

## Correlation Between Near-Vision Acuity and the Incidence of Peritoneal Dialysis–Related Infections

Shigeki Kojima,<sup>1</sup> Tsutomu Sakurada,<sup>2</sup> Kenichiro Koitabashi,<sup>2</sup> Kaori Kojima,<sup>3</sup> Shiika Watanabe,<sup>1</sup> Daisuke Uchida,<sup>1</sup> Nagayuki Kaneshiro,<sup>1</sup> Yusuke Konno,<sup>1</sup> Yugo Shibagaki<sup>2</sup>

*Peritoneal dialysis (PD)–related infections (PDIs) such as peritonitis, exit-site infection, and tunnel infection are serious complications affecting patients on PD. Because patients with diabetes (DM) and of older age have increased in number in Japan, the number of patients with visual impairment is estimated also to have increased. Near vision is necessary for performing proper PD daily care. However, no studies have reported whether visual impairment is likely to increase the risk of PDIs.*

*Our study included 31 PD patients (16 men, 15 women; mean age:  $61.5 \pm 11.8$  years; mean PD duration:  $27.3 \pm 20.3$  months; 38.7% with DM; 54.8% wearing glasses) who performed their own PD care. At our facility and related facilities, we used a standard near-vision test chart, which classifies vision into 12 grades, from 0.1 (poor) to 1.5 (clear), to assess near-vision binocular visual acuity in those patients between March 2015 and September 2015. In addition, we retrospectively examined the medical records of the patients to determine their history of PDIs. We then evaluated the correlation between near-vision acuity and the incidence of PDIs.*

*Mean measured near-vision acuity was  $0.61 \pm 0.29$ , and we observed no significant difference in the visual acuity of patients with and without DM ( $0.55 \pm 0.31$  vs.  $0.63 \pm 0.26$  respectively,  $p = 0.477$ ). In addition, we observed no significant difference in the incidence of PDIs between patients with and without DM ( $1.298 \pm 1.609$  per year vs.  $1.164 \pm 0.908$  per year*

*respectively,  $p = 0.804$ ). We did not find a correlation between near-vision acuity and the incidence of PDIs ( $r = -0.071$ ,  $p = 0.795$ ).*

### Key words

Near vision, peritoneal dialysis–related infections

### Introduction

Because peritoneal dialysis (PD)–related infections (PDIs) can potentially shorten the treatment period, PDIs such as peritonitis, exit-site infection (ESI), and tunnel infection (TI) are important complications for patients on PD. Furthermore, patients experiencing recurrent peritonitis episodes have a worse prognosis (1); thus, the prevention of PDIs is very important.

Recently, because of improvements in patient education, methods of exit-site care, and medical devices, the numbers of PDIs are declining (2–4). However, PDIs often still occur because of touch contamination or inadequate daily care. In Japan, the current peritonitis incidence rate is 1 episode in 73.5 patient–months, and ESIs and TIs occur at a rate of 1 episode in 30 patient–months (5). Increasingly, diabetic nephropathy is the primary cause of end-stage renal disease, and the number of elderly patients on PD is increasing with the increase in the aging population in Japan. It is likely that the number of patients with visual impairments from diabetic retinopathy, presbyopia, or cataracts is also increasing.

Some case reports have related the experiences of blind patients using PD or the relationship between visual impairment and peritonitis (6,7). Those reports have used distant vision or questionnaires to evaluate visual acuity in their subjects. However, we thought that distant vision is different from the near vision that is important to actual PD care.

The aim of the present study was to clarify whether near-vision impairment is a risk factor for PDIs.

From: <sup>1</sup>Division of Nephrology and Hypertension, Kawasaki Municipal Tama Hospital; <sup>2</sup>Division of Nephrology and Hypertension, Department of Internal Medicine, St. Marianna University School of Medicine; and <sup>3</sup>Division of Ophthalmology, St. Marianna University School of Medicine, Kawasaki, Kanagawa, Japan.

## Methods

Our retrospective multicenter cohort study was performed between March 2015 and September 2015. It was approved by the Institutional Review Board of St. Marianna University School of Medicine (no. 2790). The study subjects were patients on PD who underwent a near-vision test twice during the observation period at St. Marianna University School of Medicine Hospital or Kawasaki Municipal Tama Hospital.

We used a standard near-vision test chart (Handaya, Tokyo, Japan). The chart, which is designed to evaluate near vision for reading, classifies vision into 12 grades, from 0.1 (poor) to 1.5 (clear). Examinees use both eyes to view the chart from a 30-cm distance, reading the characters or the Landolt ring on the chart in ascending order (0.1 to 1.5) for the evaluation of visual acuity. The evaluation of near vision was based on the conditions under which they handled their PD care (with visual correction or not). We evaluated near vision twice in each patient to obtain average values, and we counted every PDI event retrospectively by examining the medical records of the patients.

## Statistical analysis

Data are expressed as mean  $\pm$  standard deviation. For comparisons of paired data, the nonparametric Wilcoxon signed-rank test was used. For correlations between continuous variables, the Spearman rank correlation test was used. A  $p$  value less than 0.05 was considered statistically significant. All statistical analyses were performed using the SPSS software application (version 18; SPSS Japan, Tokyo, Japan).

## Results

We analyzed 31 PD patients. Table I shows their baseline characteristics. All patients used ultraviolet or heated-plate germicidal exchange devices and performed their daily PD maneuvers by themselves. Of the 31 PD patients, only 1 (whose near-vision acuity was 0.45) experienced peritonitis (the incidence rate was 1 episode in 18.5 patient-months). The overall incidence rates were 1 episode in 221.5 patient-months for peritonitis and 1 episode in 12.3 patient-months for ESI or TI.

We next analyzed the relationship between near-vision acuity and the incidence of ESIs or TIs. The mean near-vision acuity in the cohort was  $0.61 \pm 0.29$ , and we observed no significant difference in visual acuity between the patients with and without

diabetes [DM ( $0.55 \pm 0.31$  vs.  $0.63 \pm 0.26$  respectively,  $p = 0.477$ )]. In addition, we observed no significant difference in the incidence of PDIs overall between the patients with and without DM ( $1.298 \pm 1.609$  per year vs.  $1.164 \pm 0.908$  per year respectively,  $p = 0.804$ ). We did not find a correlation between near-vision acuity and the incidence of PDIs ( $r = -0.071$ ,  $p = 0.795$ , Figure 1).

## Discussion

The age at dialysis initiation is increasing in Japan; currently, the mean is 67.2 years (8). Furthermore, the leading cause of end-stage renal failure is diabetic nephropathy, and 37.6% of patients are on dialysis because of DM (8). It is therefore likely that the number of patients with visual impairments is not negligible. Visual impairments are predicted to result in inferior quality of daily PD care because of the difficulty of adequate observation of the exit-site and the catheter. However, the relationship between visual impairment and PD-related complications has never been objectively studied.

TABLE I Clinical profile of the study patients

Variable	Value
Mean age (years)	61.5 $\pm$ 11.8
Men/women ( $n$ )	16/15
With/without DM ( $n$ )	12/19
With/without glasses ( $n$ )	17/14
Mean PD duration (months)	27.3 $\pm$ 20.3

DM = diabetes mellitus; PD = peritoneal dialysis.

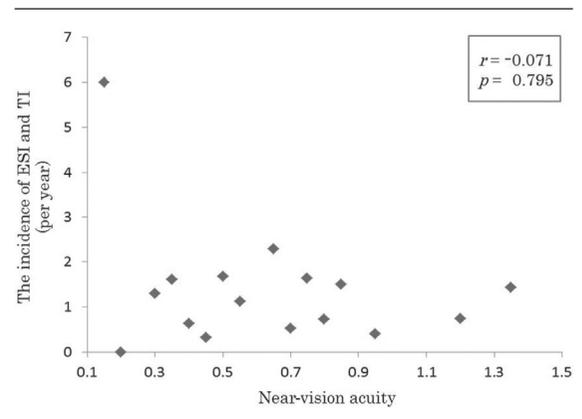


FIGURE 1 Relationship between near-vision acuity and the incidence of peritoneal dialysis-related infections.

In our study, we focused on the importance of near vision instead of the typically examined distant vision, because adequate near-vision acuity is necessary to perform PD maneuvers properly. Near-vision acuity is usually examined to assess reading or writing ability. A near-vision test chart is inexpensive, and the assessment procedure is quite simple compared with distant vision assessment, which requires a large space and special instruments. Although distant vision acuity is known to gradually get worse after the age of 10 (9), the changes in near-vision acuity that occur with age have not been reported. However, it is known that to be able to read newspapers and books, near-vision acuity exceeding 0.5 is needed. The present study shows that patients on PD generally have marginal near-vision acuity.

We conducted our research based on the hypothesis that visual impairment would increase the risk of PDIs. However, as with earlier published data showing that the lack of a relationship between peritonitis and visual impairment, including complete blindness (10,11), we could find no relationship between visual impairment and ESIs or TIs. In other words, even if near vision is poor, PDIs can be prevented with careful performance of the necessary care. However, it is known that ESIs and TIs can cause catheter-related peritonitis. Thus, appropriate exit-site care has the potential to diminish the risk of peritonitis.

On the other hand, in the field of caring for the diabetic foot, visual impairment would be expected to increase the risk of ulceration because of a disorganized and unclean environment or an increased risk of injury during nail clipping. It has been reported that visual impairment increases the risk of foot injury in diabetic patients (12) and that patients with foot ulcers have significantly poorer visual function (13). We should note that the foot, being peripherally located, is likely to have defective circulation in these patients. However, the issues of daily management to prevent PDIs in patients on PD are similar to the tasks for preventing diabetic foot ulcers in patients with DM.

The main limitations of our study include the relatively small number of patients and the retrospective cohort design. Further investigations involving more patients and using prospective long-term observation are needed to support our conclusions. In addition, because of difficulties in assessing the level of skilled motor behavior in the study patients, we could not adjust the data with respect to that aspect of PD care.

## Conclusions

Our study did not prove an association between poor near-vision acuity and PDIs.

## Acknowledgment

We thank the nurses at the Kidney Center of Kawasaki Municipal Tama Hospital for their assistance in measuring near vision.

## Disclosures

The authors have no conflicts of interest to declare.

## References

- 1 Szeto CC, Kwan BC, Chow KM, *et al.* Recurrent and relapsing peritonitis: causative organisms and response to treatment. *Am J Kidney Dis* 2009;54:702–10.
- 2 Han SH, Lee SC, Ahn SV, *et al.* Improving outcome of CAPD: twenty-five years' experience in a single Korean center. *Perit Dial Int* 2007;27:432–40.
- 3 Rocha A, Rodrigues A, Teixeira L, Carvalho MJ, Mendonça D, Cabrita A. Temporal trends in peritonitis rates, microbiology and outcomes: the major clinical complication of peritoneal dialysis. *Blood Purif* 2012;33:284–91.
- 4 Barretti P, Moraes TM, Camargo CH, *et al.* Peritoneal dialysis-related peritonitis due to *Staphylococcus aureus*: a single-center experience over 15 years. *PLoS One* 2012;7:e31780.
- 5 Eriguchi M, Tsuruya K, Yoshida H, *et al.* Validation of the exit-site scoring system recommended by the 2005 guidelines of the International Society for Peritoneal Dialysis. *Perit Dial Int* 2011;31:698–700.
- 6 Osaka C, Kinoda T, Nishio N, *et al.* CAPD manipulation in a patient of total blindness with diabetic renal failure. Instructing self-exchange of PD bag [Japanese]. *Jin To Toseki* 2002;53(suppl):479–81.
- 7 Yanagisawa M, Haruhara K, Miyashita M, *et al.* Introduction to peritoneal dialysis for a blind patient [Japanese]. *Jin To Toseki* 2008;65(suppl):228–31.
- 8 Masakane I, Nakai S, Ogata S, *et al.* An overview of regular dialysis treatment in Japan (as of 31 December 2013). *Ther Apher Dial* 2015;19:540–74.
- 9 Ichikawa H. Visual function and aging [Japanese]. *Jpn J Clin Ophthalmol* 1981;35:9–26.
- 10 Chandran PK, Lane T, Flynn CT. Patient and technique survival for blind and sighted diabetics on continuous ambulatory peritoneal dialysis: a ten-year analysis. *Int J Artif Organs* 1991;14:262–8.
- 11 Golper TA, Brier ME, Bunke M, *et al.* Risk factors for peritonitis in long-term peritoneal dialysis: the Network 9 peritonitis and catheter survival studies. Academic Subcommittee of the Steering Committee of

- the Network 9 Peritonitis and Catheter Survival Studies. *Am J Kidney Dis* 1996;28:428–36.
- 12 Shaw JE, Boulton AJ. Poor vision as a contributory factor in diabetic neuro-arthropathy. *Diabetes Res Clin Pract* 1997;38:21–3.
- 13 Sriussadaporn S, Mekanandha P, Vannasaeng S, *et al.* Factors associated with diabetic foot ulceration in Thailand: a case–control study. *Diabet Med* 1997;14:50–6.

*Corresponding author:*

Shigeki Kojima, MD, Division of Nephrology and Hypertension, Kawasaki Municipal Tama Hospital, 1-30-37 Shukugawara, Tama-ku, Kawasaki, Kanagawa, Japan.

*E-mail:*

s2kojima@marianna-u.ac.jp