SHORT REPORTS

Automated Peritoneal Dialysis for a Patient with Hearing Loss: A Case Report

KEY WORDS: Automated peritoneal dialysis; APD; hearing loss; warning signal.

According to a Japanese annual report published in 2010, 3,453 patients underwent automated peritoneal dialysis (APD) using cyclers that year (1). The main advantage of APD is that daytime activities become dialysis-free because the dialysis is performed during sleep time. However, it is difficult to introduce APD in end-stage kidney disease (ESKD) patients with hearing loss because they would not hear the audible alarm signals. We report a case of an ESKD patient with hearing loss who used APD with a vibrating watch messaging system.

CASE DESCRIPTION

The patient was a 39-year-old Japanese man with ESKD complicated by mitochondrial myopathy, encephalopathy, lactic acidosis, and stroke-like episodes (MELAS syndrome). At the age of 33, he had developed progressive hearing loss that required a hearing aid. Laboratory examination showed deterioration of renal function (serum creatinine concentration 1.5 mg/dL) and a renal biopsy was performed to diagnose the disease. Electron micrographs revealed accumulation of abnormally enlarged mitochondria with complex cristae inclusions observed in the renal tubular epithelial cells. Furthermore, molecular genetic testing by polymerase chain reaction (PCR) had demonstrated the presence of the A3243G point mutation of the mitochondrial tRNA^{leu} gene in peripheral blood leukocytes. From these results, he was finally diagnosed with MELAS syndrome. The deterioration of renal function could not be suppressed, and ESKD gradually developed (serum creatinine concentration 9.0 mg/dL). Although his hearing loss was suitable for cochlear implant surgery, the patient and his family did not wish to have the surgery performed.

We explained renal replacement therapy to the patient and his family, and they chose peritoneal dialysis (PD) as the dialysis modality. At the age of 39, the patient received PD catheter implantation surgery by the embedded catheter technique (2). Moreover, the patient hoped to utilize APD in order to continue his work. During training, we found that the patient could not hear the warning alarm of the APD cycler. We therefore tested the application of the SilWatch (Tokyo Shinyu Co., Ltd., Tokyo, Japan), which is used as a communication tool for patients

with hearing loss (3). SilWatch is a watch-type receiver that generates vibrations as an alert when it receives information via radio transmission. The transmitter device is capable of detecting an audio signal and creating the radio transmission (Figure 1). After obtaining informed consent from the patient, we tested the reaction of the patient using this system while he was sleeping during his hospital stay. First, we had to adjust the alarm sound volume of the cycler so that the transmitter could receive it. We chose the Baxter HomeChoice Peritoneal Dialysis Automated Cycler Machine (Baxter Ltd., Tokyo, Japan). The prescription was for 9 hours for each treatment, based on a 2-L (glucose-based PD solution) dwell volume. The frequency of exchange was 2 cycles at the start. The transmitter was placed near the cycler, and the patient wore the watch-type receiver on his wrist. The watch-type receiver would vibrate on sensing the signals at the maximum sound level of the cycler. We randomly set the alarm during the patient's sleeping period for several days to observe the patient's reactions. Currently, the patient responds to the warning sound, awakens, deactivates the alarm, and takes any necessary corrective action to resume the therapy. Since the patient was discharged, the alarm has been activated twice monthly and the patient has awakened and resolved the alarm issue. The patient's hearing ability has progressively deteriorated since the initiation of APD, but he is still able to work as before using the APD system with the SilWatch.

Figure 1 — The SilWatch system (Tokyo Shinyu Co., Ltd., Tokyo, Japan) is used as a communication tool for patients with hearing loss. The left item is a watch-type receiver, the central item is a transmitter, and the right item is a battery charger for the receiver (<http://www.shinyu.co.jp/english/products.html>).

DISCUSSION

It is well known that auditory ability deteriorates with aging, centered on high-frequency hearing loss (4). In addition to aging, diabetes, the most common primary disease of patients on dialysis, is often complicated by hearing loss (5). Additionally, other ESKD patients have hearing loss due to impairment that can be drug-induced or inherited. The present patient had MELAS syndrome, which is a rare inherited disease. There are reports in the literature of adult patients on maintenance hemodialysis for treatment of ESKD due to MELAS syndrome (6). On the other hand, there have been very few reports concerning adult patients with ESKD due to MELAS syndrome who are treated with continuous APD (7,8). Additionally, there have been no previous reports of adult patients introduced to APD. Hameed *et al.* reported a case of a boy who was introduced to APD due to a mitochondrial disorder with hearing loss (9). However, the boy is 6 years old, and is unlikely to perform APD without assistance from a hearing adult.

Various assistive listening devices (ALDs) are available to improve the quality of life of patients with severe hearing loss. For example, methods of converting the auditory signals of doorbells and telephones to optical signals have been developed; these devices are already available in the marketplace. However, it is difficult to detect optical signals during sleep. Kushner *et al.* reported a hearing-impaired patient who was introduced to APD using ALDs with a vibration function (10). However, the Kushner report contained no patient details, such as age, gender, or underlying disease. The present report is the first to provide detailed background information on the introduction of APD to an ESKD patient with hearing loss.

In conclusion, the SilWatch is effective for use in conjunction with APD by ESKD patients with hearing loss. We expect that the quality of life of patients with hearing loss will be improved by this method in the future. This experience suggests that novel techniques can remove hearing-loss as an impediment to the use of APD and that hearing-impaired patients can be considered candidates for APD.

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The authors have no financial conflicts of interest to declare.

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