

CONTRIBUTIONS OF SUSHRUTA TO ANATOMY

B Deepa, K Pushpalatha

Correspondence to: Dr Deepa Bhat, Assistant Professor, Department of Anatomy, JSS Medical College, JSS University, S S Nagar, Mysore, Karnataka. 570015. (India) E-mail: deepavijaybhat@gmail.com

ABSTRACT

Sushruta, a practitioner of ancient Indian Medicine has made significant contributions to various branches of medicine. He is glorified as Father of Indian Surgery. He performed surgeries in the era when no diagnostic facilities were available. What astonishes is the favorable outcome from most of his procedures. Probably, the exhaustive knowledge of basic sciences he had would have made him a versatile surgeon. This article has compiled the contributions of this great stalwart to anatomy and interprets his perspective towards teaching this subject.

Keywords: Sushruta, Dissection, Cadaver, Anatomy, Preservation

INTRODUCTION

The famous Sir Astley Cooper, President of the Royal College of Surgeons, said that 'without dissection there can be no anatomy, and that anatomy is our Polar Star, for without anatomy a surgeon can do nothing, certainly nothing well (Dooley, 1973). Anatomy is widely appreciated as being one of the cornerstones of medical education. Learning anatomy through the dissected cadaver is viewed as the uniquely defining feature of medical courses. Explosion of knowledge in the field of medicine was feasible due to exploration of human body through human cadaver dissection.

Often history is considered as facts of past, which are obsolete, and no longer beneficial in practice. Even history of Anatomy is not an exception to this. It is full of imperative lessons in the Art and Science, which following generations ought to learn (Malomo, 2006). Many prominent personalities from India and other countries have made significant contributions over centuries. Considerable information has been added to pool of anatomy knowledge from Galen to Gray. Sushruta, popularly known as Father of Surgery owes a major share among them. The present article unfolds the vast knowledge of Anatomy which Sushruta had and his contributions to various sections of

Anatomy. It also reviews on how the thorough knowledge of Anatomy might have helped him in becoming a versatile surgeon.

Sushruta practiced and taught medicine around 600BC. He is famous as a disciple of Dhanwantari, who is known as Lord Deity of Ayurveda, the Indian system of medicine. He hailed from Kashi, a sacred Hindu place located in Northern India. The most credible compilation of his achievements and teachings are available in the treatise called "Sushruta Samhita". This book is a comprehensive compendium with 184 chapters, description of 1120 illnesses, 700 medicinal plants, 64 preparations from mineral sources and 57 preparations based on animal sources (Dwivedi, 2007).

Contributions of Sushruta to Anatomy: Embalming, Preservation and Dissection:

The study of anatomy is dealt with in the *Sarirasthana of the Susrutasamhita* in its ten chapters. Sushruta was a strong upholder of human dissection as evident from his texts. His texts include a systematic method for the dissection of the human cadaver. He had given considerable thought to anatomical structure and function. His writings nowhere give an indication that they were acquired

from animal dissection. They were mastered from extensive human dissection which they skilled despite religious interference. He considered that aspiring surgeons must first be an anatomist for skilful and successful practice.

Sushruta was the first person who had established the preservation of deceased and cadaver dissection in scientific manner to learn medical science. (Singh, 2011) He explained the method of preserving the dead body and preparation before dissection. There is adequate evidence that in ancient India; anatomical study of the human body was carried out. To quote the appropriate translation, "Any one, who wishes to acquire a thorough knowledge of anatomy, must prepare a dead body and carefully observe and examine all its parts". The method of study was to submerge the body in water and allow it to decompose: an examination of the decomposing body was carried out at intervals to study structures, layer by layer, as they got exposed following decomposition (Prasad, 2013)

The following is the method that Sushruta developed that enabled him to work within the confines of religious interference. His book describes 'For dissecting purposes, a cadaver should be selected which has all of whose parts of the body present, of a person who had not died due to poisoning, but not suffered from a chronic disease (before death), had not attained a 100 years of age and from which the fecal contents of the intestines have been removed. Such a cadaver, whose all parts are wrapped by any one of "munja" (bush or grass), bark, "kusa" and flax, etc. and kept inside a cage, should be put in a slowly flowing river and allowed to decompose in an unlighted area. After proper decomposition for seven nights, the cadaver should be removed (from the cage) and then dissected slowly by rubbing it with the brushes made out of any of usira (fragrant roots of plant), hair, bamboo or "balvaja" (coarse grass). The human body could be visually examined in detail by this way (Singhal & Guru, 1973).

Teaching Anatomy

To obtain proficiency, skill and speed in various surgical procedures, Susruta had devised various experimental modules. For example, incision and excision are to be practised on vegetables and leather bags filled with mud of different densities; scraping on hairy skin of animals; puncturing on the vein of dead animals and lotus stalks; probing on moth-eaten wood or bamboo; scarification on wooden planks smeared with beeswax, etc.

Susruta ordains that anyone who wants to attain surgical skill should study anatomy by practical observation of the various structures and by dissecting the dead body (Agarwal, 2013)

Interestingly, the Susruta Samhita mentions the role of a student in the dissection: 'A pupil, otherwise well-read, but uninitiated, in the practice (of medicine or surgery) is not competent to take in hand the medical and surgical treatment of disease (Loukas, 2010). The two great sages of Indian Medicine-Sushruta and Charaka headed advanced schools of surgery and medicine respectively. They laid the rule that, before undertaking practice of medicine or surgery, the medical graduate had to obtain the permission of the king, as the head of the state, after satisfying him that the intending practitioner of medicine and surgery had been fully trained and qualified to do so. Through this they intended to prevent quacks practising medicine.

Embryology

Sushruta proposed first to deal with embryology and then anatomy of human body; which is an extension of the embryo. He dealt rudiments of embryology and anatomy of human body together with obstetrics to interpret their clinical relevance (Agarwal, 2013). Evidence from Sushruta Samhita indicates that Hindu surgeons of prehistoric India not only had considerable knowledge about various congenital diseases, but also their treatment. (Raveenthiran V 2011).

The Samhita describes the sequential development of the structures of the foetus. Sushruta has mentioned in one of the chapters of Sharirasthana that the foetus develops seven layers of skin, naming each layer and the specific diseases which may affect that layer in adult life. He was also aware of diseases by genetic inheritance. He mentions many congenital defects acquired from parents and those resulting from indulgences of the mother during pregnancy. Therefore he advises her to avoid exertion for the perfect development of the foetus (Mukundcharandas, 2005).

Developmental and heredity concepts were known to Sushruta. He has given a rudimentary account of human epigenetic development in his book. He also attaches importance to neuroembryology in the Sarirasthana section. (Singh, 2011).

What astonishes much more is the proficiency he accomplished just by mere observation, which is possible in present day only with the aid of investigations and ultrasonography.

Gross Anatomy

The knowledge of circulation of vital fluids through the body was known to Sushruta in 6th century BC itself. Also he seems to have possessed knowledge of the arteries, which were described as 'channels' (Dwivedi, 2007).

Sushruta was well aware of the urinary stones, their varieties; the anatomy of urinary bladder along with its relations is well recorded in the chapter on urinary stones (Agarwal). He concluded - "The surgeon who is not well cognizant of the nature and position of the vulnerable parts in the 8 srotas (ducts) namely the perineal raphe, spermatic cords, ducts of the testes, Yoni (vagina), the rectum, the urethra, urine carrying ducts or ureters and the urinary bladder and is not practiced in the art of surgery, brings about the death of many innocent victims" (Das, 2007). Sushruta had an in depth understanding about various procedures which represents the equivalent of modern techniques used in plastic and reconstructive

techniques and thus implies a good knowledge of human facial anatomy.

Sushruta delineated five anatomical divisions (Madalas) of the eye: eyelashes, eyelid, sclera, choroid and the pupil (Raju, 2003). He described 101 number of marmas (vital spots) in the body which causes fatal result on injury, either sudden death or subsequent deformity. The detailed anatomical landmark of each and every marma was described by Sushruta (Singh, 2011). He performed surgeries in the antiquity era itself covering most of the branches viz. general surgery, ENT, urology, orthopaedics, paediatric surgery, plastic surgery, orodental surgery, obstetrics and gynaecology.

Skeletal Anatomy

Sushruta deserves the credit of classifying skeletal injuries into groups in respect of their anatomical variation, prognostic values and ensured proper management even before discovery of Roentgen X rays.

He classified bones based on dissections as flat bones, small cubical bones, cartilages, thin curved bones and long bones. Classification of this accuracy shows he was a keen observer and could apply anatomical knowledge gathered into practice. He had a thorough knowledge on types of fractures, dislocation, sprain, their healing process which helped in successful management with proper rehabilitation. Various devices were also designed by him in management of bone injuries (Deshpande, 1970)

Neuroanatomy

This gifted surgeon has included elementary neurosurgery in his conspectus:

"Ten nerves maintain the functions of the body by carrying impulses of sound, touch, vision, taste, smell, respiration, sighing, yawning, hunger, laughing, speech, and crying . . ."

"A pair of nerve each responds to sound, touch, vision, taste, and smell." "Two nerves lower down at the back of ear (vidhura) which if cut produce deafness; a pair of nerves inside the two nostrils which if cut cause anosmia; a pair of nerves below the end of the

eyebrow which if cut causes blindness.”—
Susruta Samhita.

Sushruta considered the head as the centre of all functions. Through exquisite dissections, he described the cranial nerves in detail and envisaged their physiologic importance. He has also explained in various chapters of his book on neurological disorders like hemiplegia, epilepsy, fainting, stiff neck and many more (Anirban, 2011)

Conclusion: From his works it is evident that there is no area of medicine not ventured by Sushruta. No wonder he has been glorified

Conflict of Interest: Nil

as Father of Surgery, Plastic Surgery, and Urology etc. The writings of many great eminent scholars passed from ancient India to Arabians after the invasion by Alexander the Great. From them it passed on to Greeks and Romans. Hence the ancient India deserves the credit of origin of modern medicine rather than to Greece and Arabia (Rao, 1966). The paradox still persists why the achievements of this ancient Indian legendary was not in limelight. Also we boldly can affirm the need to uphold cadaver dissection to gain knowledge in Anatomy, thus to become skilled surgeons.

REFERENCES

1. Agarwal DP. Susruta: The Great Surgeon of Yore. http://www.infinityfoundation.com/mandala/t_es/t_es_agraw_susruta_frameset.htm. accessed on 26.12.2013
2. Banerjee AD, Ezer H, Nanda A .2011. Susruta and Ancient Indian Neurosurgery, *World Neurosurg.* 75, 2:320-323.
3. Das S.2007, Urology in ancient India. *Indian J Urol* ;23:2-5
4. Deshpande PJ, Sharma RK and Prasad GC .1970. Contributions of Susruta to the fundamentals of orthopaedic surgery, *Indian Journal of History of Science*;Vol 5(1):13-35.
5. Dooley D,1973,A Dissection of Anatomy, *Ann. R. Coll. Sur, Engl:* 53(1) 13-26.
6. Dwivedi G and Dwivedi S. 2007. Sushruta – the Clinician – Teacher par Excellence, *Indian J Chest Dis Allied Sci*, 49: 243-244
7. Loukas M, Lanteri A, Ferraiola J, Tubbs R S, Maharaja G, Shoja MM, Yadav A and Rao VC. 2010. Anatomy in ancient India: a focus on the Susruta Samhita, *J. Anat.* 217, pp646–650
8. Malomo AO, Idowu OE, & Osuagwu FC, 2006,Lessons from History: Humana anatomy, from the origin to the renaissance, *Int. J. Morphol*, 24(1):99-104.
9. Mukundcharandas S, Published On: 8 Aug 2005 , Sushrut (Father of Cosmetic Surgery) [http://www.baps.org/Spiritual-Living/Weekly-Satsang/Enlightening-Essays/Sushrut-\(Father-of-Cosmetic-Surgery\)-2155.aspx](http://www.baps.org/Spiritual-Living/Weekly-Satsang/Enlightening-Essays/Sushrut-(Father-of-Cosmetic-Surgery)-2155.aspx) accessed on 20-12-2013
10. Prasad A <http://www.surgerytimes.com/history.html> accessed on 18.12.2013
11. Rao MS, 23 September 1966.THE HISTORY OF MEDICINE IN INDIA AND BURMA ,A paper read at the Symposium on the History of Medicine in the Commonwealth, organized by the Faculty of the History of Medicine and Pharmacy, and held at the Royal College of Physicians of London
12. Raveenthiran V. 2011 .Knowledge of ancient Hindu surgeons on Hirschsprung disease: evidence from Sushruta Samhita of circa 1200-600 BC *Journal of Pediatric Surgery*; 46(11); 2204-08.
13. Singh RK, Vyas MK. 2011. Surgical procedures in Sushruta Samhita, *IJRAP.* 2(5) ,1444-1450