Decreased male fertility potential increase blood pressure reactivity

Amit Kant Singh[1,*], Shailendra Pal Singh[2], Brig. T. Prabhakar[3], Mohan Singh[4], Pankaj Kumar Jain[5], Santosh Kumar Sant[6], Shikha Seth[7], Brijendra Singh[8]

[1]Professor, [6]Professor and Head, Departments of Physiology,
[2]Professor, [4]Professor & Head, Dept. of Surgery,
[3]Director, [5]Professor & Head, Dept. of Community Medicine,
[7]Professor, Obstetrics & Gynecology, UP RIMS & R, Saifai, Etawah, India
[8]Additional Professor, Department of Anatomy, AIIMS, Jodhpur, India

[*]**Corresponding Author:**
E-mail:amitbhu2008@gmail.com

Abstract:

Background & objectives: Arterial blood pressure is an important physiological parameter in epidemiology of cardiovascular disease. Hypertension has been reported to be generally associated with sympathetic over activity. Several authors have made use of a technique, known as Cold Pressor Test to study blood pressure reactivity to a standard stimulus. Thus this study was undertaken to evaluate the response to the standard stimulus in the normozoospermics and subjects with oligoasthenotetatozoospermia (OAT).

Methods: The study was conducted on 60 subjects 30 normozoospermics and 30 oligoasthenotetratozoospermics based on semen analysis report between the age group of 20 years to 25 years. The blood pressure was recorded using the standard auscultatory technique and cold pressor test was done as described by Hines & Brown (1932).

Results: The significant increase ($p<0.05$) in post test SBP and DBP was observed in the subjects with OAT.

C**onclusions:** As there is a significant increase in post test SBP and DBP in the subjects with OAT, thus it is concluded that individuals with decreased fertility potential have increased blood pressure reactivity.

Key words: Normozoospermia, Oligoasthenoteratozoospermia, Blood pressure, cold pressor test.

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2394-2126.2016.00023.2

Introduction

Arterial blood pressure, an important physiological parameter has great etiological significance in epidemiology of cardiovascular disease due to its association with age, height, weight, diet, stress, socio-economic status etc.(1) Familial aggregation of hypertension documents an important genetic component. Concordance of blood pressure is greater within families than in unrelated individuals, greater between monozygotic than between dizygotic twins and greater between biological than between adoptive siblings living in same household. About 70% of familial aggregation of blood pressure is attributed to shared genes rather than shared environment.(2) Hypertension has been reported to be generally associated with sympathetic overactivity.(3) But the sympathetic response of certain individuals from both normotensive and hypertensive population have been reported to be more pronounced.(4) Previous studies of family history of patients with hypertension have shown a hereditary factor in 76-86% of cases.

Reactive Oxygen Species (ROS) are ubiquitous reactive derivatives of O2 metabolism found in the environment and in all biological systems. ROS are implicated in many intracellular signaling pathways leading to changes in gene transcription and protein synthesis and consequently in cell function.

Within the cardiovascular system, ROS play a crucial physiological role in maintaining cardiac and vascular integrity and a pathophysiological role in cardiovascular dysfunction associated with several clinical conditions, including hypertension (5,6). The most important ROS detectable within the vasculature include the superoxide anion (•O2−), hydrogen peroxide (H2O2), hydroxyl radical (•OH), and the reactive nitrogen species peroxynitrite (ONOO−), which have been regarded as a nasty, life-threatening, and destructive oxygen-derived toxicant. In healthy conditions, ROS are produced in a controlled manner at low concentrations and function as signalling molecules regulating vascular contraction-relaxation and cell growth (7). Physiologically, ROS generation is tightly regulated by endogenous cellular antioxidants, which include superoxide dismutase (SOD), catalase, thioredoxin, glutathione, and antioxidant vitamins. In physiological conditions, the rate of ROS generation is counterbalanced by the rate of elimination. In contrast, under pathological conditions, such as hypertension, ROS are produced in concentrations that cannot be controlled by the usual protective antioxidant mechanisms employed by the cells, leading to a state of

oxidative stress (6). Indeed, when produced in excess, •O2 − reacts with nitric oxide (NO) to produce a dramatic concentration of the toxic ONOO− which promotes a variety of negative effects on cellular function. These include alteration of transcription factors, kinases, protein synthesis, and redox-sensitive genes, which in turn influence endothelial function, increase vascular contractility, vascular smooth muscle cell growth and apoptosis, monocyte migration, lipid peroxidation, inflammation, and increased deposition of ECM proteins, all major processes deeply involved in the pathogenesis and progression of vascular damage in cardiovascular disease (8,9).

It is known that oxidative stress affects the testicular function by disruption of germinal cell epithelial division and differentiation along with the induction of germ cell apoptosis (10,11).

As the ROS is involved in the cardiovascular dysfunctions and also the testicular dysfunction thus it is hypothesised that the blood pressure reactivity is affected in the male subjects with impaired fertility potential.

Therefore this study was under taken to evaluate the blood pressure reactivity in oligoasthenoteratozoo-spermic and normozoospermic subjects by cold pressor test as described by Hines and Brown (4).

Materials and Methods

The study was conducted in the Department of Physiology on the male partners of the infertile couples reporting to the out patient department of the Departments of Surgery and Obstetrics and Gynecology and referred to Department of Physiology, UP RIMS & R, Saifai, Etawah.

After obtaining the informed written consent 60 subjects of the age between 21 to 25 years were assessed during the study out of which 30 were normozoospermics and 30 were oligoasthenoteratozoo-spermics as per the semen analysis reports. The subjects having the family history of hypertension were not included in the study. The blood pressure was recorded using the standard auscultatory technique and cold pressor test was done as described by Hines & Brown (4). The data obtained was analyzed statistically using student's t- test.

The study was approved by the institution ethical committee for research on humans.

Results

The mean age of the normozoospermic group was 38.3 ± 7.2 years and OAT group was 39.1 ± 5.1 years. The semen parameters of both the groups are as given in table 1. The significant increase in post test SBP and DBP was observed in the OAT subjects (table 2).

Table 1

Semen Parameter	Normozoospermia (n= 30)	Oligoasthenoteratozoospermia (n=30)
Volume (ml)	2.3 ± 1.2	2.5 ± 0.5
pH	7.9 ± 0.3	7.5 ± 0.7
Liquefaction time(min)	29.7 ± 6.0	32.3 ± 7.1
Sperm concentration (million/ml)	42.6 ± 2.1	18.7 ± 4.2
Motility (%)	72.3 ±1.2	47.1 ± 3.2
Morphology (%)	51.5 ±1.2	34.2 ± 3.7

Table 2

	Normozoospermia (n= 30)	Oligoasthenoteratozoospermia (n=30)
Pre Test		
PULSE (per minute)	75.61 ± 8.36	86.57 ± 9.12
SBP (mm Hg)	107.50±9.15	119.38±11.18
DBP (mm Hg)	79.09 ± 10.41	85.23 ±8.52
Post Test		
PULSE (per minute)	86.80 ± 9.61	112.84 ± 9.05
SBP (mm Hg)	121.00±9.19	158.69*±12.82
DBP (mm Hg)	93.00 ± 9.07	108.84*±9.39

*P< 0.05, student's t- test.

Discussion

The increased SBP and DBP as observed in the study (table-2) was due to the cold pressor response which is an indicator of sympathetic activity after cold stress. A healthy response to a cold pressor test(CPT) is sympathetic activation which in turn causes an increase of blood pressure. Clinically the test evaluates autonomic function (12, 13, 14). Studies have reinforced cold pressor test as a tool to predict the chances of a person becoming hypertensive later on in life (15). The association between hypertension and sympathetic over activation has been established (16, 17, 18). As abnormal autonomic response plays a role in cardiac morbidity as shown by various studies, in the later life (19). Sympathetic over activity plays an significant role in development of neurogenic hypertension (20).

The systolic blood pressure rise was more than that of the diastolic pressure rise. Systolic blood pressure is influenced by cardiac contractility which increases by sympathetic innervations. It is an indicator of work load on the heart and is characterized by a lot of fluctuations. Diastolic blood pressure on the other hand undergoes less degree of fluctuations and is of greater prognostic importance than the systolic blood pressure. Arterial blood pressure is an important factor in epidemiology of cardiovascular disease due to its association with anthropometric and demographic causes (21, 22, 23).

According to Kasagi, Germano et al, Lambert and Schlaich blood pressure responses to cold pressor test are probably affected by different factors related to participants emotional state and coping style (21, 22, 23).

It is known that oxidative stress affects the testicular function by disruption of germinal cell epithelial division and differentiation. along with the induction of germ cell apoptosis (10,11).

The mechanisms underlying the apoptosis induction by oxidative stress are not clear. However, they are shown to be due to the involvement of cytokine-induced stresskinase and E-selectin expression in the testicular vascular endothelium (11, 24, 25).

Induction of apoptosis leads to testicular neutrophil recruitment and increases the generation of intra-testicular reactive oxygen species (ROS). ROS in turn, cause peroxidative damage to cell membranes and also activate germ cell apoptosis (26, 27, 28). The rate of phagocytosis by Sertoli cells is also enhanced by increased germ cell apoptosis so as to clear the dying and damaged germ cells (29, 30).

The ROS produces toxic effects at 3 different levels. Firstly ROS activates apoptotic mechanism on gamete cells (11, 24, 25). Secondly suppress the cell division and differentiation directly (10). Thirdly, activates the phagocytic mechanism in Sertoli cells so that damaged and apoptotic cells are phagocytosed (29, 30).

Conclusion

As there is significant increase in post test SBP and DBP observed in the OAT subjects thus it is concluded that the decreased male fertility potential increases blood pressure reactivity.

Conflict of Interest: None
Source of Support: Nil

References:

1. Guyton AC, Hall JE. Blood Pressure: Textbook of Medical Physiology. 10th ed. Harcourt Brace And Company; p. 205-6; 2003.
2. Goldman L, Ausiello D. Blood pressure: Cecil textbook of Medicine. 22nd ed. An Imprint of Elsevier, Philadelphia; p.346; 2004.
3. De Quattro V, Feng M. The sympathetic nervous system: the muse of primary hypertension. *J Hum Hypertens* 16 suppl 1: S64-9; 2002
4. Hines EA, Jr. Significance of vascular hyperreaction as measured by cold pressor test. *Amer Heart J* 19:408-16; 1940
5. K. K. Griendling, D. Sorescu, B. Lass`egue, and M. Ushio- Fukai, "Modulation of protein kinase activity and gene expression by reactive oxygen species and their role in vascular physiology and pathophysiology," *Arteriosclerosis, Thrombosis,and Vascular Biology* 20 (10), 2175–2183; 2000.
6. U. Landmesser and D. G. Harrison, "Oxidative stress and vascular damage in hypertension," *Coronary Artery Disease* 12 (6), 455–461; 2001
7. R. M. Touyz and E. L. Schiffrin, "Ang II-stimulated superoxide production is mediated via phospholipase D in human vascular smoothmuscle cells," *Hypertension* 34 (4), 976–982; 1999.
8. R. M. Touyz, F. Tabet, and E. L. Schiffrin, "Redox-dependent signalling by angiotensin II and vascular remodelling in hypertension," *Clinical and Experimental Pharmacology and Physiology*. 30 (11), 860–866, 2003.
9. R. M. Touyz and E. L. Schiffrin, "Reactive oxygen species invascular biology: implications in hypertension," *Histochemistry and Cell Biology*, 122, 4,339–352, 2004.
10. Naughton CK, Nangia AK, Agarwal A. Varicocele and male infertility: Part II. Pathophysiology of varicoceles in male infertility. *Hum Reprod Update* 34, 2, 976–982; 2001
11. Turner TT, Tung KSK, Tomomasa H, Wilson LW. Acute testicular ischemia results in germ cell-specific apoptosis in the rat. *Biol Reprod* 57: 1267–1274; 1997
12. Wood D.L., Sheps S.G., Eleback L.R. and Schirger A., Cold pressor test as a predictor of hypertension, *Hypertension*, 6, 301–306; 1984
13. Briggs J.F. and Getting H., Vasomotor response of normal and hypertensive individuals to thermal stimulus (cold), *Minn Med.*, 16, 481–486; 1981
14. Hines E.A., Jr. Significance of Vascular Hyper reaction as measured by Cold-Pressor test, *American Heart J*., 19,408–416; 1940
15. Kelsey R.M., Patterson S.M., Barnard M. and Alpert B.S., Consistency of hemodynamic responses to cold stress in adolescents, *Hypertension*, 36, 1013–1017; 2000
16. Jacques de Champlain and Marie Reine Van Amerigen, Regulation of Blood Pressure by Sympathetic Nerve fibres and Adrenal Medulla in Normotensive and Hypertensive Rats, *Circulation Research*, 31, 617–628; 1972
17. Mancia G., Di Rienzo M., Giannattasio C., Parati G. andGrassi G., Early and late sympathetic activation in hypertension, *Scand Cardiovasc J Suppl*., 47, 9–14; 1998
18. DeQuattro V. and Feng M., The Sympathetic nervous system: the muse of primary hypertension, *J Hum Hypertens*, 16 Suppl 1, S64–S69; 2002
19. Pramanik T., Regmi P. and Shrestha P., Detection of individuals prone to develop hypertension in their future life, *Nepal Med Coll J*., 10, 35–37; 2008
20. Schneider G.M., Jacobs D.W., Gevirtz R.N., O'Connor D.T., Cardiovascular haemodynamic response to repeated mental stress in normotensive subjects at genetic risk of hypertension: evidence of enhanced reactivity, blunted adaptation and delayed recovery, *J Human Hypertens*, 17, 829–840; 2003
21. Verma V., Singh S.K. and Ghosh S., Identification of susceptibility to hypertension by the cold pressor test, *Indian J Physiol Pharmacol*, 49(1), 119-20; 2005

22. Kasagi F., Akahoshi M. and Shimaoka K., Relation between cold pressor test and development of hypertension based on 28 year follow up, *Hypertension*, 25, 71-6; 1995
23. Germano G., Lintas F., Truini A., Raggazzo M., Lannetti G.D. and Sperduti L et al., Blood pressure, *High Blood Pressure and Cardiovascular Prevention*, 2(10), 87-90; 2003
24. Lysiak JJ, Turner SD, Nguyen QA, Singbartl K, Ley K, Turner TT. Essential role of neutrophils in germ cell-specific apoptosis following ischemia/ reperfusion injury of the mouse testis. *BiolReprod* 65: 718–715; 2001
25. Lysiak JJ, Nguyen QA, Kirby JL, Turner TT. Ischemia-reperfusion of the murine testisstimulates the expression of proinflammatory cytokines and activation of c-jun N-terminal kinase in a pathway to E-selectin expression. *Biol Reprod* 69: 202–210; 2003
26. Giuglian D, Marfella R, Coppola L, et al. Vascular effects of acute hyperglycemia in humans are reversed by 1-arginine: evidence for reduced availability of nitric oxide during hyperglycemia. *Circulation* 95: 1783–90; 1997
27. Du XL, Edelstein D, Dimmeler S et al. Hyperglycemia inhibits endothelial nitric oxide synthase activity by posttranslational modification at the Akt site. *J Clin Invest* 108: 1341–8; 2001
28. Beckman JS, Koppenol WH. Nitric oxide, superoxide, and peroxynitrite: the good, the bad, and ugly. *Am J Physiol* 271: C1424–37; 1996
29. Cudicini C, Lejeune H, Gomez E, Bosmans E, Ballet F, Saez, J, Jegou, B. Human Leydig cells and Sertoli cells are producers of interleukins- 1 and-6. *J Clin Endo Metab* 82: 1426–1433; 1997
30. Lysiak JJ, Bang HJ, Nguyen QA, Turner TT. Activation of the nuclear factor kappa B pathway following ischemia-reperfusion of the murine testis. *J Androl*; 26: 129–135, 2005