	32.2 s	Normal
	INR	1,01 s	Normal
	CT	10.0 minute	Normal
	BT	2.0 minute	Normal
Lipid Profile	Cholesterol LDL	249.0 mg/dL	High
	Cholesterol HDL	40.00 mg/dL	Low
	Cholesterol total	323.00 mg/dL	High
Glucose Profile	Random Blood Glucose	333 mg/dL	High
D-dimer	D-dimer	4028 ng/mL	High
	Albumin	2.1g/dL	Low
	Total Bilirubin	5.7 mg/dL	High
Blood Chemistry	Direct Bilirubin	5.4 mg/dL	High
	Indirect Bilirubin	0.30 mg/dL	High
	SGPT	57 u/L	High
	SGOT	93 U/L	High
	Serum Creatinine	2.0 mg/dL	High
Blood Gas Analysis	BUN	33.3 g/dL	High
	PH	7.53	High
	PCO2	32.40	Normal
	HCO3	27.00	High
	Blood K+	4.48 mmol/L	Normal
Electrolyte	Blood Cl-	92 mmol/L	Low
	Total Ca2+	10.1 mg/dL	High
	Mg2+	1.5 mg/dL	Low
	Na+	132 mmol/L	Low

The results of anatomic pathology analysis showed connective tissue and fat tissue necrosis and hemorrhage, containing dense infiltration of inflammatory cells lymphocytes, plasma cells, mikrofag and PMN. Found fibrin wide distribution of PMN and erythrocyte cell so it can be confirmed that preparations are part of the aneurysmal thrombus. Microbiology culture examination for pus showed negative results. Monitoring is done every day before the patients underwent ruptured aneurysm repair procedure, during the week the patient was complaining of tingling and pain at the site of the surgery, through a physical examination the dorsalis pedis artery pulsation was not palpable but not found finger cyanosis.

The next surgical procedure performed after patient's conditions stable. We've done a repair with open surgical repair in the form of femorotibial bypass surgery using vein graft. Patients were placed in the supine position and the effect of general anesthesia. Right great saphenous vein taken from saphenofemoral junction and ends above the knee. The patients were then transferred into a prone position for excursions popliteal artery performed through the posterior approach.

Proximal Anastomosis is made between a vein graft with a distal of right femoral artery while the distal anastomosis made between the vein graft with right tibial artery so it will bypass the popliteal artery that had ruptured before.

RESULT

After the surgical procedure, patients experienced improvement in conditions. Dorsalis pedis artery pulsation can be evaluated. Tissue perfusion also improved. Complaints tingling and pain of the patients improved. Sterile pus was found in the location of the lesion so that 5 days after the patient performs a debridement procedure to excised gastrocnemius tissue necrosis and cleans the pus. For the last treat, we've done wound debridement several times until secondary healing is achieved. After approximately 3-month treatment, the patient recovered with little limitation of motion in the knee joint due to the keloid tissue. Evidence of angiography ultrasound prove their good flow and adequate on the location of the lesion before. The patient's clinical condition is also much improved. Based on direct interviews of the patient, the patient stated that he has been

healthy and can move normally. Pain in the legs during activity had already disappeared.

DISCUSSION

Peripheral aneurysm largely resulted from the degeneration process that included up regulation of proteolytic pathways, inflammation and loss of the arterial wall matrix. The natural history of most of the aneurysm is the gradual expansion with an increased risk of rupture or, in some cases, especially popliteal aneurysms can occur thrombosis and embolisation on the distal.⁴ Some clinical conditions can affect the formation of aneurysms, such as changes in lipid and glucose metabolism, hypertension, anatomical disruption, infection and connective tissue disease.⁵ In this case, the patient had a history of type 2 diabetes, hypertension and dyslipidemia. A study shows that in the case of popliteal aneurysms, 98.5% of patients were male, 67.7% had a history of hypertension, 61.2% had a history of dyslipidemia and 19.5% had a history of diabetes mellitus. Hypertension is known as the second largest risk factor among the male gender in the pathogenesis of popliteal aneurysms. This is because hypertension can affect the growth of the aneurysm. High flow pressure accompanied by RAAS system activation can lead to the activation of blood vessel growth factors such as VEGF that can activate angiogenesis and initiate growth and development of aneurysms.⁵ Diabetes can affect the formation of aneurysms through its role in the inflammatory process where a decline in the synthesis and activity of matrix metalloproteinase (MMPs), which has implications in the pathogenesis of aneurysms.^{5,6} regulate MMP structural proteins and extracellular tissue remodeling and is also involved in mediating vascular smooth muscle cells migrate from the tunica media to the intima and the degradation of the extracellular matrix surrounding the cells. MMP transcribes protease that causes the loss of elastin in blood vessels, can cause blood vessels bulging and ruptured of the aneurysms that have been developed.⁵

Acute symptoms that are the most common in the case of popliteal aneurysm is intermittent claudication or even at rest (lower limb ischemia) caused by thrombosis of the aneurysm or distal embolization of thrombus intra-aneurysmal. While symptoms can be either chronic leg pain and swelling in the calf.⁷ A study conducted in 2010 showed that 48.5% of patients with popliteal artery aneurysms have a mass at the popliteal fossa with pulsatile, followed by 33.3% feel the edema and pain, 9.1 % of patients experienced bleeding.⁸ in this case, the patient shows symptoms of pain which is exacerbated when walking and edema in

the popliteal fossa. On physical examination, the patient was also found the mass in the popliteal fossa.

Rupture of popliteal aneurysms are very rare cases and occurs in about 1-5% of cases of popliteal aneurysms. A case study showed a rupture of popliteal aneurysms. 93% of patients gender to male with an average age of 57 years. A total of 63.9% of patients with hypercholesterolemia, hypertension 55.7%, and 11.5% of patients with type 2 diabetes. Diagnosis hypercholesterolemia statistically significant in affecting the role of symptoms, severity of ischemia, rupture of the aneurysm and the risk of limb amputation ($p = 0.02$). Additionally, hypercholesterolemia and age has a significant correlation to the formation of thrombus in the popliteal aneurysms ($p = 0.047$).⁹ In this case, the rupture of the aneurysm may be influenced by a history of dyslipidemia and age over 50 years in patients.

The diagnosis of arterial aneurysm rupture is quite difficult. In this case, the patient is difficult evaluated using ultrasound Doppler but patients in conditions that not possible to allow to do CT scan with contrast due to poor kidney function. Not done angiography for the same reasons. Based on previous literature, duplex ultrasound is most useful test that can be used to confirm the diagnosis of popliteal aneurysms or for exclude diagnosis. Ultrasound can predict accurately the size of the aneurysm, the presence of intraluminal thrombus, and assess the compression of the surrounding vein.⁷ Diagnosis of popliteal aneurysm is quite a challenging because of the appearance that often resembles the other diseases.^{7,8} This case study provides further evidence of the difficulty of determining diagnosis and management of PAA. Limitations of the tool supporting the diagnosis and non-specific clinical symptom of PAA led to the diagnosis becomes difficult. Clinical Symptom PAA shown in the case resembles other vascular diseases such as DVT because of their symptoms such as pain in the lesions, swollen, warm palpability and redness around the lesion with D dimer test results above 500 ng / ml. Based on previous literature, venous symptoms that appear in the PAA caused by extrinsic compression of the popliteal venous aneurysm in an artery due popliteal.²

Management of the ruptured artery aneurysm that is currently used is with endovascular repair and open surgery. In this case, we chose the treatment with open surgery due to endovascular repair was not possible. Based on previous studies and case reports, popliteal artery bypass surgery is one of the most often done in cases of ruptured aneurysms popliteal.^{10,11,12} the

most commonly used approach is based on a study of 717 surgical limbs is medial approach (87%) followed by posterior approach (8.4%) and miscellaneous approach (1.4%).¹⁰ Medial approach most commonly used for these strategies, surgeon can perform a vein graft retrieval and repair as well as well as provide access to the distal portion artery.^{11,12} but in this case, we were using a posterior approach because its more accessible and safe to install graft on an artery that has been ruptured. It is said that the advantages of the posterior approach are the location of the aneurysm can be exposed as a whole and short interposition graft with an end-to-end anastomosis can be performed.¹⁰ In addition, a posterior approach is also said to have long-term results are better due to the reduced risk of further expansion. Posterior approach also has a better 30-day patency ($p = 0.007$) and the lower risk of amputation in 1 year ($p = 0.012$) (Table 2).¹³ Most used short graft from the popliteal above the knee to a point proximal anastomosis and popliteal below the knee to distal anastomosis (76%), while the installation of the femoral artery graft as the proximal anastomosis point and as a distal point is tibia artery is 17.4%.¹⁰

Another management that possibly for popliteal aneurysm ruptures is endovascular repair. EPAR has the advantage in less invasiveness and less morbid. But, based on a study done before, it can be seen that although OPAR risk of

complications wound 5 times bigger than EPAR ($p < 0.001$) and length of stay in hospital is more than 2 times compared EPAR ($p < 0.01$), but OPAR has a lower risk the thrombotic complications ($p = 0.019$), more rarely to do reintervention ($p < 0.01$).¹⁴ management with EPAR tend conducted in patients who were older (> 80 years; $p = 0.01$) with a lower risk of complications compared OPAR (8% vs 17%; $p = 0.02$).¹⁵ EPAR is already widely used these days due to the development of technology and the benefits are less invasive clearly visible. Data showed 22.2% EPAR conducted in Europe with 12.2% in patients with acute thrombosis and 24.1% in the case of elektif.¹⁶ But long-term results of Opar EPAR proved more significant than the 5-year patency of 75% vs. 55% ($p = 0.014$).¹⁷ Based on demographic data, EPAR more frequently used in patients with a history of smoking ($p = 0.07$), older age ($p = 0.06$) and male gender ($p = 0.4$). However, if the patient has a history of CAD, systemic hypertension and symptomatic patients with symptoms of claudication, pain at rest, acute ischemia and aneurysm rupture then the choices tend to be more frequently used significantly is OPAR (Table 3).¹⁸ This makes the selection of the cases discussed Opar be appropriate given the age of patients 52 years old with a history of hypertension and aneurysm that has been ruptured.

Indication	All procedures	<i>p</i>
Surgical approach (N)	Medial 349	Post. 121
Prim. patency (N)	309/340	118/120
30 days (%)	90.9	98.3
Sec. patency (N)	325/341	120/121
30 days (%)	95.3	99.2
Amputations (N)	8/345	0/121
30 days (%)	2.3	0
Prim. patency (N)	247/296	89/101
1 year (%)	83.4	88.1
Sec. patency (N)	267/297	95/104
1 year (%)	89.9	91.3
Amputations (N)	17/308	0/109
1 year (%)	5.5	0

Post. = posterior approach.

Table 2. Posterior approach in overall popliteal aneurysm repair procedure. It shown that posterior approach is clinically better than medial approach and statistically better in the primary patency for 30 days and risk of amputation for 1 year.¹³

	Open group (178 cases)	Endo group (134 cases)	<i>p</i>
Male gender	13 (7.5%)	13 (9.5%)	0.4
Mean age	70 ± 8.9 yrs.	74.9 ± 7.9 yrs.	0.06
Smoker or past smoker	98 (55%)	94 (70%)	0.07
Coronary artery disease	61 (34%)	41 (30.5%)	0.3
Arterial hypertension	142 (80%)	93 (70%)	0.08
Hyperlipaemia	60 (33.5%)	46 (34%)	0.7
Diabetes	37 (20.5%)	28 (21%)	0.8
COPD	45 (25%)	31 (23%)	0.7
Asymptomatic PAA	63 (35.5%)	82 (71%)	<0.001
Symptomatic PAA	115 (64.5%)	52 (29%)	<0.001
Claudication	42	32	
Rest pain	32	9	
Acute ischaemia	41	10	
Rupture	—	1	
Run off score <2	67 (37.5%)	31 (23%)	0.007
Other aneurysms	42 (23.5%)	16 (13.5%)	<0.001
Aorto-iliac	35	5	
Renal	2	—	
Splenic	2	—	
Axillary	1	—	
Contralateral femoral	1	—	
Cerebral	1	—	

Table 3. OPAR tend to be used in patients with history of CAD ($p=0.3$), Systemic hypertension ($p=0.08$), and also a case with a pain while doing activity, rest, acute ischemic and rupture ($p<0.001$).¹⁸

A study conducted in 2012 to investigate the comparison of the results with the management of Opar and EPAR showed that primary patency rate at 2 years was 78.1% after management in Opar group and 59.4% in EPAR group ($p = 0.02$; 95% CI 2.7-7.3), freedom of reinterventions within 2 years was 79% for OPAR and 61.5% for EPAR ($p = 0.2$; 95% CI = 5.6-7.1) and secondary patency within 2 years was 81.6% for Opar and 78.4% for EPAR but these results did not statistically significant ($p = 0.9$). Reviewed EPAR group, there were 4 cases of thrombosis up to 1 case of stenting the proximal part of the endograft. Also, one case thrombosis occurred repeatedly in the group EPAR along a study.¹⁹ When a case of popliteal aneurysm ruptured is not handled properly, the most common complication are associated limb amputation and mortality. The rate of amputation within 30 days of untreated cases is 14.8%, while if handled was 3.7% ($p = 0.0098$) (Table 2).¹³

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