International Journal of Healthcare Sciences ISSN 2348-5728 (Online)
Vol. 2, Issue 2, pp: (269-270), Month: October 2014 - March 2015, Available at: www.researchpublish.com

Temperature Controlling Mechanisms in the Male Gonad

Arunachalam Kumar

Professor of Anatomy, Kanachur Institute of Medical Sciences, Mangalore 575018, India

Abstract: **This brief article touches upon and discusses some newer areas of interest in thermoregulatory mechanisms operating in the human system. The male gonad can best function optimally only when it's ambient temperature is lower by a few degrees than the core body temperature. We present here tow such cooling mechanisms – one the chaotic system and the other the surface area increase theory due to differing levels of suspension to the two testicles.**

Keywords: **male gonad, thermoregulation, chaotic cooling systems, surface area, spermatogenesis**.

1. INTRODUCTION

The male mammalian gonads, the testes can best function (producing gametes) only in ambient temperatures lesser than body temperature. Towards production efficiency a number of bio-mechanisms are in operation, especially in the reproductive age male.

Among the factors that enable the testes to maintain or remain in a conducive temperature range, physiologists have proposed the organ's venous return process is one of the paramount. The pampiniform plexus of veins, a densely convoluted network of veins ascends from each testis forming a loose sheathe of vessels wrapped around the spermatic cord. Within the pelvis, the veins unite to form either the left or right testicular vein, to ultimately drain into the inferior vena cava, directly or circuitously (as in the left) through the left renal vein. Venous blood being cooler than arterial, the sheath formed by the pampiniform plexus serves to cool the arterial blood descending into the organ. While the argument is sound and logical, there still remains a hitch: why then do the female reproductive organs, the ovaries too though situated well within the pelvis, possess veins in the form of a pampiniform plexus draining it? The ovary through its locale within the abdomen / pelvis demonstrates it does not have need to 'cool' itself.

Obviously there are more or hitherto unknown mechanisms too that help keep the testes cool: it is claimed that the uneven levels of suspension of the scrotal sac encased gonads is itself an example of 'exposing' more surface area to ambient temperature than if the sacs were on level with each other.

The free suspension of the testicles in a loosely wrapped and hyper mobile sac, contributes to a random swing of the organs. The involuntary up, down, anterior, posterior, right or left, circular and elliptical motions that the hung scrotum exhibits, continuously, induces a chaotic cooling system to operate. The non-volitional erratic excursions of the freely suspended sac, allows for better exposure and fanning of its contents to ambient environmental temperature, more effectively. The scrotum is a classic example of natural chaotic cooling system, and that this may well be the primary contributor to thermoregulatory mechanisms in the metabolically active gonad (1, 2)

That the testicles are pulled up, involuntarily, if and when temperatures go below optimal levels, through a reflex muscular contraction, the retracted scrotum becomes less mobile and more fixed or, far less chaotic in movement. This control of erratic excursions and the subsequent inhibition of the chaotic cooling system, arrests continued cooling. The question is, could prolonged and continuous restrictive apparel lead to more serious complications than just azoospermia or oligospermia? Could limiting the chaotic cooling trigger malignant testicular tumors?

The temperature regulation is cardinal to functional efficiency of the mammalian male gonad, the testis. Anatomically, to provide a cooler environ that better facilitates spermatogenesis: the testicles are housed outside the abdomen in a separate sac. Anatomically one or the other half of the scrotal sac hangs at a lower level than the other. The testes, housed within

the sacs are also situated, suspended, one slightly lower than its other counterpart. While many theories on why and how of the testicular levels have been proposed, including those engendered by vascular, functional, embryological or evolutionary influences, none of the proposed scientific reasons are totally convincing.

One additional, yet overlooked cause for the naturally displaced level could be, simply, to expose more surface area of the active organ to cooler environs. While it is an accepted fact that scrotum outside the abdominal cavity is paramount to the functional efficiency of the testes in a preferred lower temperature – it still does not address the question – why hang at different levels?

Assuming the scrotum symmetrical, the two medial surfaces of the two testes would face each other, juxtaposed – the total surface area of testes exposed to lower environmental temperature would be that provided by the two lateral surfaces only.

By modulating, differential rates of descent of the testes in the prenatal developmental stage, the final position of the testis allow for more surface area exposure to environment – the additional, being a part of the lower medial surface of the lower testis and part of the upper medial surface of the higher testis. In effect, just by suspension at two levels, nearly one entire extra surface is available for thermoregulation and cooling. That is the surface area available now becomes two lateral, plus two halves of the two medial. This extra area available to the testes, probably is yet another a significant but overlooked embryonic factors that dictates differential rates of descent and displacement of anatomical levels of twin reproductive male organs.

A number of factors have been mooted that engender temperature regulations – one of the more widely accepted ones is the arrangement of a much coiled wrap- around arrangement of venous channels that drain the organs. This anatomically odd arrangement forms the 'pampiniform plexus', which ascends into the pelvis to unite into a single testicular vein. The venous return of the gonad is, therefore in parts, reticular and linear.

This mesh – like venous arrangement sheathing the testicular artery is held by physiologists as one of the more vital factors cooling the testes. The returning venous blood, through its coiled arrangement, cools the descending arterial blood on its way to the target organ and increases its functional efficiency (1, 2)

A second factor is the very displacement of the sac to below and away from the abdomen, directly exposing the scrotum to ambient room temperature, which is cooler than core body temperature. In my view, while these two factors play significant roles, neither is convincing enough to account dramatic lowering in testicular temperature; In theory we had earlier mooted – of increase in total surface areas of testes, due to varying hanging heights of the two gonads in the same individual , may contribute to temperature lowering. The crenated surfaces of the skin, the extra half surface of the medial side of the lower testes are possible factors too that serve o dissipate heat from building up in the organ (3).

It is proposed that the free suspension of the testicles in a loosely wrapped and hyper mobile sac, contributes to a random swing of the organs. This involuntary up, down, anterior, posterior, right or left, circular and elliptical motions that the hung scrotum exhibits, continuously, induces a chaotic cooling system to operate. The non – volitional erratic excursions of the freely suspended sac, allow for better exposure and fanning of its contents to ambient environmental temperature, more effectively. In our opinion the scrotum is a classical example of natural chaotic cooling system and that this may well be the primary contributor to thermoregulatory mechanisms the metabolically active gonad.

That the testicles are pulled up, involuntarily, if and when temperatures go below optimal levels, through a reflex muscular contraction: the retracted scrotum becomes less mobile and more fixed or far less chaotic in movement. This control of erratic excursions and the subsequent inhibition of the chaotic cooling system, arrests continued cooling this question is could prolonged and continuous restrictive apparel lead to more serious complications than just azoospermia or oligospermia? Could limiting the chaotic cooling trigger malignant testicular tumors?

REFERENCES

[1] Arunachalam Kumar, The Functional Anatomy of the Male Gonadal Vessels: A Re-Appraisal, International Journal of Scientific Research and Education 2: 8, 1728-1740, 2014

[2] Arunachalam Kumar, Burn the bra: compromised chaotic cooling as cause for testicular and breast carcinomas Medical Hypotheses, 73 (6) 1079-80, 2009,

[3] Arunachalam Kumar & Kumar JC, Swinging high and low: why do testes hang at different levels? Medical Hypotheses 69 (3) 2008