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RESEARCH ARTICLE

Top 100 Cited Articles on Peritoneal Dialysis: A Bibliometric Analysis

Yoo Jin Lee[1], Bong Soo Park[1], Jin Han Park[1], Kang Min Park[2], Il Hwan Kim[1], Junghae Ko[1], Sihyung Park[1] and Yang Wook Kim[1,*]

[1]*Department of Internal Medicine, Inje University Haeundae Paik Hospital, Busan, South Korea*
[2]*Department of Neurology, Inje University Haeundae Paik Hospital, Busan, South Korea*

Abstract:

Background:

The purpose of this study is to broaden the understanding of peritoneal dialysis by presenting the most-cited articles pertaining to this subject.

Methods:

We searched articles on the Web of Science and selected 100 articles according to the frequency of citations. Next, we reviewed the contents of the articles and identified the characteristics of these articles.

Results:

There are 21 journals in which the top-100 cited articles were published. The names of the journals, in the order in which the articles are cited, are as follows: Kidney International (25 articles), Nephrology Dialysis Transplantation (13 articles), and Journal of the American Society of Nephrology (12 articles). The top 100-cited articles were published in 15 countries. The country with the greatest number of publications was the United States of America (19 articles). The institution with the greatest number of articles (7 articles) was the University Health Network of Toronto. The author who wrote the most number of articles (5 articles) was Davies SJ.

Conclusion:

This study is the first in the field of nephrology to provide a list of the top-100 cited articles dedicated to peritoneal dialysis. Through this study, the research trends and major academic interests pertaining to peritoneal dialysis would be identified.

Keywords: Publications, Peritoneal dialysis, Analysis, End-stage renal growth (ESRD), Science Citation Index (SCI), Citation analysis.

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1. INTRODUCTION

End-stage renal growth (ESRD) is a condition in which the renal function is terminated, and dialysis is required. Since the prescription of dialysis to patients with chronic kidney disease is subjective, ESRD is defined as an advanced stage of chronic kidney disease with a glomerular filtration rate of less than 15 mL/min/1.73 m2 or as symptomatic uremia that requires dialysis [1]. ESRD is recognized as a major global health problem. The prevalence of ESRD is increasing, both globally and in Korea [2, 3]. Patients with ESRD may often suffer from various complications due to multi-organ dysfunction. In ESRD, two forms of renal replacement therapy may be used: peritoneal dialysis (PD) and hemodialysis (HD). As PD and HD, both have advantages and disadvantages over the other, the selection of the appropriate modality can be determined by the patient's preference, age, or other co-morbidities. Due to the technological innovation of peritoneal dialysis, treatment-related complications have been reduced. This has resulted in the increased use of PD as the long-term treatment of ESRD [4].

The Science Citation Index (SCI) was used to select journals with high academic contributions. The SCI was introduced in 1964 by the Institute for Scientific Information (ISI). It was also necessary for building indexes and collecting citation information for database screening of scientific journals. The SCI has become one of the most frequently and widely used databases for evaluating research performances and retrieving literature. In the field of science, as the number

* Address correspondence to this author at Department of Internal Medicine, Inje University Haeundae Paik Hospital, 875 Haeun-daero, Haeundaegu, Busan 48108, South Korea; Tel: +82-51-797-3320, Fax: +82-51-797-3282, E-mail: kyw8625@chol.com

of articles increased, there was a corresponding increase in the limitation of providing these articles in the form of books and compact discs. This led to the development of a larger Web version known as the Science Citation Index Expanded in the Web of Science. The number of citations reflects the interest of the academic community. Reviewing frequently-cited articles can provide information on key areas and the areas of substantial growth in the specific field.

As the high number of citations is an indicator of high impact in the academic community, most-cited articles are especially important. The most-cited articles provide interesting insights on how topics, authors, and articles affect the field of study over time. Several studies have previously conducted analyses on highly-cited papers in various fields. These fields include anesthesiology, general surgery, plastic surgery, orthopedic surgery, dermatology, emergency medicine, obstetrics and gynecology, headache disorders, and critical-care medicine [5 - 13]. However, no previous study has analyzed the top-100 cited articles on PD.

The purpose of this study is to broaden the understanding of peritoneal dialysis by presenting the most-cited articles pertaining to it.

2. MATERIALS AND METHODS

We performed a citation analysis of PD. The study was conducted in the following manner.

First, we searched for articles only related to peritoneal dialysis by excluding those that involved HD. We searched on the Web of Science (https://apps.webofknowledge.com) by limiting the document type to journal articles and reviews. The publication time was set from 1969 to 2019, a total of 50 years. Articles that fit these criteria were sorted based on the citation count.

Second, we selected 100 articles related to PD according to citation frequency. Then, we reviewed the contents of each article and organized these according to the number of citations, article title, publishing journal, topic categories, year of publication, and authorship. The topic categories were subtyped as mortality and survival, peritoneal membrane characteristics, presence of peritonitis, epidemiology, and pathophysiology. When there was more than one author, the first author was used as the criterion. Recommendations were excluded. No statistical technique was used. The data were presented using descriptive statistics.

3. RESULTS

A total of 10,803 PD-related articles were reviewed. We selected 100 articles and ranked them from the highest to the lowest number of citations (Table **1**). The most-cited article was cited 565 times. The top 20 articles were cited over 230 times.

Table 1. The top 100 cited articles about peritoneal dialysis.

Rank	Journal	Title	Number of citation
1	Journal of the American Society of Nephrology	Relative contribution of residual renal function and peritoneal clearance to adequacy of dialysis: A reanalysis of the CANUSA study	600
2	New England Journal of Medicine	Peritoneal dialysis and epithelial-to-mesenchymal transition of mesothelial cells	518
3	Annals of Internal Medicine	Continuous ambulatory peritoneal-dialysis	503
4	Journal of the American Society of Nephrology	Increased peritoneal membrane transport is associated with decreased patient and technique survival for continuous peritoneal dialysis patients	436
5	Annals of Internal Medicine	Peritonitis during continuous ambulatory peritoneal-dialysis	348
6	Nephrology Dialysis Transplantation	Longitudinal changes in peritoneal kinetics: The effects of peritoneal dialysis and peritonitis	308
7	Journal of the American Society of Nephrology	Cardiac valve calcification as an important predictor for all-cause mortality and cardiovascular mortality in long-term peritoneal dialysis patients: A prospective study	304
8	Kidney International	Effect of fluid and sodium removal on mortality in peritoneal dialysis patients	304
9	Peritoneal Dialysis International	Pathogenesis of peritoneal fibrosing syndromes (sclerosing peritonitis) in peritoneal-dialysis	300
10	Kidney International	The Euro-Balance Trial: The effect of a new biocompatible peritoneal dialysis fluid (balance) on the peritoneal membrane	296
11	Journal of the American Society of Nephrology	Peritoneal glucose exposure and changes in membrane solute transport with time on peritoneal dialysis	291
12	Journal of the American Society of Nephrology	Global trends in rates of peritoneal dialysis	260
13	New England Journal of Medicine	Staphylococcus-aureus nasal carriage and infection in patients on continuous ambulatory peritoneal-dialysis	260
14	Peritoneal Dialysis International	Vascular and interstitial changes in the peritoneum of CAPD patients with peritoneal sclerosis	259
15	Kidney International	A randomized multicenter clinical-trial comparing isosmolar icodestrin with hyperosmolar glucose solutions in CAPD	254
16	Kidney International	Protein losses during peritoneal-dialysis	252
17	Nephrology Dialysis Transplantation	Associations of serum fetuin-A with malnutrition, inflammation, atherosclerosis and valvular calcification syndrome and outcome in peritoneal dialysis patients	247
18	Nephrology Dialysis Transplantation	Sclerosing peritonitis: the experience in Australia	246

(Table 1) contd.....

Rank	Journal	Title	Number of citation
19	Transactions American Society for Artificial Internal Organs	Simple and safe technique for continuous ambulatory peritoneal-dialysis (CAPD)	241
20	American Journal of Kidney Diseases	The relative importance of residual renal function compared with peritoneal clearance for patient survival and quality of life: An analysis of the Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD)-2	231
21	Infection and Immunity	Effects of the composition of peritoneal-dialysis fluid on chemi-luminescence, phagocytosis and bactericidal activity in vitro	229
22	Archives of Internal Medicine	Sclerotic thickening of the peritoneal membrane in maintenance peritoneal-dialysis patients	228
23	American Journal of Kidney Diseases	Encapsulating peritoneal sclerosis in Japan: A prospective, controlled, multicenter study	222
24	American Journal of Kidney Diseases	Functional longevity of the human peritoneum – How long is continuous peritoneum dialysis possible – Results of a prospective medium long term study	211
25	Kidney International	Metabolic balance studies and dietary-protein requirements in patients undergoing continuous ambulatory peritoneal-dialysis	209
26	Peritoneal Dialysis International	Peritoneal catheters and exit-site practices toward optimum peritoneal access: 1998 update (Official report from the international society for peritoneal dialysis)	201
27	Annals of Internal Medicine	Effects of an angiotensin-converting renal function in patients receiving enzyme inhibitor on residual peritoneal dialysis - A randomized, controlled study	200
28	Kidney International	Long-term clinical effects of a peritoneal dialysis fluid with less glucose degradation products	199
29	Journal of the American Society of Nephrology	Inflammation, residual kidney function, and cardiac hypertrophy are interrelated and combine adversely to enhance mortality and cardiovascular death risk of peritoneal dialysis patients	197
30	Peritoneal Dialysis International	ISPD position statement on reducing the risks of peritoneal dialysis-related infections	187
31	Journal of the American Society of Nephrology	Meta-analysis: Peritoneal membrane transport, mortality, and technique failure in peritoneal dialysis	187
32	Kidney International	Glucose-absorption during continuous ambulatory peritoneal-dialysis	185
33	Nephrology Dialysis Transplantation	Peritoneal solute transport predicts survival on CAPD independently of residual renal function	181
34	Nephron	Morphological changes in the peritoneal vasculature of patients on CAPD with ultrafiltration failure	180
35	Journal of the American Society of Nephrology	Vascular proliferation and enhanced expression of endothelial nitric oxide synthase in human peritoneum exposed to long-term peritoneal dialysis	171
36	Journal of the American Society of Nephrology	Randomized, double-blind trial of antibiotic exit site cream for prevention of exit site infection in peritoneal dialysis patients	165
37	American Journal of Kidney Diseases	Sclerosing encapsulating peritonitis in patients undergoing continuous ambulatory peritoneal dialysis: A report of the Japanese Sclerosing Encapsulating Peritonitis Study Group	163
38	Kidney International	Albumin homeostasis in patients undergoing continuous ambulatory peritoneal-dialysis	163
39	American Journal of Kidney Diseases	Strict volume control normalizes hypertension in peritoneal dialysis patients	162
40	Journal of the American Society of Nephrology	Measurement of residual renal function in patients treated with continuous ambulatory peritoneal dialysis	161
41	Journal of Laboratory and Clinical Medicine	Growth factors VEGF and TGF-beta 1 in peritoneal dialysis	160
42	Kidney International	A longitudinal, 5 year survey of urea kinetic-parameters in CAPD patients	160
43	Lancet	Prospective controlled trial of a y-connector and disinfectant to prevent peritonitis in continuous ambulatory peritoneal-dialysis	160
44	Nephron	Morphology of the peritoneal membrane during continuous ambulatory peritoneal-dialysis	159
45	American Journal of Kidney Diseases	Peritoneoscopic versus surgical placement of peritoneal dialysis catheters: A prospective randomized study on outcome	156
46	Kidney International	Mortality and technique failure in patients starting chronic peritoneal dialysis: Results of the Netherlands cooperative study on the adequacy of dialysis	154
47	Peritoneal Dialysis International	Heat sterilization of fluids for peritoneal-dialysis gives rise to aldehydes	154
48	American Journal of Kidney Diseases	Mesenchymal conversion of mesothelial cells as a mechanism responsible for high solute transport rate in peritoneal dialysis: Role of vascular endothelial growth factor	151
49	Kidney International	Longitudinal relationship between solute transport and ultrafiltration capacity in peritoneal dialysis patients	149
50	Nephrology Dialysis Transplantation	Plasma and dialysate IL-6 and VEGF concentrations are associated with high peritoneal solute transport rate	149
51	Journal of Clinical Endocrinology & Metabolism	Circulating Fibroblast Growth Factor 23 in Patients with End-Stage Renal Disease Treated by Peritoneal Dialysis Is Intact and Biologically Active	147

(Table 1) contd.....

Rank	Journal	Title	Number of citation
52	New England Journal of Medicine	Continuous ambulatory peritoneal-dialysis in diabetics with end-stage renal-disease	147
53	American Journal of Kidney Diseases	Analysis of microbiological trends in peritoneal dialysis-related peritonitis from 1991 to 1998	146
54	Kidney International	Long-term exposure to new peritoneal dialysis solutions: Effects on the peritoneal membrane	144
55	Lancet	Pharmacokinetics of recombinant human erythropoietin in patients on continuous ambulatory peritoneal-dialysis	144
56	Plos One	Fluid Status in Peritoneal Dialysis Patients: The European Body Composition Monitoring (EuroBCM) Study Cohort	141
57	Kidney International	Outcomes of single organism peritonitis in peritoneal dialysis: Gram negatives versus gram positives in the Network 9 Peritonitis Study	141
58	Nephron	Permanent loss of ultrafiltration capacity of the peritoneum in long-term peritoneal-dialysis – an epidemiological study	140
59	Kidney International	Role of an improvement in acid-base status and nutrition in CAPD patients	139
60	American Journal of Kidney Diseases	Risk factors for peritonitis in long-term peritoneal dialysis: The network 9 peritonitis and catheter survival studies	139
61	Kidney International	A quantitative description of solute and fluid transport during peritoneal-dialysis	136
62	Lancet	Peritonitis in continuous ambulatory peritoneal-dialysis – laboratory and clinical studies	136
63	Nephrology Dialysis Transplantation	Aqueous solute concentrations and evaluation of mass-transport coefficients in peritoneal-dialysis	134
64	Kidney International	High volume, low-frequency continuous ambulatory peritoneal-dialysis	134
65	Journal of the American Society of Nephrology	Higher peritoneal transport status is associated with higher mortality and technique failure in the Australian and New Zealand peritoneal dialysis patient populations	133
66	Nephrology Dialysis Transplantation	Association between inflammation and changes in residual renal function and peritoneal transport rate during the first year of dialysis	133
67	Nephrology Dialysis Transplantation	Long-term blood pressure control in a cohort of peritoneal dialysis patients and its association with residual renal function	133
68	Kidney International	Bicarbonate/lactate-based peritoneal dialysis solution increases cancer antigen 125 and decreases hyaluronic acid levels	133
69	Kidney International	Peritoneal transport characteristics with glucose polymer based dialysate	132
70	Journal of Clinical Microbiology	Examination of the morphology of bacteria adhering to peritoneal-dialysis catheters by scanning and transmission electron-microscopy	132
71	Kidney International	Toxicity of peritoneal-dialysis fluids on cultured fibroblasts, L-929	131
72	Journal of Infectious Diseases	Peritonitis due to a mycobacterium-chelonei-like organism associated with intermittent chronic peritoneal-dialysis	130
73	Kidney International	Longitudinal membrane function in functionally anuric patients treated with APD: Data from EAPOS on the effects of glucose and icodextrin prescription	127
74	Kidney International	Glucose degradation products in PD fluids: Do they disappear from the peritoneal cavity and enter the systemic circulation?	127
75	Peritoneal Dialysis International	Decrease in Staphylococcus aureus exit-site infections and peritonitis in CAPD patients by local application of mupirocin ointment at the catheter exit site	127
76	Journal of Infectious Diseases	Peritoneal-macrophages and opsonins – anti-bacterial defense in patients undergoing chronic peritoneal-dualysis	127
77	American Journal of Kidney Diseases	Changes of cytokine profiles during peritonitis in patients on continuous ambulatory peritoneal dialysis	126
78	Kidney International	How much peritoneal dialysis is required for the maintenance of a good nutritional state?	126
79	Nephrology Dialysis Transplantation	Clinical biocompatibility of a neutral peritoneal dialysis solution with minimal glucose-degradation products - A 1-year randomized control trial	125
80	Nephrology Dialysis Transplantation	Broadening Options for Long-term Dialysis in the Elderly (BOLDE): differences in quality of life on peritoneal dialysis compared to haemodialysis for older patients	124
81	Nephrology Dialysis Transplantation	Association between residual renal function inflammation and patient survival in new peritoneal dialysis patients	124
82	Journal of Clinical Investigation	Altered permeability of peritoneal membrane after using hypertonic peritoneal dialysis fluid	124
83	Journal of Clinical Endocrinology & Metabolism	Relationship between Plasma Fibroblast Growth Factor-23 Concentration and Bone Mineralization in Children with Renal Failure on Peritoneal Dialysis	123
84	Kidney International	Analysis of peritoneal-macrophages in continuous peritoneal-dialysis patients	122
85	Journal of the American Society of Nephrology	Effects of Biocompatible versus Standard Fluid on Peritoneal Dialysis Outcomes	121

(Table 1) contd.....

Rank	Journal	Title	Number of citation
86	Clinical Journal of the American Society of Nephrology	Encapsulating Peritoneal Sclerosis in the New Millennium: A National Cohort Study	121
87	American Journal of Kidney Diseases	A randomized controlled trial to evaluate the efficacy and safety of icodextrin in peritoneal dialysis	121
88	Kidney International	Randomized controlled study of biocompatible peritoneal dialysis solutions: Effect on residual renal function	119
89	Peritoneal Dialysis International	Peritoneal catheters and exit-site practices toward optimum peritoneal access: A review of current developments	119
90	Peritoneal Dialysis International	Emergence of mupirocin-resistant Staphylococcus aureus in chronic peritoneal dialysis patients using mupirocin prophylaxis to prevent exit-site infection	119
91	Nephron	Peritoneal-dialysis fluid inhibition of polymorphonuclear leukocyte respiratory burse activation is related to the lowering of intracellular pH	119
92	Lancet	Ultrafiltration with an isosmotic solution during long peritoneal-dialysis exchanges	118
93	Obstetrics and Gynecology	Retrograde menstruation in women undergoing chronic peritoneal-dialysis	118
94	European Journal of Clinical Investigation	Alterations in the peritoneal transport of water and solutes during peritonitis in continuous ambulatory peritoneal-dialysis patients	116
95	Peritoneal Dialysis International	A long-term study of a bicarbonate/lactate-based peritoneal dialysis solution - Clinical benefits	115
96	Peritoneal Dialysis International	The effect of serum-albumin at the start of continuous ambulatory peritoneal-dialysis treatment on patient on patient survival	115
97	Kidney international	Assessing the peritoneal-dialysis capacities of individual patients	114
98	Nephrology Dialysis Transplantation	Cost of peritoneal dialysis and haemodialysis across the world	114
99	Peritoneal Dialysis International	Induction of 1,2-dicarbonyl compounds, intermediates in the formation of advanced glycation end-products, during heat-sterilization of glucose-based peritoneal dialysis fluids	112
100	Peritoneal Dialysis International	Cross-sectional assessment of weekly urea and creatinine clearances and indexes of nutrition in continuous ambulatory peritoneal-dialysis patients	111

There are 21 journals in which the top-100 cited articles were published. The names of the journals, in the order in which the articles are cited, are as follows: Kidney International (26 articles), Nephrology Dialysis Transplantation (13 articles), and Journal of the American Society of Nephrology (12 articles). Nearly half of the articles have been published in these three journals (51 articles) (Table **2**).

The top-100 cited articles have been published in 15 countries. The country with the greatest number of publications was the United States of America (19 articles). The other countries were the United Kingdom (18 articles), Canada (13 articles), Sweden (9 articles), and the Netherlands (8 articles) (Table **3**).

Table 2. Journals with two or more of the top-100 cited articles on peritoneal dialysis.

Rank	Journal	Number of articles
1	Kidney International	26
2	Nephrology Dialysis Transplantation	13
3	Journal of the American Society of Nephrology	12
4	American Journal of Kidney Disease	11
5	Peritoneal Dialysis International	11
6	Lancet	4
7	Nephron	4
8	Annals of Internal Medicine	3
9	New England Journal of Medicine	3
10	Journal of Clinical Endocrinology Metabolism	2
11	Journal of Infectious Diseases	2

Table 3. Countries with three or more of the top-100 cited articles on peritoneal dialysis.

Rank	Country	Number of articles
1	United States of America	19
2	United Kingdom	18
3	Canada	13
4	Sweden	9
5	Netherlands	8
6	Hong Kong	6
7	Belgium	5
8	Australia	3
9	Italy	3
10	Japan	3
11	Spain	3

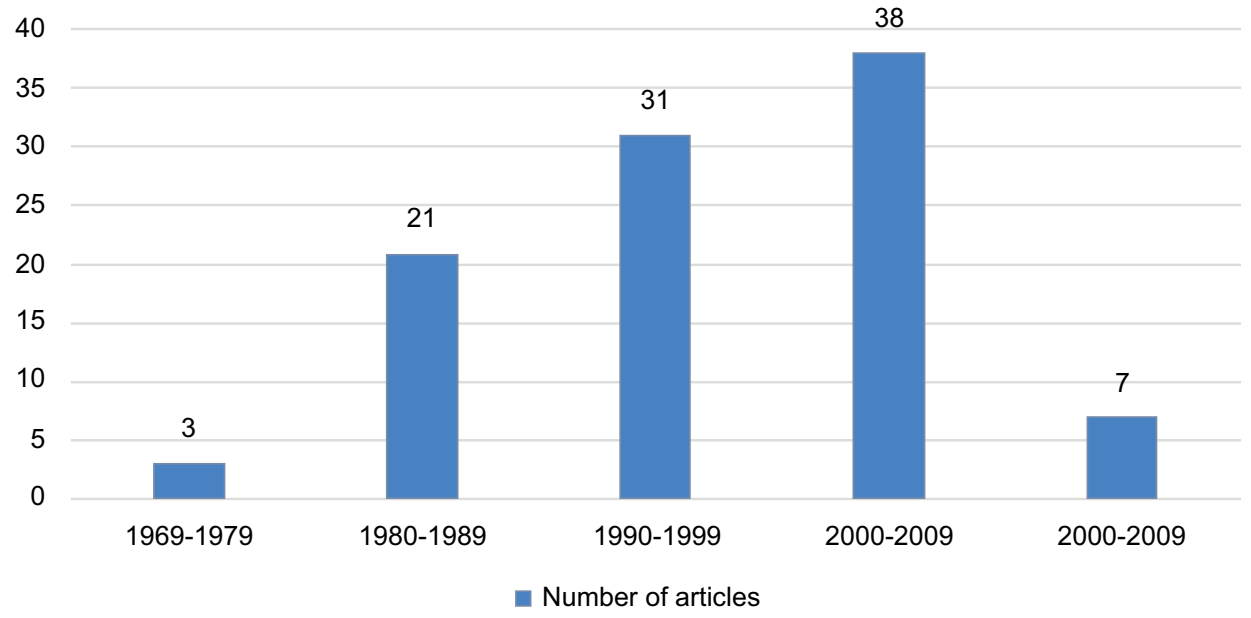

Fig. (1). Number of top-100 cited articles on peritoneal dialysis according to decade.

Fig. (**1**) summarizes the publication decades of the top-100 cited articles. Forty-five articles have been published since 2000. The earliest was published in 1969, while the most recent one was published in 2013.

Eight institutions provided more than three of the top-100 cited articles (Table **4**). Counting was based on the first author's name for articles with multiple authors. The institution that published the greatest number of articles was the University Health Network of Toronto (7 articles), followed by The Chinese University of Hong Kong (6 articles) and the University of Amsterdam (6 articles).

Table 4. Institutions of the first author's origin which have three or more of the top-100 cited articles on peritoneal dialysis.

Rank	Institution	Number of articles
1	University Health Network Toronto, Canada	7
2	Chinese Univercity of Hong Kong, People's Republic of China	6
3	University of Amsterdam, Netherlands	6
4	University Hospital of North Staffordshire, United Kingdom	5
5	Cardiff University, United Kingdom	4
6	Karolinska University Hospital, Sweden	4
7	St. Joseph's Healthcare Hamilton, Canada	3
8	Ghent University, Belgium	3

Table 5. First authors with two or more of the top-100 cited articles on peritoneal dialysis

Rank	First author	Number of articles
1	Davies SJ	5
2	Blumenkrantz MJ	3
3	Wang AY	3
4	Chung SH	2
5	Gokal R	2
6	Mistry CD	2
7	Rippe B	2

Table **5** lists the top-ranked authors who had three or more published PD articles. The author who wrote the most number of articles was Davies, SJ (5 articles).

4. DISCUSSION

This study identified the top-100 cited articles for PD. These articles provided interesting insights into scientific advances and perspectives in the field of PD using the ISI database.

The most-cited article was published in 2010 by the Journal of the American Society of Nephrology and was authored by Bargman JM [14]. Previous CANUSA data showed that clearance of small solutes like creatinine and urea was associated with patient survival. The solute clearances could be divided into either peritoneal or renal clearance. This article analyzed the peritoneal and renal clearances separately in terms of the CANUSA date. The results showed that the contribution of residual renal function is more important than peritoneal clearance.

The second most frequently-cited article was titled "Peritoneal dialysis and epithelial-to-mesenchymal transition of mesothelial cells" [15]. This article was cited 518 times. It was authored by Yáñez-Mó, M in 2005 and published in the New England Journal of Medicine. The article stated that mesothelial cells undergoing epithelial-to-mesenchymal transition may change the pathophysiology of ultrafiltration failure. For patients undergoing PD, markers related to mesothelial cells such as snail, E-cadherin, and α2 integrin may be useful markers for follow-up.

The earliest paper on PD is "A simple and safe technique for continuous ambulatory peritoneal dialysis(CAPD)" [16]. This article was published in April 1978 in the Transactions American Society for Artificial Internal Organs. It reports the experience of performing CAPD using plastic dialysis bags instead of intermittent peritoneal dialysis using glass dialysate containers in 28 patients. This technique is safer because peritonitis was reduced. It was more suitable for chronic dialysis by making dialysis available at home. Since this paper, a large number of articles related to the benefits of CAPD have been published, and CAPD patients have increased.

The most interesting topic was under the umbrella of pathophysiology (28 articles). The articles under this topic covered laboratory changes during PD, changes in metabolism, and changes in residual renal function. The second most interesting topic was about the PD membrane (20 articles). The article with the greatest number of citations related to PD patient physiology was authored by Michael, J in 1981 and published in Kidney International [17]. The article discussed protein losses during PD. It stated that there was no significant difference in the patient's weekly protein loss on intermittent maintenance PD and continuous ambulatory PD. Rather, protein loss was increased in patients who developed peritonitis. According to the results of this study, the dialysate protein losses did not limit the usefulness of PD.

We found some interesting trends among the article topics as these have changed over time. First, the most frequent subject was pathophysiology. This was consistent with the results of the analyses in other fields [5, 6, 8, 13]. Other topics often mentioned in many articles were basic research, treatment, and pathophysiology. Second, more articles were being published as time passed from the 1980s, 1990s, to the 2000s. Throughout the 1990s to 2000s, sixty-nine of the top-100 cited articles were published. Physiology articles were evenly published in each decade, but these articles were most common during the 2000s. This is probably due to the increase in the number of patients undergoing PD [18] and the possibility of increased large-scale researches launched. The second most interesting topic, the PD membrane, was published mainly in the 1980s. This trend is presumed to be due to the high initial interest in the role of membranes in PD. The differences among patients were revealed after the initiation of peritoneal dialysis.

Nineteen articles originated from the United States, while eighteen articles were published from the United Kingdom. Other fields also have the largest number of articles that came from the United States [5 - 8, 10 - 13]. There are a total of 9 top 100 cited articles published in Asia. Today, Asia is facing a strategic test to catch up with the West in several fields of research. As the access to data improves and large-scale research becomes possible in Asia, it is expected that many papers with a high level of evidence will be published. Accordingly, the number of citations and contributions will increase. We found that none of the top-100 cited articles came from South America or Africa. This could be related to the difficulties in access to information, research, publishing, and language barriers in these areas.

Kidney International was the most frequently cited journal (25 articles), followed by Nephrology Dialysis Transplantation (13 articles). More articles have been published in General Nephrology Journals, not specific PD journals such as Peritoneal Dialysis International. The reason can be estimated as follows. First, Peritoneal Dialysis International began publishing in June 1980. Second, because it deals with a

variety of aspects of nephrology and urology, the accessibility to the journal itself is high and it has a high preference for authors. Institutions in the United States have made significant contributions to the research of PD. This can be explained by the enormous financial resources and the large-scaled American scientific community. Moreover, United States authors prefer to publish at accessible American journals and usually cite from American papers written in English [19]. However, the institution with the greatest number of citations on PD was the University Health Network of Toronto. It is a group comprising the Toronto General Hospitals, the Princess Margaret Cancer Centre, the Toronto Rehabilitation Institute, Toronto Western Hospitals, and The Michener Institute of Education. As a large, hospital-based research center in Canada, it has conducted research on transplantation, oncology, cardiology, infectious diseases, neurosciences, rehabilitation medicine, surgical innovation, and genomic medicine. It is among Canada's Top 40 Research Hospitals in 2018.

There are some inherent limitations to our study. Because of a debate about the value of citations, we attempted to analyze these citations. The citation count does not reflect whether it is a positive or negative reference [20]. The more frequently cited paper might not necessarily be the most meaningful and important one [21]. Certain types of articles, such as guidelines, systematic reviews, and meta-analyses tend to be cited more than other study designs [22]. It is also likely that older articles and journals have been cited more. However, identifying citation numbers is widely recognized as a good way to judge the merits of an article. The analysis of the citation rate would be able to identify the advanced field of expertise and provide a historical perspective on its scientific progress.

CONCLUSION

This study is the first in the field of nephrology to provide a list of the top-100 cited articles dedicated to peritoneal dialysis. Through this study, the research trends and major academic interests pertaining to peritoneal dialysis would be identified.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No human and animal were used for studies that are the basis of this research.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

REFERENCES

[1] Inker LA, Astor BC, Fox CH, *et al.* KDOQI US commentary on the 2012 KDIGO clinical practice guideline for the evaluation and management of CKD. Am J Kidney Dis 2014; 63(5): 713-35. [http://dx.doi.org/10.1053/j.ajkd.2014.01.416] [PMID: 24647050]

[2] Luyckx VA, Tonelli M, Stanifer JW. The global burden of kidney disease and the sustainable development goals. Bull World Health Organ 2018; 96(6): 414-422D. [http://dx.doi.org/10.2471/BLT.17.206441] [PMID: 29904224]

[3] Jin DC, Yun SR, Lee SW, *et al.* Current characteristics of dialysis therapy in Korea: 2016 registry data focusing on diabetic patients. Kidney Res Clin Pract 2018; 37(1): 20-9. [http://dx.doi.org/10.23876/j.krcp.2018.37.1.20] [PMID: 29629274]

[4] Mehrotra R, Devuyst O, Davies SJ, Johnson DW. The current state of peritoneal dialysis. J Am Soc Nephrol 2016; 27(11): 3238-52. [http://dx.doi.org/10.1681/ASN.2016010112] [PMID: 27339663]

[5] Paladugu R, Schein M, Gardezi S, Wise L. One hundred citation classics in general surgical journals. World J Surg 2002; 26(9): 1099-105. [http://dx.doi.org/10.1007/s00268-002-6376-7] [PMID: 12209239]

[6] Baltussen A, Kindler CH. Citation classics in anesthetic journals. Anesth Analg 2004; 98(2): 443-51. [http://dx.doi.org/10.1213/01.ANE.0000096185.13474.0A] [PMID: 14742385]

[7] Tsai YL, Lee CC, Chen SC, Yen ZS. Top-cited articles in emergency medicine. Am J Emerg Med 2006; 24(6): 647-54. [http://dx.doi.org/10.1016/j.ajem.2006.01.001] [PMID: 16984831]

[8] Loonen MP, Hage JJ, Kon M. Plastic Surgery Classics: Characteristics of 50 top-cited articles in four Plastic Surgery Journals since 1946. Plast Reconstr Surg 2008; 121(5): 320e-7e. [http://dx.doi.org/10.1097/PRS.0b013e31816b13a9] [PMID: 18453945]

[9] Stern RS, Arndt KA. Top cited authors in dermatology: A citation study from 24 journals: 1982-1996. Arch Dermatol 1999; 135(3): 299-302. [http://dx.doi.org/10.1001/archderm.135.3.299] [PMID: 10086451]

[10] Brandt JS, Downing AC, Howard DL, Kofinas JD, Chasen ST. Citation classics in obstetrics and gynecology: the 100 most frequently cited journal articles in the last 50 years. Am J Obstet Gynecol 2010; 203(4): 355.e1-7. [http://dx.doi.org/10.1016/j.ajog.2010.07.025] [PMID: 20875501]

[11] Kelly JC, Glynn RW, O'Briain DE, Felle P, McCabe JP. The 100 classic papers of orthopaedic surgery: a bibliometric analysis. J Bone Joint Surg Br 2010; 92(10): 1338-43. [http://dx.doi.org/10.1302/0301-620X.92B10.24867] [PMID: 20884968]

[12] Park KM, Park BS, Park S, Yoon DY, Bae JS. Top-100 cited articles on headache disorders: A bibliometric analysis. Clin Neurol Neurosurg 2017; 157: 40-5. [http://dx.doi.org/10.1016/j.clineuro.2017.03.022] [PMID: 28384598]

[13] Baltussen A, Kindler CH. Citation classics in critical care medicine. Intensive Care Med 2004; 30(5): 902-10. [http://dx.doi.org/10.1007/s00134-004-2195-7] [PMID: 14985952]

[14] Bargman JM, Thorpe KE, Churchill DN. Relative contribution of residual renal function and peritoneal clearance to adequacy of dialysis: a reanalysis of the CANUSA study. J Am Soc Nephrol 2001; 12(10): 2158-62. [PMID: 11562415]

[15] Yáñez-Mó M, Lara-Pezzi E, Selgas R, *et al.* Peritoneal dialysis and epithelial-to-mesenchymal transition of mesothelial cells. N Engl J Med 2003; 348(5): 403-13. [http://dx.doi.org/10.1056/NEJMoa020809] [PMID: 12556543]

[16] Oreopoulos DG, Robson M, Izatt S, Clayton S, deVeber GA. A simple and safe technique for continuous ambulatory peritoneal dialysis (CAPD). Trans Am Soc Artif Intern Organs 1978; 24: 484-9. [PMID: 716044]

[17] Blumenkrantz MJ, Gahl GM, Kopple JD, *et al.* Protein losses during peritoneal dialysis. Kidney Int 1981; 19(4): 593-602. [http://dx.doi.org/10.1038/ki.1981.57] [PMID: 7241892]

[18] Jain AK, Blake P, Cordy P, Garg AX. Global trends in rates of peritoneal dialysis. J Am Soc Nephrol 2012; 23(3): 533-44. [http://dx.doi.org/10.1681/ASN.2011060607] [PMID: 22302194]

[19] Campbell FM. National bias: a comparison of citation practices by health professionals. Bull Med Libr Assoc 1990; 78(4): 376-82. [PMID: 2224301]

[20] Smith R. Beware the tyranny of impact factors. J Bone Joint Surg Br 2008; 90(2): 125-6. [http://dx.doi.org/10.1302/0301-620X.90B2.20258] [PMID: 18256074]

[21] Seglen PO. Citations and journal impact factors: questionable indicators of research quality. Allergy 1997; 52(11): 1050-6. [http://dx.doi.org/10.1111/j.1398-9995.1997.tb00175.x] [PMID: 9404555]

[22] Royle P, Kandala NB, Barnard K, Waugh N. Bibliometrics of systematic reviews: analysis of citation rates and journal impact factors. Syst Rev 2013; 2: 74. [http://dx.doi.org/10.1186/2046-4053-2-74] [PMID: 24028376]