

Rising to the Challenge: Spinal Ailments in India

Globally, there have been rapid developments in the prevention, diagnosis, and comprehensive management of various spinal ailments.¹ This assumes importance since spinal problems pose a grave challenge to humanity. Lower back pain, for example, is among the top 10 causes for the highest number of disability-adjusted life years lost worldwide.² Furthermore, it is the leading cause of disability and work absence, causing a great economic burden to the community.³ Spinal cord injury (SCI), on the other spectrum, is considered the most devastating ailment to afflict mankind.⁴

The challenge becomes multifold in resource-challenged countries like India. Numerous factors such as the inadequacy and inaccessibility of services, the nonavailability of multidisciplinary comprehensive care, the lack of a barrier-free environment, and financial constraints hinder the comprehensive management of SCI and other spinal ailments, further contributing to this challenge.⁵

The revolution in the management of spinal ailments is especially evident in the field of SCI.⁶ What was described till seven decades ago as an “ailment not to be treated,” can now be rephrased: “Life after a SCI can be happy, meaningful and worth living.” Similarly, there have been advancements in the management of most spinal ailments resulting in a significant improvement of outcomes.

India has been slow in responding to this revolution. It continues to be a land of paradoxes, with some health-care facilities matching the best practices in the world, whereas many others lack facilities for basic healthcare.⁵ There remains a vast imbalance in the availability of specialized spine services between urban and rural areas due to the aggregation of tertiary centers in cities and a lack of a systematic referral system for spinal ailments.^{7,8} Despite much development over the last few decades, there exists a substantial gap between what is “possible” or “needed” and that “actually available” to the common man.⁹

Apart from working routinely as clinicians and surgeons, we can help improve the current scenario. We could do this by ensuring we are well versed with recent developments in spine care with a view to improve outcomes and focusing on research activities in an endeavor to find novel solutions, especially those relevant to the Indian scenario. This may involve bridging the gap in service delivery in the underprivileged areas/sections of the society; setting up centers for treatment, research, or training for spinal problems; creating awareness about prevention; and providing recommendations to policymakers.

The role of medical professionals in bridging the gap can be discussed as issues of service delivery, education, research,

and advocacy. Let us throw some more light on two of these areas, which fall within the scope of this journal.

As medical professionals, it is our moral responsibility to be well versed with recent advancements in management, facilitating patient access to the same.

Diffusion tensor imaging, functional magnetic resonance imaging of the spinal cord, tractography, positron emission tomography, and single photon emission computed tomography are some of the latest advancements in the diagnosis of spine disorders and the assessment of the extent of damage to the neural structures. They may provide objective information to be used for assessing retained function, designing rehabilitation programs, and predicting the potential for the recovery of function in SCI patients. EOS™ is another diagnostic advancement with the potential of providing the surgeon true weight-bearing angulations in the spine. This helps in better surgical planning in deformity cases and in reducing reoperation rates.¹⁰

Better protocols of conservative management have emerged owed to a better understanding of spinal ailments resulting in improved outcomes. The relevance of conservative management as the first line of treatment, except in the presence of red flags, has thus been further consolidated.

Motion preservation techniques, minimally invasive access surgery, computer-assisted image-guided (spinal navigation) technology, robotic surgery, and electrical stimulation strategies are the latest advancements which have drastically changed surgical management of spinal ailments. Intraoperative neuromonitoring has increased the bar of safety in spine surgery, particularly in cases with kyphosis, scoliosis, or preexisting neurological impairments.¹¹ Baclofen pumps have improved the quality of life for people with SCI.

Various technological advancements have sprung up for the rehabilitation of SCI patients and those with back pain. Robotics and exoskeletons have helped consumers in customized exercises and better community inclusion. Other newer modalities include virtual reality, augmented reality, body weight suspension training, and pressure mapping technology.¹²

A number of assistive technology devices are now available for better community inclusion of consumers. These range from environmental control units to low-cost wheelchairs.¹³ They can be modified as per the patients’ customized needs. Furthermore, the modification of environments for participation has seen rapid developments.

There have been a lot of developments in preventive medicine as well. Community awareness about lower

back pain has led to the inclusion of ergonomic designs of furniture in offices, decreased the load in bags of school children, included posture correction and exercises in routine lifestyle, and back injury avoidance in heavyweight lifting in both gyms and competitive sports. SCI day is observed on September 5, to create community awareness.

Considering the diversity of India with the majority of the population residing in rural areas, healthcare at home using telehealth is of prime importance. This becomes especially important for SCI individuals owed to issue of making them travel in a less friendly environment and/or infrastructure.^{14,15} With the Government putting emphasis on the Ayushman Bharat Program, tapping into the potential of telehealth assumes special importance.¹⁶

These recent advancements have had a significant impact on patient care. Robotic spine surgery, for example, has increased accuracy to 98%–99% and reduced radiation exposure (74% as compared to C-arm and 50% as compared to navigation), complication rates as well as the length of hospital stays.¹⁷

However, such advancements are unfortunately unavailable to a vast majority of the Indian population. While it is important to make all these advancements available, a few may take priority over others. For example, there is no comprehensive biomechanics laboratory providing facilities for training, research, and implant testing across the country. With the “Make in India” initiative of the Government of India, such a laboratory becomes vital to facilitate newer designs of implants suited for Indian population and implant testing to ensure quality as per approved standards.

The challenge of optimal management of spine ailments is as huge as the magnitude of the problem. Unfortunately, our understanding of the problem and its solutions is inadequate to meet this challenge. For example, we still do not know the exact etiology of pain in prolapsed intervertebral disc and back pain. In addition, we do not well understand the barriers to spinal cord regeneration and the strategies to effectively overcome the same. This however leaves a big scope for professionals and researchers to derive a better understanding of the problem and consequent innovative solutions. There have been quite a few technological innovations, providing a ray of hope to the huge community suffering from spinal problems.

Innovations in diagnostics include biomarkers, some of which are being studied to delineate the severity of the initial SCI and may have a prognostic value for the degree of functional recovery.¹⁸ Moreover, various biomarkers are being studied for disc degeneration and lumbar stenosis.¹⁹ The chief utility of identification of these markers is “precision medicine,” i.e., to guide a more personalized therapeutic plan. High interleukin-6 levels, for example, have been found to be associated with less favorable

outcomes in lumbar radiculopathy. Similarly, leptin, bone morphogenetic protein-4 (BMP-4), and circulating miRNA are currently under investigation for idiopathic scoliosis.

Epidural stimulation in SCI is one of the innovations with immense potential.²⁰ In a small case series, after intensive rehabilitation, some participants were able to walk in their communities during stimulation and even regain control over previously paralyzed movement in the absence of stimulation.²⁰ This technology is still in a nascent stage and much research and development is required before it can be introduced into practice. The brain–machine interface is another innovative technique attracting global attention. It helps translate neurological information into commands which an external software or hardware could understand. Such interfacing can easily control robotic parts such as prosthetics and help patients in their daily activities.²¹ “Artificial muscle” has generated hope for the development of products, which could provide movement in paralyzed limbs at a price affordable by individuals in low- and middle-income communities.²² Artificial intelligence and decision support systems have the potential to help young surgeons and peripheral hospitals to plan the management of patients.²³

Growth-stimulating protein injections (e.g., BMP-14), virus-mediated *in vivo* gene therapy, and cell therapies (e.g., mesenchymal stem cells, chondrocytes, etc) are some upcoming strategies for degenerative disc disease.⁴ Targeted biologics (e.g., receptor activator of nuclear factor-kappa B ligand for giant cell tumors), proton-beam therapy, stratification of tumor subtypes, and the delivery of precision medicine are transforming primary spine oncology.²⁴ Newer osteobiologics and biomaterials are rapidly being developed with new technologies (e.g., titanium-polyetheretherketone composites, hydroxyapatite-coated implants, and silicon nitride ceramics).²⁴

Innovations assume importance in emerging countries so that the masses could benefit from locally relevant and affordable solutions. A solution for a problem in the west may not be relevant for the Indian population. Through innovation, locally relevant solutions have to be found. For example, the wheelchair ideally suitable for the western environment may be a total failure in many Indian environments.¹³ Furthermore, there exists a need for Indian researchers to innovate cheaper versions of various devices, such that Indian masses could afford the benefit of advancements in technology. For example, a very small percentage of the Indian population would be able to afford the cost of diaphragmatic pacing or an epidural stimulation device; a cheaper Indian version would bring respite to the target population.

Furthermore, it is important in emerging countries like India to pool the limited resources for research to have optimal outcomes. It thus becomes vital for clinicians, engineers, researchers, and designers to together engage

in transdisciplinary research for the delivery of far better results than when they work in isolation. Unfortunately, there is hardly any such platform in India. Encouraging transdisciplinary research can go a long way in promoting research for spinal ailments in India.

In our quest for implementing recent advancements and engaging in innovative research, we should not forget to move forward ethically. Medical professionals across the globe face numerous common ethical dilemmas, but some are unique to resource-challenged countries. We need to tackle the dilemma by maintaining a healthy relationship with the patient as well as industry and establishing our practice on sound principles of management backed by a judicious mix of evidence base and experience. Moreover, it is our responsibility to help curb unethical practices which come to our notice. For example, there are almost daily claims in the media on how stem cell “therapy” results in miraculous improvement. These procedures have been introduced into practice without undergoing valid clinical trial programs. Ethical challenges thus remain in offering cellular/stem cell transplantation as “therapy.”²⁵ “Stem cell tourism” continues to thrive as global clinics continue to promote unproven therapies to a susceptible population.

We should not get cowed down by the challenge. We should be aware that there are various strengths of the Indian society that help to overcome the challenge, such as a strong family, spouse, as well as community support, a positive attitude, innovativeness, and the availability of cheap and abundant workforce.⁵ Furthermore, India has produced some of the best professionals who could take up any challenge and provide effective solutions.

Since the time of its inception, the Association of Spine Surgeons of India (ASSI) has been working relentlessly to bridge the gap in the management of spinal ailments through a comprehensive approach. Scientific and educational activities include national, regional and local conferences, instructional courses, symposia, continuing medical education (CMEs), and workshops. ASSI has been implementing 2-year fellowship programs in centers across India. In addition, ASSI conducts outreach programs across the country and has launched its own journal, textbooks, and monographs.^{26,27} The society has also been a strong propagator of research and has launched research grants, established a spine registry and an Application (APP)-based case discussion forum. Furthermore, it has been working with other societies to create awareness about the prevention of spinal ailments, for strengthening the injury prevention program and to lobby for the control of unethical practices pertaining to stem cell/cellular transplantation.

Recently, it was felt that it was time to introspect on the achievements of ASSI over the 35 years since its inception, to review its current objectives to determine if these remain relevant and appropriate, to listen to the voice of members with a view to transform their ideas into reality and to

brainstorm on a strategy for the success of its ventures and chalk out a roadmap for the future. ASSI has thus come up with a 5-year strategic plan, which came into force in January 2019. This discusses certain specific aspects of the philosophy or the aims and objectives of the organization requiring special focus and attention.²⁸ Foreseen in the plan is the development of clinical guidelines and pathways and short term subspecialty fellowship programs; capacity development and creating excellence in spine surgery in deserving centers of India; elearnspine.org – an educational web resource, which could disseminate information on all aspects of management of spinal ailments; mentorship programs and the promotion of multicentric research in various subspecialties such as trauma, deformity, infection, degenerative spine, minimal access surgery, and tumors. These initiatives should go a long way in bridging the current gap.

The aim of this editorial is thus to encourage health-care professionals to ensure their patients get access to advancements in knowledge and technology and to stimulate minds to work for newer developments in spine care. Understanding the gaps and bridging them would thus be the key to advancement.

Let us rise up together to the challenge posed by spinal ailments.

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