Kerala Journal of PMR



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Vol:20 issue:1

From the Editor's Desk

"Our whole universe was in a hot dense state...Math, science, history, unraveling the mysteries.....

That all started with the big bang (bang)".¹

The big bang that led to the birth of our universe happened nearly 13 billion years ago, our earth is nearly 4.5 billion years old & Ultrasound waves have existed in nature for over a million years. Lazzaro Spallanzani, an Italian priest & Physiologist analyzed the ability of bats to navigate in the dark. He demonstrated that blindfolded bats could navigate in the darkness, while bats with their mouths covered bumped against obstacles. This led him to conclude that 'The ear of the bat serves more efficiently (than the eye) for seeing, or at least for measuring distances..', a matter of heresy, back then in the 1790s. 'Spallanzani's bat problem' remained an enigma till 1938, when two young Harvard students, Donald R. Griffith & Robert Galambos used a Sonic detector to record directional Ultrasound noises being emitted by bats in navigating flight.

In 1942 Karl Dussik, a Neurologist at the University of Vienna, attempted to locate brain tumors and the Cerebral ventricles by measuring the transmission of Ultrasound beams through the head. The foundations of Ultrasonic tissue diagnosis were laid with the publication of A-mode (amplitude mode) Ultrasound investigations of surgical specimens of intestinal and breast malignancies, the development of a linear handheld B-mode (brightness mode) instrument and early descriptions of endoscopic (transrectal and transvaginal) A-mode scanning transducers, by John Julian Wild, a medical graduate from Cambridge in 1955. Another path breaker in the development of Medical Ultrasound in clinical practice was Professor Ian Donald of Glasgow. At that point in time, abdominal & pelvic examination was considered flawless for diagnosing abdominal pathologies. With the help of the engineering firm Kelvin Hughes Ltd, Ian Donald used a 'flaw detector' to differentiate cystic and solid abdominal masses—in one case altering a clinical diagnosis of terminal carcinoma to simple ovarian cyst—leading to the publication of their findings in the *Lancet* in 1958, a major milestone in medical ultrasound.

The first report of Musculoskeletal Ultrasonography was published in 1958 by K. T. Dussik who measured the acoustic attenuation of articular and periarticular tissues including skin, adipose tissue, muscle, tendon, articular capsule, articular cartilage and bone. The first B-scan image of a human joint was published in 1972 by Daniel G. McDonald and George R Leopold in the *British Journal of Radiology*. They described the use of Ultrasound imaging in differentiating Baker's cysts from thrombophlebitis, a common application in current clinical practice. Spurred by McDonald and Leopold and with technical improvements in Ultrasonography—including Compound Linear Array technology, improved computer processing and Power Doppler—many investigators have now contributed to the Ultrasound description of the musculoskeletal system in health and disease².

As we all know using MSK Ultrasound is akin to having a compound eye which helps in diagnosing Rheumatological conditions, Neurological entities & what not?! This tool helps us

to perform interventions perfectly, while avoiding untoward consequences of the same. From intra-articular injections to USG guided Botox, all the way to USG guided tenotomies, the array of interventions that can be performed under USG guidance is mushrooming as time goes by. As Physiatrists, it is imperative that we evolve with the times & get acquainted with the latest developments in the arena of MSK Ultrasound. Right from the time of the big bang, the universe has been expanding & evolving & so should we. I hope this issue helps you evolve & expand your horizons. Until next time, happy reading...

- 1. 'Big Bang Theory' Theme
- 2. https://academic.oup.com/rheumatology/article/43/7/931/2899082

Dr. Bineesh Balakrishnan

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"Articles are the responsibility of the Authors"

Basics of Ultrasound-Part 1

BASIC PHYSICS:

Ultrasound is sound with frequency greater than 20, 000 cycles per second or 20kHz.

For diagnostic USG we use a frequency of 1-20 MHz.

PECULARITIES OF ULTRA SOUND WAVES

Ultrasound is a mechanical longitudinal wave that propagates through a medium and interacts with the medium as it passes through it. It propagates in the form of compressive



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wave length. High to frequency means number of waves in a particular area is large. Low frequency means number of waves in a particular area is small. It is the major factor in determining the beam penetration. The high frequency waves have less penetration but high resolution low and frequency waves have more penetration but the resolution will be less.

Velocity of sound wave

and rarefaction waves and requires a medium for the propagation. That is the reason why we use gel for doing ultrasound.



Fig 1:Propagation of ultrasound waves

Ultrasound waves have the following characteristics-

- Wave length: Wave length is the distance between two analogous points on a wave. It is calculated by dividing the velocity of propagation by frequency.
- Frequency: Frequency is defined as the number of waves per second and unit is Hertz. Frequency is inversely proportional

varies with density and stiffness of the media. The greater the stiffness the faster the wave travels. Therefore, velocity of sound is lowest in liquid and highest in solids and very little in air.

The average velocity in soft tissue is 1540m/s.

When a sound wave encounters resistance with a material of different density it is known as acoustic impedance. Acoustic impedance depends on the density of the medium and the propagation speed of the wave, but as the speed varies very little in biological tissue impedance depends mainly on density. So the larger the difference in density greater will be the returning echo. When sound waves reach the tissue interface some waves are transmitted others are reflected back which depends on the differences in acoustic impedance of the tissues, i.e., if difference in acoustic impedance is high, more waves are reflected back.

PRINCIPLES OF USG

Ultrasound probes are made up of piezo electric crystals. When you apply а mechanical pressure to the crystals, they are deformed and produce electrical potentials, i.e., mechanical energy is converted to electric energy. This is known as piezoelectric effect. The reverse also occurs, when electrical current is applied to the probe piezoelectric crystals are malformed and leads to emission of sound waves. This is known as reverse piezoelectric effect. The process of obtaining an ultrasound image begins with the reverse piezoelectric effect. The ultrasound machine sends a pulsed electrical signal to the transducer crystals, which transforms that energy into an intermittent acoustic wave, a form of mechanical energy. These sound waves, called pulses are then transmitted to the tissues via a sonoconductive gel. This pulses interact with tissue and some will be reflected back to the transducer, whereas others are absorbed and refracted.

The reflected intermittent pulses return to the transducer and are called echoes. They are then converted via the direct piezoelectric effect to an electrical signal. This electrical signal is then translated into an image on the ultrasound screen.

Superficial structures which reflect first will be displayed at the uppermost part of monitor. Deeper structures are displayed at the bottom of screen since their echoes take longer time to return. Different transducers with varying crystal properties and thickness determine the frequency of the pulses.





The reflected echoes from the transducer are sent to the receiver as analogs.

Here 5 processes happen

- 1. Amplification
- 2. Compensation
- 3. Compression
- 4. De-modulation
- 5. Rejection or wall filtering.

Except for de-modulation which is done by the machine everything else can be manipulated by the sonographer to improve the image quality.

The different ways the sound beam interferes with the tissues of the body is the foundation of ultrasound.

1. Reflection

Sound reflects off a surface at an angle equivalent to the incident angle. Interfaces where the sound interacts with a smooth surface at a 90° angle are called specular reflectors. The problem with specular reflectors is if the probe is not at 90° to the interface the angle of reflection is away to the transducer and the returning echoes are not received and interpreted. This is important in scanning tendons and nerves. The amount of reflection depends on the difference in acoustic impedance between interfaces. In general high density materials have high acoustic impedance. If acoustic impedance of two media is similar sound passes easily through them. If there is some difference in acoustic impedance of two media some sound is reflected back and some passes through the media.

2. Scatter or non-specular reflectors.

Here sound basically scatters around in all directions. This occurs in irregular particles or small particles which have linear dimensions equal to the wavelength of the beam or smaller. This is what gives different tissues their unique kind of echo texture.

3. Refraction.

When the incident beam strikes at the interface between two medias at an angle other than ninety degrees refraction occurs at the transmitted portion of the beam. The transducer doesn't know that refraction has occurred and thus beam reflections from an object will be assumed to have come from a straight line. Some of the artifacts in the ultrasound are due to refraction.

4. Diffraction.

It is the phenomenon by which beam spreads out as it moves farther away from a point source. This affects lateral resolution of the beam.

5. Interference

Two types are there- constructive interference and destructive interference.

Constructive interference is the algebraic summation of two waves which are in phase. The result is an increase in amplitude.

Destructive interference is the algebraic summation of two waves which are out of phase . The result is decrease in amplitude. The concept plays a role in beam focusing and pulsed Doppler.

6. Attenuation.

As the ultrasound beam passes through a medium the energy content of the ultrasound progressively decreases. This loss of energy is termed as attenuation. It is the overall effect of scatter and absorption. This determines the depth of penetration. Penetrance is inversely related to the frequency.

ECHOGENICITY;

It is the reflective activity of a tissue, if in a tissue reflective capacity is high it is known as hyperechoic structure.

If the reflective capacity is low it is known as hypoechoic structure

If there is no reflection then it is anechoic that is it appears black.

ATTENUATION;

When sound waves travel through tissue, the intensity of pulse slows down as it reaches deep structures this is due to reflection, refraction, scattering & absorption.

RESOLUTION;

Axial resolution is the ability to discern between two points along or parallel to the beam's path. Lateral resolution is the ability to discern between two points perpendicular to a beam's path. Both are good with linear high frequency probes.

Transducer types

Curved array transducer

Transducer elements are arranged in a curved line. This creates a sector shaped image and large aperture produce a wide near field image.

Phased array transducer

Transducer elements are arranged in a row and aperture is small.

Linear array transducer

Active elements in a linear array are arranged in a straight line and typically not steered and this results in evenly placed beams at best resolution. Higher frequencies are usually used.

Most transducers have a small mark at one end of transducer matching indicator on left side of ultrasound image.

Scanning planes

Basic scanning planes are

- a) Transverse scanning plane
- b) Sagittal plane
- c) Coronal plane

Imaging modes

A mode. This is the simplest form of ultrasound imaging and is based on pulse echo principle. It is not found in most imaging systems used today.

B mode (Brightness mode)

B scans gives 2 dimensional information about the cross section when an image is shown on dark background. Signals of maximum strength appear as white, lack of signal is shown as black (anechoic) and signals of intermediate strength appear as shades of grey. B mode images may be displayed as static or real time images.

M mode (Motion mode)

This represents movement of structures over time. The image is one dimensional line with amplitude of an echo corresponding to pixel brightness. This is plotted over time to show changes of motion.

Doppler mode

Doppler ultrasound evaluates blood velocity as it flows through a blood vessel.

Knobology



Fig3: Ultrasound Machine

There are different knobs in ultrasound machines for image optimization. Proper manipulation of the knobs is essential for obtaining good quality images. **Power button-** It is used to on and off the machine.

Probe selection- Usually 3 different probes are attached to one machine. Select the appropriate button for selecting the probe. Usually for superficial structures a linear high frequency probe is used and for deeper structures a curvilinear probe is used.



Fig 4: Convex (low frequency probe) Linear (High frequency probe)

Depth adjusting- Depth control adjusts the depth of the screen. Depth should be set just below the target of interest. The size of the target structure and temporal resolution is optimized by setting the correct depth. If the depth is set very high the target structure appears smaller.

Focal zone

As the ultra sound waves come out of the probe they converge to an area before they diverge. This area is the focal zone. Lateral resolution i. e. the ability to distinguish to structures lying side by side is best at focal zone. Focal zone should be set over the area of interest.

Gain

Gain control decides the overall brightness of the image. We can make the image bright (hyper echoic) or dark (hypo echoic) by rotation of the gain dial clockwise or anticlockwise.

Time gain compensation (TGC).

In most ultrasound machines it is seen as row of sliding controls. As ultrasound beam passes through the tissues, they get attenuated. The returning echoes from the deeper part are not as strong as the superficial echoes. So, the machine automatically adds extra gain as it passes deep and amplifies the signals for successively deeper echoes. Some structures in the body attenuates signal more rapidly than others depending on the attenuation coefficient of tissues. Attenuation also varies with frequencies, higher the frequency more the attenuation. Similarly, the attenuation also increases with increasing depth. To get a uniform image TGC is adjusted to increase the brightness of deeper structures.

Freeze and save.

After obtaining a good image press the freeze button and save the image for future use. Measurements can be made on freezed images. Real time settings are used during interventional procedures.

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We know well

Medicine is so

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Some say the

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Level up your PMR practice

One day a young upcoming consultant called and asked if they and their medical director could visit our department. As he was setting up a new department funding wasn't going to be issue, an but he needed to



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know what to put on the shopping list. Another day the CEO of a Gujurati trust hospital came to see our department and asked where and how to start. Considering the plethora of options available it's hard to know what to buy when you have a blank cheque. This article aims to help with the decisionmaking process.

With the invasion of technology and business models, modern medicine has become commodity and service based industry, and some patients expect this. Health is something they feel can be bought, and as they hold the money they will try to dictate terms. The current language in this market is that of 'direct to customer' and 'plug-in and play'.

All this cannot change a basic fact. Eventually a patient has to come to us for particular services. The West tried empowering paramedicals to meet the optimal 'doctor' to patient ratio. COVID showed us they can't. Regardless as a nation we are moving in the same direction. With an emerging holocracy healthcare where advance in practice paramedics pretend to perform some of our roles, decentralization is the lingua franca. And this leads to less patients coming to us for care. So how do you pay off the big purchases that are known to help in when in a precarious position?

One's practice portfolio is defined by services

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offered. If what you have to offer can be found next door people will go there instead. This means you either have to be the neighbor or be unique. Being unique means buying into big tech or offering services others can't. For those in a corporate setting, administration will value those who make money and are marketable. Myopic administrators will try to just meet the basics by hiring PT. Few PTs will have an expansion plan as they are engaged in the daily grind of serving patients. When they do, they may not see how to pay a big purchase off. Even when they can, they may not be able to get another consultant to provide the patients. This is a window of opportunity. Being responsible for the outcomes is a burden, but bearing that cross means you can do whatever you have to within the limits of evidence based medicine and ethics. This means working like a donkey, but we do what we have to for our patients.

What are your options? Service types fall into the following categories: Diagnostic, Therapeutic, and Preventive. All the hype is on therapeutics. People want to be treated. Diagnostics go hand in hand with this as they help decide what is appropriate. Our current healthcare models leave Preventive in the dust as there is no major interest or funding for this. Naturally for the intrepid Preventive is the best place to start. This will gain traction when society as a whole no longer wants to suffer and would rather avoid issues in the first place. That will take time, but it is coming up as society is becoming more focused on the individual than the family. The easier areas though will be the other two. Of them the majority of our allied medical colleagues will already have the diagnostic angle covered. The therapeutic options employed will usually be agents proven over the past decades or the latest hype. So what is left for us?

Work satisfaction is related to a sense of accomplishment. One way is when patients improve. Work with whatever cases you are given. It may not be what you like, but you're bound to learn about yourself and the work environment this way. As you do, find ways to work towards your dreams. If you go in reverse starting with what you like, your dreams may become bittersweet, being flavored by growing pains.

Table 1: A case	based	approach	to	making
your shopping lis	st			

Туре	Cases	Diagnosis	Treatment options
Acute	Myofascial Pain, Fibromyalgia, Pelvic floor, Rheumatology	Diagnostic US	PT modalities
		machine, EMG/ NCS vs SEMG	SEMG biofeedback, US guided injections
Chronic	Acquired Brain Injury, Parkinson's/ Neurodegenerative Diseases, Peripheral Nerve issues	Often taken care of by associated colleagues	Neuro suite 1: Tilt- table, parallel bars, galvanic stimulator, readymade cockup splints and AFO, Swedish knee cage Neuro suite 2: HBOT, robotic rehab, USG procedures, FES devices, tDCS, rTMS, Virtual reality
Preventive	Cardiopulmonary, Lifestyle, chronic wound	plethysmography,	Limb centre, HBOT

With any money spent, return of investment is the bottom line. Two years is the golden period to pay it off. Whatever you buy is expected to have the minimal number of disposables to reduce future expenditure, minimal to no extra staffing requirements, mobility when possible, and availability. The more you can present a plan that includes these the easier it will be to generate revenue and pay off the device, after which it begins paying the hospital. When you submit a plan on what to purchase, administration needs to hear this information. Proactive members will directly ask for this, while others will ask indirectly. Be prepared.

You'll have to petition your allied doctors for patients. Keep in mind that there are those willing to refer if you have something new, and others who will refuse to send until you provide evidence. The same may still not share cases when you provide the evidence. They are either threatened by your growth or don't want to get blamed by upset patients. Both abound as money is at stake. Have a powerpoint presentation ready with all the latest evidence supporting what you are proposing. If possible, get certification. If you do, that from abroad is valued more than the local level. All of this shows a level of commitment that earns the confidence of others in what you propose. Next is make social media content anyone can access. You can have patients view it in their leisure. If patients get good outcomes, they will take care of publicity for you. The last level is research, publications, and grants for the same. If your colleagues stumble upon your articles in Pubmed without your guidance, it adds credence to your capacity.

Aside from spending and making money is the emerging 'big team concept'. In this each player has a role to perform, and equal value. It's a bit different from the current 'superhero mentality. The superhero Dr does Dr' everything, and as a result is challenged to do any one thing to a level of research/ publication. Many equate such doctors to movie stars or temple idols. The concept is there is a big person and the final goal is to reach them. When rehabilitation is denigrated to Physiotherapy the therapist becomes the end goal and everyone else in between just a traffic sign. When we use the word rehabilitation, all members are sublated into the bigger picture which is actually what all the stake-holders want. The big team then is composed of many different parts that all work in unison to yield a better outcome. Being a part of these makes you indispensible and helps you gain face value provided you do it well. It is needless to say it's a double edged sword. If you are not affable, available and accommodating things can get messy fast.

When I for certified in HBOT in 2013 I never thought so many other centres in India would follow suit. Now within five hours of the hospital we have five new centres, many run by PMR. Once you prove a service that is viable others will imitate. This can cut into patient volumes simply because the copycat has become the patient's friendly neighborhood service (provided they live in that locale). To stay viable and keep patients coming you have to establish yourself as an authority. The easiest way is through social media. The next step up is conference talks. The definitive way is with indexed research publications. The mistake most people make is they think simply having the latest tech makes them on par with those who've been doing it for years. There is a level of expertise one gains by doing the same thing daily. This is what you have to stress when you promote your services.

Specializing will develop you professionally and provide a unique perspective on the cases you manage. The bottom line here is do it and don't worry about others.

Basics of Ultrasound-Part 2

By Dr. Sreejith K.

ULTRASOUND ARTIFACTS.

Artifacts are appearances within the image that do not directly correspond to the tissues being imaged.

They are not always undesirable as some lesions are recognized and characterized by the artifacts they produce.

Anisotropy is apparent when scanning tendons or ligaments. When ultrasound probe is not placed perpendicular to the structure of interest such as tendons or ligaments it may appear falsely hypo echoic as the returning echoes are reflected away from the transducer and is not picked up by the machine. Usually hypo echoic appearance suggests pathology. So it is very important that you should keep the transducer perpendicular to the structure of interest. Usually nerves are less anisotropic compared to tendons so this feature helps us to differentiate tendons from nerve.



Fig5: Ultrasound probe perpendicular to nerve and tendons.



Fig6: Probe slightly tilted



Fig7: Anisotrophy of tendons and nerve when probe is not placed perpendicular to tendons and nerve. Tendons are more anisotrophic than nerve.

Post acoustic shadowing:- Occurs as an area of low amplitude echoes behind an area of

strongly attenuating tissue. This is caused by severe attenuation of the beam at a particular interface. This results in very little sound being transmitted beyond that particular interface. Usually the tissue will be a dense structure like a calcification in a tendon. It always occurs at interfaces with large acoustic mismatch as soft tissue bone interface. This attenuation is usually due to absorption or reflection of sound.



Fig8: Post echoic shadowing behind the bone (Rib)

Post-acoustic enhancements. The exact opposite of acoustic shadowing is acoustic enhancement. This is seen as localized area of increased echogenicity behind an area of low attenuation. Hence it is seen behind fluid filled structures such as cyst. This occurs as sound travels easily through fluids and those structures that will create a low level of attenuation to the US beam and hence produce high amplitude signals distal to the structure.



Fig9: Post acoustic enhancement below a fluid filled septate cyst

Reverberation artifacts

Reverberation occurs where the sound pulse bounces back and forth between two highly reflective interfaces. The equal time interval between returning reverberant signals results in a series of equally spaced echoes distal to deepest reflecting interface. This artifact is usually seen below the procedural needle.



Fig10: Reverberation artifacts under the procedural needle Scanning skills

Ultrasound produces a two dimensional image of a 3 dimensional structure. It represents a "slice" through the body. Consequently the probe must be moved from one end of a structure to other end to get a complete picture.

How to hold the transducer

The transducer should be held in nondominant hand like a pen so that wrist will get maximum range of motion in all planes. The fourth and fifth finger tips should contact the skin.



Fig11: Correct way of handling the probe.

The usual transducer manipulations are

- 1. Sliding
- 2. Tilting



Fig12: Tilting

- 3. Rotating
- 4. Heel toeing



Fig13: Heel toeing

Ultrasound appearance of common structures Echogenicity

- 1. Hyper echoic
- 2. Hypo echoic
- 3. Anechoic
- 4. Iso echoic

Echo-texture

Muscle-looks relatively hypoechoic with hyper echoic septa or perimysium surrounding the hypo echoic muscle bundle, on longitudinal view (like veins of a leaf). On transverse view, the septae appear as spot echoes with short, curvilinear, bright lines spreading throughout the hypo echoic background ("Starry night pattern").



Fig14: Transverse scan of muscle. "starry night pattern"



Fig15: Longitudnal scan of muscle. "pennate" appearence.

Tendon-Normal tendons on longitudinal view appears hyper echoic with a fiber like or fibrillar echo texture. On transverse view it has a" Broom stick" appearance.



Fig16: Transverse scan of tendons. "Broom stick appearence".

Nerves-Normally the nerves have a fascicular appearance in long axis. In short axis, it has a honeycomb or speckled appearance.



Fig17: Transverse scan of nerve "Honeycomb appearance"



Fig18: Long axis view of nerve and tendons. See the fascicular and fibrillar pattern respectively.

Ligaments-They usually connect two bones and are hyper echoic and striated.

Steps before doing ultrasound scan.

1. Proper operator ergonomics is a good practice. Adjust the bed or stool height and position the usg machine to maintain a proper operator posture.

2. Select the proper presets like MSK, Regional, Nerve etc

- 3. Proper probe selection.
- 4. Apply ample amount of Gel.
- 5. Adjust the Depth.
- 6. Adjust the focus.

7. Adjust the Gain and Time gain compensation (TGC).

8. Scan.

USG Tips-Abdominal Muscles and Low Back Pain

Low back pain is a common scenario in a PMR setting. Majority of low back pain patients attending а PMR OPD will be suffering solely from mechanical low back pain or they will be having a component of mechanical pain contributing to their low back pain.

Concept of core muscle and core muscle activation is important in understanding and treating mechanical low

back pain. Transversus abdominis muscle along with the lumbar multifidus muscle are the key muscles involved in segmental stabilisation of spine. So, their dysfunction is an important causative factor for chronic low back pain. Their training which is known as the core muscle strengthening forms the integral part of a chronic low back pain treatment. It is usually done by the Abdominal drawing-in manoeuvre which is defined as an inward movement of the lower abdominal wall in which the patient is instructed to draw the umbilicus toward the spine while maintaining a normal lumbar lordotic curve along with relaxation of the more superficial musculature (Mani et al.).



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1. To assess the sonographic characters like size, echogenicity of the muscles of the abdominal wall and spine.

2. For providing visual feedback for core strengthening exercises.

The sonographic character of various muscles are assessed in many conditions like rotator cuff disease. In

low back pain size and echogenicity of various muscles can be assessed. Muscles like transversus abdominis, rectus abdominis and multifidus show changes in patients with chronic low back pain.

While doing the exercise, ultrasound is useful to provide visual feedback, where the patient can see the different muscles contracting and they can make the desired movement accordingly.

The below given images (figures 1-4) are the abdominal muscle ultrasound images of a middle aged woman with chronic low back pain and a young athlete. The change in muscle size and echo-texture is evident. The probe is oriented in the transverse plane and is moved from midline (to view the rectus abdominis and linea alba) to the lateral side (to view the external and internal oblique muscles and the transversus abdominis). Patient is instructed to make in drawing movement and the transversus muscle is assessed dynamically. Fine tuning of the exercise is done by properly recruiting the muscle with ultrasound feedback. This is a very useful technique which improves the quality of core strengthening exercises to a greater extent.



Figure – 1 Short axis view of rectus abdominis (RA) and Linea Alba (LA) in a young athlete.



Figure-2 Short axis view of External oblique (EO), Internal Oblique (IO) and Transversus Abdominis (TA) in the same person.



Figure-3 Short axis view of Rectus Abdominis (RA) and Linea Alba (LA) in a middle aged female with low back pain. Note the hyper echogenicity of the muscle and reduction in size compared to the previous image.



Figure-4 The Ext. Oblique, Int. Oblique and Tr. Abdominis muscles in the above patient. Compare the size and echogenicity with the USG image of the athlete. It's hard to identify the muscles (so the arrow is pointed at the junction of external and internal oblique, thin Tr. abdominis can be seen deep to IO)

SUGGESTED READING

- 1. Deydre S Teyhen etal. Rehabilitative ultrasound imaging of the abdominal muscles. J Orthop Sports Phys Ther. 2007 Aug;37(8):450-66.
- Bindu VB, Mohanraj M, Shehadad K. Ultrasonological findings in multifidus muscle in chronic back pain patients. Journal of Evolution of Medical and Dental Sciences. Jan 2022;11(1):55-60.

Ultrasound Guided Botox Injections

Introduction:

Use of Botulinum toxin for treating spasticity, dystonia, comfort in wearing orthosis, and managing sialorrhea is an important part in the overall management of neurogenic disability by the physiatrist. In most cases, knowledge of surface landmarks muscle and palpation is all that is necessary to guide the needle in to the target tissue



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with confidence that the intended target has been reached. However in certain cases, use of additional help in the form of guidance by electromyography or ultrasound will be appreciated by the discerning clinician.

There are five main scenarios where ultrasound guidance will help. This is mainly because the target tissue is too deep or too close to a critical structure or a number of muscles are closely packed together to be able to carry out a non-guided procedure with confidence. These scenarios are:

- a. Cervical Dystonia
- b. Tibialis Posterior injection for foot equinovarus deformity
- c. Iliopsoas injection in children for flexed hip in cerebral palsy

d. Forearm muscle injections

e. Salivary gland injections for sialorrhea

Technical Considerations:

Proficiency in interpretation and localization of structures under ultrasound is a skill which needs to be developed by clinicians regularly injecting botulinum toxin. Ultrasound machine linear with and curvilinear probes may be needed to cover all possibilities. It is recommended to use moderate pressure on the probe and scan the target structure to avoid any critical structures in the planned needle path to the

target tissue. It is recommended to avoid using alcohol for skin preparation to avoid inactivating the toxin. Sterile plastic wrap can be applied to the probe head to avoid direct contact of the non-sterile probe to skin, however this does not seem always essential. Either an in-plane or out-of-plane technique can be used to guide the needle to the target tissue – in situations where no critical structures are in the needle path – an out-ofplane technique is easier to learn and master.

Cervical Dystonia:

The middle sternocleidomastoid is close to the pharyngeal constrictors and dysphagia is a possibility, hence imaging can be considered. Deeper muscles like longissimus, obliqus capitis inferior cannot be targeted without ultrasound guidance since they cannot be selectively activated by the patient. The anterior scalene is very close to the brachial plexus and hence guidance is very much recommended. The levator scapulae lies under the overlying trapezius and it is better to target this muscle with ultrasound guidance. All other muscles can be confidently targeted without resorting to ultrasound.

Tibialis posterior:

This muscle lies deepest in the calf and it is recommended to use a spinal needle to approach this muscle, specially in adult women due to the possibility of having to traverse a larger subcutaneous path. The need to use ultrasound arises from the fact that the tibial vessels lie close to the muscle injection site and it is safer to visualize this structure while injecting. I like to use ultrasound while injecting the lateral gastrocnemius as well since the muscle is found more medially than one would suppose from knowledge of traditional anatomy texts.

Iliopsoas:

Similar to the tibialis posterior, the iliopsoas is also a deep muscle and it is better to use ultrasound guidance to approach this muscle. In children, use of ultrasound helps much more because the muscle is not as bulky as in adults and it is easy to inadvertently inject the hip adductors instead of the correct muscle. Additionally a single pass is needed to guide the needle correctly thereby eliciting better co-operation from an anxious child.

Forearm muscles:

Many of the finger flexors are close to each other and use of ultrasound helps in targeting each finger flexor separately and accurately with a single pass of the needle. In complex dystonias, like writer's cramp both flexors and extensors can be targeted depending on the pattern of dystonia better and faster with ultrasound guidance.

Salivary glands:

Unlike muscles, salivary glands have a homogenous appearance on the ultrasound and accurate needle placement to avoid facial or masticatory muscles can be achieved by using ultrasound to place needles. The submandibular gland in particular is closely associated with the external carotid artery and hence the safety of needle placement is greatly enhanced by using image guidance in injecting this structure.

Conclusion:

It is desirable to use image guidance to target certain structures when injecting botulinum toxin. The use of ultrasound in rehabilitation practice is on the rise and the modern physiatrist is expected to have working knowledge of this modality in performing interventions. In pre-selected conditions, use of this device is safe and worth the additional expense and effort incurred.

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Members in Action-1



Dr. Ravi Sankaran, *Professor & HOD of PMR at Amrita Institute of Medical Sciences, Kochi*, went to a workshop on Neural Therapy in New York on October 14-16. **Dr. David Vinyes** was the primary course director.



Dr. Roy R Chandran, Associate Professor of *PMR at Government Medical College, Kozhikode* was a panelist on a session on the "Role of Exercise in Diabetes". The program was organized by RSSDI (Research Society for the Study of Diabetes in India) on the 19th of October.

സൗജന്വ മെഡിക്കൽ ക്യാമ്പ് & എക്സിബിഷൻ

സെറിബ്രൽ പാൾസി ബാധിച്ച കുട്ടികൾക്കായി അമലയിൽ സൗജന്യ മെഡിക്കൽ ക്യാമ്പ്



The Department of PMR of Amala Medical College, Thrissur conducted a free Medical camp for Cerebral Palsy children on the 19th of October at the Child Development Centre of the institution.



An online session on Mini-CEX (Mini -Clinical Evaluation Exercise) was taken by **Dr. Reeba Mary Mani**, *Associate Professor* of *PMR at Government Medical College, Kozhikode.* This edifying session was organized by the Kerala Chapter of IAPMR on 21st October.



The PMR Department of Dr. Moopen's Medical College, Wayanad under the aegis of Dr. Babeesh Chacko, Consultant Physiatrist, took differently abled patients to the Karapuzha Dam on October 20th. This was done with the aim of allowing the patients to interact with each other, enjoy the outdoors & create awareness of their condition among the common folk.



അതിവ്യാപനശേഷിയുള്ള പുതിയ വകഭേദം; ഇനിയുമൊരു കോവിഡ് തരംഗം ഉണ്ടാകാം

വരും ദിവസങ്ങളിൽ XBB എങ്ങനെ പെരുമാറുമെന്ന് കൃത്വമായി പറയാനാവില്ല; നിലവിൽ ഏറ്റവും വ്യാപനശേഷിയുള്ള വേരിയന്റ് ഇതുതന്നെയാകുമെന്ന് ചില വിദഗ്ധർ അഭിപ്രായപ്പെടുന്നു. വേഗത്തിൽ ഓടാനും ഇമ്വൂണിറ്റിയിൽ നിന്ന് ഒളിഞ്ഞുനിൽക്കാനും ഇതിന് കെൽപ്പുണ്ട്. ഒരാളിൽ നിന്ന് മറ്റൊരാളിലേയ്ക്ക് കടക്കാൻ ചെറിയ വൈറൽ ലോഡ് മതി എന്നതാണ് കാരണം. ഇതിനെതിരെ വാക്സിൻ ഉയർന്ന തോതിൽ പ്രവർത്തിക്കണമെന്നുമില്ല. അടുത്ത ആഴ്ചകളിൽ പുതിയ ഒരു തരംഗം ഉയർന്നു വരാനും സാധ്വതയുണ്ട്.



Dr. U Nanadakumaran Nair, *Professor & HOD of PMR at Kollam Medicity,* wrote an article on the new XBB variant of Covid-19. The article outlined how the virus can evade the immune response & hence the fate of its spread could be highly unpredictable.



Dr. Suhaila Kallada, Specialist in Physical Medicine & Rehabilitation, at Cambridge Medical & Rehabilitation Centre, Abu Dhabi, attended the prestigious MENA Stroke Conference. This hybrid conference was conducted in Abu Dhabi from October 21-23rd.



Dr. Nittu Devassy, Assistant Professor of *PMR at Amrita Institute of Medical sciences, Kochi*, gave a talk in Thrissur Orthopaedics State Conference on 'Cuff Substitution Rehabilitation in Shoulder'. This conference was on 23rd October 2022.



A free Medical camp at St. Joseph's Church, Amalanagar, Thrissur, was organized by *Department of PMR and Physiotherapy Unit of Amala Medical College*, on the 23rd of October. This camp was conducted under the aegis of **Dr. Sindhu Vijayakumar**, *Associate Professor of PMR*.



A succinct session on 'Aches & Pains in Diabetes' was presented by **Dr. Unnikrishnan Ramachandran**, *Consultant Physiatrist at Saraswathy Hospital*, *Trivandrum*. This session was part of the monthly meeting of Trivandrum Physiatrists Club, held on October 25th at Hotel Residency Tower.

ലോക ഒക്യുപേഷണൽ തെറാപ്പി ദിനം വീൽ ചെയറിൽ ജീവിക്കുന്നവരുടെ കൂട്ടായ്യയുമായി ബിലിവേഴ്സ്

തിരുവല്ല: ലോക ഒക്യപ്പേഷണ ൽ തെറാപ്പി ദിനത്തിന്റെ ഭാഗ റോഷിൻ മേരി വർക്കി പാനൽ മായി ബിലീവേഴ്സ് ചർച്ച് മെ ഡിക്കൽ ആശുപത്രിയിൽ വീ ൽ ചെയറിൽ ജീവിക്കുന്നവരു ചർച്ചനടത്തി.

ന്ന് പേരിൽ വീൽ ചെയറിനെ ൽരേണ്ടതിനെക്കറിച്ചം അതി ആശ്രയിച്ച്കഴിയുന്നവർക്ക്വേ ന് ബിലിവേഴ്സിന്റെ ഫിസിക്ക ണ്ടി പിന്തുണാ സംരംഭം ഉദ്ഘാ ടനംചെയ്ത.ഈ വർഷത്തെലോ ബിലിറ്റേഷൻ വിഭാഗം നടത്തു ക ഒക്കുപേഷണൽ ദിനത്തിന്നെ പ്രവർത്തനങ്ങളെക്കറിച്ചും ന്റെ ചിന്താവിഷയത്തെ ആസ്റ്റ മോഹി മാർസ്മർ പ്രാഹാസ് ചർച്ചയിൽ വിശദീകരി ദമാക്കി സീനിയർ ഒക്കുഷേഷ

ണൽതെറാഷിസ്റ്റ് ഫേബാ ജോ സ്നാസമായിസംവദിച്ചു ഇടർ ന്ന് വിൽചെയറിൽ ജീവിക്കണ ജോൺസൺ ഇടയാറൻറ്റ്റെ പി വർത്തവരവരുടെങ്ങനാഭവങ്ങൾ എം.ആർ അംബാസഡർ ആഗ് പങ്കുവച്ചു. ബിലീവേഴ്സ് ചർച്ച്ന എബ്രഹാം, സോഷ്യൽ വർ മെഡിക്കൽ കോളേജ് ആശുപ ത്രി മെഡിക്കൽ സൂപ്രണ്ട് ഡോ. സ്റ്റുകളായ ഭവൻ വി.പി, അനീ ജോംസി ജോർജ് ഉദ്ഘാടനം ഷ അലക്സാണ്ടർ എന്നിവ ജോംസി ജോർജ് ഉദ്ഘാടനം

വിൽപെയറിൽ ജീവിക്കന്ന വർക്കം അവരുടെ കുടുംബാംഗ ടെ കൂട്ടായ സംഘടിപ്പിച്ചു. അൾക്കാ വേണ്ട മാനസികവും വിൽചെയർവാരിയേഴ്സ്എ സാമുഹികവുമായ പിത്രണ ന ൽ മെഡിസിൻ ആൻഡ് റീഹാ ക്കുകയും സംശയങ്ങൾക്ക് മറുപ

വിൽ ചെയറിനെ ആശ്രയിച്ച് കഴിയുന്നവർക്ക് വേണ്ടിയുള്ള പിന്തുണാ ക്കർ അന്തജ റോസ്, തെറാപി അലക്സാണ്ടർ എന്നിവ ചെയ്യ.ചടങ്ങിൽ പി.എം.ആർ ർവേദിയിൽ സന്നിഹിതരാ

സംരംഭം ബിലീവേഴ്സ് ചർച്ച് മെഡിക്കൽ കോളേജ് ആശുപത്രി മെഡിക്കൽ സുപ്രണ്ട് ഡോ.ജോംസി ജോർജ് ഉദ്ഘാടനം ചെയ്യു. യിരുന്നു.പി.എം.ആർ വിഭാഗ ക്ഷ നൽകന്നവയാണ് കൂട്ടായ്യ

ത്തിന്റെ ഇതു പോലെയുള്ള ന്റ യിൽ പങ്കെടുത്തവർ അഭിപ്രാ തന സംരംഭങ്ങൾ ഏറെ പ്രതി യഷെട്ടു.

Day World Occupational Therapy was observed at Believer's Church Medical College Hospital, with the inauguration of wheel chair support group in BCMCH that includes paraplegics, quadriplegics, monoplegics etc after Spinal Cord Injury, Polio. Dr. Roshin Mary Varkey, Associate Professor & HOD of PMR at BCMCH, was part of a panel discussion and gave a brief talk on evaluation and management after SCI.

ലോക പക്ഷാഘാത ദിനം: സെമിനാർ നടത്തി

പെറിന്തര്മുള്ള ബോക പക്ഷാ ഘാത നീനത്തോടനുബന്ധിച്ചി പെരിന്തരാണ്ണ ജില്ലാ ആശുപത്രി യിൽ പക്ഷാഘാത ദിനാപരണ ബെജിനാർ നടത്തി. ഹിസിക്കൽ ອສະເມໄຕບໄດຣັ, ແລະຍຸງໄດງ കെഷർ, എൻസിഡി ക്ലിനിക് എന്നി വിദാഗങ്ങളുടെ നേതൃത്വ ത്തിലാണ് പരിപാടി സംഘടിപ്പിച്ച ത്. ആശുപത്രി സുപ്രണ്ട് ഡോ. ബിന്ദു ഉദ്ഷാടനം ചെയ്തു. ഡോ.അനുപ് ആധ്യക്ഷ്യം വഹി 44

ഡോ.ബിജി കുരുൽ, നഴ്സിങ് സുപ്രണ്ട് രജനി, ജെഎച്ച്ഐ സെന്തിരികുമാർ, ബിജുമോൻ, നദീറ, ഉമ്മർ നേത്രത്തിൽ, സ്റ്റാ ഫ് കൗൺസിൽ ട്രഷാർ ഷാഹി, ഡോ.പിത്ര എന്നിവർ പ്രസംഗി

:241 (acouted and an and a second പലപ്പിത്ര നിരുപകൻ മധു ജനാർ രന്ത് നയിച്ചു. ത്യൂടിഷൻ സെമി നാർ ഡയറ്റിഷൻ നിമ പ്രഭ. ഗ്രൂപ്പ് ചറിസിയോതെറപ്പി ഹർഷ എന്നി വര് നയിച്ചു.

World Stroke Day was observed at District Hospital Perinthalmanna, by the Department of PMR, the Palliative Care Unit & the NCD Clinic. The seminar was presided over by the Hospital Superintendent, Dr. Bindu & other eminent officials from the hospital. Dr.

chief Anoop was the guest. Junior Consultant, Dr. Chitra K. R represented the **PMR** for the department same. 29.10.2022 ശനി രാത്രി 9 മണിക്ക് കേരള ലിറ്റററി സൊസൈറ്റി ഡള്ളാസ് നിധി ബുക്സ് വായനമുറി അവതരിപ്പിക്കുന്ന നോവൽ ചർച്ച: മഞ്ഞിൽ

ഒരാവശ



Dr. U Nandakumaran Nair, was part of an online book review where he reviewed a Malavalam book, Manjilu Oruval, on an online platform. This session was arranged by the Kerala Literary Society of Dallas & Nidhi Books on October 29th.



Sindhu Vijavakumar, Dr. Associate Professor of PMR at Amala Medical College, Thrissur, was part of a Multi disciplinary camp for Cerebral Palsy at the Regional Early Intervention Centre, Thrissur on October 29th.



Dr. Bineesh Balakrishnan, Assistant Professor of PMR at Sree Narayana Institute of Medical Sciences, Kochi, presented a session on 'Introduction to PMR' at the Annual Conference of QPMPA Kerala. This was held on 30th October at Central auditorium, North Paravur.



On 29th October in General Hospital Trivandrum a lady surgeon who was sincerely attending patients even after her duty time was attacked by a patient without any provocation. The culprit was arrested and immediately remanded by the active intervention of KGMOA, District Health Authorities and the public. However, the pathetic situation of workplace insecurity and heavy workload remained unchanged.

Demanding urgent steps to improve the situation, KGMOA conducted a protest dharna on 31/10/2022, Monday morning 8am, in front of General Hospital in which members from all over the district attended. In this KGMOA had support of KGMCTA and IMA. Being the *President of KGMOA Trivandrum*, **Dr. Arun A. John**, played a lead role in the organisation and conduct of all these aforementioned activities. **Dr. Arun** is *Consultant Physiatrist at GH Trivandrum*.

The Afterglow...



The Rehabcon 2022 Midterm CME was a spectacle to behold. The misty mountains of Lakkidi (in Wayanad) provided the perfect backdrop for what was to be a 2-day academic & visual feast. Rain Country Resort which was the venue was serene & breathtakingly beautiful. Nearly 100 delegates were present for this CME. The inauguration of this mega event was done by **Dr. P.C Muralidharan**, *President of the Kerala Chapter of IAPMR*.

On Day 1, a sumptuous lunch was followed by academic sessions. The topics discussed ranged from Geriatric rehab to Critical care rehabilitation. The succinct talks were followed by lively discussions. Paper/case presentations then followed to pique the interests of Junior residents & doctors. The icing on the cake was the sightseeing trip which was organized around early evening. The Executive Committee meeting was conducted to discuss the pressing issues & future plans of the Kerala chapter of IAPMR. The day's programs ended with the cultural programs & banquet dinner.



Day 2 started with more interesting case presentations by the Residents & Junior doctors. The talks on this day were engrossing, covering topics like Virtual Reality, Exercise & Fitness, to name a few. The Key note address by Dr.Sreedevi Menon P, Professor & Head of PMR at Government Medical College, Kozhikode, was riveting & inspiring. The panel discussion which was chaired by Dr. P.C Muralidharan was undoubtedly the best segment of this day. The heavenly backdrop, the edifying talks, the sumptuous meals, & the lighthearted banter among the delegates, made this CME an unforgettable experience. Profound gratitude is due to the Organizing Chairperson- Dr. Sudheera V.T, the Organizing Secretary- Dr. Noufal Ali, the Scientific Committee Chairperson- Dr. Babeesh Chacko, & the President of Kerala Chapter of IAPMR- Dr. P.C Muralidharan, who gifted this memorable experience to all of us...

Sports Rehabilitation- Part 1

One of the central tenets of sports rehabilitation is to be prepared to intervene in a timely & efficient manner. You may have if the to assess environmental factors are appropriate for an endurance event. If they're not you'll have to call off the event. You'll need an Emergency Action with deal Plan to players who have injured their spine, suffered concussions. injuries. other or



Dr. Bineesh Balakrishnan is the Assistant Professor in the Department of P. M. R, at Sree Narayana Institute of Medical Sciences, Chalakka, North Paravur, Kochi. He finished his MBBS from Government Medical College, Thrissur & his MD (in P. M. R) from Government Medical College, Kozhikode. He also cleared his DNB in P. M. R. His areas of interest include Sports rehabilitation & Neurorehabilitation.

team physician has to deal with the medicolegal responsibilities¹.

Physical Training & Periodization

The body adapts to physical training, both metabolically & neuromuscularly in a specific manner the exercise to being performed. The principle of overload dictates training that the stimulus should be greater than how the athlete normally

Placing of fluid aid stations during marathons, & discussing hydration protocols with athletes are also part of your job. Watching if a rehabilitated player is performing optimally after you cleared him to play again requires preparedness. The two kinds of venues where a team physician/sports physician works are, in the sidelines of a sporting event or during mass participation endurance events.

What are the responsibilities of a team physician?

The most important obligation is to the athlete as a patient. He decides if the athlete is fit to play after a pre participation evaluation. Treatment & rehabilitation of an injured athlete is again part of this obligation. Return to play is a very crucial decision to be taken by the team physician. As is expected the performs in competition. Hence the training variables must be periodically increased for the athlete to progress. The different training variables are:-

Frequency of training

Intensity of training

Type of exercise mode

Time of exercise duration

Volume of exercise (the total amount of exercise)

Progression of the exercise program $(Mnemonic is FITT-VP)^2$

Periodization is a structured training approach based on the principle of overload. There are two types of periodization- linear periodization (more commonly followed) & undulating periodization. In periodization training is divided into defined periods to achieve:-

- 1. Buildup of training stresses
- 2. Time for rest & adaptation to training
- 3. Continual progression of training

In linear periodization, one year of training is broken down into macrocycles each lasting multiple months. Each macrocycle is made up of shorter mesocycles lasting around a month. Mesocycles are subdivided into microcycles commonly lasting a week. In each mesocycle there's a buildup of training frequency & intensity over the first 3 weeks and then a slight decrease in the fourth week allowing for rest and the subsequent metabolic training adaptations to occur. The athlete then proceeds to the next mesocycle. The intensity & amount of training in each mesocycle depends on where the athlete is in relation to the competitive season, based on which there are three macrocycles. They are-preseason or "buildup phase, " competitive season or "maintenance and fine-tuning phase," and finally a postseason or "recovery phase." Of these the preseason macrocycle is the biggest, occurring just before the competitive phase, where the athlete generally focuses on higher volume & lower intensity exercise. The focus in the competitive season macrocycle (which follows the preseason macrocycle) is to develop and maintain peak fitness with a focus on high-intensity training and sportspecific technique drills. In the final macrocycle, the post season one, the athlete takes time to recover from the previous year's training and physically and mentally prepare for the next year of training and competition.

Overtraining Syndrome:-When prolonged, excessive training occurs concurrently with insufficient recovery, the athlete might have unexplainable performance decrements resulting in chronic maladaptation leading to overtraining syndrome. Common symptoms of overtraining syndrome, in addition to an unexplained performance decrement, include generalized fatigue, mood disturbance, poor sleep, and increased rates of illness and injury. By definition, these symptoms persist despite more than 2 weeks of rest¹.

The Kinetic Chain Model

The kinetic chain model is based on the concept that each complex athletic movement is the summation of its constituent parts. In a throwing athlete, the upper limbs act like a funnel for the energy generated by the core & lower limbs.

"Catch-up" occurs when an athlete tries to compensate with one segment for a deficiency in a separate segment. This phenomenon puts higher stress on the tissues of the distal segment and predisposes it to injury. In a tennis player if the injury/dysfunction is in the trunk, the distal segments- the shoulder, elbow & wrist will be put to higher stress, & hence predisposed to injury.

A good sports physician will look for the biomechanical culprit rather than just trying to isolate the painful tissue. For example, if the tissue diagnosis is Medial/Lateral epicondylitis, the potential biomechanical diagnosis is Posterior Deltoid weakness. For a tissue diagnosis of Hamstring strain the potential biomechanical diagnosis is overly tight Hamstrings, & weak Gluteal musculature. The potential biomechanical diagnosis for a metatarsal fracture is a supinated foot.

Prehabilitation

Prehabilitation is based on the concept that many sports injuries can be prevented if the athlete engages in an appropriate preseason prehabilitation program. Most of the current evidence with regard to prehabilitation is in the context of non- contact ACL injuries. Stretching programs, Balance perturbation, & Plyometric training all have a role in prehabilitation of the athlete. A good many sports injuries are due to overuse & it is good to discuss this in detail during the preseason training. Prehabilitation programs are sport specific, and often position specific, but always address the basic components of all athletic movements and the potential "breaks" in the kinetic chain: (1) flexibility, (2) strength, and (3) endurance. For example, a soccer prehabilitation program could involve daily postactivity stretching, strength and plyometric training three times per week, and cardiovascular exercise three times per week¹.

Phases of Injury & Rehabilitation

There are 3 phases through which an injury recovers. The first phase involves the initial injury and the subsequent inflammation, edema, and pain. This phase is typically short, lasting days, depending on the severity of the injury. The reparative phase of the injured tissue might last from 6 to 8 weeks. It involves cell proliferation, granulation tissue formation, and neovascularization. The last phase is remodeling, which occurs as the tissue matures and realigns. Excessive inflammatory response or exuberant repair can result in poor outcomes. For example, problems experienced during the remodeling phase can result in excessive scar tissue formation development and of recurrent/chronic injury¹.

Rehabilitation of the injured athlete can be divided into acute, recovery, and functional phases. The acute phase addresses the clinical symptoms and should focus on treating tissue injury. This phase correlates with the inflammatory stage of injury in that primary tissue damage is followed by secondary resulting injury, from hypoxia and inflammatory enzymatic activity. The goal at this stage should be to reduce pain and inflammation and promote tissue healing. Reestablishment of nonpainful range of motion (ROM), prevention of muscle atrophy,

and maintenance of general fitness should be addressed³. PRICE (*P*rotection, *R*est, *Ice*, *C*ompression, *E*levation) protocol is used in this phase. Of late, POLICE protocol is becoming famous. *Here instead of rest*, *optimal loading is used*. Surgery to repair the damaged tissue is done in this stage. Isometric strengthening can be done as tolerated. Passive ROM must be viewed with caution in the acute to subacute injury phase because it might injure the tissue, leading to increased pain and inflammation¹.

The recovery phase correlates with the fibroblastic repair stage, in which inflammatory changes at the site of the injury are replaced by granulation tissue. This phase should focus on obtaining normal passive and active range of motion (PROM and AROM), improving muscle control, achieving normal muscle balance. and working on proprioception. Loading of injured tissues should be done in a progressive manner since the tensile strength of affected tissue may be reduced. Biomechanical and functional deficits including lack of flexibility and inability to run or jump should be addressed in this phase³.

During final the functional stage of rehabilitation, the focus remains on kinetic chain issues and technique errors. Strength, balance, power, endurance, functional ROM, and NMC (Neuromuscular Coordination) are aggressively addressed. Sport-specific drills are used during this stage and advanced to include practice. Full RTP is achieved when the injury is no longer painful; when there is normal flexibility, strength, and proprioception; and when appropriate sportspecific mechanics and sport-specific skills are achieved and reproducible¹. Remember that there are set criterias for determining return to play for each injury.

Biomechanics of running

of the basic differences in the One biomechanics of running, when compared with walking is the presence of the float phase. In this phase both feet are in the air & this occurs at the beginning of initial swing & the end of terminal swing. As the speed of running increases the stance phase decreases in duration. As speed of running increases, velocity & range of lower limb motion increase, & this serves to reduce vertical displacement & increase efficiency. The body lowers its center of gravity by increasing hip flexion, knee flexion, & ankle dorsiflexion. Foot contact pattern changes in running. In slower running the foot contact is heel to toe, as in walking. As running speed increases, foot strike occurs with the forefoot and heel simultaneously or the forefoot strikes initially followed by the heel lowering to the ground. In sprinting, weight bearing is on the forefoot from loading response to toe-off.

Which is superior barefoot or shod running?

While using cushioned shoes promotes rearfoot strike, barefoot (minimalist) running promotes forefoot strike. Forefoot strike reduces vertical loading rates, which thereby reduces overuse injuries in runners including patellofemoral pain, plantar fasciitis, anterior compartment syndrome, and tibial stress fractures. Many forefoot strike runners will transition to rearfoot strike when fatigued, & rearfoot strike while running barefoot produces the greatest vertical loading rates. More research is needed to conclusively decide whether shod running is superior to barefoot running¹.

Biomechanics of jumping & landing

Biomechanics of jumping & landing has been well studied in the setting of non-contact ACL injuries of the knee. These knee injuries occur more frequently with the knee in flexion. In this position greater knee extensor loads result in anterior tibial translation & ACL injury. There's a well-defined difference observed in the jumping & landing mechanics which is one likely reason for higher rate of noncontact ACL injuries in females. Female athletes land more erect with less hip & knee flexion, & less hip abduction & external rotation. They also generally have an increased Quadriceps to Hamstring activation ratio creating greater knee extension forces. A metaanalysis of metaanalyses of ACL injury reduction training programs showed an overall 50% reduction in risk of all ACL injuries in all athletes, and 67% reduction in non-contact ACL injuries in females. Randomized control trials (RCTs) have showed a 64% to 75% reduction in ACL injuries with as little as 15-minute warm-ups performed twice weekly. Hence ACL injury prevention is not time consuming¹.

Biomechanics of Swimming

There are four competitive strokes in swimming: freestyle (crawl), backstroke, butterfly, & breaststroke. Four phases of the swim stroke are common to freestyle, backstroke, and butterfly. The first phase is the entry or catch phase & starts with hand entry into the water until the beginning of its backward movement. The propulsive phase is divided into two separate phases: pull and push. The pull phase ends as the hand arrives in the vertical plane of the shoulder, & in the push phase, the hand is positioned below the shoulder and pushes through the water until its exit from the water historically at the level of the greater trochanter. The final phase-the recovery phase, entails the aerial return of the hand.

The overarching principle for shoulder rehabilitation & prehabilitation in this sport, is that most shoulder pain in swimmers (impingement and rotator cuff tendinopathy) is caused by dynamic muscle imbalances, weakness, and biomechanical faults, rather than hard anatomic factors. A major tenet of shoulder rehabilitation in swimming is scapular stabilization, with a prime focus on endurance training of the serratus anterior and lower trapezius. *The serratus anterior is a muscle of particular focus because it has been demonstrated to function at 75% of its maximum test ability in swimming, being active throughout the swim stroke cycle.* Other tenets of shoulder rehabilitation in swimming include stretching the internal rotators and posterior capsule and cervical and thoracic mobilization.

D'n'D- Drugs & Doping

"Doping" refers to any substance or method used to increase performance, possibly to the detriment of the health of the athlete or the ethics of the competition. The World Anti Doping Association was created to unify the fight against doping. The World Anti-Doping Code was developed in 2003 and enforced in 2004, with a complete listing of banned substances and methods. Banned substances are divided into those that are banned in and out of competition and those that are banned in competition only.

If/when an athlete has an illness or condition that requires treatment with a banned medication, a therapeutic use exemption (TUE) can provide the authorization to take the needed medicine.

Now what about prescribing drugs in sports?

Analgesics:-Acetaminophen can be linked to decreased muscle building after exercise, as is Ibuprofen. Prostaglandins are normally released after eccentric resistance exercise, & this response might be blunted by consumption of maximal doses of Ibuprofen & Acetaminophen.

Anti-inflammatories:-Owing to their antiinflammatory effects, NSAIDs likely inhibit the production of prostaglandin E2, which is known to play a role in bone healing. NSAIDs may be contraindicated in those with suspected or known fractures. Steroids when given orally, rectally, intravenously, or intramuscularly, their use is prohibited by WADA. Topical preparations for skin, eye, ear, nose, or buccal cavity or for iontophoresis are allowed. For applicable athletes, epidural and intraarticular steroid injections, as well as inhaled steroids, require a TUE (Therapeutic Use Exemption).

Antihypertensives: - ACE Inhibitors & CCBs (Calcium Channel Blockers) are the drugs of choice in hypertensive athletes. Two other classes of drugs- Diuretics & β Blockers have side effects that may hinder performance. Diuretics can decrease cardiac output, plasma volume & peripheral vascular resistance. Dehydration & electrolyte alterations can result in cramps or even heat stroke. B blockers can inhibit glycolysis and glycogenolysis resulting in hypoglycemia after exercise. They can reduce exercise tolerance by increasing perceived effort. Decreased heart rate recovery after exercise can result from the negative chronotropic effects of β -blockers. They are also banned in certain sports because of their anxiolytic effects.

Diabetes Drugs:- Insulin doses might need adjustment for persons with insulin dependent diabetes who start a new exercise program. Because of increased insulin sensitivity with exercise, a 20-40% reduction in dose is typical. High-intensity exercise (i.e., greater than 80% VO2_{max}) can cause a temporary increase in blood glucose secondary to Sympathoadrenal activation. In such situations, supplemental insulin, should be used at lower doses than that given for hyperglycemia at rest. Since muscle contraction can accelerate insulin absorption, IM injections should be avoided. Cold can decrease absorption rates of insulin & heat can increase it, & hence, athletes with insulindependent diabetes mellitus should avoid modalities that use extremes of temperature like hot & cold whirlpools.

Asthma drugs:- Exercise Induced Bronchospasm can be treated using β -agonist like Salbutamol about 5 to 20 mins before exercise. Inhalation of Cromolyn Sodium can be added if needed. For patients with chronic persistent asthma inhaled Corticosteroids are the standard treatment.

Continued on page 38.

Members in Action-2



World Stroke Day was observed by the *Department of PMR at the NIPMR (National Institute of PMR)* on November 2nd. An awareness session for the patients & their bystanders was arranged by the Department of PMR as part of this observance.

10TH NOVEMBER, 2022

INAUGURATION OF PELVIC DYSFUNCTION CLINIC

The Department of Neurology invites all to the inauguration of Pelvic Dysfunction Clinic.

Workshop Hall, 9th Floor, Nalanda Block, (S) 4:00 pm Amrita Hospital, Kochi

(The inauguration ceremony will take place at Workshop Hall followed by virtual talks)

4.00 PM	Inauguration Dr. Prem Nair (Group Medical Director, Amrita Hospitals)			
	Dr. Gireesh Kumar KP (Principal, Amrita School of Medicine)			
4.50 PM	Break			
5.00 PM	Sexual dysfunction in neurological practice Dr. Jalesh N. Panicker Professor & Head, Dept. of Uro-neurology, UCL Hospital, London			
5.25 PM	Lower urinary tract dysfunction in men Dr. Kannan Nair (Dept. of Urology, Amrita Hospital)			
5.50 PM	Voiding dysfunction in women Dr. Jalesh Panicker (Dept. of Uro-neurology, UCL Hospital, London)			
6.15 PM	Management of constipation & incontinence : Role of Gastroenterologist			
	DI. Shine Sadasivan (Dept. of Gastroenterology, Arnina Hospital)			
6.40 PM	Challenging cases Dr. Saraf Udit Umesh (Dept. of Neurology, Amrita Hospital)			
7.05 PM	Pelvic floor rehabilitation Dr. Ravi Sankaran (Dept. of PMR, Amrita Hospital)			
🖸 zoor	Meeting ID: 881 5930 33 Passcode: a			

The inaugural function of the Pelvic Dysfunction Clinic at Amrita Medical College was conducted on November 10th. **Dr. Ravi Sankaran**, *Professor & HOD of PMR at Amrita Medical College*, presented a session on 'Pelvic Floor Rehabilitation' in this function.



Dr. Roy R Chandran, Associate Professor of PMR at Government Medical College, Kozhikode attended the Annual Conference of IMA Kerala State Branch. **Dr. Roy** served as the Secretary for the IMA Kerala Health Scheme for the last 3 years. After an illustrious term in this post, he officially stepped down from it during this function.



Rehab assessment and management of differently abled children of Deepthi Special

school, Adoor on the occasion of Children's day, was conducted by the *Department of PMR at Believer's Church Medical College Hospital (BCMCH)*. This was done under the aegis of **Dr. Roshin Mary Varkey**, Associate *Professor & HOD of PMR at BCMCH*.



PMR department was chosen as "Department of the week" by BCMCH for its outstanding performance. The department comprises of Physiatrist, Rehab consultant, Junior resident, Physiotherapists, Occupational Therapists, Speech and Swallow therapists, Psychologists, & Medical Social Workers. The PMR team is led by **Dr. Roshin Mary Varkey**, *Associate Professor & HOD*.



Dr. Unnikrishnan Ramachandran, Consultant Physiatrist at Saraswathy Hospital, Trivandrum, presented a session on 'How to Exercise to Prevent Lifstyle Disorders' as part of the observance of World Diabetes Day by the Diabetes Care Centre, Trivandrum



Dr. Vipin Vijay, *Junior Consultant in PMR*, *at Thaluk Hospital, Punallur*, presented an awareness session during the World Diabetes Day observance by the DMO Kollam.



Under the guidance of **Dr. Ravi Sankran**, *Professor & HOD of PMR at Amrita Medical College, Kochi*, a workshop for MBBS students was arranged in the department. This sensitization session was conducted on November 17th.



Dr. Santhosh K. Raghavan, *Professor & HOD of PMR at Government Medical College, Aleppey*, presented an edifying session on 'Concepts of Rehabilitation Medicine in Hansen's Disease' on November 17th. This talk was part of a Dermatology conference.



The Blessing Ceremony of the *Physical Medicine & Rehabilitation Department at Pushpagiri Medical College*, was conducted on November 18th. This was done by **His Grace Rev. ArchBishop Thomas Kuriloos** & **Dr. P.C Muralidharan**, *President of the Kerala Chapter of IAPMR*. A Rehab Exhibition- 'Pushpagiri Rehab Expo' was also inaugurated by **Dr. P.C Muralidharan** on the same day.



The Department of PMR at Pushpagiri Medical College is being led by **Dr. Jimy Jose**, *Assistant Professor & Faculty in Charge* of the same.



The patients from *Thanal Brain & Spine Centre* were taken to the Payambalam Beach on November 20th. This outing was arranged by **Dr. Muneer C. & Dr. Sreejith Choorapra**, *Consultant Physiatrists* at this centre. **Dr. Fathima Haneena**, *Consultant Physiatrist at KIMS Trivandrum*, wrote an article on 'Communication in Locked-in syndrome' in the KIMSHealth e-journal.

Dr. Sooraj Rajagopal, Associate Professor of *PMR at Government Medical College, Kozhikode*, presented an online session on 'WPBA-Workplace Based Assessment' on December 2nd. This session was organized by the Kerala Chapter of IAPMR.

Sports Rehabilitation-Part 2

By Dr. Bineesh Balakrishnan

Performance Enhancing Drugs

Anabolic steroids:-Anabolic steroids enhance athletic performance by exerting anabolic effects by binding to the Androgen receptors. They also exert anti catabolic effects by competitive inhibition of the glucocorticoid receptor. By exerting psychological effects, they push the athlete to train harder & more often. As we all know the side effects of anabolic steroids range from voice changes, hirsutism all the way to liver damage & stroke. In athletes, premature deaths have been attributed to anabolic steroid use commonly as a result of suicide or acute myocardial infarction.

Erythropoetin & Blood Doping: - endurance athletes are particularly sensitive to the oxygen carrying capacity in their blood. Altitude/hypoxic training, where endurance athletes to increase oxygen carrying capacity of their blood by training at high altitudes (to elevate Erythropoetin levels), or sleeping in 'altitude tents'(Google that!!) is a subject of much research. The availability of rhEPO has led to its abuse in sports. Both rhEPO & blood transfusion can increase the oxygen carrying capacity of blood by increasing the number of RBCs in the blood. The resulting elevated hematocrit may cause stroke, myocardial infarction & pulmonary embolism. Blood transfusions can result in HIV, Hepatitis B, Hepatitis C infections, besides transfusion reactions.

Stimulants:- Stimulants include Caffeine, Ephedrine, Pseudoephedrine, Phenylephrine, Amphetamines, & Methylamphetamines. This class of supplements increase arousal, heart rate, respiratory rate & blood pressure. Side effects range from insomnia, agitation, restlessness, anxiety, all the way to heat intolerance, stroke, myocardial infarction, & death. Pseudoephedrine is a commonly used drug in this class. It has been shown to improve cycling power output & pace in a 10km run, in studies, though other trials contradict these findings. The use of this drug is subject to a threshold limit & is banned by WADA when it's concentration in urine is greater than 150µg/mL. Caffeine is an adenosine receptor antagonist which is ergogenic in most exercise situations. Caffeine has not been prohibited by WADA, but is being monitored in competitions since 2004.

Supplements

A supplement is a substance taken to augment the diet. A 2002 metaanalysis found that, of the more than 250 dietary products available, only β -hydroxy- β -methyl butyrate & creatine supplements have sufficient evidence to conclude that they significantly augment lean body mass & strength with resistance training. Common side effects of creatine include muscle cramps & gastrointestinal distress. Another metaanalysis in 2014 metaanalysis concluded that whey protein when combined with resistance exercise or a weight loss program can be used to improve body composition parameters. A number of cases of renal failure have been reversed by withdrawal of Creatine supplementation¹.

Preparticipation Examination

The primary goals of the PPE are to (1) identify life-threatening conditions, (2)identify conditions that can limit competition, (3) identify factors that predispose the athlete to injury, and (4) meet the legal requirements institution and of the state. Added opportunities are to discuss preventative health and high-risk behaviors, establish rapport with the athlete, and evaluate the general health of a potentially underserved population. The lead physician must make the determination to clear the athlete without restrictions or with recommendations for further evaluation or treatment. Alternatively, athletes might not be cleared for participation in certain sports or might not be cleared for participation in any sport. A routine ECG evaluation is done in India as part of the Preparticipation Evaluation. If an athlete has normal ECG findings & is asymptomatic, with no history of inherited cardiac disease or Sudden Cardiac Death, then no further evaluation is needed. For an athlete with only one borderline ECG finding among Left axis deviation, Left atrial enlargement, Right axis deviation, Right atrial enlargement, Complete RBBB, no further evaluation is needed if athlete is asymptomatic & with no history of inherited cardiac conditions or SCD. The presence of 2 or more borderline ECG findings mentioned earlier, or the presence of grossly abnormal ECG findings (Q waves, Epsilon waves, profound Sinus Bradycardia), need detailed evaluation for sudden cardiac death.

Emergency Assessment & Care

Sudden Cardiac Arrest:- The leading cause of death in young athletes is SCA, typically as a result of a structural cardiac abnormality. The most common structural abnormality resulting in death in young athletes is HCM, accounting for approximately 30% of all SCA-related deaths in this cohort. Commotio cordis, accounting for approximately 5% to 20% of SCA, and coronary artery abnormalities, accounting for approximately 15% of SCA, are the second and third most common causes of SCA in young athletes. Coronary artery anomalies are the most common cause of SCA in young female athletes. In athletes older than the age of 35, coronary artery disease is by far the most common cause of SCA, at 75%. Most patients with SCA are found in asystole or Pulseless Electrical Activity- both of which are non-shockable rhythms, as in a Defibrillator won't be of use in these conditions. The next most common findings are VF & VT both of which are shockable. Survival in SCA is dismal (~11%).

Cervical Spinal Cord Injuries:- these injuries are one of the most catastrophic in all of sports medicine. Assess any fallen athlete for the need for BLS. Any athlete who is unconscious or unable to move must be treated as having a spinal cord injury or an unstable cervical fracture until proven otherwise. If the athlete must be moved, the spine must be kept in a neutral position, & the athlete should be placed supine. Athletes found prone must be moved safely into a supine position by a minimum of 4 trained individuals, & this transfer must be practiced as a part of the Emergency Action Plan.

Exercise Associated Collapse:-this has a broad differential diagnosis. The common causes include benign EAC, Exercise Associated Hyponatremia, Cardiogenic Collapse (which we have discussed), & heat related illnesses. As a rule of thumb if the athlete collapses before reaching the finish line while still running the diagnosis is more ominous.

• Benign Exercise Associated Collapse- the most common cause of collapse in a marathon runner who crosses the finish line is benign EAC- due to postural hypotension i.e., while running the calf muscle returns blood to the central circulation. However, when the marathon runner stops running there is pooling of blood in the calf leading to decrease in blood pressure & collapse. It is important to keep the athlete walking after finishing the race. If the athlete collapses & the diagnosis of benign EAC is made, then we should start oral rehydration, elevate the lower limbs & pelvis above the level of the heart. If the athlete does not respond to this in 15-30 mins then look for more ominous causes.

- Exercise Associated Hyponatremia is a kind of hypervolemic hyponatremia causing early symptoms of lightheadedness nausea which & progresses to headache, confusion & & if left vomiting, untreated to obtundation, seizures & death. The mechanism is supposed to be similar to SIADH. When too much plain water is consumed there is а dilutional hyponatremia which eventually cascades into cerebral & neurogenic edema pulmonary edema. If only mildly symptomatic in runners who are fluid overloaded then all that is needed is fluid restriction, a natural diuresis ensues & the patient usually recovers. If the S. Na+ remains low then hospital observation might be needed. If the patient develops encephalopathic features then give high flow Oxygen, a bolus of 3% NaCl & shift quickly to a nearby hospital. To prevent this condition, the athletes should be advised to drink only when thirsty, take only 400-800mL of fluids every hour of the race, & fluid aid stations should be placed at every 1. 5 miles of the race.
- Heat related conditions include heat exhaustion which is inability to continue exercise in the heat & a failure of the cardiovascular response to workload, high environmental temperatures, & dehydration. In heat exhaustion the body

temperature is normal. Heat stroke is a medical emergency in which there is multi organ system failure secondary to hyperthermia. In this case cooling of the whole body should be attempted & also make sure there are provisions for CPR & starting I. V fluids.

Concussions:- these are mild traumatic brain injuries sustained as a result of direct blows to the head or forces transmitted through the head & neck. If you suspect a concussion assess it using scales like Standardized Assessment of Concussion (SAC) or SCAT-5. The player should not be allowed to play in the same game. Most concussions resolve & patients become symptom free by 7-10 days (in nearly 80% of cases). Once the athlete is asymptomatic at rest, a stepwise approach RTP protocol must be completed before competition is resumed.

Stingers:- also called Burners, these are peripheral nerve injuries thought to be due to stretch or compression of cervical nerve roots or brachial plexus. It presents as a sudden onset lancinating or burning pain in one upper limb after a traumatic event. The symptoms typically follow a dermatomal distribution most commonly in a C5, C6 or C7 distribution. C5 is the most common dermatome involved. No established guidelines for RTP after a Stinger exist, but if the stinger resolves completely in 15 mins, then the player can reenter the same game. If the full recovery occurs within 1 week of an initial Stinger then they can return to play in the next week. If they sustain two Stingers then give rest for 2 weeks.

Three common causes for anemia in athletes are- Iron Deficiency Anemia, Physiologic Anemia (due to hemodilution in endurance athletes) & Foot strike Hemolysis due to RBC destruction in the feet from running impact. Treatment of iron deficiency anemia is to give Ferrous Sulphate or Gluconate 325mg thrice a day along with Vitamin C for 2-3 months. For physiologic anemia cessation of training for 3-5 days is enough, after ruling out iron deficiency anemia. For foot strike hemolysis no treatment is needed.

The Female athlete

On average women have larger surface area to mass ratio, lower bone mass, & a wider & shallower pelvis than men & hence women might tolerate heat better than men, might be more prone to osteoporosis & might develop knee problems more frequently. One important entity to look out for in females is the female athlete triad. This is characterized by low energy availability, menstrual dysfunction & low bone mineral density. Female athletes presenting with features of the female athlete triad require appropriate work-up and referrals. Although referrals to a nutritionist, psychologist/therapist, and other medical specialists, such as endocrinologists, cardiologists, and gastroenterologists, might be necessary, a primary treatment focus should be to restore energy balance by improving caloric intake and potentially decreasing energy expenditure (limiting aerobic exercise). Finally, pregnancy should be excluded in any amenorrheic female of childbearing age.

Pediatric & Adolescent Athlete

Physical activity in children and adolescents prevents osteoporosis, improves self-esteem, and reduces anxiety and depression. Furthermore, there is a positive relationship between physical fitness and academic achievement in English and mathematics. When advising pediatric athletes about their training program, the following points should be noted:-

- Have a preparticipation medical evaluation.
- Have a certified supervisor for technique & safety

- Include warm up & cool down phases
- Avoid maximal lifts
- Gradually increase resistance
- Avoid performance enhancing drugs
- Engage in concomitant aerobic conditioning

Older Athlete

The US Department of Health and Human Services recommends 150 minutes or more of aerobic exercise per week, strength training of all major muscle groups twice per week, and balance training. Although the underlying mechanisms are debated, higher levels of physical activity are associated with lower incidence rates and decreased symptoms in many afflictions associated with aging, including psychiatric illness, neurologic disease, metabolic disease, cardiovascular disease, pulmonary disease, musculoskeletal disorders, and cancer. Together, these benefits confer a lower risk of mortality, a higher level of cognitive function, and an enhanced quality of life to both healthy and unhealthy older individuals. While prescribing exercises it is essential to incorporate balance training. Effort should be proportional to the fitness level & the chronic health conditions in the athlete¹.

Adaptive Sports

The two factors limiting the involvement of people with disabilities in sports are the two As- Awareness & Access. But there is an upward trend, while only 400 participants were there in the Rome Paralympics in 1960, there were 3591 athletes in the Beijing Paralympics in 2008. Athletes who compete in the Paralympics are placed into 6 disability categories:-

- 1. Wheelchair
- 2. Amputee
- 3. Cerebral Palsy

- 4. Visual impaired
- 5. Intellectual disability
- 6. 'Les autres' (for 'others' the athletes who cannot be placed in the other groups).

So if you thought the Paralympics was all speed & wheelchairs, there's more to it!

Now about the injury rates & injury patterns in adaptive sports. Rates of injury are similar to that in normal sports. Lower limb injuries are more common in ambulatory athletes (visually impaired, amputees, Cerebral Palsy), whereas upper limb injuries are more common in athletes who use a wheelchair. Besides this wheelchair athletes have a Osteoporosis, Spasticity, propensity for difficulties Thermoregulation, in & Autonomic Dysreflexia¹.

Now let's discuss two studies- An RCT of 42 professional fast bowlers, to study the benefits of plyometrics, while training, was carried out as briefly described below. They were divided into two groups. The study group received 12 weeks of plyometric training, while the control group continued their conventional training. Both groups underwent isokinetic knee strength & vertical & standing broad jump testing before & after the 12 week period. The study group showed a significant improvement (p<0. 05) in jump performance & eccentric strength. It was concluded that plyometric training reduces injury risk & improves performance cricket fast in bowlers⁴.

The next study aimed to investigate which characteristics of athlete, wheelchair & athlete-wheelchair interface are the best predictors of wheelchair basketball mobility performance. A total of 60 experienced wheelchair basketball players performed a wheelchair mobility performance test to assess their mobility performance. Forward stepwise linear regression analyses were performed on a set of 33 characteristics (stepwise linear regression is a method of regressing multiple variables while simultaneously removing those that aren't important).



The vertical distance between the front seat & the footrest was negatively associated with mobility performance. It is worthy of note that the sporting wheelchair adjustments that were used for racing & basketball 25 years ago have become integral to the manual wheelchairs that people currently use⁵.

References:-

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Members in Action- 3



Dr. Roshin Mary Varkey, Associate Professor & HOD of PMR at BCMCH, organized an event and gave an opening speech along with welcome address on the occasion of International Day of Persons with Disabilities. As part of the celebrations, new schemes and concessions health were introduced and offered for wheelchair dependent warriors which included spinal cord injury patients.



Dr. Sindhu Vijayakumar, Associate Professor of PMR at Amala Medical College, presented a talk on 'Assistive Technology & Rehabilitation; Need of the Hour', at Believers Church Medical College on December 2^{nd} . This was a part of the observance of the International Day of Persons with Disabilities.



Community Rehabilitation and Home modification evaluation for spinal cord injury patients, was done by the *Department of PMR, Beleivers Church Medical college Hospital*, under the guidance of **Dr.Roshin Mary Varkey**, Associate Professor & HOD.

The Department of PMR at Government Medical College, Kozhikode observed Disability Awareness Week, from December 3rd to 9th.



Dr. Sooraj Rajagopal, Associate Professor of Medical College, PMR at Government Kozhikode enlightening, presented an interactive session Disabilities on & Challenges on the TV Program 'Hello Doctor' on December 3rd.



World Disability Day was observed in the PMR Ward under the leadership of **Dr. Sreedevi Menon P.**, *Professor & HOD of PMR at Government Medical College, Kozhikode*. The Residents, Interns, Office Staff, patients & their bystanders were all a part of this observance.



As part of the Disability Week observance, a meeting of the All Kerala Wheelchair Rights Foundation was arranged under the aegis of **Dr. P.C Muralidharan** (*President of Kerala Chapter of IAPMR*), **Dr. Sudheera V.T** (*Secretary of Kerala Chapter*) & **Dr. Noufal Ali** (*Joint Secretary of Kerala Chapter of IAPMR*). This meeting helped to create awareness about disability rights & to further the cause of the disabled.



Dr. Reeba Mary Mani, Associate Professor of PMR at Government Medical College, Kozhikode, presented an enlightening talk on 'Spinal Muscular Atrophy', on World Disability Day. This session was held at the State Institute of Sports Medicine. **Dr. Reeba** is the Nodal Officer for SMA at Government Medical College, Kozhikode.



As part of the Disability Awareness Week, Quiz competitions were conducted for the Interns & Undergraduates by the Department of PMR, Government Medical College, Kozhikode, under the guidance of **Dr. P.C Muralidharan**, *Associate Professor of PMR at Government Medical College, Kozhikode*.



The Department of PMR at Government Medical College, Kozhikode, conducted a Poster Designing Competition as part of the aforementioned awareness week.





A talk on 'Disability in Children' was presented by Dr. Vinni P, Junior Resident in PMR, at Government Medical College, Kozhikode. An awareness session on CP was also conducted by Allied Health Staff- Miss Nehal Rintu, to help mothers better take care of their CP children.



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As part of the Disability Awareness Week, the Undergraduates of Government Medical College, Kozhikode were sensitized about how to use a wheelchair. The eventful week of awareness sessions, meetings, quizzes, poster designing & all did a lot to spread the influence of PMR in the District of Kozhikode.



The Trivandrum Physiatrists Club observed the International Day for Persons with Disabilities on December 3rd with a session on 'Advanced Prosthetics & Orthotics' by **Mr. Arun Cherian**, from Rise Bionics, Bangalore.





International Day for Persons with Disabilities 2022 observance was conducted at District Peroorkkada Model Hospital, by the Department of Physical Medicine and Rehabilitation, in association with Indian Medical Association Trivandrum and KGMOA Trivandrum. The theme of the day was 'Rehabilitation innovations for inclusive development.' A Bone Mineral Density detection camp was conducted, which was attended by 130 people including the staff and patients. The services of Dietician and Physiotherapist was provided at the camp for providing health education regarding diet and exercises for improving bone health. The theme of the day was conveyed to the public through a Flash Mob, conducted at the hospital premises led by Palliative care team.

The public function that followed was presided by Dr Sheeja A L, Superintendent, DMH Peroorkkada. Dr Sindhuja N S, Jr Consultant PMR welcomed the gathering. The function was inaugurated by Dr G S Vjayakrishnan, President,IMA Trivandrum and Dr S G Churchin Ben, Additional DHS (Rtd) and Physiatrist, delivered the keynote address. The differently abled staff of our hospital were appreciated for their services rendered and they were honoured on the Dr Anilkumar S. occasion by Chief Consultant PMR.(Rtd). Dr Arun A John, Consultant Physiatrist GH Trivandrum and District President, KGMOA Trivandrum gave the felicitation address. The uniqueness of the

program was the whole hearted involvement of the multitalented differentially abled staff, who presented few entertainment programs which exceeded the expectations of the gathering and was admired by all.



The PMR Dept at DMMC, Wayanad (Aster, Wayanad) organised 'Kootayama' а or of their already rehabilitated gathering patients. The previous patients turned 'motivators' & sources of inspiration for the patients currently admitted in the institution. This was followed by a comprehensive evaluation & follow up of these previous patients in the PMR Department. This program was organized under the leadership Babeesh Chacko, Consultant of **Dr**. Physiatrist at Aster Wayanad.



The International Day of Persons with Disabilities was observed at Sree Narayana Institute of Medical Sciences (SNIMS) on December 1st. Two short sessions were presented on this day- 'General Principles of Disability' by **Dr. Soumya Thankappan**, *Senor Resident in PMR at SNIMS* & 'Locomotor Disability' by **Dr. Bineesh Balakrishnan**, *Assistant Professor of PMR* in the institution.





The Department of Physical Medicine and Rehabilitation, GMC Trivandrum, observed The International Day of Persons with Disabilities on Dec 3rd, from 1:30pm to 3 pm. It was attended by The Principal, Vice Principal, all faculties, staff, students, patients and their relatives. The program started with speeches by dignitaries, spreading awareness about the RPWD act, followed by distribution of wheelchairs to two of our poor patients. The program ended with cultural programs, games and distribution of prizes. It was a memorable day especially for the patients and bystanders, who really enjoyed themselves.



Dr. Sindhu Vijayakumar, Associate Professor of PMR at Amala Medical College, Thrissur presented a session on 'Management of Cerebral Palsy' to create better awareness among parents & therapists at the REIC (Regional Early Intervention Centre), at Government Medical College, Thrissur. This was part of the International Day for Persons with Disabilities observance.



The inaugural meeting of the Thrissur Physiatry Club was held on December 4th, at Hotel Ashoka Inn. There was an edifying session on 'Pediatric Rehabilitation' with talks by Dr. Sinjitha V.K, Senior Resident in PMR from Amala Medical College, & Dr. Sindhu Vijavakumar, Associate Professor in PMR from Amala Medical College. This was followed by a lively discussion. The meeting was attended by 14 Physiatrists from in & around Thrissur. the program was conducted under the aegis of senior Physiatrists- Dr. Santhosh Babu, Dr. Babu Varghese, & Dr. ShibyT.G.



The meeting of the **Cochin Physiatry Club** was conducted on December 9th at Hotel Avenue Regency. The scientific session was on 'Parkinson's Disease Rehabilitation'. **Dr. Saraf Udit Umesh**, Assistant Professor of Neurology & Head of Movement Disorders at Amrita Medical College, presented a talk on 'An Overview of Parkinson's Disease', while 'Rehabilitation of Parkinson's Disease' was

addressed by **Dr. Ravi Sankaran**, *Professor* & HOD of PMR at Amrita Medical College.

FUNCTIONAL MOTOR SCALE(FMS)

- 3 items (distances), each of which is rated from 1-6 depending on assistance required, or "C" for crawling or "N" if distance is not completed
- Maximum score is a 6 for each of the distances (5m, 5om, and 50om)
- For each of three distances (5m, 5om, and 500m), a rating of 1-6 is assigned depending on the assistance required. 1 = uses wheelchair, 2 = uses a walker or frame, 3 = uses crutches, 4 = uses sticks (one or two), 5 = independent on LEVEL surfaces, 6 = independent on ALL surfaces, "C" = crawling (for mobility at home), "N" = does not apply [e.g., child does not complete the distance (500m)]



Dr. Sreejith K., *Professor & HOD of PMR at Government Medical College, Kottayam* presented an interesting session on 'MSK Ultrasound Based Minimally Invasive Surgeries' on December 30th. The session was organized by the Kerala Chapter of IAPMR.



The meeting of **Thrissur Physiatry Club** was held on January 8th at Hotel Ashoka Inn. The scientific session on 'Oral Biological Agents in Rheumatology' was presented by **Dr. Paul T. Antony,** *Consultant Rheumatologist & Immunologist at Amala Medical College, Thrissur.* The meeting was presided over by senior Physiatrist- **Dr. Santhosh Babu.**

Questions

- In the presence of disuse atrophy, the echogenicity of the muscle ______ as a result of volume loss in the myocytes and increased fibrofatty tissue content of the muscle.
 (a) Increases (b) Decreases (c) Stays the same (d)
- 2. The normal cortical bone surfaces are smooth and echogenic with _____ acoustic shadowing.
 - (a) Anterior (b) Medial (c) Posterior (d) Lateral
- 3. Probes with lower frequency ranges (5 to 7.5 MHz) are often used to assess structures that are _____
 - (a) Superficial (b) Deeper (c) Vascular (d) Lymphatic
- 4. On a long axis scan, the normal Supraspinatus tendon should appear...(a) Band shaped (b)Broom shaped (c) Brick shaped (d) Beak shaped
- - (a) Infraspinatus (b) Subscapularis (c) Teres Minor (d) Supraspinatus
- 6. The shape of the calcification focus in Calcific tendinopathy can be..

(a) Curvilinear (b) Granular (c) Nodular (d) a & b (e) a & c (f) a, b & c

7. A normal Subacromial Subdeltoid bursa is usually less than ____ mm in thickness

(a) 2 (b) 5(c) 6 (d) 7

- 8. Bicipital sheath effusion may also be seen in ______tendon tear.
 - (a) Infraspinatus (b) Supraspinatus (c) Subscapularis (d) Triceps
- 9. The normal suprapatellar recess is slit-like, with the thickness no more than ____ mm.
 (a) 0.5mm
 (b) 1 mm
 (c) 2 mm
 (d) 3 mm
- When scanning the patellar tendon, the patient should be placed in supine position, with the patellar tendon tightened by flexing the knee to ______ degrees.
 - (a) 50-70 (b) 60-80 (c) 90-100 (d) 100-110

The Afterglow...



<u>Key</u>

1. (a)

The appearance of a muscle with USI is determined by the complex interweaving of fibrous tissue and myocytes in the stromal architecture of the muscle. Reflections arise at interfaces between relatively dense fibrous tissue and relatively soft muscle tissue, where fibrous tissue wraps around individual muscle fascicles. In sagittal section, these fascicular interfaces form longitudinal striations along the length of the muscle. With an axial section of the muscle, the end-on view of the fascicular structure produces a stippled cellular mosaic pattern.

2. (c)

The most common mechanism of injury of muscles in elite athletes is related to indirect muscle injury (muscle strain), usually at the myotendinous junction. Blunt trauma is the most common mechanism of direct muscle injury in sports that may involve collisions. Multiple classification and grading systems have been proposed, with categorical grading systems based on sonographic findings still in use. Grade 1 muscle strains may show a normal appearance of the muscle fibers but sometimes may present as focal or diffuse ill-defined hyperechoic areas within the muscle at the site of injury. Grade 2 muscle strain manifests as partial disruption of the muscle fibers, sometimes associated with an intramuscular hematoma. Grade 3 muscle strains demonstrate complete disruption (100% of the cross-sectional area) of the muscle with retraction of the proximal fibers. An intramuscular hematoma may also be seen in grade 3 injuries. Perifascial edema may be present and can be seen with any grade of muscle injury. The normal cortical bone surfaces are smooth and echogenic with posterior acoustic shadowing. The subcortical bone and underlying marrow cannot be evaluated with ultrasound, a disadvantage when compared to MRI. Tendons tend to be intermediate between cortical bone and muscle in terms of echogenicity and have a dense nonpulsatile fibrillar pattern that helps to separate their appearance from vessels and nerves. Furthermore, they can be readily recognized by having the subject contract the muscle connected to the visualized tendon so that its active movement can be directly observed. This highlights one of the very unique and valuable features of USI: its ability to generate real-time images of structures that are dynamically active.

3. (b)

Typically, a linear array probe is used in musculoskeletal examination, as its wider view and higher near-field resolution provide good images of superficial structures. The degree of U/S penetration also depends on its frequency. Probes with higher frequency ranges (7 to 12 MHz) are commonly used to assess very superficial structures. Probes with lower frequency ranges (5 to 7.5 MHz) are often used to assess structures that are deeper, since they allow greater tissue penetration. In addition, power Doppler, a technique that takes into account the velocity of red blood cells being scanned, can be used to indirectly demonstrate blood flow within the scanned area.

4. (d)

Pain on resisted shoulder abduction suggests pathology of the supraspinatus tendon. On long-axis scan, a normal supraspinatus tendon should appear as a beak-shaped, echogenic fibrillar structure extending under the acromion, between the humeral head and the subacromial/subdeltoid bursa. On short-axis scan, the tendon appears as a band of medium-level echogenic structures, deep to the subdeltoid bursa and superficial to the hypoechoic hyaline cartilage on the humeral head.

5. (d)

Calcific tendinopathy of the shoulder is a common disorder, characterized by the deposition of calcium, predominately hydroxyapatite within the rotator cuff tendons. The deposition is most often at the insertion of the supraspinatus tendon on the greater tuberosity followed by the infraspinatus and the subscapularis. The diagnosis of calcific tendinopathy is mainly based on standard radiographs which can demonstrate the size and location of the calcific deposition. Ultrasound can define the tendon involved and guide therapeutic procedures. In ultrasonography, rotator cuff calcifications appear as echogenic focus with or without acoustic shadowing. The shape of the calcification focus can be curvilinear, granular, or nodular. Furthermore, the calcifications in tendons can be either symptomatic or asymptomatic. For symptomatic rotator cuff calcification, conservative therapeutic options include oral nonsteroidal anti-inflammatory drug, local steroid injection, and shockwave therapy. Ultrasound can not only localize the lesion but also guide steroid injection precisely to the calcified areas. Furthermore, ultrasound-guided percutaneous needle aspiration and lavage is claimed to be effective to treat calcific tendinopathy.

6. (f)

7. (a)

Subacromial-subdeltoid bursitis is often associated with repeated trauma; in middleaged or older individuals, it tends to be linked with overuse or degenerative changes in the rotator cuff. A normal bursa should appear on U/S as a thin hypoechoic stripe, covered by a narrow layer of echogenic peribursal fat, located between the underlying supraspinatus tendon and the overlying deltoid muscle. Typically, it is less than 2 mm in thickness, even counting the hypoechoic layer of fluid located between the two sides of the bursa. Fluid accumulation within the subacromial/subdeltoid bursa is often noted in patients with infectious or inflammatory bursitis. However, it can also be observed in patients with full-thickness tear of rotator cuff tendon or in individuals with shoulder impingement syndrome. If a needle intervention is deemed necessary, U/S can be utilized to guide bursal fluid aspiration or steroid injection.

8. (b)

In biceps tendinopathy, effusion in the tendon sheath is associated with focal tenderness and often with heterogeneity of the tendon. It was demonstrated that the power Doppler signal was more frequently observed medial to the biceps tendon in shoulders with clinically diagnosed biceps disorder. Fluid accumulation in bicipital tendon sheath may indicate intra-articular pathology rather than biceps tendon pathology per se because of the connection of the sheath with the glenohumeral joint. Bicipital sheath effusion may also be seen in supraspinatus tendon tear.

9. (c)

The suprapatellar recess is located between the quadriceps tendon and the prefemoral fat. Knee effusion is demonstrated as a distended suprapatellar recess with anechoic space, which is easily compressed, and without vascularity on power Doppler imaging. In repeated injuries or inflammatory arthritis such as rheumatoid arthritis, synovium hypertrophy can occur within the suprapatellar recess. The enlarged synovium often appears as a hyperechoic mass, either attached to the wall of the suprapatellar recess or floating within it. As in other scenarios, increased synovial vascularity indicates active inflammation.

10. (b)

Patients with patellar tendinopathy (also known as "jumper knee") may complain of anterior knee pain while jumping or going downstairs. Local tenderness over the patellar tendon is a common manifestation. The normal longitudinal patellar tendon should appear as parallel, fibrillar, echogenic structures. Commonly observed sonographic findings of patellar tendinopathy include loss of fibrillar pattern, reduced echogenicity, and tendon hypertrophy in comparison with the contralateral knee. Increased vascularity on power Doppler examinationsuggests an acute inflammatory process.

Questions

- 1. On Ultrasound imaging, nerves can be differentiated from the _____other major tubular structures.
 - (a) 2 (b) 3 (c) 4 (d) 5
- - (a) Flexion (b) Extension (c) Valgus (d) Varus
- 3. The diffuse, thickened hypoechoic area with loss of normal fibrillar pattern of Common Extensor Tendon is compatible with _____.
 - (a) Calcification (b) Complete Tear (c) Partial Tear (d) Tendinopathy
- 4. A small effusion in the subacromial/subdeltoid bursa may be identified ______ to the greater tuberosity, especially with the arm extended and internally rotated.
 (a) Inferior (b) Lateral (c) Medial (d) Superior
- 5. On Ultrasound, normal muscle should appear as ______like, longitudinal fibrils.
 (a) Beak (b) Club (c) Ear (d) Feather
- 6. On Ultrasound, the severity of muscle injury can be divided into _____ grades.
 (a) II (b) III (c) IV (d) V
- In Grade I muscle injury, echogenicity of the injured muscle may be reduced due to swelling or _____.
 - (a) Bleeding (b) Rupture of fibrils (c) Fibrofatty infiltration (d) Volume loss
- 8. The "bell clapper sign"- the ruptured end of muscular fibril floating within the local effusion, is seen in Grade _____ muscle injury, on USG.
 (a) I (b) II (c) III (d) IV
- Rupture is suspected when the thickness of PCL at the tibial spine is greater than ______ mm and with a waxy posterior margin.
 - (a) 5 (b) 6 (c) 7 (d) 10
- 10. The normal PCL should appear as a _____, fan-shaped structure.(a) Hypoechoic (b) Hyperechoic (c) Anechoic (d) Isoechoic



All The Light You Cannot See...

Using MSK Ultrasound is like switching on the lights in a pitch dark room. 'Blind' interventions could be on their way out....



Key

1. (b)

Nerves can have either an echogenic cross section when surrounded by relatively hypoechoic tissues or a relatively hypoechoic appearance in surrounding tissues that are relatively hyperechoic. With high-resolution USI, a stippled transverse crosssectional appearance can be seen reflecting the fascicular internal structure of the nerve. Nerves can be differentiated from the three other major tubular structures: tendons/ligaments, arteries, and veins. Tendons/ligaments have well-defined anatomic locations, are densely hyperechoic, and can be made to move in a specific manner with appropriate patient movements. Arteries tend to pulsate regularly and veins collapse when compressed.

2. (c)

An ulnar collateral ligament (UCL) tear may result from either acute or chronic valgus stress to the elbow. Repeated overhead throwing or pitching is a common cause of UCL injury. A dynamic U/S study can assess joint laxity by comparing the degree of joint widening of both arms during valgus stress. Both U/S and MRI have been used to assess UCL injury, and their diagnostic accuracies are quite comparable.

3. (d)

Lateral epicondylitis is usually caused by repetitive traction of the common extensor tendon (CET) at its osteotendinous attachment to the lateral humeral epicondyle. In the longitudinal view via U/S examination, the CET should appear as an echogenic beak-shaped structure. Main U/S features of a "tennis elbow" may include swelling of the tendon, partial tear, calcification, and hyperemia. The diffuse, thickened hypoechoic area with loss of normal fibrillar pattern is compatible with tendinopathy. A focal anechoic area on ultrasonography indicates a complete or partial rupture of the CET, which may require surgical intervention. As expected, calcification of the tendon can be seen as echogenic foci within the CET with or without acoustic shadow beneath the lesion.

4. (b)

Subacromial-subdeltoid bursitis is often associated with repeated trauma; and in middle-aged or older individuals, it tends to be linked with overuse or degenerative changes in the rotator cuff. A normal bursa should appear on U/S as a thin hypoechoic stripe, covered by a narrow layer of echogenic peribursal fat, located between the underlying supraspinatus tendon and the overlying deltoid muscle. Typically, it is less than 2 mm in thickness, even counting the hypoechoic layer of fluid located between the two sides of the bursa. A small effusion in the subacromial/subdeltoid bursa may be identified lateral to the greater tuberosity, especially with the arm extended and internally rotated. The examiner should be careful not to compress and displace the small amount of fluid. Fluid accumulation within the subacromial/subdeltoid bursa is often noted in patients with infectious or inflammatory bursitis. However, it can also be observed in patients with full-thickness tear of rotator cuff tendon or in individuals with shoulder impingement syndrome. If a needle intervention is deemed necessary, U/S can be utilized to guide bursal fluid aspiration or steroid injection.

5. (d)

It may result from direct trauma or may sometimes be caused by overstretching, especially with insufficient warmup. On U/S, normal muscle should appear as featherlike, longitudinal fibrils. Muscle tear will manifest as a disruption of muscular fibrils. An anechoic area within an injured muscle suggests hematoma or effusion.

- 6. (b) III
- 7. (a)

In grade I injury, no obvious muscular fibril rupture is observed, indicating a minor injury. Echogenicity of the injured muscle may be reduced due to swelling or bleeding.

8. (b)

In grade II injury, fibrillar tear can be observed, with disruption of the normal muscular texture. An anechoic area due to either local hematoma or effusion is often apparent. Sometimes, the ruptured end of muscular fibril floats within the local effusion and is referred to as the "bell clapper sign."

In grade III injury, the muscle tear is unfortunately complete. The round end of the ruptured "stump" can be seen, and the muscle gap will widen during stretching.

9. (d)

Unlike the anterior cruciate ligament, the posterior cruciate ligament (PCL) can be clearly visualized on U/S examination. When scanning the PCL, the patient should be placed in prone position, with the knee extended. The transducer is located between the lateral margin of the medial femoral condyle and the midportion of the tibial intercondylar region.

10. (a)