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ONE **Life** CELEBRATE IT.

Getting diagnosed with cancer is not the end. With the advent of leading-edge technologies, cancer can now be successfully treated. Though access to world-class cancer care is paramount when it comes to treating cancer, having a positive outlook towards life can do wonders. An insatiable love for life and an unflinching desire to celebrate every moment no matter what make these cancer survivors awe-inspiring personalities.



*Radixact - A revolutionary cancer treatment technology introduced in India for the first time at Mumbai.

OVERVIEW OF THE INDIAN HEALTHCARE INDUSTRY.

For decades, India's muted healthcare spending was the result of a relatively low presence of accessible, available and affordable healthcare services on one hand while low incomes on the other. This reality is being corrected faster than ever. An increase in healthcare awareness is driving investments in the sector; increased incomes are also catalysing healthcare expenditure. Today, healthcare sector in India has become one of the largest in terms of revenue and employment. The Indian healthcare sector is further growing at a rapid pace as a result of its strengthening spectrum of services and increasing expenditure by public as well private players.

In India, the healthcare sector is bucketed into two major spectrums - public and private. The Government managed public healthcare system comprises limited secondary and tertiary care institutions in key cities, which focus on providing basic healthcare facilities in rural areas, while the private sector provides secondary, tertiary and quaternary care with a major concentration in tier I and tier II cities. Over the last two decades, a majority of tertiary care institutions in the public sector have been facing a resource crunch resulting in their inability to maintain their equipment, pay for consumables and upgrade their infrastructure to meet the growing demand for complex diagnostic and therapeutic treatments. As a result, there is an increasing preference for private hospitals. Today, the private sector plays a dominant role in the delivery of healthcare services in India. It is predominant in medical education, training, diagnostics and technology, manufacture of pharmaceuticals, hospital design, and in construction and management of ancillary services. Over 75% of the human resources and advanced medical technology, 68% of all hospitals and 37% of total hospital beds in India are in the private sector. Further, the sector has grown rapidly in the last few years, witnessing the emergence of several large private players and attracting huge capital investment. The growing dominance of the private sector and the consequent increase in competitive forces, is transforming the Indian healthcare sector from a supply driven market to a demand driven/ consumer-centric market.

Today, healthcare in India has increasingly become technology-driven, be it the development of new drugs/vaccines, medical devices/ equipment, or even the diagnostic techniques. The last decade witnessed a significant change in the delivery of healthcare services, with technology having a key role to play. Technological advancements have been made in the field of imaging which has facilitated

to deliver faster and more reliable diagnosis, with reduced doses, procedure time and new interventional application. Considerable advancements have also been made in several other areas, with the introduction of advanced medical technology thus improving the ability to monitor, prevent, diagnose, control, and cure a number of growing health conditions. Healthcare providers are increasingly adopting technology to derive various benefits, including improved patient satisfaction (through reduced turnaround time at points of care); enhanced patient safety (through improved decision-making); enhanced productivity and elimination of human error (by way of seamless integration with medical device/equipment); reduction in operational costs (through reduction in staff needed for back-office tasks); improved inventory management (by way of accurate demand estimation and timely procurement and distribution of materials), among others. Indian healthcare sector, one of the fastest growing industries, is expected to advance at a CAGR of 22.9 per cent during 2015–20 to reach USD 280 billion. There is immense scope for enhancing healthcare services penetration in India. This presents ample opportunity for development of the healthcare industry. Considering the fact that the healthcare spending in India has a huge rise in the percentage of Gross Domestic Product (GDP), there is a vast scope for enhancing healthcare services. Rural India accounts for more than 70 percent of the population of the country and is all set to emerge as a potential demand source for healthcare services. India requires 600,000 to 700,000 additional beds over the next five to six years, indicative of an investment opportunity of USD 25-30 billion. Given this demand for capital, the number of transactions in the healthcare space is expected to witness an increase in the near future. The average investment size by private equity funds in healthcare chains has already increased to USD 20-30 million from USD 5-15 million.

Transitioning from Photon to Protons – From the Frontier to the Forefront.

Radiation therapy is one of the cornerstones of contemporary cancer treatment and about 50% of patients will, at some point during their cancer history, require it. It forms a major part of the treatment plan for 40% of those who are cured of their cancer and is primarily responsible for cure in 16%. Since its first use in 1896 the face of clinical radiation therapy has continuously evolved, following a rapid arrow of progress. Thanks to imaging, computing power and technical advances in delivery.

Problems with Photon Treatments:

If given in sufficient doses, X-ray radiation techniques will control many cancers. But, because of the physician's inability to adequately conform the irradiation pattern to the cancer, healthy tissues may receive a similar dose and can be damaged. IMRT and VMAT/Rapid Arc techniques have enabled increase in the target conformity, albeit superior over the routine 3-D Conformal techniques used routinely. Consequently, a less- than-desired dose is frequently used to reduce damage to healthy tissues and avoid unwanted side effects.

Based on 15 years of experience with IMRT, we have learned that the opportunities in improving the plan quality are limited within the constraint of the present linac /MLC delivery. To improve the quality of the new IMRT plans one must inject new degrees of freedom. This may require an overhaul of the existing technologies.

Proton Opportunity:

- Protons are subatomic particles, stable positively charged, travel in straight lines with very little scatter through the tissues they travel. In proton therapy, hydrogen nuclei (protons) are used for treatment after raising their energy level with a particle accelerator, 250 MeV superconducting cyclotron or synchrotron
- Besides electronic interactions (ionization) proton also produce nuclear interactions
- Different modes of interactions means different dose distributions

Protons have the remarkable ability of losing little energy when entering tissue, but depositing more

and more as they slow down. Finally, depositing a heavy dose of radiation just before they stop, giving rise to the so-called Bragg peak energy loss dE/dx profile.

- The major advantage of this physical properties of protons over conventional radiation results in improved conformity and reduced integral dose resulting in energy distribution of protons getting directed and deposited in tissue volumes designated by the physicians - in a three-dimensional pattern from each beam used. This allows the dose to be increased beyond that which less-conformal radiation will allow. The overall affects lead to the potential for fewer harmful side effects, more direct impact on the tumour, and increased tumour control
- In short – Conventional X-rays deposit most energy before the target while protons deposit most of the energy in the target

Developing Strategies for Selecting Patients:

One approach for selecting patients is based largely on historical series. However, a report for the Dutch government describes rational categories of clinical indications, which are helpful in considering future priorities:

- **Standard:** Benefit suggested by dosimetric studies, confirmed by phase I/II trials, observational studies; clinical consensus exists
- **Potential:** Improvement in treatment efficacy may be possible, by dose escalation
- **Model-based:** to reduce side-effects, especially in re-irradiation context
- Reducing the risk of secondary-radiation-induced tumours-most relevant for children and young adults, but what is the relevant age cut-off is unanswered still

The most intriguing category is the model-based approach, where PBT is aimed primarily at reducing side effects. It is proposed that PBT could be offered if individual planning studies show that side-effects can be reduced significantly. This might include pelvic malignancies, lung, prostate, head and neck, oesophageal and left-sided breast cancers and lymphomas.



This is clearly sophisticated, but also hugely ambitious, in that it links decision making to robust data on normal tissue complication probability. Levels for reduction would have to be determined, risk groups and cost-effectiveness balanced against conventional radiotherapy options.

Cardiac dose, for example, in a left-sided breast cancer case, may be reduced by a variety of techniques in conventional radiotherapy, but if a need to treat the internal mammary chain is additionally factored in, it is easy to conceive that a PBT plan might be calculated to deliver a substantially lower risk of late coronary damage. It is difficult to conceive of comparative planning being the main method of access for PBT especially in developed countries.

Challenges remain in developing and prioritising indications over the next few years before the treatment centres open, all of which will need to take into account the limited capacity.

Problems of a wide range of highly selected indications and low numbers, insufficient to obtain robust data, could be addressed by collaborating with other countries.

Evaluating Newer Technologies:

New drugs have to undergo a rigorous three-phase testing process mandated by the Food and Drug Administration. This process, insofar as possible, ensures a rigorous assessment of safety and comparative efficacy for new drugs before they come to market.

New technology is, however, managed differently, recognising that many devices are simple upgrades of pre-existing (or 'predicate') devices. Thus, for low- and intermediate-risk devices, simple proof that they perform their stated tasks in a safe manner is sufficient. For 'high-risk' devices, some prospectively gathered clinical data are required, although randomised trials are not necessary.

Decoding the Proton Bubble:

Until 2004 there were only two clinical centres in the USA, Loma Linda University and the Massachusetts General Hospital, and so proton therapy was not a big resource drain and largely passed unnoticed. These centres generated the evidence supporting the use of proton beam in treating cancers of childhood and tumours of the skull base, the only indications currently held to be secure.

During the last decade and a half, however, the number of proton centres have expanded enormously and stands at 26 at the time of writing, with many more planned.

In addition, many competitive treatments have become established. Stereotactic body radiotherapy - a very patient-friendly alternative to proton beam and robot-assisted surgery has, through a similar advertising blitz, eaten into the radiation, and thus the proton therapy share of the market.

Several US proton centres have accepted 'reference pricing' as payment for proton therapy, meaning that they are not paid what it costs to deliver the treatment but are paid according to the next most expensive alternative. This, being better than no payment at all, will allow some to survive. Other academic institutions are trying a new model, forming consortia in which many centres have a share in a single facility. The first of these, in New York City, should open within 2 years, but whether co-operation can be maintained long-term is unknown.

There are now enough academic centres open that there is a critical mass for research co-operation and many trials are underway, including randomised trials against alternative treatments. As European centres open, the trials base will enlarge further and evidence can be rapidly generated that will confirm the benefit of proton therapy in some clinical situations and refute it in others. Payers have complained that they are paying for a therapy without evidence of benefit. They are right, and this needs to be rectified fast.

Potential Clinical Challenges / Underpinnings:

Simply put, proton stops, but they do sharply. But stopping can be dangerous if we don't know where:

1) Bragg peak placement inaccuracy due to physical reasons, such as heterogeneous tissue densities, patient movement, daily positioning, and beam delivery-related factors, such as lateral scattering of the beam.

2) Within Bragg peaks, energy is deposited as clustered rather than sparse ionisation events. This causes more complex DNA damage that is more difficult or impossible for enzymatic DNA repair mechanisms to restore, resulting in enhanced biological effects. These may be advantageous within a cancer, but possibly deleterious for normal tissues in the tumour vicinity and which require to be treated to full or near-full dose to achieve local tumour control.

3) Currently, the medical prescription of proton therapy dose includes a 10% reduction in dose to all tumours and tissues to compensate for enhanced bio-effectiveness. This correction factor is being challenged, but to understand this issue, it is necessary to be familiar with the physics and biology terms associated with enhanced bio-effectiveness, and how this is modified by physical and biological characteristics.

While technology continues to evolve, majority of these clinical challenges can be overcome by properly configuring the technologies using Advanced Pencil-Beam Scanning technologies, Planning systems, Image guidance tools, etc.

Future of Proton Therapy:

The future for proton therapy has to lie in smaller, more efficient, delivery units.

Current systems can occupy a space the size of a football field. This kind of space may be unavailable within the footprint of a hospital or too expensive in many cities. Several vendors have managed to produce units with just a single gantry costing less than \$30 million. These treat far fewer patients than multi-gantry systems but carry somewhat less financial risk for the institution.

Much engineering research has looked at reducing gantry size to cut down on weight and space. Others look to eliminate the gantry altogether and simply manoeuvre the patient within a fixed beam. Some are investigating fundamental alternatives to the cyclotron for generating the proton beam.

If these come to pass, and the price can be vastly reduced, then proton therapy can enjoy a revival, and perhaps even an expansion.

PBT is here to stay and is a welcome advance in radiotherapy and we are in a position to make a major contribution to the science and clinical application of PBT.



**Photon beam therapy to be introduced in India for the first time.*

What is the cost of low cost in healthcare?

The growing population and ascend in chronic care needs are wielding substantial demands on our healthcare frameworks. It is greatly stressing that about 50-60 million Indians are constrained to spend half of their yearly family income to address medical issues, particularly with regards to hospitalization. The out-of-pocket costs for medical services are extremely high for us, which influence disservice to almost 7% (Rao, n.d.) of our population. Access to capital has been one of the biggest roadblocks to the growth of the Indian healthcare sector. Today, majority of the system constitutes of private healthcare and the Indian government spends only about 1% of its GDP on healthcare, which is among the lowest globally for any country. However, to meet India's burgeoning healthcare needs, both the public and private sector will have to join hands to build value-based and cashless healthcare. This implies providing high-end care at a subsidized cost compared to other countries; to enhance healthcare services. It is the commitment of the state to give free and universal access to quality healthcare services to its citizens as India keeps on being among the nations of the world that have a high weight of ailments. The various wellbeing projects and policies in the past have not possessed the capacity to accomplish the coveted objectives and targets.

However, with the recent launch of one of the major policy initiatives by the government, Ayushman Bharat – National Health Protection Mission for the underprivileged section of the Indian population, will help in the accomplishment of the dream of Universal Health Coverage of the Indian population. Ayushman Bharat is an attempt to ensure that universal healthcare reaches the weaker section of the society and it may certainly boost the ratio of people availing primary healthcare and some of the secondary healthcare. But the current framework of the scheme will not be beneficial for people who need tertiary care as the remunerations under the scheme will not be sufficient to avail value based healthcare. Under the scheme, tertiary healthcare service providers will be forced to cut cost at every level which will lead to offering sub-standard healthcare to patients under the scheme. They may not be able to avail the necessary medication, technology and clinical expertise to get the best outcome and will soon lose confidence in the system. However, implementation of the scheme will be a big challenge since it would involve focusing on the critical success factors, maintaining good quality of care for patients, strengthening primary care and healthcare infrastructure.

Quality of patient care

A scheme of such scale is most likely to face obstacles when 'quality of patient care' is considered. In case of serious and major illness, emergency and ICU care, there is a high chance of an Ayushman patient to receive low quality healthcare due to the capped amount to be granted. Hence, the mortality and morbidity rate will be very high. The trust and confidence of the poor will be immensely affected. Let's say, if I am a below poverty line person and I require a certain drug treatment i.e. for my cure, if the system doesn't pay, I'm helpless. So, I will not get the right treatment and my survival is at stake. Therefore, if you are an Ayushman patient you will get low quality care as the amount paid is less comparative to the cost of the treatment. For the vulnerable class, the government funding is essential to make healthcare universally available but there is also a need to improve the

outcomes for the money spent - only then we can make value-based healthcare a reality.

Strengthening primary care and healthcare infrastructure

Giving financial protection to the poor not only gives them access to healthcare but is also cost-effective. That is, it gives great incentives as the advantages of financial protection far exceeds the expenses. However, cost-effective health coverage must cover primary care. The WHO prescribes allotment to primary care, particularly for presently unprivileged low-income population. In India, reallocation of assets is important to fortify primary care and to embrace innovation and well-being programs, to be cost-effective in terms of expenses and anticipated benefits. Solid primary care is crucial to keeping overall access to healthcare reasonable and inexpensive in the nation. Our greatest imperative to get this going isn't due to lack of capital or framework, but an intense deficiency of human resources and infrastructure. Most public healthcare facilities have noteworthy deficiency of specialists, doctors, nurses and other healthcare experts. To address this, the government should use existing foundation in private medical schools, that has been under-used because individuals can't afford the cost of it. To utilize these spaces, bundle rates must be made competitive and at standard with the market rates. The government says that volumes will help take care of the expenses, yet that is after a point of time. Now, they must get the beneficiaries, and make it reasonable for the hospitals as well.

Outcome-based payments

Quality healthcare is defined as value-based medicine that is assessed by outcome. Today, nearly 80 percent of healthcare in India is provided by the private healthcare system and in order to meet the burgeoning healthcare needs of the Indian population through value-based medicine, the country needs a synchronized effort by both private and public sector. The scheme encourages hospitals to maintain certain minimum standards. The reward to hospitals is 10% higher if they have NABH accreditation and a basic technology criterion has been stated for hospitals to be qualified for this scheme. Hospitals that meet certain quality benchmarks ought to be permitted to serve NHPS beneficiaries. Quality should be assessed not only by the infrastructure offered at the hospital but also by authentic patient outcomes attained. The only solution is to have a mandatory universal health cover for all sections of the society. This will increase the pool and allow cross-subsidy between the government and the private sector for different sections of the society. Over and above, the power to judge the need should be with an autonomous insurance company that can negotiate with the private service providers on a reasonable remuneration which is beneficial for both parties. It is a proven and successful model followed by various developed countries and will bring a sustenance in India as well. It is a long road to make quality healthcare accessible but we need to take up the challenge and pave way for a correct system where people receive the right treatment at the right time irrespective of their economic status.

Over the long haul, Ayushman Bharat should focus on fortifying of primary care, incorporation of outpatient treatment and general health care delivery framework with a specific end goal to make the government's progress to accomplish Universal Health Coverage.