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Morgans, Heather A., "Association Between Blood Pressure and ESA Dose in Pediatric Patients on Dialysis" (2021). *Research Days*. 17.

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Association Between Blood Pressure and ESA Dose in Pediatric Patients on Dialysis

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Background

-Hypertension is a reported side effect of Erythropoiesis Stimulating Agents (ESAs), with mechanisms of action related to elevated hematocrit levels and direct vasopressor effects.

-Limited information exists on the relationship between ESA dosage and hypertension in children receiving maintenance dialysis.

Objectives

-Primary: Determine whether there is a significant association between ESA dose and blood pressure (BP) in pediatric patients receiving maintenance dialysis.

-Secondary: Evaluate the covariates related to ESA dose and BP (hemoglobin level, growth hormone use, number of antihypertensive medications, BMI, total daily output, and dialysis modality)

Methods

-Data entered into the IPDN database from January 2007-September 2019 was analyzed.

-Systolic and diastolic BP measurements obtained at clinic visits were averaged and standardized based on age, height, and sex.

-ESA dose was measured in units/kg/week and categorized into 3 groups (<100u/kg/week, 100-250u/kg/week, >250u/kg/week) with Darbepoetin and continuous erythropoietin receptor activator (CERA) converted to equivalent units of Epopen.

-Kruskal Wallis test was used for continuous variables and Chi-Square for categorical. Logistic Regression was used to evaluate the covariates (SPSS Version 26).

Results

-A total of 3791 children were included in the analysis with mean age of 11 years and 55.7% male. The mean prescribed ESA dose was 218.73 units/kg/week.

Demographics within ESA Groups				
Variable	<100u/kg/week Epopen (N=1293)	100-250u/kg/week Epopen (N=1636)	≥250u/kg/week Epopen (N=862)	p-value
Age, years (median, SD)	14.20 (5.45)	11.46 (5.65)	6.68 (5.83)	p < 0.001*
Sex, M (N, %)	729 (56.4%)	901 (55.1%)	482 (55.9%)	p = 0.771**
Ethnicity (N, %)				p < 0.001**
1= Caucasian	705 (54.5%)	722 (44.1%)	358 (41.5%)	
2= East Asian	205 (15.9%)	343 (21%)	145 (16.8%)	
3= Hispanic	166 (12.8%)	223 (13.6%)	123 (14.3%)	
4= Indian	63 (4.9%)	125 (7.6%)	52 (6%)	
5= Arabic	33 (2.6%)	79 (4.8%)	88 (10.2%)	
6= African / African American	36 (2.8%)	45 (2.8%)	33 (3.8%)	
7= Other	85 (6.6%)	99 (6.1%)	63 (7.3%)	

*Kruskal Wallis, **Chi-Square; p < 0.05 indicates significance

Comparison of ESA Dose and Blood Pressure

Variable	<100u/kg/week ESA (N=1293)	≥250u/kg/week ESA (N=862)	Significance	Odds Ratio (OR) ESA dose ≥250u/kg/week: elevated BP (Z-score ≥1.68)
Systolic BP standardized score for age/sex/height Median	0.93	1.30	H ² (2)= 38.836 p < 0.001	OR = 1.40 (95% CI 1.20-1.63) p < 0.001
Diastolic BP standardized score for age/sex/height Median	0.72	0.87	H ² (2)= 23.495 p < 0.001	OR = 1.20 (95% CI 1.01-1.42) p = 0.035

Logistic Regression: Covariates and Systolic/Diastolic Elevated BP (>90th percentile)

Variable	Systolic BP Standardized Score ≥ 1.68 (X ² = 473.089, df= 8, p<0.001)			Diastolic BP Standardized Score ≥ 1.68 (X ² = 319.937, df= 8, p<0.001)		
	p-value	OR	95% CI	p-value	OR	95% CI
ESA Dose (<250u/kg/week)	<0.001	1.594	1.306-1.946	<0.001	1.476	1.191-1.829
BMI standardized score	0.002	1.086	1.032-1.143	0.759	0.992	0.940-1.046
Dialysis Modality (HD)	<0.001	0.557	0.466-0.666	0.646	0.955	0.787-1.16
Number of Antihypertensive Medications	<0.001	1.676	1.584-1.774	<0.001	1.586	1.498-1.679
Use of Growth Hormone, (No)	0.201	1.297	1.097-1.535	0.098	0.824	0.655-1.037
Total Daily Output/kg	0.107	0.998	0.995-1.00	0.420	0.999	0.996-1.002
Hemoglobin Level gm/dL	<0.001	0.930	0.893-0.969	0.019	0.950	0.910-0.992

Discussion

-Pediatric patients receiving maintenance dialysis were more likely to have elevated blood pressure (>90th percentile for age/sex/height) if they were receiving >250u/kg/week of ESA.

-Elevated BMI, higher number of antihypertensive medications, hemodialysis modality, and lower hemoglobin levels were associated with blood pressure >90th percentile for age/sex/height. Growth hormone use and daily output per kg were not significantly associated with elevated blood pressure.

-There was a significant difference in age between the 3 ESA groups with the higher dose group (>250u/kg/week) being the youngest (median age of 6.68 years). This is likely related to higher ESA doses required to achieve target hemoglobin response in this age group.

Conclusion

Patients with ESA dose > 250u/kg/week may be at higher risk for elevated blood pressure. Further studies are warranted to evaluate the relationship between ESA dosing and blood pressure and to assess the efficacy of anemia management strategies designed to minimize the risk of treatment related complications.

References

-Agarwal, A. K., & Singh, A. K. (2010). Therapy with Erythropoiesis-Stimulating Agents and Renal and Nonrenal Outcomes. *Heart Failure Clinics*, 6(3), 323-332. doi: 10.1016/j.hfc.2010.03.006

-Agarwal, R. (2017). Mechanisms and mediators of hypertension induced by erythropoietin and related molecules. *Nephrology Dialysis Transplantation*, 33(10), 1690-1698. doi: 10.1093/ndt/gfx324

-Krapf, R., & Hulter, H. N. (2009). Arterial Hypertension Induced by Erythropoietin and Erythropoiesis-Stimulating Agents (ESA). *Clinical Journal of the American Society of Nephrology*, 4(2), 470-480. doi: 10.2215/cjn.05040908

-Lestz, R. M., Fivush, B. A., & Atkinson, M. A. (2014). Association of higher erythropoiesis stimulating agent dose and mortality in children on dialysis. *Pediatric Nephrology*, 29(10), 2021-2028. doi: 10.1007/s00467-014-2820-9

-Schaefer, F., Hoppe, B., Jungraithmayr, T., Klaus, G., Pape, L., Farouk, M., ... Vondrak, K. (2015). Safety and usage of darbepoetin alfa in children with chronic kidney disease: prospective registry study. *Pediatric Nephrology*, 31(3), 443-453. doi: 10.1007/s00467-015-3225-0

-Suttrop, M. M., Hoekstra, T., Mittelman, M., Ott, I., Franssen, C. F. M., & Dekker, F. W. (2013). Effect of Erythropoiesis-Stimulating Agents on Blood Pressure in Pre-Dialysis Patients. *PLoS ONE*, 8(12). doi: 10.1371/journal.pone.0084848

-Warady, B. A., & Silverstein, D. M. (2013). Management of anemia with erythropoietic-stimulating agents in children with chronic kidney disease. *Pediatric Nephrology*, 29(9), 1483-1505. doi: 10.1007/s00467-013-2557-x

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