A bibliometric analysis of the 100 most influential papers on peritoneal dialysis

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Abstract

Background: We aimed to identify the 100 most cited articles published on peritoneal dialysis (PD) and analyze their characteristics to provide information on the achievements and developments of PD research over the past decades.

Methods: The Science Citation Index Expanded (SCIE) in the Web of Science Core Collection was comprehensively searched from 2000 to 2018, using the keywords “Peritoneal dialysis” or “Dialysis, Peritoneal” or “Dialysis, Peritoneal” or “Peritoneal Dialyses”. The top 100 cited articles were retrieved by reading titles and abstracts. Significant information was further elicited, including the authors, journals, countries, institutions, and publication year.

Results: The United States was the most productive country (n=51), Li Pkt published the highest number of papers (n=7), the Journal of the American Society of Nephrology produced the highest number of contributions (n=28), and Baxter International Inc., the University of California System, and the University of Toronto were the institutions with the highest number of articles (n=10).

Conclusions: This is the first bibliometric study to identify the most influential papers in PD research. This report describes the major changes and advances in research regarding PD as a guide for writing a citable article.

Abbreviations: GFR = glomerular filtration rate, PD = peritoneal dialysis, SCIE = Science Citation Index Expanded.

Keywords: bibliometric analysis, citation, nephrology, peritoneal dialysis

1. Introduction

According to the latest global report, The Global Kidney Health Atlas, almost 1 in 10 people in the world suffer from chronic kidney disease. Individuals with terminal chronic kidney disease, which means those with a glomerular filtration rate < 15 ml/minutes/1.73 m² require some type of therapy to replace renal function.[1] This therapy can include one of the available dialysis modalities, peritoneal dialysis or hemodialysis, or kidney transplantation. As compared to hemodialysis, PD is home-based, cost-effective, preserves residual renal function therapy for patients with terminal chronic kidney disease, and may yield better short-term outcome after transplantation.[2] PD is a renal replacement therapy based on infusing a sterile solution into the peritoneal cavity through a catheter, using the peritoneal membrane as the dialysing surface, and provides for the removal of solutes and water.[3] This solution is packaged in clear flexible plastic bags, which is in close contact with the capillaries in the peritoneum. Because it is hyperosmolar to plasma due to the addition of osmotic agents, it allows the transportation of diffusion solute and the loss of osmotic ultrafiltration water. There is an increasing number of related articles on PD, improving peritoneal function, reducing the occurrence of peritonitis, and improving the quality of life of dialysis patients. However, there is still a lack of knowledge about the quality of scientific production in this field.

The citation number of an article is often used to assess the academic impact of research. There is a unique tool called bibliometric analysis that analyzes the characteristics and quality of published articles. It was first published in Journal of the American Medical Association (JAMA) in 1987 and has been widely used in various fields to assess and evaluate the importance of published articles or research trends.[4–6]

With this fact in mind, this study used the database to rank the 100 most cited papers to determine published papers in the most frequently cited medical journals by other authors. By analyzing the characteristics of these papers, we intended to determine which qualities make PD papers important to the profession.

2. Methods

2.1. Search strategy and criteria

On Feb 1, 2020, authors comprehensively searched relevant studies on the Science Citation Index Expanded (SCIE) database
of Web of Science Core Collection. The searching strategy is “TS=(Peritoneal dialysis OR Dialyses, Peritoneal OR Dialysis, Peritoneal OR Peritoneal Dialyses)”. And the language was restricted in English. Then we excluded papers by literature type, only article, review, proceedings were included. Third, irrelevant articles were excluded after screening titles and abstracts and articles were further ranked in descending order of citations. Finally, the 100 most cited articles were included in this analysis (Fig. 1).

### 2.2. Data extraction

All articles were reviewed by 2 independent well-trained investigators. The following information was listed for 100 cited articles: the journal name, publication year, and overall citation rate (total citations/average citations/2019 citations). The ethical approval was waived, as no patients or animals were involved in this study.

### 3. Results

#### 3.1. The top 100 articles

As shown in Figure 1, a total of 16,885 articles focusing on PD were identified from the database. The number of publications concerning PD had an annually significant increase worldwide. The top 100 cited articles are listed in Table 1. The most cited article, a prospective, randomized, controlled trial study, was published in the Journal of the American Society of Nephrology in 2002, and this paper was cited a total of 733 times and 21 times in 2019. The average citation times per year of this article were 43.12. Each of the top 100 cited articles was cited no less than 150 times.

#### 3.2. Countries that contributed more than 5 articles to the top 100 articles

As listed in Table 2, the United States was the most productive country, with 51 articles, followed by Canada with 19 articles, England with 11 articles, Netherlands with 10 articles, China with 10 articles, Germany with 8 articles, and Spain with 7 articles. Moreover, the United States had the highest total citation times and mean citation times in 2019, but Spain had the highest mean citation times per article, with 334.43 citation times.

#### 3.3. The authors who contributed more than 5 articles in the top 100 articles

With respect to the authors listed in Table 3, Li Pkt was the most productive author, with 7 articles, followed by Fink Ne, Piraino B, and Powe Nr, with 6 articles. Moreover, Fink Ne had the highest total citation times and mean citation times in 2019, but Piraino B had the highest mean citation times per article, with 335 citation times.
| Rank | Paper                                                                                                           | Year | Total citations | Average citations per paper | Citation (2019) |
|------|------------------------------------------------------------------------------------------------------------------|------|-----------------|----------------------------|-----------------|
| 1    | Effects of increased peritoneal clearances on mortality rates in peritoneal dialysis: ADEMEX, a prospective, randomized, controlled trial | 2002 | 733             | 43.12                      | 21              |
| 2    | Morphologic changes in the peritoneal membrane of patients with renal disease                                   | 2002 | 708             | 41.59                      | 33              |
| 3    | Peritoneal dialysis-related infections recommendations: 2010 update                                            | 2010 | 642             | 71.11                      | 34              |
| 4    | Relative contribution of residual renal function and peritoneal clearance to adequacy of dialysis: A reanalysis of the CANUSA study | 2001 | 596             | 33                         | 34              |
| 5    | Peritoneal dialysis-related infections recommendations: 2005 update                                             | 2005 | 576             | 41                         | 8               |
| 6    | Peritoneal dialysis and epithelial-to-mesenchymal transition of mesothelial cells                                | 2003 | 518             | 32.19                      | 33              |
| 7    | Survival advantages of obesity in dialysis patients                                                             | 2005 | 433             | 30.64                      | 22              |
| 8    | Predictors of loss of residual renal function among new dialysis patients                                       | 2000 | 384             | 20.16                      | 20              |
| 9    | Quality of life in end-stage renal disease patients                                                              | 2001 | 338             | 18.78                      | 17              |
| 10   | A simple comorbidity scale predicts clinical outcomes and costs in dialysis patients                             | 2000 | 335             | 17.53                      | 13              |
| 11   | Cost analysis of ongoing care of patients with end-stage renal disease: The impact of dialysis modality and dialysis access | 2002 | 321             | 18.82                      | 17              |
| 12   | Cinacalcet HCl, an oral calcimimetic agent for the treatment of secondary hyperparathyroidism in hemodialysis and peritoneal dialysis: A randomized, double-blind, multicenter study | 2005 | 310             | 22.14                      | 13              |
| 13   | Cardiac valve calcification as an important predictor for all-cause mortality and cardiovascular mortality in long-term peritoneal dialysis patients: A prospective study | 2003 | 303             | 18.94                      | 10              |
| 14   | Effect of fluid and sodium removal on mortality in peritoneal dialysis patients                                 | 2001 | 302             | 16.78                      | 8               |
| 15   | The Euro-Balance Trial: The effect of a new biocompatible peritoneal dialysis fluid (balance) on the peritoneal membrane | 2004 | 295             | 19.67                      | 6               |
| 16   | Interleukin-6 is an independent predictor of mortality in patients starting dialysis treatment                  | 2002 | 295             | 17.35                      | 17              |
| 17   | Peritoneal glucose exposure and changes in membrane solute transport with time on peritoneal dialysis            | 2001 | 291             | 16.17                      | 7               |
| 18   | Survival of functionally anuric patients on automated peritoneal dialysis: The European APD Outcome Study        | 2003 | 282             | 17.63                      | 16              |
| 19   | National Kidney Foundation K/DOQI clinical practice guidelines for nutrition in chronic renal failure             | 2001 | 274             | 15.17                      | 34              |
| 20   | Validation of comorbid conditions on the end-stage renal disease medical evidence report: The CHOICE study       | 2000 | 271             | 14.21                      | 10              |
| 21   | Similar Outcomes with Hemodialysis and Peritoneal Dialysis in Patients with End-Stage Renal Disease             | 2011 | 267             | 33                         | 24              |
| 22   | Adult peritoneal dialysis-related peritonitis treatment recommendations: 2000 update                            | 2000 | 263             | 13.84                      | 1               |
| 23   | Quantifying comorbidity in peritoneal dialysis patients and its relationship to other predictors of survival    | 2002 | 262             | 15.41                      | 20              |
| 24   | Adapting the Charlson Comorbidity index for use in patients with ESRD                                         | 2003 | 261             | 16.25                      | 24              |
| 25   | Changes in serum calcium, phosphate, and PTH and the risk of death in incident dialysis patients: A longitudinal study | 2006 | 260             | 19.85                      | 7               |
| 26   | Icodextrin improves the fluid status of peritoneal dialysis patients: Results of a double-blind randomized controlled trial | 2003 | 257             | 16                         | 6               |
| 27   | Global Trends in Rates of Peritoneal Dialysis                                                                | 2012 | 256             | 36.43                      | 46              |
| 28   | Transient overexpression of TGF-beta 1 induces epithelial mesenchymal transition in the rodent peritoneum      | 2005 | 254             | 18.07                      | 14              |
| Rank | Paper                                                                 | Year | Total citations | Average citations per paper | Citation (2019) |
|------|----------------------------------------------------------------------|------|-----------------|----------------------------|----------------|
| 29   | Associations of serum fetuin-A with malnutrition, inflammation, atherosclerosis, and valvular calcification syndrome and outcome in peritoneal dialysis patients | 2005 | 246             | 17.57                      | 14             |
| 30   | The differential impact of risk factors on mortality in hemodialysis and peritoneal dialysis | 2004 | 246             | 16.33                      | 8              |
| 31   | Effect of starting with hemodialysis compared with peritoneal dialysis in patients new on dialysis treatment: A randomized controlled trial | 2003 | 244             | 15.19                      | 14             |
| 32   | Mortality and hospitalization in hemodialysis patients in five European countries: results from the Dialysis Outcomes and Practice Patterns Study (DOPPS) | 2004 | 241             | 16.07                      | 12             |
| 33   | Initial survival advantage of peritoneal dialysis relative to hemodialysis | 2002 | 241             | 14.18                      | 3              |
| 34   | Epithelial-to-mesenchymal transition and peritoneal membrane failure in peritoneal dialysis patients: Pathologic significance and potential therapeutic interventions | 2007 | 233             | 19.25                      | 21             |
| 35   | Health economic evaluations: The special case of end-stage renal disease treatment | 2002 | 232             | 13.65                      | 10             |
| 36   | Aspirin, beta-blocker, and angiotensin-converting enzyme inhibitor therapy in patients with end-stage renal disease and an acute myocardial infarction | 2003 | 229             | 14.31                      | 12             |
| 37   | Comparing the risk for death with peritoneal dialysis and hemodialysis in a national cohort of patients with chronic kidney disease | 2005 | 227             | 16.07                      | 11             |
| 38   | Depression in patients with chronic renal disease – What we know and what we need to know | 2002 | 227             | 13.29                      | 13             |
| 39   | 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 | 2003 | 226             | 14.13                      | 11             |
| 40   | Restriction of dietary glycoamins reduces excessive advanced glycation end products in renal failure patients | 2003 | 226             | 14.13                      | 10             |
| 41   | Differences in quality of life across renal replacement therapies: A meta-analytic comparison | 2000 | 225             | 11.84                      | 5              |
| 42   | Encapsulating peritoneal sclerosis in Japan: A prospective, controlled, multicenter study | 2004 | 221             | 14.73                      | 11             |
| 43   | Left Ventricular Mass in Chronic Kidney Disease and ESRD | 2009 | 218             | 21.4                       | 17             |
| 44   | Encapsulating peritoneal sclerosis: Definition, etiology, diagnosis, and treatment | 2000 | 218             | 11.47                      | 9              |
| 45   | Hemodialysis and peritoneal dialysis: Comparison of adjusted mortality rates according to the duration of dialysis: Analysis of the Netherlands Cooperative Study on the Adequacy of Dialysis 2 | 2003 | 204             | 12.75                      | 11             |
| 46   | Propensity-Matched Mortality Comparison of Incident Hemodialysis and Peritoneal Dialysis Patients | 2010 | 202             | 22.11                      | 15             |
| 47   | Relationship between Dialysis Modality and Mortality | 2009 | 200             | 20                         | 13             |
| 48   | Warfarin Use and the Risk for Stroke and Bleeding in Patients with Atrial Fibrillation Undergoing Dialysis | 2014 | 199             | 39.4                       | 27             |
| 49   | Hepcidin-A Potential Novel Biomarker for Iron Status in Chronic Kidney Disease | 2009 | 199             | 19.9                       | 16             |
| 50   | Progressive vascular calcification over 2 years is associated with arterial stiffening and increased mortality in patients with stages 4 and 5 chronic kidney disease | 2007 | 199             | 16.58                      | 15             |
| 51   | Body mass index, dialysis modality, and survival: Analysis of the United States Renal Data System Dialysis Morbidity and Mortality Wave II Study | 2004 | 199             | 13.27                      | 8              |
### Table 1 (continued)

| Rank | Paper                                                                 | Year | Total citations | Average citations per paper | Citation (2019) |
|------|-----------------------------------------------------------------------|------|-----------------|-----------------------------|-----------------|
| 52   | Effects of an angiotensin-converting renal function in patients receiving enzyme inhibitor on residual peritoneal dialysis — A randomized, controlled study | 2003 | 199             | 12.44                       | 6               |
| 53   | Long-term clinical effects of a peritoneal dialysis fluid with less glucose degradation products | 2001 | 199             | 11.06                       | 1               |
| 54   | Inflammation, residual kidney function, and cardiac hypertrophy are interrelated and combine adversely to enhance mortality and cardiovascular death risk of peritoneal dialysis patients | 2004 | 197             | 13.13                       | 8               |
| 55   | Inflammation is associated with carotid atherosclerosis in dialysis patients | 2000 | 197             | 10.37                       | 1               |
| 56   | Decreased survival among sedentary patients undergoing dialysis: Results from the dialysis morbidity and mortality study wave 2 | 2003 | 195             | 12.19                       | 19              |
| 57   | Septicemia, access, and cardiovascular disease in dialysis patients: The USRDS Wave 2 Study | 2005 | 192             | 13.71                       | 12              |
| 58   | Nasal carriage of Staphylococcus aureus and prevention of nosocomial infections | 2005 | 191             | 13.64                       | 11              |
| 59   | Description of 12 cases of nephrogenic fibrosing dermopathy and review of the literature | 2006 | 190             | 14.54                       | 3               |
| 60   | Successful treatment of calciphylaxis with intravenous sodium thiosulfite | 2004 | 189             | 12.6                        | 7               |
| 61   | Patient ratings of dialysis care with peritoneal dialysis vs hemodialysis | 2004 | 188             | 12.53                       | 7               |
| 62   | Hemofiltration and peritoneal dialysis in infection-associated acute renal failure in Vietnam | 2002 | 188             | 11.06                       | 4               |
| 63   | ISPD position statement on reducing the risks of peritoneal dialysis-related infections | 2011 | 187             | 23.38                       | 21              |
| 64   | Mortality studies comparing peritoneal dialysis and hemodialysis: What do they tell us? | 2006 | 187             | 14.38                       | 7               |
| 65   | Patient education and access of ESRD patients to renal replacement therapies beyond in-center hemodialysis | 2005 | 187             | 13.07                       | 8               |
| 66   | Gene transfer of transforming growth factor-beta to the rat peritoneum: Effects on membrane function | 2001 | 187             | 10.39                       | 4               |
| 67   | Quality-of-life evaluation using short form 36: Comparison in hemodialysis and peritoneal dialysis patients | 2009 | 187             | 9.84                        | 6               |
| 68   | Meta-analysis: Peritoneal membrane transport, mortality, and technique failure in peritoneal dialysis | 2006 | 184             | 14.15                       | 15              |
| 69   | The kidney disease outcomes quality initiative (K/DOQI) guideline for bone metabolism and disease in CKD: Association with mortality in dialysis patients | 2005 | 184             | 13.14                       | 9               |
| 70   | Pulmonary hypertension in patients with end-stage renal disease | 2003 | 183             | 11.44                       | 14              |
| 71   | The effect of contraindications and patient preference on dialysis modality selection in ESRD patients in the Netherlands | 2004 | 182             | 12.13                       | 5               |
| 72   | Evaluation and management of ultrafiltration problems in peritoneal dialysis | 2000 | 181             | 9.42                        | 10              |
| 73   | The importance of residual renal function in dialysis patients | 2006 | 179             | 13.77                       | 20              |
| 74   | Charlson comorbidity index as a predictor of outcomes in incident peritoneal dialysis patients | 2001 | 178             | 9.89                        | 8               |
| 75   | Randomized, double-blind, placebo-controlled, dose-titration, phase III study assessing the efficacy and tolerability of lanthanum carbonate: A new phosphate binder for the treatment of hyperphosphatemia | 2003 | 177             | 11.06                       | 0               |
| 76   | A randomized controlled trial of hemoglobin normalization with epoetin alfa in pre-dialysis and dialysis patients | 2003 | 176             | 11                          | 3               |
| 77   | Importance of dialysis adequacy in mortality and morbidity of Chinese CAPD patients | 2000 | 176             | 9.26                        | 2               |
| 78   | An evaluation of an integrative care approach for end-stage renal disease patients | 2000 | 175             | 9.16                        | 6               |
| Rank | Paper                                                                 | Year | Total citations | Average citations per paper | Citation (2019) |
|------|-----------------------------------------------------------------------|------|-----------------|----------------------------|----------------|
| 79   | Mortality differences by dialysis modality among incident ESRD patients with and without coronary artery disease | 2003 | 173             | 10.81                      | 2              |
| 80   | Vascular proliferation and enhanced expression of endothelial nitric oxide synthase in human peritoneum exposed to long-term peritoneal dialysis | 2000 | 171             | 9                          | 2              |
| 81   | A Systematic Review and Meta-Analysis of Utility-Based Quality of Life in Chronic Kidney Disease Treatments | 2012 | 170             | 24.29                      | 32             |
| 82   | Hemodialysis Vascular Access Modifies the Association between Dialysis Modality and Survival | 2011 | 170             | 21                         | 12             |
| 83   | Changes in quality of life during hemodialysis and peritoneal dialysis treatment: Generic and disease specific measures | 2004 | 170             | 11.27                      | 9              |
| 84   | Peritonitis remains the major clinical complication of peritoneal dialysis: the London, UK, peritonitis audit 2002-2003 | 2009 | 168             | 16.6                       | 18             |
| 85   | Dialysis-associated systemic fibrosis (Nephrogenic fibrosing dermopathy) – Study of inflammatory cells and transforming growth factor beta 1 expression in affected skin | 2004 | 165             | 16.3                       | 2              |
| 86   | Randomized, double-blind trial of antibiotic exit site cream for prevention of exit site infection in peritoneal dialysis patients | 2005 | 164             | 11.64                      | 9              |
| 87   | Effect of Kt/V on survival and clinical outcome in CAPD patients in a randomized prospective study | 2003 | 164             | 10.25                      | 4              |
| 88   | Effect of icodextrin on volume status, blood pressure and echocardiographic parameters: A randomized study | 2003 | 164             | 10.25                      | 4              |
| 89   | Association of Residual Urine Output With Mortality, Quality of Life, and Inflammation in Incident Hemodialysis Patients: The Choices for Healthy Outcomes in Caring for End-Stage Renal Disease (CHOICE) Study | 2010 | 162             | 18                         | 24             |
| 90   | Strict volume control normalizes hypertension in peritoneal dialysis patients | 2001 | 162             | 9                          | 4              |
| 91   | Survival following parathyroidectomy among United States dialysis patients | 2004 | 159             | 10.53                      | 14             |
| 92   | Prognostic value of ultrasonographic measurement of carotid intima media thickness in dialysis patients | 2001 | 157             | 8.72                       | 4              |
| 93   | The impact of education on chronic kidney disease patients’ plans to initiate dialysis with self-care dialysis: A randomized trial | 2005 | 155             | 10.86                      | 7              |
| 94   | Nephrogenic fibrosing dermopathy: A novel cutaneous fibrosing disorder in patients with renal failure | 2003 | 155             | 9.69                       | 1              |
| 95   | Effect of glucose degradation products on human peritoneal mesothelial cell function | 2000 | 154             | 8.11                       | 2              |
| 96   | Peritonitis-related mortality in patients undergoing chronic peritoneal dialysis | 2005 | 153             | 10.86                      | 6              |
| 97   | Impact of dialysis modality on survival of new ESRD patients with congestive heart failure in the United States | 2003 | 153             | 9.56                       | 2              |
| 98   | Hope and advance care planning in patients with end stage renal disease: qualitative interview study | 2006 | 152             | 11.69                      | 11             |
| 99   | What do American nephrologists think about dialysis modality selection? | 2001 | 152             | 8.39                       | 4              |
| 100  | Staphylococcus aureus serves as an iron source for Pseudomonas aeruginosa during in vivo coculture | 2005 | 150             | 10.57                      | 14             |
3.4. Top 5 sources that contributed the most papers to the top 100 articles

As shown in Table 4, the Journal of the American Society of Nephrology was the most popular journal, with 28 articles, followed by the American Journal of Kidney Diseases and Kidney International, with 17 articles, Peritoneal Dialysis International, with 8 articles, Nephrology Dialysis Transplantation, with 6 articles. The Journal of the American Society of Nephrology also had the highest total citation times and citation times in 2019. However, Peritoneal Dialysis International had the highest mean citation times per article, with 298.5 citation times.

3.5. The top 5 institutions contributing to the most cited papers in the top 100 articles

With respect to the institutions listed in Table 5, Baxter International, Inc., the University of California System, and the University of Toronto were the most productive institutions, with 10 articles, followed by the Chinese University of Hong Kong and Pennsylvania Commonwealth System of Higher Education, with 8 articles. Baxter International, Inc. also had the highest total citation times. However, Pennsylvania Commonwealth System of Higher Education had the highest mean citation times per article, with 316.88 citation times.

4. Discussion

In this bibliometric analysis, we identified the 100 top cited articles in the field of PD research over the past decades. These are representative of the many landmarks that have occurred in PD research over the past decades.

The most popular article, which had 733 citations, was basic research, reporting that further research is required to assess factors other than small-solute clearances and to determine their effects on survival. The following reasons might account for the popularity of this study. First, the study was published in 2002. As we know, papers conducted in earlier years were likely to be cited more frequently. Additionally, the methodology of the study was scientific and strict, which guaranteed the reliability of the conclusion. The second-place paper was classic clinical research. The findings created a comprehensive analysis of the morphologic changes that occur in the parietal peritoneal membranes of patients undergoing PD. The third and the fifth articles were guidelines on PD-related infections. The results demonstrate that influential guidelines also achieved the most citations. PD-related infections are one of the most important complications following PD, which has a great impact on the PD patients. The critical glomerular filtration rate (GFR) level has not been defined, but is probably that reached after 2 to 3 year of peritoneal dialysis treatment, when the survival advantage of peritoneal dialysis over hemodialysis is lost.

Among the top cited articles, the majority originated from the United States and European developed countries. The United States ranked first with 51 articles, followed by Canada and England. The United States had the highest total citation times, and citation times in 2019. However, Spain had the highest average, at 334.43 citations per article. This shows that PD has been studied more frequently in Spain in recent years. There is no
doubt that the United States made the greatest contribution to the developments of research on PD. Our study also found China was in 5th the rankings. Because of the high prevalence of PD in China, where 73% of dialysis patients are on PD, extensive research funding has been used to study the development of PD, demonstrating that China has made considerable progress in PD research. The scientific research has achieved rapid progress in recent years, and authors in Asian countries did have a place in the field of PD research. I believe developing countries should try their best to improve the quality of articles in future.

The majority of the top cited articles were published in journals with the high impact factors, including the New England Journal of Medicine, Lancet, Science, and Nature. In our study, 28 percent of the top-cited papers were published in the Journal of the American Society of Nephrology, as the most productive journals, including total citation times, and citation times in 2016, followed by the American Journal of Kidney Diseases, Kidney International and Peritoneal Dialysis International. Peritoneal Dialysis International, which has been a hot spot for PD in recent years, had the highest average of 298.5 citations per article. This result highlights a growing trend in which highly influential articles are published in specialized journals and are not limited to the most well-known general medical journals.

Baxter International Inc., the University of California System, and the University of Toronto had the largest number of papers, followed by the Chinese University of Hong Kong and Pennsylvania Commonwealth System of Higher Education. Three of the 5 institutions are from the United States, 1 from North America, and 1 from Asia. This finding seems to conform to the phenomenon “the better the economic ranking of a country, the higher the quantity and quality of its biomedical publications”. However, authors in China are gaining an increasingly important place in the field of PD because of their increasing gross national product and the expenditure allotted for research and development.

In our study, peritonitis was found to be a hot spot in PD research. Peritonitis is a common and serious complication of PD. Although less than 5% of peritonitis episodes cause death, peritonitis is a direct or major cause of death in approximately 16% of PD patients. In addition, severe or long-term peritonitis can cause changes in the structure and function of the peritoneum, eventually leading to membrane failure. Furthermore, peritonitis is a major cause of PD technology failure and conversion to long-term hemodialysis. Older articles may be cited more than recent articles because citations logically depend on the year they were published and because citations accumulate over time. Due to short publication times, some of them may have been missed in our analysis of high-quality articles. Moreover, language of publication plays a major role and has a clear bias for articles published in English journals. Despite these obvious flaws, the data presented here provide insight into the achievements and developments of PD research over the past decades.

5. Conclusion

In this study, we analyzed the 100 most cited articles focused on PD via bibliometric approaches. To our knowledge, this is the first bibliometric study to identify the most influential papers in PD research. This report presents major advances and changes in research regarding PD and can serve as a guide for writing a citable article.

Author contributions

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References

[1] Zimmerman AM. Peritoneal dialysis: increasing global utilization as an option for renal replacement therapy. J Glob Health 2019;9:020316.
[2] Andreoli MCC, Totoli C. Peritoneal dialysis. Rev Assoc Med Bras (1992) 2020;66(Suppl 1):s37–44.
[3] Blake PG, Bargman JM, Brimble KS, et al. Clinical practice guidelines and recommendations on peritoneal dialysis adequacy 2011. Perit Dial Int 2011;31:218–39.
[4] Qu Y, Zhang C, Hu Z, et al. The 100 most influential publications in asthma from 1960 to 2017: a bibliometric analysis. Respir Med 2018;137:206–12.
[5] Cuocolo R, Ponsiglione A, Dell’Aversana S, et al. The cardiac conundrum: a systematic review and bibliometric analysis of authorship in cardiac magnetic resonance imaging studies. Insights Imaging 2020;11:42.
[6] Huang L, Shi X, Zhang N, et al. Bibliometric analysis of trends and issues in traditional medicine for stroke research: 2004-2018. BMC Complement Med Ther 2020;20:39.
[7] Paniagua R, Amato D, Vonesh E, et al. Effects of increased peritoneal clearances on mortality rates in peritoneal dialysis: Ademex, a prospective, randomized, controlled trial. J Am Soc Nephrol 2002;13:1307–20.
[8] Williams JD, Craig KJ, Topley N, et al. Morphologic changes in the peritoneal membrane of patients with renal disease. J Am Soc Nephrol 2002;13:470–9.
[9] Li PK, Szeto CC, Piraino B, et al. Peritoneal dialysis-related infections recommendations: 2010 update. Perit Dial Int 2010;30:393–423.

[10] Piraino B, Bailie GR, Bernardini J, et al. Peritoneal dialysis-related infections recommendations: 2005 update. Perit Dial Int 2005;25:107–31.

[11] 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;12:2158–62.

[12] Ghali JR, Bannister KM, Brown FG, et al. Microbiology and outcomes of peritonitis in Australian peritoneal dialysis patients. Perit Dial Int 2011;31:651–62.

[13] Perez Fontan M, Rodriguez-Carmona A, Garcia-Naveiro R, et al. Peritonitis-related mortality in patients undergoing chronic peritoneal dialysis. Perit Dial Int 2005;25:274–84.

[14] Davenport A. Peritonitis remains the major clinical complication of peritoneal dialysis: the London, UK, peritonitis audit 2002-2003. Perit Dial Int 2009;29:297–302.

[15] Szeto CC, Wong TY, Chow KM, et al. Are peritoneal dialysis patients with and without residual renal function equivalent for survival study? Insight from a retrospective review of the cause of death. Nephrol Dial Transplant 2003;18:977–82.

[16] Brown MC, Simpson K, Kerstens JJ, et al. Peritoneal dialysis-associated peritonitis rates and outcomes in a national cohort are not improving in the post-millennium (2000-2007). Perit Dial Int 2011;31:639–50.

[17] Boudville N, Kemp A, Clayton P, et al. Recent peritonitis associates with mortality among patients treated with peritoneal dialysis. J Am Soc Nephrol 2012;23:1398–405.