

Simge Bardak<sup>a,\*</sup>, Kenan Turgutalp<sup>a</sup>, Ebru Ballı<sup>b</sup>,  
Banu Coşkun Yılmaz<sup>b</sup>, İclal Gürses<sup>c</sup>, Kaan Esen<sup>d</sup>,  
Serap Demir<sup>a</sup>, Ahmet Kiyıkım<sup>a</sup>

<sup>a</sup> Division of Nephrology, Department of Internal Medicine,  
School of Medicine, Mersin University, 33079 Mersin,  
Turkey

<sup>b</sup> Department of Histology and Embryology, School of Medicine,  
Mersin University, Turkey

<sup>c</sup> Department of Pathology, School of Medicine, Mersin University,  
Turkey

<sup>d</sup> Department of Radiology, School of Medicine, Mersin University,  
Turkey

\* Corresponding author.

E-mail address: [bardaksimge@gmail.com](mailto:bardaksimge@gmail.com) (S. Bardak).

2013-2514/© 2016 Sociedad Española de Nefrología. Published  
by Elsevier España, S.L.U. This is an open access article  
under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<http://dx.doi.org/10.1016/j.nefro.2016.08.005>

## Risk factors associated with hernias on peritoneal dialysis<sup>☆</sup>

### Factores de riesgo asociados a hernias en diálisis peritoneal

Dear Editor,

Dialysis fluid in the peritoneal cavity increases intraperitoneal pressure (IPP).<sup>1</sup> This increase in pressure may lead to complications in the abdominal wall, particularly hernias. It may also contribute to the failure of ultrafiltration, and it may be cause of abandonment of the technique.

The aim of the study was to assess the frequency of hernias, identify the risk factors for the development of hernia and to determine whether or not they lead to failure of the dialysis technique.

We studied prevalent patients on peritoneal dialysis at day 01 August 2015 in the Complejo Asistencial Universitario de Leon, in Leon, Spain. We analysed the variables: age; gender; type; time on dialysis; presence of polycystic kidney disease; history of abdominal surgery; diagnosis and repair of hernia before starting dialysis; anthropometric parameters (body mass index (BMI), fat tissue index (FTI) and lean tissue index (LTI) measured by bioimpedance); daytime/sc volume; nocturnal/sc volume; residual volume; and IPP and ultrafiltration measured by a peritoneal equilibration test. We compared the group of patient with hernias with the group without hernias. Continuous variables were expressed as mean and standard deviation; in the case of discrete variables, absolute frequencies and percentages are provided. The association between qualitative variables was evaluated with the chi-square test and quantitative variables using Student's 2-tailed t-test. For the comparisons, the tests were considered to be significant

when  $p < 0.05$ . SPSS<sup>®</sup> statistical software for Windows was used.

We analysed 44 patients, 27 males (61.4%), 17 females (38.6%), 28 on continuous ambulatory peritoneal dialysis (CAPD) (63.6%), the average time on dialysis  $27.63 \pm 19.1$  months, 3 PKD (6.8%), 22 had a history of abdominal surgery (50%) and 8 (18.8%) had a hernia repair prior to starting dialysis.

There were 8 hernias (18.8%), 3 umbilical and 5 inguinal, 7 in males (87.5%), 50% on CAPD. In 6 patients, the prescription was changed to automated peritoneal dialysis (APD) with a dry day, one patient remained on CAPD with reduction of volume/sc; with these prescription changes, 6 (75%) patients remained asymptomatic and without complications such as incarceration or strangulation. One hernia (12.5%) was repaired surgically with mesh implant, and the patient was switched temporarily to haemodialysis due to the presence of persistent pain.

There were no differences between patients with hernias or without hernias in the variables age, dialysis modality, BMI, FTI, LTI, time on dialysis, volume/sc, ultrafiltration and IPP. In contrast, there was greater residual volume in the patients with hernias:  $467 \pm 61.8$  compared to  $360.9 \pm 116$  ml ( $p = 0.017$ ). There were more subjects with PKD and more with hernias and previous abdominal surgery in the group with hernias ( $p < 0.05$ ) (Table 1). 100% of the group with hernias had IPP  $> 13$  cm/H<sub>2</sub>O.

We analysed the 34 patients who had IPP  $> 13$  cm/H<sub>2</sub>O and compared them to those with lower IPP. Time on dialysis

DOI of original article:

<http://dx.doi.org/10.1016/j.nefro.2016.03.015>.

<sup>☆</sup> Please cite this article as: Sastre A, González-Arregoces J, Romainoik I, Mariño S, Lucas C, Monfá E, et al. Factores de riesgo asociados a hernias en diálisis peritoneal. Nefrología. 2016;36:567-568.

**Table 1 – Comparison between patients with and without hernias.**

	Hernia	No hernia	p Value
Treatment with dialysis	25.9 (13.3)	28.01 (20.4)	0.7
Age	57 (19.8)	63.6 (17.6)	0.3
BMI	26.6 (2.5)	26.2 (5.8)	0.8
FTI	11.6 (4.7)	12.4 (5.7)	0.7
LTI	14.7 (3.9)	13.14 (3)	0.2
Daytime/sc infusion volume	1048.3 (58.2)	1051.9 (242.3)	0.9
Nocturnal/sc infusion volume	1068.6 (56)	1146.3 (142.6)	0.8
IPP	15.37 (1.8)	15.83 (4.5)	0.7
Residual volume	467 (61)	360.9 (116)	0.02
Ultrafiltration	619 (239)	458.5 (250)	0.1
Gender, female/male	12.5/87.5%	44.4/55.6%	0.01
PLKD	25%	2.7%	0.01
Previous surgery	62.5%	47.2%	0.04
Previous hernia	37.5%	13.8%	0.02

FTI: fat tissue index; BMI: body mass index; LTI: lean tissue index; IPP: intraperitoneal pressure; PLKD: polycystic liver and kidney disease. Data are expressed as mean plus standard deviation.

was  $31.47 \pm 18$  vs  $14.55 \pm 15$  months ( $p$  0.012), BMI  $27.68 \pm 4$  vs  $21.62 \pm 46$  kg/m<sup>2</sup> ( $p$  0.001), FTI  $13.6 \pm 5$  vs  $7.6 \pm 4$  ( $p$  0.02), daytime/sc infusion volume  $1103.12 \pm 132$  vs  $875 \pm 349$  ml/m<sup>2</sup> ( $p$  0.003) and residual volume  $411.11 \pm 94$  vs  $275.14 \pm 125$  ml ( $p$  0.001). We found no significant differences in the rest of the variables, including ultrafiltration.

Frequency of hernias vary in the range of 12–37% in different studies,<sup>2</sup> similar to that found in our series, and there is no reason why a hernia should influence the continuing success or failure of the technique.<sup>3</sup> No patient in our series has had to abandon the technique so far, although it has been needed to increase the use of cyclor with dry day.

As in other studies, neither IPP or infusion volume appear to predict the development of abdominal hernias.<sup>1,4</sup> A positive association has however been described with being elderly, polycystic kidney disease, BMI,<sup>5</sup> prolonged time on peritoneal dialysis<sup>6</sup> and previous hernias.<sup>7</sup> There is a negative association with being female.<sup>6</sup>

We were unable to demonstrate any association with age or a lower LTI, perhaps because of the small sample size.

We can conclude that 18.8% of our patients developed an abdominal hernia as a complication; nevertheless 100% were able to continue with their dialysis technique.

The risk factors in our series were: being male; polycystic kidney disease; having had previous hernias; previous abdominal surgery; and greater residual volume.

IPP > 13 cm/H<sub>2</sub>O was associated with more time on dialysis, higher BMI, FTI and daytime volume/sc and greater residual volume.

Since 100% of these complications occur with IPP > 13 cm/H<sub>2</sub>O, we recommend adjusting the dialysis prescription to not exceed these limits, especially in patients with the risk factors described.

We believe that our finding of residual volume being a risk factor for hernias is a new observation; the tolerated pressure limit could be reduced to 13 cm/H<sub>2</sub>O in patients at high risk of developing mechanical problems affecting the abdominal wall.

## REFERENCES

- Dejardin A, Robert A, Goffin E. Intraperitoneal pressure in PD patients: relationship to intraperitoneal volume, body size and PD-related complications. *Nephrol Dial Transplant.* 2007;22:1437–44.
- García-Ureña MA, Rodríguez CR, Vega Ruiz V, Carnero Hernández FJ, Fernández-Ruiz E, Vázquez Gallego JM, et al. Prevalence and management of hernias in peritoneal dialysis patients. *Perit Dial Int.* 2006;26:198–202.
- Balda S, Power A, Papalois V, Brown E. Impact of hernias on peritoneal dialysis technique survival and residual renal function. *Perit Dial Int.* 2013;33:629–34.
- Hussain SI, Bernardini J, Piraino B. The risk of hernia with large exchange volumes. *Adv Perit Dial.* 1998;14:105–7.
- Del Peso G, Bajo MA, Costero O, Hevia C, Gil F, Díaz C, et al. Risk factors for abdominal wall complications in peritoneal dialysis patients. *Perit Dial Int.* 2003;23:249–54.
- Gracia Toledo M, Borrás Sans M, Gabarrell A, Durán J, Fernández Giráldez E. Factores de riesgo para desarrollar hernias abdominales en enfermos en diálisis peritoneal. *Nefrología.* 2011;31:218–9.
- Yang SF, Liu CJ, Yang WC, Chang CF, Yang CY, Li SY, et al. The risk factors and the impact of hernia development on technique survival in peritoneal dialysis patients: a population-based cohort study. *Perit Dial Int.* 2015;35:351–9.

Aránzazu Sastre\*, Jose González-Arregoces, Igor Romainoik, Santiago Mariño, Cristina Lucas, Elena Monfá, Ana Aguilera, Benjamin de León, George Stefan, Mario A. Prieto

Servicio de Nefrología, Complejo Asistencial Universitario de León, León, Spain

\* Corresponding author.

E-mail address: [aranchasastre@hotmail.com](mailto:aranchasastre@hotmail.com) (A. Sastre).

2013-2514/© 2016 Sociedad Española de Nefrología. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).