

History of Anatomy in India*

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“India is the cradle of human race, the birthplace of human speech, the mother of history, the grandmother of legend and the great grandmother of tradition. The most valuable and most instructive materials in the history of man are treasured up in India only.”

— Mark Twain

History of mankind is inseparably entwined in the history of India. Medicine is as old as man and must have come into being with the first awakening of human consciousness. Is it then a wonder that history of medicine should be an integral part of history of India? Anatomy is the oldest and the most important of all medical sciences. There is enough evidence of practice of this science in the ancient Hindu India. In this article, evidence is presented to show that the Hindus were the first scientific cultivators of the most important and essential department of medical knowledge namely practical anatomy.

Pre-Vedic Period

Five thousand years ago, around 3000 BC Indus Valley Civilization flourished on the banks of the river Indus, contemporaneous with Mesopotamian civilization. Medicine was practised by priests, who were considered next only to Kings and the practice itself was a mixture of magic, rites and rituals. Archaeological excavations from this ancient period show clear evidence of knowledge of comparative anatomy. There are cave paintings depicting pictures of animals on which the critical areas are marked. These areas when hit would have killed the animals. So, herein lie the evidences of the first ever lessons in surface anatomy.

Vedic Period

Around 1500 BC, northern India was invaded by Indo-European tribes such as the Aryans and that led to the start of Vedic period. Srila Vyasadeva also known as Veda Vyasa rendered the four *Vedas* - *Rig*, *Yajur*, *Sama* and *Atharva Vedas* to his disciples. The *Rig Veda* mentions the heart, lungs, stomach and kidneys. The *Atharva Veda* lists medicinal herbs, plants and also mentions “the wonderful structure of man”. The *Atharva Veda* refers to heart as “lotus with nine gates”, an amazingly accurate description of the heart as we know it today. We do know that the heart indeed looks like a lotus bud if held with its apex upwards and there are nine openings in all: 3 in the right atrium, 4 in the left atrium and one each in the right and left ventricles. The *Atharva Veda* refers to *dhamanis* – which are ducts with thick walls equivalent to arteries; *siras* – which are ducts with thin walls equivalent to veins, and still finer ducts are referred to as *snavas* similar to capillaries. However some misconceptions existed and the Vedic scholars considered nerves also as hollow tubes or ducts which is quite far from reality.

The *Vedas* were followed by other writings. The *Brahmanas*, which can be considered as guidebooks for the *Vedas*, came next. *Aranyakas* and then *Upanishads* followed *Brahmanas*. *Upanishads* contain knowledge acquired sitting around one teacher in the “*Guru-Shishya* tradition” where the disciples sit around the teacher and learn. One such *Upanishad* called *Garbha Upanishad* (1400 BC) describes the development of embryo in an astonishingly precise manner:

“From the conjugation of blood and semen the embryo comes into existence. During the period favourable for conception after the sexual intercourse it becomes a *kalala* (one-day-old embryo). After remaining seven nights it becomes a vesicle – *budbuda*. After a fortnight it becomes a spherical mass *pinda*. After a month it becomes a firm mass. After two months the head is formed. After three months the limb regions appear.” Similar descriptions are also found in the teachings of Vag Bhata, Vishnudhara and in Agni Purana.

This accurate description of the embryo in the *Upanishad*, which predates microscopes, is truly amazing as it matches almost accurately with the present-day knowledge of embryology. Seven days old embryo is indeed vesicular and is called blastocyst. The description of formation of the head and the limb regions, also, more or less, matches with the time of their development, as we know them today.

Post-Vedic Period

The post-*Upanishadic* period from 800 BC to 1000 AD may be considered the “The Golden Age of Indian Medicine”. *Ayurveda*, the science of life (Ayur = long life; Veda = science) evolved during this period and two great proponents of this science existed and practised medicine in India – Sushruta and Charaka. Sushruta lived two centuries before Christ and was a contemporary of Atreya who was Charaka’s teacher. *Charaka Samhita* can be dated back to 1 AD. The first written evidence of *Ayurveda* is in the Sanskrit writings of *Charaka Samhita* and *Sushruta Samhita*. These two manuscripts form the twin pillars of *Ayurveda*. Both these *Samhitas* devote a complete section *Sarira sthana* to the subject of anatomy. In these sections besides gross anatomy, embryology and histology are also dealt with which indicate a comprehensive study of Anatomy. Naturally the histological features described before the advent of the microscopes were mainly speculative.

During this period the ancient Indians also pioneered in human dissection. Indian anatomists were aware that in order to attain a satisfactory knowledge of human anatomy one had to take recourse to dissection and it was practised in ancient India as is mentioned in *Sushruta Samhita*:

“Anyone who wishes to acquire a thorough knowledge of anatomy must prepare a dead body and carefully observe and examine all its different parts. One should select a body, which is complete in all its parts. Having removed all the excrementitious matter from it, the body should be wrapped in grass and placed in a cage. Having firmly secured the latter in a hidden spot in a river, the body should be allowed to decompose. After an interval of seven days, the thoroughly decomposed body should be taken out and very slowly scrubbed with a whisk made of grass roots (of *kusa*). At the same time every part of the body great or small, external or internal, beginning with the skin should be examined with the eye.” Since the Hindu anatomists were forbidden by tradition and religious beliefs to cut the body, it was only natural for them to use *kusa* grass to peel off the layers of the skin and study the interiors.

These early Indian anatomists divided the body into six parts – the four extremities, the neck and the trunk. The emphasis in Hindu anatomy was given first to the bones and then to the muscles, ligaments and then joints. Ancient Indian anatomists belonging to *Atreya-Charaka* school counted 360 bones and those of *Sushruta*’s school noted 300 bones in the human body. They included teeth, nails, cartilages, the bony prominences and protuberances as separate bones, a fact that accounts for the large number they got.

Although Charaka’s knowledge of the muscles was very rudimentary, he gives the number of muscles of the body as 500. Sushruta not only gives the total number of muscles but their distribution as well stating that of the 500 muscles: 400 are in the four extremities, 66 in the

trunk and 34 in the region above the clavicles. With reference to the heart and the vessels, Charaka does not add much to what is given in *Atharva Veda* but gives the number of *dhamanis* as 200 and that of *siras* as 700. Sushruta describes the *dhamanis* and *siras* as having their origin in the umbilicus. He also describes *rasa* as flowing through these ducts. Beside *dhamanis* and *siras*, Sushruta also mentions *srotas* numbering 22.

As far as the nervous system is concerned, very little is said about the brain in Indian medical literature. Bhela, author of *Bhela Samhita* recognised the brain and considered it as the centre of the *manas*. Sushruta was aware of at least four pairs of cranial nerves – one *nila* and one *manya* situated on either side of larynx which when injured produced loss or change of voice (hoarseness); one pair of *vidhura* behind the ears which when cut produced deafness; a pair of *phana* inside the nose, destruction of which produced loss of smell and a pair of *apanga* below the eyes which if cut, would produce blindness.

Charaka and Sushruta also described the viscera. Charaka uses the word *kloma* and Sushruta uses the word *pupphusa* for the lungs, but both refer to the lungs in singular. Both Charaka and Sushruta were acquainted with the stomach and intestine. Sushruta called the rectum *gudam* and stated its length. He also describes its interior as having three spiral grooves. Sushruta also describes the urinary bladder, uterus “*garbha-saya*” and vas deferens. The shape of the uterus is likened to the mouth of *rohit* fish.

Sushruta Samhita also describes *marmas* which are the meeting places of any two or more of the elements of the body: *mamsa* - flesh or muscles, *sira* - vessels, *snayu* - ligaments, *asthi* - bones and *sandhi* - joints. The effects of injury to these *marmas* have also been described. Injury to *gulpha marma* at the junction of foot and calf would result in pain, paralysis and lameness. Injury to *indravasti marma*, which is 12 to 13 fingerbreadths above ankle, in the middle of the calf, can cause excessive haemorrhage and even death. *Janu marma* at the junction of thigh and knee, when injured would result in lameness. *Vitapa marma* at the junction of scrotum and inguinal region, if injured would cause impotency.

Sushruta aptly called as the Father of Surgery can easily be also named as the Father of Applied Anatomy. As noted above, the knowledge of the structure of the body gained through dissection and later surgery was applied to various clinical conditions and the anatomico-clinico- pathologic correlation was used well in the practice of medicine and surgery.

The art and science of medicine was being taught during this time in the great university towns of Nalanda, Taxila and Varanasi (Benares). The invasion of Mohammedans from the northwest, led to the decline in the glory of India and with it, the importance of Indian medicine also had a downslide, but not before it lent its tenets to the Greeks, Arabians and Egyptians in the west and to the Chinese in the east.

Modern Period

The medical education in India revived with the arrival of the British (1600 AD) and the colonisation of India. Medical schools were established in the late 19th century in the metropolitan towns of Madras, Calcutta and Bombay. Madras Medical School began its operations in 1835. Dr. Mortimer of that School used to teach the native apprentices/ pupils, muscles and bones from pasteboard models. This led to the framing of an early textbook in Practical Anatomy “Mortimer’s Manual of Anatomy”. This manual precedes “Cunningham’s Manual of practical Anatomy”. In pre-independent India, British used to dominate the faculty in these medical schools and professorial posts were manned by officers of Indian Medical Service (IMS). With a lot of reluctance a few non-clinical professorial posts were opened to non-IMS Indians and Dr. Y.G. Nadgir was the first to be appointed to a chair in Anatomy at the Grant

Medical College, Mumbai. It took almost four decades for the number of Indian anatomists on the faculty to grow from one to one dozen. Now all the medical colleges in India have a full-fledged department of anatomy where even today manual dissection is done and taught with a lot of fervour, even as virtual dissection in computers is possible.

Lack of uniformity in the standards of teaching anatomy in different institutions gave the impetus to start a common platform to discuss and decide the academic aspects. Thus was born "Anatomical Society of India"- ASI on 20th May 1951. It was ceremonially inaugurated in the Medical College of Calcutta, where Dr. A. A. Ayer of Madras was elected as the first president. The main objective of the society was the advancement of the study of and research in Anatomy. It was also decided to bring out a journal under the aegis of the society. The "Journal of Anatomical Society of India", which began as a humble publication, has metamorphosed into an indexed journal that promotes online education in Anatomy at firstprofindia@yahoogroups.com.

Thus in India, the science of Anatomy has valiantly climbed the steps of time having been taught and practised from the pre-Vedic period to the present era of online education on computers and it is sure to go on and achieve greater strides in future.