

## Honoring the Past: A Prologue to Future Spine Surgery

Dear Friends,

As the president of the Neuro Spinal Surgeons Association (NSSA), I am most humbled by this professional honor. Let me express my gratitude to the members of the NSSA for bestowing their trust in me. We owe a lot to my predecessors in this position, and the various members and volunteers who served this society, for bringing it to what it is today. Thank you all for your efforts for the NSSA. I must acknowledge the hard work of the executive committee for making my job easier while assuming this great responsibility. I wish to thank the members of the organizing committee who have put in a yeoman's effort to bring this meeting together and make it the success I believe it is. My special thanks to all the members and guests of the NSSA for coming to my city, the City of Joy!

One of the privileges of giving a presidential oration is to pay public homage to those who have been supportive and instrumental in my professional journey. I am profoundly indebted to the institutions I belong to. My beloved parents, I cannot have praise high enough for them. My most enduring acknowledgment, as always, is to my wonderful partner Mala who has been my anchor to windward, and provided stability; and our dear children Lydia and Vedant for their support, love, and understanding. I must give my thanks to those magnificent teachers to whom I was lucky enough to be apprenticed. Prof V Hemlatha influenced me to perform spine surgery. Prof KVR Shastry initiated me into research, when I had the opportunity to work on the animal model of spinal injury. I love and respect them. Dr Patrick Kluger introduced me to the world of modern spine surgery, and nurtured me in Germany. Prof PS Ramani influenced me to be with you today. I have special respect for Mrs Ramani. They demonstrated the humility, warmth, and kindness that cannot be learned by formal study, but comes from observing the example of people who manifest those qualities in their own personality.

Spine is personality. It has taken approximately 525 million years since the Cambrian explosion when the vertebrates originated. The fossilized skeleton of *Diplodocus carnegii* depicts an extreme example of the backbone that characterizes the vertebrates.<sup>1,2</sup> This is a great time to be a neurospine surgeon, perhaps the best time in all of human history. With astonishing technological application, it will rewrite all of future spine surgery techniques. The well-planned scientific program is replete with learned discussions of the great advances in various aspects of spine surgery by experts. My presentation today is not a treatise on the advancement of treatment or the espousal of any fundamental philosophy of neurospinal surgery; rather I'd like to offer my gratitude to the heroes whose efforts have brought us this far. Like Antony said in Shakespeare's *Tempest*, "What's past is prologue; what is sustained for the future is the knowledge."<sup>3</sup>

During the next 15 minutes, we will glimpse into the dawn of spine care and surgery dating back to the ancient period. It is not a comprehensive review, but offers some interesting highlights in the history of spine surgery.

Medicine has evolved with superstition, faith, tradition, logic, and today's technology. A student of medicine cannot afford to lose sight of the discoveries of the ancient, and their hypotheses that may appear to be erroneous today were, nevertheless, the foundation of most of the scientific discoveries that we cherish today. Most of the antiquity we think of revolved around the Mediterranean Sea and India.<sup>4</sup> The concept of spine remains ancient. Spine in Sanskrit implied the *MERUDANDA* or the axis of the Universe. There has been no dearth of references pertaining to spine in any culture throughout history. *Kundalini yoga* described in *Mandukya Upanishad* goes back to primitive pre-Aryan antiquity. There are various chakras, the congregation of which leads to the highest energy or superconsciousness. According to the Vedas, our spine is like *Mount Meru* and when churned, the nectar of immortality and bliss, in terms of a disease-free and a blissful life, can be extracted.<sup>5</sup>

Everything in Indian life focuses on spine – starting from music, dance, and exercise. So much was the strength of spine that the king of heaven *Indra's* all powerful weapon was prepared out of the spine of *Sage Dadhichi* and used to kill the demon *Vritra*. The history of the spine basically starts in India. In the epic of Mahabharata, during his wanderings, Lord Krishna came across a woman who was a hunchback, a "*Kubja*." Krishna decided to cure her deformity. Unlike the common belief, there was no miracle involved here. In fact, Krishna knew the body-science very well, and made use of it. *Rishi Vyaas* describes in great detail the sequence of the corrective method used by him.<sup>6</sup> The ancient surgeon *Susruta* documented in great detail the method of treating spinal injuries. This reflects his great knowledge on the subject. On the treatment of cervical spine dislocation, he instructed to grasp the head at the neck along with the angle of the jaw and lift it up.<sup>7,8</sup>

Because these concepts of anatomy and treatment were to be remembered by listening and passed down by word of mouth over a period of several centuries, medical thinking probably stagnated owing to the inability of the physician of the time to deviate from that which was recommended by tradition, superstition, and an orthodox society.<sup>9</sup>

For the ancient physician, the fear of operating was a real one, especially when one had to deal with the central nervous system. Two centuries before the birth of Christ, *King Hammurabi of Babylon* (1955–1912 BC) introduced a set of equitable laws that dealt with matters of everyday life. The penalties established in this codex for making surgical errors led surgeons in that period to approach patients with some trepidation. In Hammurabi's Code, there are nine paragraphs devoted to the physician; one in particular deals with the operator who carries a bronze knife (scalpel) for wound care.<sup>10</sup>

The Edwin Smith Papyrus, written approximately 500 years after the time of Hammurabi, is the oldest medical text believed to exist. Physicians in ancient Egypt did not perform actual surgical procedures, but appear to have been surprisingly observant. They made observations about how different sites of injury, such as different levels of spinal injuries, affected normal body functions. Complete injuries were thought to be hopeless and were not treated. Incomplete injuries were treated with prostrate positioning and binding the area with fresh meat and then honey until recovery.<sup>11</sup>

Knowledge of the spine and spinal cord continued to advance when the Greeks arrived in the city of Alexandria. Hippocrates was the first to mention about sciatica syndrome, back pain, and spine fracture leading to paralysis. He also made an important observation that paralysis occurs on the same side as the lesion in the spinal cord. Hippocrates advocated the treatment of incomplete injuries with rack and gravity reduction and sudden, violent "jolting" techniques known as "*succussion*." This technique known as *Hippocratic bench* was replaced by *Hippocratic ladder* with patients fastened head upside down and hung by feet.<sup>12</sup>

During the time of *Ptolemy*, Alexandria was very open to learning. One experiment conducted in Alexandria that was not permitted elsewhere in the Mediterranean was vivisection. Greek philosophers (*Herophilus* and *Erasistratus*) cut open the backs of living prisoners to study the spinal column.<sup>13</sup>

During the turn of the century there lived *Celsus*. His book *De Medicina* is one of the best sources concerning medical knowledge in the Roman world. The one most relevant for the spine surgeon was his observation that a cervical spine fracture could lead to vomiting and difficulty in breathing and, not uncommonly, to death. Injury to the lower spine, on the other hand, he demonstrated, could cause weakness or paralysis of the leg, as well as urinary retention or incontinence.<sup>14</sup>

The next great contributor to the advancement of spine care was *Galen* who lived in the Roman era (129–200 AD). He was a physician to gladiators, and considered the best physician since Hippocrates. His observations remained unquestionable for 1500 years. Galen associated the level of spinal cord injury with deficits. He was the first to use the terms *scoliosis*, *lordosis*, and *kyphosis*. He advocated surgery for traumatic bone fragments affecting the spine and brain. Infection was thought to be a sign of good healing, hence the term *laudable pus*.<sup>15</sup>

During the 7th century, *Paul of Aegina* was the first to propose actual surgery on the injured spine. He wrote an epitome of seven books that summarized Galen's traditions and Greek medical thought. Known as a skillful surgeon, he performed trephination for the compressed spinal cord with removal of bone fragments. Paul of Aegina introduced the role of laminectomy and removal of bone fragments. Surgery of the spine was still thought to be uniformly fatal.<sup>16</sup>

*Avicenna of Baghdad* (10th century) was an important medical figure during the Arabic and Byzantine era, which lasted from 99 to 1037 AD. His greatest work, *Canon Medicine*, contained a series of illustrations on how to reduce or stabilize a spinal injury with distraction. Overall, however, he had a hopeless outlook on spinal injuries and did not support the concept of surgical intervention.<sup>17</sup>

During the 11th century, resurgence in spine surgery in Italy was marked by the famous *School of Salerno* led by *Roger of Salerno*. He dominated the field throughout Europe. His book *Practice of Surgery* was later owned by Harvey Cushing.<sup>18</sup>

Later in 13th century came *Theodoric of Bologna* and his textbook *Chirurgica de Theodoric*. Theodoric outlined how to examine the spine-injured patient. He believed that pus hindered proper wound healing, and he promoted surgery using a wine-antiseptic method that contradicted Galen and Avicenna. This was considered very controversial, and Theodoric was vilified by his peers.<sup>19</sup>

During the Renaissance, the great Leonardo da Vinci had painted the spinal column. This painting is considered to be the first accurate picture/representation of the spine, capturing perfectly its curve and tilt.

Henry Cline performed what was called a trephination of the spine in 1814. He removed a fractured spinous process in a patient with complete paralysis and a thoracic fracture-dislocation. The patient promptly died. Cline's case alone seemed to sound the death knell for spinal surgery for the remainder of the 19th century. A lack of adequate pain relief drove surgeons to operate as fast as possible. With hurried surgery, mistakes, poor techniques, bleeding, infection, and death, surgery of the spine was considered inhumane.<sup>20</sup>

American surgeon and pioneer Alban Gilpin Smith is thought to be the first surgeon to perform a successful laminectomy for trauma in Danville, Kentucky, in 1829. This was the first successful report since Paul of Aegina 1500 years earlier.

Entering the 20th century, Pott disease and associated deformity and traumatic injury remained the primary spinal pathologies treated by surgeons. Surgical debridement as described by Pott remained the mainstay of treatment until surgical stabilization techniques began to emerge.

Knowledge of spinal anatomy and pathologies combined with better instrumentation and the use of ether and chloroform as anesthesia led to the start of surgical procedures in the mid-1800s. Surgery of the spine specifically began in the late 1800s, but it was not systematized until around 1916 when Dr Charles Elsberg, a neurosurgeon from New York, published a textbook entitled "*Diagnosis and Treatment of Surgical Diseases of the Spinal Cord and Its Membranes.*" Dr Elsberg not only described his cases but instructed readers on how to perform surgical procedures on the spine and spinal cord for different conditions, presenting spinal disorders as a separate medical specialty, thus marking the birth of spine surgery. He is considered the father of spine surgery.<sup>21</sup>

One of the greatest figures in the treatment of degenerative conditions of the spine was Ralph Cloward,<sup>22</sup> best known for his anterior cervical surgery.

During my residency in the 1980s, the philosophy was "let the orthopedic surgeons do the instrumentation and we'll do the decompression." That's what we've always done. In 1993, neurosurgical and orthopedic representatives came forward with more cordial relationship for spine surgery. The common enemy of lawsuits pertaining to instrumentation united them.

Now, we have more sophisticated instrumentation. We understand biomechanics much better. Spine has come a long way in neurosurgery as more and more neurosurgeons are taking up spine surgery. The most rewarding thing we can do now is to help create a better tomorrow free of spinal diseases. The future will be close to heaven. Then I believe the journey of the neurospinal association will be successful.

Thank you for listening and thanks to the many authors whose work I have paraphrased and plagiarized.

## REFERENCES

1. Penumaka A. The Cambrian explosion and the origins of diversity. *Harvard Science Review*; 2011.
2. Hatcher JB. *Diplodocus (Marsh): its osteology, taxonomy, and probable habits, with a restoration of the skeleton.* Memoirs of the Carnegie Institute; 1901.
3. Respectfully quoted: a dictionary of quotations. 1989. Number: 1296 William Shakespeare. *The Tempest*, act II, scene I, lines 253-254.
4. Majmundar NJ, Assina R, Prestigiacomo CJ, Gandhi CD. Neurosurgery in ancient India: Susruta. *Ind J Neurosurg* 2015 Aug;4(2): 117-123.
5. Johari, H. *Chakras: energy centers of transformation.* Destiny Books; 2000 Sep 1. p. 21-22.
6. Ganguli, KM. *The Mahabharata of Krishna-Dwaipayana Vyasa (Translated into English prose from the original Sanskrit text); published between 1883 and 1896. (By Pratap Chandra Roy (1842-1895), Calcutta).*
7. Ramani, PS; Hedge, T; Sharma, A. *A brief history of neurosurgery.* Mumbai: Lavanya Prints Pvt. Ltd.; 1994.
8. Banerjee AD, Ezer H, Nanda A. Susruta and ancient Indian neurosurgery. *World Neurosurg* 2011 Feb;75(2):320-323.
9. Macdonell, AA. *A history of Sanskrit literature.* Motilal Banarsidass; 1962.
10. Prince JD Review: *The code of Hammurabi.* *Am J Theol* 1904 Jul;8(3):3601-609.
11. Garrison, FH. *An introduction to the history of medicine c. 2.* WB Saunders Company; 1921.
12. Marketos SG, Skiadas P. Hippocrates: the father of spine surgery. *Spine* 1999 Jul 1;24(13):1381.
13. Von Staden H. *Herophilus: the art of medicine in early Alexandria: edition, translation and essays.* Cambridge University Press; 1989 Apr 20.
14. Celsus, AC. *De Medicina.* Florence: Nicolaus Laurentii; 1478.
15. Galen C. Experimental section and hemisection of the spinal cord (taken from *De Locis affectibus*). *Ann Med Hist* 1917;1:367-371.
16. Aegineta, P. *The seven books.* Adams, F., translator. London: Sydenham Society; 1844-1847.
17. Rinio, B. *Avicenna: Liber Canonis, De Medicinis Cordialibus, et Cantica.* Basel: Per Joannes Heruagios; 1556.
18. Corner GW. On early Salernitan surgery and especially the "Bamberg surgery" with an account of a previously undescribed manuscript of the Bamberg surgery in the possession of Dr. Harvey Cushing. *Bull Inst Hist Med* 1937 Jan;5:1-32.

19. Borgognoni, BT. The surgery of Theodoric ca. A.D. 1267. Campbell, E.; Colton, J., translators. New York: Appleton-Century-Crofts; 1955-1966.
20. Keller T, Holland MC. Some notable American spine surgeons of the 19th century. Spine 1997 Jun;22(12):1413-1417.
21. Elsberg, CA. Diagnosis and treatment of surgical diseases of the spinal cord and its membranes. Saunders; 1916.
22. Cloward RB. The anterior approach for removal of ruptured cervical disks. J Neurosurg 1958 Nov;15(6):602-617.



**GK Prusty**  
Professor

The Calcutta Medical Research Institute of Neurosciences  
The Calcutta Medical Research Institute  
Kolkata, West Bengal, India

