

ANATOMY IN THE VEDIC LITERATURE

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In the Vedic literature we meet with descriptions of the structure of the human body, which reveal that the anatomical knowledge of the ancient Indians was of no mean order. In the present paper an account of this knowledge has been reported along with those developed in other contemporary nations of the world. Descriptions are found in the Vedic literature of all the important bones and other bodily parts which conform more or less to our modern knowledge.

This description shows an evolution of the anatomical knowledge of the ancient Indians: The *Saṃhitās* represent a description of the general structure of the human body. In the *Brāhmaṇas* a detailed account of chest, neck, back portion of the body, ribs, abdominal portion and the hand is found to occur. A similar account of the human heart, nervous system, sense-organs is given in the *Āraṇyakas* and the *Upaniṣads*.

A somewhat detailed description of the human body with various organisms and their functions, embodied in the Vedas, *Brāhmaṇas*, etc., shows that the Vedic people were not unaware of the elementary knowledge of anatomy of the human body. This developed in the post-Vedic period into separate medical treatises like *Caraka Saṃhitā*, *Suśruta Saṃhitā*, *Aṣṭāṅga-Saṃgraha*, *Aṣṭāṅga-hṛdaya*, etc. In this present paper an endeavour has been made to present the idea of human anatomy, as revealed in the religious scripture of the Aryans.

The Vedic Age is divided into four broad divisions—(1) first the *Saṃhitā* (collection of hymns in the form of prayers) period (the four *Saṃhitās*, namely *R̥k*, *Sāma*, *Yaju* and *Atharva*), (2) next the period of the *Brāhmaṇas* (theological and ritual treatises), (3) then the period of the *Āraṇyakas* (appendices of the *Brāhmaṇas*) and the *Upaniṣads* (philosophical texts regarding the absolute one), (4) the last is the period of the *Vedāṅgas*. The age of the Vedas cannot be ascertained definitely. It differs in about a thousand years in the calculations of different authors.¹

According to some² the Vedic period began on about 2000 or 2500 B.C., or somewhat earlier and ended between 750–500 B.C. But if we accept the period of the Indus Valley Civilization from about 2500 B.C.–1800 B.C.,³ then the Vedic literature should begin after 1800 B.C.

The modes of describing the human body differ, however, in three different periods of the Vedic literature.

During the *Samhitā* Age the Vedic sages were seized with a larger curiosity as to—How the earth was created? How human physique had attained its shape?—These questions deeply agitated the ancient sages as revealed in the hymns of the *Rv.*⁴ and the *Av.*⁵

In the *Av.*⁶ we find Ṛṣi Nārāyaṇa enquiring about the creation of human body. In this context he had described the skeleton of the human body in a general way. The description is made from the lower parts upwards of the human body. The first verse tells us of the component parts of feet. The next two verses (i.e. second and third) describe the legs. The fourth mentions the breast bones, the bones of the neck, the breast, the shoulder bones, the backbone. In this verse the actual number of bones constituting the parts are not given. The fifth verse mentions the upper extremity with two arms and the collarbone. In the next verse we get mention of the head with seven apertures (two ears, two nostrils, two eyes, and the mouth). The last two verses refer to the jaw, with tongue attached to it, the brow (*lalāṭa*), the central facial bone (*kakāṭikā*), the pile of the jaw (*hanucitya*), the cranium with the temples (*kapāla*).

This is the skeletal view in the *Av.* The next important information, found in the *Samhitā* period, relates to the various organs of the body, the basic elements (*aṣṭacakra*—which according to Sāyana indicates eight elements of the body, namely blood, flesh, marrow, fat, ligament, bone, semen and material substance responsible for vigour of the body), sense-organs, the vital-airs, and moreover, the idea of three *guṇas*—*sattva*, *rajas* and *tamas*⁷—as the cause of the origin of human body. This idea of *guṇas* was developed more clearly in the Upaniṣadic period.

The different body parts, referred to in the *Samhitās*, are mainly those found discussed in connection with diseases and their treatment and the rest have been mentioned in connection with the creation of human body.⁸

During the age of the *Brāhmaṇas* we find a detailed observation of human body. The number⁹ of bones, marrow, muscles and ligaments have been mentioned on the basis of observations of days and nights and their subdivisions in year. Almost identical ideas are found to occur in ancient Chinese medical treatises.¹⁰

The structure¹¹ of chest, neck sides, vertical column and hand have been described and the number of bones in each case have been mentioned in analogy with the framework of verses, chanted at the time of arranging bricks in the sacrificial altars, constructed in the form of human body and with the number of daily offerings connected with the performances of *yajña* (sacrifice). The priests who constructed the altars had a clear picture of human body in their mind. And with this idea in mind they arranged bricks in such a systematic way that they did not even fail to point out the place of the vital airs in the body as indicated by the position of perforations of the bricks used for the construction of the altar.

In the times of the *Āraṇyakas* and the *Upaniṣads*, much stress was given on the communion of the human soul with the soul of the universe. The human body at that time was compared to the body of the universe. In other words they believed the analogy between microcosm and macrocosm which is also found mentioned in the *Av.*¹² The same idea is found in the writings of Alcmean, the Greek physician in 500 B.C., where man is said to be the microcosm—a miniature of the universe the macrocosm.¹³ The ancient Chinese (as found in the 'Yellow Emperor's Classic') believed that man is composed of the same elements as the universe and as functioning along the same principles as the macrocosm.¹⁴ In the Vedas and the *Upaniṣads* this idea of microcosm and macrocosm has been represented as follows:

<i>Human body</i>	<i>Cosmic body</i>
(a) <i>Mana</i> (mind)	<i>Vṛhata</i> (moon)
(b) <i>Prāṇāpanau</i> (respiration)	<i>Mātariśvan</i> (air)
(c) <i>Caḥṣu</i> (eye)	<i>Sūrya</i> (sun)
(d) <i>Śrotra</i> (ear)	<i>Antarikṣa</i> (atmosphere)
(e) <i>Śarīra</i> (body)	<i>Prthivī</i> (earth)

The *Ait. Up.*¹⁵ represents it as follows:

<i>Human body</i>	<i>Cosmic body</i>
(a) <i>Vāca</i> (speech)	<i>Agni</i> (fire)
(b) <i>Prāṇa</i> (breath)	<i>Vāyu</i> (wind)
(c) <i>Caḥṣu</i> (eye)	<i>Āditya</i> (sun)
(d) <i>Śrotra</i> (ear)	<i>Dik</i> (quarters)
(e) <i>Mana</i> (mind)	<i>Candramā</i> (moon)
(f) <i>Reta</i> (semen)	<i>Āpa</i> (water)

With this belief in the identity of human soul with the universal soul, the ancient Indian sages practised meditation and performed yogic exercises for the salvation of their soul. This is possibly the reason why a knowledge about human heart, nervous system, sense-organs and vital airs was considered necessary. This happened in the early part of the *Upaniṣadic* age. In the later part of this age, the *Upaniṣadic* texts laid much stress on the embryonic development of the foetus (vide *Garbhopaniṣad*). They have discussed it in connection with the human soul's entering the body as soon as the conception commences in the womb.

From the account given in various Vedic texts, we can form an idea of the anatomical knowledge of the following parts of the human body:

I. *Śira* (head):

The *Av.*¹⁶ refers to the three parts of the head—(a) *lalāṭa* (brow), (b) *kakāṭikā* (different explanations are given by different scholars for *kakā-tikā*):

- (i) The central facial bone (Das Gupta);¹⁷ (ii) Particular part of the frontal bone (Monier Williams);¹⁸ (iii) Neck (Filliozat);¹⁹ (iv) The bones of the nose, the cheek and the arcs of the eye-brow (Hoernlé);²⁰

and (c) *kapāla* (the cranium with the temples).

The number of skull bones (*kapāla*—*kaṃ pālayati*—*kaṃ* means 'head' and *pālayati* means to 'protect', i.e. the bones which protect the head) comprising the skull is three, according to the *Av.*²¹ and the *S.B.*²², and four in the *Sank. Ar.*²³ The upper skull bones are stated to be attached to the other skull bones in the *S.B.*²⁴ The upper skull bone is probably the brain-case or cranium on which the skull bones are attached. The number of skull bones in modern anatomy is, however, eight. The *S.B.*²⁵ describes the human head as made of skin, bone and the brain. The *G.B.*²⁶ mentions marrow in addition to these three. The *Av.*²⁷ further describes the head as having seven apertures (*khāni*)—two ears, two nostrils, two eyes and the mouth.

II. *Grīvā* (neck):

The structure of the neck as described in the Vedic texts, especially in the *Samhitās*²⁸ and in the *Brāhmaṇas*,²⁹ consists of the following parts of the neck:

Posterior part.—The posterior part of the neck is made of (a) one strong bone (*vīrya*, i.e. vertebral column) with 14 *karūkāras* (lateral processes) on the two sides of the vertebral column; (b) one artery carrying the blood upwards (*uṣṇiḥa*—*ūrdhvaṃ snigdhabhya raktādīnā utsātābhyo vā nādībhya*, Sāyana on *Rv.*, X.163.2, *snāyubhya* in place of *nādībhya*, *Av.*, II.32.2); (c) eight *manyās* (carotid arteries).

Anterior part.—The anterior part of the neck is the throat (*kaṇṭha*), in which there lies the wind-pipe (*dhamani*?).

The structure given in the Vedic texts probably refers to the cervical column (i.e. *grīvā* with 14 *karūkāras* (posterior)) and to the wind-pipe (anterior) in the light of our modern knowledge. The exact number of bones, according to modern anatomy is not 14 but seven. Hoernlé³⁰ comments: 'the two transverse processes to each vertebral are counted as separate bones. So the numbers they counted as 14'.

III. *Hanu* (jaw):

The *Av.*³¹ mentions the jaw as a composite organ. The expression found in the *Av.* is *hanu-citya*. The term *citya* from \sqrt{ci} 'to pile' indicates piling. Piling in the sense refers to the structure arranging with different bones one after another. Hoernlé³² suggests that this term *hanu-citya* suggests alveolar process jaw-bone and two rami.

IV. *Akṣi* (eye):

The structure of the eye is not mentioned in the *Samhitā* texts. The *Brāhmaṇa*³³ literature refers to the black, the white and the eye-ball of the eye. The position of the eye-ball (*Maṇḍala*) is also defined in the *Brāhmaṇas*.

Two passages of the *S.B.*^{34a} and *Brh. Ar. Up.*^{34b} give elaborate descriptions of the eye as follows:

- (1) First Lohini-rāji (red arteries and the red veins of the white part of the eye).
- (2) Then *Āpa* (vitreous humours).
- (3) ,, *Kanīnika* (pupil).
- (4) ,, *Maṇḍala* (eye-ball).
- (5) ,, *Kṛṣṇa* (iris).
- (6) ,, *Śukra* or *Śukla* (white part of the eye-ball).
- (7) Lastly, the eye-lashes in the upper and lower part of the eye.

In the *Maitrī Upaniṣad*³⁵ mention is made of the two arteries (*nāḍīs*) of the eyes, which extend to the heart and provide nourishment to the eye by carrying blood from the heart.

V. *Vakṣa* (thorax):

The *S.B.*³⁶ through the analogy of the formation of different metres (*chandās*) describes the chest of the human body beautifully.

There are four sides of the chest: (a) *kikasa* (thoracic vertebral), (b) *pārśvas* (two sides), (c) *uras* (sternum) with 16 *jatrus* (costal cartilages) on each side of the sternum.

The number of costal cartilages given in this text are not in accordance with the modern anatomy where 12 cartilages are counted on each side of the sternum. Among the 12, the cartilages of the upper three 'false ribs', i.e. eighth, ninth, tenth, are attached to the cartilages of the seventh rib. The remaining two ribs (i.e. eleventh, twelfth) do not connect at all with the sternum being 'floating ribs'. That is why Hoernlé³⁷ considers that Indian anatomists counted the costal cartilages as either eight or seven.

VI. *Hṛdaya* or *Hārdi* (heart):

The idea of heart was not well developed in the age of the *Samhitās*. In the description of the human body in a somewhat allegorical way, the expression *pundarikam navadvāraṃ* is found to occur in the *Av.*³⁸ According to commentator Sāyana it indicates the lotus-shaped heart with nine openings.

In the Upaniṣadic period, the heart is described fully. It is stated there as made up of flesh with a network structure.³⁹ *Purītat* (i.e. pericardium), the coating of the heart, has been mentioned first in the texts of the *V.S.*⁴⁰ Moreover in the same text⁴¹ there occurs the mention of two lumps of flesh (*kośi*) of the heart.

In the *Upaniṣads*⁴² the heart is conceived of as the wheel of a chariot in which the arteries, emanating from the heart, are described as the spokes of the wheel. The number of arteries in the heart, stated in different *Upaniṣads*, differs. According to some⁴³ the number is 101 whereas in the *Brh. Ar. Up.* and other *Upaniṣads*,⁴⁴ the number of arteries, with their branches and sub-branches, are 72,000 which pass from the heart to the pericardium.

The weight of the heart is stated in the *Gar. Up.*⁴⁵ as eight *palas* (8,701 grains Troy).

VII. *Pārśva* (sides):

The *S.B.*^{46a} gives the following account of the structure of the two sides.

The two sides of the body are formed by 26 *parśus* or *pariśavas* (ribs). These ribs are fastened at either end to the thoracic vertebral (*kīkasa*) at the back and interior to the costal cartilages (*jatru*) in the front. These ribs are attached to the *aṇḍapariśus*^{46b} (globular end of the rib—ball-bearing?).

The number of ribs given here is in accordance with the modern anatomy. In modern anatomy we see 12 on each side, this number may be increased by the development of a cervical or lumber rib, or may be reduced. So it was not unusual for our ancient anatomists to count the number as 13 on each side.

VIII. *Prṣṭi* (vertebral or vertical column):

The *S.B.*⁴⁷ refers to the three divisions of the vertical column: (a) *grīvā* (cervical), (b) *amūka* (thoracic) and (c) *udara* (lumbaric).

In the thoracic portion of the vertebral column there are 32 *prṣṭikunḍīlas* or *karūkaras* (vertebra). The lumbaric portion (*udara*) is stated as consisted of 20 *kuntapas* ((a) transverse processes forming spikes on both sides of the ten lower spinal vertebral of the last true rib—Eggeling; (b) glands—St. Petersburg Dictionary).

IX. *Vasti* (bladder):

The *Av.*⁴⁸ describes it as the size of a bow. The urine is conveyed to the bladder by the two veins, called *gavinī*. To the bladder are attached the *vasti-bīla* (bladder-orifice) and *mehana* or *vartram* (urinary duct).

X. Upper limbs:

From the account given in the Vedic texts we can form an idea of the component parts of the upper limbs. These are the shoulders (*aṃsa*) and the hands, the arm (*bāhu*), the forearm (*doṣan*) and the palm (*pāṇi*).

Aṃsa (shoulder).—The *Av.*⁴⁹ mentions of the two parts of the shoulder consisting of *akṣa* (collar-bone) and *kaphoḍa* (shoulder-blades). According to the *S.B.*⁵⁰ the shoulder-blades (*phalaka*) are very small bones. Besides these the *Av.*⁵¹ further mentions the shoulder bones in construction of the shoulder.

Bāhu (hands).—The hands are joined to the trunk by means of the collar-bones.⁵² They are made up of three parts.⁵³ The name of the three parts are known as *bāhu* (arm), *doṣaṇ* (forearm) and *pāṇi* (palm). The joint linking the arm and the forearm is *aratni* (elbow).

The palm consists of two parts—*ucchalāṅkhas* (long bones, i.e. metacarpus) in the midst of the hand and the *aṅgulīs* (digits) each with three joints.⁵⁴

A later treatise of the Vedic literature refers to *maṇibandha* (wrist).⁵⁵

XI. *The lower limbs:*

From the description given in the *Av.*⁵⁶ and the *S.B.*⁵⁷ the following idea about the structure of the lower part of the body can be made.

The lower limbs are connected to the trunk by means of *Śroni* (hips). *Vakṣaṇa* (groin) is a joint connecting the thigh with the belly. There are three parts of the leg—(a) *ūru* (thigh), (b) *jaṅghā* (lower part of the leg) and (c) the *pāda* (foot). The knee resembles a 'fourfold frame' *catuṣṭayam yujyate samhitāntam* for the joining of thigh with the lower part of the leg. The foot consists of five parts—(a) *pārṣṇi* (the heel), (b) *gulpha* (ankle or ankle-bone), (c) *ucchalāṅkha* (long bones, i.e. metatarsal bone) in the middle, (d) *pratiṣṭhā* (base, mod. carpus) and (e) *aṅgulīs* (digits) each with three joints.

Besides these the *Vedas*^{58a} mention the part *prapada* (fore part of the feet) which according to Karambelkar^{58b} 'transverse arches of the feet'.

These are the descriptions of some of the body parts, occurring in various Vedic treatises.

A more or less comprehensive list on the different parts of human body, as recorded in the Vedic literature is given by Jean Filliozat in his book *La doctrine classique de la Médecine Indienne ses origines et ses parallèles, Grecs.*^{58c}

From the account given in the *Vedas* and the *Vedāṅgas* it may be concluded that the practice of dissection of human body was followed during the Vedic Age, otherwise it would have been extremely difficult and almost impossible to make such an elaborate description. In this connection reference may be made to the dissection of horse's body, described in the *Rv.*⁵⁹ whereas an elaborate description of the different parts of horse's body based on dissection is found in the different treatises of the *Yajurveda.*⁶⁰

The description of human body as found in the Vedic literature is neither a fantastic nor a fanciful one. For the number and shape of the bones, as described there, conform more or less to our modern knowledge.

Now a question may arise whether the knowledge of human body, as found in the Vedic texts, was indigenous or borrowed from any foreign sources.

In Mesopotamia anatomical knowledge as gathered from Sand Tablet, Gold Tablet and Code of Hammurabi (6000 B.C.) relates to liver as the most vital organ of the body as consisting of scarlet architecture of vessels and ligaments 'sharply etched beside the green moon of the gall-bladder'.⁶¹

In Egypt from the period of old dynasty (i.e. c. 2000 B.C.), an idea of various parts of the human body was acquired by the priestly class who embalmed the dead body. But there was no written record left as to the extent of their knowledge. The Edwin Smith Papyrus and the Ebers Papyrus (which narrates the history of the period of the eighteenth dynasty, i.e. 1580 B.C.) mention some external and internal organs of the human body, especially the heart. The anatomical image of the human body was conceived by the ancient Egyptians, as consisting of a network of channels through which air, blood, food and sperm constantly flowed like water in the irrigation canals of their land. Hence in analogy with the droughts, floods and obstructions of the water in the canals similar phenomena may occur in the channels of the human body.⁶² The distinction between artery and vein was not known to the Egyptian priests, nor had they any knowledge of the kidney. But in India from the period of the *Av.* (i.e. about 1200 B.C.), the existence of various bodily channels, carrying blood and excreta, though in a crude form, was known. The texts of the Papyrus though earlier than that of the *Av.*, the Egyptians, however, made no further addition to their knowledge in later ages.⁶³ Moreover, the anatomical knowledge of ancient Egyptians was rather limited and not as detailed as we find in the Vedic texts.

The ancient Chinese conceived of the human body as a miniature form of the universe. According to Chinese anatomy,⁶⁴ mentioned in their oldest medical record, 'Nei-Ching' about 2698 B.C.-2599 B.C., there are five principal organs, like heart, lungs, liver, spleen and kidney, which function in the nourishment of the body. With these five principal organs, five viscerae are attached. These are intestine, rectum, gall-bladder, bladder and stomach.

In India the human body is believed to be a form of eternal *puruṣa* (universal soul) and in anatomical speculation there was no distinction between principal and secondary organs.

In ancient Greece, the earliest literary records, which made mention of the human organs, are the two epics of Homer, *Iliad* and *Odyssey*, written in about the ninth century B.C.

It is difficult to draw any genetic relationship between these different countries in this matter, though they might have influenced each other in course of time.

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(b) *Jaiminīya Brāhmaṇa*: Edited by Raghu Vira and Lokesh Chandra, Nagpur, International Academy of Indian Culture, ii.5.3.
- ⁴⁷ *S.B.*, XII.2.4.12,14.
- ⁴⁸ *Atharva-veda*, I.6–8.
- ⁴⁹ *Ibid.*, X.2.7.
- ⁵⁰ *Satapatha Brāhmaṇa*, XII.2.4.7.
- ⁵¹ *Atharva-veda*, X.2.4.
- ⁵² *Ibid.*, X.2.8.
- ⁵³ *Sāṅkhāyana Āraṇyaka*, II.4.
- ⁵⁴ *Atharva-veda*, X.2.1.
- ⁵⁵ *Satapatha Brāhmaṇa*, XII.2.4.2–6.
- ⁵⁶ *Atharva-veda*, X.2.1.
- ⁵⁷ *Satapatha Brāhmaṇa*, XII.2.4.2.6; XII.2.1.2, 3.
- ⁵⁸ (a) *Rgveda*, X.163.6; *Atharva-veda*, II.33.5.
(b) *Atharva-veda* and *Āyurveda*, Nagpur, 1961, p. 296.
(c) Filliozat, *loc. cit.*, 121–28. Translated by Dev Raj Chanana, cf. Karambelkar, *loc. cit.*, pp. 292–98.
- ⁵⁹ *Rgveda*, I.162.13.
- ⁶⁰ *Taittirīya Saṃhitā*: Edited by Dr. E. Roer and E. B. Cowell (1886–99), V.7.11–23.
Kāthaka Saṃhitā: Edited by Schroedar Vor Laplad, Leipzig, F. A., Brocklhaus, 1909–21, Vols. I–IV, V.3.6.
- ⁶¹ Ibanez, Felix Marti, Ariel. (*Essays on the Arts and the History and Philosophy of Medicine*. M.D. Publication, New York, 1962, p. 119.
- ⁶² ——— *loc. cit.*, p. 120.
- ⁶³ *Taton, Rene*, ed. 'History of Science'; ancient and medieval science from the beginning to A.D. 1450; translated by A. G. Pomeraus, London, Thames and Hudson, 1963, p. 15.
- ⁶⁴ Veith, Ilza, *loc. cit.*, p. 5.

Abbreviations :

Av. = *Atharva-veda*; *Ait. Up.* = *Āitareya Upaniṣad*; *Brh. Ar. Up.* = *Bṛhadāraṇyakopaniṣad*; *Gar. Up.* = *Garbhopaniṣad*; *G.B.* = *Gopatha Brāhmaṇa*; *R.V.* = *Rgveda*; *S.B.* = *Satapatha Brāhmaṇa*; *Sank. Ar.* = *Sāṅkhāyanāraṇyaka*.

APPENDIX

The passage of the *Śatapatha Brāhmaṇa*, bearing the ideas about the structure of neck, chest vertebral column, sides and hand, in analogy with the framework of verses with the arrangement of bricks in the sacrificial altars and with the number of daily offerings, connected with the performances of *yajña*, has been represented thus:

(a) *Head and neck :*

Śatapatha Brāhmaṇa, XII. 2. 4.

'*Sīra evāsya trivṛt | tasmāt tat tri vidhaṃ bhavīti, tvagasthi mastiṣkaḥ || 9 grīvāḥ pañcadaśaḥ caturdaśāvātāsāṃ karūkarāṇi, vīryaṃ pañcadaśaṃ, tasmād eibhīranvibhīh satibhīrgurum bhāroṃ harati, tasmād grīvāḥ pañcadaśaḥ ||*' 10

The three-versed hymn-form (*trivṛt*) is the head (*śīras*), whence that (head) is threefold—skin, bone and brain. (9). The fifteen-versed hymn-form (*pañcadaśa*) is the neck-bones (*grīvāḥ*); for 14 of these are the transverse process (*karūkara*); and their strength (*vīrya*) is the fifteenth; hence by means of them, though small, man can bear a heavy load. Therefore fifteen-versed hymn-form is the neck-bones.

(b) *Chest :*

'*Urah saptadaśaḥ| aṣṭavanye jatravo'stavanya, uraḥ, saptadaśaṃ, tasmād urah saptadaśaḥ ||*' (11)

(c) *Abdominal portion of the spine :*

'*Udaramekaviṃśaḥ viṃśatīrvā antarodare kuntapānyudaramekaviṃśaṃ, tasmād-udaramekaviṃśaḥ*' (12)

The twenty-one-versed hymn-form (*ekaviṃśa*) is the abdominal portion of the spine (*udara*). For within the abdomen there are 20 transverse processes (*kuntapa*), and the abdominal portion of the spine is the twenty-first. Therefore the twenty-one-versed hymn is the abdominal portion of the spine. (12)

(d) *Sides :*

'*Pārsve trinavaḥ| trayadaśanyāḥ pārsvastrayodaśanyāḥ, pārsve trinave, tasmāt pārsve trinavaḥ ||*' (13)

The thrice-nine-versed hymn-form (*trinava*) is the two sides (*pārsva*). There are 13 ribs (*parsu*) on the one side, and 13 on the other; and the two sides made up the thrice-ninth. Therefore the thrice-ninth hymn is the two sides. (13)

(e) *Thoracic portion of the spine :*

'*Anūkaṃ trayastrīṃśaḥ| dvāstrīṃśad vā etasya karūkarānyanūkaṃ trayastrīṃśaṃ, tasmādanūkaṃ trayastrīṃśaḥ ||*' (14)

The thirty-three-versed hymn-form (*trayastrīṃśa*) is the thoracic portion (*anūka*) of the spine; for there are 32 transverse processes (*karūkara*) in it, and the thoracic portion of the spine is the thirty-third. Therefore, the thirty-three-versed hymn is the thoracic portion of the spine. (14)

(f) *Position of the breast-bone, ribs (Śatapatha Brāhmaṇa, VIII. 6.2):*

Urastrīṣṭubhah | tā retahsīcorvelayopadadhāti, prṣṭayo vai retahsīca, uro vai prati prṣṭayah || (7) parśavo bṛhatyah | kīkasāḥ kakubhah, so'ntarena trīṣṭubhas'ca kakubhas'ca brhatirupadadhāti, tasmādimā ubhayatra parśava baddhāḥ kīkasāṣu ca jātruṣu || (10)

The trīṣṭubh (metres) are the breast-bone, the sacrificer places them on the range of the two retahsīc (bricks), for the retahsīc (bricks) are the back-bones (prṣṭī) and the back-bones lie ever against the breast-bone. (7) The bṛhatī (metres) are the ribs (parśu) and the kakubh (metres) are the thoracic vertebral (kīkasa). The sacrificer places the bṛhatī between the trīṣṭubh (metres) and kakubh (metres), whence these ribs (parśu) are fastened, at either end, to the thoracic vertebral (kīkasa) at the back and (interiorly) to the costal cartilages (jātru) in front.