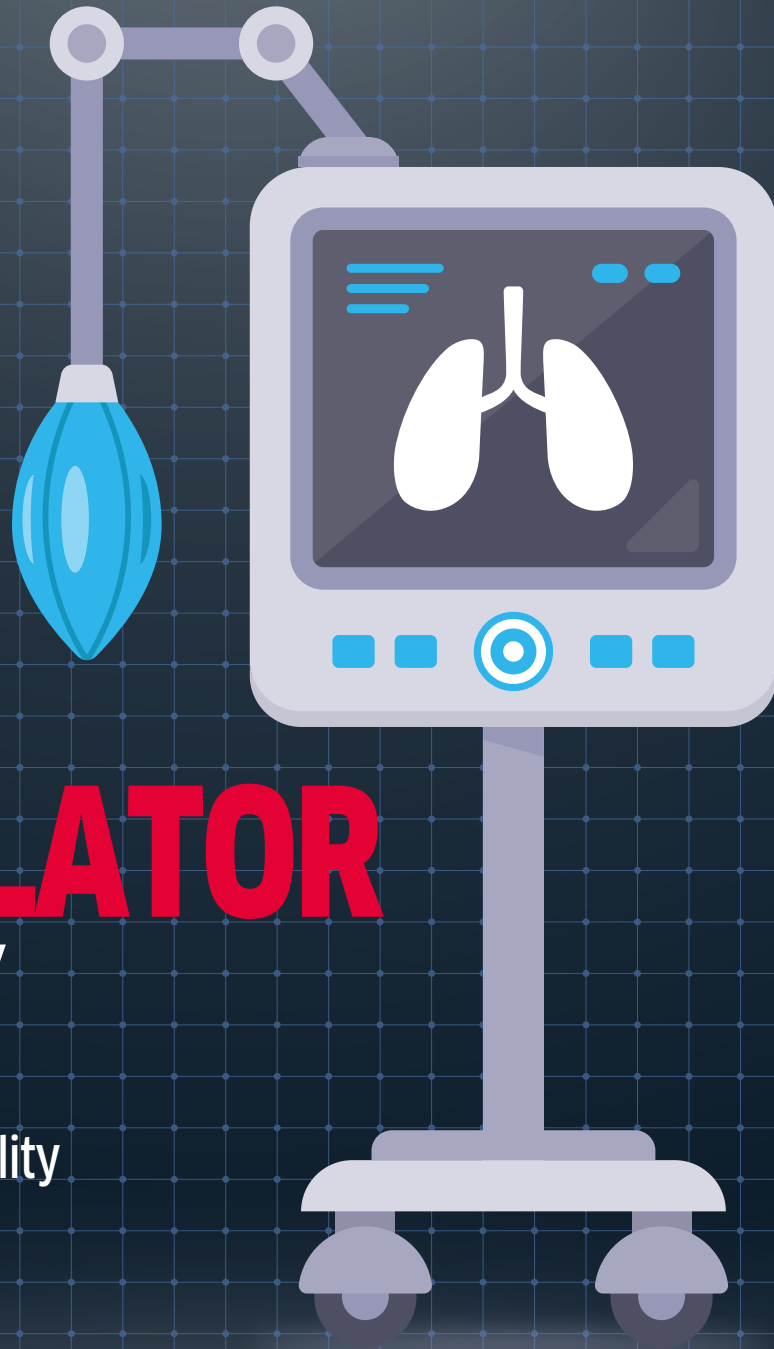


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WMIT, Global Medical Industry Convergence Cluster

Wonju Medical Industry Techno Valley (WMIT) was founded in 2003, by a spontaneous help and close cooperation between local government and universities as a non-profit organization.

WMIT established customized "MEDISTRY" provision system for Korean medical manufacturers, which currently includes comprehensive support for multilateral analyses on preceding technologies, mechanical and

instrumental design, pilot production, safety and reliability tests to secure conformity to international standards and activities for making inroads to global market for corporations to have global competitiveness.



Wonju Medical Industry Techno Valley

WMIT works to cultivate professional human resources, promotes R&D based innovative technologies, support the global network for interchange and collaboration business incubation and guides domestic corporations to enter international procurement markets, especially in the field of healthcare and state-of-the-art medical instrument technologies with bio-convergence.

As a way of making inroads to Indian market, member companies of WMIT, NEODR (www.neodr.net), SONICWORKD (www.sonicworld.kr), MIONE (www.mione.co.kr), UNISPATECH (unispatech.co.kr), YUWONMEDITECH (yuwonmeditech.com), HYUNDAE MEDITECH (www.hyundaemed.co.kr), FORU (en.for-u.co.kr), HAHOMEDI (hahomedi.com) are herewith presenting their grand products.

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EDIT NOTE

Ventilator Story



We have been bringing you the latest on medical technology and healthcare news through our portal www.indiamedtoday.com. After a hiatus of four months, IndiaMedToday print editions are back in full swing. So grab your copy, enjoy, and send us your feedback.

Have we had a clear-eyed assessment of Indian medical device manufacturers' constraints and avenues for the industry's potential growth? We look at ventilator manufacturing in India and the difficulties the segment has seen in the past couple of months. We find out what happens when experts from outside the medical industry turn their attention to healthcare and look

at how bottlenecks and shortages have limited the availability of key medical products.

In this issue, we also bring you Intuitive Surgical's journey in India. We talk to Mandeep Kumar about the future of robotic surgery in India; look at the high-tech world of robotic surgery through this interview.

We also examine how FDI in healthcare has affected private hospitals and brought about a change in healthcare delivery.

Also in this issue, we learn about point-of-care ultrasound and how it has helped Covid management.

Plus, we explore the potential of re-inventing clinic design with KGD Infrastructure. In addition, the latest trends, insight and analysis in medical devices and healthcare delivery in India in our revamped issue.

As always, if you have any comments or would like to submit an article, please don't hesitate to contact me at mneelam.kachhap@indiamedtoday.com

Editor
M Neelam Kachhap



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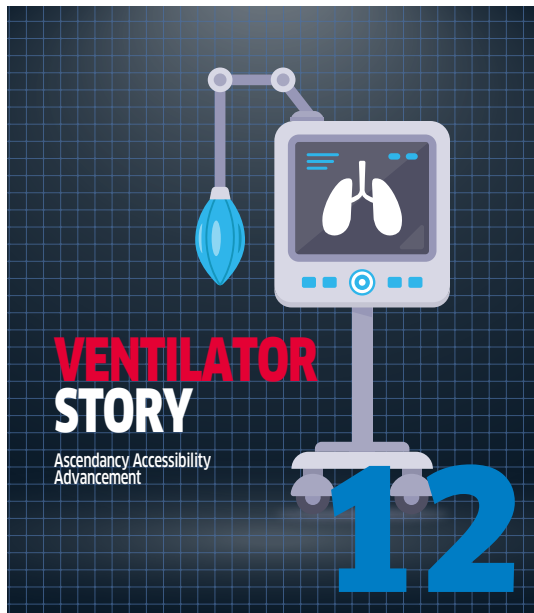


Facebook



LinkedIn

CONTENTS



COVER STORY

Ventilator Story

Ascendancy Accessibility Advancement



PULSE

FDI in Hospitals

This is the time to look at new investment plans



INFRASTRUCTURE

Re-inventing Clinic Design

Project Highlight - Sakra Clinic



INTERVIEW

Intuitive Surgical Bullish on Indian Market

Mandeep Singh Kumar - VP & GM, Intuitive India says future of robotic assisted surgeries in India is extremely bright



RADIOLOGY

Lessons in Lung USG

Role of Lung Ultrasound in Covid-19

UPFRONT

04 Editorial

06 News Roundup

www.indiamedtoday.com

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NEWS ROUNDUP

FIR against Hospitals

Two first-incident-reports (FIR) were filed against private hospitals in July, 2020 in India. One FIR was filed against the Sakra Hospital at Bengaluru for allegedly not providing information about availability of beds for COVID-19 patients, media reported. The report also mentioned the virus-infected patients treated between 23-29 July, which was part of the FIR.

Various issues thus have been named in the FIR and charged under the Disaster Management Act, 2005, and the Epidemic Diseases (Amendment) Ordinance, 2020, against the head of the hospital Deepak Balani, Deepthi, and Deepak Agarkad, The Hindu reported.

In Mumbai, Nanavati Super Speciality Hospital came under the scanner for alleging overcharging COVID-19 patients. An FIR was filed after the Brihanmumbai Municipal Corporation (BMC) ordered an inquiry into the matter TOI reported.

The hospital has been charged under Sections 188 (disobedience to order duly promulgated by public servant) and 34 (when a criminal act is done by several persons in furtherance of the common intention of all, each of such persons shall be liable for that act in the same manner as if it were done by him alone) of the Indian Penal Code.

Modern Family Doctor to provide telehealth services

Primary healthcare clinic chain, Modern Family Doctor (MFD), has partnered with EnableX.io, Asia's leading cloud communication service provider, to bring remote healthcare access to patients. While it previously allowed patients to schedule or book appointments and make payments via its telehealth app, it now also offers doctor-patient video and audio consultations with advanced communication capabilities, MFD witnessed 30 per cent decrease in no-show and last-minute cancellations.

Suresh Babu, COO, MFD said, "EnableX's communication platform has made it simpler for the patients to connect with doctors using our app. The scalable,

easy-to-use API and toolkits together with comprehensive documentation made it convenient for us to embed the video/voice channel within our app in a week's time, without us needing to create our own infrastructure."

Through the one-stop telehealth app, patients can now access more than 100 MFD medical specialists and doctors. The one-stop experience allows patients to seamlessly use the app to check doctor's profile, book appointments, receive virtual face-to-face consultation and get doctor's prescription all within the comfort of their homes, on any device.



Late. Dr. Subhash Chandra V

Renowned Cardiologist, Dr Subhash Chandra V passes away after Prolonged Illness

Noted Cardiologist, Dr Subhash Chandra V (66) passed away after a prolonged illness at Bangalore. He was the consultant Cardiologist at Manipal Hospital, Bangalore and former head of cardiology at the Fortis Hospitals Bangalore.

Dr Subhash Chandra V graduated from St. John's Medical College and had carried out more than 40,000 coronary

and non - coronary interventions through his span of practice. He had established the Department of Cardiology at the Manipal Hospital Old Airport Road branch and made it a worldwide destination for patients seeking expert cardiac care through his disciplined practice and the highest level of integrity and ethics. He pushed the cardiology department to go above and beyond to provide the best of services to his patients. A brilliant cardiologist, known for his flawless service, his core area of expertise included complex coronary interventions, structural heart diseases, aortic and peripheral interventions and complex pediatric interventions.

He was also a member of several national and international societies, including the prestigious Royal College of Physicians and the Society of Therapeutic Neuro-interventions. He is best known for helping out others in the similar field, both in India and abroad, he has also mentored different physicians in different aspects of cardiology.

MicroGO bags Grand Challenges Explorations Grant to develop solution for safe childbirth

MicroGO, a Chennai based R&D-driven manufacturing company that is building a pipeline of products focused on sustainability and hygiene, has received the Grand Challenges Explorations grant-India (GCE-India) to develop an all-in-one solution safe delivery, healthy child. The firm will use its patented platform Tubelet™ with an intention to reduce maternity mortality rate (MMR) and infant mortality rate (IMR) in the country. MicroGO's Safe Delivery-Healthy child will be an integrated solution for providing safe delivery and safe water, and ensuring sanitation for the new born babies during their formative years, upto 6 months. It is an integrated solution that will not only provide a hygienic environment during birth but also a carry along kit provided to the mothers that maintains hygienic conditions for the infant and the new



mother for next 6 months.

Major Healthcare Federations Joins Together to Review ways to Overcome COVID

Top leaders and representatives from major healthcare federations AHPI, FICCI, CII, NATHEALTH, ASSOCHAM, Indian Chamber of Commerce, PHANA, NASSCOM and a number of nursing healthcare federations met in Delhi to take stock of the COVID situation. On the occasion of Doctor's day, the top leadership also expressed gratitude to all doctors, nurses, frontline workers, and support professionals who are putting their lives at risk to serve people affected by this pandemic. One of the most important lessons from this pandemic is recognition that we need a significant expansion of the healthcare infrastructure and supporting ecosystem. It is therefore important to work together with healthcare federations and private healthcare providers to recommend to Government price and cost models for key components of healthcare delivery and help identify locations (town/cities) that are best suited for the Government to initiate public-private partnership in order to create offline and online models of success can be replicated and scaled. The meeting reinforced the need to

create a unified platform where different federations representing key stakeholders can create consolidated industry positions on key building blocks that can fast track India's journey towards universal health coverage and help innovate a unique health system "Made in India" for India.

HealthQuad VC Closes Inr 514 Cr Second Healthcare Fund, Spreading Positive Vibes

Healthcare focused VC, HealthQuad said that its second fund with a commitment of INR 514 crores, helping it achieve 93 per cent of the target fund size of INR 550 crores. This comes at a time when profits have plummeted and operations are shuttering due to the COVID-19 pandemic and there is dire need to revive the industry. The fact that investors have demonstrated strong belief in Indian healthcare opportunities is encouraging and evidence of India's ability to develop disruptive healthcare solutions.

The fund has been supported by some of the leading global investors including Ackermans & van Haaren (AvH), Teachers Insurance and Annuity Association of America (TIAA), Indian DFI SIDBI, Swedfund and pharma giant Merck Sharpe and Dohme (MSD). HealthQuad is backed by KOIS, a global pioneer in impact investing and innovative finance and the

sponsors of Quadria Capital, healthcare focused private equity fund in Asia that provides a strong ecosystem of sector knowledge, network, brand, commercial synergies and market access.

Through the second fund, HealthQuad seeks to invest in disruptive, technology based and innovation driven businesses which transform healthcare in India, generate value and also create deep social impact. Considering the success and overwhelming demand, the fund will exercise its green-shoe option.

Under the current circumstances, when the world is grappling with the Covid-19 pandemic, this fund raise entrusts strong and positive belief in disruptive healthcare business models that will address the imminent and long-term needs of the Indian healthcare sector.

Biocon Gives Clarification on Clinical Study of Itolizumab for COVID-19 after Backlash

On July 11, Biocon Limited announced that the Drugs Controller General of India approved its drug Itolizumab "for emergency use in India for the treatment of cytokine release syndrome (CRS) in moderate to severe acute respiratory distress syndrome (ARDS) due to COVID-19.

Since then, the company has been on the receiving end of severe backlash from the scientific community and the doctors alike for the small sample size and the Itolizumab for COVID-19 trial methodology. Experts criticised Biocon for touting Itolizumab as a 'breakthrough drug' for treatment of Covid-19 patients because the sample size used for the trial was small (30), and more evidence was required to prove the efficacy of the drug in reducing mortality.

Biocon in a press release said that Itolizumab when administered to patients with moderate to severe ARDS due to COVID-19 effectively controlled hyper-activation of the immune system in response to the SARS-CoV-2 virus and prevented morbidity and mortality related to the 'cytokine storm'. Older patients and

NEWS ROUNDUP

those with co-morbidities like diabetes and hypertension, who were treated with Intolizumab, recovered well.

Roche, Summit Cancer Centers to collaborate on use of new digital healthcare tools

Roche, a global pioneer in pharmaceuticals and diagnostics announced on the 13th of July the formation of a collaboration with Summit Cancer Centers to explore the use of clinical decision support tools and artificial intelligence-type approaches to the management of patient health information to bring a distinctly personalized approach to care for patients with cancer. This initiative will include the first integration of NAVIFY Tumor Board software with the OncoEMR system to incorporate electronic medical record information in tumor board reviews.

The implementation of the cloud-based NAVIFY software will also include, for the first time, integration with the OncoEMR electronic medical record system, which

Summit employs across its network, to include comprehensive, longitudinal patient health information in the tumor board review. The ability to integrate NAVIFY Tumor Board with the OncoEMR system is of particular significance to Summit because the OncoEMR system includes patient health data generated by different medical systems (e.g., testing labs, radiology images, etc.) that are needed for the evaluation, management and treatment of Summit's patients. The integration with the NAVIFY software allows Roche's decision support software to provide a more comprehensive patient health profile and facilitate a more efficient and more informed discussion during the tumor board.

NephroPlus launches India's First Dialysis on Wheels Program

Dialysis service provider NephroPlus, has launched a new dialysis on wheels program. Due to the increasing number of COVID19 cases, both patients and nephrologists have started increasingly

opting for home haemodialysis. Dialysis patients are a vulnerable group because of their existing comorbidities, repeated exposure to risky hospital environments and immuno-compromised state due to Chronic Kidney Disease. These patients are consequently more prone to acquire infections and develop severe diseases as compared to the general population. Understanding this need, NephroPlus, which is India's largest dialysis network has launched India's first "Dialysis on Wheels" Program where a patient can undergo dialysis inside an ambulance itself which comes to their home. The patient need not invest in equipment or worry about the risk of infection or access to emergency care. This model is expected to bring down the cost of Home Haemodialysis significantly which will lead to further adoption by patients. A first in India, the pilot mobile van initiative will be accessible to patients across Delhi, Gurgaon, Faridabad, Ghaziabad & Noida region who seek essential dialysis treatment right outside their homes. The ambulance van is designed by industry experts and comprises a fully operational dialysis setup that will be conducted by a highly trained dialysis technician.



Plum Group Health Insurance Startup Raises INR 7 Cr in Seed Funding

Bengaluru based group health insurance startup, Plum, has raised INR 7 Crores in seed funding. The round was led by Incubate Fund with participation from Gemba Capital and Tracxn Labs along with angel investors including Abhijit Gupta and Ram Sahasranam of Praxify Health, Sudheendra Chilappagari of Belong.co, Nitin Jayakrishnan of Pando and Alvin Tse of Xiaomi.

Plum is on a mission to enable employee group health insurance for over 1.1 million companies in India by reinventing how health insurance works. The company plans to use the funding to scale business & engineering teams so as to solve some of the hardest engineering challenges in Insurtech and build innovative distribution channels. Within just 4 months of launch, Plum has managed to get over 100 companies as customers.

Plum, through its online platform, provides customizable plans, transparent pricing, and high-quality healthcare experience. The platform understands the needs of a corporate and guides them on setting up their group health insurance in less than 60 mins. Plum combines modern technologies with robust processes to deliver unprecedented simplicity & efficiency.

AiMeD Partners with Wadhvani Foundation to Support Growth of MSMEs in the MedTech

Association of Indian Medical Device Industry (AiMeD) has entered into a strategic partnership with Wadhvani Foundation, a global non-profit organization to help the MSMEs address

the various challenges faced by them at this critical time of Covid-19 pandemic to create an Aatma Nirbhar Bharat. Select 200 MSME partners of AiMeD could benefit from the 'Sahayata Program' powered by the Wadhvani Foundation. The partnership will provide a gamut range of services to beneficiary MSMEs- ranging from access to self-learning resources to one-on-one mentorship by domain experts and consulting professionals.

Rajiv Nath, Forum Coordinator, AiMeD said, "We are thankful to be approached by Wadhvani Foundation in their sincere attempt to give Sahayata to AiMeD's Progressive MSME Members to help them address the unprecedented challenges under current COVID times to create an Aatma Nirbhar Bharat. While many Medical Devices did see a spike in demand and boost to business there are other products that have seen a slump in demand as Patients stayed away from Hospitals ever since the State Govts. stopped distinguishing between COVID & Non-COVID Hospital. The Mentoring & Training offered by Wadhvani Foundation will be a great help."

Metro Hospital Bags World Stroke Organization's Platinum Award

Metro Hospital, centre for neurosciences bags platinum award from stroke organization (Geneva, Switzerland) for offering highest quality of stroke care services making it the only hospital in Uttar Pradesh and one out of four hospitals in India to get this prestigious award. The prestigious award conferred to Metro Hospital, Noida in recognition to its technical skill, efficient processes and efficient patient services offered by its neuro sciences department.

Explaining the repercussions of stroke Dr. Sonia Lal Gupta, Director and Senior Consultant, Metro Centre of Neurosciences, Metro Hospital Noida, said, "Stroke is the second leading cause of death and disability worldwide and is responsible for 116 million years of healthy life lost each year. The impact on individuals, families

and society is incalculable. Over 13 million people will have a stroke this year and around 5.5 million people will die as a result. Stroke can have different short- and long-term effects depending on which part of the brain is affected and how quickly it is treated."

NMIMS Develops Unique 5-year Integrated program in Biomedical Science

Biomedical sciences combine the fields of biology and medicine in order to focus on crucial health aspects. They are a set of sciences applying portions of natural or formal science to knowledge, interventions, or technology for the betterment of lives. They help to gain intelligence about the human body, diagnose diseases, deliver drugs, and more. There is a rising level of interest in the biomedical space and the future holds great promise because of the amazing opportunities it presents. The well-rounded, 5-year integrated M.Sc. in Biomedical Science at NMIMS Sunandan Divatia School of Science has been designed to maximize its theoretical and practical applications.

It's a '5-year Integrated program after Class 12' with a curriculum designed to cater to the needs of Biotechnology, Pharmaceutical, Clinical Data Management, Molecular Diagnostics and Biomedical Industries. The program lays emphasis on the overall development of laboratory skills of research students coupled with an expansion of their knowledge base through interdisciplinary course work. The course is reviewed regularly in consultation with their Board of Studies, which comprises experts from academia, research institutions & industry pan India. Terumo Acquires Quirem Medical to Enhance Its Interventional Oncology Field Terumo Corporation recently announced its completed acquisition of Quirem Medical B.V., a Netherlands-based healthcare startup specializing in the development of next-generation microspheres for Selective Internal Radiation Therapy (SIRT),

NEWS ROUNDUP

a treatment for liver tumors. Under the terms of the agreement, Terumo acquired 80.1% of the shares of Quirem Medical. This is over and above its current share position of 19.9%, making Quirem Medical now a wholly owned subsidiary of Terumo. Terumo will make a one-time, up-front payment of USD 20 million with up to USD 25 million additional payments based on the achievement of future milestones by 2030. It will be funded through cash on hand and will not significantly impact the company's financial projections for the current fiscal year ending March 31, 2021.

Medical Fraternity Death Due to Covid-19

A number of healthcare workers have lost their lives as India registers new Covid-19 cases every day. The total death toll is breaching the 39 thousand mark, including many fallen warriors, a number of deaths were recorded in July. Official figures and individual state medical associations are recording the death of healthcare workers due to Covid-19. Recently the State secretary of the Indian Medical Association (IMA) Bihar said that the

pandemic had claimed 11 lives of doctors in the state. Among them was 67-year-old ENT-specialist Dr NK Singh, working at Patna Medical College and Hospital and Dr Ashwani Kumar, GP from Gaya.

News of sad demise from Delhi came, where young doctors have succumbed to covid-19. A 26-year-old resident junior doctor Dr Abhishek Bhayana recently passed away, after testing negative for the virus twice. He was later found to be Covid-19 positive. Another young frontline worker, Dr Joginder Chaudhary 27years was working at Dr Baba Saheb Ambedkar Hospital and passed away in July. A contractual doctor with Delhi government's National Health Mission (NHM), Dr Javed Ali 42 years died after battling the disease for three-weeks.

In Mumbai, 60-years-old consultant physician Dr Ramesh Veer of Veer Hospital, Thane passed away in July. A urologist from Dombivli, Mumbai Dr Pankaj Kumar Chaudhary, 40, lost his battle with the virus.

Another senior doctor died of COVID-19 in Kolkata Dr Tarun Kumar Banerjee was undergoing treatment at a private hospital after testing positive for COVID-19.

Dr Manjunath died at Bengaluru. He

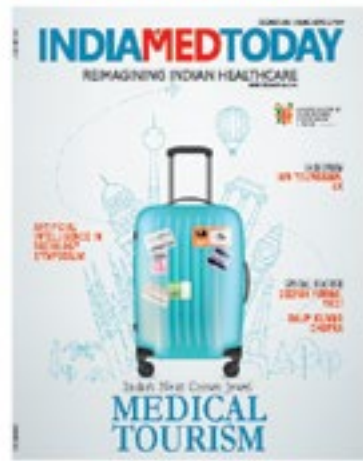
worked in the state Health and Family Welfare department and was based at Ramanagara. His family has alleged that he died because three hospitals refused to admit him. The state department is investigating the allegations. Another doctor lost his life treating covid patients at Mysuru. He was 53 years old. Dr MB Pranesh, 83, senior neurologist from Coimbatore died due to COVID-19 in July. Dr PK Sharma, a senior private medical practitioner from Tinsukia died due to Covid-19 in Assam in July. Another doctor, Dr Jahan Iqbal Ahmed, associate professor of Ophthalmology at GMCH, succumbed to the disease a few days earlier.

Sadly, we report the death of two young doctors who committed suicide. Both of them were working on the frontlines. Anurag Kumar was working at the All India Institute of Medical Sciences (AIIMS) died by suicide by jumping off the 10th floor of the hospital. He was 25-year-old junior doctor, and was depressed. Another 24-year-old post-graduate doctor at Government Stanley Medical College and Hospital jumped to his death from the third floor.

We *condole* with the families of all the deceased healthcare workers.

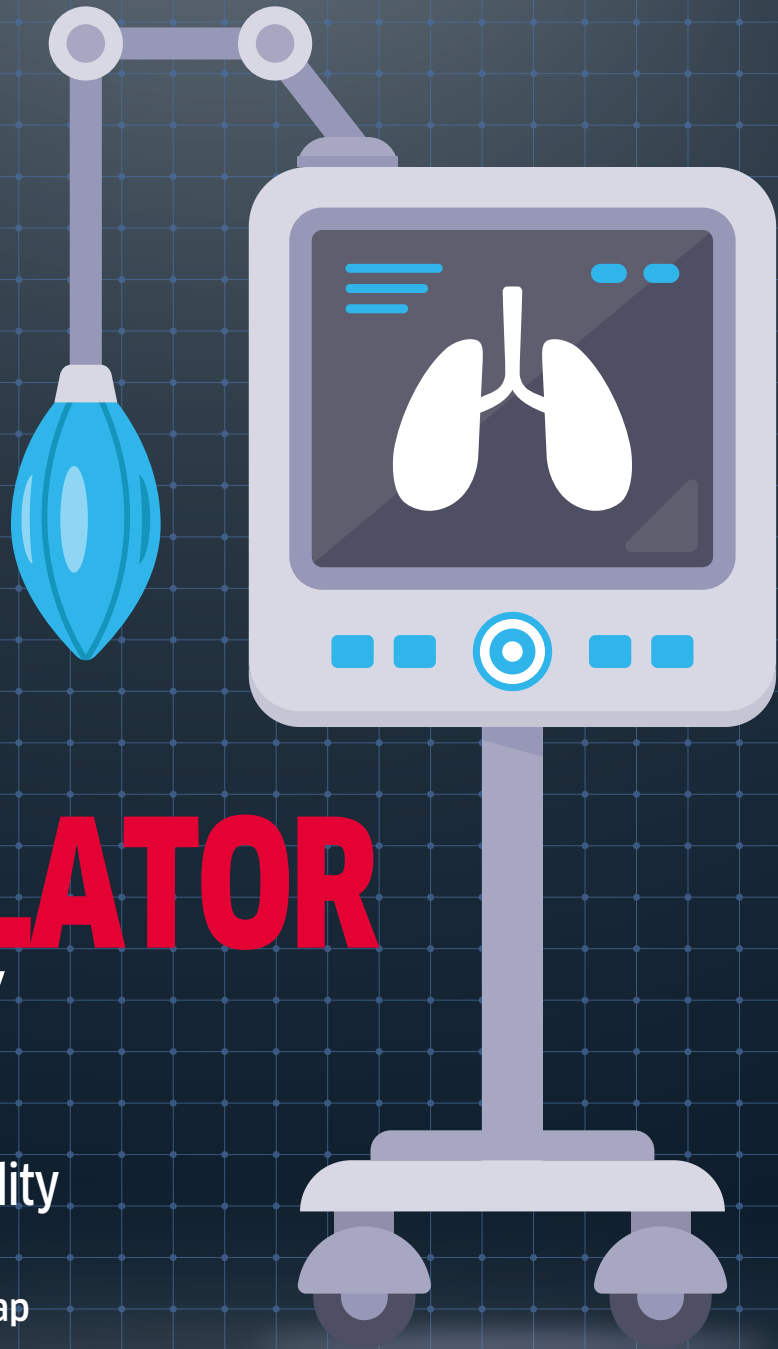
-pages compiled by Nikita Sushil Kumar





THE HEALTHCARE BUSINESS MONTHLY





VENTILATOR STORY

Ascendancy Accessibility
Advancement

Author: M Neelam Kachhap

COVER STORY

A wave of innovation swept through India as the Coronavirus disease-19 (COVID-19) pandemic unfolded in the country. Ventilators took centre stage and the wheels of medical device manufacturing started churning. Academic institutions, automobile manufacturers, Government PSUs and even engineering graduates started dreaming about ventilators. The domestic manufacturers were happy to help and others were trying to fix their logistical hurdles to be able to service the growing demand in India? It seemed like India was set for the ventilator shortage challenge and become the largest ventilator producer in the world in no time.

Covid-19 Pandemic

What started as an epidemic from China in Dec 2019, spread across the globe quickly to become a pandemic by March, 2020. A new coronavirus, named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was wreaking havoc in the European countries; England, Spain and Italy were devastated. This new virus was causing a flu-like disease which was much more deadly, Covid-19 had arrived.

Because of its highly contagion nature and death toll, governments across the world had to take drastic measures to avoid it. India went into total lockdown on March 24, 2020. Taking cue from Italy and England India ramped up its healthcare infrastructure. Covid isolation wards were earmarked at both government and private hospitals and Covid quarantine centres were set up on war footing.

However, when the cases started to explode, the lack of co-ordination among government departments, healthcare providers and policy makers; shortage of medical equipment; unavailability of hospital beds and rising death toll overshadowed our gains.

However, when the cases started to explode, the lack of co-ordination among government departments, healthcare providers and policy makers; shortage of medical equipment; unavailability of hospital beds and rising death toll overshadowed our gains.

Ascendancy: Why ventilator took centre stage during Covid-19

As clinicians around the world learned more about Covid-19 it was clear that patients with severe disease needed breathing support. "In severe cases of COVID-19, patients may contract pneumonia," says Dr K K Aggarwal, Former President, Indian



COVER STORY



Medical Association. “The resulting fluid build-up in the lungs reduces the ability to take in oxygen and expel carbon dioxide,” he explains. Ventilators help the patients breathe or in some cases breathe for the patient.

A mechanical ventilator is a machine that works as an external lung, when patients are not able to breathe properly on their own. “The mechanical ventilator is used when oxygen levels are low or patients have severe shortness of breath from an infection such as pneumonia,” explains Dr Aggarwal.

In March, 2020 industry body AiMed (Association of Indian Medical Device Industry) said that India will face shortage of ventilators by mid-May. AiMed said that the country might need anywhere between 110000 - 220000 ventilators by May 15 in the worst-case scenario and there were only 57000 ventilators available in India at that time.

“There is a pressing need for ventilators in India and a huge disparity in their availability in various states. For instance, Mumbai alone has 800-1000 ventilators, while states such as Tamil Nadu and Madhya Pradesh have 1500 and 1800 respectively. The city of Bengaluru, has approximately 400 ventilators, whereas Kerala has 5000,” said Rajiv Nath, Forum Coordinator, AiMeD.

Sensing an opportunity in the demand and supply gap in India's healthcare space, many veterans from other industries took to collaboration and manufacturing medical devices. Large companies like Maruti, Mahindra & Mahindra, Kalyaani Group, Tata Motors, Hyundai etc., joined hands with domestic manufacturers to rapidly scale up production of ventilators.

This brought ventilators to the limelight. Now, people even in remote villages started to innovate on breathing devices. Ventilator became a part of the national vocabulary and everyone had an opinion on what ventilator should be and how it should be used.

Between March and April, many deals were signed to scale up production capacity of ventilator manufacturers. Mysuru based, Skanray Technology created a consortium with BEL, BHEL and Mahindra & Mahindra to ramp up production from standard 2000 pcs per month to currently 5000 pcs per month and 30,000 pcs per month by May. Similarly, AgVa has tied up with Maruti to scale up production from 400 pcs per month to 4000 pcs per month in April to 10,000 pcs per month by May.

Large companies like Maruti, Mahindra & Mahindra, Kalyaani Group, Tata Motors, Hyundai etc., joined hands with domestic manufacturers to rapidly scale up production of ventilators.

At the same time, the PM CARES Fund Trust said that it would allocate two thousand crore rupees to equip government run COVID hospitals in all States and Union Territories with 50 thousand 'Made-in-India' ventilators.

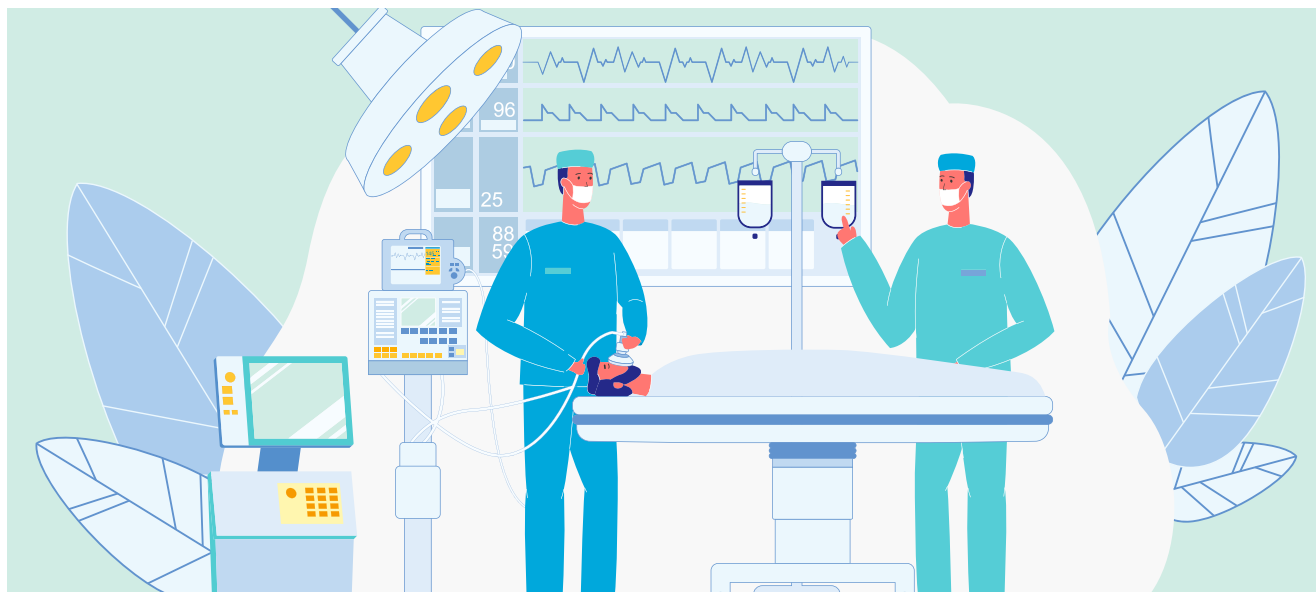
While the domestic manufacturers were busy ramping up production, traditional ventilator manufacturers around the world were also looking to enhance their production. Large medical device manufacturers like Hamilton Medical, Dräger, Mindray, Medtronic, Löwenstein, Vyair Medical, Philips, GE Healthcare, and Fisher & Paykel Healthcare, among others were constantly trying to break the supplychain and logistic barriers.

In fact, Medtronic made the full design specifications, produce manuals and design documents for its portable ventilator hardware public so that engineers around the world could benefit from it.

Back in India, innovative ventilators prototypes were making news every day. According to news reports, a first-year student of Industrial Design Centre at IIT Bombay developed Ruhdaar a low-cost ventilator using locally available materials. Then, Sree Chitra Tirunal Institute for Medical Sciences and Technology, jointly build a prototype of an emergency ventilator system based on artificial manual breathing unit with Wipro 3D. A group from IIT Roorkee collaborated with AIIMS, Rishikesh to create the low-cost, portable Prana-Vayu ventilator.

Even the Indian start-ups jumped into the ventilator innovation bandwagon. A few 3D printing start-ups like Supercraft3D and Ethereal Machines came up with ventilator splitters to help administer breathing to two patients simultaneously. A start-up from Startup Incubation and Innovation Centre, IIT Kanpur, Nocca Robotics, designed and developed a fully functional invasive ventilator, the NOCCA V310 ICU ventilator. The Biodesign Innovation Labs, built an emergency and transport ventilator called RespirAID. In fact, government agencies were also not left behind in the race to develop a path-breaking low-cost product. Indian Railways, announced the development of a low-cost ventilator at its Kapurthala Rail Coach Factory, called Jeevan. Interestingly, Council of Scientific and Industrial Research (CSIR) and National Aerospace Laboratories came up with a non-invasive Bilevel Positive Airway Pressure (BiPAP) ventilator called SwasthVayu.

In fact, Medtronic made the full design specifications, produce manuals and design documents for its portable ventilator hardware public so that engineers around the world could benefit from it.



COVER STORY



This overwhelming response to Covid-19 and ventilator requirement meant that India's entrepreneurial zeal would soon turn it into a global exporter of ventilators. However, the ground reality painted a different picture.

Accessibility: Ventilator Shortage, Overuse and Spare Capacity

In the beginning of June 2020, the health ministry reported 336 deaths in one day with the total death toll climbing to 12,573. The total number of Covid-19 positive patients in India was rising to breach five lakh mark. The lockdown had been eased and patients were returning to hospitals for other pressing medical conditions. Consequently, ventilators became somewhat prized. So much so that people started to buy mechanical ventilators for personal use.

Sadly, reports of patients dying due to unavailability of healthcare interventions started making headlines. The Indian Express reported the death of a 68-year-old man who needed ventilation, but was not able to avail one. Similar reports emerged from Gujrat, Telangana and even Karnataka. Many patient groups and politicians started to raise the issue of shortage of ventilators in India.

"For a hundred bed hospital about 5-10 percent beds are demarcated for ICU and half of these beds have ventilators," explains Ayanabh DebGupta, Co-founder & Group President, Medica Hospitals. At large teaching hospitals this could go up to 15 percent of total bed strength, he adds. The number of ICU beds at government tertiary care centers and medical colleges like AIIMS could go up to 20 percent of the available bed strength. According to a paper published by the Center For Disease Dynamics, Economics & Policy, India currently has 19 lakh hospital beds out of which 95 thousand beds are ICU beds and 48 thousand beds have ventilators. However, it was not clear if all available ventilators were in use or whether all ventilators were in working condition.

"Ventilator shortage has not occurred in Delhi," says Dr Kapil Kochhar, Additional Director, Department of Bariatric, Minimal Access & General Surgery, Fortis Hospital, Noida. "For some time in June when cases were increasing exponentially there could have been a shortage, but by mid-July things were under control. Today, most mechanical ventilators are easily available in India," he adds.

Dr Binila Chacko, Professor and intensivist, CMC Vellore says that even in developed countries, when there was a surge of cases, there was demand-supply mismatch in terms of ICU beds and ventilators. "It is likely that India is also facing similar challenges, especially in pockets where a large number of cases have been reported," she says.

Even as clinicians were worrying about ventilator shortage, a few critical care

"It is likely that India is also facing similar challenges, especially in pockets where a large number of cases have been reported," she says.

specialists flagged the overuse of ventilators. They argued that most of the patients could be treated with less invasive and simple respiratory support even though their oxygen levels were low. "About five percent of patients with COVID-19 infection develop severe lung injury that requires ventilatory support," explains Dr Chacko.

Though, some clinicians were baffled by the findings that Covid-19 patients with very low oxygen concentrations were still not exhibiting any signs of organ damage or brain inactivity. On the contrary, they were quite active. In a letter published in the American Journal of Respiratory and Critical Care Medicine, researchers from Germany and Italy wrote that their Covid-19 patients were unlike any others with acute respiratory distress. They said that these patients' lungs were relatively compliant, a sign of healthy lung in sharp contrast to expectations for severe ARDS, even when they had low blood oxygen. For long, oxygen saturation rate below 93 per cent (normal range 95-100 per cent) is accepted as a sign of potential hypoxia and impending organ damage. Dr Kochhar says, "When the oxygen saturation in a patient goes below 95% and there are other clinical symptoms along with it then we start off with all the measures to improve oxygen saturation."

In Karnataka, 8,281 patients have been put on ventilator since the time the first case was diagnosed, The Hindu reported. "The proportion of patients coming to CMC with COVID-19 infection and requiring some form of ventilatory assistance is about 6-8 per cent. The higher proportion probably reflects referral bias given that there is very limited ICU facility in a 100-km radius around Vellore," shared Dr Chacko.

"We are using simpler, noninvasive strategies first," including the oxygen concentrators, oxygen helmets and even nasal cannulas said Dr Kochher. Yet some, ICU doctors are moving patients to mechanical ventilators too quickly. "Covid protocols are reviewed frequently and the decision is driven by oxygen saturation levels, but there could be some centers which do not have multi-parameter ventilators or simpler breathing devices and hence put the patient on the available resource," said Dr Kochher.

Clinicians have said that for many Covid-19 patients ventilators could be of little benefit and may even be harmful to some. An emergency medicine consultant said, "We have to

"We have to be more careful about the risk of long-term cognitive and physical effects of sedation and intubation from ventilator."



COVER STORY

be more careful about the risk of long-term cognitive and physical effects of sedation and intubation from ventilator.” The consultant did not want to be named so as not to appear to be criticizing colleagues said that there have been reports and small observations from China, Italy and Germany where 90 per cent of the patients on ventilator died. However, he cautions that these studies have mentioned that the patients who died were above 70 years and some had co-morbidities.

He went on to say that some patients with very low oxygen concentrations have also benefited from continuous oxygen support and not needed mechanical ventilation.

Advancement: How ventilators can be improved

While, clinicians are still battling one of the most unprecedented pandemic of our time, Indian medical device manufacturers are more determined than ever to benefit patients and the economy.

Making ventilators is not easy because they are complex machines. From the simplest to the most complex of ventilators need more than 1,500 parts. Before Covid, these parts were sourced from suppliers across 15 or 20 countries. As Covid-19 started to spread countries began closing borders and restricted imports and exports. The global supply chain and logistics industry was confronted with an unprecedented challenge. Like everything else, ventilator production also saw a downward growth.

In India, manufacturers were facing additional challenges. The companies that received large orders from government were facing dual challenge; of availability of components and finding components to fit government specifications. “HLL Ltd, the procurement agency under MoHFW provided specifications of ventilators in March which were similar to multinational brands,”

Awaiting clarification from the government manufacturers with unsold inventory were facing falling demand. The only way they could salvage their investments was to export but the government had banned the export of ventilators.



explains Nath from AiMed. "Upon representation by Indian medical device industry, and subsequent intervention by Union Minister (Commerce), a committee was formulated by DRDO which revised the specifications," Nath added. However, HLL ignored those specifications and released purchase orders with a rider that ventilators with higher specifications should be provided. Thereafter it issued a permitted deviation in its RFP which confused manufacturers with a third version of specifications. While the price fixed by HLL was Rs.1.48 lakhs, the specifications were equivalent to a ventilator costing 12-15 Lakhs.

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During this time a few manufacturers opted out of the government tender to be able to focus on innovation. One such company was Innvolution Healthcare. The Noida based company has recently launched Vi Swaas Pro, developed in collaboration with IIT, Bombay. Vi Swaas Pro is a pressure and volume controlled ICU grade ventilator available in the market currently. Gaurav Agarwal, Managing Director, Innvolution said, "On 2nd April we partnered with IIT Bombay to design and develop a high end ICU ventilator, which is both pressure and volume controlled. I'm happy that in 28 days we were able to build this prototype. We were able to test and validate it at one of the most advanced lung simulation labs in the country at DY Patil Hospital Mumbai. Leveraging Betic's strong capabilities in rapid prototyping of medical technologies and building upon Innvolution's strength in medical electronics, we aim to get this prototype CE certified by the German body TUV soon."



This and similar innovative ventilators are awaiting clinical deployment. These companies will be able to make a mark on the ventilator and respiratory device market as the exports open. According to BIS Research, the global ventilator market was estimated to be around \$1,142.0 million in 2019. However, COVID-19 outbreak changed the expectations and the market is now expected to grow at a CAGR of 15 per cent during the forecast period from 2021-2030.

"There are certainly innovations that are required in the field of ventilation, not only in India, but also globally. The challenge of such innovation is that critically ill patients who require high ventilatory support need to be managed with high end ventilators that are able to synchronize with the patient's breathing appropriately and able to match the ventilatory requirements of the patient. Current ventilators that have been created in our country appear to be able to match the demands of less sicker patients but not the very sick patients. Thus more resource and inputs are required to create high end ventilators that could cater to the entire spectrum of needs of critically ill patients who require ventilatory support," concludes Dr Chacko.

Intuitive Surgical Bullish on Indian Market

Mandeep Singh Kumar – VP & GM, Intuitive India says future of robotic assisted surgeries in India is extremely bright



Mandeep Singh Kumar - VP GM Intuitive

In 2018, Intuitive Surgical began direct operations in India, following seven years of existence in the country through a distributor, Vattikuti Technologies. Intuitive set-up direct operations in India to deepen its support and work with health care professionals in their pursuit of the clinical and economic benefits that robotic-assisted surgery offered. Two years down the line, Mandeep Singh Kumar – VP & GM, Intuitive India talks to M Neelam Kachhap, Editor, IndiaMedToday about why the robotic surgery pioneer is bullish on India Market.

Kindly share global perspective for the robotic assisted surgery market?

In the last 20 years of our journey, we have had more than 5500 robotic programmes established across the globe and about

7.2 million patients who have benefited from the robotic assisted technology. Our mission has been 'a patient first approach', where we have looked at how a surgery can be made easier for the surgeon to perform and at the same time benefit patients. Intuitive started in the US, Europe and then set up its base in certain Asian countries. Our previous management in India was a national distributor named Vattikuti Foundation. As we saw the market potential, we felt we would be able to benefit many more patients if we were to have a direct presence in India.

It has been exactly two years, since we have had a direct establishment in India. We are focusing on better customer connect and building our team capabilities.

You said 5500 programmes have been established globally. Could you identify how many among these are Indian and how many are from the South East Asian market?

We have about 70 programmes that are running in India. We started in 2002 at AIIMS and since then we have seen a significant increase in acceptance of robotic assisted surgeries, both in the private and government sectors.

What is it that excites you as a company being here in India?

Apart from India's market potential, we also considered the surgeon community in India, which was keen on adopting such procedures. Also, both private and government institutions have senior functionaries whose vision is to have an established robotics programme. India has also seen a rise in incidence of cancer which provides us a way to help patients as they could get maximum benefit out of this surgery. All these factors combined,

makes us feel confident that we can bring the value of da Vinci surgery to more and more patients and that completely aligns with our mission.

Do you have more programmes in the southern states than the north?

Both the south and the north are equivalent for us. South has a higher penetration into the private hospital chains and the north has large number of government installations like AIIMS Delhi, AIIMS Rishikesh, AIIMS Jodhpur, Safdarjung, PGI Chandigarh. Some say the penetration in the eastern part of the country is lower at this time, but the north, south and west are fairly equally represented.

How has your experience been with the government institutions?

Institutions in the south and west have been interested in adopting the technology, for example the Kidwai Cancer Institute, Bangalore, Tata Memorial, Mumbai and Adyar Cancer Institute, Chennai. There could be two reasons for that; first, these institutions offer teaching and referral so this is where the technology base can be established. Second reason is that the government institutions treat a lot of patients with complex cases. So, utilisation of our equipment in the government institutions is much higher.

In November 2019, the installation at Safdarjung Hospital, New Delhi was inaugurated by the Minister of Health and Family Welfare, Dr Harsh Vardhan. All these projects have been dedicated to oncology-focused complex cases using the technology to provide benefit to the customers. Hence, government will remain a key part of our strategy. In future, we will like to launch programs at AIIMS Patna, AIIMS Bhubaneswar or state government institutions because our focus is on developing a strong oncology programme.

Could you give an approximate figure of the market size for robotic assisted surgeries?

Honestly, there is no such syndicated data that estimates the market size of India in an accurate manner. We have been trying to do this for ourselves, but no syndicated body has conducted a research to publish data with utmost accuracy.

I read a report that said global surgical robots market is USD 6.7 billion in 2020. Can you help me validate this, or give me a yardstick on which one could measure this?

Intuitive global reports talk about the number of procedures we are doing which helps us measure the adoption of new technology. At Intuitive, we take into consideration the number of surgical procedures as our success measurement. We have done 7.2 million procedures and number of surgeries is more important to us than four or five billion revenue globally. We want to prioritise our patients first. Today, there is no significant data as to how many surgeries of a nature are conducted on a monthly and an annual basis. We are working with certain companies to get an estimated figure based on which we measure our penetration in the Indian market.

I understand getting information like the number of surgeries is difficult, but as a company, how many procedures have you done since 2002 in India?

We do not report country-wide procedures, but since we have gone direct in India, we are growing our procedures close to 20 per cent year-on-year. On a country

level, we only report growth rates, not individual procedure numbers.

Globally intuitive is growing at about 17- 18 percent; 17 percent within the US, and 20- 22 percent out of the US, so the average is about 18- 19 percent. In India, we are looking at growth in the range to 20- 25 percent in terms of procedure penetration year-on-year.

Which geographies does the Bangalore office handle?

The office at Bangalore primarily focuses on the India operations. The South East Asia and Australian markets are being looked at from a distributor's standpoint. Also, we have a joint venture in China with a company called Fosun Pharma.

Do the neighbouring countries like Sri Lanka and Bangladesh also benefit from this sales office in India?

For establishing a robotics programme in any new market, we need an ecosystem with clinical staff and service staff. For the potential we see today, these markets would not warrant that kind of an investment at this stage. Also, Intuitive's philosophy is to go deep into the market before we expand, so we want to focus on India now as we see great potential here.



Intuitive da Vinci XI endowrist instruments

INTERVIEW

Let's talk about the economies of robotic surgery in India, could you elaborate on the affordability aspect here?

There are two ways we look at our product value, there is an economic value and a clinical value. Our focus is on the clinical value, also the economic value can only be related to a clinical value.

There are 21,000 globally peer reviewed papers that talk about the benefits of robotic assisted surgery in terms of lesser hospital stay, lesser blood loss, lesser complication. To explain this better I will share an example. The surgery for the prostate if not done well, can lead to two potential side effects, losing sexual potency and urinary continence. You can't put economic value against such issues. So, the focus is on clinical value from a procedure standpoint and to make sure we have the flexibility to make payment plans for customers to be able to invest in such technology.

Are you launching low- cost equipment in the X surgical product line?

Both products, Xi and X are fourth generation products, we launched X a couple of years before in India, The Manipal institute, Aditya Birla Pune and the latest is in Ramaiah Hospital Bangalore. We believe that the future of Robotic assisted surgeries in India is extremely bright and we can play a major role in that space.

Does insurance cover such surgeries and would you be partnering with the government to include this technology in universal health coverage?

Most of the surgical procedures that we work on can be done in the usual method. However, robotics gives the surgeons better visualisation, better dexterity and better precision. The reproductively of results and elimination of potential side effects to a higher degree is delivered by robotics surgery.

Insurance is important for the adoption of any technology. As we see increasing trends in technology, insurance paces itself. Some government schemes, like NHS, already include robotics surgery within its purview. Private sector players have also started listing robotic surgery, like Max Bupa Insurance. IRDA issued guidelines last year stating that insurance companies cannot exclude reimbursement for 14 categories including robotics surgeries. It's also our duty to work closely with insurance to provide the overall benefit that robotic surgeries can provide.

Do you think the data collected by your system could be used for a larger good?

There are two main uses of the data. First at the hospital level, it helps understand the work that can be done in the hospital in terms of surgeon capital. Second it helps in quantifying the impact of the surgery. As

we generate this data, we understand the surgeon's habits and at the same time we also understand what kind of interventions are providing better clinical outcomes which helps in building a customised learning programme for the surgeon. Also, with the help of algorithms data could start informing or directing surgeons as to what could deliver better results in a surgery. This is how we use both machine learning and artificial intelligence.

Will the data be available for external analytics for understanding the disease or in the field of epidemiology?

At present, all our data is anonymised for internal and external use but we do not share the data with any external sources.

What is the future of Robotic Surgery in India?

In the end, I would like to say that Intuitive will stay committed to India. The Indian surgical population has given us a warm reception and have been passionate about adopting new technologies. We can bring clinical value to high patient load practice and so that is where we focus on.

We believe that the future of robotic assisted surgeries in India is extremely bright and we can play a major role in that space



FDI in Hospitals

This is the time to look at new investment plans

Nikita Sushil Kumar

As the economy feels the weight of Covid-19 pandemic, business are scrambling to bridge the cash flow gap. Healthcare delivery too is adversely affected by the pandemic as lockdown has disrupted patient footfalls and cash flow. In this challenging environment, private hospitals are turning to investment partners, looking for a source of capital. Since the past 30 years, FDI is permitted in the hospital sector. The private healthcare sector has in the last two decade attracted a lot of FDI interest and has seen the emergence of world class globally competitive Indian players in this segment.

Are Hospitals Healthy

Even though, private hospitals are seeing a dip in their revenues, hospitals still have to spend on maintaining and upgrading their facility and spend on costly medical devices and health technology systems. Hospitals also have to bear with increasing demand for charity care and other types of community services. As a result, the cash deficit has been mounting and hospitals are forced to relook at their investment portfolios.

The Indian Healthcare sector is growing exponentially and becoming a promising segment for investment. Healthcare delivery industry in India comprises of hospitals, diagnostic center,

medical devices, clinical trials centers, medical tourism, telemedicine and health insurance. Of this market in India about 80 percent is accounted for by the hospitals. The hospital segment is witnessing huge investor demand from both global as well as domestic investors. The private hospital segment is growing at a CAGR of 16-17 percent. From \$61.8 billion in 2017 the segment is expected to reach \$132 billion by 2023.

Healthcare is the second-largest service-sector employer in the country, providing jobs for about 4.5 million people directly or indirectly. Interestingly, the private healthcare sector in India accounts for over 75 percent of total healthcare expenditure in the country and is one of the largest in the world. However, private healthcare delivery is highly fragmented with over 90 percent of private healthcare being serviced by the un-organised sector. In India, around 2-3 percent of hospitals are 200-bed plus, 6-7 percent are 100-200 bed size hospitals, and the bulk 80 percent of private sector hospitals are very small, less than 50 beds. These numbers are expected to rise. With growing affordability of the middle class more and more Indian consumers are willing to pay for quality healthcare, fueling the growth of this sector.



"There is a decent FDI interest in the hospital sector but it is largely limited to corporate chains and large hospitals"

Sunil Thakur
MD, Quadria Capital



"A limited number of investable assets and the competition to invest in them makes the assets expensive to invest into"

Sumit Goel

Co-founder & Director, Bravelily India

Strategic Investment Options

How are hospitals managing these investments? We asked a few industry experts to shed light on this. Sunil Thakur, MD, Quadria Capital, Mumbai, said, "Hospitals are raising money through a variety of sources including commercial debt, owner's equity, private equity and public market."

Investment also depends on the lifecycle of the hospital. Sumit Goel, co-founder & Director, Bravelily India and ex-Partner, Healthcare Consulting, KPMG India explains, "Type of investment in a hospital depends on the stage at which a private hospital is. At an early stage, it could be promoter funding, in addition to funding by banks. At a later stage it could be private investments and at some stage even a public funding through an IPO could be expected. In some of the models such as PPP, there could be indirect participation of the government and its resources as well."

In order to meet the growing demand of healthcare services investment from both foreign and domestic sources are needed. Rekha Dubey, CEO, Aditya Birla Memorial Hospital, Pune, threw some light on this, "There is growing interest among foreign players and non-resident Indian (NRIs), domestic and international financial institutions, private equity firms, venture capital firms, and banks to explore investment opportunities in the Indian healthcare market. In order to promote foreign players, the Government of India raised the FDI cap in the hospital sector to 100 percent under automatic route in

January 2000. With this liberalised rule, since the last one and a half-decade, the government has been actively engaged in building a positive economic climate for the healthcare industry."

Equity financing is another attractive option for hospitals says Abhishek Singh, Head BD & Strategic Initiatives, American Oncology Institute, Hyderabad. "Private Equity is typically a pure play financial investor and strategic Investor represents a player from the industry willing to put in money as equity. Now, both of the above kinds could be categorized further depending on the nature and aspiration of the fund whether it is growth focused or a buyout fund," he shared. A strategic investor mostly also looks at buyout possibilities as it has all the expertise to take the company forward. "Another fund type - venture capital typically comes at an even earlier stage than growth when the proof of concept is being established. All such funds (except strategic investors) have different fund sizes and time horizon for exit and return expectations from their equity participation in a given company. A larger buyout fund would typically have a larger time frame for exit than the other kinds," Singh said.

Domestic vs Foreign Investment

Investment income is viewed as an extra source of cash flow for various expenditures in a hospital's capital budget. Therefore, it is important to understand the roles of these investments both foreign and domestic investment on the segment.

Dubey, explained this further, "The increase in private investment signals a high return on investment in the domestic economy whereas public investment shows the improvement in infrastructure and thereby reduction in the cost of doing business. These roles of domestic investment motivate foreign investors to reap the benefits of high returns. However foreign capital inflow may also be beneficial for the investors of the host country." FDI has its impact on domestic investment as well, Dubey says, "The impact of FDI on domestic investment is ambiguous; that is, FDI may have crowding out or crowding in impact on domestic investment. Crowding out impact of FDI means it is meaningless for FDI recipient countries but crowding in impact of FDI on domestic investment is beneficial for the host country."

The key difference between FDI and domestic investment is capital requirement, as Singh explains, "Depending on the size of capital requirement, equity players can be of two types - Indian PE investors (domestic sources) or Foreign PEs. In the case of domestic sources, typically the investment is on a small to mid-scale, generally between 10-50 million US dollars but in the case of Foreign PEs, the investment could be anywhere between 30- 100 million USD and upwards. However, in the last few years there have been some India based funds also which have targeted to invest in the higher brackets and are thus raising bigger funds keeping in line with the increasing maturity and requirements of the market."



"Liberal foreign investment regime may not result in increased FDI inflows if regulatory and structural impediments continue to constrain investment"

Rekha Dubey

CEO, Aditya Birla Memorial Hospital

FDI in Hospitals during Pandemic

Has there been a decrease FDI interest in Indian hospitals? The interest of FDI in hospitals has been decent, Thakur says. "There is a decent FDI interest in the hospital sector but it is largely limited to corporate chains and large hospitals. It spans from multi-specialty to single specialty," he added. He further went on to say that the interest lies more in federated and retails models of single specialties like dialysis centers, IVFs, ophthalmology etc. With the current uncertainty the world is facing, investments have been facing a big challenge, "However, the healthcare/hospital industry is going to boom in the coming years," says Dubey.

The Indian market is expected to remain attractive with many candidates available for funding or takeover, Singh opines. "While some amount of consolidation has already started happening with a few large funds (e.g. KKR backed Radiant, General Atlantic etc.) and large international strategic players (e.g. Parkway) already taken bets in the Indian healthcare market, there is further action expected as more healthcare providers funded by growth PEs need to give exit to their investors (e.g. Manipal Hospitals, KIMS). It is expected that more such companies would either get listed in the public capital market or could be candidates for other Strategic players yet to find a place in Indian healthcare market 'or' could do a buyback from the investors," he says.

Challenges Investors Face

In spite of the very liberal investment policy on FDI in hospitals, FDI presence

in Indian hospitals is not grown as much as in other industries. According to one estimate, foreign investors have tapped only 10 percent of the Indian healthcare market and thus the scope for FDI remains large.

Goel points out that a significant constraint for investors is that there are a limited number of investable assets and the competition to invest in them makes the assets expensive to invest into. It also raises expectation of other hospitals that are looking for investment and the business case may not justify the huge premium that the investor would need to pay.

Domestic constraints such as high initial establishment costs, low health insurance penetration, manpower shortages, and high cost of medical equipment are some of the other reasons why FDI penetration is less in India. Dubey goes on to say, "These constraints also impede domestic investment in hospitals. The liberal foreign investment regime may not result in increased FDI inflows if regulatory and structural impediments continue to constrain investment in the host economy. Investment liberalisation must thus, be supplemented by domestic regulatory reforms to create an environment that is conducive to all investors."

Different investor types have different aspirations and hence the kind of challenges they face is different as well. But there are some challenges which remain the same throughout the sector.

"The bureaucratic processes and elongated times for approvals, multiplicity of regulatory challenges lacking convergence are issues faced here as well", laments Singh. Citing some examples he further points out that some investors have learnt to negotiate these challenges.

"There are number of examples where investors have recognized all such dynamics and still made their bets in the industry and made very good exits either in the form of secondary sale to another set of investors, getting listed on public capital markets (e.g. NH, HCG, Dr. Lal's, Aster Healthcare, Metropolis etc.) or being taken up by larger strategic player (e.g. Global, Continental taken up by Parkway). Some of these investments may not have turned up to the expected potential but those are company specific matters and not so much industry specific," he says.

He also mentions the ongoing challenge faced by IHH with Fortis Hospital, "Challenge faced by IHH in Fortis is unfortunate, as the deal got entangled with another overbearing matter involving the earlier promoters of Fortis; but we hope that the matter will be resolved soon."

Impact on Operations

It was a popular thought that foreign investment in hospitals would have significant effect on service and procedure, cost of service, manpower and quality of healthcare delivery. Goel confirms this. Investments always create a positive impact on hospitals, he says. Further elaborating on the kind of impact

FDI creates, he says, “The bigger focus has been on putting the governance systems in place and making promoters more accountable to a more professional board. The investors have also nudged the hospitals to become more patient centric, invest in clinical technologies, have more robust clinical and non-clinical processes and deploy appropriate technologies to support the operations.”

“You will see most hospitals going in for internal capability upgrades post the investment and going by the state of most of the hospitals, it is always a welcome step,” he adds.

While, some hospitals welcome capability upgrades others are not so forthcoming. Singh says that mostly, these investors get IT based systems to avoid any kind of manipulation and also accreditation becomes a priority to set the infrastructure right. “There is a lot of politics involved in the whole system consolidation process. When such large amount of money comes in, the investors expect better financial audits, service audits, more risk coverage, patient feedback by virtue of the right people, monthly reports, etc.. They emphasize more on IT cooperation and less manipulation,” explains Singh. “However, with all these changes the overhead cost would slightly go up, it would erode the margins but it promises

profit in the long run. Another thing investors stress upon is getting the infrastructure in place and ensuring the hospital is accredited.”

How to Attract FDI

To attract more FDI emphasis should be given to promising business models, a good team and a growth plan. Goel says, “To attract FDI, hospitals must invest their resources into making themselves investible. For hospitals, this is a journey that starts from defining themselves, their focus and business models, chalking out a growth plan and putting requisite building blocks, such as systems and processes in place. Above all, they need to have a performance to demonstrate that they have a team which investors can bet on and that team has what it takes to execute the growth plan.”

Thakur pointed out some of the policy initiatives, which would help in attracting more FDI.

“Clear and sustained policy framework by the government, strong primary care network to define care pathway, increasing insurance penetration, government and private support in increasing and upskilling clinical and paramedic resources and market driven pricing model within the overall policy framework are essential to drive FDI in healthcare,” he says.



“Funds have different sizes and time horizon for exit and return expectations from their equity participation in a given company”

Abhishek Singh

Head BD & Strategic Initiatives,
American Oncology Institute





Agreeing to Thakur, Singh says, “Regulation policies are a major issue in India. Once they manage to work around that India is full of opportunities, as healthcare is a booming industry here and even the economic environment in this sector is improving now.”

Investment promotion activities should be strong says Dubey. “Contribute to the set-up of Investment Promotion Agencies (IPA). A successful IPA could target suitable foreign investors and could then become the link between them and the domestic economy. On the one hand, it should act as a one-stop-shop for the requirements such as investors demand from the host country,” Dubey suggests.

She also says that having a vendor development programs will aid in both domestic and foreign economies. “Govt should set-up a vendor development program to support the matchmaking process between the foreign customers and local suppliers. To strengthen the capacity of the domestic economy, such a program could offer financing opportunities to indigenous suppliers for required investment on the basis of

purchase contracts from foreign buyers,” explained Dubey. In addition she also talks about the establishment of Export Processing Zones. “The govt should support the establishment of Export Processing Zones (EPZ) in a way that they spearhead into the domestic economy of the respective developing country. For instance, regulations discriminating against the creation of local supplier relationships need to be avoided. A secondary industrial zone could be set up for local suppliers. It could be a geographical site adjacent to EPZs or a legal status allowing for easy foreign-domestic linkages.”

Road Ahead

Foreign investments in hospital and healthcare services have many positive implications. One major impact of foreign investment in healthcare is generation of the necessary infrastructure. Thakur says, “It will help build hard clinical and care infrastructure and create a conducive environment for ancillary systems.”

Investment also helps in increasing the physical capacity in the healthcare services (more diagnostic centres, increase in super specialty hospital range).

Besides, it also helps in upgrading the standards and quality of healthcare, in upgrading technology and creating employment opportunities. All this contribute to positive benefits to healthcare sectors and the economy at large

Lessons in Lung USG

Role of Lung Ultrasound in Covid-19



Dr. D Umashankar
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Coronavirus disease-19 (COVID-19) is an infectious disease caused by a novel coronavirus, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus belongs to the same family of RNA-viruses that caused severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). It was first reported in Wuhan, the capital of Hubei province in China, in Dec 2019 and since has spread all over the world overwhelming the healthcare infrastructure of many developed countries.

The WHO said that the outbreak is a Public Health Emergency of International Concern (PHEIC) on Jan 30, 2020 and declared the novel coronavirus (COVID-19) outbreak a global pandemic on March 11, 2020. The WHO also provided the nomenclature of the virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease it caused as COVID-19.

Today, five months after the WHO declaration of pandemic the SARS-CoV-2 infections are in the millions and death rates are increasing, placing enormous demands on healthcare providers. Healthcare delivery needs to be responsive and adaptive.

The Covid-19 disease is spreading mainly through the droplet route, the virus causes mild symptoms in most cases. However Covid-19 comes with a range of clinical presentations, from asymptomatic to severe life-threatening symptoms. The most common clinical presentation as seen globally is fever, sore throat, cough, body ache, loss of smell and taste. Other uncommon presentations include abdominal pain, severe fatigue, diarrhea, and breathlessness among other less frequent symptoms. A life-threatening complication of SARS-CoV-2 infection is an acute respiratory distress syndrome (ARDS), which occurs more often in older adults and those with immune disorders and comorbidities. Severe forms of the infection, being a sign for treatment in the intensive care unit (ICU), comprise acute lung inflammation, ARDS, sepsis and septic shock.

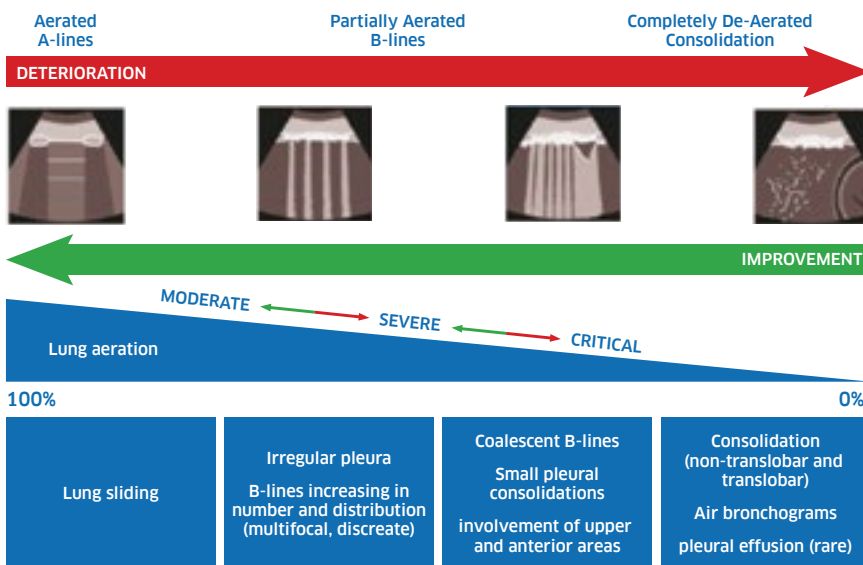
At present, the diagnostic strategy is based on the combination of a history of travel to endemic areas, exposure to a known case, clinical characteristics as enumerated above and RT-PCR (real-time polymerase chain reaction) assay from specimens taken predominantly by oropharyngeal & nasopharyngeal swabs, followed by imaging tests including Ultrasound (USG), Chest X-Ray (CXR) and Computed Tomography (CT). Other findings supporting the diagnosis include neutrophilia, lymphopenia, and elevated ESR, LDH, CRP, Elevated Troponin and D-dimer levels.

How does USG see lungs

There has been considerable development in lung USG or chest USG in the last decade in both theoretical and operative aspects, because of this chest USG and its clinical application has strengthened to define much of the diagnostics characteristics.

One of the key aspects of lung USG is the ability to define the variations affecting the ratio between tissue and air in the superficial lung. Normally, the lung comprises air, which totally reflects the incident ultrasound waves at the level of the visceral pleura as a specular reflector. This back scattering of USG waves produces artifacts characterised by horizontal reverberations of the pleural line (A-lines) and mirror effects.

When the ratio between air, tissue and fluid changes, the lung no longer presents as a complete specular reflector. Based on the relative water content in the lung tissues, a multitude of localised vertical artifacts appear on the USG images. In addition, when the subpleural density goes toward the value of 1 g/mL (about that of the solid tissue), then consolidations appear.



"Lung USG can detect relative increase in water content in the lungs and assess them in a range between normal and consolidative"

Figure 1 Sonographic characteristics of moderate, severe and critical pleural and parenchymal changes in patients with COVID-19





It is this finding, at the subpleural level, that lung USG can detect relative increase in water content in the lungs and assess them in a range between normal and consolidative. Finally, the number of lesions on the lung surface, and their evolution or regression over time, can also be evaluated.

The study of these patterns shows very high sensitivity in cases of interstitial and alveolar-interstitial lung diseases, which have a peripheral distribution. Many studies on acute respiratory distress syndrome (ARDS) confirm this. Other studies related to the 2009 influenza A (H1N1) epidemic confirmed these hypotheses even in a virally infectious setting.

CT Vs USG in Covid-19

Experts consider CT a gold standard in diagnosing chest diseases.

An analysis of the CT images from patients with COVID-19 pneumonia shows lesions that are patchy, multiple, peripheral and bilateral with lower lobe predominance. Some of these lesions are confluent especially in late or advanced cases. Experts describe the lung lesions as ground-glass opacities with a mixed consolidative pattern. Crazy-paving appearances develop from ground-glass opacities because of inter and intralobular septal thickening. The lesions most often have a wedge-like appearance with a pleural base. Major consolidations show air bronchogram. Pleural effusion is very rare. The right lower lobe is most frequently affected followed by the upper and lower left lobes. The involvement of the posterior lung and multiple lobes is a very common finding in COVID-19.

Table 1 CT and ultrasonographic features of COVID-19 pneumonia

Lung CT	Lung ultrasound
Thickened pleura	Thickened pleural line
Ground glass shadow and effusion	B lines (multifocal, discrete, or confluent)
Pulmonary infiltrating shadow	Confluent B lines
Subpleural consolidation	Small (centomeric) consolidation)
Translobar consolidation	Both non-translobar and translobar consolidation
Pleural effusion is rare	Pleural effusion is rare
More than two lobes affected	Multilobar distribution of abnormalities
Negative or atypical in lung CT images in the super-early stage, then diffuse scattered or ground glass shadow with the progress of the disease, further lung consolidation	Focal B lines is the main feature in the early stage and in mild infection; alveolar interstitial syndrome is the main feature in the progressive stage and in critically ill patients; A lines can be found in the convalescence; pleural line thickening with uneven B lines can be seen in patients with pulmonary fibrosis

Lung USG can identify changes in the physical state of superficial lung tissue, which are identified on CT but remain largely hidden in a majority of chest radiographs. These occurrences make the role of lung USG relevant in the COVID-19 pandemic. Also in experimental models of ARDS, lung USG has proved capable of detecting lung lesions before the development of hypoxemia. The pathological progression of COVID-19 pneumonia is therefore well suited to a surface imaging technique such as lung ultrasound.

How to get best results of lung USG

We can perform lung ultrasounds using almost any ultrasound equipment, from the most basic to the most advanced ultrasound scanner. Also, the use of curvilinear, high frequency linear and phased array sector probes provide almost similar results. However, a curvilinear transducer along with a high-resolution linear transducer is the best option to demonstrate diagnostic quality reproducible results.

Experts recommend a pragmatic approach depending on the level of operator experience and the requirements of the clinical team. The use of single scanning would provide a focused and rapid picture of involvement of key regions of the lung.

Where time allows, use of the 12-zone lung ultrasound score provides a potential mechanism to bring objectivity to quantifying the level of involvement, as a comprehensive whole-organ assessment. In addition, it allows for communication of findings between serial scans, different operators and different care settings, so that changes can be better quantified and communicated. Across 12 scanning zones, (six on each hemithorax) to a maximum score of 36, the four lung ultrasound aeration patterns (scored 0–3) are normal pattern (A-lines or non-significant B-lines), generating zero points; significant B-lines (≥ 3 per rib space), generating one point; coalescent B-lines with or without small consolidations, generating two points; and consolidation, generating three points.

Typical lung findings in Covid-19

When we look at the lung USG, these are some things we find

- Thickening of the pleural line with pleural line irregularity.
- B lines in a variety of patterns including focal, multifocal, and confluent.
- Consolidations in a variety of patterns including multifocal small to large consolidations involving the entire lobes. We invariably see mobile air bronchogram in large consolidations.
- Appearance of A lines during recovery phase.
- Pleural effusions are uncommon.

The observed patterns occurred across a continuum from mild alveolar interstitial pattern, to severe bilateral interstitial pattern, to lung consolidation.

Based upon the available literature, it is thought that lung ultrasonography has a major utility in management of COVID-19 with respiratory involvement. Experts opine that Chest CT can be used for cases where lung ultrasonography does not answer the clinical question. Radiologists relate the findings of lung

ultrasonography features of SARS-CoV-2 pneumonia/ARDS to the stage of disease, the severity of lung injury, and comorbidities. The key pattern is of varying degrees of interstitial syndrome and alveolar consolidation. Radiologists correlate this with the severity of the lung injury. Lung ultrasonography helps in rapid assessment of the severity of SARS-CoV-2 pneumonia/ARDS at presentation,

- To track the evolution of disease,
- To monitor lung recruitment maneuvers,
- To guide response to prone position,
- The management of extracorporeal membrane therapy,
- For making decisions related to weaning the patient from ventilatory support.

Advantage of Lung ultrasound

First, the evaluating clinician can take lung images directly at bedside, reducing the number of health workers potentially exposed to the patient.

Second, lung ultrasound can allow a first screening and discriminate low-risk patients (lung ultrasound-negative patients that can initially wait for second-level imaging if clinically stable and, therefore, reducing the risk of nosocomial exposure) from high-risk patients (such as those with abnormal lung ultrasound patterns) that might require second level imaging or even experimental therapies.

Third, portable devices are definitely easier to sterilize due to smaller surface areas.

Fourth, lung ultrasound can be performed on bedside. This means that, clinicians could service recuperating patients with clinical examination and lung imaging at their homes using portable machines.

Fifth, lung ultrasound is radiation free and can be performed many times (resources permitting) and would allow close monitoring of clinical conditions and also detect very early changes in lung conditions.

Sixth, lung ultrasound can be easily performed in the outpatient setting allowing general practitioners a better evaluation of patients.

Seventh, performing a CT scan involves the risk of transporting critically unwell patients to CT suite followed by the necessary decontamination procedures. This makes CT risky and time consuming while a bedside lung ultrasound can derive the same information.

Last, ultrasound machines used in lung ultrasound are relatively reasonably priced that could be easily used in resource restricted settings.

Disadvantages of Lung Ultrasound

Although there is much evidence to support the clinical value of lung ultrasound, radiologists underpin practice through education, competency and associated governance procedures.

As with other point-of-care ultrasound areas, examinations should be conducted to answer a focused clinical question and we should align procedures with agreed national and local standards.

Relative utility of CXR v/s CT v/s LUS in COVID-19

Critically ill patients frequently need lung / chest imaging because of the constant evolution of their clinical conditions. A key part of monitoring critical patients in the ICU is thoracic ultrasound, as it allows the intensivist to examine the lung and pleural space. High-resolution computed tomography (HR-CT) scans remains the gold standard imaging technique for lung / chest evaluation, but transportation of patients outside the ICU is difficult and potentially harmful. HR-CT scans expose patients to doses of radiation and should be reserved for specific situations (e.g., the evaluation of mediastinal pathologies and confirmation of pulmonary embolism). Bedside chest X-ray (CXR) is still considered the standard of care for many diagnostic applications in the ICU. However, this imaging technique has important methodological limitations and often yields low accuracy. Furthermore, it is important to consider radioprotection issues. As lung abnormalities may develop before clinical manifestations and nucleic acid detection, experts have recommended early chest CT for screening suspected patients. The high contagiousness of SARS-CoV-2 and the risk of transporting unstable patients with hypoxemia and hemodynamic failure, make chest CT a limited option for the patient with suspected or established COVID-19. Lung / chest ultrasonography gives results similar to CT Chest and superior to standard chest CXR for evaluation of pneumonia and/or ARDS with the added advantage of ease of use at point of care, repeatability, absence of radiation exposure, and low cost. Cumulative ionizing radiation has known harmful effects. Using bedside ultrasound could reduce standard CXR and CT Chest in the ICU.

"High contagiousness of SARS-CoV-2 and the risk of transporting unstable patients with hypoxemia and hemodynamic failure, make chest CT a limited option for the patient"

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Re-inventing Clinic Design

Project Highlight – Sakra Clinic



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India's Healthcare industry is on a remarkable ascend. Driven by the ever evolving technologies in the healthcare field, it's also under a constant flux. In such times, it becomes vital to keep the focus on technological integration, sustainable design and uncompromised attention to quality and care.

Sakra World Hospital, an established healthcare brand, promoted by Secom & Toyota Tsusho, from Japan, holds such a vision as the caregiver in India. As their design partners, KGD realized this vision to its every detail in Sakra's Advanced Multi-specialty Premium clinic at Sarjapur, Bangalore.

As our first step towards the vision of sustainable design and construction, there were several efforts made towards conserving most of the existing infrastructure at the site. KGD firmly believes in least wastages in its construction practices. It strongly promotes re-cycle & up-cycle of materials and finishes. The design team worked in complete alignment with this approach and the clinic was planned such that most of the infrastructure of the previously existing facility, a corporate office, could be re-used for the clinic.

In the overall planning of the clinic the design team kept in mind the existing



INFRASTRUCTURE

facility's layout. The zone that was assigned for cabins with clear glazing, was changed into consultation rooms. This helped in utilizing the existing glass partitions and doors.

The services were also planned with maximum re-cycling in mind. It did need enhancements and additions to provide for an experience of international standard. With an open mind and innovative methods, a huge amount of construction material was saved, and construction cost was brought down.

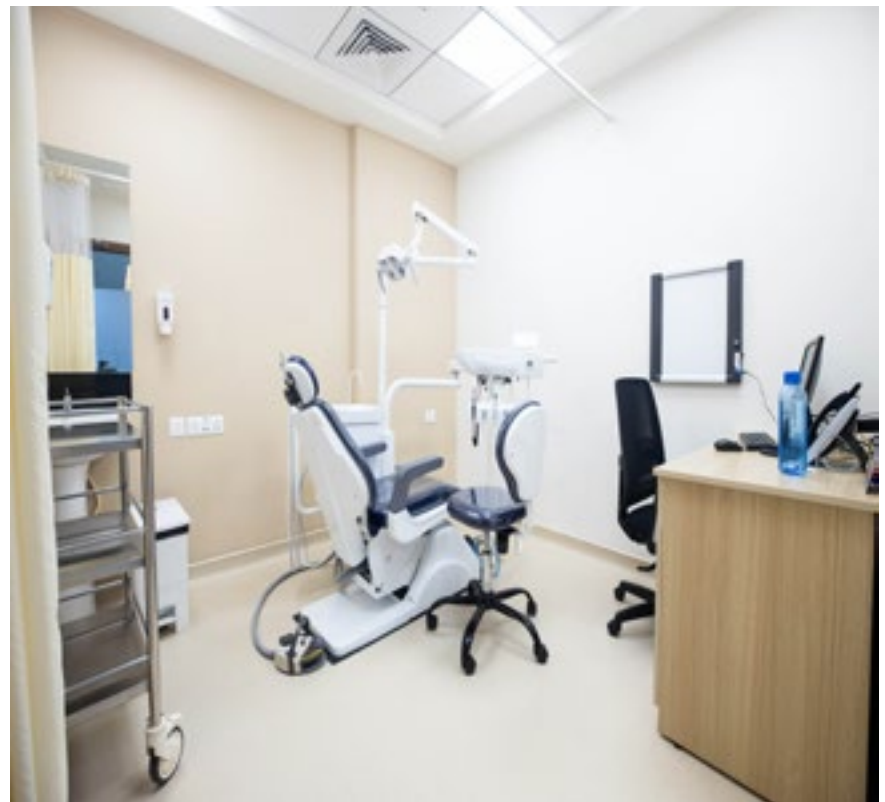
A corporate office was transformed into a world-class healthcare facility, without ripping off most of its services. One of the many steps we took for a low-carbon foot-print was that most of the already laid-down data cables were pulled out, checked for quality standards and re-laid as per the clinic's requirements. The existing electrical panel was also re-cycled and the electrical planning was done so it could aptly support a clinic's function. The existing light fixtures went through quality checks and most of these were conserved for re-use.

No stone was left un-turned in our commitment to this vision. The team could even find ways to reuse the existing desk's carcass for a new reception desk. The whole team, right from the drawing board to the construction site, was living the vision in all its attempts. Although each one is a small step, it collectively contributed in delivering an environmentally responsible project at all levels.

Another feat towards sustainable practices was to keep the timelines short and condensed, in the process saving time and energy, two much valuable resources both for Sakra & KGD. The whole project's design & construction was completed within 60 days, with the construction time limited to 45 days. This tight schedule could be successful through lean construction methods and collaborative planning, delivered with highest safety standards. This enabled Sakra to serve the people of Bangalore soon and it also set a good mark for Sakra for its future projects to come.

Sakra believes that clinics are usually the first centers for patients' interface with the medical world. So Sakra's care must start right here! To serve people with this commitment, they brought forth digital integration, offering an efficient and a user-friendly experience. Throughout the clinic, most advanced technologies had to be implemented and highest level of service had to be provided to people. Such an intent couldn't be achieved unless the clinic was built with adherence to all international standards. In the healthcare sector these standards are stringent and any compromise can critically impact people's health and a brand's reputation. For example a minor leakage in X-ray rooms could lead to a major mishap. Hence utmost care was taken in meeting expectations of this brand from Japan, by employing international norms. A facility of approx. 6000 sq. ft. area was created to satisfy art, science and technology of the healthcare industry. Today, this clinic successfully fulfils a patient's overall experience, staff efficiency, functionality, and offers a hygienic & a low maintenance environment.

The partnership of Sakra and KGD got suitably aligned to offer the best in the healthcare world





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