The effect of different membranes on sleep rhythm in hemodialysis patients

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The subjective evaluation of sleep and the effects of different membranes used during hemodialysis on sleep rhythm has been investigated on 23 male and 10 female subjects at the Hemodialysis and Transplantation Unit of Türkiye Yüksek İhtisas Hospital. The patients were divided into two different groups according to the membranes used. The first group consisted of15 cases that hava undergone hemodialysis with bicarbonate dialysate and high-flux polysulphon membranes. The second group of cases included 18 patients that had hemodialysis with acetate dialysate and low-flux cuprophan membranes. There were no statistical differences between two groups when mean ages, the time of dialysis, routine biochemical tests and the modes of medical therapy were compared. Frequent wake-ups, nihgtmares, fear and anxiety were met 40% in the first group, while these sleep rhythm disturbances were met in the 61% of cases in the second group and the difference was statistically significant ($p<0.05$). As a conclusion, we believe that utilisation of synthetic membranes with biocompatible properties compared to cellulose membranes, and the prevention of hypoxia during and after the hemodialysis may lower the frequency of sleep rhythm disturbances. [Turk J Med Res 1995, 13(5): 198-200]

Key Words: Hemodialysis, Sleep rhythm, Polysulphon, Cuprophan

Sleeping is a period that serves to an existing aim with its specific properties which happens with the active interference of the nervous system as a result of many neurohumoral and neurochemical changes (1-3).

The main property of the deep sleep periods is the continuing regulation of autonomic nervous system on the metabolisms of respiration, heart, brain and other systems (4,5). Growth hormone is secreted, synthesis of proteins are increased, the metabolic rate and some of the physiologic activities are decreased in general (6).

Almost there is not any study in the literature about the sleep rhythm disturbances in hemodialysis patients. In this study, the subjective evaluation of the sleep and the effects of different membranes on sleep rhythm was investigated.

MATERIALS AND METHODS

The patients were divided into two groups according to the membrane used during hemodialysis. The first group consisted 5 female and 10 male., total 15 patients whose mean age was 38.8 years (22-52) and mean duration of dialysis was 32.6 months (6-64). In this group High Flux Polysulphon (1.25 m^2) membrane and bicarbonate dialysate have been used. Blood flow rate was (QB) 250 ml/min, dialysate flow rate was (QD) 500 ml/min. Dialysis program of 3 times in a week with' 4 hour sessions were applied.

The second group of patients consisted 6 female and 12 male, total 18 cases with a mean age of 45 years (19-71) and mean duration of dialysis 18.6 month (9-43). Cuprophan membranes (1 m^2) and acetate dialysate have been used with blood flow rates (QB) of 250 ml/min and dialysate flow rates (QD) of 500 ml/min. The same dialysis program was used.

The comparisons of sleep rhythm disturbances between two groups were based on the subjective evaluation of the patients complaints such as sleeplessness, hard time to fall asleep, frequnt wake-ups, frequent nightmares, morning fatigue.

RESULTS

There were no statistically significant differences between two groups, when sex distribution, age, duration of dialysis, blood biochemistry and the mode of the medical therapy.

Received: April 20,1995 **Accepted:** July 15,1995

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Sleep rhythm disturbances were observed in 52% (n:17) of the whole 33 patients (Figure 1). When the distribution of sleep rhythm disturbances between groups were investigated, it was found to be more frequent in the second group. In the first group, this phenomenon was met in 40% (n:6), whereas the same complaints were met in 61% (n:11) in the second group ($p<0.05$).

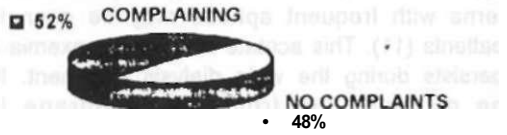

Figure 1. Sleep Rhyhm disturbances in hemodialysis patients

DISCUSSION

Even though there have been a considerable incerase on the investigations of mechanisms of sleep, the sleep rhythm disturbances of hemodialysis patients were not investigated thoroughly.

The studies of Manzo et al. revealed that, the complaints such as frequent wake-ups, nightmares and anxiety were met much more often on the day of the dialysis. They believe that this is the result of the incerased clearance of the substances that causes sleeping (7). Their findings also imply the more frequent sleep disturbances in the cuprophan membrane group, which is compliant with our study.

When the permeability differences of the two membranes are taken into account, the clearance of the substances that causes sleep would be much higher with polysulphon membranes. The observations on hemodialysis patients are inconsistent with this idea. They usually fall asleep as soon as they are connected to the hemodialysis machines. This finding may suggest the incerased clearance of the substances that may cause sleep rhythm disturbances.

The death fear, anxiety of being dependent to machines for living and depressions are frequently met in the cases that are recently taken into the hemodialysis programmes. Also, the dietary irregularities that cause weight gain of the patients and the organic symptoms on the night prior to the hemodialysis might be the reasons for the subjective sleep disturbance complaints. The respiratory comfort and the security feelings cause immediate sleeping of cases when connected to the hemodialysis machines that suggests that the psychological disturbances might be the reason for the sleep rhythm disturbances.

The studies of Decostanzi et al. revealed decreases of blood rubidium and bromine levels in hemodialysis patients compared to healthy individuals (8). Also, post-dialysis blood bromine levels were found to be lesser. The rubidium and bromine levels were found to be the least in brain tissue when the tissue levels of these substances were measured in brain, bone, skin and spleen (8). It is suggested that the increased clearance of trace elements such as rubidium and bromine may also play a role in the development of sleep rhythm disturbances (8).

Growth hormone is secreted during the deep phase of sleep (9). The blood levies of growth hormone is found very low after the hemodialysis sessions in these patients (9). This was not investigated to be co-related with the sleep rhythm disturbances.

During dialysis with acetate, the opposite concentration gradients for acetate and bicarbonate results in acetate being transported into the blood and bicarbonate out of the blood. This can be measured in blood as an increase of plasma acetate and a recrease of plasma bicarbonate, accompanied by a lowered pH and pC02. The oxygen consumption should normally be compensated by increased respiration. However, during acetate metabolism, the respiratory drive is reduced, because carbon dioxide is metabolically consumed in the activation of acetate. In addition, carbon dioxide and bicarbonate are lost in the dialyser by diffusion into the dialysate. Taking all this into account, the respiratory quotient becomes too low to drive respiration. And hypoventilation with mild

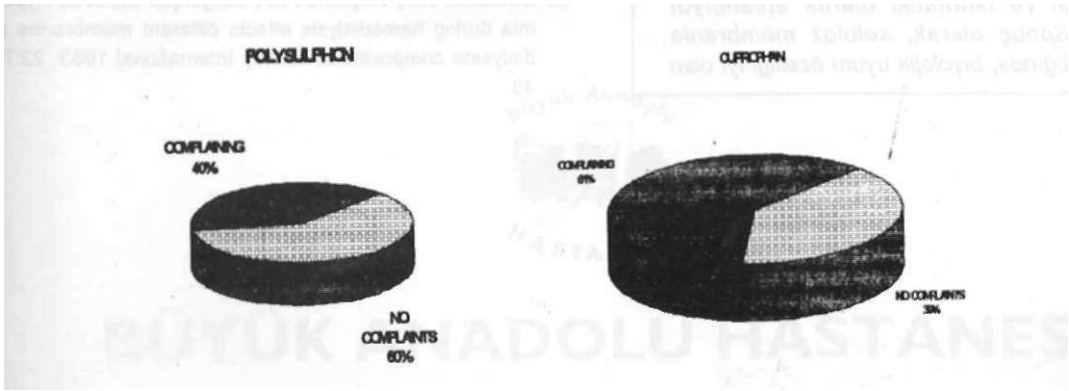

Figure 2. Sleep rhythm disturbances according to different membranes used during the hemodialysis

hypoxemia are the results (10). Irregular breathing patterns with frequent apneas may be seen in these patients (11). This acetate induced hypoxemia normally persists during the wole dialysis treatment. It should be distinguished from the membrane induced hypoxemia which is an early phenomenon and is caused by pulmonary plugging with leukocytes after the activation of the complement systems (12). The combination of low complement activating membranes (synthetic membranes) and bicarbonate produces the least hypoxemia, whereas using a high complement activating membrane (cellulose membranes) and acetate give the most severe hypoxemia (12).

In our study, the sleep rhythm disturbances was found less (40%) in the polysulphon membrane and bicarbonate dialysate group when compared with the other group.

As a conclusion, we believe that biocompatible properties of synthetic membranes and the avoidance of hypoxemia, with bicarbonate dialysate helps to improve the sleep rhythms.

Even though, there have been precious step taken, it has not been possible to reach the mysterious world of sleep.

Hemodiyaliz hastalarında çeşitli membranların uyku ritmine etkisi

Türkiye Yüksek İhtisas Hastanesi Hemodiyaliz ve Transplantasyon ünitesinde yirmi-üç erkek on kadın bireyde çeşitli memranların uyku ritmine olan etkisi ve uykunun sübjektif değerlendirmesi yapıldı. Hastalar membranlara göre iki farklı gruba ayrıldı. Birinci grup High-Flux polisulfon membranın ve bikarbonattı diyalizatın kullanıldığı 15 hastayı içermekteydi. İkinci grupta ise 18 hasta vardı ve asetatlı diyaizatla Low-Flux koprofon membran kullanılmıştı. Her iki grup arasında ortalama yaş, diyaliz zamanı, rutin biyokimyasal testler ve uygulanan tıbbi tedavi seçenekler açısından fark yoktu. Sık uyanma, kabus, korku ve endişe birinci grubun %40'ında tespit edilirken, ikinci grubun %61'inde tespit edildi ve istatistiki olarak anlamlıydı (P<0.05). Sonuç olarak, selüloz membranla karşılaştırıldığında, biyolojik uyum özelliği iyi olan sentetik membranların kullanımın ve hemodiyalizden sonra ve hemodiyaliz sırasında hipokseminin önlenilmesinin uyku ritim bozukluğu frekansını azaltacağına inanmaktayız. [Turk J Med Res 1995(5);198-200]

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