

Is Ageing Related to Shrinkage of Heart: A Hypothesis

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Received date: August 02, 2017; Accepted date: August 28, 2017; Published date: September 01, 2017

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Abstract

At the start shrinking of body is explained by citing article of Louise Atkinson in which she says your body is one incredibly shrinking one from your brain to your heart –almost everything gets smaller with age. Present article also argues around the concept of shrinkage and its correlation to locally acquired wisdom. Pain in back and neck is described in relation to shrinking of muscles. Brain shrinkage and bony shrinkage is discussed along with measures to prevent it. Heart shrinkage (John Hopkins study) is linked to chest wall shrinkage (community acquired knowledge) through anatomical continuity between heart and thoracic wall. Results of study conducted to assess various aging parameters reveals that chest wall including its attached muscles shrinks towards the core of body i.e. heart and finally article discusses the clinical implications of the ageing phenomenon in backache, sympathetic activation, cardiovascular aging and dietary habits. Cardiovascular aging is described in detail in reference to recent Cedars Sinai hospital study of cardio-sphere derived stem cells and reversal of aging process.

Keywords: Aging and heart shrinkage; Cardiovascular aging; Aging and local wisdom; Aging and chest wall shrinkage

Background

The phenomenon of aging is being put in a slightly different way and so also its introduction which includes few examples from local wisdom [1].

First of all we start with broader topic of shrinking. Louise Atkinson in her article says your body is one incredibly shrinking one from your brain to your heart –almost everything gets smaller with age [2]. We also go along with this viewpoint and primarily argue around the concept of shrinkage and its correlation to locally acquired wisdom.

Shrinking of body with age is not an uncommon sight e.g. the hunch back of old age as everybody knows is a natural consequence of ageing wherein the muscle weakness and disc degeneration leads to this hunchback or hyperkyphosis [3]. In other words muscle and bone shrinkage leads to this exaggerated curve in back. This conceptual idea of shrinking of muscles is further explained by following observations. Take for instance, the symptom of pain in back in elderly for which physicians advise so many investigations like X ray, MRI scan, blood tests like Vitamin D level and HLA B 27 antigen for diagnosis; however it is concluded by researchers that investigations are rarely necessary for low back pain [4]. In majority of the cases no specific pathology is revealed because this backache can be attributed to normal ageing process as also stated by local north Indian saying ('kamar tootna' [5] in Hindi language for broken and shrunken back muscles) which literally implies that a person loses strength and stamina in old age. Another common trouble in elderly is pain in neck which is frequently labelled as cervical spondylosis [6]. This neck pain like low back pain can be attributed to weakening and shrinking of muscles with age (locally in hills said as 'khetta tootna' for shrunken neck muscles) rather than making a pathological diagnosis of cervical spondylosis.

Our brain shrink leading to dementia and Alzheimer's [7], however the incidence of Alzheimer's disease is seemingly less in our part of world [8]. The reason may not be difficult to comprehend and in all likelihood it could be due to routine consumption of clarified butter (or the so called ghee in local parlance) in diet which is rich in omega-3 fatty acids [9] and other essential nutrients.

Our bones also shrunk leading to osteoporosis [1] and for preventing this bone loss, Vitamin D and calcium tablets are routinely prescribed nowadays; however the knowledge about having healthy bones may not be new as people at large always knew the importance of having strong bones, to the extent that a holy Sage (wise and much respected person) by the name of Dadhichi [10] in Hindu mythology had such strong bones that these bones were used as weapons after his demise. There is so much to learn from one's society and likewise our point of research in this study is presumably based on the traditional concept about ageing process.

Now let us come to our present topic of heart shrinkage. We know that heart does shrink as told by Johns Hopkins university school of medicine in their study where they have concluded that heart shrink 0.3 gram per year after middle age; using MRI scans they have proved that heart shrinks in old with proportionate decline in heart capacity to pump blood [11,12].

One traditional information (locally heard here across generations) about ageing is that person's chest wall shrinks with age and this shrinkage is the reason for decline in physical well-being in old. Before going any further first we need to establish some relationship between heart and chest wall or thoracic wall [13] in order to correlate heart shrinkage as told by John Hopkins with our traditional knowledge about ageing.

We know from our anatomical knowledge that heart is connected with outer chest through strong sterno-pericardial ligaments [14], so there exists a link between heart and chest wall. Even heart's outer lining pericardium is in continuity with pleural lining of adjoining

lungs, that's why pericardial effusion invariably leads to pleural effusion [15]. If mesentery of intestine which supports various abdominal organs can be considered one single organ [16] then same thing can also be said about supporting structures of thoracic cavity. So, one can safely argue that various organs in thoracic cavity (including heart) are connected to each other and also to the outer thoracic or chest wall. So henceforth we will be assuming (and rightly so) that heart shrinkage can lead to chest wall shrinkage as heart and chest are in continuity.

Now coming to the question does chest really shrink and if it does whether it is associated with ageing, we need to know and for which we are looking for some answers through this study. We are putting this community acquired information of chest wall shrinkage through scientific and analytical testing as follows.

Material, Methods and Results

This is a combination of retrospective and prospective study over a period of ten years from 2006 to 2016 done at a private clinic at Shimla, capital city of northern Indian Himalayan state of Himachal Pradesh. Selected few healthy elderly individuals (total ten in number) in the age group 65 to 90 years who didn't have hypertension and diabetes, were non-smokers, non-alcoholics and free from any major systemic illness were subjected biennially (once in two years) to following tests:

Chest wall circumference and mobility: maximum chest circumference (during full inhalation) measured with tape at two levels, one at the level of axilla (4th rib) and another at the level of xiphoid process by a single well trained observer. In clinical setting, a simple and inexpensive technique for measuring chest is a tape measure which has shown to be reliable in healthy volunteers [17,18]. Mobility (thoracic excursion) at different levels was also measured using measuring tape as it is a simple and economical method [19].

Peripheral temperature and oxygen saturation: assessment of peripheral temperature of extremities by observer using dorsum of the hand while the subject is seated at rest. Judging the skin temperature for coolness or warmth using back of hand is a basic clinical skill and even assessment of fever can also be done through this technique [20]. Simultaneously peripheral oxygen saturation (SPO₂) levels were measured using pulse oximeter. The purpose of keeping the assessment of peripheral temperature and oxygenation in study is its relation to the argument of our hypothesis that ageing is primarily cardio-vascular through shrinkage of heart and its vessels.

Back and neck muscles bulk and strength: this was subjective in nature and asked from interview how one feels about these with advancing age. This question was kept in study because these muscles are attached to chest wall either through their point of origin or insertion [21]. These muscles are also included in the important group of muscles of body i.e. core muscles. These core muscles are linked with healthy ageing in some recent studies [22].

All participants belong to good socio economic status and were personally known to us and few of them were our own blood relatives.

We found out that there is decrease in chest wall circumference up to 1.5 cm in a decade with proportionate decline in thoracic excursion, extremities increasingly getting colder, decrease in SPO₂ levels (from peak of 100; falling to 90 and less) and decline in back and neck muscles bulk and strength with advancing age. Results did point

towards the fact that with advancing age chest wall including its attached muscles does shrink and shrink towards its core i.e. heart.

Discussion and Conclusion

Though this study may have its limitations (like imprecision and fewer participants) however it throws a good insight into certain clinical aspects of ageing which is stated below.

First clinical implication is regarding the argument that ageing is primarily cardiovascular through shrinkage of heart and its vessels (argument which is supported by our observation of decreased peripheral temperature and oxygenation). In clinics we have examined elderly people who faint while doing exercises and even done one post mortem examination of a cardiac diseased patient who died while he was undergoing massages to tone up his body. The core internal organs of the body are more important and why to divert the precious vascular supply to periphery thereby decompensating the already worn out and ageing heart which may lead to fainting episodes and heart failure. In many respects, heart failure can be thought of as the quintessential final cardiovascular aging pathway, representing the convergence of age associated changes in cardiovascular structure and function, aging changes in other organ systems and the progressive increase in cardiovascular diseases in the elderly [23]. Heart failure in aged is mainly diastolic dysfunction and this diastolic dysfunction with consequent aging may be reversed after cardiac stem cell therapy [24]. Animal study reveals that cardio-sphere derived cells (cdc), a specific type of stem cell, secrete tiny vesicles that could 'turn back the clock' for age related heart conditions [25]. Investigators from prestigious Cedars- Sinai medical center injected cdc's into the hearts of rats with an average age of 22 months, which is considered aged; results of those test show improved heart function, demonstrated longer heart cell telomerases (compound structures located at the ends of chromosomes that shrink with age) and improved exercise capacity in rats who received the said therapy [24,25]. This path breaking research on cardio vascular aging and its reversal is recently published in European heart Journal.

Another clinical application is regarding cell condensation or cell shrinkage due to sympathetic activation. In elderly individuals we know there is sympathetic over activity mainly due to essential hypertension which leads to apoptotic changes, cell condensation and cardiovascular remodeling [26-28]. This pathological heart shrinkage due to high blood pressure further leads to deterioration of cardio vascular health and to counter this cardio-selective beta blocker drugs are used. Our personal clinical experience is that very old should be given prophylactic beta blockers not only to prevent arrhythmias but also to inhibit sympathetic activation which commonly occurs due to hypertension.

Another clinical correlation is about pain in neck and back. Low back pain is a major problem, ranked as the highest contributor to the disability in the world and older people with back pain have a 13 per cent higher chance of dying early as recently stated in a study published in European Journal of Pain [29]. One of the causes of backache and neck muscle spasm as already told could be overworked aging heart (because these muscles are attached to chest which in turn is connected to heart) so this reason should be kept in differential diagnosis by physicians and one can also defer taking unnecessary painkillers. Other modalities of treatment like few days rest (to de-stress the body including heart) with gradual return to work should be tried.

Last is about the role of diet in ageing. One should simply stick to traditional diet (such as lacto-vegetarian [30] here) which is in line with culture, social practises and body needs. The food which is being eaten in certain communities for centuries should not be simply forsaken if some studies say so (like advice about not using ghee or clarified butter as it is thought to contain saturated fat). All sorts of advisories are issued and one regarding reduced intake of salt seems to be a bit irrational. Cardiologists advocate reduced consumption of salt/sodium for healthy heart in spite of the fact that sodium deficit can clinically manifest as decreased effective circulatory blood volume [31]. Sodium is important for body as it maintains blood volume, helps in conducting muscle and nerve impulses [32]. We get sodium easily through common salt; if it were not for discovery of salt in antiquity we would be eating much more meat for fulfilling our dietary sodium requirements as plant food contains less sodium. How a body with less overall circulating blood volume will be healthy is difficult to understand; rather we should advocate adequate salt consumption even in hypertensive's, so that they don't have to consume heavy bulky diets (which may further lead to weight gain) for their sodium requirements and moreover blood pressure should be controlled by other means/medications [33].

Ageing process is not that simple rather it is multi-dimensional and complex phenomenon having physical, mental and socio-economic implications; so healthy ageing therefore requires a concerted effort from everybody involved.

To conclude it can be safely argued from present study that there can be an association between ageing and shrinkage of chest wall/heart with its clinical implications. This hypothesis of ageing should be regarded as having a rational basis and hence be evaluated and tested further.

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