

Water chlorine concentration used for hemodialysis in hospitals of Recife city, Pernambuco*

Cloração da água utilizada nas sessões de hemodiálise em hospitais da cidade do Recife-Pernambuco

Cloración del agua utilizada en las sesiones de hemodiálisis en hospitales de la ciudad de Recife-Pernambuco

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ABSTRACT

Objective: To evaluate the use of recommendations and the water chlorine concentration used for hemodialysis in hospitals of Recife City, Pernambuco. **Methods:** This retrospective study reviewed documentations of water chlorine concentration for hemodialysis in 8 hospitals from August 2006 to May 2008. Water chlorine analysis was performed with orthotolidine 0.1% at the beginning of the hemodialysis. **Results:** Of the 3.781 samples of water assessed, only 840 samples (22.2%) had an adequate concentration of Chlorine (0.2 to 0.5 ppm). The majority of the samples (2.849, 75.4%) had chlorine concentration above the recommended criteria. Only a small number of samples (92, 2.4%) had no chlorine in the water. **Conclusion:** Findings indicated significant variability in water chlorine concentration for hemodialysis, suggesting the need for strict regulations of dialysis services to promote quality care and safety to patients on hemodialysis. **Keywords:** Hemodialysis; Chlorine/analysis; Water/analysis

RESUMO

Objetivo: Avaliar a cloração da água fornecida por hospitais da cidade do Recife-Pernambuco, para a realização de hemodiálise (HD) intrahospitalar, utilizando as recomendações exigidas para os procedimentos dialíticos nas unidades de diálise de pacientes crônicos. **Métodos:** Análise retrospectiva dos registros efetuados sobre o nível de cloro na água utilizada para hemodiálises em oito hospitais dessa cidade, no período de agosto de 2006 a maio de 2008. A análise do cloro era realizada, no momento do início das sessões de HD na água fornecida pelos hospitais em pontos do pré-tratamento (torneira abastecedora) utilizando como reagente a solução de ortotolidina a 0,1%. **Resultados:** Foram realizadas 3.781 aferições. Destas, 840 amostras (22,2%) encontravam-se em níveis considerados adequados: > 0,2 a 0,5 ppm. Em 2.849 amostras (75,4%), os níveis de cloro estavam acima do preconizado pela legislação e em 92 amostras (2,4%) verificou-se a ausência de cloro. **Conclusão:** Observou-se variações significativas nas dosagens de cloro na água fornecida pelos hospitais para a realização de HD intra-hospitalares, reforçando a importância das aferições do cloro antes de todas as HD à beira do leito. Ressalta-se a necessidade de uma regulamentação que oriente os padrões de qualidade da água fornecida para HD intra-hospitalar, visando proporcionar maior segurança aos pacientes atendidos.

Descritores: Hemodiálise; Cloro/análise; Água/análise

RESUMEN

Objetivo: Evaluar la cloración del agua suministrada por los hospitales de la ciudad de Recife-Pernambuco, para la realización de hemodiálisis (HD) intrahospitalaria, utilizando las recomendaciones exigidas para los procedimientos dialíticos en las unidades de diálisis de pacientes crónicos. **Métodos:** Análisis retrospectivo de los registros efectuados sobre el nivel de cloro en el agua utilizada para hemodiálisis en ocho hospitales de esa ciudad, en el período de agosto de 2006 a mayo de 2008. El análisis del cloro se realizaba, al momento de iniciar las sesiones de HD en el agua suministrada por los hospitales en puntos del pre-tratamiento (grifo abastecedor) utilizando como reactivo la solución de ortotolidina a 0,1%. **Resultados:** Se efectuaron 3.781 evaluaciones. De éstas, 840 muestras (22,2%) se encontraban en niveles considerados adecuados: > 0,2 a 0,5 ppm. En 2.849 muestras (75,4%), los niveles de cloro estaban por encima de lo preconizado por la legislación y en 92 muestras (2,4%) se verificó la ausencia de cloro. **Conclusión:** Se observó variaciones significativas en las dosis de cloro en el agua suministrada por los hospitales para la realización de HD intrahospitalarias, reforzando la importancia de las evaluaciones de cloro antes de todas las HD al borde del lecho. Se resalta la necesidad de una reglamentación que oriente los patrones de calidad del agua suministrada para HD intrahospitalaria, visando proporcionar mayor seguridad a los pacientes atendidos.

Descriptorios: Hemodiálisis; Cloro/análisis; Agua/analysis

* Study developed in eight hospitals of the city of Recife (PE), Brazil.

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INTRODUCTION

Patients with renal insufficiency, submitted to hemodialysis (HD), are particularly vulnerable to contaminants in the water used to prepare dialysate or in that used to reprocess dialysers. These patients are exposed to great amounts of water, and they do not have adequate barriers, nor can they eliminate such contaminants, including: aluminum, calcium, chlorine, chloramines, copper, fluorides, magnesium, nitrates, sodium, sulfate and zinc, in addition to bacteria and endotoxins. Water used in HD must have the quality standard required by the *Portaria n.º 82* (Decree n. 82) of the Ministry of Health from January 3rd, 2000, and the *Resolução da Diretoria Colegiada n.º 154* (Resolution n. 154 of the Collegiate Board of Directors) from June 15th, 2004⁽¹⁾.

The use of chlorine to disinfect water began with the application of sodium hypochlorite, obtained from the electrolytic composition of salt. Beginning in 1902, chlorination was adopted in Belgium in a continuous way⁽²⁾. Chlorination processes have evolved throughout time, with the beginning of water chlorination with the application of a small amount of chlorine in 1908. Around 1918, there was a great expansion in the use of liquid chlorine with the use of chloramines and, subsequently, the joint addition of ammonia and chlorine to obtain a residual amount of chloramines. In 1948, there was a more refined chlorination process, with the use of combined and free chlorine and bacteriological control-based chlorination.

Disinfection is the main and most common goal of chlorination, and the words chlorination and disinfection are used as synonyms⁽³⁾. The decrease in the incidence of waterborne diseases was only achieved with the spread of the chlorination technique. Assessment of chlorine in the HD water consists in the measurement of chlorine and chloramine, whose parameters must be 0.5 mg/L and 0.1 mg/L, respectively. Removal of all chlorine from dialysis water is essential for the patient's safety. Patient reactions resulting from inadequate monitoring of water systems used for HD are thoroughly described by the scientific literature^(4,5). Health complications in patients, due to exposure to such substances, were observed, such as hemolysis, hemolytic anemia and methemoglobinemia. Hemolysis can manifest as a symptomatology of pain or thoracic and lumbar discomfort.

Highly suggestive findings of substantial hemolysis also include dyspnea and the "Port wine" color of the venous line blood in the hemodialysis system. If the hemolysis is not recognized early, severe hypercalemia develops, which may lead to death.

OBJECTIVE

The objective of this study was to assess chlorination of the water supplied by hospitals of the city of Recife (PE) to perform in-hospital HD, following the recommendations required for dialytic procedures in the units for dialysis of chronic patients.

METHODS

A retrospective analysis of 3,781 records of chlorine levels in the water used for in-hospital HD, made by the nursing team, was performed in eight hospitals of the city of Recife (PE), of which one was public and seven private, between August 2006 and May 2008. Chlorine analysis was made in the water supplied by hospitals where patients were admitted, at the beginning of each HD session. The water collection point was the supplying tap (pre-treatment). For this analysis, an ortho-tolidine solution at 0.1% was used as reagent.

RESULTS

Between August 2006 and May 2008, a total of 3,781 chlorine measurements were made in the water of eight selected hospitals, whose patients were in the HD program, on the edge of bed. Of all these, 840 samples (22.2%) were found to be on levels considered adequate (> 0.2 to 0.5 ppm), according to what is recommended by the *Portaria n.º 82/2000* (Decree n. 82/2000 of the Ministry of Health and the *RDC n.º 154/2004* (Resolution n. 154 of the Collegiate Board of Directors). In 2,849 samples (75.4%), the chlorine levels were above those established by law, of which 989 samples (26.2%) showed levels > 0.5 to 1.0 ppm, 728 samples (19.3%) showed levels > 1.0 to 1.5 ppm, 466 samples (12.3%) showed levels > 1.5 to 2.0 ppm, 436 samples (11.5%) showed levels > 2.0 to 3.0 ppm, and yet 430 samples (6.1%) showed levels > 3.0 to 5.0 ppm. In addition, 92 samples

Table 1 – Amounts of free chlorine found in the water of eight hospitals of the city of Recife (PE), between August 2006 and May 2008

Period	Zero (2.4%)	>0.2 to 0.5 (22.2%)	>0.5 to 1.0 (26.2%)	>1.0 to 1.5 (19.3%)	1.5 to 2.0 (12.3%)	>2.0 to 3.0 (11.5%)	>3.0 to 5.0 (6.1%)	Total of HD (100%)
Aug to Dec 2006	17	176	194	123	51	68	39	668
Jan to Dec 2007	56	381	588	404	244	229	153	2,055
Jan to May 2008	19	283	207	201	171	139	38	1,058
Total	92	840	989	728	466	436	430	3,781

(2.4%) had no chlorine.

DISCUSSION

The importance of adequate water chlorination as a disinfection method, leading to a reduction in the incidence of waterborne diseases is well-known.

Removal of all chlorine from the water used for HD using a specific water treatment process (activated carbon filter and reverse osmosis) guarantees the prevention of exposure to chlorine and chloramine residues for patients.

Until now, there is no specific legislation to regulate the parameters of the water used in in-hospital HDs. The present study followed what is recommended by the above mentioned law⁽⁶⁾ for dialysis units of chronic patients. In cases where water chlorination above the predetermined standards was detected, those responsible for the hospitals were instructed, so that procedures were performed while guaranteeing the patients' health.

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CONCLUSION

There were significant variations in the amounts of chlorine in the water used to perform HD on the edge of bed and supplied by the selected hospitals. In the majority of cases, chlorine levels above those established by specific legislation were observed. Moreover, in some cases, there was no chlorine in the water supplied by the hospitals mentioned (2.4%).

The importance of chlorine measurements before all HDs and the need for regulations on quality standards for the water supplied for in-hospital HD should be emphasized, aiming at greater safety of the patients cared for.

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