

Polycystic Kidney Disease Presenting as Subarachnoid Hemorrhage Due to Ruptured Cerebral Aneurysm

– An Autopsy Case –

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Autosomal dominant polycystic kidney disease (ADPKD) is a hereditary disorder characterized by multiple expanding cysts in both kidneys, and they ultimately destroy the renal parenchyma and cause renal failure. Intracranial aneurysms are found in approximately 10% to 15% of ADPKD patients. Subarachnoid hemorrhage (SAH) from a ruptured intracranial aneurysm is a frequent complication in patients with ADPKD and it makes up a considerable proportion of the causes of death in this group of patients. We report here an autopsy case of polycystic kidney disease that was morphologically identical to ADPKD, and the patients had presented after death with SAH due to a ruptured cerebral aneurysm.

Key Words : Polycystic kidney disease; Cerebral aneurysm; Subarachnoid hemorrhage

Autosomal dominant polycystic kidney disease (ADPKD) is one of the most common single gene hereditary disorders in humans.¹ It can present at any time during life, but it most frequently becomes symptomatic during the fourth and fifth decades with a gradual onset of renal failure. The kidneys become markedly enlarged and they develop a bosselated outer cortical surface, which is produced by multiple cysts of varying sizes. The manifestations of ADPKD are not limited to the kidneys. Cysts may also be found in the liver, pancreas, spleen and pineal glands. Other features include the presence of cerebral and coronary artery aneurysms, mitral valve prolapse, abnormal aortic valves, colonic diverticula, and skeletal malformations.² Subarachnoid hemorrhage (SAH) from a ruptured cerebral aneurysm is not common, but it is a serious complication in ADPKD patients. We report here an autopsy case of polycystic kidney disease that was morphologically identical to ADPKD, and the patients presented after death with SAH due to a ruptured cerebral aneurysm.

CASE REPORT

A 51-year-old-woman was discovered apneic and unresponsive in the living room of her home. She had taken a walk in the evening before her death. After the walk, she had watched the television in a living room. At the time of discovery, the television was turned on and she was laid out on the floor of the living room. She had no significant past medical history and no significant symptoms were reported by the family members. Any specific diseases were not detected in her family members.

She was approximately 162 cm tall and weighed 53 kg. She didn't have any evidence of acute traumatic injuries. The heart had a normal coronary vasculature system with no evidence of coronary atherosclerosis. Within the abdominal cavity, both kidneys were enlarged. The right and left kidney weighed about 700 g and 680 g, respectively. The external surface of both kidneys appears to be composed of numerous cysts up to 7.5 cm in diameter, and the renal parenchyma was completely replaced by

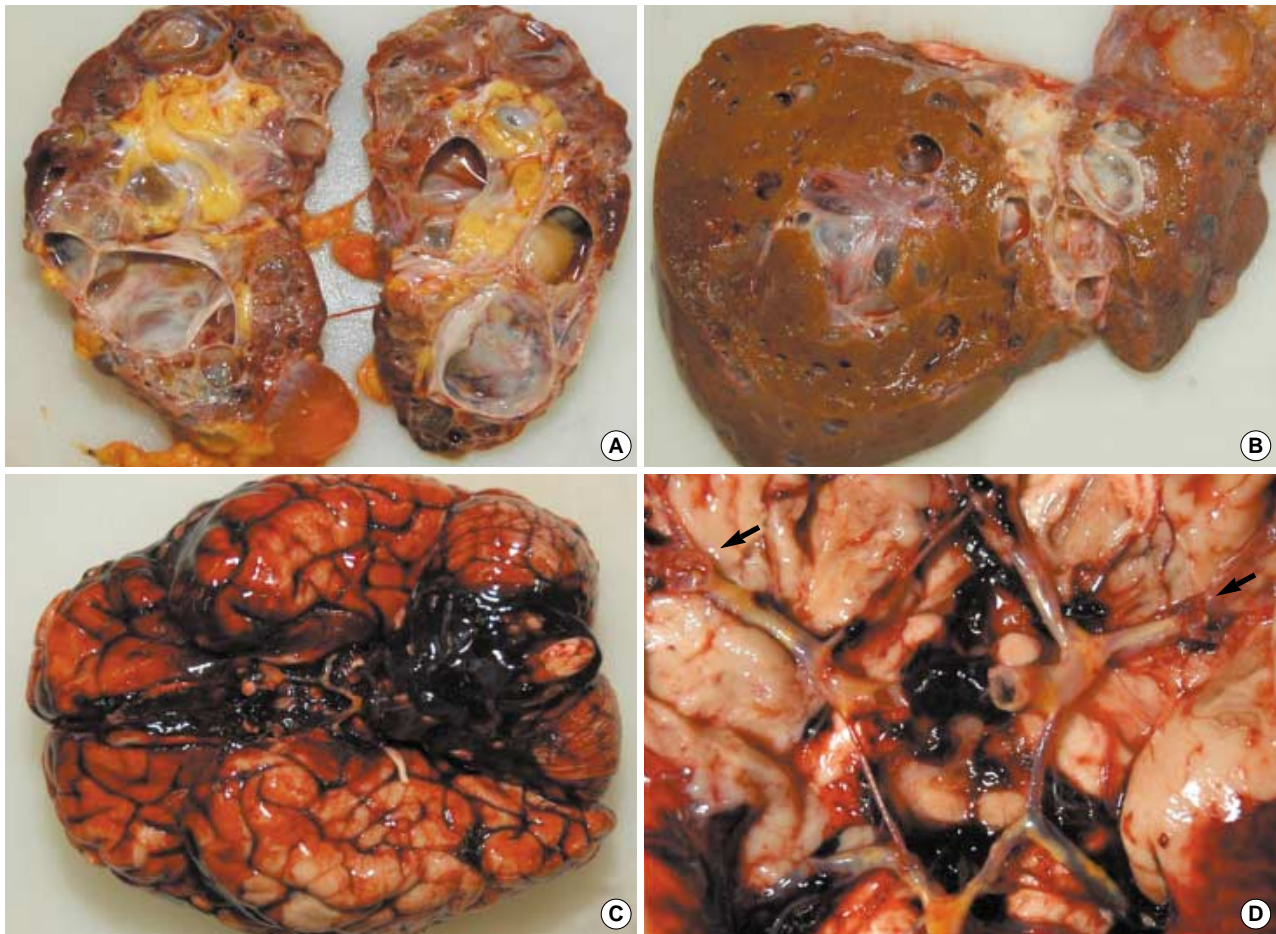


Fig. 1. (A) Both kidneys show various sized cysts containing serous fluid. (B) The sections of the liver has various sized cysts. (C) Subarachnoid hemorrhage is prominent on the base of the brain. (D) Two aneurysms are found (arrows). One is situated in right middle cerebral artery, and the other is in left middle cerebral artery.

multiple expanding cysts (Fig. 1A). There were various sized cysts and these cysts contained serous fluid. Microscopically, the lining cells of the cysts were flattened ductal epithelium, and normal renal structure was dispersed in the intervening parenchyma. The liver weighed 2,360 g and displayed various sized cysts (Fig. 1B). The lining cells of the cysts were cuboidal or flattened biliary epithelium. SAH was present over the cerebral hemisphere and this was particularly prominent on the base of brain (Fig. 1C). The lumen of the cerebral arteries was slightly narrowed by atherosclerotic change. Two berry aneurysms were found. One was 0.5 cm in diameter and located at the branching point of the right middle cerebral artery. The other was 0.7 cm and located at the branching point of the left middle cerebral artery. The aneurysm of the left middle cerebral artery was ruptured (Fig. 1D).

DISCUSSION

Both kidneys in this case were completely replaced by multiple expanding cysts. The size of the cysts was various and up to 7.5 cm. These renal features were morphologically identical to that of ADPKD patients. The renal cysts of ADPKD patients develop in all segments of the renal tubule and the glomerular capsule as saccular expansions. In the early stages, the fluid of the cysts is derived from glomerular filtrate, but as the cysts enlarge, they become disconnected from the tubule of origin; thereafter, they are exclusively filled with fluid by transepithelial secretion.³ Multiple liver cysts and intracranial berry aneurysms that were found in this case, are often manifested in ADPKD patients. Considering the overall morphologic features, we could exclude other renal cystic diseases. However, for the definite diagnosis of ADPKD, chromosomal assay would actually be needed.

ADPKD patients tend to have extrarenal congenital anoma-

lies.⁴ About 40% of ADPKD patients have one to several cysts in the liver (polycystic liver disease) that are usually asymptomatic, and these cysts are derived from biliary epithelium. Intracranial berry aneurysms are found in 10% to 15% of ADPKD patients.^{5,6} The incidence of intracranial aneurysm is higher in ADPKD patients because the incidence of intracranial aneurysm in the general population was reported as 3.6% to 6.0%.⁵ ADPKD has occasionally been primarily detected at autopsy field, and the cause of death were mainly subarachnoid hemorrhage due to ruptured cerebral aneurysm.

An aneurysm is an abnormal localized dilatation of any vessel. Because of certain histopathologic and hemodynamic factors, aneurysms commonly occur in arteries that supply blood to the brain. Intracranial aneurysm is a fairly common condition that is almost always asymptomatic until the time of rupture. However, rupture of an intracranial aneurysm is a catastrophic event, with the mortality approaching 50% and devastating morbidity affects 50% of the survivors.⁴ SAH was the first symptom in 58% of patients in one series.⁷ Therefore, SAH from a ruptured aneurysm is a dangerous problem for ADPKD patients and it makes up a considerable proportion of the causes of death.⁸

The intracranial aneurysms in ADPKD patients were reported to have a tendency to rupture at an earlier age than in the general population.^{8,9} Of the reported ruptured intracranial aneurysms in ADPKD patients, 64% to 80% occurred before the age of 50, whereas in patients without ADPKD, rupture of intracranial aneurysms occurred in only 40% to 45% before the age of 50.¹⁰ The ADPKD patients with SAH from a ruptured aneurysm do not show the female preponderance that's found in patients with SAH from ruptured aneurysm.^{8,9} The aneurysms in this case were located in the middle cerebral artery. The most frequent site of aneurysms in ADPKD patients is the middle cerebral artery,^{8,9} whereas in the general population the most frequent site of aneurysms is the internal carotid artery.⁶

Several reports indicated that for the general population, the risk of rupture of small asymptomatic aneurysm is very low.^{11,12} Most of the unruptured intracranial aneurysms discovered by screening of asymptomatic ADPKD patients are small.¹³ In one study, the follow-up results of ADPKD patients do not suggest an increased risk of growth and rupture, compared to those of intracranial aneurysms in the general population.¹⁴ Therefore, widespread screening for intracranial aneurysms is unlikely to be of benefit to ADPKD patients.

In conclusion, we report here a patient who had polycystic kidney disease that was morphologically identical to ADPKD, and presented after death, by postmortem examination, with

subarachnoid hemorrhage due to the ruptured cerebral aneurysm. Intracranial aneurysm is more frequently detected in ADPKD patients than in the general population, and these aneurysms also have a tendency to rupture at an earlier age.

REFERENCE

- Gabow PA. Autosomal dominant polycystic kidney disease. *N Engl J Med* 1993; 329: 332-42.
- Gabow PA. Autosomal dominant polycystic kidney disease--more than a renal disease. *Am J Kidney Dis* 1990; 16: 403-13.
- Grantham JJ. Polycystic kidney disease: hereditary and acquired. *Adv Intern Med* 1993; 38: 409-20.
- Perrone RD. Extrarenal manifestations of ADPKD. *Kidney Int* 1997; 51: 2022-36.
- Vega C, Kwoon JV, Lavine SD. Intracranial aneurysms: current evidence and clinical practice. *Am Fam Physician* 2002; 66: 601-8.
- Rinkel GJ, Djibuti M, Algra A, van Gijn J. Prevalence and risk of rupture of intracranial aneurysms: a systematic review. *Stroke* 1998; 29: 251-6.
- Yamaura A, Ono J, Hirai S. Clinical picture of intracranial non-traumatic dissecting aneurysm. *Neuropathology* 2000; 20: 85-90.
- Gieteling EW, Rinkel GJ. Characteristics of intracranial aneurysms and subarachnoid haemorrhage in patients with polycystic kidney disease. *J Neurol* 2003; 250: 418-23.
- Schievink WI, Torres VE, Piepgras DG, Wiebers DO. Saccular intracranial aneurysms in autosomal dominant polycystic kidney disease. *J Am Soc Nephrol* 1992; 3: 88-95.
- Chauveau D, Pirson Y, Verellen-Dumoulin C, Macnicol A, Gonzalo A, Grunfeld JP. Intracranial aneurysms in autosomal dominant polycystic kidney disease. *Kidney Int* 1994; 45: 1140-6.
- International Study of Unruptured Intracranial Aneurysms Investigators. Unruptured intracranial aneurysms--risk of rupture and risks of surgical intervention. *N Engl J Med* 1998; 339: 1725-33.
- Wiebers DO, Whisnant JP, Huston J 3rd, *et al.* Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. *Lancet* 2003; 362: 103-10.
- Huston J 3rd, Torres V, Sullivan PP, Offord KP, Wiebers DO. Value of magnetic resonance angiography for the detection of intracranial aneurysms in autosomal dominant polycystic kidney disease. *J Am Soc Nephrol* 1993; 3: 1871-7.
- Gibbs GF, Huston J 3rd, Qian Q, *et al.* Follow-up of intracranial aneurysms in autosomal-dominant polycystic kidney disease. *Kidney Int* 2004; 65: 1621-7.