Pulse

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Brother Jayesh Panchal

Dear Readers,

As India celebrates 75 years of its independence, it is noteworthy that the country has made considerable progress in healthcare.

Crude mortality from 27.4 per 1000 population (1947), reduced to 7.3 in 2020. Life expectancy, from a mere 32 years (1947), has more than doubled,to 70 years in 2020.Infant mortality rate has been brought down from 134 per 1000 live births in 1947 to 28.3 in 2019. Communicable and infectious diseases too have been controlled to a considerable extent with the help of targeted national programs.

India faces the dual challenge of being a developing country combating basic health issues, like malnutrition, hygiene, sanitation, infections etc, along with urban issues of lifestyle related diseases like hypertension, diabetes, cardiac ailments etc. The recent Covid pandemic saw India taking on the role of 'pharmacy' of the world. Yet, half of India's population does not have access to essential medicines with stock-out situation at public hospitals. Increasing population, lack of focus on preventive aspects of healthcare, shortage of public healthcare infrastructure and unaffordable treatment in the private medical sector has added to the challenge.

Despite everything, India has put itself on the map of medical tourism with affordability, access to traditional therapies,easy online medical appointments, consultations and pharmacies and has had a steadily rising trend in health outcomes since past two decades. Today, healthcare is one of the largest sectors in terms of revenue and employment.Increase in public health care services, personnel, targeted initiatives and national programs have helped in augmenting healthcare. The Indian government recognised the validity of alternative medicine and in 2005, the National Rural Health Mission (NRHM) brought Ayurveda, Yoga and naturopathy, Unani, Siddha and Homeopathy (AYUSH) systems into the mainstream of healthcare thereby tapping the AYUSH workforce especially in rural areas. Technology has helped transform the Indian healthcare sector by enhancing quality, reach, compliance and data collection. India has the vision of Universal Healthcare Coverage and,Ayushman Bharat is a scheme which aims at providing a health cover of Rs.5lakhs per family per year for secondary and tertiary care hospitalisation to more than 10 crore poor and vulnerable families.

Much has been done over past 75years to strengthen our healthcare system but more needs to be done as it is an integral part of the socio-economic development of India.

This issue of Pulse looks at the advances in various specialties of medicine since independence. Hope you enjoy reading it.

सानन्दं पठन्तु । *

Dr. Shrividya Chellam
Chief Editor, Pulse

**Happy reading in Sanskrit*

Dear Readers,

I am indeed delighted to write this article from the 'HMDs Desktop' for the 23rd issue of PULSE. I was one of the editorial board members who conceptualized and published PULSE, the first ever periodic News Letter of Medical Division. We published the inaugural issue in February 2003 and since then, it has continued as a biannual publication.

With continued advances in medical diagnostics and therapeutics, there has been marked improvement in longevity, life expectancy and quality of life of society. Pulse has definitely contributed in establishing the communication link between medical professionals and various medical and non-medical readers especially from DAE community.

CHSS has been implemented in a phased programme and dispensaries have been opened at five centres initially. Indoor hospitalization facilities were provided in J. J. group of Hospitals.

Keeping pace with the growth in the medical field, Medical Division, BARC has too metamorphosed immensely in all the disciplines of medicine.

Never before there was urgency about quest for 'knowing something more" as it is experienced today. Overall standard and awareness about medical facilities are on the rise. Traditional approach of practicing medicine has changed immensely. Clinical medicine has seen sea change in the way it is practiced. The technological advances have grown by leaps and bounds. Newer equipment in surgical devices, 3 D operating camera, installation of CT scan have been added to the list of armamentaria of medical division. Recent developments in each and every department like pain management, advances in dental unit, paediatrics etc show that they are taking efforts to offer best possible medical care to beneficiaries.

Recently developed sleep lab and long-awaited MRI machine installation in radiology department are proud developments.

BARC Hospital building was inaugurated in 1976 and a decade later, annex building was erected to house more beds and more facilities. The next important mile stone is added in the growth of medical division. The new hospital wing was recently inaugurated on 29 June 2021. This will provide multispecialty higher medical facilities to our beneficiaries under one roof. It is really a proud moment to dedicate this building to CHSS beneficiaries.

Enhancement of digitalisation and adding facilities of patient portal in hospital information system for getting pathology and radiology reports is already under process.

This complete year was marked by unprecedented covid pandemic. Medical division has whole heartedly participated in management of this medical calamity with best of its ability. All the modalities required for patient care, like Outpatient department dedicated for covid management, isolation wards for covid patients, isolation facility for quarantine and treatment for needy patients were initiated and successfully run by medical division.

Our contribution in national covid vaccination drive was appreciated by community as it has helped to offer 60000 doses of vaccine to CHSS and general population.

During this period, many research projects were undertaken and going on successfully.

Looking back through the window of past, there is definitely a sense of satisfaction for the growth and development, medical division has achieved. However, there is always a way further and still many accomplishments are awaiting to be added. Constant upgradation, enhancement of skills and services in addition to humane approach definitely will progress this system further to one of its kind.

This institute is a proud creation of Dr. Homi Bhabha. It requires a commitment to exercise one's creative spirits and whole hearted involvement in work. We too, as doctors, are committed to be responsive to the health needs of the community. I am sure we will be able to meet the future challenges to the best of our ability.

Dr Anjali R Kulkarni
Head Medical Division

The National Medical Commission: A Renaming or Transformation?

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Reprinted from The India Forum, November 2019

Medical education in India has been beset so far by scandal. In medical practice, professional bodies have been opposing plans for a mid-level professional. Can the new National Medical Commission reform education and regulation to enable better healthcare?

In a much awaited and what is certainly a major change in how medical education and practice will be regulated in India, Parliament in August enacted the National Medical Commission Act 2019.

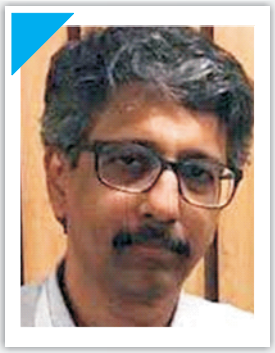
We now have the new National Medical Commission (NMC) as the regulator because the Medical Council of India (MCI) that had been mired in corruption slowly imploded and self-destructed over the years. While the Government lauds itself on enacting the legislation establishing the NMC and others have critiqued its shortcomings, the fundamental issue really is the impact the NMC will have on the delivery of effective healthcare to our fellow citizens. In other words, is the new NMC a game changer, will it nudge medical reform in the right direction or is it just another symbolic move by the state with business as usual on the ground?

There are about 529 medical colleges in India, almost half of which are state run. These colleges churn out nearly 80,000 MBBS graduates every year. In a recent development, the Government has declared that it will be setting up 75 new medical colleges in three phases, adding another 15,000 seats to the current number.

Whilst a poor doctor-patient ratio is a reality in India, the greater challenge is the rural-urban divide, and the poor training and quality of the new graduates.

In addition, there are about 30,000 new graduates trained in Ayurveda, Yoga, Unani, Siddha and Homeopathy (AYUSH) every year, many of whom make up a potential workforce for delivering basic care. Whilst a poor doctor-patient ratio is a reality in India, the greater challenge is the rural-urban divide, and the poor training and quality of the new graduates.

Dr. Sambit Dash



Dr. Sanjay Nagral

Becoming a doctor at all costs is a huge aspiration as it not only guarantees income but also social status and upward mobility. The demand for a medical seat is therefore still very high in India. The conundrum for the state has been how to harness and channelise this intense demand through appropriate training to create doctors who will be sensitive to healthcare needs and who are capable of delivering care where it is needed.

Before we delve into the evolution of and issues related to the NMC, it must be noted that the promulgation of the NMC has rankled the largest association of India's allopathic doctors, the Indian Medical Association (IMA). Normally an influential body, the IMA has in the past been able to stall several reforms in the health sector. For the IMA and most allopathic doctors, the contentious issue in the NMC Act has been the provision for community health workers, who will be mid-level healthcare professionals. This time around, the Government has ignored the IMA's opposition and pushed the NMC Act through.

All in all, the NMC with minor modifications will now operate to provide the framework for medical education and the regulation of practice across India. Thus, its importance is far reaching for the health of our people, many of whom continue to be deprived of basic care.

Medical Education in India – A Brief History

What is history? An echo of the past in the future; a reflex from the future on the past – Victor Hugo

For centuries, healthcare in India was largely delivered by traditional providers and the AYUSH group of alternative systems, as they are now designated, continue to play a major role in providing care.

Western medicine entered India along with the East India Company in the year 1600. The regulation of such services started in 1775 when the Commander-in-Chief of the British Army established the offices of the Surgeon General and Physician General. A decade later, medical departments were set up in the three British presidencies of Madras, Bengal and Bombay. Regulation of healthcare took a major turn with the Uprising of 1857, which led to the establishment of the British government in India. Along with it came services like the Indian Medical Service, Central and Provincial Medical Services, the public health commissioner, and the like. In 1869, medical departments in the presidencies were subsumed into the Indian Medical Service.

While all that was happening on the regulation front, allopathic medical education in India started with the setting up of the Native Medical Institution in Calcutta in 1822, which trained 20 Indian students in western medicine. The British also facilitated teaching of Unani in the Calcutta Madrasa and Ayurveda in the Sanskrit College, Calcutta, in 1826.

In what can be termed as a clash of cultures and also owing to the Independence movement, traditional or indigenous systems of medicine were at loggerheads with western medicine.

However, aspersions were cast on teaching indigenous systems of medicine and Governor General William Bentinck set up a committee to look into how Indians could be trained in western medicine. The committee criticised the practices of the Native Medical Institution and suggested that the state set up medical schools that would teach all branches of medical science as in Europe. In 1835, the Native Medical Institution, Calcutta Madrasa and Sanskrit College folded up and in the same year the Calcutta Medical College was established.

Around the same time, events in Bombay Presidency led to plans for establishment of a medical college to address the healthcare needs of Indians who died in large numbers due to lack of medical care. The Grant Medical College was set up in 1843. There were two levels of instructions in the college. A longer one to become doctors and a shorter one to become medical subordinates for British government services. A medical school established in Madras in 1835 started by conducting different 2-year courses to train Indians.

By the 1850s, university affiliated medical schools had been opened in various provinces. However, by the end of 1877 less than 3% of medical practitioners were trained in western medicine. The rest practiced indigenous systems of medicine. In what can be termed as a clash of cultures and also owing to the Independence movement, traditional or indigenous systems of medicine were at loggerheads with western medicine. The latter received state patronage and the former was seen as of a second class. This historical evolution has a bearing on the current state of affairs and will help us frame the issues that have cropped up with the establishment of the NMC.

Enter the Medical Council of India

We are now certain that the MCI is a den of corruption – Supreme Court of India (2001)

The formal establishment of a medical education regulator in India took place when the MCI was set up in 1934 under the Indian Medical Council Act, 1933. Modelled around the British General Medical Council (GMC), the MCI with its own constitution was a classic model of self-regulation that had been globally accepted. Many bodies like the GMC in the United Kingdom (UK) continue to play this role effectively. But, alas, the MCI soon became an unchallenged entity regulating a scarce resource like medical seats and was involved in one scandal after another.

Simultaneously from the mid 1970s, India saw the introduction and growth of the private medical college sector. Many of these private colleges lacked the necessary infrastructure but had money and political connections. Soon this became a gravy train for those running the MCI.

While inspections of MCI had become a dreaded experience for private medical colleges, government medical colleges wallowed in mediocrity.

Things came to a head in 2010 when the then President of MCI, Dr Ketan Desai, was arrested and jailed on charges of

receiving a bribe of Rs. 2 crore for granting permission to a particular medical college. That the Supreme Court of India labelled the MCI a "den of corruption" was just another nail in its coffin. While inspections of MCI had become a dreaded experience for private medical colleges, government medical colleges wallowed in mediocrity. With the curriculum unchanged for decades and no focus on outcomes, the large number of MBBS graduates that the system churned out lacked basic competency.

Beginning from 2010, through various Bills and Ordinances, the government of the day toyed with reviving and refreshing the MCI, including by setting up a Board of Governors to oversee the working of the MCI until a new regulator emerged.

After the Ranjit Roy Chaudhury committee of 2014 suggested reforms of medical education, one of the first things that the new National Democratic Alliance (NDA) government, which took chargein May 2014, did, was to examine overhauling of the MCI. In September 2015, the Parliamentary Standing Committee on Health and Family Welfare while endorsing the Ranjit Roy Chaudhury committee's recommendations gave a damning report on the failure of the MCI in all its mandates. Later, in May 2016, the Supreme Court of India ordered the establishment of an Oversight Committee, which officiated MCI activities.

The NITI Aayog's role in shaping the replacement of MCI was crucial. In a report submitted in August 2016, the planning body, taking into account mainly the reports of the Parliamentary Standing Committee and the Ranjit Roy Chaudhury committee, proposed for the first time, the establishment of a new regulator, the NMC.

MCI to NMC – Nomenclature or More?

The world as we have created it is a process of our thinking. It cannot be changed without changing our thinking. – Albert Einstein

With the MCI dissolved and the NMC with a new member structure taking its place, we need to examine how the new structure and workforce will make regulation efficient, transparent and yet avoid harassment.

Though the NMC proposes "no harassment" during the multitude of "inspections" of private medical colleges, it will have to spell out how it will assess medical colleges on their training capacity.

As a departure from the MCI power structure, the NMC will comprise a chairperson and 10 ex officio members. It will, however, have greater union government representation and 22 part-time members, most of whom will represent state medical councils. As a welcome step, the Act makes it compulsory for all members to declare their assets and liabilities before and after their tenure in the NMC, as also their professional or commercial engagement. While the Act states that the chairperson and members would be barred from holding posts in a private medical institution after their tenure in the NMC, there is also a caveat that such an appointment may be permitted by the central government.

Though the NMC proposes "no harassment" during the multitude of "inspections" of private medical colleges, it will have to spell out how it will assess medical colleges on their training capacity, rather than nitpicking on infrastructure that was the norm earlier.

There is no question that on the face of it, the new structure is both less democratic and less federal. This is because of the nomination structure where the Government has a bigger say and because the turn for representation of each state will come only once in three years. Of course, it needs to be noted that though the previous MCI had more elected members from various states, it was a collective disaster with no evidence of the members trying to change its direction. Whether this leaner avatar of the MCI in the form of the NMC will be transparent, impartial, free of corruption and improve efficiency remains to be seen.

The Case for a Mid-Level Healthcare Professional

Keep your face to the sunshine and you cannot see a shadow. - Helen Keller

The idea of a mid-level healthcare provider to augment the current workforce and, more importantly, improve access in under served areas is not new and has been implemented globally with success. In 2012, the MCI gave permission to the Chhattisgarh government to deliver a three-and-half year medical course, called the BSc in Community Health. This move gained significance since it undid what the Bhore Committee of 1952 did – abolishing the Licentiate in Medical Practice (LMP), the holder of which was a mid-level healthcare worker. It was only after a national consultation of medical education experts in February 2010 that the MCI gave assent to the

Ministry of Health's plan for rolling out a Bachelor of Rural Medicine and Surgery (BRMS) programme. With a career progression plan suggested by the then Planning Commission (albeit eventually with a name change), this programme was approved for Chhattisgarh.

One study showed that the competence of Rural Medical Assistants in treating the five commonest ailments encountered in a Public Health Centre was either at par or better than that of the MBBS doctors.

As part of the regulations of this cadre, these healthcare workers were not to use the prefix 'Dr', the recruitment was to be strictly local, the career progression was limited to the district level, there was to be a service bond that tied the graduate to government service, and the scope of practice of the mid-level health worker was clarified. Despite the IMA dragging the Government of Chhattisgarh to court, the state introduced a Rural Medical Assistant (RMAs) cadre and with the first batch graduating in May 2006, successfully recruited them to man Primary Health Centres (PHCs) and health sub centres. While nearly 400 PHCs in the state did not have MBBS doctors in August 2008, they all had RMAs.

One study conducted by the Public Health Foundation of India, National Health Systems Resource Centre, New Delhi, along with the State Health Resource Centre, Chhattisgarh, showed that the competence of RMAs in treating the five commonest ailments encountered in a PHC was either at par or better than that of the MBBS doctors. India is not unique in trying to attempt to build a mid-level cadre. The history of Physician Assistants (PA) in the United States (US) takes us to World War II, after which there was a severe shortage of doctors and such a cadre was therefore raised. The PA course, usually taken by paramedics and nurses, has flexibility in learning and as of 2017 there were more than 100,000 PAs in the US. In the UK there is a two- year bridge course in adult medicine and general practice. In New Zealand there is the Rural Health Development Programme, graduates of which work under a senior doctor and complement nursing and medicine. The Sub Assistant Community Medical Officer (SACMO) in Bangladesh and the Assistant Doctors in China are all examples of successful programmes of building a mid-level practitioner.

In thus what is essentially a turf war, there lies a tremendous opportunity to change healthcare delivery

It was this provision for creation of a cadre of Community Health Workers in the NMC Act that pushed the IMA to take to the streets. This has been a major bone of contention for some time since the provision for a bridge course for AYUSH professionals was mooted in the original NMC Bill. The medical fraternity portrays this as legitimising quackery. But the reality is that the typical allopathic doctor who is today largely a specialist in training, aspires to work in the lucrative private sector in urban areas and is therefore not willing or likely to work in under-served areas. The IMA has no workable solution for this problem.

In thus what is essentially a turf war, there lies a tremendous opportunity to change healthcare delivery, especially in the vast swathes of hinterland India. A WHO report of 2016 stated that 60% of India's healthcare force catered to urban India where 30% of Indians live, while 40% takes care of the remaining 70%, who are rural dwellers. According to the Ministry of Health and Family Welfare (MoHFW), the urban to rural doctor ratio stands at 3.8:1. If the NMC can bring together bodies like the MoHFW, the Ministry of AYUSH and the Central Council of Indian Medicine, (CCIM), and plan a robust bridge programme that improves the availability of providers in under-served areas, it would both provide a competent mid-level healthcare professional as well as help weed out the large population of quacks.

Nowhere NEXT

Uncertainty always creates doubt, and doubt creates fear – Oscar Munoz

The case for an exit exam as made out in the NMC Act is curious. While usually an exit exam is meant to ensure a minimum level of quality, the proposed National Exit Test (NEXT) aims to achieve much more than that. There is a general consensus that the quality of a MBBS graduate churned out by a majority of Indian medical schools is below par and also extremely uneven. With many private medical colleges running with ghost faculty members and non-existent infrastructure and many government medical colleges operating with a severe shortage of faculty and dilapidated infrastructure, it is only natural that the quality of graduates varies sharply from one college to another.

When the first version of the NMC Bill was tabled, it had a provision for a National Licensure Examination or NLE

which would be an all- India exam, qualifying in which would be mandatory to get a licence. This proposal met with resistance from the expected quarters, including the IMA, all of whom derided the proposal for yet another exam that an MBBS graduate would have to face. Even the Parliamentary Standing Committee on Health and Family Welfare expressed its reservations on this provision in its 109th report on the NMC. Facing opposition, the Union Cabinet in March 2018 dropped the plan and instead stated that the final year MBBS examination would serve as a licensure exam.

The idea of making the current final year MBBS examination in India a licensure examination is steeped in confusion.

A licensure examination is found in many countries, most notably in the US, which has been conducting the United States Medical Licensure Examination (USMLE) since 1992. However, the idea of making the current final year MBBS examination in India a licensure examination is confusing. For if it were to aim at a uniform standard of MBBS graduates, the examination needs to be uniform in nature, which is currently infeasible. The final year MBBS examination has both theory and practical components in four broad subjects (medicine, surgery, obstetrics-gynecology and pediatrics). How such an exam can be made uniform for all the 529 medical colleges in the country is not known.

Not just that, but in a surprising move this proposed NEXT will also serve as the entrance exam for the post-graduate course in India. The logic of subsuming the current NEET-PG under the new exit exam is perhaps to save the MBBS graduate from having to take yet another gruelling examination. But here the framers have perhaps missed taking into account the purpose of the different tests. As the fundamental tenet goes, a test is as good as its intended objective.

The objective of an entrance exam is to act as a differentiator. Selection for the post-graduate course is to filter tens of thousands of MBBS graduates for the 40,000 odd post-graduate seats that are currently available.While a licensure examination cannot test only the knowledge domain, an entrance test to the post-graduate course can do so. Testing all essential domains as part of the post-graduate entrance examination involves huge logistical challenges. And it is this logistical nightmare that makes one wonder how the NEXT will be conducted. The three-year implementation period can actually be used to build a system that will enhance the quality of medical education in the country.

Regulating fees

Virtue is more to be feared than vice, because its excesses are not subject to the regulation of conscience. – Adam Smith

Since the opening of the medical education sector to private players, the act of securing a MBBS seat by paying large sums of money has been mainstreamed. This has dented the "merit" argument against reservations in admissions.

In recent years, based on the Supreme Court of India guidelines and with the entrance examination for entry to the MBBS subsumed into a nationwide test called NEET, the "management quota" seats, as they were called, for which astronomical sums were charged, have been done away with. This has led to private medical schools increasing fees, often leading to meritorious students from economically weaker sections being unable to study medicine despite securing higher ranks in the entrance exam. All this leads to several perverse practices and is a major driver of corrupt practices, a glaring example of which was the Vyapam scandal in Madhya Pradesh.

The NMC Act proposes a departure from the current system: 50% of all seats will now have a fee cap in private colleges and deemed-to-be private universities, while admission to the other 50% would be decided by the NMC and/or the state governments, depending on under whose aegis they function. The Government claims that by this arrangement, with almost half the MBBS seats in the government sector, a total of 75% of the seats would have nominal fees, thus encouraging merit.

We may need a cultural shift to accepting profit- making in the higher medical education sector in a tightly regulated form.

The central government also claims that since the NEXT results and a rating of medical colleges (through the Medical Assessment and Rating Board set up under the NMC) will cause market forces to apply, institutions will regulate fees accordingly and not charge exorbitantly for the 50% of the seats under their control. However, confusion seems to writ large with Health Minister Dr Harsh Vardhan recently commenting that the "cap" or

upper limit of fees would not be mandatory and that only "guidelines" will be issued to institutions regarding fee fixation. Only after the rules are finally inked by NMC will there be clarity on this matter.

One needs to look at the medical education landscape to understand the nuances of the issue. In an ideal world, the state should have been the provider of all medical education with a transparent board, optimal entrance exam, good quality teachers, top class infrastructure, etc. However, if this is not the case, the gap will inevitably be filled by the private sector. The private sector in India, however, has had a poor record owing to the deep political affiliations of a vast majority of medical colleges, substandard facilities, abysmal teaching standards and outright corruption. The regulators are to share a large part of the blame. Since the goods (MBBS and post-graduate seats) are in short supply and the regulator corrupt, the market forces did not apply in a natural environment and the medical education ecosystem veered towards dysfunctionality. One will have to see if the fee capping provision in NMC will set things right. We may not be able to wish away the private sector, where there are a few good institutions. Running a medical college is a capital-intensive process and private players will naturally seek profit from such an endeavour. We may need a cultural shift to accepting profit-making in the higher medical education sector in a tightly regulated form. Discouraging the private sector from earning profits may result in further deterioration of teaching standards, facilities and thereby the quality of doctors. One way the NMC plans to intervene is through the mechanism of the NEXT exam. Only time will tell whether this kind of tweaking of the examination pattern will result in substantive change on the ground.

Opportunity in Change

With the enactment of the NMC Act, healthcare in India is perhaps witnessing one of its biggest changes since Independence. The dissolution of the MCI was long pending. Its position and existence had become untenable. While there are plenty of questions that remain unanswered, a few of which have been deliberated in this essay, there are opportunities and possibilities that this move for a new regulator has opened up.

For example, in crafting a well-designed exit exam, the NMC can ensure that a minimum standard of quality is maintained, and medical graduates are sensitised to our health needs. There are sound international practices vis-à-vis licensing exams that the NMC can borrow from. There are plenty of medical education experts rooted in this country's reality who could be taken on board to deliberate and decide on what is best.

In designing a robust bridge course and regulating the functioning of mid-level health practitioners, the NMC can help bridge a glaring gap in Indian healthcare delivery. The community health provider as envisaged in the NMC Act can function to provide succour to the under-served in India as well as address problems like the emerging epidemic of non-communicable diseases (NCDs). There are good in- house examples in Chhattisgarh and Assam, as well as multiple practices in other countries to follow and implement nationally.

By bringing transparency to the fee structure, the NMC can crackdown on corruption in this area to a large extent. Medical education India has been associated with substandard colleges, high capitation fees, deceit in allocation of management quota seats and in general a sense of fraud and scandal. The NMC has quite a task at hand to end these practices.

The NMC has the potential and opportunity to usher in a new era in medical education and practice, and, in turn, in healthcare delivery in India. But a regulatory body can only act and deliver within a facilitatory and congenial ecosystem that for healthcare involves the state, providers and even ordinary citizens. After all our health and well-being is too important an issue to be left to a single institution.

Acknowledgement

https://www.theindiaforum.in/article/national-medical-commission-renaming-or-transformation? utm source =website&utm_medium=organic&utm_campaign=category&utm_content=Education

Chronic Pain – Then and Now

Dr Sheetal Chiplonkar,
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Pain rightly termed as the fifth vital sign, is considered as a protective phenomenon. It alerts the body to injury and disease. However, the duration and intensity of pain can be unpleasant. Back in the 1600s, physicians started giving opium for pain relief and by the 1900s anaesthetic and analgesic drugs became popular. Till then, pain was mostly considered a problem to be managed in acute settings or during cancer treatments but soon pain management as a speciality came into existence in 1960s and the first 'International Association of Study of Pain' was born in 1970 along with a journal dedicated to study of pain. Globally, ten percent of the population is affected by some form of chronic pain , recurrent headaches being the commonest with the low back pain and neck pain coming close second. [1]

Following is an illustration of how pain medicine can help. A 63 year old female with moderate truncal obesity came to our pain OPD with prolapsed intervertebral disc and radiculopathy in left lower limb. On MRI , she had degenerative changes in the back. She had taken a few courses of analgesic drugs and was complaining of acidity and similar side effects. Her back ache and pain in the left lower limb was treated with lumbar facet joint block and transforaminal epidural steroid injection. Her pain, which was almost 7/10 on numeric rating scale, became much tolerable after the block and her quality of life improved along with her walking ability. She also had sacroiliac (SI) joint arthropathy on the same side. She came back again after a year with excruciating low back and hip pain for which cooled radiofrequency neurotomy of lateral branches of the S1, S2,S3 dorsal rami supplying the SI joint was done and patient had 50-70% pain relief from the procedure.[Figure 1]

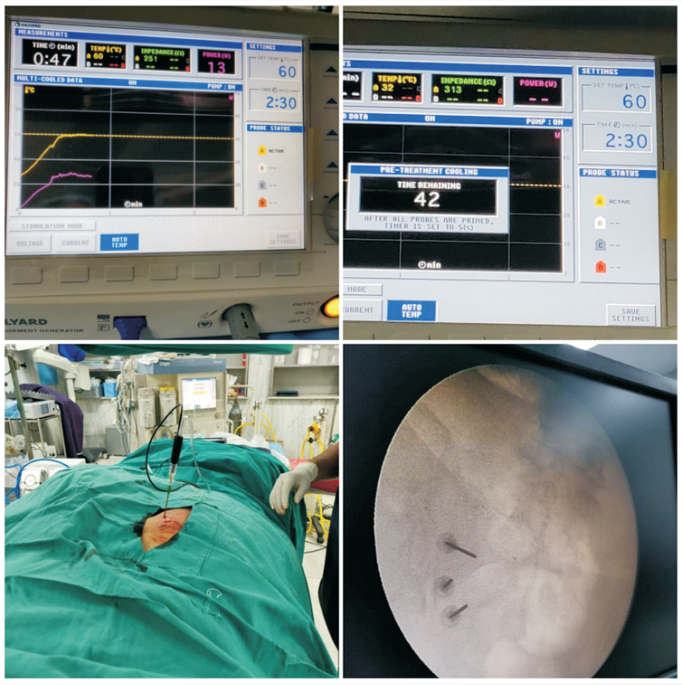


Fig. 1: Radiofrequency Ablation being done in BARC Hospital

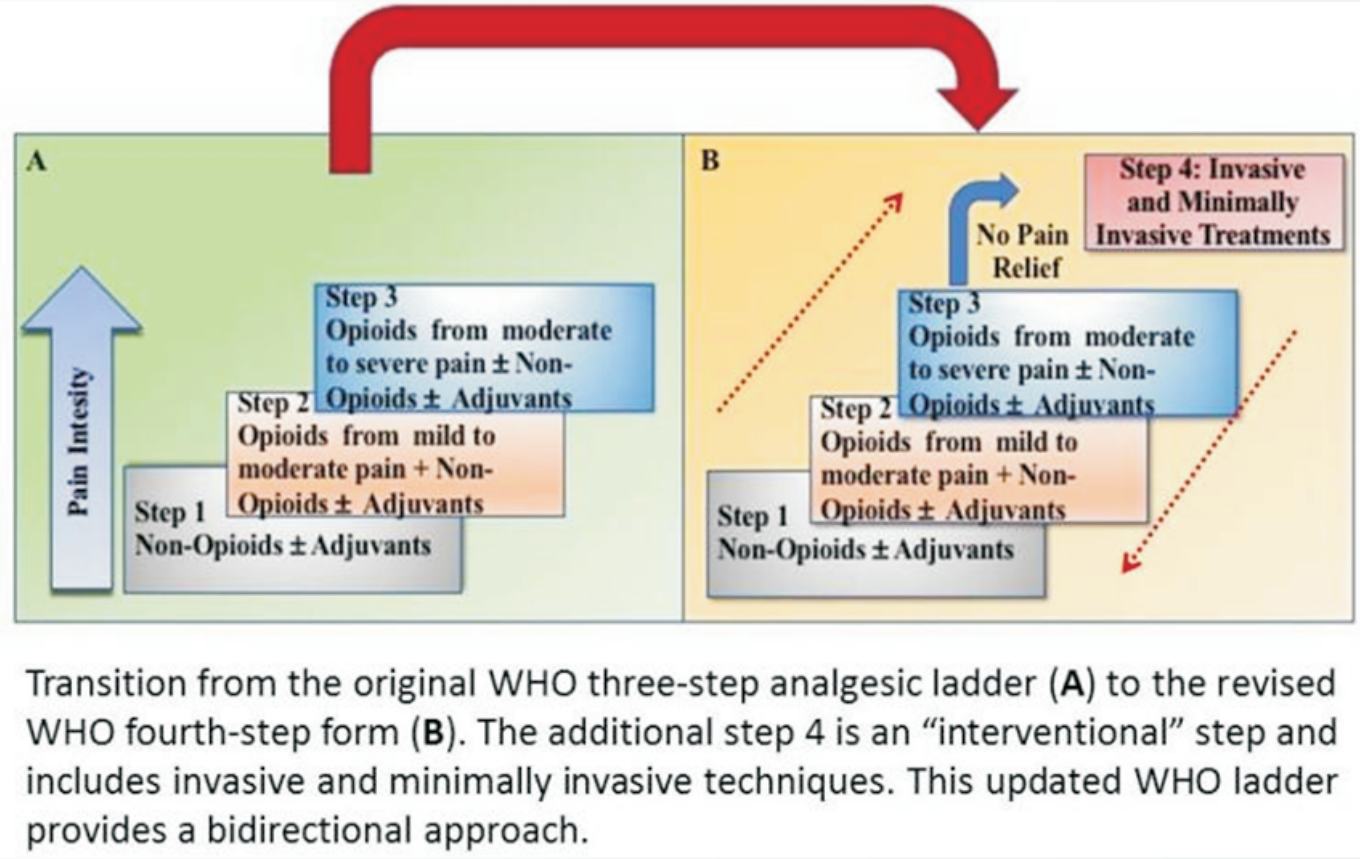
Dr. Sheetal Chiplonkar

Procedures like these not just reduce patient's dependence on drugs for pain relief, also improve quality of life and reduce systemic side effects from drugs. Improved mobility gives them a chance to perform daily activities and strengthening exercises in order to reduce the extra body weight and that goes a long way in restoring spine health.

Today, we have multiple modalities for treating chronic pain and the efforts at understanding pain are constantly evolving.

Some of them are described below.

Pharmaco therapy- 'The Analgesic Ladder' as a tool to guide the physicians in pain management was proposed by World Health Orgainization in 1986 and is very well known. The original ladder consisted mainly of three steps.[2]



Transition from the original WHO three-step analgesic ladder (**A**) to the revised WHO fourth-step form (**B**). The additional step 4 is an "interventional" step and includes invasive and minimally invasive techniques. This updated WHO ladder provides a bidirectional approach.

Fig. 2: The old and the revised WHO analgesic ladder

Step 1- mild pain- Use non steroidal anti-inflammatory , COX inhibitors and acetaminophen with or without adjuvants.

Step 2- Moderate pain- Use weak opioid analgesics like Tramadol , codeine, hydrocodone , along with step 1 and with or without adjuvants

Step 3- Persistent severe pain- Use morphine, fentanyl, , buprenorphine, tapentadol, methadone, oxycodone etc . with step 1 and with or without adjuvants.

Adjuvants or co-analgesics, include antidepressants like tricyclic antidepressants (TCAs) such as amitriptyline and nortriptyline, serotonin-norepinephrine reuptake inhibitors (SNRIs) such as duloxetine and venlafaxine, anticonvulsants like oxcarbazepine, gabapentin and pregabalin, topical anesthetics (e.g., lignocaine patch), topical therapies (e.g., capsaicin), corticosteroids, bisphosphonates, and cannabinoids.

The conventional WHO ladder was unidirectional and many clinicians felt the need to treat pain taking into consideration pain pathways and rather have a multi modal, multi-speciality approach. The fourth step was later added to this ladder which comprised of numerous non-pharmacological procedures that are recommended for treating persistent pain.[figure 2]. This group consists of interventional and minimally invasive procedures such as epidural analgesia, intrathecal administration of analgesic and local anaesthetic drugs with or without pumps, neurosurgical procedures (e.g., lumbar percutaneous adhesiolysis, cordotomy), neuromodulation strategies , nerve blocks, ablative procedures (e.g., radiofrequency, microwave, cryoablation ablations; laser-induced thermotherapy, irreversible electroporation, electrochemotherapy), cementoplasty as well as palliation radiotherapy.

The revised WHO 'Analgesic ladder' allows physicians the flexibility of escalating or de-escalating the therapies depending on the response to the various interventions.[2]

Physical therapy- It forms the primary mode of treatment for mild to moderate level of pain from arthritis, frozen shoulder, backache and headaches. Hot packs, infrared heat, paraffin (heated wax) baths, and hydrotherapy (whirlpools) provide surface heat. Heat may be generated in deep tissues by high-frequency sound waves (ultrasound). Ultrasound and TENS units effectively reduce pain and

increase the range of motion when applied to trigger point pain. Ultrasound waves can increase heat and improve circulation in the region, relax muscles, and heal tissues. TENS units work by emitting an electric signal activating the natural opioid pain-relieving system in the body. Low level LASER therapy also reduces joint stiffness and pain.

Interventions

Dry needling (Intramuscular stimulation)– It is a well-accepted technique to treat myofascial pain. Many pain physicians use them in combination with other physical therapies like massage, interferential currents and ultrasound for better results. Monofilament filiform needles of fine gauge are inserted into trigger points in the muscle under ultrasound guidance . Needling is supposed to modulate sensory nerve inputs by inhibitory mechanisms and also through sympatholytic effect causing vasodilation. This delivers growth factors to the injured area stimulating collagen formation.

Intrathecal drug delivery systems-This is an excellent pain modality for cancer patients who may have inadequate pain control or intolerable side effects from systemic opiates and adjuvant therapy. Other non-cancer related painful or spastic conditions which respond well are cerebral palsy, stroke, failed back syndrome, chronic regional pain syndromes (CRPS), peripheral nerve injury etc. [3] The equipment consists of implantable intrathecal infusion pump, intrathecal catheter, and the connecting tubing which most commonly deliver bupivacaine/morph ine/fen -tanyl /baclofen/hydromorphone/ziconotide.

Radiofrequency - One of the first use of electric current for pain management in humans dates back to 1931, when a direct current of 350 mA was delivered through a needle with a 10mm uninsulated tip placed in through Gasserian ganglion for management of trigeminal neuralgia. Later it was replaced by high frequency electric current to control the size of lesioning. Since such high frequencies(300-500 KHz) were also used in radio transmitters, the current was called radio frequency (RF) current. Its popularity waxed and waned over time till the discovery of more sophisticated machines which delivered more precise lesions with newer electrode designs and better temperature settings. Pain coming from irritated facet joint in the back, or genicular nerves of knee, sacro-iliac joints, shoulder joint are treated with radio frequency ablation.

Neuromodulation – Electrical stimulation may not be new to pain management. The natural electrical phenomena have fascinated humans since a couple of millenniums. The electrical discharges produced by the torpedo fish were highly appreciated among ancient physicians like Hippocratues, Scribonius Largus and Galen and were prescribed for headache, gout, and prolapsed anus.[4] After the publication of Gate Control Theory in 1965, there was a renewed interest in electrical stimulation resulting in today's neuromodulators and neuroprostheses. Stimulation of peripheral field, peripheral nerve, spinal cord , dorsal root , similarly deep brain stimulation and motor cortex stimulation all can be used for controlling pain. Commonest indications for neuromodulation are failed back surgery syndromes, Chronic regional pain syndromes I and II(CRPS), phantom limb pain, neuralgias, atypical facial pains . Most of the stimulation techniques offer 40-50% pain relief with a great variability among patients . Infection at the site, hematoma, hardware failure etc. have been reported. [5]

The choice of treatment usually depends upon the chronic pain aetiology and pain intensity. Severe neuralgias and neuropathies usually respond to spinal cord stimulation while moderate chronic fibromyalgias respond well to pulsed RF.

Prolotherapy and Platelet Rich Plasma (PRP) –While PRP therapy involves injection of patient's own plasma, prolotherapy consists of injecting an irritant solution typically dextrose and other substances in the inflamed painful tendon/muscle/joint. Growth factors are supposed to promote healing in the connective tissue. They are present in the plasma or triggered by irritants like dextrose.

Percutaneous procedures-

As we see huge change in the way newer minimally invasive surgeries being performed in different specialties, pain management also has its share of such newer advanced techniques.

Inventions of high frequency digital machines (fluoroscopes, ultrasound machines), radiofrequency machines with newer technology like cooled RF, CRYO machines etc. have lead to innovative percutaneous minimally invasive surgical procedures like

A. Spine -

1. Cooled RF Biaculoplasty for disc herniation

2. Nucleoplasty discectomy for disc herniation
3. Percutaneous Disc - Fx discectomy for disc herniation
4. Endoscopic Disc decompression, foraminoplasties, fixation techniques – Transforaminal and interlaminar techniques
5. Percutaneous Vertebroplasty and Kyphoplasty for vertebral compression fractures

B. Other body parts -

1. SI joint – Cooled RF ablation , Sacroplasty for Sacral fractures
2. Hip joint - Cooled RF ablation, Femoroplasty for metastatic femoral neck fractures
3. Shoulder joint – Cooled RF ablation
4. Knee Joint - Cooled RF ablation

The advantages of these procedures are they are done as day care procedures with minimal anaesthesia, they cause less pain and side effects, allow quick recovery, early discharges hence less burden on the healthcare system and higher patient and doctor satisfaction.

Stress management - Like Dennis Turk, professor of Anaesthesiology and Pain research at the University of Washington School of Medicine has joked "The reign of pain falls mainly in the brain " , it is important to understand how people make sense out of noxious stimuli in brain. A host of factors including psychosocial factors can change perception of pain. Stress can intensify this perception. Relaxation techniques including deep breathing, progressive muscle relaxation, meditation, visualization, massage, yoga, Tai chi, spirituality , are all practices proven to be helpful.

Thus, it is important to consider pathophysiology of pain, pain features, complexity of symptoms, presence of comorbidities and the social context when one approaches to treat chronic pain.

More recently, Cuomo et al. proposed the so-called 'multimodal trolley approach', which gives importance to the physical, psychological, and emotional causes of pain and suggested more personalized therapy. [6]

To summarize, different modalities given above are 'drawers' of the trolley and can be used according to the clinical needs and skills of the operator and as per available resources.

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Overview of Transfusion Transmissible Infections and Recent Advances in Screening Methodology in BARC Hospital Blood Centre

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History of blood transfusion services and Transfusion Transmitted Infections (TTI)

Blood transfusion is an integral part of the medical and surgical management of patients. It is a vital component of any health care delivery system. [1] In 1628 circulation of blood was discovered by the renowned English physician William Harvey. The first blood bank of the world was established in Leningrad in 1932. [1] Voluntary blood donation initiative was started in India during the time of World War II in 1942 when the first blood bank was established in Kolkata, West Bengal. [2] In 1954, Mrs. Leela Moolgaokar initiated voluntary blood donation drives in Bombay (now Mumbai). [2] Earlier most of the blood transfused was whole blood, later whole blood was separated into its various components such as RBCs, platelets and plasma.

Blood–borne infectious agents can be potentially transmitted through transfusion of blood and blood products donated by apparently healthy and asymptomatic donors and this has been one of the major concerns throughout the history of transfusion medicine. [3] In 1940s, syphilis screening in donated blood was introduced. In early 1970s, other blood-borne infections like viral hepatitis came into limelight. [1] This was followed by the Human Immunodeficiency Virus (HIV) in 1980s and hepatitis C in the mid-90s. [3] The magnitude of TTI is proportional to the prevalence of the infection in the donor community. [4] India has a huge burden of patient population requiring multiple transfusions. As per the National AIDS Control Organization (NACO), there is a requirement of 8.5-9 million units of blood in our country annually. [5] The known TTI in South East Asia are HBV, HIV, Syphilis, HCV, Malaria, Hepatitis A, Hepatitis G, Epstein Barr Virus, Cytomegalo Virus (CMV), Parvo virus B-19, Human T Lymphocytic Virus (HTLV-1 and HTLV-2)

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and bacterial infections . [4]NACO recommends the testing of 5 TTI namely HIV, HBV, HCV, Malaria and Syphilis [6]. The National Blood Policy (2002) and an Action Plan for Blood Safety (2003) were adopted by the Government of India to ensure adequate availability of safe blood. [2]

Testing for TTI

The risk of TTI is 1% per transfusion. [1] Testing for TTI not only improves the safety of blood but it also serves a critical public health function of identifying individuals who are asymptomatically infected who can seek early treatment and prevent secondary transmission. [2] Two aspects of preventing TTI are pre-donation screening of donors and post donation testing and modification of blood. [4] Strict donor selection criteria and screening procedures ensures that only healthy individuals donate blood. [4] The emphasis should be given in raising awareness among people towards voluntary blood donations. [4] Each unit of blood is screened for 5 TTI namely HIV, HBV, HCV, Malaria and Syphilis.

HIV

After first, second and third generation ELISA, currently fourth generation ELISA is used as a screening test for HIV which detects not only antibodies to HIV but also p24 antigen. This has reduced the window period to 15-18 days. The use of Chemiluminescence Immuno Assay (CLIA) has

further reduced the window period to 11-15 days. [6]

HBV

HBsAg screening has been part of blood screening since 1972. Use of CLIA and 4th Generation ELISA has reduced the transmission of HBV. [6] HBV positivity is the predominant TTI observed among the donors . [7]

HCV

3rd generation HCV ELISA kits detect the antibodies which appear after more than a month of infection. The available 4th generation ELISA kits detects both the capsid antigen and the antibodies and reduce the window period to 20-25 days. [6]

Malaria

Thick and thin peripheral smear examination of blood is considered the gold standard for malaria diagnosis but is quite labor-intensive. Non microscopic malaria Rapid Detection Tests (RDT) based on the detection of malaria parasite antigen in whole blood are introduced recently.

Syphilis

Rapid Plasma Reagin (RPR) test is used for screening syphilis. Confirmatory tests Treponema pallidum Haemagglutination assay or CLIA which detects both IgG and IgM antibodies to Treponema pallidum are routinely used . [6]

There is a decrease in prevalence of transfusion transmitted infections due to rigorous donor screening and is comparatively lower than observed 30 years back in our country. [6] However the problems of 'window period', false-negative results, prevalence of asymptomatic carriers, genetic variability in viral strains and technical errors remains.[8] Post transfusion hepatitis B and C is a major problem in India because of low viral load and mutant strains undetectable by routine ELISA. [4] Employing better screening technologies such as Nucleic Acid Testing (NAT) can overcome these issues. [4] Hence, the dual screening strategy of serology and NAT adds to the further safety of blood . [7]

Individual Donation (ID)-NAT

The ID-NAT assay constitutes three steps which take place in a single tube. The three steps are: sample preparation, HIV-RNA, HCV RNA and HBV DNA target amplification by transcription mediated amplification and detection of the amplicon by hybridization protection assay (HPA). A dual kinetic assay enables to differentiate between the signals of the internal control and combined HIV-1/HBV/HCV signals. The initial reactive samples are further discriminated utilizing specific probe that help differentiating the specific viruses. ID-NAT reduces the window period to an average of 5, 7 and 15.8 days for HIV, HCV and HBV, respectively. [7]

Pathogen Inactivation

The concept of pathogen inactivation in blood components is to eliminate the risk of known and unknown pathogens. Removal of leucocytes from various blood products has also been shown useful for prevention of transmission of leukotropic viruses such as HTLV, EBV and CMV [5]. Some countries use methylene blue, solvent detergent plasma and exposure of Ultraviolet A (UV-A) radiation for pathogen inactivation . [6]

Prevalence of TTI in India

The prevalence of TTI among the Indian population is seen to be ranging as HBV - 0.66% to 12%, HCV- 0.5% to 1.5%, HIV - 0.084% to 3.87%, Syphilis 0.85% to 3% and Malaria 0% respectively. [9]

Overview of TTI at BARC Blood Centre

BARC Hospital blood Centre follows stringent donor selection criteria, detailed donor history and deferral of unfit donors. Serological screening of donor's blood for TTI reactivity is done using latest and highly sensitive assays. Along with serology, ID-NAT has been recently introduced to enhance safety. In addition, leukocyte reduction methods are used before the transfusion to minimize leukotropic viruses like HTLV, CMV. Following chart shows the prevalence seroreactivity for TTI in BARC Blood Centre from year 2014 (Fig 1).

Overall our blood centre has the prevalence of HIV as 0.001 and 0.002 for HBV, HCV, syphilis and 0 for malaria. These are significantly lower than elsewhere in the population. This is due to rigorous donor screening, introduction of sensitive and newer molecular detection techniques like ID-NAT.

Conclusion

Selection of appropriate donors and usage of best available screening tests help in ensuring the safety of blood, the “liquid gold”. [3] There is constant increase in emerging viral, bacterial and parasitic agents that are transmitted by transfusion. Newer strategies are to be adopted in order to minimize transfusion transmitted infections and provide safer blood product. [6]

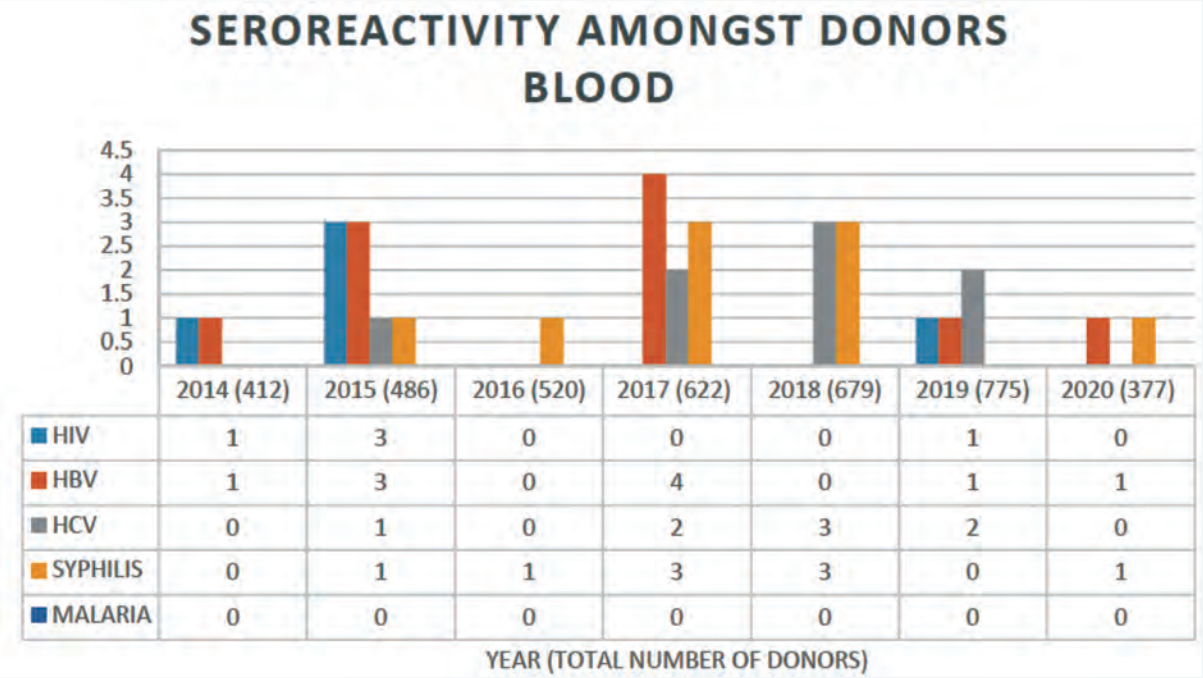

Fig. 1: Seroreactivity amongst donors blood

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Recent Advances in Orthopaedics

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Orthopaedic surgery is a diverse specialty comprised of multiple subspecialties focused on anatomic areas or pathologic processes (degenerative disease, developmental or trauma). Although the origin of Orthopaedic surgery stem from treatment of children affected by polio, a tremendous portion of Orthopaedic surgery throughout the world today involves the treatment of injuries to the bones, joints and surrounding tissues of the musculoskeletal system. Orthopaedic surgery has advanced significantly over the last 75 years, with massive strides in the understanding of injury and the techniques to successfully return these patients to a functional level of living. It is now estimated that up to 80% of orthopaedic procedures are amenable to the outpatient setting and many orthopaedic practices have sophisticated imaging capabilities in their office and surgery centers. Over the last several years, number of orthopaedic procedures done in standard in-patients setting have transitioned to out-patient procedure done in one single day.[1] The shortened recovery and associated disability with less invasive and more stable and rigid fixation have allowed patients to be more functional sooner, and reduced the morbidity of some of the previous approaches

In this article we will discuss important advancements in the field of Orthopaedic over the last 75 years. Perhaps most important change in Orthopaedic practice is shift towards subspecialty practice such as Trauma, General Orthopaedic, Arthroplasty, Arthroscopy etc. which enabled Orthopaedic surgeons to understand intricacies and develop newer methods for early and maximum functional recovery. Following are major advances in field of Orthopaedics in last few years :

1. General Orthopaedics

Understanding biology of fracture healing enabled Orthopaedicians to modulate fracture healing through various techniques such as

- Ultrasound
- Electrical stimulation

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- Extracorporeal Shock Wave Therapy (ESWT)
- Mechanical stimulation e.g., distraction histogenesis and controlled axial micromotion
- Biological methods like Bone graft substitutes, Bone Morphogenic Proteins (BMP), Platelet rich plasma, Prostaglandins and fibronectins
- Gene therapy in fracture healing[2]: Advances in molecular biology have improved our understanding of the complex chemical mediators like identification Bone morphogenic proteins, transforming growth factor β, insulin-like growth factor II and platelet derived growth factor which are responsible for the healing cascade. Manipulation of these mediators has the potential to enhance fracture healing and accelerate recovery.

This has made non-union a rare occurrence. In cases of nonunion bone banking has become a reliable and efficient source of bone graft for managing the case.

Development of newer drugs and biologicals for aggressive treatment of metabolic bone disorders e.g. Bisphosphonates/ recombinant parathyroid hormone/ Denosumab etc. for osteoporosis have enabled us to have anabolic bone building drugs to reverse osteoporosis to some extent.

Understanding in infection/ microbiological methods for isolation, identification and biology of bacterial infections has reduced incidence of Osteomyelitis. Bone infection which was nightmare for any orthopaedic surgeon is now

dealt more easily with newer class of antibiotics, improvement in timing and duration of perioperative antibiotics. Improvement in antibiotic delivery systems such as polymethylmethacrylate(PMMA) antibiotic beads, Biodegradable antibiotics and Negative Pressure Wound Therapy (NPWT) have changed the way we used to tackle Orthopaedic infections.

Development of newer materials and manufacturing techniques for orthotic and prosthetic devices have enabled us to mobilize post-operative or differently able individuals. [3]

2. Orthopaedic Trauma

- Flexible nailing of long bone fractures: Femoral fractures in children have traditionally been treated with traction, Hip Spica are now managed with titanium flexible nailing allowing early mobilization.

- Treatment of Mangled Extremities: The use of External fixators, ring fixators, vacuum-assisted devices in the treatment of severe soft tissue trauma has dramatically decreased the morbidity of the treatment of these injuries. Improvements in the surgical and pharmacologic care of these injuries have resulted in lower rates of infection and other complications.

- Pelvic and Acetabular Fractures: Pelvic and acetabular fractures are associated with severe morbidity and mortality. Advancements from open repair of these fractures to minimally invasive techniques have resulted in faster returns to work and decreased morbidity for these badly injured patients.

- ·Damage Control Orthopaedic Surgery: [4]Carefully timed and tactical emergent treatment of femoral and pelvic fractures, compartment syndromes and mangled extremities help optimize the patient's condition during the critical hours after injury. After the patients have stabilized, we then return to surgery to anatomically reduce and stabilize articular fractures and accomplish definitive stabilization.

- Nailing: Introduction of locked intramedullary nailing of long bones fractures of tibia, femur and even humerus has permitted small incisions, decreased operating time and blood loss, maintenance of rotational stability and bone length, preservation of endosteal bone and periosteal blood supply, facilitation of care to soft tissue and neurovascular injuries, early mobility and range of joint motion.

- Imaging: Advent of Digital X rays from Conventional ones has improved efficiency. Portable X ray machines have significantly helped reduced morbidity in fracture patients. C-arm has become an indispensable tool when doing fracture surgery by significantly reducing operative time and cutting costs. 3D-CT and MRI over last 20 years have become indispensable tools for fracture treatment planning in complex fractures. Nowadays 3D Printing is available for planning surgery of complex fractures.

- Minimally Invasive fixation: Treatment of certain fractures have changed from open reduction to minimally invasive techniques by helping preserve the biology of fracture thus resulting in early fracture healing.

- Implant Designs: Use of simple plates to locking plates , Plates with variable angled screws, for intra-articular fractures, Pre contoured plates according to the shape of bone to self-tapping screws have significantly made operating easier and reduce the surgery time.

- Development of newer techniques: Membrane induced osteogenesis, ring fixators, spatial frames for managing wide bone defects etc. [5]

3. Arthroscopy

Arthroscopy is a technique of visualizing joint through small scope which enables surgeon to accurately see the anatomy, pathology and to treat pathologies through small incisions. The arthroscope was initially developed to visualize the diseased knee joint. The direct viewing arthroscope of history was eventually replaced by the modern-day arthroscope with camera system and dedicated light source. The practice of arthroscopy in India started in 1980s. Despite well-established orthopedic surgical practices in India, arthroscopy as a specialized form of surgery was not uniformly developed till the late 20th century and even today specialized work is only being done in urban areas. Economic constraints, initial lack of exposure to this specialized surgical technology and a relatively longer learning curve were the major factors for delay in establishing arthroscopy. Even today, the average orthopedic surgeon does not practice arthroscopy as an outline procedure and most who do are comfortable with knee arthroscopy only. Areas like the shoulder arthroscopy are still picking up, while ankle, elbow, and hip arthroscopy are performed in selected niche centers.

However, in last 20-30 years practice of arthroscopy has evolved as number of conditions can now be safely

managed by Arthroscopy. The initial crude instrumentation has been replaced by fine, ergonomic accurate and smaller handheld instruments. Nowadays we get specialized instruments such as all inside meniscal repair device, first pass suture passer, angled jigs, specialized drills, arthroscopic shaver etc. which have greatly simplified surgical steps and reduced overall OT time. Advent of 3 Chip Camera, HD resolution, fiber-optic light source, equipments to control joint bleeding such as fluid pumps as well as advances in hypotensive anesthesia has given greater clarity of images and better delineation of abnormal and hard to reach areas inside joint. Last decade also saw technical advances in implants and materials used for arthroscopic surgeries. Bio-absorbable screws, titanium implants, radiolucent PEEK material, bioactive anchors and high tensile, virtually non-breakable ultra-high molecular weight PE sutures have reduced implants and material related complications less frequent. [6]

Commonly treated pathologies by arthroscopy nowadays include and not limited to

- Knee injuries ligament tears repairs and reconstructions
- Intra-articular fracture treatment arthroscopic repair and arthroscopy assisted repair.
- Knee cartilage injuries/ degeneration and pathologies. Repair and regeneration of cartilage (osteo-biologics)
- Knee meniscal injuries repair, meniscus replacement
- Removal of loose bodies, biopsy and treatment of synovial pathologies
- Study of patellofemoral dynamics, treatment of altered patellofemoral kinematics
- Treatment of recurrent dislocations of patella
- Arthroscopic excision of cyst and bursae in and around knee joint
- Treatment of Rotator cuff tears, subacromial impingement syndrome
- Treatment of intraarticular shoulder fractures, tuberosity fractures
- Treatment of labral pathologies of shoulder
- Biceps tendon pathologies and treatment
- Treatment of recurrent dislocations of shoulder
- Treatment of stiff shoulder
- Release of suprascapular nerve impingement
- Treatment of osteochondritis dissecans of various joints
- Intraarticular fractures of distal radius
- TFCC (Triangular fibrocartilage complex) injuries
- Ganglion excision
- Carpal tunnel release
- Subtalar arthrocscopy , and assisted arthrodesis

More and more number of orthopaedic conditions can now be treated by arthroscopy and it is benefitting patients in form of smaller incisions, immediate post op recovery and lesser incidence of post op infections.

4. Arthroplasty

Evolution of Joint Replacements (Arthroplasty) in Orthopaedics: The original intent of joint replacement was to restore motion in an ankylosed (fused) joint. This concept was later expanded to restore the functional integrity and power of the joint. Understanding concept of joint biomechanics and several components such as joint kinematics, muscle activations, joint movements, muscle forces, ground reaction forces, and joint reaction forces have increased longevity of implants and maximized functional output Hip replacement (Fig.1).

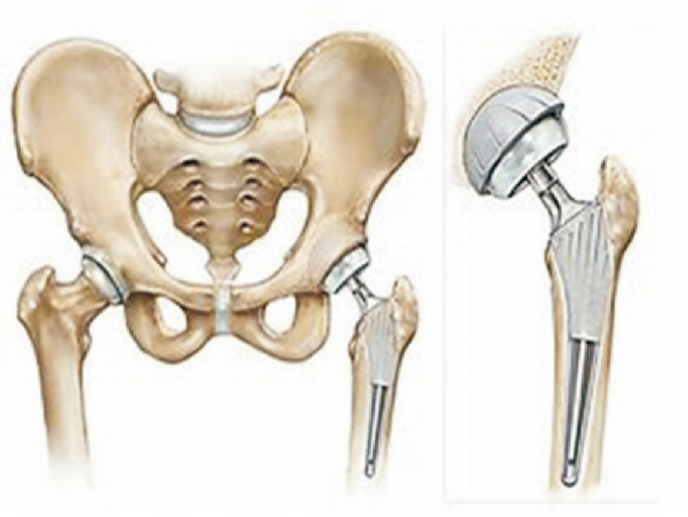

Fig.1 Hip prosthesis

Hip Arthroplasty has underwent various changes over last 75 years with simple unipolar prosthesis by Frederick R. Thompson and Austin T. Moore in the 1950s to a bipolar prosthesis and the modern frictionless arthroplasty by Sir John Charnley. Modern prostheses use special bearing surfaces such as ceramic on ceramic, metal on polyethylene

giving these prostheses a long life ranging from 12- 18 years Knee Replacement (Fig.2).

Beginning in 1950, replacement prostheses for the tibial

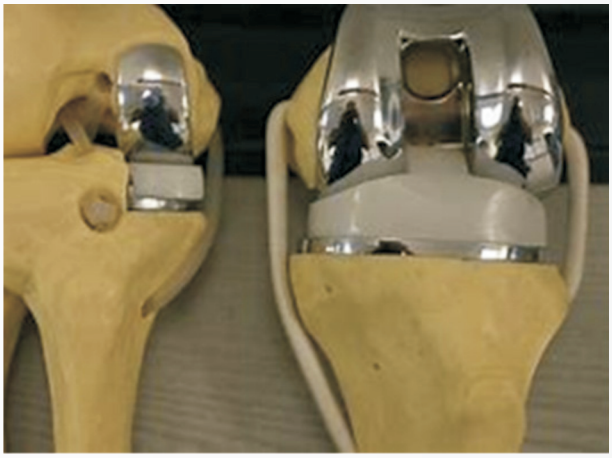

Fig.2 Knee prosthesis

plateaus were described by DePalma (1954), McKeever (1955), MacIntosh (1958), and Townley (1964) in North America. The tibial plateau replacements consisted of a unicondylar or bicondylar vitallium plate fixed in place either by a flange (McKeever), screws (Townley), or surface irregularities (MacIntosh). Knee replacement surgery evolved from total condylar to unicondylar or partial knee replacement where only the arthritic surface is replaced with component, depending on the patient arthritis profile.

Newer advances in Knee arthroplasty such as Computer aided arthroplasty to Robotic Knee Arthroplasty in recent years Shoulder Replacement (Fig.3).

Fig .3 Shoulder prosthesis

Shoulder replacement surgery was first performed in the United States in the 1950s to treat severe shoulder fractures. Shoulder joint replacement has come to be used for many other painful conditions of the shoulder, such as different forms of arthritis. The treatment options are either replacement of just the head of the humerus bone (ball), or replacement of both the ball and the socket (glenoid).

Fig.4 Elbow prosthesis

Elbow replacement (Fig.4).

Elbow arthroplasty was borne out of the failures of non-replacement surgeries to effectively treat articular and periarticular pathologies. The basic requirement for normal elbow function is a pain-free, mobile, and stable articulation. The modern era of total elbow replacement

Fig.5 Ankle prosthesis

was initiated in 1972 when Dee implanted a cemented hinged replacement Ankle replacement (Fig. 5).

Ankle replacement prosthesis are of two types – constrained and unconstrained. Constrained implants (Coaxial and Mayo designs) provide greater stability with reduced range of motion (ROM) whereas unconstrained

Fig.6 Wrist prosthesis

implants (Waugh/Irvine, Smith and Newton Prosthesis) provide greater degree of range of motion across all planes thus compromising on stability Wrist replacement (Fig.6).

Fig.7 MCP prosthesis

Wrist joint replacement surgery has emerged for patients with severe wrist arthritis with low functional demands in place of wrist fusion surgery which was done earlier MetaCarpo Phalangeal (MCP) joint replacement (Fig.7).

The earliest MCP joint replacement was done by Shaw in 1920 and Fowler and Pratt in 1940s. Pioneering work of Albert Swanson in 1966 lead to the development of silicon spacers and later silastic implants.

5. Paediatric Orthopaedics

The field of paediatric orthopaedics has undergone a remarkable transformation over the years. Today, medical and surgical advances afford children with severe orthopaedic problems a quality of life far out of reach for past generations. The field started to gain ground as a major subspecialty in the early 1990s.

- Cerebral Palsy: Advances made in its medical management including the use of Botulinum toxin, intrathecal baclofen therapy and selective dorsal rhizotomy. The surgical treatment strategy has evolved and focuses on single-event–multilevel surgery.
- Clubfoot or Congenital Talipes Equinovarus: It is a fairly common congenital condition which causes (preventable), lifelong deformity. Ponseti's technique of serial plaster correction of club foot is now a well-accepted and successful method for most idiopathic clubfeet.
- Developmental dysplasia of hip: Screening strategies, diagnostic ultrasound, and Pavlik harness are routinely used for the newborn. Closed reduction and cast or brace is used in infants who fail initial treatment or present late. Open hip reduction, is now considered to be the treatment of choice for hips irreducible by closed methods.
- Scoliosis: Improved surgical techniques, involving both anterior and posterior approaches to the spinal column, are now practiced. Use of magnetically controlled growing rods for early-onset scoliosis.
- Bone Tumors: Recent advances in diagnosis include the use of MRI Scan, PET scan and Biopsy. The surgical treatment includes limb salvage surgery like endoprosthetic replacement and alloprosthetic composite. Use of chemotherapy aimed at dealing with the microscopic metastatic spread has resulted in a spectacular prognostic improvement.

6. Spine

From wide open, extensive and crude spine surgery, there has been an evolution of modern spine surgery into a cosmetic and minimal access surgery. There has been development of regional, national as well as international associations dedicated to nurture training and proficiency of novel techniques in spine surgery e.g. Association of Spine Surgeons of India (ASSI). For the most common osteoporotic spinal compression fractures, kyphoplasty and vertebroplasty have become the front line outpatient basis interventional spine surgeries with the arrival of C-arm, O-arm (which gives lesser radiation and capable of 3-dimensional images)and bone cement(PMMA). From sub-

laminar wiring of past era, spine surgery today is much safer as it relies mainly on advanced pedicle screw and rod construct along with cages of Poly Ethyl Ether Ketone (PEEK), titanium mesh with expansion quality especially in trauma, degenerative, inflammatory as well as tumor reconstructive spine surgery along with application of navigation and neuro-monitoring. From ordinary scalpel to ultrasonic scalpel and bone substitutes like BMP and allografts from dedicated Bone Banks, spine surgery has become a day care surgery for discectomy, laminotomy and laminectomy etc. with patient enjoying shower in next 48hours post-spine surgery. There has been continuous research and development with steep learning curve for novel motion sparing spine surgeries like interspinous spacers, artificial disc replacement surgery etc. In Scoliosis particularly in pediatric patients, just like in trauma surgery using titanium elastic nail, there has been application of magnet based growing rod technique that involves implantation in operation theatre but rod lengthening in outpatient basis. There has been enhanced application of Light Amplification by Stimulated Emission of Radiation (LASER), ozone, endoscope, microscope and robotics in modern spine surgery based on customized instrumentation that facilitates reduced hospital stay of the patient along with decreased morbidity, quicker rehabilitation and ultimately increased productive functional output of manpower of organizations. [7]

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Cytogenetics: A Journey from Microscope to Microchips

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Genetic disorders are one of the major reasons for recurrent pregnancy loss, congenital malformations, intellectual disability, growth retardation, cancers and many more. They are caused by abnormalities in the chromosomes. Cytogenetics is the study of diseases caused by structural and numerical abnormalities of the chromosomes. Normal human karyotype comprises of 46 chromosomes or 23 pairs, of which 22 pair of chromosomes are autosomes and 2 sex chromosomes (X and Y). Autosomes are responsible for functions other than sex determination. They are numbered according to size.

Conventional cytogenetics initially comprised of G-banded karyotyping for disease identification (Fig1). It involves culturing of cells, harvesting chromosomes from them, preparing and staining of slides and finally visualizing under a microscope. It can detect numerical aberration(aneuploidy), balanced(translocation between chromosomes without loss or gain of chromosomal material) and unbalanced(translocation between chromosomes having loss or gain of chromosomal material) translocations, inversions, deletion and duplication. Though it can detect the presence of marker (very small unclassifiable chromosome) chromosome, it

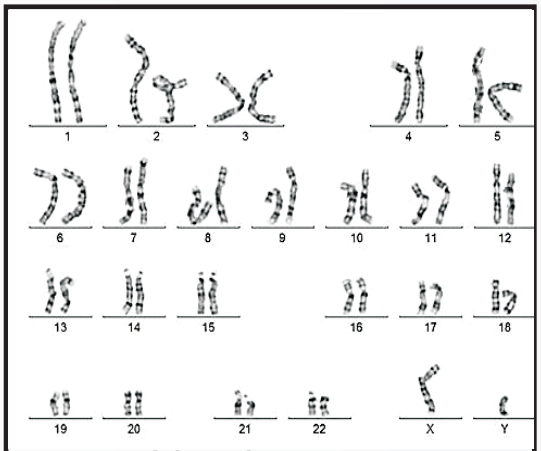

Fig.1 G-Banded normal Human Karyotype
Source : Cytogenetics and Molecular Genetics Lab, Pathology unit, BARCH

Smt. Shagufta Shaikh

cannot identify which chromosome it belongs to. A technique considered as the gold standard has some limitations too. It needs culturing of cells, skilled personnel, is labour intensive, lengthy and can be processed only in dividing cells. Karyotyping cannot detect aberrations less than 4-5Mb in size. Albeit there are some improvement in size limit by harvesting chromosomes at an earlier stage of cell cycle, but the diagnostic yield remains 3-10%.

A technique which could overcome these limitation was the need of the hour and Cytogenetics entered the molecular era with the introduction of Fluorescence In Situ Hybridization (FISH) (Fig2).

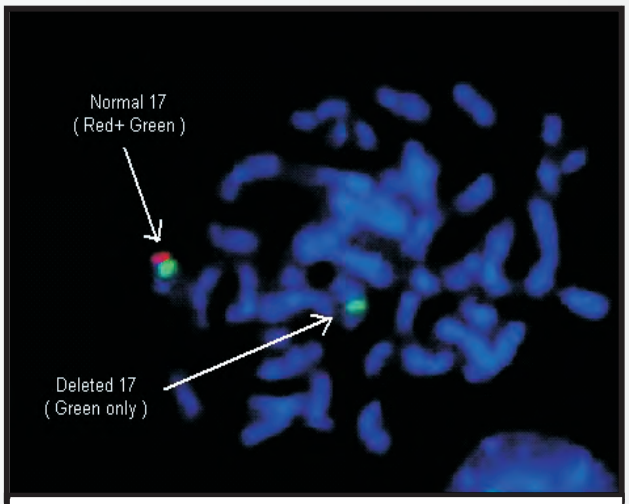

Fig.2 Fluorescence In Situ Hybridization
Source :GáborMéhes PMID: 16388316 DOI: 10.1007/BF02893852

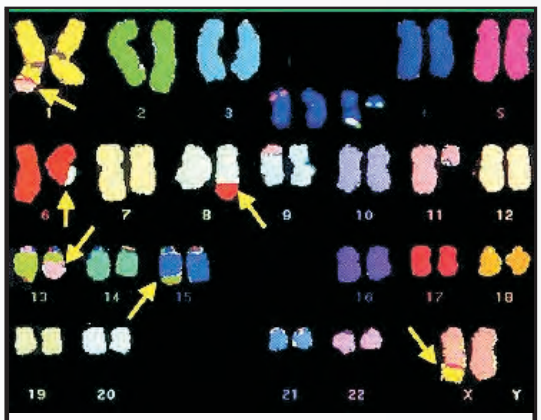

Fig.3 Spectral Karyotyping or M -FISH
Source : Jalal et al. Br J Haematol 2001; 112:975

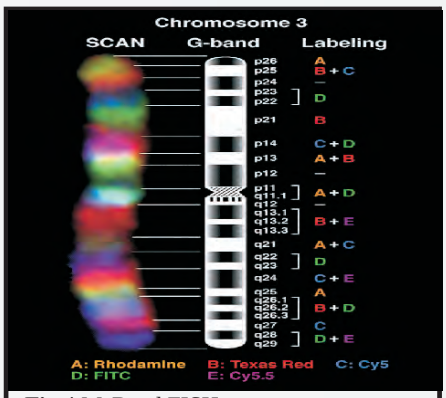

Fig.4 M-Band FISH
Source : Multicolor banding technique, spectral color banding (SCAN): new development and applications, N..Kakazu,Cytogenetic and Genome Research, 2006;114(3-4):250-6

It was originally introduced by Gall & Pardue, in 1969, wherein they used radio labelled probes to identify a specific region on the chromosome. Probe is a single-stranded sequence of DNA or RNA used to search for its complementary sequence on the chromosome. Later in 1977, these radioactive probes were replaced by fluorescent probes for greater safety, stability and ease of detection. FISH is used to detect chromosomal aberration in a suspected region of the chromosome or DNA. Fluorescent probes are designed complementary to sequence of DNA bases in that region, hence a prior knowledge of the sequence of bases in that region is a must. The probes are allowed to bind (hybridize) to that region. When seen under a fluorescent microscope, presence of that region is indicated by a fluorescent signal whereas no signal means absence of that region. Using this feature, deletion, duplication, translocation and even inversion can be detected. The advantage of this technique over karyotyping is that it can detect aberrations of smaller size, is less time consuming, does not need dividing cells, can be done on an interphase cell too. The size detection limit for FISH is 100-500 kb for Interphase cell and 2Mb for Metaphase chromosomes. The disadvantage is that prior knowledge of the suspected location is a must.

Using FISH as the base, many other techniques were devised. Spectral Karyotyping (SKY) or Multi colour FISH(M-FISH) was introduced. Both techniques are quite similar except in their detection system. SKY uses an interferometer attached to an epifluorescence microscope for detection whereas in M-FISH, the images are captured by band-pass filter sets in a fluorescent microscope. Five different coloured fluorophores (fluorescent molecule) are mixed in various combination to make probes for 23 pairs of chromosomes. These chromosomes when viewed using a detection system appear to have a unique colour.

Since each chromosome has a unique colour, complex chromosomal re-arrangements can be detected by the presence of another colour on a particular chromosome (Fig3).

Complex rearrangements frequently seen in cases of leukaemia, cannot be resolved by G-banded Karyotyping, but can be identified with this technique. Also, based on the colour of marker chromosome, it can be evaluated which chromosome it belongs to. Although it can detect only gross changes, but the advantage of this technique is that prior knowledge of the location, suspected to be abnormal is not needed. M-Band FISH is another type of FISH. It is used to identify chromosome band specific changes. Chromosomes are hybridized with band specific fluorescent probes. These probes have unique colour for each band. Any changes in the band position (deletion or duplication or inversions) can be identified based on the changes in colour pattern (Fig4)

Many other types of FISH techniques have been devised for detection of specific requirement.

Introduction of FISH to Conventional cytogenetics has not only improved the diagnostic yield but has metamorphosed

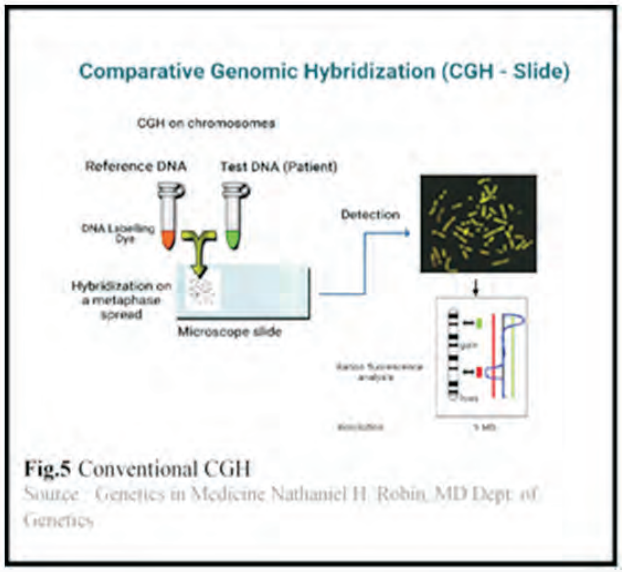

Fig.5 Conventional CGH
Source : Genetics in Medicine Nathaniel H. Robin, MD Dept. of Genetics

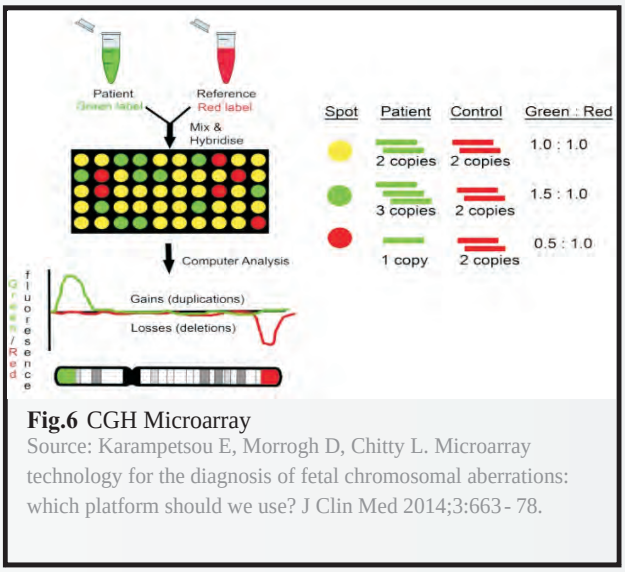

Fig.6 CGH Microarray
Source: Karampetsou E, Morrogh D, Chitty L. Microarray technology for the diagnosis of fetal chromosomal aberrations: which platform should we use? J Clin Med 2014;3:663 - 78.

cytogenetics into a colourful world of genetics.

In attempt to make this technique better, another variation of FISH methodology was introduced. It was Comparative Genomic Hybridization (CGH) and was devised by Kallioniemi et al. in 1992. As the name suggests, it compares the patient's genome with a reference genome to identify the gains and losses in it. The patient's DNA is labelled in one colour and control DNA in another colour. Both are mixed and hybridized to normal metaphases on to a slide and the ratio of the two colours is determined along the length of each chromosome. When viewed under fluorescent microscope, gains or duplications are recognized by the predominance of the subject DNA colour in that region, whereas deletions or losses are revealed by the predominance of the control DNA colour in that region (Fig 5).

The advantage of this technique over karyotyping and FISH is that it has the best of both techniques. It can detect smaller aberration like FISH and gives an overview of the whole genome like karyotyping. Use of microscope for visualization is itself a size limiting factor for identification of very small aberrations, it's time-consuming, and it cannot detect inversions as well as balanced translocations.

However to overcome the aforementioned limitations, Schena et al. in 1995, combined the principles of traditional CGH with microarray. Later researchers used oligonucleotides (small fragments of artificially synthesized DNA) to immobilize on the microarray slides.

DNA microarrays are microscope slides that are printed robotically with lakhs of tiny spots. Each spot has a defined position containing a known DNA sequence or gene. Often, these slides are referred to as Gene chips or DNA chips. The oligonucleotides attached to the slide act as probes for hybridization with a mixture of fragmented, fluorescently labelled patient and control DNA. Digital imaging systems, instead of microscope, are used to capture and quantify the relative fluorescent intensities emitted from the test and control DNA. Since the position of each spot and oligonucleotides are known, any abnormal fluorescent intensity in a region can be identified (Fig6). Data generated from these systems are then graphically visualized through dedicated software. Use of small DNA fragments for hybridization helps in detection of sub-microscopic aberrations. A further refinement of CGH microarray is the addition of SNP (Single Nucleotide Polymorphism) probes. Mosaicism, parental origin, Absence of Heterozygosity (AOH) or consanguinity in addition to deletion and duplication (Copy Number Variation or CNV) can be identified using CGH-SNP array. AOH is indicative of similarity between the two homologous chromosomes. A defective gene present in AOH region will have loss of function giving rise to autosomal recessive disorders. Hence this techniques is important in detection of autosomal recessive disorders caused either due to consanguinity or Uni Parental Disomy (UPD) wherein both chromosomes inherited by the child are from single parent instead of both parents. The genes present in AOH

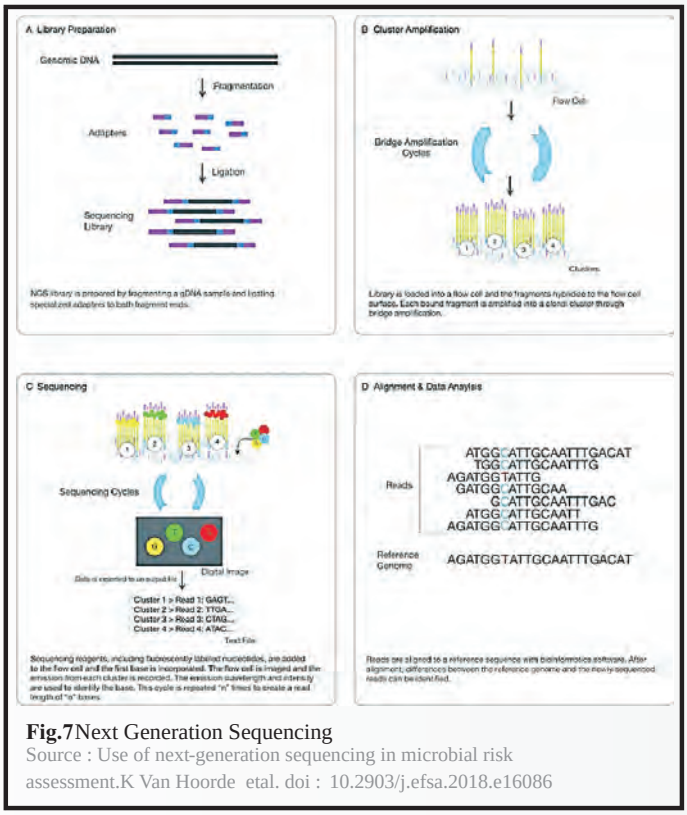

Fig.7 Next Generation Sequencing
Source : Use of next-generation sequencing in microbial risk assessment.K Van Hoorde etal. doi : 10.2903/j.efsa.2018.e16086

or CNV regions correlating with patient's phenotype can be studied further and confirmed for mutation. Average size detection limit is 5-10kb and 200 bp for high resolution micro array. Though the diagnostic yield for micro array has increased to 15-20 % but it cannot detect balanced translocation, inversions, low level mosaicism and single gene disorders.

For identification of single gene disorder, it is imperative to know the gene causing the disorder. Then comes, evaluation of the change in nucleotide (base) sequence of that gene and finally how the change might disrupt the gene functioning. Identification of nucleotide sequence can be done by Sanger Sequencing, devised by Frederick Sanger in 1975, for which he was awarded Nobel prize. Though Sanger Sequencing is still considered as the gold standard, but it cannot be used for sequencing of long genes and won't be cost effective.

Next Generation Sequencing (NGS) which is massive parallel high throughput sequencing, is the latest addition to the advances in molecular cytogenetics (Fig 7). This is the solution to sequencing of long genes. Apart for sequencing long single genes, it can sequence many genes or a DNA region or whole genome in one go and multiple times to increase the accuracy and confidence. It is cost effective and less time consuming. With the advent of NGS, each nucleotide change can be detected and hence single gene disorders like cystic fibrosis, Marfan syndrome, Huntington's disease can be genetically diagnosed. A list of genes are known to cause a particular disorders but identification of the causal gene from the list is challenging as in case of intellectual disability and Autism Spectrum disorder. Hence Targeted Gene Panel (TGP) like neurological gene panel, hearing loss gene panel, epilepsy panel etc. comprising of already known genes was introduced. Use of TGP reduces the cost and turnaround time. Also lesser amount of data is generated and is easier to handle. One disadvantage of TGP is that since it comprises of genes already known to cause the disorder, chances of missing novel genes are present. Clinical Exome comprising of nearly 8000 to 9000 genes was introduced for detection of various syndromes. Whole Exome Sequencing (WES), sequences the exons (protein coding regions) of all the genes (~28000) present in human genome while Whole Genome Sequencing (WGS) includes the introns (regulatory regions) along with exons of all the genes. WES and WGS generates huge amounts of data, hence a good knowledge of bioinformatics and high end computing systems are needed for data analysis. With NGS diagnostic yield has increased to 25-30%. With the invention of NGS rare genetic disorders which couldn't be identified using conventional cytogenetic methods can now be identified which aids in better patient management. Cancer genetics, Pre-implantation genetics, Non-invasive prenatal genetic testing, pharmacogenomics are some of the NGS application.

Conventional cytogenetics has matured into modern or present day cytogenetics due to the advances in molecular biology, bioinformatics and semiconductor technology. These newer techniques are imparting far more information at a higher resolution than just the chromosome number and morphology. It has become an indispensable tool for genetic studies. Entire dependence on microscope, cell culture dividing cells for analysis has been reduced. Truly, Cytogenetics has advanced from microscope to microchips.

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Interpretation of Fungal Growth from Samples Clinically Suspected of Post Coronavirus Disease Mucormycosis: Infection or Colonisation?

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Introduction

Invasive forms of fungal rhinosinusitis are usually caused by hyaline moulds like Aspergillus, Zygomycetes and Fusarium. [1] Invasive pulmonary aspergillosis is a known entity. Spores of these fungi pre-exist in the environment. They may colonise the nasal cavity while breathing due to their low virulence potential. Only when the immunity of the individual wanes, it may invade the paranasal sinuses and spread to adjacent organs like brain and eyes and to the lungs causing opportunistic infections. Covid-19 disease is an immunosuppressive state due to various reasons and cases of mucormycosis in patients infected with this disease are increasingly being reported. [2] Mucormycosis is a fungal infection associated with high mortality and is caused by fungi of the order Mucorales of phylum Zygomycetes. The common species causing this infection are Rhizopus and Mucor. [3] Rhino-cerebral-orbital and pulmonary are the two significant manifestations of mucormycosis in patients infected with Covid-19. [4] We share our experience regarding fungal growth from samples of two patients from similar backgrounds that we encountered in microbiology section of our institute.

Case 1

A 42 years old male patient, known case of juvenile diabetes mellitus on insulin, presented with expectorating cough since 4-5 days and was detected to be Covid-19 positive 2 weeks prior. HRCT chest showed consolidation plus cavitation in left lung. Sputum sample was detected to be positive for Acid Fast Bacilli (AFB) by Z-N stain and GeneXpert/MTB Rif was also positive for M. tuberculosis. Gram stain of the sample showed significant number of pus cells. KOH mount was negative for fungus. Fungal culture showed growth of green mould after 24 hours and in addition black woolly growth at the end of 48 hours. The growth was confirmed as Aspergillus flavus and Mucor species. He was put on anti-tuberculosis treatment and administered 13 doses of 250 mg each, liposomal amphotericin-B in a panel hospital followed by oral isavuconazole for 21 days. His clinical condition improved.

Dr. Sunayana Jangla

Case 2

An 81 years old male patient, known case of diabetes mellitus on anti-diabetic drug, presented with generalised weakness and difficulty in breathing. On current visit, he was detected to be Covid-19 positive and was shifted to panel hospital for further management. Post treatment, he was transferred back to our hospital and admitted to ICU in view of oxygen requirement and was given nasal oxygen. On examination, right nasal cavity showed crust adhered to septum near the Little's area and left nasal cavity showed crusting along middle turbinate. The crust from both nasal cavities was sent for fungal culture. Gram stain of the samples did not show pus cells. KOH mount of both samples was negative. Fungal culture showed growth of green mould after 24 hours and in addition black woolly growth at the end of 48 hours. The growth was confirmed as Aspergillus flavus and Mucor species. CT scan (plain) of paranasal sinus showed minimal submucosal thickening in right maxillary sinus without any evidence of erosion or areas of hyperdensity. So the growth was clinically considered to be a contaminant. Crusting in both nasal

cavities was seen again after two days and was again sent for fungal culture which showed the same growth. Antifungal treatment was not started. His clinical condition improved and few days later he was discharged. He has not presented again with similar complaints.

Discussion

Time between diagnosis of Covid-19 and symptoms of mucormycosis is 3-42 days as was seen in both cases. [5] Both patients were diabetic and had Covid-19 infection in recent past. Hence, clinical suspicion of mucormycosis was obvious in both.

Sputum sample of the first case had pus cells and sample grew two moulds. Patient was also symptomatic with radiological and other findings diagnostic of pulmonary tuberculosis, which could have added to his co-morbidities. Hence his antifungal treatment was justified as in this case the fungi were pathogenic.

The hallmark of mucor infection is tissue necrosis as seen by black discharge in the nasal cavity. [4] However, the crust sample received from second case did not show pus cells. There were neither symptoms suggestive of paranasal infection nor was CT scan indicative. So, in this context the fungal growth was probably colonisation of nasal cavity though the same fungi grew from repeat sample which was sent to rule out contamination. Biopsy is confirmatory but it was not sent as the sample was nasal crust. Microscopy (KOH mount) provides preliminary report and should always be followed by culture report. [3] In both cases, KOH mount was negative but culture was positive.

Key message

Mucormycosis is a fungal infection with high mortality and its increasing incidence is associated with Covid-19 affected or recovered patients. Not only Mucor but other fungi can also be involved or there can be dual infection in such settings. Type of sample plays a vital role in clinching the diagnosis and in cases where tissue involvement is suspected, tissue obtained via endoscopy or excision is preferred for laboratory examination. Negative KOH does not rule out fungus and culture can be positive inspite of negative KOH result. Hence culture should be awaited, when possible, especially for rapidly growing fungi. The same organism can present in different forms in different patients. In one it may be a pathogen causing infection while in the other it may be only a coloniser which is harmless in healthy individuals. Hence, interpretation of culture report should be done in context of clinical findings, presence of co-morbidities and radiological findings.

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Current Advances in Dental Imaging

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Introduction

The first original dental roentgenogram from a portion of a glass imaging plate was taken by Dr. Otto Walkhoff in January 1896 in his own mouth with an exposure time of 25 min.[1] Since then, dental imaging has seen tremendous progress and applications in various fields of dentistry. Changing from analogue to digital radiography has not only made the process simpler and faster but also made image storage, manipulation (brightness/contrast, image cropping, etc.) and retrieval, easier.

Broadly, imaging techniques used in dentistry can be categorized as: intra oral and extra-oral, analogue and digital, ionizing and non-ionizing imaging, and two-dimensional (2-D) and three-dimensional (3-D) imaging. This revolution is the result of both technologic innovation in image acquisition processes and development of networked computing systems for image retrieval and transmission.

- In digital radiography, the first intra-oral sensors were developed for use in dentistry by Trophy Radiologie (Vincennes, France), in 1980s Radio-Visio-Graphy (RVG)system, which produces radiographic image using a sensor with solid-state technology, breaking it into electronic pieces, displaying and storing the image using software in computer system. [2] The RVG system uses considerably reduced levels of radiation to produce an image immediately after exposure. Currently there are three types of digital radiography systems available for use in dental imaging:

- CCD-Charge-Coupled Device direct system
- CMOS-Complementary Metal Oxide Semiconductor direct system
- PSP-Photo-Stimulable Phosphor indirect system

One of the most commonly cited positive features of digital radiography is the radiation dose reduction (up to 80%, when compared with conventional plain film radiography). [3] It is estimated that the dose reduction for intra oral digital imaging is in the range of 50%-60% when compared

Dr. Julli Bajaj

to E-speed film and extra-oral digital imaging. [3] It allows manipulation of the image produced such as contrast, density, sharpness and image orientation, without any additional radiation exposure to the patient or the operator.

Intra oral radiographic examination is the backbone of imaging for the dental practitioner. It comprises of three categories:

- Periapical
- Occlusal projections
- Bitewing

Periapical radiograph

The intraoral periapical x-rays provides detailed information about the teeth and the surrounding tissues (Fig1). It is mainly utilized for assessment of pulp, roots and its supporting alveolar bone status in the inter-dental

Fig. 1: Periapical radiograph of lower anterior teeth showing radiolucency with loss of lamina dura

Fig. 2: Occlusal view showing impacted tooth

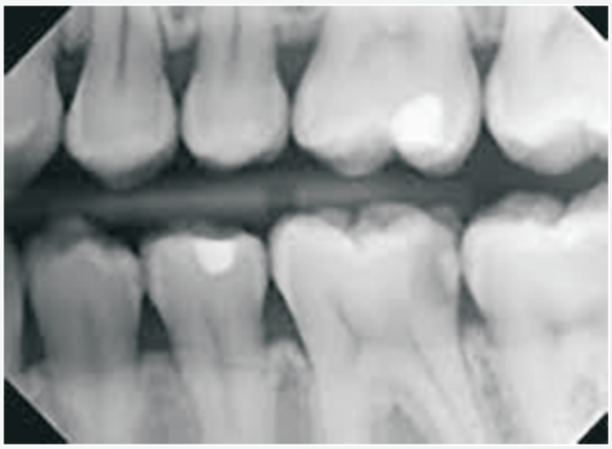

Fig. 3: Bitewing x-ray showing dental caries in interproximal area of tooth

region. It also aids in detection of periapical pathology, crown/root fractures etc. Radiation dose used is 0.001mSv.

Occlusal radiograph

It displays a large segment of a dental arch that cannot be viewed on a periapical radiograph, such as a cyst. It helps to locate supernumerary/impacted teeth and foreign bodies in the jaws and stones in the ducts of sub-mandibular glands (Fig 2).Radiation dose used is 0.007mSv.

Bitewing or inter-proximal radiographs

These are taken to evaluate inter-proximal surfaces of 3-4 upper and lower teeth simultaneously (Fig 3)and are particularly valuable for detecting inter-proximal caries in the early stages of development before it manifest clinically, reveal secondary caries below the restorations and evaluating the inter-proximal bone condition. Radiation dose used is 0.001mSv.

Extra-oral radiographic examination used in dentistry

- Panoramic radiographs or Ortho Pantomo Gram OPG
- Computed tomography CT
- Cone beam computed tomography CBCT

Extra-oral radiographs help to examine larger areas of the jaws and skull, monitor growth and development of cranio-facial skeleton, to locate impacted teeth and large pathological lesions and evaluate the temporo-mandibular joint.

Panoramic imaging OPG

Panoramic X-ray became a popular and important diagnostic tool since its introduction in the 1950s. It is a two- dimensional (2-D) dental x-ray examination that captures entire mouth in a single picture. It is a specialised tomographic technique used to produce a flat representation of the curved surfaces of the jaws. The basic imaging principle is that of curved surface tomography. It visualizes the entire maxilla, mandible, temporo-mandibular joints and associated structures on a single film, i.e., gives a panoramic or bird's eye view of the jaws (Fig 4). [4] It is used as a preliminary screening radiograph to assess the dentition and bone support, identify impacted teeth, view the position of dental implants etc. It also gives a

Fig. 4: OPG showing pathology involving mandibular left third molar

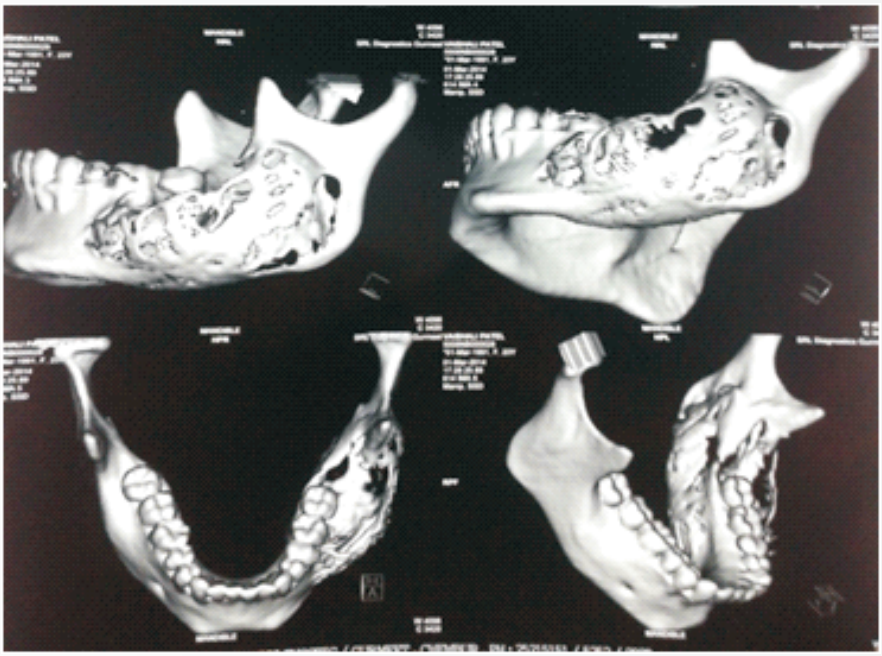

Fig. 5: CT scan shows multilocular, soap bubble appearance with buccal and lingual cortical bone expansion, case of ameloblastoma.

basic assessment of the osseous status of the temporo-mandibular joints, diagnoses maxillary and mandibular fractures. Panoramic radiographs are also being tested as a cost-effective tool to determine bone mineral density. [5,6] Panaromic x-ray offers a dose advantage over large numbers of intraoral radiographs. [7] Radiation dose used is 0.010mSv.

Limitation of panaromic radiograph

It is subject to considerable and unpredictable geometric distortion and has relatively low spatial resolution compared with intra-oral radiographs. Large differences in image projection may occur in the anterior region depending on the patient positioning and individual curvature of the jaws. Also, it does not display the fine anatomic details available on intra oral periapical radiograph.

Computed tomography (CT)

CT was the first technology to allow visualization of both hard and soft tissues of the facial bones by image processing enhancement and the ability to acquire multiple, non-superimposed cross-sectional images. CT scans were used in medicine since 1973 but it became available for dental application only in 1987.

Current CT scanners are called multi-slice CT scanners as they contain linear array of multiple detectors (up to 64 rows) that simultaneously acquires tomographic data at different slice locations. The benefits of it include decreased scan time, reduced artifacts, and improved resolution (up to 0.4 mm isotropic voxel). [9] It is considered the gold standard imaging technique to assess injuries of the maxillofacial skeleton region. It is an excellent tool for detecting complex facial fractures, like those involving the frontal sinus, naso-ethmoidal region, and the orbits. CT helps in defining the displacements of fractures prior to surgical reduction and fixation. It helps to diagnose undisplaced fractures of the mandible and the condyle, which are not apparent on panoramic radiographs.

Latest CT scanners, images with sectional thickness of 0.25 mm can be obtained. This can be useful for determining the implant site in terms of bone density, and location of adjacent anatomic structures. [8] It offers superb visualization of impacted teeth and its relation to nearby anatomic structures which guides the surgeon during surgical removal of impacted teeth. 3-D images from spiral CT helped in evaluating the close relationship between maxillary sinus disease and adjacent periodontal defects and their treatment. CT scan can precisely distinguish between intrinsic and extrinsic salivary tumours and is used for staging these tumours. [1] (Fig 5)

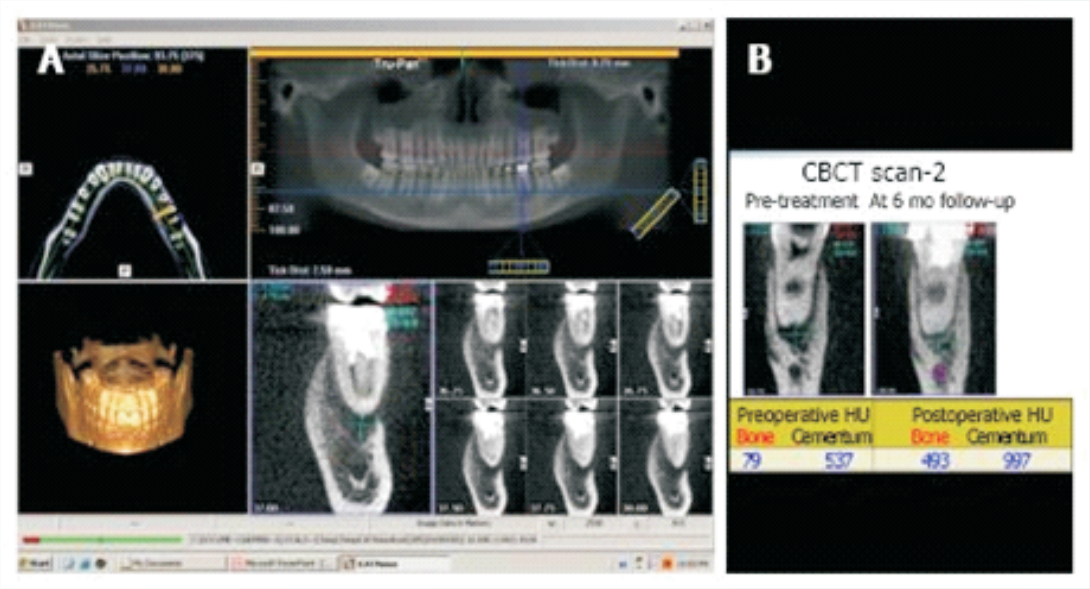

Fig. 6: Cone beam computed tomography: A: cone beam computed tomography scan gives a three-dimensional view of the area of interest. In this case, the periapical lesion is being evaluated; B: The image gives values in Hounsfield unit of cementum and alveolar bone density to measure post treatment healing.

Limitation of CT

High radiation exposure, high costs of the scans and scatter because of metallic objects eg. metal crowns and bridges, metallic restorations. It has poor resolution compared to conventional radiographs. CT has limitation in the diagnosis of dental fractures (like small fissures) which are below the resolution capability of CT and may result in false-negative readings.

Radiation dose for CT scan maxilla-mandible is 2.1 mSv, for CT scan maxilla

1.40 mSv and for CT scan mandible, 1.32 mSv.

Cone beam computed tomography (CBCT)

Currently it is largely used as a diagnostic tool in various branches of dentistry (Fig 6). Although CBCT lacks sufficient soft tissue contrast and standardized gray scale value, dentists prefer to use CBCT rather than conventional multi-slice CT. This is because CBCT is smallersized, of lower costs, and easier to operate compared with conventional CT. In addition, CBCT provides 3D images with voxel sizes comparable with or smaller than those of conventional CT, thereby overriding the need for conventional CT. Accordingly, CBCT coupled with computer-guided planning permits implant designs appropriate for a particular implant site, in terms of implant type (shape and surface structure), dimensions (length and diameter), and placement (entry point and angle). It also allows surgeons to decide the need for and type of bone augmentation (such as bone chip/split and sinus lift) for a particular edentulous region lacking sufficient amount of bone to support the implant. However, radiation dose with CBCT, especially for the thyroid, remains highly problematic, even though lower than that of conventional CT . [11]

Radiation dose of one CBCT scan equals 3-20% that of a conventional CT scan, CBCT mandible is 0.0753 mSv, field of view FOV CBCT 6cm maxilla is 0.0365mSv, 6cm mandible 0.0753 is mSv, 8cm both jaws is 0.1004 mSv and 87-206 mSv for a full craniofacial scan

Limitations of CBCT

CBCT has the problem of scattering and beam hardening artifacts caused by high density structure [10] which diminishes the contrast and limits the imaging of soft tissues. Therefore, CBCT is primarily indicated for imaging hard tissues. Also, CBCT cannot be helpful in detecting bone density because of distortion of Houns field Units. CBCT has lengthy scan times (15-20 sec) need the person to stay completely firmed. CBCT must not be used routinely for dental diagnosis or for screening purposes.

Latest advancement in radiographic imaging

- Magnetic resonance imaging MRI
- Ultrasound

Magnetic resonance imaging (MRI)

It is a non-invasive method to detect the internal structures, differentiate between soft tissues and hard tissues. The MRI has high contrast sensitivity to soft tissue differences as hydrogen is found in abundance in soft tissue, but is lacking in most hard tissues and this is the main reason behind MRI replacing the CT for soft tissues imaging. [3] The principle behind MRI is the use of non-ionizing radio frequency electromagnetic radiation in the presence of controlled magnetic fields, to obtain high quality cross-sectional images of the body. [2] The main use of MRI in dentistry is for investigation of soft-tissue lesions in salivary glands, TMJ and tumour staging. MRI plays an important role in examining the true extent of the lesions in areas which looks normal on radiographs or CT. Also MR imaging can reliably assess bone water concentrations, bone marrow compositions, and bone mineral densities, all of which could influence the quality of bone tissues that are required for adequate host reactions and rigid supports for dental implants. [9, 10]

Magnetic resonance (MR)–based dental implant planning can achieve results comparable to those with CBCT based planning.

Limitations of MRI

MRI is usually not supposed to be used in patients with cardiac pacemakers, implantable defibrillators, some artificial heart valves, cerebral aneurysm clips, or ferrous foreign bodies in the eye. Metallic dental restorations can generate artifacts producing a major diagnostic problem in CT examinations of malignant tumors in the maxillofacial region.[3] Claustrophobic patients should not be positioned in the close confines of an MRI machine. Other drawback of MRI includes long scanning time and much expensive compared to other conventional radiographic methods. [3]

Ultrasound (US)

It is a non-invasive, non-ionizing, inexpensive, and painless imaging tool proven to be a valuable diagnostic tool in soft tissue and hard tissue assessment in dentistry. The first data of diagnostic US in dentistry was reported in 1963 by Baum et al.

US can be an important diagnostic tool for patients in whom MRI is contra-indicated, such as those with cardiac pacemakers, claustrophobia and metallic prostheses. [3]

US have ability to define the internal muscle structures more clearly than CT.

It can also asses the muscles and soft tissue thickness which could help practitioners to select the proper orthodontic mini screw in clinical practice. [13] Dental implant placement without incision and flap elevation. US plays an important role in locating submerged implants accurately for surgical exposure for subsequent Prosthodontic rehabilitation[14]. It is an alternative diagnostic method for imaging of the TMJ disorders. US has been investigated for its capability to identify carious lesions, tooth fractures or cracks, periodontal bony defects, maxillofacial fractures etc. It also helps to differentiate solid and cystic lesions in the parotid gland, sialoliths in parotid, submandibular and sublingual salivary glands. These appear as echo-dense spots with a characteristic acoustic shadow. [15]

US guidance can prevent injuring the facial nerve during biopsy of the parotid gland. It demonstrates the internal muscle structures more clearly than CT. US is a reliable diagnostic technique in determining the pathological nature (granuloma vs cysts)of periapical lesions. It has been used in guided fine-needle aspiration, measurement of tongue cancer thickness and diagnosis of metastasis to cervical lymph nodes.

Limitations of Ultrasound

It includes inability in diagnosing displaced fractures, complex maxillofacial fractures, posterior orbital floor fractures and intra-capsular mandibular condyle fractures due to overlapping of zygomatic arch. [12] US is restricted by bone and therefore is indicated only if there is a bony defect over the lesion through which ultrasonic waves can traverse.

Conclusion

Recent advances in imaging technologies have revolutionized dental diagnostics and treatment planning, since their introduction and it seems that their needs will be increasing in the future. Correct use of appropriate imaging

technology and their correct interpretation, following the ALARA (As Low As Reasonably Achievable) principles and cost-effectiveness,can help to detect pathologies in very early stages, which ultimately help to reduce morbidity and mortality and improve the quality of life of the patients.

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Protect Your Hearing – Act Now!

Dr. Nalini Bhat, Former Head
Department of ENT, BARC Hospital

Hearing loss is very common and unfortunately, deafness is an invisible disability. This has led to the problem being neglected for long not just by individuals and society but also by policy makers. However corrective action has been initiated and hopefully we will be able to largely prevent and rehabilitate all who are affected in the near future.

The WHO has declared 3rd March as World Hearing Day to raise awareness and promote hearing care across the world, while International Noise Awareness Day will be celebrated on April 28, this year.

Dr. Nalini Bhat

Facts and Figures

Hearing loss is more common than diabetes, cancer or vision loss. Unaddressed hearing loss costs the global economy US$ 750 billion annually while preventing and addressing the problem will be much cheaper. In 2018, 466 million (6.1% of world population) people had disabling hearing loss (DHL). Of these 93% are adults and 7% are children. Above age of 65 years, 1 in 3 people have disabling hearing loss. These numbers are higher in Asia as compared to the west. Unless action is taken, these numbers are likely to increase to 933 million in 2030 as shown in the figure 1. This is mainly because of increasing number of people being exposed to loud sounds through use of personal audio systems as well as entertainment venues.

There are many causes of hearing loss and they are different in children and adults. Most of these causes can be

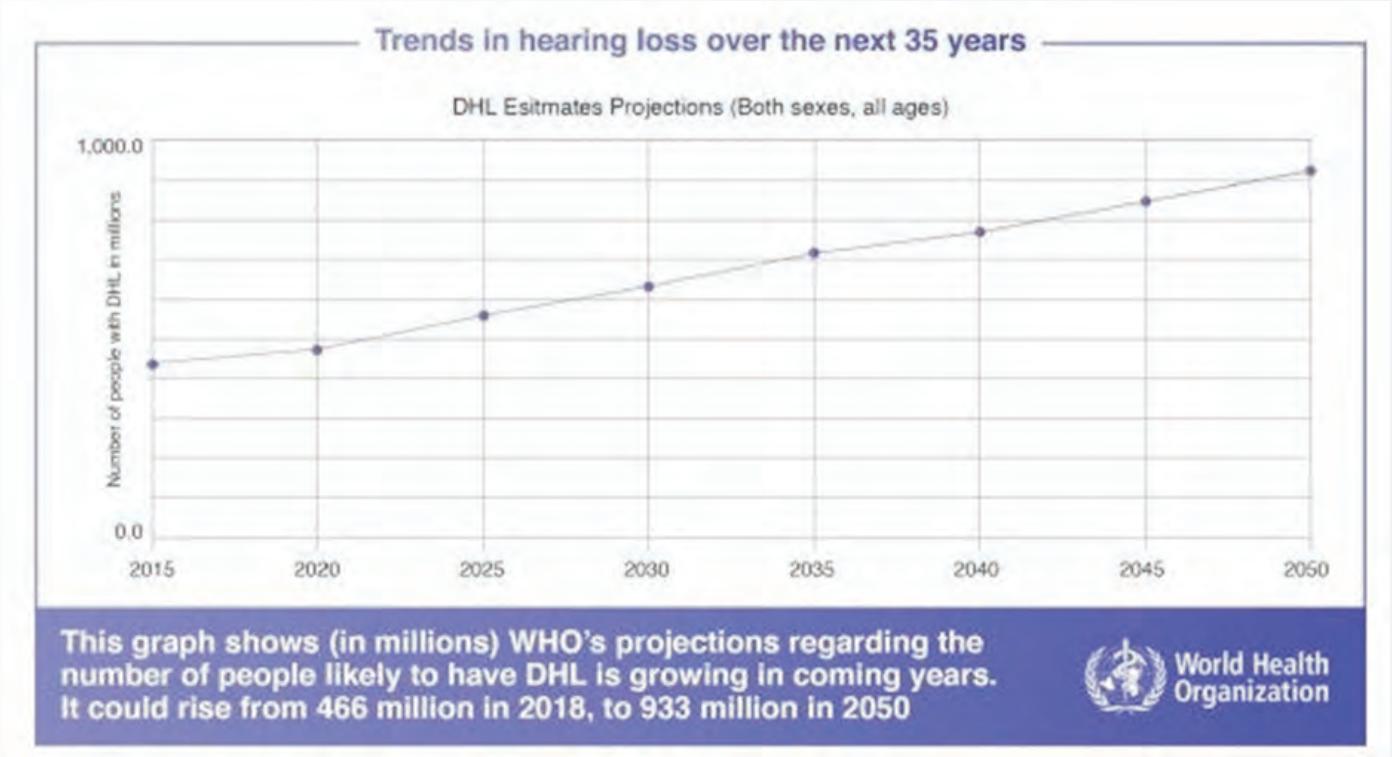

Fig. 1:Trends in disabling hearing loss over the next 35 years

Fig. 2: Sound levels of various events

prevented with actions such as protection against noise, good ear practices and immunization. Further, hearing loss and ear diseases can be addressed when identified in time and managed appropriately.

In this article I have addressed the problem of hearing loss in adults. Two common reasons for hearing loss are 'Age' and 'Noise exposure'. These damage the hair cells in the inner ear which once damaged, cannot be restored. Taking protective measures early will ensure good hearing for a lifetime

Know your Noise

The damage caused by noise is proportional to the level of sound exposure measured in decibels (dB) and the duration of exposure. Approximately, 85 dB of sound exposure for 8 hours a day is the acceptable limit while noise decibels above that is harmful. Above 140dB even for a few seconds without protection, is not acceptable. The sound level of various events is shown in figure 2.

Two simple rules to know that you are being exposed to hazardous noise levels are -

1. If you have to raise your voice to speak to a normal hearing person who is at arms distance.
2. If your ears are ringing or sound seems dull/flat for some time after leaving the noisy area.

Recommendations to Reduce Noise Exposure

At Home/Workplace	At Public Places
• Turn down volume of television and music devices to the lowest audible level. • If listening to loud music , limit the time of exposure or take listening breaks. • Use quieter products which meet technical standards for noise whenever they are available. • Use of ear protection devices (ear plugs /muffs) when exposure is unavoidable. • Keep hearing protection aids available at convenient places like car/purse/workplace.	• Move or stay far away from the loudest sound producing source such as loudspeakers or cannons at college stadiums especially if attending with children. • Limit the length of time of exposure to loud sounds. • Bring hearing protection devices with you. Keep them in your car, pockets, or other easily accessible places. • Be a quiet enforcer. If there is too much noise at social places ask organizers to tone it down. • Finally, one can complain to the nearest police station, or file an online complaint with the State's police complaint portal if noise is causing disturbance, harm or annoyance.

Good Ear Practices

- Do not self-clean ears. The ear buds only push the wax deeper into the ear and pointed objects are harmful. Ears are naturally self-cleansing.
- Do not self-medicate or pour oil into ear.
- Do consult a qualified doctor if you have any ear or hearing related issues. Most hearing issues due to outer or middle ear causes are correctable.
- Make your doctor aware if you have hearing loss issues so that certain medications that can harm hearing can be avoided.
- Screen for hearing loss especially if you are at risk, are above 50 years of age or feel you are hearing less. This can be done by downloading the 'hearWHO'

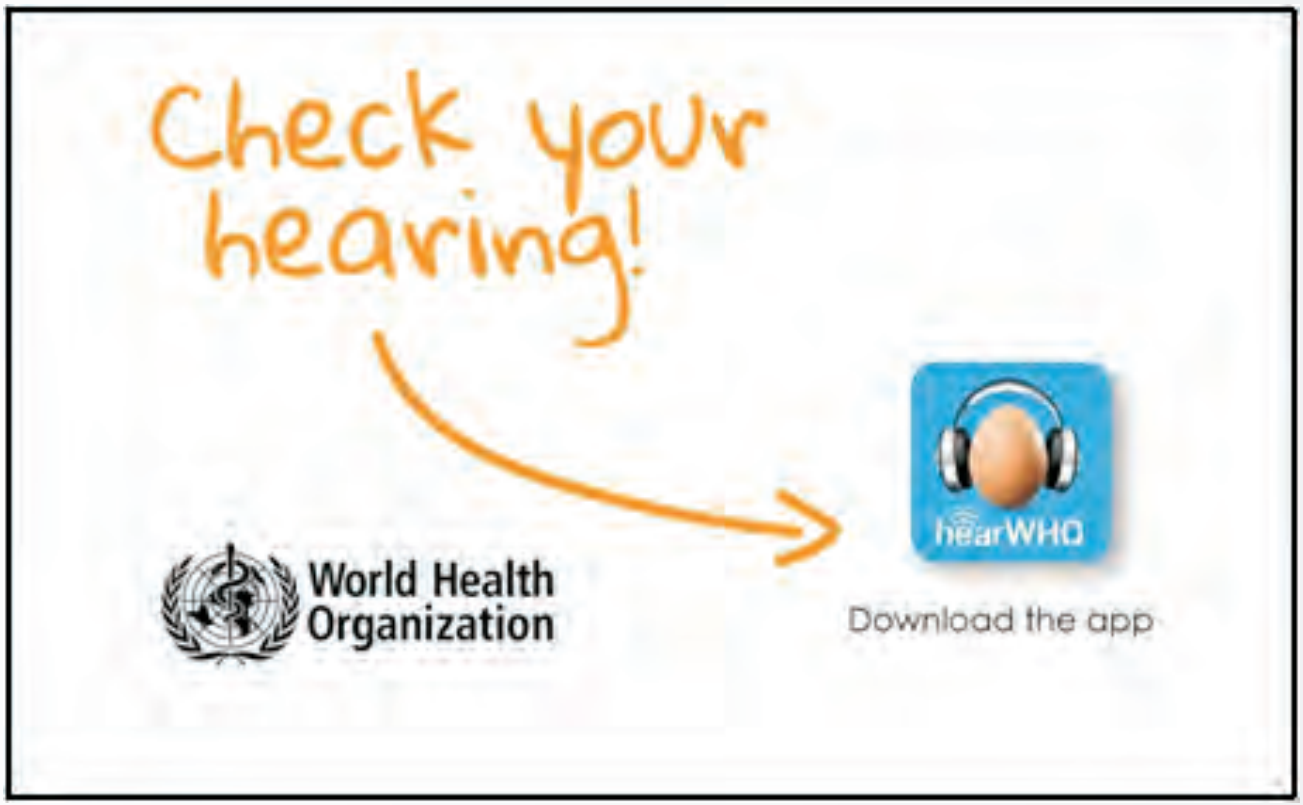

Fig.3: A hearing screening tool by WHO

app (Fig.3). If this shows hearing loss then do seek professional help from an ENT specialist and audiologist.

If you have hearing loss, do not shy away from help

- Let your family members and friends know about your hearing loss so that they can modify the way of communication with you.
- Look at the person speaking to you to get visual clues.
- Use hearing aids and assistive devices. These take time to adjust so be patient.
- Do not get bogged down by your hearing loss.

Finally for those interacting with people with hearing loss

- Remember 1 in 5 people have hearing loss that may cause difficulty in communication.
- Speak slowly and clearly.
- Repeat or rephrase, if necessary.
- Use an app that can translate speech into text or writing tools to communicate.
- Wear a transparent mask so that your lips are visible, if possible.
- Be inclusive, make that extra effort to communicate.

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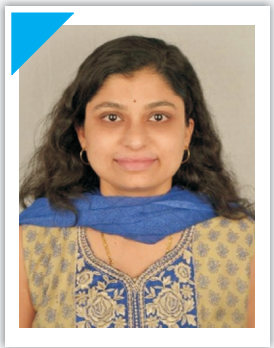
The Academic Cell – BARC Hospital

Dr. Aditi Chaudhari
Department of Psychiatry, BARC Hospital

The Academic cell was constituted on 18th January 2021 with the aim to bring under one umbrella all the academic activities being undertaken at BARC Hospital. This includes CMEs, Clinical meetings, workshops and training programs, observerships and lectures in basic sciences. It will also liaison with the Scientific and Ethics committees which oversee the various research projects being carried out at BARC Hospital. Head, Medical Division, Dr. A. R. Kulkarni is the Co-ordinator of the committee and Dr. S. U. Nadkarni is the Co-Coordinator. The other members include Dr. P. D. Bhandarkar, Dr. N. N. More, Dr. Sangeeta Sawant, Dr. S. C. Kantharia, Dr. K. S. Dalal, Dr. P. H. Bhirud and Dr. U. P. Chaturvedi. Administrative support is provided by the APO, DA, Medical Division. Dr. Aditi Chaudhari is the member-secretary. Under the purview of the Academic Cell, an online lecture series has been started from April 2021. The lectures are taken by the faculty of the Medical Division on web based video meet every Friday from 2:30 pm to 3:30 pm and have received an enthusiastic response from doctors across all DAE Units. Till date, 11 lectures have been conducted on various topics. The details have been tabulated below:



Dr. Aditi Chaudhari

No	Day	Date	Department	Topic	Speakers
1	Friday	9.4.2021	Anaesthesia	Cardiopulmonary Resuscitation	Dr. Kajal Dalal Dr. Jalpa Kate
2	Friday	16.4.2021	Medicine	Management of Unconscious patient	Dr. Shweta Sharma
3	Friday	23.4.2021	Pathology	Rational Use of Laboratory Investigations	Dr. Raji Naidu
4	Friday	30.4.2021	Psychiatry	Diagnosis and Management of Delirium	Dr. Saumitra Nemlekar
5	Friday	7.5.2021	Surgery	Urinary Catherterization Protocol and Catheter Induced Complications	Dr. Shachi Lokur
6	Friday	21.5.2021	Mandala Dispensary	Overview of Rabies	Dr. Neha Mudaliar

7	Friday	28.5.2021	Radiology	Rational Use of Imaging- Clinical Features for Better Management of Patients	Dr. Ajay Chaubey, Head Radiology Unit
8	Friday	4.6.2021	ENT	Covid-19 Associated Mucormycosis (CAM)- Collateral Epidemic	Dr. Pallavi Bhandarkar Head, ENT Unit
9	Friday	11.6.2021	Deonar West Dispensary	Dengue Fever	Dr. Ravikant Khande
10	Friday	18.6.2021	Deonar East Dispensary	Adolescent Hypertension	Dr. Anita Patil
11	Friday	25.6.2021	Ophthalmology	Ophthalmic Emergencies	Dr. Divya Gupta
12	Friday	2.7.2021	Kharghar Dispensary	Dyslipidemia	Dr. Vaishali Wadhe
13	Friday	9.7.2021	Obstetrics & Gynaecology	PCOS	Dr. Santoshi Prabhu Dr. Vaishali Jadhav

A few more proposals are in the pipeline. These include displaying the academic schedule of each department on the hospital website and having a review committee for all the theses being submitted to NBE twice a year to suggest improvements along with a nomination for the best thesis. There will be an orientation program on how to submit the research protocol to the Scientific and Ethics Committees as well as an introductory lecture on basic Biostatistics. The workshops on cardiopulmonary resuscitation and communication skills will continue as before. All units are to be encouraged to update the library books in their subjects through proper procedure to enhance the use of library services.

The Academic Cell is thus a forum to maintain and promote a culture of academia at BARC Hospital. It aims to be of benefit to the residents who are enrolled in our DNB teaching programs as well as to all the practicing doctors at BARC Hospital and dispensaries in Mumbai as well as all other DAE units.

Candidates passing DNB exam in 2021.

Congratulations!!

Dr. Pooja Hingu
Dept. of Anaesthesia

Dr. Dinesh Babu Vadranapu
Dept. of Anaesthesia

Dr. Jagruti Keskar
Dept. of Obstetrics & Gynaecology

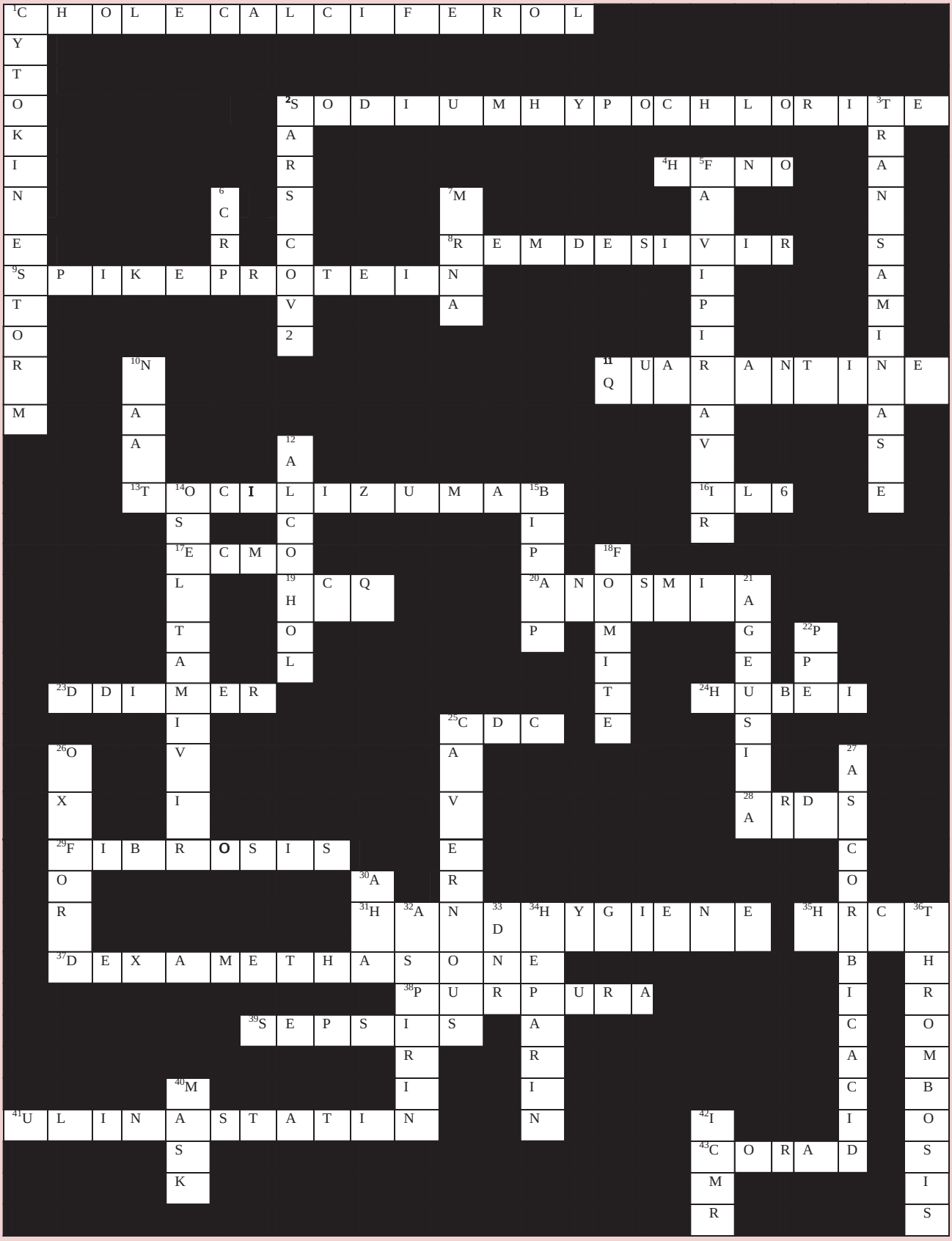
Dr. Jai Singh Yadav
Dept. of Obstetrics & Gynaecology

Dr. Amol Gagare
Dept. of Medicine

Dr. Shashanka Chillapuram
Dept. of Medicine

Dr. Surveswar Reddy
Dept. of General Surgery

Answers to Crossword, Pulse Vol. 22, January 2021.



This time, there were no entries with all the correct answers as given above.

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