

Comparison of Acquired Cystic Kidney Disease between Hemodialysis and Continuous Ambulatory Peritoneal Dialysis

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Objectives : ACKD has been described mainly in patients treated with hemodialysis (HD), and there are only a few reports about the prevalence of ACKD in continuous ambulatory peritoneal dialysis (CAPD) patients. Therefore, we compared the prevalence of ACKD in patients receiving HD and CAPD, and evaluated the possible factors which may affect the development of ACKD.

Methods : Forty nine HD and 49 CAPD patients who had received dialysis therapy for at least 12 months were enrolled in this cross-sectional study. Patients who had a past history of polycystic kidney disease and had acquired cystic kidney disease on predialysis sonographic exam were excluded. Detection of ACKD was made by ultrasonography and ACKD was defined as 3 or more cysts in each kidney.

Results : The prevalence of ACKD was about 31% (30/98) and there was no significant difference between HD and CAPD patients (27% vs. 34%, $P > 0.05$). The prevalence of ACKD was not associated with age, sex, primary renal disease, the levels of hemoglobin, BUN and serum creatinine. However, the duration of dialysis was significantly related to the development of ACKD (presence of ACKD, 74.4 ± 42.4 months vs. absence of ACKD, 37.824.1 months, $p < 0.05$).

Conclusion : The prevalence of ACKD is not different according to the mode of dialysis, and the major determinant of acquired cyst formation is duration of dialysis.

Key Words : Acquired cystic kidney disease, Continuous ambulatory peritoneal dialysis, Hemodialysis

INTRODUCTION

Acquired cystic kidney disease (ACKD) is characterized by the development of multiple cysts in the patients of chronic renal failure without a history of hereditary cystic renal disease. ACKD is for the most part clinically asymptomatic, but clinical concern about ACKD has increased because of its relation to renal

cancer.

In 1977, Dunnill et al.¹⁾ first described ACKD in patients on maintenance hemodialysis (HD). Since then there have been a number of reports on the association of ACKD with HD²⁻⁸⁾. However, there have been only a few reports about the prevalence of ACKD in patients receiving continuous ambulatory peritoneal dialysis (CAPD)⁹⁻¹¹⁾. We compared the prevalence of ACKD between HD and CAPD patients and evaluated the possible factors which might affect the development of ACKD.

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MATERIALS AND METHODS

Of a total 375 patients with end-stage renal disease receiving HD or CAPD at the Kangnam and the Uijeongbu St. Mary's Hospital, 98 patients (HD;49, CAPD; 49) were enrolled in this study. We included patients who were treated with only one dialysis modality for more than 12 months and those without polycystic kidney disease or other cysts on predialysis ultrasonographic examination. One radiologist and one urologist, who were not aware of *the* patients' information, performed renal ultrasonography and checked *the* presence, number and size of cysts and renal mass. To evaluate the possible factors that might affect the development of ACKD, we reviewed medical records and characterized the patients according to age, sex, duration of dialysis, erythropoietin use and primary renal disease. During the study period, all patients had venous blood taken for the levels of BUN, creatinine, hemoglobin and hematocrit. For HD patients, blood sampling was done just before dialysis treatment. We defined ACKD as 3 or more cysts in each kidney³⁾ and recorded *the* number of cysts from more affected kidneys. The results were expressed as mean standard deviation and analyzed with SPSS statistical program. Student's t-test and Mann-Whitney U-test were used for continuous variables between 2 groups and chi-square test for categorical variables. P value less than 0.05 was considered significant.

RESULTS

1. PATIENTS'S CHARACTERISTICS

The mean age of our patients was 50 years (range, 15-79) and 47 patients were men. The mean dialysis duration of these patients was 49.3 months (range, 12-186 months). Primary renal disease consisted of diabetes mellitus (n=32), chronic glomerulonephritis (n=30), hypertension(n=12), unknown(n=10) and others(n=14). The clinical and laboratory findings of patients are shown in Table 1. There were no significant differences in age, sex, underlying renal disease, dialysis duration and the levels of hemoglobin and hematocrit between the two groups. The levels of BUN and serum creatinine in CAPD patients were significantly lower than in HD patients.

2. PREVALENCE AND NUMBER OF CYSTS

The prevalence of ACKD was about 31%(30/98) and there was no significant difference between HD and CAPD patients (27% vs. 34%, P>0.05). The size of cysts was not different between the two groups, but the number of cysts in CAPD patients was higher than in HD patients (5.5 ± 2.7 vs. 3.5 ± 0.7 , P<0.05)(Table 2). The duration of dialysis in ACKD patients was not significantly different between the two groups (HD; 79.4 ± 36.4 vs. CAPD; 70.6 ± 40.1 months).

3. CLINICAL AND LABORATORY PARAMETERS BETWEEN PATIENTS WITH AND WITHOUT ACKD.

The presence or absence of ACKD is tabulated, based on the clinical and laboratory parameters (Table 3). The mean age, sex, underlying renal disease, erythropoietin use, and laboratory findings were not different between the two groups. However, duration of dialysis was significantly longer in the patients with ACKD than in those without ACKD. When the patients were divided into 2 groups according to the duration of dialysis, the prevalence of ACKD was 14% in the group of 3 years' dialysis and 45% in the group of more than 3 years' dialysis (P<0.05)(Table 4).

DISCUSSION

Our study demonstrates that prevalence of ACKD is not different between CAPD and HD patients. In general, CAPD is commonly supposed to be at less risk of developing ACKD than HD^{12,13)}. But recent studies have found the incidence is nearly equal between the two modes of dialysis^{10,11,14)}. Our study clearly shows that dialysis mode dose not affect the occurrence of ACKD.

ACKD is more commonly observed in patients on dialysis for longer periods¹⁴⁻¹⁶⁾. Matson et al¹⁴⁾ have shown that, after 1 to 3 years of dialysis, the prevalence of ACKD is 10% to 20%, rising thereafter to reach 40% to 60% at 3 to 5 years of dialysis, and more than 90% after 5 to 10 years of dialysis. In our result, prevalence of ACKD was 14%(6 of 44 patients) in patients on dialysis for less than 3 years and 45%(24 of 55 patients) for more than 3 years. In addition, the mean dialysis duration of the patients with ACKD was significantly longer than that of the patients without ACKD (74.4 vs.

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Table 1. Comparison of clinical and laboratory characteristics between HD and CAPD patients.

	HD(n=49)	CAPD(n=49)
Age (years)	52 ± 14	49 ± 12
Male(%)	23(47%)	24(50%)
PRD		
CGN	17	13
DM	15	17
Others	17	19
Dialysis duration(months)	47.3 ± 36.7	51.2 ± 33.8
EPO treatment	26(53%)	21(43%)
Hb(g/dl)	8.8 ± 1.4	8.9 ± 1.3
Hct(%)	25.5 ± 4.4	26.5 ± 4.1
BUN(mg/dl)	84.9 ± 24.3	53.6 ± 15.1*
Scr(mg/dl)	11.7 ± 3.6	9.8 ± 1.7*

*p < 0.05 (Student's T-test)

PRD: primary renal disease, CGN: chronic glomerulonephritis, DM: diabetes mellitus, EPO: erythropoietin, Hb: hemoglobin, Hct: hematocrit, BUN: blood urea nitrogen, Scr: serum creatinine Table

Table 2. Comparison of prevalence and cyst characteristics of acquired cystic kidney disease between HD and CAPD patients.

	HD	CAPD
Prevalence(%)	13/49 (27%)	17/49 (34%)
Number of cysts	3.5 ± 0.7	5.5 ± 2.7*
Size of cysts(cm)	1.5 ± 0.6	2.0 ± 1.7

*p < 0.05 (Mann-Whitney U-test)

Table 3. Comparison of clinical and biochemical parameters between patients with and without acquired cystic kidney disease

	With ACKD (n=30)	Without ACKD (n=68)
Age (years)	52 ± 11	50 ± 14
Male(%)	16(53%)	31(46%)
PRD		
CGN	10(33%)	20(29%)
DM	9(30%)	23(34%)
Others	11(37%)	25(37%)
Dialysis Duration (months)	74.4 ± 42.4	37.8 ± 24.1*
EPO treatment	11(37%)	36(52%)
Hb(g/dl)	9.0 ± 1.3	8.8 ± 1.4
BUN(mg/dl)	68.5 ± 25.1	69.6 ± 25.9
Scr(mg/dl)	11.5 ± 3.6	10.4 ± 3.1

*P < 0.05 (Student's T-test)

PRD; primary renal disease, EPO; erythropoietin, BUN; blood urea nitrogen, Scr; serum creatinine

Table 4. Prevalence of acquired cystic kidney disease according to the duration of dialysis

	3 years	> 3 years
Total number	44	54
Pt. With ACKD	6(14%)	24(45%)*

* P < 0.05 (Fisher's exact test)

37.8 months). Our finding was consistent with previous reports¹⁴⁻¹⁸) that the major determinant of acquired cyst formation is duration of dialysis.

There has been a controversy over the relationship between erythrocytosis and ACKD. Some authors reported that there is a significant positive correlation between occurrence of ACKD and improvement of anemia, and this relation is associated with an increase of erythropoietin levels^{3,19)} or cyst size⁴⁾. On the other hand, others reported that there was no correlation between level of hemoglobin and presence of ACKD^{5,6,20)}. In our study, there were no significant differences in the level of hemoglobin, hematocrit and erythropoietin use between patients with and without ACKD. Even when we excluded patients who had received erythropoietin treatment, we could not find any relation between hemoglobin levels and ACKD. (Data were not shown)

Although the level of BUN was higher in HD patients than in CAPD patients, there was no difference between patients with ACKD and those without ACKD. This finding suggests that ACKD is not related to the degree of uremia.

In the majority of patients with ACKD, clinical features are asymptomatic and incidentally detected by ultrasound, CT scanning or at autopsy^{16,18)}. Apart from bleeding, the most significant complication of ACKD is the development of renal tumors. It is clear that the incidence of renal cancer is significantly increased in ACKD patients^{7,16,18)}. Truong et al.²¹⁾, through a comprehensive review of the literature, represented that there is up to a 50-fold increased risk of renal cell carcinoma in ACKD compared to the general population. We already have experienced 2 cases of renal cell carcinoma associated with ACKD in our dialyzed patients. Both patients were men who had been treated exclusively with CAPD for more than 2 years. The presenting symptom of one patient was frank pain with perirenal hematoma, and the other was weight loss²²⁾. Therefore, it seems to be very important to detect ACKD before it develops into renal cell cancer, considering the asymptomatic clinical features of ACKD.

It is generally agreed that there is a need for regular screening of symptomatic ACKD patients for early detection of renal cell carcinoma. However, whether screening is needed for asymptomatic patients remains controversial because of the lack of data about the effect of screening on the outcome of patients^{21,23)}.

Nevertheless, many investigators recommend that patients should undergo annual screening after the third year of dialysis because the incidence of ACKD increases significantly after 3 years of dialysis^{5,16,17)}. Recently, Sarasin et al.²⁴⁾ reported that screening for ACKD offers dialyzed patients as much as a 1.6 year gain in life expectancy. They used strategies of performing either computed tomography or ultrasound every three years in all dialysis patients, and annually in patients who were found to have cysts.

Sonography or CT scanning is useful as initial screening tools. In general, CT scanning is preferable to sonography. The reasons are that the small kidneys of end stage renal disease and cysts less than 1 cm are often difficult to image by sonography, and CT scanning is probably more sensitive than sonography for detecting solid tumor^{9,18,25)}. However, our preference is sonography as a screening procedure because of its easy availability and economic reason.

In summary, an ultrasound study in our patients with ESRD revealed a similar prevalence of ACKD, irrespective of the mode of dialysis, i.e., HD or CAPD. We also found that the duration of dialysis is significantly related to its development as shown by other studies. On the basis of our experience and previous literature, we recommend periodic screening of ACKD and renal tumor by ultrasonography in patients on dialysis.

REFERENCES

1. Dunnill MS, Millard PR, Oliver D. Acquired cystic disease of the kidneys. A hazard of long-term intermittent maintenance hemodialysis. *J Clin Pathol* 1977; 30: 868-77.
2. Heinz-Peer G, Schoder M, Rand T, Mayer G, Møstbeck GH. Prevalence of acquired cystic kidney disease and tumors in native kidneys of renal transplant recipients: a prospective US study. *Radiology* 1995; 195: 67-71.
3. Ono K, Kikawa K, Okamoto T, Matsuo H. Normalization of hematocrit in regular hemodialysis patients: The role of renal cyst formation. *Trans Am Soc Artif Organs* 1985; 31: 639-43.
4. Goldsmith HJ, Ahmand R, Raikhura N, Lal SM, McConnell CA, Gould DA, Gyde OH, Green J. Association between rising hemoglobin concentration and renal cyst formation in patients on long term regular hemodialysis treatment. *Proc Eur Dial Transplant Assoc* 1983; 19: 313-8.
5. Lie B, Hust W, Asgarzadeh A, Mann H. Acquired renal

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- cysts in maintenance dialysis patients. *Urologe* 1986; 25(2): 109-12.
6. Ikeda R, Suzuki K, Tsugawa R. Renal cell carcinoma and acquired cystic disease of the kidneys in patients on long-term hemodialysis. *Hinyokika Kyo* 1995; 41(9): 709-17.
 7. Gardner KD, Evan AP. Cystic kidneys an enigma evolves. *Am J Kidney Dis* 1984; 3:403-13.
 8. Feiner HD, Katz LA, Gallo GR. Acquired cystic disease of kidney in chronic dialysis patients. *Urology* 1981; 17: 260-264
 9. Smith JW, Sallman AL, Williamson MR, Lott CG. Acquired renal cystic disease: Two cases of associated adenocarcinoma and a renal ultrasound survey of a peritoneal dialysis population. *Am J Kidney Dis* 1987; 10(1): 41-6.
 10. Shigawa I. Acquired renal cystic disease and its complications in continuous ambulatory peritoneal dialysis patients. *Perit Dial Int* 1992; 12(3): 292-7.
 11. Jabour BA, Ralls PW, Tang WW, Boswell WD Jr, Colleti PM, Feinstein EI, Massry SG. Acquired cystic disease of the kidneys : computed tomography and ultrasonography appraisal in patients on peritoneal and hemodialysis. *Invest Radiol* 1987; 22(9): 728-32.
 12. Trabucco AF, Bozek SA, Johannson SL. Acquired renal cystic disease and neoplasia in patients on chronic peritoneal dialysis. *J Urol* 1987; 137: 223A.
 13. Beardsworth SF, Goldsmith HJ, Ahmad R, Lamb G. Acquisition of renal cysts during peritoneal dialysis. *Lancet* 1984; 2: 8417-8, 1482.
 14. Matson MA, Cohen EP. Acquired cystic kidney disease: Occurrence, Prevalence and renal cancers. *Medicine* 1990; 69(4): 217-26.
 15. Katz A, Sombolos K, Oreopoulos DG. Acquired cystic disease of the kidney in association with chronic ambulatory peritoneal dialysis. *Am J Kidney Dis* 1984; 3: 403-13.
 16. Brennan JF, Stilmant MM, Babayan RK, Siroky MB. Acquired renal cystic disease: Implications for the urologist. *Br J Urol* 1991; 67: 342-8.
 17. Bretan PN, Busch MP, Hricak H, Williams RD. Chronic renal failure: A significant risk factor in the development of acquired renal cysts and renal cell carcinoma: Case reports and review of the literature. *Cancer* 1986; 57: 1871-9.
 18. Levin E. Acquired cystic kidney disease. *Radiologic Clinics of North America* 1996; 34(5): 947-64.
 19. Bezerra HM, Maia GP, Bezerra Neto FA, Serra M, de Almeida JB. Severity of acquired cystic kidney disease determines improvement in chronic kidney failure anemia. *Rev Assoc Med Bras* 1997; 43(1): 4-8.
 20. Thomson BJ, Jenkins DA, Allan PL, Elton RA, Winney RJ. Acquired cystic disease of the kidney in patients with end-stage chronic renal failure: a study of prevalence and aetiology. *Nephrol Dial Transplant* 1986; 1(1): 38-43.
 21. Truong LD, Krishnan B, Cao JT, Barrios R, Suki WN. Renal neoplasm in acquired cystic kidney disease. *Am J Kidney Dis* 1995; 26: 1-12.
 22. Park YH, Chang KS, Kim JC, Yoon JH, Hwang TK. Three cases of renal cell carcinomas in dialyzed patients. *Korean J Urol* 1998; 39(3): 278-82.
 23. Mindell HJ. Imaging studies for screening native kidneys in long-term dialysis patients. *AJR Am J Roentgenol* 1989; 153: 768-9.
 24. Sarasin FP, Wong JB, Levey AS, Meyer KB. Screening for acquired cystic kidney disease: a decision analytic perspective. *Kidney Int* 1995; 48(1): 207-19.
 25. Taylor AJ, Cohen EP, Erickson SJ, Olson DL, Foley WD. Renal imaging in long-term dialysis patients: A comparison of CT and sonography. *AJR Am J Roentgenol* 1989; 153: 765-7.