ORIGINAL ARTICLE

Vol. 40 (1): 44-55, January - February, 2014
doi: 10.1590/S1677-5538.IBJU.2014.01.07

Associated factors and prevalence of erectile dysfunction in hemodialysis patients

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ABSTRACT

Purpose: The proposal of this study was to determine the prevalence and the associated factors of erectile dysfunction (ED) among hemodialysis (HD) patients.
Materials and Methods: This was a cross-sectional study based on data collected from HD male patients. Clinical, demographic and laboratory data of all patients were collected in three HD clinics from December 2010 to June 2011. Patients answered questions of erectile function domain from International Index of Erectile Function. Data were evaluated by descriptive analysis and by univariate (ULRA) and multivariate logistic regression analysis (MLRA).
Results: Three hundred and five patients participated of the study. The prevalence of ED was 68.19%. ED was associated with diabetes (DM), benign prostatic hyperplasia, glomerulonephritis as cause of chronic renal failure (CRF), smoking habits, lower creatinine levels (ULRA), use of calcium channel blocker (MLRA), aging, lower education level, alcohol consumption, DM (as cause of CRF) and coronary insufficiency (ULRA and MLRA).
Conclusions: ED was highly prevalent in the HD men. It was independently associated with aging, current use of alcohol, long alcohol use (even for those who do not drink more), lower education level, diabetes as cause of CRF, coronary insufficiency and use of channel blockers calcium.

ARTICLE INFO

Key words:
Renal Dialysis; Erectile Dysfunction; Impotence, Vasculogenic

Int Braz J Urol. 2014; 40: 44-55

Submitted for publication:
January 16, 2013

Accepted after revision:
November 14, 2013

INTRODUCTION

Erectile dysfunction (ED) is a medical problem that alters patient's quality of life due to association with many problems as anxiety, loss of self-esteem, depression and marital misfit (1). The association of chronic renal failure (CRF) with ED is a well known fact (2). The population of CRF patients in hemodialysis (HD) is growing, in part, because of longer survival (3). This fact has highlighted the importance of quality of life of the HD patients (4), including the erectile function (EF).

The prevalence and determinants of ED are highly variable among HD patients. The determinants are not fully known and the prevalence ranges from 43 to 87% (5-13). These facts occur due to the lack of standardization of assessment of ED by previous researches (8-10).

In 1997, Rosen et al. reported the International Index of Erectile Function (IIEF) (14). This instrument has been shown to be a cross-culturally and psychometrically valid measurement of male ED. It is a brief, reliable, and valid self-administered questionnaire that standardizes

ED evaluation and allows the determination of the prevalence of this disorder.

In this study, we aimed to determine the prevalence and the associated factors of ED among HD patients.

MATERIALS AND METHODS

This was a cross-sectional study based on data collected in three HD centers, from December 2010 to June 2011. The HD centers are not linked or associated with each other or any University; they provide services for patients in the public health system and patients with and without health insurance and perform dialysis of approximately one third of the hemodialysis population of Goiânia, Brazil.

The present study was approved by the Ethics Committee of the Federal University of Goiás Clinical Hospital (under registration nº. 090/2011). Patients included in this work were male voluntary with 18 years of age or older undergoing HD therapy for at least three months. Patients were excluded if they did not complete the EF domain from IIEF, refused to participate in the study, did not sign the consent form or had cognitive or communication impairment.

The six questions of EF domain from IIEF (13) were self answered by each patient during HD sections. This study used the translated Portuguese version of the IIEF. The score for each item ranges from 0 to 5 for questions 1-5 and from 1 to 5 for the question 15. The severities of ED were defined as follows: normal (no ED): 25-30, mild: 19-24, mild to moderate: 13-18, moderate: 7-12, and severe: 1-6 (according to IIEF-1997).

It was considered the diagnosis of comorbidities. Clinical data described in this work were obtained from review of medical records. They included: body mass index (BMI), etiology of CRF, time on HD, presence of hypertension, Diabetes Mellitus (DM), heart or prostate diseases and current medications used.

The following socio demographic variables were collected from each patient in an interview during HD: age, civil status, education level, history of illegal drugs use, cigarettes or alcohol use.

Laboratory parameters were obtained by blood samples at midweek dialysis. These samples were collected up to 30 days before patient's interview. Laboratory data included: creatinine, hemoglobin, hematocrit, triglycerides, low density lipids (LDL)-cholesterol, high density lipids (HDL)-cholesterol, total cholesterol, albumin and parathormone (PTH) levels. To ascertain the adequacy of dialysis prescription for each patient, dialyzer clearance of urea X dialysis time/volume of distribution of urea (Kt/V) was estimated, using laboratory results gathered from chart review of the previous month to the study.

The data were tabulated on Microsoft® Excel 2007 and evaluated by Statistical Package for the Social Sciences (SPSS) 15 for Windows. A descriptive analysis of score of EF domain from IIEF and of the clinical, socio demographic and laboratory data from all patients was carried out. Continuous variables were divided into categories to facilitate analysis (categorical variable). All variables were evaluated by the proportion in each category. The univariate logistic regression analysis (ULRA) was performed on the EF domain from IIEF versus clinical, socio demographic and laboratory data. Those variables in which the ULRA had a P value less than 0.1 were considered for inclusion in multivariable logistic regression analysis (MLRA). Results were expressed as adjusted odds ratios and their 95% confidence interval. Statistical significance was set at $P < 0.05$ in all analysis.

RESULTS

Among 349 eligible patients, 305 (87.39%) participated of this study. Forty-four (12.60%) patients were excluded, 29 (8.30%) did not complete the EF domain from IIEF, 7 (2.00%) refused to take part of the study, 3 (0.85%) refused to sign a declaration of informed consent and 5 (1.43%) had cognitive or communication deficits. The mean ± SD age was 54.09 ± 13.17 years, the schooling time was 7.41 ± 4.60 years and the HD time was 50.65 ± 41.15 months. The underlying etiologies of renal failure of the patients who participated in the study included hypertension (34.42%), Diabetes Mellitus (18.36%),

glomerulonephritis (7.54%), polycystic kidney (5.24%), abuse of medications (3.93%), unknown (24.59%) and others (5.57%).

The prevalence of ED was 68.19%. The degree of ED among HD patients was mild in 9.83%, mild to moderate in 6.22%, moderate in 9.18%, and severe in 42.95% of patients. Among HD patients with ED, 11 (5.88%) received some type of treatment. Nine (4.82%) used oral drugs, 1 (0.53%) intracavernosal drugs and 1 (0.53%) patient received a penile prosthesis.

Most patients (81.31%) were using some antihypertensive. Despite this no antihypertensive drugs (diuretics, adrenergic inhibitors, direct vasodilators, calcium channel blockers, angiotensin converting enzyme inhibitors, angiotensin receptor blockers 1 and direct renin inhibitors) or other medications (erythropoietin, anxiolytic, anticonvulsant and antidepressant) were found to increase the probability of ED on ULRA.

ED was associated with, aging, lower education level (Table-1), history of cigarette use previous or current, duration of smoking (smoking or smoked), being an ex-smoker, higher pack-year index, pattern of high consumption of cigarettes (current or previous) (Table-2), history of alcohol consumption (current and past) current alcohol consumption, longer alcohol consumption (current or previous) (Table-3), the presence of diabetes (regardless of being or not the cause of the CRF), BPH or coronary insufficiency (Table-4), lower creatinine levels (Table-5), DM and glomerulonephritis (as underlying etiologies of renal failure) (Table-6) on ULRA.

Hypertension, history of drug use (previous or current), use of calcium channel blockers or adrenergic inhibitors had P between 0.05 and 0.10 on ULRA, therefore, these variable was assessed by MLRA.

ED was independently associated with aging, current use of alcohol, long alcohol use (even for those who do not drink anymore), lower education level, DM (as cause of CRF), coronary insufficiency and use of channel blockers calcium (Table-7). The aging, DM (as cause of CRF), and

Table 1 - Association of socio demographic data with Erectile Dysfunction in hemodialysis patients.

Socio demographic data	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
Age (years)						
< 50	64	66.0	49	23.6		
≥ 50	33	34.0	159	76.4	< 0.001	6.293 (3.711-10.672)
Marital status						
Single	28	28.9	65	31.3		
Married	69	71.1	143	68.8	0.674	
Body mass index						
< 25	65	67.0	137	65.9		
≥ 25	32	33.0	71	34.1	0.844	
Educational level						
Incomplete elementary education	47	48.5	133	63.9		
Elementary school or up graduate	50	51.5	75	36.1	0.011	1.89 (1.16-3.07)

*Estimated by univariate logistic regression analysis; **ED =** Erectile Dysfunction; **OR =** odds ratio;
P = Statistical significance; **95% CI =** 95% confidence interval.

Table 2 - Association of smoking habits with Erectile Dysfunction in hemodialysis patients.

Smoking habits	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
History of current or previous smoking						
No	54	55.7	85	40.9		
Yes	43	44.3	123	59.1	0.016	1.82 (1.12-2.96)
Active smoker[a]						
No	86	88.7	187	89.9		
Yes	11	11.3	21	10.1	0.741	0.88 (0.41-1.90)
Former smoker[b]						
No	65	67.0	106	51.0		
Yes	32	33.0	102	49.0	0.009	1.95 (1.18-3.23)
Nonsmokers[c]						
No	43	44.3	123	59.1		
Yes	54	55.7	85	40.9	0.016	1.82 (1.12-2.96)
Pattern of current cigarette smoking (smokers)						
Light[d]	7	63.6	14	70.0		
Moderate[e]	3	27.3	5	25.0		
Heavy[f]	1	9.1	1	5.0	0.647	0.76 (0.23-2.49)
Pattern of current cigarette smoking (smokers and former smokers)						
Light[d]	23	53.5	43	35.5		
Moderate[e]	12	27.9	42	34.7		
Heavy[f]	8	18.6	36	29.8	0.045	1.59 (1.01-2.51)
Years of smoking (smoking or smoked)						
< 20	22	51.2	32	26.2		
≥ 20	21	48.8	90	73.8	0.003	2.95 (1.43-6.06)
Pack-year index						
< 20	30	69.8	56	46.3		
≥ 20	13	30.2	65	53.7	0.009	2.68 (1.27-5.63)

*Estimated by univariate logistic regression analysis; [a]Smoked more than 100 cigarettes and currently smoke; [b]Smoked or had smoked up to 100 cigarettes and currently do not smoke; [c]Smoked or had smoked a maximum of 100 cigarettes and currently do not smoke; [d]Smoked more than 100 cigarettes and currently or previously smokes up to 10 cigarettes / day; [e]Smoked more than 100 cigarettes and currently or previously smokes 10 to 20 cigarettes / day; [f]Smoked more than 100 cigarettes and currently or previously smokes more than 20 cigarettes / day; **ED =** Erectile Dysfunction; **OR =** Odds ratio; **P =** Statistical significance; **95% CI =** 95% confidence interval.

Table 3 - Association of habit of use of alcohol and drugs with Erectile Dysfunction in hemodialysis patients.

Parameters	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
History of alcohol use current or previous						
No	12	12.4	51	24.5		
Yes	85	87.6	157	75.5	0.017	2.30 (1.16- 4.55)
Current use of alcohol [a]						
No	70	72.2	182	87.5		
Yes	27	27.8	26	12.5	0.001	2.70 (1.47-4.94)
Former user of alcohol [b]						
No	39	40.2	77	37.0		
Yes	58	59.8	131	63.0	0.593	1.14 (0.70-1.87)
Never used alcohol [c]						
No	85	87.6	157	75.5		
Yes	12	12.4	51	24.5	0.017	2.30 (1.16-4.55)
Pattern of alcohol consumption (current alcohol user)						
Moderate [d]	22	81.5	23	88.5		
Excessive [e]	5	18.5	3	11.5	0.481	1.74 (0.37-8.18)
Pattern of alcohol consumption (former and current alcohol users)						
Moderate [d]	37	43.5	66	41.8		
Excessive [e]	48	56.5	92	58.2	0.792	1.07 (0.63-1.83)
Years use of alcohol (even if already not drink any more)						
< 20	42	49.4	45	28.7		
≥ 20	43	50.6	112	71.3	0.001	2.43 (1.41-4.21)
Current or previous history of illegal drug use						
No	85	87.6	196	94.2		
Yes	12	12.4	12	5.8	0.051	

*Estimated by univariate logistic regression analysis; [a]Currently use alcohol regularly; [b]Currently does not use alcohol but had already regularly used; [c]Never used alcohol. [d]Regular or previously use of alcohol up to 2 doses (350mL of beer or 150mL of wine or 50mL of distilled) / day; [e]Regular or previously use of alcohol, 5 doses / occasion or more / at least 1 time / week or three or more doses daily;
ED = Erectile Dysfunction; **OR =** Odds ratio; **P =** Statistical significance; **95% CI =** 95% confidence interval.

Table 4 - Association of clinical data with Erectile Dysfunction in hemodialysis patients.

Clinical data	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
Diabetes						
No	88	90.7	126	60.6		
Yes	9	9.3	82	39.4	< 0.001	6.363 (3.036-13.339)
Hypertension						
No	21	21.6	51	24.5		
Yes	76	78.4	157	75.5	0.583	
Cardiac arrhythmia						
No	95	97.9	196.0	94.2		
Yes	2	2.1	12.0	5.8	0.168	
Coronary insufficiency						
No	96	99.0	180.0	86.5		
Yes	1	1.0	28.0	13.5	0.008	14.93 (2.00-111.45)
Congestive heart failure						
No	95	97.9	199	95.7		
Yes	2	2.1	9	4.3	0.334	
Cardiac valvulopathy						
No	97	100.0	204	98.1		
Yes	0	0.0	4	1.9		
Other heart diseases						
No	95	97.9	195	93.8		
Yes	2	2.1	13	6.3	0.134	
Benign prostatic hyperplasia						
No	95	97.9	179	86.1		
Yes	2	2.1	29	13.9	0.006	7.70 (1.80-32.95)
Prostate cancer						
No	97	100.0	206	99.0		
Yes	0	0.0	2	1.0		
Time on hemodialysis (months)						
< 48	50	52.1	122	59.2		
≥ 48	46	47.9	84	40.8	0.244	
Long of diagnosis of chronic renal failure(months)						
< 48	38	39.6	88	42.9		
≥ 48	58	60.4	117	57.1	0.584	

*Estimated by univariate logistic regression analysis; **ED =** Erectile Dysfunction; **HD =** hemodialysis; **OR =** Odds ratio; **P =** Statistical significance; **95% CI =** 95% confidence interval.

Table 5 - Association of laboratory values and Erectile Dysfunction in hemodialysis patients.

Laboratory parameters	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
Hemoglobin (g/dL)						
< 10	24	24.7	51	24.5		
≥ 10	73	75.3	157	75.5	0.966	
Hematocrit (%)						
< 30	22	22.7	48	23.1		
≥ 30	75	77.3	160	76.9	0.939	
Albumin (g/100mL)						
< 3.5	3	3.1	9	4.4		
≥ 3.5	93	96.9	195	95.6	0.598	
Cholesterol (mg/dL)						
< 200	75	78.1	150	75.4		
≥ 200	21	21.9	49	24.6	0.603	
Cholesterol LDL (mg/dL)						
< 130	84	89.4	170	87.6		
≥ 130	10	10.6	24	12.4	0.669	
Cholesterol HDL (mg/dL)						
< 40	48	50.0	88	44.4		
≥ 40	48	50.0	110	55.6	0.371	
Triglycerides (mg/dL)						
< 150	47	49.0	85	42.7		
≥ 150	49	51.0	114	57.3	0.313	
Creatinine (mg/dL)						
< 8	15	15.5	66	31.7		
≥ 8	82	84.5	142	68.3	0.003	0.394 (0.211-0.734)
Parathormone (pg/mL)						
< 300	42	43.3	109	52.7		
≥ 300	55	56.7	98	47.3	0.129	
Kt/V						
< 1.2	21	21.6	34	16.7		
≥ 1.2	76	78.4	170	83.3	0.297	

*Estimated by univariate logistic regression analysis; **ED =** Erectile dysfunction; **HDL =** High density lipids; **Kt/V =** Dialyzer clearance of urea X dialysis time/volume of distribution of urea; **LDL =** Low density lipids; **OR =** Odds ratio; **P =** Statistical significance; **95% CI =** 95% confidence interval.

Table 6 - Association of cause of chronic renal failure with Erectile Dysfunction in hemodialysis patients.

Cause of chronic renal failure	Without ED		With ED		P-values*	OR (95% CI)
	n	%	n	%		
Medication abuse						
No	91	93.8	202	97.1		
Yes	6	6.2	6	2.9	0.177	0.45 (0.14-1.43)
Diabetes Mellitus						
No	92	94.8	157	75.5		
Yes	5	5.2	51	24.5	< 0.001	5.98 (2.30-15.51)
Glomerulonephritis						
No	84	86.6	198	95.2		
Yes	13	13.4	10	4.8	0.011	3.06 (1.29-7.26)
Hypertension						
No	57	58.8	143	68.8		
Yes	40	41.2	65	31.3	0.088	1.54 (0.94-2.54)
Polycystic disease						
No	91	93.8	197	94.7		
Yes	6	6.2	11	5.3	0.751	0.85 (0.30-2.36)
Unknown[a]						
No	75	77.3	155	74.5		
Yes	22	22.7	53	25.5	0.597	1.17 (0.66-2.06)
Others						
No	92	94.8	196	94.2		
Yes	5	5.2	12	5.8	0.828	1.13 (0.39-3.29)
Total	97	**100.0**	**208**	**100.0**		

*Estimated by univariate logistic regression analysis; [a]Patients with more than one possible cause of chronic renal failure; **ED =** Erectile Dysfunction; **OR =** Odds ratio; **P =** Statistical significance; **CI =** confidence interval.

coronary insufficiency increased the risk of ED in 5.24, 7.24 and 11.31 times respectively (Table-7). These three variables were those that had the greatest association with ED.

DISCUSSION

A high prevalence of 68.19% of ED in HD patients was found in our work. The prevalence of ED in HD patients has a wide variability among studies (43 to 87.7%) probably due to different methodologies and diagnostic criteria (5-13). The studies used different definitions and tools for ED assessment; some of them had low number of patients, were performed in a single-center evaluation and the populations evaluated differed from each other (6-9,12,13). Despite the great variability of ED in HD patients the most recent studies

Table 7 - Model of Multivariate Regression Logistic Analysis to identify factors independently associated with erectile dysfunction in hemodialysis patients.

Factor	P-values*	OR (95% CI)
Current use of alcohol	0.006	3.25 (1.41-7.51)
Educational level	0.006	2.66 (1.32- 5.37)
Diabetes	0.003	7.24 (1.99-26.36)
Age	< 0.001	5.24 (2.61-10.49)
Calcium channel blockers	0.037	2.26 (1.05-4.84)
Coronary insufficiency	0.025	11.31 (1.35-94.54)
Years of use of alcohol (even if do not drink any more)	0.036	2.28 (1.06-4.90)

*Estimated by multivariate logistic regression analysis; **OR =** Odds ratio; **P =** Level of statistical significance; **95% CI =** 95% confidence interval.

showed high prevalence. Severe ED rate of 42.95% observed in our study is similar to results of previous researches that observed proportions ranging from 25.4 to 45.8% (6,7,10-12).

Similar to our results, several researchers showed association of ED with increased age of HD patients (5-8,10-12,15,16). In the Massachusetts Male Aging Study (17) (2004), the prevalence of ED was strongly and independently associated with age. Despite this, the NIH Consensus Development Panel on Impotence (18) (1993) concluded that since other risk factors for ED appear with aging, ED could not be considered a direct result of aging. One of these age-related risk factors is the presence of atherosclerosis, which is also a known risk factor for ED (19). Atherosclerosis is responsible for the abnormal function and responsiveness of penile vasculature, and it can also contribute to the pathogenesis of ED (16).

There is no consensus about the impact of education status on ED. Although some studies showed no association between education level and ED (7,11), Moreira et al. (19) (2002) found that the education level is inversely correlated to ED and Johannes et al. (21) (2000) reported that the risk of developing age-related ED was higher in men with lower education degree. A possible reason is that poor education can be associated with low socioeconomic background. It is likely that people with lower education have more difficulty to health care access, so these people are subjected to higher rates of comorbidities associated with HD and/or less adequate treatment of uremia itself. Our data showed that independent of other factors, patients with lower education had more ED.

DM is the most common cause of CRF (15), and it is a risk factor for ED (17). As ED occurs in almost all diabetic patients with CRF (7,8) in our work, DM was also an independent risk factor of ED in male HD patients. Causes of ED in DM men are several: vascular disease (22), autonomic neuropathy, gonadal dysfunction, impaired neurogenic and endothelium mediated relaxation of penile smooth muscle (23,24) and additionally HD (6,7,10).

There is an association of ED and cardiovascular diseases (19). Endothelium dysfunction occurs in cardiovascular diseases and it may contribute to the pathogenesis of ED (25). The current study found an independent association between coronary insufficiency and ED.

In the present study, ED was positively and independently associated with current alcohol use and length of consumption of alcohol (past or current). Although individuals may be sexually disinhibited through the use of alcohol, clinical studies have shown that alcohol abuse causes irreversible damage to nerve endings in penis tissue, which is manifested as ED (26).

Rosas et al. (10) (2001) found among HD patients that history of prostatic diseases was a statistically significant predictor of ED in unadjusted analyses. Lue (26) (2000) regards possible association of ED and benign prostatic hyperplasia (BPH), however, Stolic and Bukumiric (19) (2010) indicated that BPH did not constitute significant parameters among ED patients. In the present research, the association between ED and BPH was observed, however, not independently of other factors.

Several researches showed association between ED and cigarette use (27-29). This occurred because smoking causes vasoconstriction in the penile venous plexus and thereby affects contraction of cavernous smooth muscle, which has a negative effect on EF (26). Despite this, other studies did not find this association (8,13,15,16,19). Association between ED and smoking habits (previous or current) not independent of other factors was found in this work.

Although high pre-dialysis creatinine levels significantly associated with sexual dysfunction are frequently reported (5,30), Messina et al. (7) (2007) found that pre-dialysis creatinine levels were significantly lower in patients with ED. Our study showed association between lower creatinine levels and ED only on unadjusted analysis for confounding factors, as in Rosas et al. (10) (2001) study. The decreased creatinine levels in the ED patients may be a reflection of reduced muscle mass in older patients that are most likely to present ED.

No association of ED and PTH in HD patients has been verified in the present work and others (9,11,19). However, Rosas et al. (10) (2001) found lower levels of PTH associated with ED only on unadjusted analysis for confounding factors. In small-scale, studies have been advocating that treatment of secondary hyperparathyroidism may result in significant improvement in sexual function in patients with CRF (31).

Patients with CRF usually do no present significant association between the use of antihypertensive drugs and ED (8,10). On the other hand, in a revision research that lists the principal drugs used by the general population that are associated with ED, antihypertensive drugs were frequently found (32). In the current study it was found an independent association between ED and the use of calcium channel blockers. It is difficult, however, to determine whether the erectile impairment in controlled hypertension is due to the influence of the disease, medications, or both (10).

There are many considerations in this study that limit our findings. First, our sample size was relatively small, so this limits the possibility of detecting some interactions such as ED and obesity or hypertension. Second, this is a cross-sectional study, so it is just possible to establish association links between ED and risk factors without certainty of a causal relation between them. Third, this study did not assess variables that have been linked to ED, such as autonomic neuropathy, peripheral vascular disease, residual renal function and levels of testosterone, prolactin, zinc and thyroid hormones.

CONCLUSIONS

In summary, in this research, the HD men had high prevalence of ED and the main variables associated were higher age, current use of alcohol, long alcohol use (even for those who do not drink more), lower education level, DM (as cause of CRF), coronary insufficiency and use of channel blockers calcium.

ABBREVIATIONS

BMI = body mass index
BPH = benign prostatic hyperplasia
CRF = chronic renal failure
DM = Diabetes Mellitus
ED = erectile dysfunction
EF = erectile function
HD = hemodialysis
HDL = high density lipids
IIEF = International Index of Erectile Function
Kt/V = dialyzer clearance of urea X dialysis time/ volume of distribution of urea
LDL = low density lipids
MLRA = multivariable logistic regression analysis
PTH = parathormone
SD = standard deviation
SPSS = Statistical Package for the Social Sciences
ULRA = univariate logistic regression analysis

CONFLICT OF INTEREST

None declared.

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