

REDESCRIPTION OF ZANG KIDNEY MODEL — ANATOMICO-FUNCTIONAL TIE

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Traditional Chinese Medicine (TCM) conventionally described Zang organs according to the Zangfu manifestation theory. Current TCM studies showed that the hypothalamic-endocrine-immunological axis may represent the Zang Kidney. Zang is described as a set of interrelated parts rather than an anatomical organ. This paper reviewed how the Zang Kidney could mean the same anatomical organ but with added dimension. Re-inclusion of musculature with its related reflexive functions helped restoring the anatomical functional tie. The one retro-infra-peritoneal organ mass of adrenal, kidney and bladder, ovary, reproductive structures, and the pelvic and back musculature may be taken as the Zang Kidney “situated internally”. Zang Xiang “external manifestations” may be expressed as functional features of that one structure as it serves for controlling water and fluid metabolism, related bladder function, sexual behaviour, reproduction and functions for life, and also functional features of the intricate interrelationship between that structure with neuro-endocrine mechanisms in mating, craftsmanship and in life. These correspond well with Zang Kidney described, and meet its essential meaning more closely than previous models. This anatomico-functional model can better interpret TCM literature and be easily understood by current science.

Key words: Zang Kidney, Zang Xiang, anatomical functional structure, modern medical science

Introduction

This paper is a step to describe Traditional Chinese Medicine (TCM) mechanisms in scientific terms. So far, the largest barriers to this are its different language and lack of research. Zang Kidney is quite different from the anatomical organ, the kidney. For framing future research, this paper aims to identify meaningful and useful modern anatomico-physiological homologues and states that match TCM Zangfu

networks and functions. To start with, it is presumed that TCM and western medicine essentially started with the same body bio-physiological features, being different only after long cultural separation.¹ By reviewing the TCM Zang Kidney, understanding the limitations of modern models, and reinterpreting it in that presumptive perspective, a useful model can be deciphered.

A note to clarify the wording used. TCM texts capitalize the first letter to denote a word signifi-

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cantly different from modern medical usage. Here, for clearer and easier reading, Zang Kidney, Zang Spleen, Zang organs are abbreviated with prefix as zKidney, zSpleen, zOrgans respectively.²

From Ancient to Orthodox Zang Kidney Model

TCM ancient literature anatomically described many body parts. Internal Zang-fu were classified as five Zang organs, six Fu organs and six extraordinary Fu organs. That was an anatomico-functional classification. The zOrgans, Zang, are solid organs, called in ancient Chinese Cang (cang, to store; zang, storehouse) to depict organs which collect and store. In contrast, the Fu or zViscera are hollow, through organs that receive and let through. In contrast, the word organ in western medicine means a list of fully differentiated structural and functional units specialized for some particular function.

I. From anatomy to function

Literature on zKidney began with its anatomy before discussing its functions.

To start with, the kidneys were described anatomically in the most ancient TCM texts, the Yellow Emperor's Inner Cannon (HuangDi Nei Jing) and Eighty Eight Classic Medical Questions (Nan Jing). The actual anatomy of kidneys was not described in Nei Jing, but in Lingshu, the elevated or lowered kidney was described to cause problems.³ In Nan Jing⁴ "The Kidney consists of two pieces, weighing one catty and one liang". Nei Jing Suwen⁵ explained "The loin, the home of the Kidney". This represents the anatomical kidney. TCM called it the water organ.⁶ In TCM, the same as in modern physi-

ology, the Kidney has a dominating influence on water metabolism and fluid metabolism.

Zang solid organs and Fu hollow organs form the core while the other body parts are functionally related to them. Ancient Chinese scholars observed that the body as a whole varies with environment in adaptation. Without the modern cellular knowledge, they expressed these in holistic terms according to their refined understanding of the universe. The body core would then function and vary with nature according to Yin Yang and harmony principles. Diseases would be due to disturbances of nature on poor body constitution and adaptation. Then, the interrelationship between various body parts were used to account for inner harmony and its disturbance. This is the Zangfu manifestation (Zang Xiang) theory which expressed the Zang organs as functional organ networks in the body systems, generalizing from the physiological functions and pathological features of the Zangfu organs. Xiang, or manifestations, in Chinese refers to the picture as well as the equivalent symbolization of things. The book Classified Classics,⁷ similar to an earlier commentary by Wang Bing,⁸ stated that "The Zangfu organs situated internally are manifested externally (physiological and pathological features reflected externally), thus called Zang Xiang".

The understanding of Zang Xiang is highly important to clinical TCM. Current workers tried to understand it through diseases and from clinical methods being used. Nevertheless, Zang organs are essentially different from WSM terms. This could be due to the fact that the concepts of Zang organs and Zang Xiang have developed since ancient times and during the course of time, correlation between anatomy and functional physiopathology became insignificant. The difference has led to divergent

views on handling TCM words when confronted with modern science. TCM words of common usage may describe what lacked and should be considered technical terms. Others take them for the similar things but different only in breadth and dimension. Others question their validity.

Currently on Zang organs, TCM is more in a way of describing a set of interrelated parts rather than one anatomical organ. In current TCM literature, the main physiological functions and features of the zKidney are: “storing essence, governing water metabolism and receiving Qi. It is important in human reproduction, growth and development and, at the same time, is the root of all Yin Yang of the whole body. The Zang Kidney in the body responds to the bones and opens through orifices at the ears and the perineal Yin tracts. It manifests in the hair as lustre, in will commitment or Zhi (determined drive and desire) as fear, and in fluids as saliva. The Kidney meridian channel and the Bladder channel are mutually related exteriorly/interiorly. The Zang Kidney, according to Yin Yang, is the Yin of all Yin’s, and is categorized as the water element among the five Chinese cosmic elements. It is the most important Zang organ of the body.”⁹

II. Mounting gap between function and anatomy

Is this current Zang Kidney description matched for function with anatomy?

Anatomy was understood sufficiently in ancient times. The zKidney as an entity was not challenged among TCM practitioners and in traditional texts until the western view in anatomy and physiology confronted China. However, the longer the cultural development, the more TCM described the body

in terms of functional entities away from anatomy matters. The earliest TCM text, *Nei Jing*, was written only after earlier centuries of practice of Chinese medicine. Over the subsequent centuries, most TCM scholars further developed and added new concepts, justifying with added observations and experience by following the ancient tradition particularly *Nei Jing* with its conceptual framework. The Zang organ, to start with in those early times, could be a functional unit based on materialistic reality. There were no microscopic views to answer for anatomical physiology. Trying to go one step further to answer for interrelationship between various body parts, the Zangfu manifestation theory was formalized later, being first well expressed by Wang Bing in the Tang Dynasty.⁸ In fact, not all the ascribed functions were described in *Nei Jing*. For example, the zKidney function as the primordial power house was developed in the Ming dynasty,¹⁰ and that of receiving Qi ascribed in the Ching dynasty.¹¹ Thus, the currently described zKidney functions could be the cumulative additions of thoughts and ideas over time onto that early framework. In time, physiology could not be matched with modern anatomy. In the later era of TCM, the description of zKidney was quite different. For example, the classic *Golden Mirror for Original Medicine* (*Yi Zong Jin Jian*)¹² described it with a complex anatomy: “The Kidney consists of two pieces, shaped like beans, paired and curved, attached on both sides one and half inch from the spine. Externally there is a yellow fatty wrap, each having two strips, the upper strip connecting to the heart, the lower strip going to the big bone under the spine. At the end of the spine, roughly like half a hand, there are two dens where the Kidney strip passes through, going up the spinal cord marrow up the brain, to join with the sea of

marrow.” Such is an obvious attempt to give previously described functions an anatomical base, but hardly acceptable to current science. Rather than an anatomical organ, zKidney becomes a mechanistic complex consisting of nowadays many structures to account for its multiple functions.

Modern Neuroendocrine Zang Kidney Model

In modern medicine, anatomy, function and physiology have to be closely related. Present TCM scholars, with due considerations to modern world-views, have to answer for the gap. However, available full translated accounts of TCM¹³⁻¹⁵ are expressed only in almost non-materialistic terminology of TCM language.

Up till now, there is no way to interpret the zKidney functions with one single anatomical entity. Making it up with multiple disparate organs is not meaningful. TCM needs be reinterpreted in the modern context without losing the original TCM meaning and framework. Modern workers are concerned with Zang Xiang. Currently, the word Zang takes a rich meaning, including its many interrelated body parts and their functions, and its relationship with other body parts, demonstrating the mutual positive and negative influences among the body systems. The scientific study on zKidney was one of the earliest works in this reform for modern reinterpretation.

Much research has been done in China from the integral, organ, cellular and microscopic levels to investigate for the essential meaning of zKidney. These researches have demonstrated that the hypothalamic, adrenal and ovarian function are closely related to zKidney. Led by Shen, sub-clinical hypo-

thalamic-pituitary-adrenal (HPA) axis dysfunction was found in zKidney-yang deficiency patients presenting with various diseases.^{16,17} Clinical studies documented that, regardless of disease types, whether asthma or non-ovulatory menstrual disorders, HPA axis dysfunction and adrenal function were related to zKidney-yang deficiency^{18,19} and were remediable with zKidney herbs.²⁰⁻²⁵ These studies were further demonstrated in animal models.²⁶⁻²⁹ Further studies were done on senescence and the concept of physiological senescence related to failing HPA axis function analogous to failing zKidney with age was developed. Similarly, in zKidney deficiency, blood testosterone (T) was decreased while estradiol (E2) and E2/T ratio were increased³⁰ in male patients,³¹ while in female patients E2 and E2/T ratio were decreased.³² T was lower while E2, FSH, LH were higher in zKidney-yang deficiency than in zKidney-yin deficiency subjects.³³ In short, hypothalamus-pituitary-ovary-adrenal dysfunction were notable in zKidney dysfunction.³⁴⁻³⁶ Further study on other hypothalamic functions such as thyroid and sex hormone axis³⁷ and immunological functions²⁹ revealed that the Immune-endocrine axis³⁸ and zKidney function are closely related. It appears that this neuro-endocrine axis really represent the zKidney.^{32,39,40}

I. Current anatomico-functional interpretation

This modern zKidney is not fully described here since there are lot of materials available to refer to.³⁶ Simply, it was first expanded to a Hypothalamic-endocrine network (especially the hypothalamic-thyroid-adrenal-ovarian axis) and now to a Neuro-endocrino-immunological model. Its difference from the kidney organ is explicit. The word Kidney in zKidney-yin deficiency refers to a

symptom complex unrelated to the modern kidney physiology and pathology. Each Zang organ is not separate, but can be explained only in its relationship with the other Zang organs as a whole.

That model is justified by Zang Xiang conceptual frameworks, which is vital in TCM theory, applications and therapy. But all these conclusions may have come about because of the inability to find the one anatomico-functional match. For thousands of years, the traditional understanding and practice took zKidney to be like a tangible entity. Scholars pushed hard from confrontation with the worldview of anatomy and physiology would relinquish the real organ as the key substance and choose the more important relational Zang Xiang as the core concept in keeping up with its meaning. To go more modernized, it becomes a conceptual framework, nothing like a real complex. Hence, modern TCM workers go further to seek using modern system or network theories to explain Zangfu relationships. To quote, “The Zang of TCM has its materialistic basis, and its form and structure. However, its materialistic basis or form and structure are dispersed, being diverse in many systems and organs, and somehow the materialistic basis or form and structure may not be fixed combinations”.⁴¹

Theoretical models can influence or direct diagnosis and therapy, or even act to pool clinical experiences. However, models certainly cannot be viewed as real complexes as they may change from time to time with new experience and observation. In contrast, there has been little change in all those centuries in the TCM Zang core concept. Not based on the usual solid acceptable standards in mainstream medicine, this model suffers from not being easily accepted since there can be many other ways to combine for similar networks.

In the end, it seems truly impossible to match the zKidney with modern anatomical structures as one coherent anatomical mass with meaning. Is it the end to reviewing the anatomico-functional tie?

New Anatomico-Functional Zang Kidney Model

Let us presume that in ancient TCM, zKidney was essentially started or defined as a structure with a name and configuration consistent with anatomy, while the frame model of Zang Xiang, generalizing manifestations of physiology and pathology, were added on top of it later. This first requires finding out the initial ancient anatomico-functional structure of zKidney, and then reviewing the derived Zang Xiang functions.

To rediscover the anatomico-functional zKidney, there is need to re-include musculature in reframing our theoretical framework. TCM started in primitive times with primary understanding to relieve pains and illnesses through stroking and pressure over muscles and tendons. Hot packs, vacuum, acupuncture, and massage were important therapeutic modalities acting through muscles and tendons, and cumulated experiences were used to treat other diseases. On the other hand, Western Medicine once followed a reductionist path to understand the body part by part. While these are tied together in systems, including digestive, respiratory, excretory, endocrine etc, the importance of muscles has all along been unintentionally downplayed in all discussions in general body pathophysiology. This perspective deficiency gap has become an obstacle to restore meaning and understanding of TCM in a modern context, particularly in the construct of zKidney.

I. Muscles and tendons essentially inside Zang Kidney

The Society of Deficiency Symptom Complex and Aged Diseases in the Chinese Association of Integrative Medicine drew up diagnostic criteria⁴² for zKidney deficiency, and three out of the following features need be present: (i) Back sore or pain (except injury caused), (ii) legs sore, weak knees or ankle pain, (iii) tinnitus or deafness, (iv) hair loss or teeth loosened, (v) post void dribbling or incontinence, (vi) decreased sex potency, infertility, and barrenness. It is clear that tendon-muscle symptoms are prominent features of zKidney disorders: in zKidney Qi deficiency, back and legs are sore and weakened; in zKidney-essence deficiency, there is lower limb weakness; in zKidney-yang deficiency, back and legs are sore and cold; in zKidney-yin deficiency, limbs are wasted and weak. In fact back and lower leg muscle problems associated with zKidney deficiency can be remedied with zKidney medicine. Furthermore, in zKidney Qi deficiency, urinary dribbling, incontinence, spermatorrhoea, early ejaculation are due to inadequate Qi, and in zKidney-yin or yang insufficiency, sexual energy may be weakened, all being related to the strength of muscles and pelvic health.

Related with the zKidney inside-out is the zBladder channel. The zBladder channel,⁴³ after continuing over the base of the skull, divides into two branches that descend parallel with the spine. The two branches, connecting also the kidney and the bladder, pass through the back down the thigh to meet each other at the knee fold and down a single channel. Its meridian aponeurotic system covers the main tendon-muscular structures of the whole back and the legs. These are all the important postural and dynamic muscles of the body.

These muscles are intricately related to smooth facilitated operational mechanisms including coping, courting, drive assertion, obtaining more Qi energy and sexual dynamics. Based on the TCM principle that “overtiredness and sexual indulgence causes zKidney deficiency”, Li⁴⁴ experimented with rats mating frequently or forced to swim to produce exhaustion. Typical zKidney deficiency was demonstrated. This demonstrated the importance of muscle exhaustion among other factors. Previous zKidney models failed to include the muscles and its supportive system in consideration. Removing this blind spot shed new light on understanding the zKidney.

II. Defining the functional anatomical Zang Kidney

The Zang Kidney, in the ancient Chinese, could mean the same anatomical organ but with added dimension. The one retro-infra-peritoneal organ mass of adrenal, kidney and bladder, ovary, reproductive structures, and the pelvic and back musculature may be taken as the zKidney internally^{45,46} (Figure 1A).

This is one functional structure, as discussed later, because they can be seen as one integral, closely interactive, closely inter-coordinated complex. Repro-

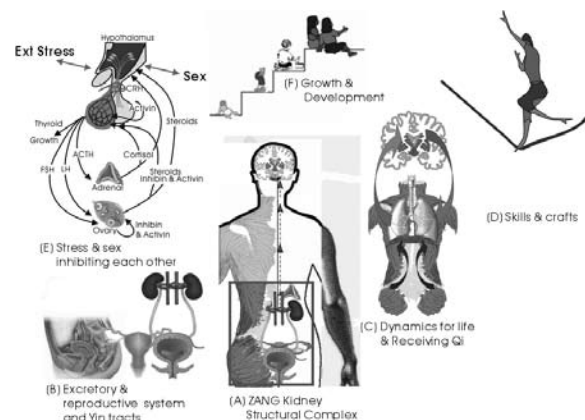


Fig. 1. Zang Kidney, Structure and Functions.

duction, excretion, mating and coping behaviours and assertion with stress tolerance in living are served by the Intrinsic Functions of that one functional structural complex.

This view with a structural base allows a re-understanding and a coherent construct of the zKidney and Zang Xiang manifestations into three inter-reacting levels. From the one internal zKidney Anatomical Structure, Intrinsic Structural Functions are produced and all of these are supported with Internal Interactive Complex Mechanisms.

Essentially it serves four areas: controlling water and fluid metabolism, related bladder functions, sexual behaviour, reproduction, and functions for life.⁴⁶ The internal support would be a host of neural, endocrine, receptor mechanisms among others to achieve homeostasis and to cater for life needs. These would produce external observable Zang Xiang manifestations.

III. Supporting understanding for the new zKidney Model

This present view of zKidney, as a functional structural complex closely interacting with supporting mechanisms, would be able to embrace known features and current findings which in the new light also become evidences for this model. This one functional structural complex includes adrenals since hypothalamus-pituitary-adrenal dysfunction was notable in zKidney dysfunction, and the zKidney-yang deficiency animal model can be produced by excessive cortisol or by damaging the adrenals. Including the kidneys and the front perineal tract, as well as the ovary, is concordant with the zKidney as a water organ “governing water metabolism and important in human reproduction”. The zKidney “governing

fluids” can be understood by metabolic and hormonal events around the kidneys. The hind perineal tract is included since constipation, faecal incontinence and rectal prolapse are features in zKidney deficiency (Figure 1B).

The back and pelvic musculature form one important functional group. These are the postural muscles for coping. Kungfu calls for force and power originating from the lower back at the Dantian, sacral chakra level, and for committing power for kungfu dynamics⁴⁷ (Figure 1C). Training this area is training to obtain more Qi energy, illustrating zKidney function of Na Qi or receiving Qi. Life functions can be attributed to postural, coping and aggressive dynamics displayed by the back and pelvic musculature. These are supported by the adrenals, meeting life needs. Symptoms of the Tendon-muscles are prominent in zKidney disorders.

Internal neuroendocrine mechanisms for support are those mechanisms closely linked to the zKidney structure. The postural and pelvic muscles are muscles for courting and mating. Together with muscles coordinating the two perineal tracts, they are important in animals for reproduction. In mating, the back muscles undertake tremendous work and need be coordinated with the pelvic muscles. They are intricately related to facilitate smooth operational mechanisms. To illustrate, a lordosis behaviour (standing coupled with a strong vertebral dorsiflexion) is displayed during courting and mating by rats typifying female quadrupeds.⁴⁸ This behaviour consists of a facilitated series of responses over which any step missing would disable the male to fertilize. It needs an estrogen and progesterone-primed female. Started after cutaneous stimulation, a facilitated interactive neural program from the primed hypothalamus activates the lateral

vestibular nucleus and the medullary ventral reticular formation so that their respective tracts in the lower brainstem and spinal cord exert powerful controls over the large postural muscles to assure smooth courtship performance for mating. Poor strength of muscles and pelvic health manifests in zKidney Qi deficiency with urinary dribbling, incontinence, spermatorrhoea, early ejaculation, and in zKidney-yin or yang insufficiency with weakened sexual energy. Furthermore, these muscles are also basic to agility, kungfu dynamics and supporting assertion of fine stable movements including dancing and other skills or crafts.⁴⁹ (Figure 1D). It is interesting that sex drives and environmental stress or assertion are related to each other, inhibiting each other as stress breaks this priming of the extremely estrogenic and progesterogenic dependent hypothalamic function. Such survival-based behaviours allow sexual drive to break in front of stressing environmental confrontations (Figure 1E). When compared with other supportive mechanisms not so dependably facilitated, the close link of these mechanisms to the zKidney structure as one functional complex can be appreciated.

Higher up, neural adaptations with hormones determine programmed behaviour through specific hormone receptors in the brain. Exemplified above, these assure smooth behavioural performance in such courtship behaviours for mating. In humans, compared with animals, cultural influences are more important for drives. Motivation mechanisms may be a general arousal⁵⁰ or a specific mechanism for each particular biological need. Desires are cultivated on top with social experiences and cultural influences. Even with impressive intellectual capacity with the cerebral cortex, humans are still subject to the wide variety of facilitating and inhibitory drive mechanisms. Will,

determination or commitment would be dependent on these cultural memories and drives. These memories may reside in neuroendocrine substructures acting through the musculature complex to coordinate responses for coping, aggression and commitment dynamics of life and living, all functions of zKidney. This interactive complex may thus aptly be called housing commitment, Zhi,⁵¹ which is the consolidation of desires and drives through experience (Figure 2). Thus the neuroendocrinal axis, including the hypothalamus, is one part of those internal mechanisms, while neural adaptation and coordination are also important.

To further understanding of the other Zang Xiang manifestations, growth and development has been related to the hypothalamus (Figure 1F), an essential function of the zKidney. Hormones and zKidney related chemicals, including vitamin D, sex hormone and erythropoietin, affect bones, producing marrow, Sui, for manufacturing blood. The two types of Sui, the blood Sui or bone marrow and the brain Sui or the sea of marrow, are primed by zKidney, the latter illustrated earlier as hormones priming the brain. In fact, since primitive life, the hind end is an important structure, through design or evolution, to couple with such interrelated interacting supportive systems for

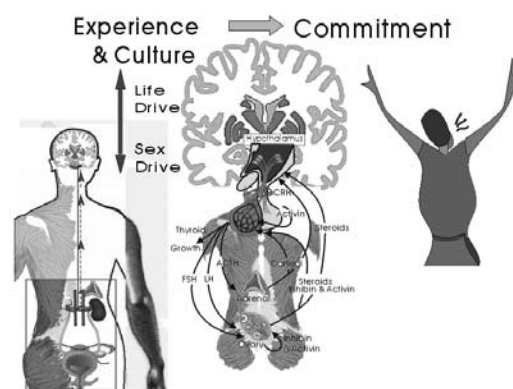


Fig. 2. Zang Kidney, Will Commitment.

living and survival. This formation allows zKidney to be aptly called in TCM the primordial foundation of the body. Health and strength in all these structures and internal mechanisms produce hair lustre.

In conclusion, the Zang Kidney can be perfectly expressed by a functional anatomical zKidney, which anatomical mass is made up of the hind-end retro-infra-peritoneal organs and the pelvic and back musculature, together with closely interactive neuro-endocrinal structures important in drives and development including the hypothalamus, brainstem and will-determination parts of forebrain. Its functional expressions or external Zang Xiang is observed in the associated interactive components. Its action domain during drive and development may subserve the bones, the thyroid, the immunological system and hair lustre among others. The complex serves all functions described under traditional Zang Kidney:- controlling water and fluid metabolism, related bladder function, sexual dynamics and reproduction, obtaining more Qi energy, and functions for life including coping drive and commitments for dynamics in life.

Functional Anatomical Zang Kidney, Evidence and Validation

Three main approaches stand out in past studies on Zangfu physiopathology: to review the original TCM classics on theory and applications, to expose TCM classical knowledge with modern interpretation and experimental proof and to research by clinical studies. The key is to keep them relevant to, and consistent with, the ancient texts and current usage in disease and therapy relating to zKidney. This present model will be reviewed for its supporting evidences in

contrast with the past model, a Hypothalamic-Endocrine-Immunological network of many dispersed organs.^{16,36}

I. Validating with ancient texts

To validate it, its meaning may be checked for consistency (True T/ False F) with ancient texts. To reduce comparing through the tremendous volume of many ancient texts, Nei Jing may be used as a ‘gold standard’. Two points are essential for any modern model (Table 1).

Thus, taking aside the word “kidney” used in describing Kidney Meridians, the present model is sound and more acceptable as it is more consistent with its usage in Nei Jing.

The next validation step is to check for any word “kidney” appearing throughout Nei Jing. Taking aside its use in Kidney Meridians, any such word with context and meaning inconsistent with the current interpretation would be incongruent and treated as an outlier. The less the number of outliers, the more representative this model would be. Going through Nei Jing for incongruence, in time for example, one may come to the word “creek”⁵² associated with the site of zKidney disease, and check which meaning fits better. “Creek” has usually been referred to the site where muscles and tendons cross, and here again can be justified better by the tendomuscular tensegrity depicted in the present zKidney model. To go completely through Nei Jing would need to be covered in another article. Similarly, after Nei Jing, one can validate the same with other ancient texts.

II. Supporting the Model with pathophysiology understanding

One may go through the list of understanding

in zKidney pathophysiology in ancient texts, and see how the past model or the present model covers and comprehends better in attributing function or dysfunction to their components (+/-).

Going through the list (Table 2), the present model is more plausible as it explains better more of the points listed. It portrays the Zang Xiang manifestations comprehensively. The standard text described

Table 1. Comparison of Models with meaning in Nei Jing (T: consistent, F: inconsistent).

	Nei Jing	Past Model	Present Model
1. Zangs, solid zOrgans in contrast to Fu, hollow zViscera	T	F	T
2. Zang Kidney refers to matters around kidney / loin	T: in general F: describing meridians	F	T: for zKidney Except “Kidney Meridians” to describe meridians

Table 2. Features (+ present, - absent) in Models as related to physiopathology described in texts.

	Past Model	Present Model
1. “The Kidney is the water organ, governing fluids.” ⁶	+	+
2. Kidney excretion is controlled by adrenal mineral corticoids.	+	+
3. The zKidney “opens through perineal Yin tracts” ⁹ (the vulva, urethra, and rectum)	-	+
4. Tendon-muscle symptoms prominent in zKidney disorders, e.g. back knee soreness and weakness ⁴²	-	+
5. Over-tiredness and sex indulgence cause zKidney deficiency and sex impotency.	+	+
6. Muscle exhaustion is related to zKidney deficiency ⁴⁴	-	+
7. Symptoms of zKidney disorders include urinary frequency, urgency, incontinence, impotence, premature ejaculation, infertility.	+	+
8. Symptoms of zKidney disorders include prolonged morning diarrhoea, rectal prolapse or constipation.	-	+
9. Symptoms of zKidney disorders include teeth and hair loss, and tinnitus or deafness.	+	+
10. Physiological senescence is related to failing HPA axis function analogous to failing zKidney with age. ^{36,38}	+	+
11. Hypothalamic functions and dysfunction are intimately related to zKidney function and zKidney Yang and Yin deficiency. ^{18,19,40}	+	+
12. The zKidney helps receiving Qi. ¹¹	-	+
13. The zKidney is important in reproduction and development ⁵³	+	+
14. In Zang Kidney, Zhi consolidates ⁵¹	-	+
15. The zKidney governs skill and craftsmanship ⁴⁹	-	+

storing essence Jing,^{53,54} receiving Qi,¹¹ governing water metabolism,⁵⁴ governing fluids,⁶ reproduction, growth and development,^{53,54} being the primordial power house,¹⁰ affecting bones Gu, producing marrow Xue Sui or Gu Sui,⁵⁵ to fill the brain substance Nao Sui, manufacturing blood Xue, lustre manifesting in the hair,⁵⁶ connected from the interior to the exterior through the zBladder,⁵² opening to the two yin tracts, governing technical skills or craftsmanship⁴⁹ and housing commitment.⁵¹ Now there really is a Zang organ “situated internally”.

Any future observations found as being enlightened by this model frame would further support its usefulness. For example, when pelvic girdle movements were found to contribute to inspiratory airflow in crocodilians and birds and probably archosaurs,⁵⁷ it further substantiates its importance in receiving zKidney Qi. Demonstration of this in man would also lend support. Other similar phylogenetic studies to illustrate the primordial importance of zKidney for power and interactive function would strengthen its validity. Validating the essential tie between associated mechanisms and zKidney is important. The degree of the closeness of the link can be explored by the degree of smoothness in internal facilitation over that of other less linked mechanisms.

III. Validating with usage in disease therapy

Success with zKidney therapies has been used as supporting evidence pointing to zKidney dysfunction being treated (Table 3). Distinction should be made between diseases which are internationally categorized and zKidney dysfunction, a body state which can be coexistent with various diseases.

Here the present model would need much more experimental support. But it is here that the model should predict that, apart from relating zKidney to hypothalamic function, further study on therapy with strengthening the back muscles would strengthen the zKidney and alleviate zKidney symptoms. Such therapies may consist of exercise, qigong, Tai Qi, massage, acupuncture or zKidney herbs. For example, warming the lower back muscles by hot packs is useful for relieving asthmatic attacks in the middle-aged.⁵⁸ To clarify, the health of muscles has often been attributed to the zSpleen. The zSpleen actually influences the muscles of the extremities, but the postural back and pelvis muscles form another tensegrity system. Tendon-muscular strengthening therapy by itself or as a significant part in combination therapy to (1) improve zKidney deficiency in various diseases and (2) improve pathological senescence can be two possible lines of investigation. Confirming these in future or lack of

Table 3. Effectiveness (+, -) on zKidney dysfunction with therapy on Model Components.

	Past Model	Present Model
1. Regardless of disease types, their associated HPA axis dysfunction related to zKidney-yang deficiency, ^{18,19} can be remedied with zKidney herbs. ²⁰⁻²⁵	+	+
2. Back and lower leg muscle problems associated with zKidney deficiency can be remedied with zKidney herbs.	-	+
3. Support of back muscles alleviate disorders that require zKidney Receiving Qi, like asthma. ^{58,59}	-	+

disconfirming evidence would support the present model. There are such supporting reports, scattered maybe due to the lack of the current zKidney framework to guide. Thus it was noted that Tuina acumassage may improve senescence⁵⁹ or reduce the problem of premature ejaculation⁶⁰ associated with zKidney deficiency. Further clinical studies to differentiate between the meanings of zKidney Yin, Yang, Qi, or Essence deficiency in relation to the components of the present model will also be useful. Particularly noteworthy is that essence is presumably stored, besides in an organ, in muscles and its tensegrity tone.

Concluding Remarks

This approach by no means refutes scientific findings of previous workers. Previous compromise retains only the internal interacting mechanisms to achieve necessary anatomico-functional coherence. This approach recombines that concept with the anatomical base into one coherent structural-functional complex. This is made possible by recognizing the importance of musculature and the densely placed components in the formation of an entity with the facilitated reflexive network of internal neuroendocrine structures.

I. Advantages of the present anatomico-functional model over previous models

(I) It would be easier to understand that the ancient people referred to one piece of structure rather than grouping many disparate functional entities.

(II) This single structure supports functions including controlling water and fluid metabolism, related bladder function, sexual behaviour and reproduction and functions for life. Most if not all of the

corresponding described functions of the zKidney can be explained.

(III) Inclusion of musculature embraces courting and mating behaviours, important to understand zKidney deficiency disorders.

(IV) The mechanism of receiving Qi by the zKidney is better visualized when related to musculature.

(V) Dynamics of life and living such as coping and aggression supported by zKidney are more easily understood in the presence of the back and leg musculature with its neuroendocrinal support.

(VI) This structure now includes the perineal hind tracts and the rectum, which symptoms are present in zKidney deficiency syndromes; it is only not standing out or downplayed in previous models.

(VII) The statement that “the zKidney governs technical skills or craftsmanship”, untouched by previous models, can now be better explained by the intricate support of these muscles.

(VIII) Additionally, this anatomico-functional model explains better the first description of zKidney anatomy in the most ancient TCM literature, Huangdi Nei Jing, in which description of the elevated or depressed zKidney that causes postural pains (Figure 3) and injuries would be better reinterpreted as the loin: “elevated or depressed loin muscles cause postural pains; and strong loin muscles protect against back pains, well centred loin muscles create ease and are not easily injured, and deviated loin muscles would cause backaches³. Without the understanding that the ancient writers essentially started on zKidney with name and structure consistent with anatomy as the kidney, this literature in Nei Jing could hardly be explained.

(IX) The physiology and pathology of the internal supportive complex of neural, endocrine and

receptor function can be used to explain the external manifestations of Zang organ networks and Zang Xiang features.

(X) The statement that “the zKidney houses commitment, Zhi”, can be explained better with this model.

(XI) This model provides, after all these years, a match between anatomy and function of the Zang organ. This is more acceptable to modern science. This platform can pull ancient Zang concepts to modern medicine and will allow elaborations on zKidney and diseases in plain words.

This anatomico-functional structural formation is an integrated system. It is richer in breadth and depth than former models. The anatomico-functional model would expand our framework to probe for more useful research and observations to understand and utilize the TCM concepts, and build TCM models based on scientific acceptable structures to elaborate ancient literature on health and diseases of zKidney. The importance of network backup from past observations is retained while the present model offers a more stable comprehensive entity. This is the first paper of its kind to redefine Zang and Zang Xiang in terms of a functional structural complex as the internal Zang with the Zang manifestations expressed externally. This approach can be similarly used to illustrate the five Zangs.

Previous findings can now be re-interpreted with this model⁶¹. Further studies should relate how treatment to strengthen the back and pelvic muscles would strengthen the zKidney and alleviate zKidney symptoms.

TCM classifies zKidney dysfunction by its clinical symptom complex into zKidney Yang deficiency, Yin deficiency, Qi deficiency and Essence deficiency.

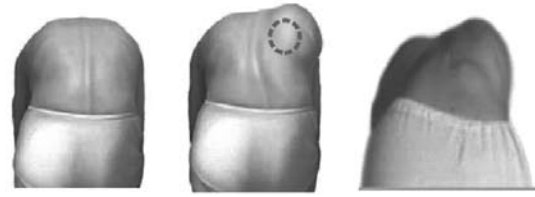


Fig. 3. Zang Kidney, Postural Pain.

Functional disorders without marked symptoms of heat or cold syndromes are considered to be a zKidney-Qi deficiency disorder. Somatic disorders without cold or heat symptoms with symptoms of dizziness, ringing in the ears, soreness and lumbar or knee aches, poor bones and maldevelopment, are classified as zKidney-Essence deficiency. However, there may be difficulty to standardize the widely overlapping spectrum of clinical manifestations, thus causing a limitation in diagnosis which is often not unified even for one patient. In this comprehensive model, these classical syndromes of zKidney dysfunction and symptom complexes could now be further delineated with modern anatomical structures and physiological mechanisms at those many interrelated levels. For example, Yang deficiency patients are associated with decreased cyclic AMP and increased cyclic GMP, while Yin deficiency patients have the reverse⁶². The cAMP / cGMP ratio is often used as a Yin Yang marker. To note, cAMP itself increased cortisol production.⁶³ Other hypothalamic pituitary adrenal axis hormone profiles have also been used. Postural muscle coordination and power should also be used.

Searching for biochemical or physiological markers may help additionally to make useful needed criteria in defining the different zKidney dysfunction syndromes. Additional anatomical and physiological assessment should improve such definition. A diagnosis of zKidney dysfunction would then, apart from

the diagnostic label of zKidney Yang, Yin, Qi, or Essence deficiency, comprise of the fuller diagnosis with the various levels of derangement specified. These may be at multiple levels including higher central or lower nervous system, hypothalamic or its related endocrinal axis, the target organs like ovaries or kidneys, the action sites like uterus, perineal tracts, and the muscular bulk with its varying degree of coordination through spinal and upper nervous tracts.

All these may allow better clinical differentiation and application in treatment, with the Zang organ and Zangfu manifestation theory in concert with modern medicine. TCM therapy of zKidney dysfunctions has been useful to support patients with major or chronic debilitation and in diseases with zKidney deficiency like asthma and menstrual disorders. Therapy in TCM is based on the clinical syndrome diagnosed. Other modules of treatment could then be explored and coordinated with herbal treatment for the type of zKidney deficiency. These may be active or passive manipulative treatment with strengthening methods like Tuina, electromagnetic devices, Kungfu and Tai Qi exercises. Developing tests for stability or facilitative cohesiveness of internal interactive mechanisms of zKidney may turn out a good index to measure zKidney strength and how use of medicine or nutraceuticals, including calcium, may strengthen it. Therapy under the present model allows manipulation and treatment at the various levels. Understanding and use of acupuncture may be expanded at the various levels in each of the classical zKidney syndrome.

Senescence is a feature of physiological zKidney deficiency. The Zang improvement of zKidney allows better aging, even delaying senescence. In addition to zKidney herbs, the present model expands the realm to use active or passive strengthening methods and

training or exercise to improve senescence. It reemphasizes the TCM integral concept that strengthening the postural muscles and their coordination would strengthen the zKidney axis up to the remote parts to the marrow and the brain. The model opens up the possibility to confirm that supporting the zKidney components to redeem body quality is a way to help restoring zKidney strength that may improve hair quality, decrease senescence and tinnitus. It reaffirms why good sense of commitment with peace of mind and less psychosomatic noise, good posture, Tai Qi with such muscle coordination training, and such other strengthening at the various zKidney levels all improve aging.

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中醫腎臟模組重劃 — 解剖與功能結構關連

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本文是以現代醫學家能了解的層面去描繪傳統中醫學說中的[腎]臟。傳統中醫學以臟象學說演譯臟腑。而現代研究中醫[腎]臟理論時發現, 它與現代醫學的神經、內分泌及免疫系統的功能有著密切的關係, 提出把下丘腦—垂體—靶腺軸及免疫網路功能來演譯[腎]臟, 但是[腎]臟反視為一組相互關聯的結構而不是獨立之[器官], 功能不與一塊解剖結構關連。本文復審研究, 由這個層面深入, 加上肌肉及其有關的反射反應機能, 可具體把中醫[腎]臟的結構與功能互相匹配上。將人體末端一塊整體功能結構, 即腹腔腹膜以後及以下的組織, 包括腎上腺、腎及泌尿器官、生殖器官、卵巢、盤腔肌肉及下背筋腱肌肉, 視為“居於內”的[腎]臟; 而這身體末端一組結構的功能, 包括水液代謝、膀胱功能、求偶、性交、交配、生殖、和生命的應付等, 以及協調這組結構的腦神經及荷爾蒙的互動緊密機制、其影響生命的動力、啟動成志及技巧等機能, 則視為“觀於外”的[腎]臟臟象。這[腎]臟範例與中醫學的腎臟本質意義相距不遠, 亦比過去的模式更為貼切, 能成全主流基本要求標準, 包括解剖與生理的密切關連。所以這模型比起過去的理论模型, 較易為現代科學上的同儕所認受。本文亦介紹以古籍及現代研究複證的方法, 此範例有助於中西醫學發展, 其好處在於獨特而有啟導性的意義。

關鍵字：中醫腎臟、臟象、功能解剖結構、現代醫學

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