(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 4, Issue 2, Page No: 517-520
March-April 2021

Prevalance of Hypertension at High Altitude in Children among Highlanders and lowlanders

Dr. Zahid Hussain
DCH, DNB, MRCPCH (UK), Paediatric Unit, Sonam Norboo Memorial Hospital, Leh Ladakh

Type of Publication: Original Rsearch Paper
Conflicts of Interest: Nil

ABSTRACT

A cross sectional study was conducted to measure the prevalence of systemic hypertension among 310 children visiting a private clinic comprising of native highlanders and lowlanders at Leh Ladakh, India. Leh is situated at an Altitude of 3500 meters from Sea level. The Low landers were children born at low altitude but either visiting the place as tourists or studying at high altitude over the last 2 years. During summer months from May to September hundreds of thousands of tourists from low altitude places visits Leh including children. Most of them do rapid ascent through flights and few slow ascent via roads which takes two days to reach at Leh from Low altitude places. The prevalence of hypertension and prehypertension was 10% and 14.2% respectively. Prevalence was significantly higher among the native highlanders as compared to the lowlanders.

Keywords: High altitude, Hypertension, children

INTRODUCTION

High BP in children has been considered as potential risk for Hypertension in adulthood. BP varies with age, sex, weight and height in children; therefore diagnosis is complicated and nearly 75% of hypertensive children remain un diagnosed. This study was done at Leh India at an altitude of 3500 meters from sea level to determine with prevalence of HT and prehypertension among native highlanders and lowlanders visiting the place during summer months.

The cross sectional study was conducted amongst children aged 11-15 years visiting a private clinic for various reasons in 2018-19. A total 310 children (173 boys and 137 girls) were interviewed and examined. Children with already diagnosed Hypertension were excluded. Automated BP Measuring apparatus (Omron) was used. Hypertension was defined as average systolic BP and /or diastolic BP more than 95th percentile for gender, age and height on three occasions. Prehypertension was defined as average SBP or DBP levels more than 90the percentile but less than 95th percentile . Data was analysed using SPSS version 17.0. Chi-square test was used to analysis and P value less than 0.05 was considered statistically significant. Permission was obtained from parents and Assent was also obtained from children.

Participants were equally distributed across the different age groups (data not shown) .The overall prevalence of Hypertension in our study population was 10% and prehypertension was 14.2% . There was significant difference between prevalence of Hypertension between Highlanders and Lowlanders. (Table 1). Increasing prevalence of hypertension might be due to childhood obesity as well as growing awareness of the disease. We suggest that children should be screened regularly for hypertension to prevent complications.

Determinants	*HT,n(%)	^Pre-HT ,n (%)	Normal,n(%)	Total	P-Value
Subjects					
Lowlanders	9(5.5)	23(14.0)	132(80.5)	164	0.017
Highlanders	22(15)	21(14.4)	103(70.6)	146	
Age					
10-12	16(12.9)	17(13.7)	91(73.4)	124	0.967
13-15	15(8.06)	27(14.5)	144(77.4)	186	
Gender					
Males	14(8.1)	20(11.6)	139(80.3)	173	0.111
Females	17(12.4)	24(17.5)	96(70.1)	137	
Body Mass Index					
Obesity & overweight	3(11.6)	5(19.2)	18(69.2)	26	
Normal	19(12.3)	23(14.8)	113(72.9)	155	
Underweight	9(7.0)	16(12.4)	104(80.6)	129	
Total	31(10.0)	44(14.2)	235(75.8)	310	

*HT .. Hypertension, ^Pre-HT… Prehypertension

Discussion: High prevalence of Systemic Hypertension at high altitude inhabitants of the Tibetan Plateau has previously been reported in several studies in adults [5,9]. Sympathoadrenal activity and endothelin and nitric oxide imbalance have been attributed to in the pathogenesis of hypoxia-induced arterial Hypertension [2,14]. Difference of altitude 1700 meters have been reported as independent risk factor for higher SBP & DSP in children with similar demographic characteristics and positively correlated with BMI [1]. A difference of 3000 m in altitude was associated with higher SBP and DBP in these children aged 6 to 18 years [3]. High Haematocrit and BMI was associated with hypertension among adults at high altitude as compared to lower altitude [4]. The prevalence of hypertension was 37.0% in all participants and highest in migrants settled in Leh (48.3%), followed by dwellers born in Leh town (41.1%) compared with those in rural areas (33.5). The prevalence of hypertension in nomads (all: 27.7%, Tibetan/Ladakhi: 19.7/31.9%)) living at higher altitude (4000-4900 m) was relatively low. The prevalence of hypertension in children was higher as compared to some earlier studies [21]. This could be due to different socioeconomic, demographic characteristics. The prevalence of prehypertension in our study was similar to that of study done by Rahman et al [21].

Limitation: As it is likely that few children may have secondary hypertension, this study couldn't determine the percentage of secondary hypertension among these children.

References:

Volume 4, Issue 2; March-April 2021; Page No 517-520

1. Sükrü Arslan, Nur Arslan, Alper Soylu, Cihangir Akgün, Ibrahim Tepebasili, Mehmet Türkmen, and Salih Kavukçu. High altitude and blood pressure in children. Yale J Biol Med. 2003; 76(4-6): 145–148. PMCID: PMC2582720
2. Wolfel EE, Selland MA, Mazzeo RS, Reeves JT. Systemic hypertension at 4,300 m is related to sympathoadrenal activity. J Appl Physiol (1985) 1994 Apr;76(4):1643–1650. [PubMed] [Google Scholar]
3. Syed Shah, Abderrahim Olhaj and Faisal Aziz. Blood pressure in children. Role of High Altitude? Pediatrics February 2015, 135 (Supplement 1) S12-S13; DOI: https://doi.org/10.1542/peds.2014-3330V
4. Khalid ME, Ali ME, Ahmed EK, Elkarib AO. Pattern of blood pressures among high and low altitude residents of southern Saudi Arabia. J Hum Hypertens. 1994 Oct;8(10):765–769. [PubMed] [Google Scholar]
5. Sun SF. Epidemiology of hypertension on the Tibetan Plateau. Hum Biol. 1986 Aug;58(4):507–515. [PubMed] [Google Scholar]
6. Yang Liu, Ji-Hang Zhang, Xu-Bin Gao, Xiao-Jing Wu, Jie Yu, Jian-Fei Chen, ShiZhu Bian, Xiao-Han Ding & Lan Huang. Correlation between blood pressure changes and AMS, sleeping quality and exercise upon high-altitude exposure in young Chinese men. Military Medical Research volume 1, Article number: 19 (2014)
7. Hainsworth R, Drinkhill MJ, Rivera-Chira M: The autonomic nervous system at high altitude. Clin Auton Res. 2007, 17: 13-19. 10.1007/s10286-006-0395-7. [PubMed] [Google Scholar]
8. Sizlan A, Ogur R, Ozer M, Irmak MK: Blood pressure changes in young male subjects exposed to a median altitude. Clin Auton Res. 2008, 18: 84-89. 10.1007/s10286-008-0459-y. [PubMed] [Google Scholar]
9. Shrestha S, Shrestha A, Shrestha S, Bhattarai D: Blood pressure in inhabitants of high altitude of Western Nepal. JNMA J Nepal Med Assoc. 2012, 52: 154-158. [PubMed] [Google Scholar]
10. D'Este D, Mantovan R, Martino A, D'Este F, Artusi L, Allibardi P, Franceschi M, Zerio C, Pascotto P: The behavior of the arterial pressure at rest and under exertion in normotensive and hypertensive subjects exposed to acute hypoxia at a median altitude. G Ital Cardiol. 1991, 21: 643-649. [PubMed] [Google Scholar]
11. Siques P, Brito J, Banegas JR, Leon-Velarde F, de la Cruz-Troca JJ, Lopez V, Naveas N, Herruzo R: Blood pressure responses in young adults first exposed to high altitude for 12 months at 3550 m. High Alt Med Biol. 2009, 10: 329-335. 10.1089/ham.2008.1103. [PubMed] [Google Scholar]
12. Heistad DD, Abboud FM: Dickinson W. Richards Lecture: Circulatory adjustments to hypoxia. Circulation. 1980, 61: 463-470. 10.1161/01.CIR.61.3.463. [PubMed] [Google Scholar]
13. Tripathy V, Gupta R. Blood Pressure variations among Tibetans at Different Altitude. Ann Hum Biol. 2007 Jul-Aug;34(4):470-83. doi: 10.1080/03014460701412284. PMID: 17620154
14. Mazzeo RS, Wolfel EE, Butterfield GE, Reeves JT: Sympathetic response during 21 days at high altitude (4,300 m) as determined by urinary and arterial catecholamines Metabolism. 1994, 43: 1226-1232. 10.1016/0026-0495(94)90215-1. . [PubMed] [Google Scholar]
15. Ni Z, Bemanian S, Kivlighn SD, Vaziri ND: Role of endothelin and nitric oxide imbalance in the pathogenesis of hypoxia-induced arterial hypertension. Kidney Int. 1998, 54: 188-192. 10.1046/j.1523-1755.1998.00987.x. [PubMed] [Google Scholar]
16. Mazzeo RS, Child A, Butterfield GE, Mawson JT, Zamudio S, Moore LG: Catecholamine response during 12 days of

Volume 4, Issue 2; March-April 2021; Page No 517-520

high-altitude exposure (4, 300 m) in women. J Appl Physiol. 1998, 84 (1985): 1151-1157.

17. Bernardi L, Passino C, Wilmerding V, Dallam GM, Parker DL, Robergs RA, Appenzeller O: Breathing patterns and cardiovascular autonomic modulation during hypoxia induced by simulated altitude. J Hypertens. 2001, 19: 947-958. 10.1097/00004872-200105000-00016.
18. Imray C, Wright A, Subudhi A, Roach R: Acute mountain sickness: pathophysiology, prevention, and treatment. Prog Cardiovasc Dis. 2010, 52: 467-484. 10.1016/j.pcad.2010.02.003.
19. Beidleman BA, Fulco CS, Muza SR, Rock PB, Staab JE, Forte VA, Brothers MD, Cymerman A: Effect of six days of staging on physiologic adjustments and acute mountain sickness during ascent to 4300 meters. High Alt Med Biol. 2009, 10: 253-260. 10.1089/ham.2009.1004
20. Norboo T, Stobdan T, Tsering N, Angchuk N, Tsering P, Ahmed I et al.Prevalence of hypertension at high altitude: cross-sectional survey in Ladakh, Northern India 2007-2011. BMJ Open 2015 Apr 20;5(4):e007026. doi:10.1136/bmjopen-2014-007026.
21. Buch N, Goyal JP, Kumar N, Parmar I, Shah VB, Charan J. Prevalence of hypertension in school going children of Surat city, Western India. J Cardiovas Dis Res. 2011;2:228-32.
22. Rahman AJ, Qamar FN, Ashraf S, Khowaja ZA, Tariq SB, Naeem H.Prevalence of hypertension in healthy school children in Pakistan and its relationship with body mass index, proteinuria and hematuria. Saudi J Kidney Dis Transpl. 2013;24:408-12.

Volume 4, Issue 2; March-April 2021; Page No 517-520