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EURODOPPS

DIALYSIS OUTCOMES AND PRACTICE PATTERNS STUDY

Geographical and Seasonal Patterns of Blood Pressure in Hemodialysis Patients: a EURODOPPS Study

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Background

In hemodialysis (HD) patients treated in a single facility, we found that blood pressure (BP) before dialysis sessions was associated with seasons and outdoor temperature.[1] We wanted to extend the study of BP to other facilities in Europe and to assess the existence of geographical influences on both BP level and seasonality.

Methods

Clinical data were obtained from the Dialysis Outcomes and Practice Patterns Study (DOPPS) phases 3-4 (2005-2011) for patients from European countries. For each phase, patients were randomly sampled from national samples of HD facilities. Every four months, BP was measured immediately before and after the dialysis session according to usual clinical practices, preferably in sitting position. Informed patient consent was obtained in accordance with local requirements.

Temperature recordings from meteorological stations corresponding to HD facilities were obtained (Figure 1). Geographical exposure of patients was defined as the country of treatment or the latitude of meteorological stations. Seasons were defined by month: Winter (December, January, February), Spring (March, April, May), Summer (June, July, August), Autumn (September, October, November).

BP level was analyzed using mixed models with location (country or latitude), climate (season or outdoor temperature) and their interaction (location×climate) as fixed effects, adjusting for study design and repeated measures. A latitude of 50 was set as the reference.

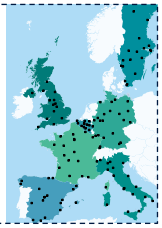

Figure 1. Spatial distribution of HD facilities across 7 European countries

Results

Patients

The study included 9655 HD patients with dialysis vintage ≥ 6 months, from 263 facilities (121 locations) from 7 countries and over 50 000 observations. Median follow-up was 1.3 (interquartile range: 0.7 ; 2.3) years. The patients characteristics at study start are presented in the following table.

Table. Patients characteristics at baseline

Country	Spain	Italy	France	Belgium	Germany	United Kingdom	Sweden
Number of patients (n)	1571	1384	1401	1246	1556	1144	1353
Age (year)	64.0 ± 15.6	66.1 ± 13.7	65.4 ± 15.2	68.5 ± 13.6	64.8 ± 14.3	61.5 ± 15.6	64.8 ± 14.2
Gender (% Male)	59%	59%	58%	57%	59%	58%	65%
Post-dialysis BMI (kg/m²)	25.2 ± 4.5	24.8 ± 5.1	25.3 ± 5.6	25.7 ± 5.1	26.5 ± 5.2	26.3 ± 5.4	25.9 ± 6.0
Comorbidities (% yes)							
Hypertension	86%	74%	87%	82%	92%	70%	84%
Diabetes	31%	28%	35%	38%	40%	28%	41%
Renal disease (%)							
Diabetes (I or II)	19%	17%	23%	24%	27%	16%	26%
Glomerulonephritis	13%	14%	13%	9%	15%	12%	13%
Hypertension	11%	15%	15%	14%	16%	8%	17%
Other/Uncertain	57%	54%	49%	53%	42%	64%	44%
Dialysis vintage (year)	2.0 (0.8 ; 5.4)	2.7 (0.8 ; 6.7)	2.3 (0.8 ; 5.9)	1.7 (0.8 ; 4.2)	2.0 (0.8 ; 5.1)	2.3 (0.8 ; 5.7)	1.8 (0.8 ; 4.9)
Weekly dialysis duration (hr/week)	12.0 ± 2.3	11.5 ± 1.8	12.0 ± 1.9	12.0 ± 2.0	13.3 ± 2.3	11.3 ± 1.7	13.0 ± 2.4
Intradialytic weight loss (% post-dial weight)	3.1 ± 1.4	3.7 ± 1.5	3.4 ± 1.5	2.7 ± 1.5	2.6 ± 1.6	2.4 ± 1.3	2.7 ± 1.5
Blood pressure (mmHg)							
Pre-dialysis SBP	132.6 ± 22.8	133.7 ± 23.3	138.9 ± 25.0	139.4 ± 24.1	132.7 ± 20.8	143.1 ± 25.2	140.4 ± 26.5
Pre-dialysis DBP	70.7 ± 13.1	72.3 ± 12.6	71.8 ± 15.1	71.2 ± 14.1	72.0 ± 12.0	74.1 ± 15.1	74.0 ± 14.0
Post-dialysis SBP	126.3 ± 23.1	128.9 ± 24.4	132.4 ± 25.1	131.5 ± 23.3	127.3 ± 20.8	132 ± 25.2	134.7 ± 26.6
Post-dialysis DBP	68.7 ± 13.0	71.4 ± 12.8	69.9 ± 15.0	69.1 ± 13.4	70.2 ± 11.6	69.4 ± 14.4	71.8 ± 13.9

Data summarized as percentage, mean ± standard deviation and median (interquertile range).

Geographical Patterns of BP

There were significant differences in pre- and post-dialysis BP across Europe (Table, P < 0.001). Pre- and post-dialysis BP were significantly lower in Southern places (Figure 2-left, P ≤ 0.02). For each 10-degree increase (1111 km North), pre- and post-dialysis SBP increased of 5.1 [3.7 ; 6.4] and 4.4 [2.9 ; 5.9] mmHg and pre- and post-dialysis DBP of 1.7 [0.8 ; 2.6] and 1.0 [0.2 ; 1.9] mmHg.

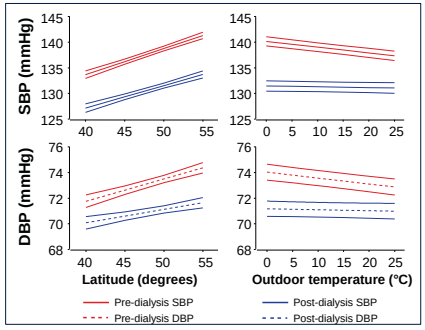

Figure 2. BP level by latitude (left) **and outdoor temperature** (right). Estimates and 95% CI from mixed models.

Seasonal Patterns of BP

Pre-dialysis BP was globally lower in summer and higher in winter (P < 0.001, figure 3), while post-dialysis BP showed no clear association with seasons (P ≥ 0.09). Pre-dialysis BP was inversely associated with outdoor temperature (figure 2-right; estimate and 95% confidence interval for SBP and DBP: -1.1 [-1.4 ; -0.8] and -0.5 [-0.6 ; -0.3] mmHg/10°C, P < 0.01) while post-dialysis BP was not (P > 0.1).

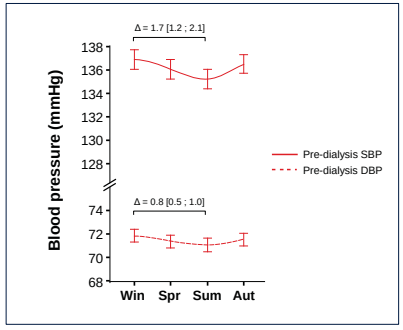

Figure 3. Mean pre-dialysis blood pressure by season. Estimates and 95% CI from unadjusted mixed models.

Interaction between Geographical and Seasonal Patterns of BP

Seasonal patterns of SBP were more pronounced in southern places (Figure 4, P_{int} = 0.04), with an additional 0.8 [0.1 ; 1.5] mmHg for each 10-degree decrease in latitude. The effect of temperature on pre-dialysis SBP was also more pronounced in southern or warmer locations (P_{int} < 0.01).

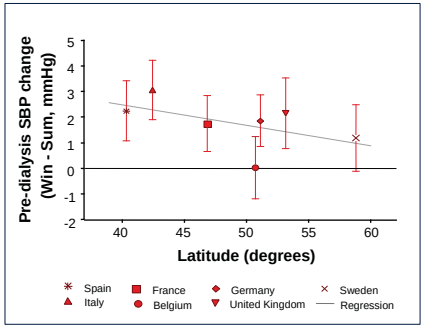

Figure 4. Mean seasonal change by latitude and country. Estimates and 95% CI from unadjusted mixed models.

Conclusions

In Europe, patients from southern locations have lower pre- and post-dialysis BP. Pre-dialysis BP is globally lower in summer and with warmer temperature, and this effect is more pronounced in southern/warmer locations. The maintained or transient rise in BP may be associated with cardiovascular complications. In addition, there is a need to consider this variability when studying longitudinal change in BP.

Acknowledgements The EURODOPPS Initiative is supported by the ERA-EDTA and the DOPPS Program. The study was performed thanks to support from ERA-EDTA received in the form of a travel grant.

References

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