ORIGINAL ARTICLE

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Hospital admission and early readmission rates in haemodialysis patients

Internamento hospitalar e reinternamento precoce em doentes em hemodiálise

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ABSTRACT

Rationale More than 35% of all haemodialysis (HD) patients admitted to a hospital are readmitted in the next 30 days after discharge, with high morbidity, mortality and costs. It is suspected that serious flaws in fluid and anaemia management during the hospitalization, which are not detected and corrected upon re-entry in the outpatient programme, can be a cause. We tried to quantify this phenomenon and clarify its causes and opportunities for prevention.

Patients and Methods Retrospective registry study including all patients of NephroCare Portugal network that were submitted to a hospital admission (admission 1) during 2013 and 2014. Two groups were identified: Group A – Patients that had a new admission (admission 2) in the 30 days after discharge of the index admission (admission 1), Group B – Patients that were not readmitted. Causes for hospital admission: hydration status, haemoglobin values, ESA and dry weight prescriptions, and blood pressure control were analysed pre- and post- hospital admission 1.

Results A total of 4546 patients were included for analysis registering a hospitalization rate of 0.63 episodes/patient-year. The overall 30 days hospital readmission rate was 34.9% (22.9% in 2013 and 44.7% in 2014).

In Group A, with 634 first admissions, there was a significant difference between the normohydrated weight as determined by BCM before and after the first admission: Average weight 65.6 (± 14.7) vs. 63.7 (± 13.9)kg, $p < 0.0001$ (CI 2.2 – 1.5), as well as a difference between the prescribed dry weight pre- and post-admission: 65.9 (± 14.0) vs. 64.6 (± 13.8)kg, $p < 0.0001$ (CI 1.6 – 1.2). In group B there was a significant difference between the normohydrated weight as determined by BCM before and after the index admission: Average weight 65.6 (± 14.6) vs. 64.3 (± 14.3)kg, $p < 0.0001$ (95% CI 1.1 – 1.6), as well as a difference between the prescribed dry weight pre- and post-admission: 65.6 (± 14.1) vs. 64.7 (± 14.0)kg, $p < 0.0001$ (95% CI 0.8 – 1.1).

All patients in Group A and 46.9% of those in Group B were severely overhydrated (› 15%) after discharge from the index admission, Dry weight was decreased in that month in 72% of Group A patients and in 39.1% of Group B, leaving 28.1% of patients in group A without a proper prescription and only 7.8% in Group B.

Differences between the two groups for anaemia treatment and B.P. measurements were not clinically relevant.

Conclusions The 30 day-Hospital readmission rate is extremely elevated. In the present series, the best opportunity for prevention of these readmission events seems to be a better fluid management immediately after discharge.

Key-Words: Haemodialysis; hospital admission.

RESUMO

Fundamento Em algumas series, mais de 35% de todos os doentes tratados por hemodiálise, que estiveram internados num hospital, são readmitidos nos 30 dias após a alta, com elevadíssima morbilidade, mortalidade e custos económicos. Pensa-se que este problema preocupante possa estar associado a deficiências no manejo do estado de hidratação, no tratamento da anemia, ou até do metabolismo mineral, que não corrigidos precocemente após retorno à sua unidade de diálise de ambulatório. Tentámos quantificar este fenómeno e clarificar as suas causas e oportunidades de prevenção.

Doentes e Métodos Estudo retrospectivo, baseado em registo, incluindo todos os doentes tratados na rede de clínicas NephroCare Portugal que foram submetidos a um internamento hospitalar (internamento 1) durante 2013 e 2014. Identificámos dois grupos: o grupo A – que agrupa os doentes que sofreram um reinternamento no período de 30 dias após a alta (internamento 2) do primeiro internamento, grupo B – os doentes que não foram reinternados nesse período. Analisámos os motivos de internamento: estado de hidratação, valores da hemoglobina, prescrições de peso seco e ESA, bem como o controlo da pressão arterial pré e pós o internamento hospitalar inicial.

Resultados Foram incluidos 4546 doentes, que registaram uma taxa de hospitalização de 0.63 episódios / doente.ano. A incidência de reinternamento aos 30 dias foi de 34.9% (22.9% em 2013 e 44.7% em 2014).

Quer no grupo A como no grupo B, com 634 e 1179 internamentos respectivamente, notou-se uma diferença significativa entre o peso normohidratado determinado por bioimpedância antes e após esse internamento, bem como no peso seco prescrito antes e após a hospitalização.

Todos os doentes no grupo A e 46.9% dos do grupo B apresentavam hiperhidratação severa (› 15% do volume extra-celular considerado normal) após a alta do internamento index. Após a alta desse internamento, a prescrição do peso seco foi diminuida nos 30 dias que se lhe seguiram em 72% dos doentes do grupo A e em 39.1% dos doentes do grupo B, deixando 28.1% dos doentes do grupo A e 7.8% do grupo B sem a correcção atempada e apropriada do peso seco.

As diferenças entre os 2 grupos no tratamento da anemia e control da pressão arterial não foram clinicamente relevantes.

Conclusões A readmissão hospitalar nos 30 dias após a alta é extremamente elevada entre nós. Na nossa experiência, uma melhoria mais enérgica e tempestiva do manejo do estado de hidratação parece constituir a melhor oportunidade de prevenção.

Palavras-Chave: Hemodiálise; internamento hospitalar.

INTRODUCTION

The issue of re-hospitalization was recently raised by the U.S. Affordable Care Act that made its "Readmission reduction program" a high priority based on the report by Jencks and co-workers that revealed inadequate care coordination in hospital discharges, resulting in an approximately 20% readmission rate within 30 days of all hospital discharges[1].

Data from the US Renal Data System (USRDS) showed an overall re-hospitalization rate for patients

with ESRF of 34 to 36% within 30 days of discharge[2], meaning that, in the US, an end-stage renal disease (ESRD) patient treated by dialysis is admitted to the hospital on average two times per year, with high morbidity, increased mortality compared to the index admission and staggering costs.

It is suspected that serious flaws in fluid, anaemia and mineral metabolism management during the hospitalization, which are not detected and corrected upon re-entry in the outpatient programme, as well as poor transition of care from inpatient to outpatient status could be causing this events[3].

The author thought he should quantify this phenomenon in this country, clarify its causes and opportunities for prevention.

PATIENTS AND METHODS

This is a retrospective, registry-based study. All patients of NephroCare Portugal network that were submitted to a hospital admission (admission 1) during 2013 and 2014 were analysed. The number of hospitalization episodes/patient-year were recorded for those 2 years.

Data was extracted from our EuCliD© (Fresenius Medical Care – Bad Homburg) database.

Two groups were identified: Group A – Patients that had a new admission (admission 2) in the 30 days after discharge of the index admission (admission 1); Group B – Patients that were not readmitted in that period.

For each group it was registered:

- Cause of the index admission (admission 1) in both groups
- Cause of the readmission (admission 2) in group A
- Hospital admission causes were grouped in the following classes: i) Congestive heart failure, ii) Coronary heart disease, iii) Stroke, iv) Vascular access infection, v) Other infections, vi) Haemorrhage, vii) Other causes.
- Last assessment of the hydration status by bioimpedance spectroscopy using the BCM© module (Body Composition Monitor, Fresenius Medical Care, Bad Homburg, Germany)(4) in the month before admission 1 and the BCM result in the 1st month after discharge (recommended normohydrated weight was recorded). Fluid management using BIS as determined by BCM is a fully validated bedside clinical tool[5].
- Dry weight prescribed by the attending nephrologist before admission 1 and before admission 2 in group A, or at 30 days in group B.
- Last haemoglobin value pre-admission 1 and Hb before admission 2 in group A, or at 30 days in group B.
- ESA dose before admission 1 and before admission 2 in group A, or at 30 days in group B.
- Systolic blood pressure (SBP) pre-HD in the day of both BCM measurements.

ANALYSES: BCM normohydated recommendation weight, dry weight prescribed, haemoglobin and systolic blood pressure values in each patient pre- and post- the index admission were compared through the paired samples *t*-test for groups A and B, and the Δs for all these parameters (pre- vs. post- admission) were compared between group A vs. group B through an independent samples *t*-test.

Patients who after hospital discharge, the 2nd BCM value shows an overhydration › 15%, or had Hb drop below 9gr/dl, were checked for changes in dry weight and ESA prescriptions, and, if the response was more effective in group A than in group B.

RESULTS

In the beginning of 2013, 4546 patients were being dialyzed in NephroCare clinics around the country and were included for follow-up. A hospitalization rate of 0.63 episodes/patient-year was registered. In 2014, 4523 patients were being dialyzed, generating 0.62 episodes of hospitalization/patient-year.

The overall 30 days hospital readmission rate was 34.9% (22.9% in 2013 and 44.7% in 2014).

Causes of hospital admission are pointed out in Table I. Overall, infections and, in particular, vascular access infections were the major causes in both years, only 24% were due to cardio/cerebro vascular causes.

Table I

Causes of hospital admission in groups A and B

GroupA								GroupB		
2013				2014						
#	Admission 1 Causes	Admission 2 Causes	#	#	Admission 1 Causes	Admission 2 Causes	#	Admission Causes	2013	2014
6	**Congestive heart failure**	Other infections	1	6	**Congestive heart failure**	Stroke	6	**Congestive heart failure**	18	16
		Stroke	5	6	**Stroke**	Other infections	1	**Stroke**	24	10
13	**Stroke**	Other causes	2			Stroke	5	**Coronary heart disease**	25	9
		Other infections	2	16	**Coronary heart disease**	Other causes	1	**Hemorrhage**	24	13
		Stroke	9			Other infections	2	**VA Infection**	96	48
10	**Coronary heart disease**	Other causes	2			Stroke	12	**Other infections**	125	64
		Stroke	8			VA Infection	1	**Other causes**	428	279
14	**Hemorrhage**	Other causes	3	18	**Hemorrhage**	Hemorrhage	1	**Grand Total**	**740**	**439**
		Other infections	1			Other infections	5			
		Stroke	10			Stroke	12			
25	**VAInfection**	Other causes	4	36	**VA Infection**	Other causes	4			
		Other infections	2			Other infections	3			
		Stroke	10			Stroke	11			
		VA Infection	9			VA Infection	18			
58	**Other infections**	Other causes	6	61	**Other infections**	Other causes	7			
		Other infections	22			Other infections	27			
		Stroke	26			Stroke	25			
		VA Infection	4			VA Infection	2			
153	**Other causes**	Other causes	32	212	**Other causes**	Hemorrhage	2			
		Other infections	15			Other causes	37			
		Stroke	98			Other infections	14			
		VA Infection	8			Stroke	151			
	Grand Total		**279**			VA Infection	8			
					Grand Total		**355**			

In a qualitative assessment it is interesting to note that for all causes of first hospital admission, stroke, and not a cardiovascular event, was one of the most common cause for the second hospital admission, along with other infections.

In Group A, with 634 first admissions, there was a significant difference between the normohydrated weight as determined by BCM before and after the first admission: Average weight 65.6 (± 14.7) vs. 63.7 (± 13.9)kg, $p < 0.0001$ (95% CI 2.2 – 1.5), as well as a difference between the prescribed dry weight pre- and post-admission: 65.9 (± 14.0) vs. 64.6 (± 13.8) kg, $p < 0.0001$ (95% CI 1.6 – 1.2).

There was also a significant difference between the haemoglobin value pre- and post-admission: 10.3 (±1.7) vs. 9.9 (± 1.6) gr/dl, $p < 0.0001$ (95% CI 0.5 – 0.3), but no significant differences between systolic blood pressures before and after admission.

The same pattern was found in group B, with 1179 hospital admissions.

There was a significant difference between the normohydrated weight as determined by BCM before and after the index admission: Average weight 65.6 (± 14.6) vs. 64.3 (± 14.3)kg, $p < 0.0001$ (95% CI 1.1 – 1.6), as well as a difference between the prescribed dry weight pre and post-admission: 65.6 (± 14.1) vs. 64.7 (± 14.0)kg, $p < 0.0001$ (95% CI 0.8 – 1.1).

There was also a significant difference between the haemoglobin value pre- and post-admission: 10.7 (±1.7) vs. 10.2 (± 1.6) gr/dl, $p < 0.0001$ (95% CI 0.4 – 0.6), but no significant differences between systolic blood pressures before and after that admission 136 (± 27.6) vs. 135 (±27.9) mmHg, $p = 0.053$.

The Δs for the observed parameters, BCM normohydated recommendation, dry weight prescribed,

Table II

Overhydration and anaemia pre and post-hospitalization and prescription changes

		Patientswith:											
	Tot. Hosp.	OH>15(Pre)		Hgb<9(Pre)		OH>15(Post)		Hgb<9(Post)		WeightChanged		ESAChanged	
Group A	**634**	634	100.0%	145	22.9%	634	100.0%	180	28.4%	456	71.9%	204	32.2%
Group B	**1179**	453	38.4%	178	15.1%	553	46.9%	262	22.2%	461	39.1%	273	23.2%

haemoglobin and systolic blood pressure (pre- vs. post-admission) were compared between group A and group B, and a significance difference was found of a larger Δ in group A for the BCM normohydrated value (p = 0.011, 95% Δ CI -0.91 to -0.11) and dry weight prescribed (p < 0.001, 95% Δ CI -0.66 to -0.23) and no significant difference for haemoglobin and SBP.

All patients in group A and 46.9% of those in group B were severely overhydrated (> 15%) after discharge from the index admission, dry weight was decreased in that month in 72% of group A patients and in 39.1% of group B, leaving 28.1% of patients in group A without a proper prescription and only 7.8% in group B (Table II).

Haemoglobin dropped below 9gr/dl post-hospital discharge in 28.4% of all patients in group A and in 22.2% of those in group B, ESA prescription was changed in 32.2% in group A and in 23.2% in group B, an identical correction acumen.

DISCUSSION

Hospital readmissions among dialysis patients are a significant burden for patients, providers and the healthcare system. Most of the responsibility for preventing readmissions has been placed on the hospital care, however, there is compelling evidence that other care providers, including nephrologists and dialysis facilities must contribute to decreasing this readmission rate as well.

Chan *et al.*[5] reported a significant decrease in re-hospitalization rates among dialysis patients whose vitamin D was administered, as well as haemoglobin levels were monitored and ESA doses adjusted within a week of hospital discharge. Also, in a recent paper, Erickson *et al.* showed that an extra clinical visit to a dialysis patient by his nephrologist in the first month after discharge reduced the absolute probability of 30 days hospital readmission by 3.5% (95% CI 1.6 to 5.3%), saving at current Medicare reimbursement rates US$ 240 million per year[6]. The authors suggested that 30-day readmission rate should be part of a pay-for-performance initiative directed toward dialysis units. Actually the US CMS are presently exploring a hospital readmission measure to incorporate into the Quality Incentive Program for dialysis facilities[7]. This performance indicator would be expressed as a standardized readmission ratio (SRR) of the observed number of readmissions in a dialysis facility divided by the case-mix adjusted expected number of readmissions for that facility, accounting among other variables for age, nutrition status, comorbidities, discharge diagnosis, number of days of the index hospitalization. This performance indicator, however, still needs a lot of fine-tuning. This paper follows closely on a report from the DOPPS, showing that frequency and duration of patient-physician contact in haemodialysis units also affects mortality[8]. In the experience of others, the highest rates of readmission within the first 30 days after discharge occur in the first 7 days (36%) and gradually decline with subsequent days after the initial hospitalization[5], suggesting that the greatest benefit from the nephrologist visit occurs within the first few days after hospital discharge.

In the present series, the surprisingly huge overall 30-day readmission rate of 35% was identical to reports from the U.S.[2]. These figures include frail patients, with repeated hospital admissions, that should probably have been introduced to the concept and planning of conservative treatment, but also includes unduly and precipitous hospital discharges of unstable patients, severe infections not completely

treated, with logistic flaws interrupting antibiotic courses initiated in-hospital, as well as those cases in which that hospital readmission could have been prevented at the dialysis unit level.

In a registered-base study parameters that were already identified as culprits of this situation by other groups were focused on and, somehow, could be modified and, that way, preventing a few hospital readmissions.

All patients in the group that was readmitted in the first 30 days after discharge (A) and 46.9% of those that were not readmitted within 30 days (B) were severely overhydrated (extra-cellular water 15% above the normohydration value as determined by the BCM module) after discharge from the index admission. Normohydrated weight decreased on average 2kg from pre- to post-index admission in group A and 1.3kg in group B.

Dry weight was decreased in that month in 72% of group A patients (on average dropped 1.3kg) and in 39.1% of group B (on average dropped 0.9kg), leaving 28.1% of patients in group A without a proper prescription change and only 7.8% in group B. Although most readmission causes were not directly related to fluid overload, overhydration is known to be associated with mortality through mechanisms other than cardiac morbidity (....).

There was also a significant drop of haemoglobin of 0.5gr/dl from pre- to post-index admission, both in groups A and B, probably without clinical relevance, but that was efficiently corrected in the ensuing 30 days. No significant changes in blood pressure peri-hospital admission.

Medication reconciliation after hospital discharge is critical, crossing all aspects of care. Patients with ESRF are prescribed an average of 11-12 medications, an average of 17 to 25 doses per day, a huge source of confusion, interactions and adverse effects. Patients come in with hospital prescriptions, prescribed by physicians frequently not aware of the pre-admission medication list, sometimes duplicating the same medication patients were already taking under different names (brand name, generics, copies...), so when returning to the dialysis unit a "resume previous orders" approach may prove to be quite dangerous[7,8].

Also in this same reasoning it is very important to obtain the complete discharge information that is not always provided by the patient. In a population like ours, in which infection continues to be the major cause of hospital admission, a common miss regards information on antibiotic treatment began during the hospital stay and needing continuation as an outpatient, that is accidently interrupted. Another issue to be addressed in early post-hospital discharge care relates to nutritional deterioration of patient status in the hospital. The frailty and precarious nutritional status of dialysis patients is well known and hospitalization adds to that burden. The prescription of oral nutritional supplements as early as possible after the return to the dialysis unit, appears to significantly reduce mortality and hospitalization rates[9].

In summary, reviewing the available literature, strategies probably useful to reduce the staggering re-hospitalization rate in dialysis patients include: Effective hospital discharge communication between the hospital attending nephrologist and the dialysis unit (always obtain the hospital discharge note), formal patient evaluation by the nephrologist in the dialysis unit in the first 5 days after return, objective assessment and correction of the dry weight and nutritional status, vascular access performance review, laboratory assessment of haemoglobin and phosphorus, and finally a thorough medication reconciliation of prescribed drugs by discharging hospital and the previous outpatient medication in the dialysis unit[9-11].

In the author's experience, thorough fluid management with rigorous adjustment of dry weight seemed to be the most crucial item to be corrected upon patient returning from hospitalization, although he values intangible aspects detected in a formal doctor-patient consultation that cannot be quantified, but once corrected may make the difference in future morbidity.

Reducing the high rates of re-hospitalization in ESRF patients is certainly in the best interest of patients, of referring hospitals, and the financial interests of the dialysis unit, on average there were 2000 dialysis treatments lost per year only in patients readmitted in the first 30 days after discharge in the NephroCare Portugal network, therefore deserving an extra effort by all the stakeholders.

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Conflict of interest statement: The author is an employee of NephroCare Portugal.

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