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ROYAL CARE HOSPITALS

making life better

- **Editor & Publisher**

Dr. K. Madeswaran

Chairman - Consultant Neuro & Spine Surgeon

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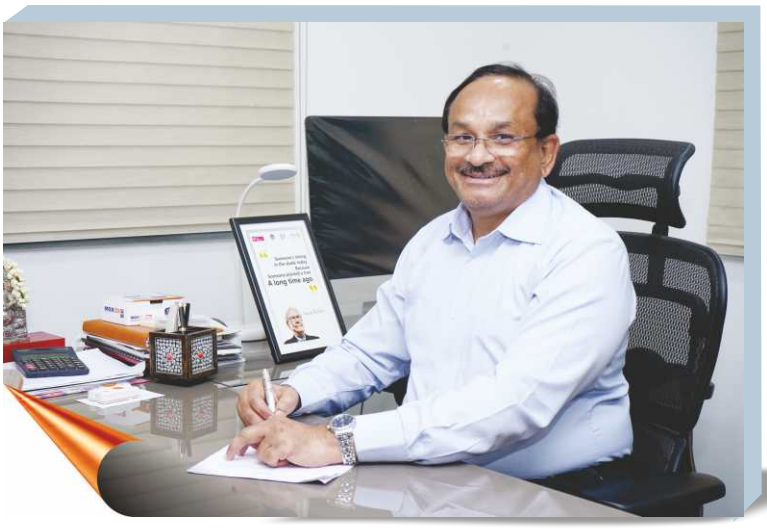
CHAIRMAN'S COLUMN



Dear all,

Warm greetings to everyone

The future of healthcare in India looks promising but also presents some significant challenges. India has made significant progress in healthcare in recent years, but there are still gaps in access to quality healthcare, especially in rural areas.

The increasing adoption of digital health technologies such as telemedicine, remote monitoring, and AI-enabled diagnostics is likely to revolutionize healthcare delivery in India. These technologies can help bridge the gap in access to healthcare in rural areas, where there is a shortage of medical professionals. With the rising burden of chronic diseases, the healthcare sector in India is likely to shift its focus from curative care to preventive care. India's healthcare sector is dominated by the private sector, but there is increasing collaboration between the private and public sectors to improve healthcare outcomes. Public-private partnerships (PPP) are likely to play a critical role in driving innovation and expanding access to healthcare services.

We want to focus on upskilling and reskilling existing healthcare professionals and investing in training the next generation of healthcare professionals. We at Royalcare continue to invest in newer technologies and human resources to bring in revolutionary change and the best healthcare access to the common people.

Regards

Dr. K. Madeswaran

Founder Chairman

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From The EDITOR'S DESK

"Success is not final, failure is not fatal,
it's the courage to continue that counts "..

- Winston Churchill

The Hospital has been pushing frontiers in technology ever since its inception and the last few months have been no different. We have newer equipment, and modern technologies that have been introduced and patients benefit from it immensely. Robotic surgery has made the life of many patients a breeze and they return home very quickly.

The hospital was awarded BEST SUPER SPECIALITY HOSPITAL for the 4th consecutive year by Radio City ICON awards in recognition of its exemplary achievements. The department of microbiology also introduced for the 1st time in entire Tamil Nadu the VITEK MS Prime for rapid identification of organisms to make treatment more effective and hasten the recovery of the patients.

The new MRgFUS, which is the first of its kind in the entire Indian sub-continent was inaugurated by His Excellency Noar Gilon, Ambassador of Israel to India who praised the hospital and said this treatment would change the lives of many Parkinson's and movement disorder patients.

Royal Care Nephrology team conducted the hands-on training program in the 42nd South India conference and it was well attended and received with great appreciation from many senior nephrologists from around the country. Royal care hospital conducted various camps and conferences on cancer, women's Day, Pengal Nalam, CRITICIMA, etc for the benefit of the general public and medical fraternity.

We also celebrated Republic Day with great zeal. In this edition, we have various articles on breast imaging and cancer, carotid endarterectomy, and therapeutic plasma exchange. We congratulate Dr. K. Vijayan who got the 2nd prize in award papers at the Indian national stroke congress 2023 and also Dr.Senthil Kumar for being appointed as the coordinator for the public relations and communications committee of IRIA for the year 2023. We welcome the new consultants who have joined Royal Care Hospital and wish them success in their endeavors.

Royal Care Super Speciality Hospital Dedicates

INDIA's 1st MRgFUS Technology to the Nation

Mr Naor Gilon, Ambassador of Israel to India, inaugurated and dedicated India's first MRgFUS Technology to the nation in the presence of Dr K. Madeswaran, Chairman and Managing Director, of Royal Care Super Speciality Hospital and other dignitaries in the city. Royal Care Super Speciality Hospital, Coimbatore has set up India's First MRgFUS (Magnetic Resonance Guided Focused Ultrasound Surgery) – a new technology for the treatment of Essential Tremors and Tremor Dominant Parkinson's disease.

MRgFUS is a technology that has the potential to change the way movement disorders are being treated. Tremors have long been treated with various medications without significant benefit. For the treatment of essential tremors and tremor-dominant Parkinson's disease MRgFUS is approved by the Central Drugs Standard Control Organization (CDSCO) which is a part of the Ministry of Health and Family Welfare of India. MRgFUS has also been approved by the US Food and Drug Administration (USFDA).

According to Dr K. Madeswaran, Chairman and Managing Director of Royal Care Super Speciality Hospital, "The Royal Care Super Speciality Hospital is equipped with advanced medical equipment and technologies and has often been the first in introducing the latest innovations in the medical field to the country. The newest and the most advanced of them is the Magnetic Resonance Guided Focused Ultrasound for the treatment of essential tremors and tremor-dominant Parkinson's disease. This procedure is conducted by a team of highly qualified and experienced neurosurgeons and neurologists who have been specifically trained in the focused ultrasound technology to target sub-millimetre areas in the brain."

As part of the inauguration of the MRgFUS treatment facility at Royalcare, MRgFUS LIVE CASE DEMONSTRATION and CME was organised at Hotel Le Méridien, Avinashi Road, Coimbatore on 14th February 2023.

During the CME, a lecture on Introduction to MRgFUS was done by Dr. K. Madeswaran, Chairman. A lecture on the MRgFUS International experience was delivered by Dr. Jui Cheng Chen, Medical University Hospital, Taiwan. MRgFUS Indian Experience was delivered by our Dr. V. Arul Selvan, Consultant Neurologist. Live case demonstration was done by Dr. K. Vijayan, Consultant Neurologist and Neurosonologist, Dr. K. Raguraja Prakash, Consultant Neuro Surgeon, Dr. R. Senthilkumar, Consultant Neuro Surgeon, Dr. N. Senthilkumar, Consultant Radiologist and Dr. P. Selvaraj, Consultant Anaesthesiologist.

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ROYALCARE SUPER SPECIALITY HOSPITAL

Launches

LATEST TECHNOLOGY IN THE
DEPARTMENT OF MICROBIOLOGY

1st IN TAMIL NADU

VITEK MS PRIME
(First time in Tamilnadu)

VITEK® MS PRIME is a benchtop high-throughput automated identification system with a robust database, which includes intra-species diversity that delivers fast and confident microbial identification .

- Superior workflow and seamless connectivity with VITEK® 2 AST
- Robust & accurate single-choice identifications in minutes
- Supports earlier optimized antimicrobial therapy for patient care and AMS
- Backed by 55 years of microbiology expertise

MYLA Software

Myla is the name of our new lab partner that provides a revolutionary way of working that will simplify our life. Now we can recapture our time through improved connectivity, Laboratory workflow and information management.

BioFire

for the syndromic infectious disease diagnosis

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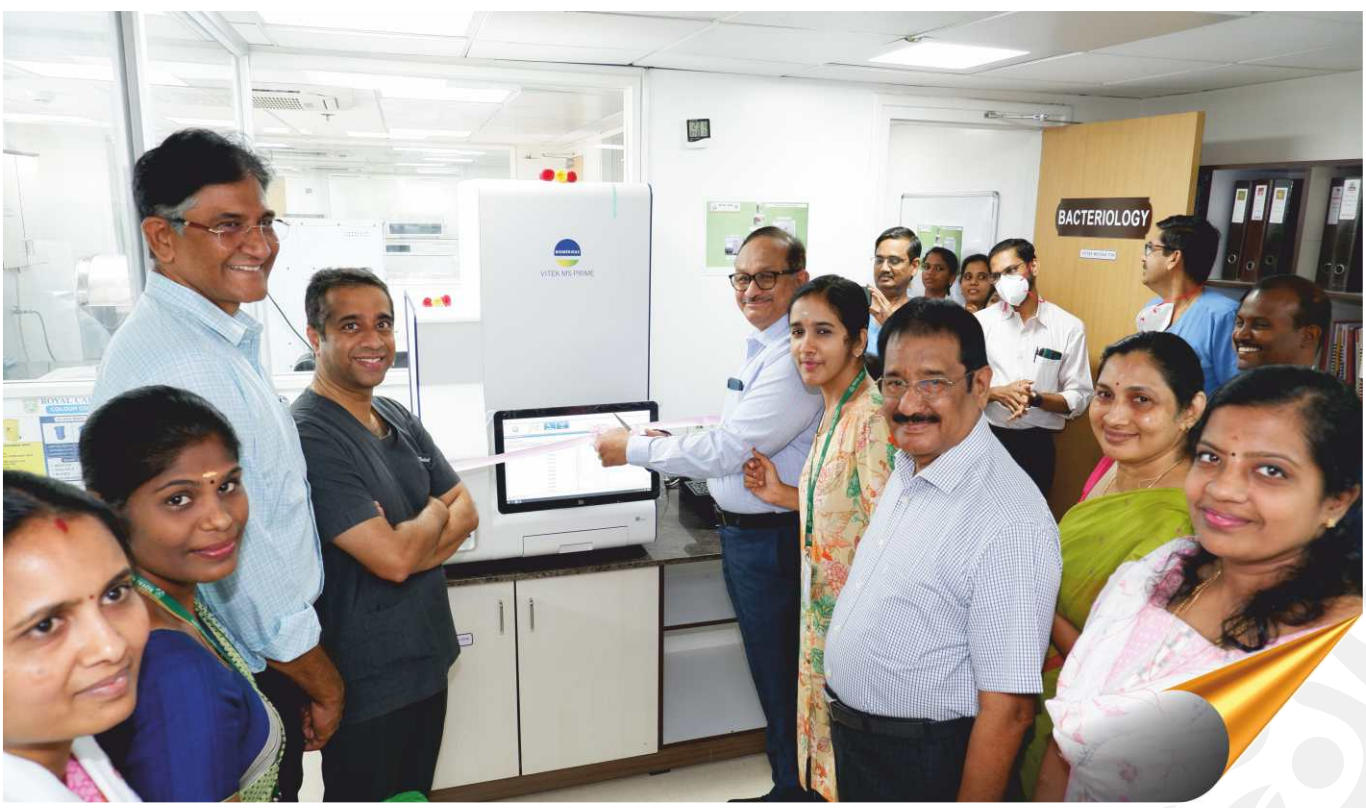
It is the first of its kind in Tamil Nadu

VITEK MS PRIME

Royal Care Super Speciality Hospital Ltd launches newer technologies in the Department of Microbiology for fast and confident identification of microbes. It is the first of its kind launched in Tamilnadu.

Matrix assisted laser desorption ionization- time of flight mass spectrometry (MALDI - TOF MS) has emerged as a potential tool for microbial identification and diagnosis. It is a tool for rapid, accurate and inexpensive identification of cultured bacteria, myco bacteria and fungal pathogens in the clinical microbiological laboratory. Vitek MS Prime is robust and evolving data base more than 1300 bacteria and fungi species. More than 15,000 strains used including Geographical strains, Internal strains, Customer strains and Culture collections (ATCC). This technology is automated, has high throughout and applicable to a broad range of common as well as esoteric bacteria and fungi. In the past, identification of bacteria and fungi was challenging, multi step process and individualized by type of organisms. With MALDI - TOF MS, colonies of bacteria and fungi are accurately identified in minutes which has positive impacts on patients. MALDI - TOF MS results in faster detection of micro organisms compared to conventional techniques. So MALDI - TOF MS is an incontrovertibly beneficial technology for the clinical diagnosis. A major advantage of MALDI - TOF is its rapid turn around time of less than 10 minutes and an overall 99.9% accuracy at the species level enabling a faster and a correct treatment for the patients.



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CAROTID ENDARTERECTOMY UNDER TRANSCRANIAL DOPPLER MONITORING

Dr. K. Vijayan
MBBS, MD, DNB, DM (Neurology), ASN (USA).,
Consultant Neurologist & Neuro Sonologist

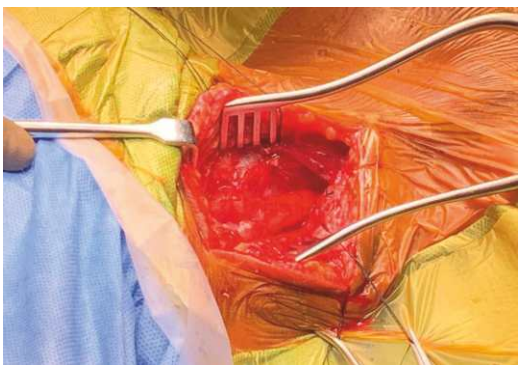
Aims : To assess usefulness of Transcranial Doppler Monitoring during Carotid Endarterectomy

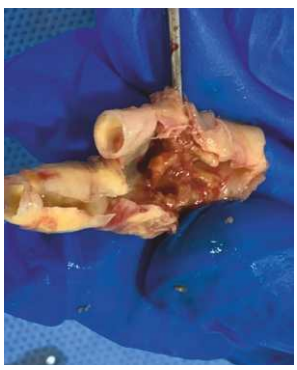
Methods : 42 Consecutive patient with symptomatic carotid stenosis were subjected to Carotid Endarterectomy under continuous TCD Monitoring of the ipsilateral Middle Cerebral Artery

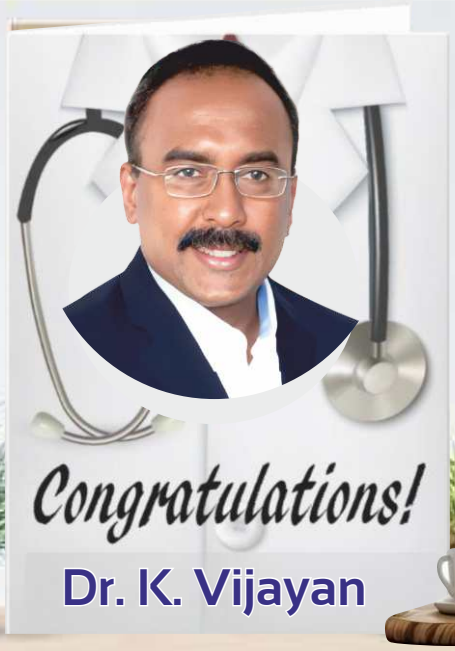
Results : A total of 42 patients underwent CEA of which there were 33 Gentlemen and 9 Ladies. 19 patient underwent Right CEA, 17 patient underwent Left CEA and 1 patient underwent bilateral CEA sequentially. Two patients underwent reexploration immediately after procedure as TCD showed no improvement in flow. One of these two patients also had multiple emboli pickedup by continuous TCD monitoring. One had hyperperfusion which was also treated accordingly.

Complications : 1 patient had Minor bleeding ; 1 patient had Neuropraxia; No patient had Peroperative stroke or postoperative stroke; There was no mortality.

Conclusions : Continuous TCD Monitoring of ipsilateral Middle Cerebral Artery is a very useful procedure for safe and effective Carotid Endarterectomy.





Got 2nd prize in Award Paper Session at Indian National Stroke Congress 2023-Chennai.

42ND Annual Conference of THE INDIAN SOCIETY OF NEPHROLOGY SOUTHERN CHAPTER

The 42nd annual conference of the Indian Society of Nephrology - Southern Chapter was held in Coimbatore under the aegis of the Nephrology Association of Coimbatore from February 10th to 12th, 2023. Over 600 Nephrologists from all the southern states attended the conference.

As part of the conference " Live Interventional Nephrology Work Shop" was conducted at Royal Care Super Speciality Hospital, Coimbatore on 9th February 2023.

It was the first of its kind workshop at a Nephrology Conference.It included cases of AV FistulaAngioplasty performed in the Cath lab and seen live in the auditorium by the attendees. It was followed by a series of demonstrations and lectures regarding Interventional Nephrology and Ultrasound Imaging by eminent regional and national faculties.

Royal Care Super Speciality Hospital played a perfect host to the event with Dr K. Madeswaran, Chairman and Managing Director, Consultant Neuro Surgeon at Royal Care Super Speciality Hospital inaugurating the Academic Feast.

The team of organising committee of the conference including Dr K. S. Ramalingam, Dr P. Ramachandran, Dr Balakrishnan, Dr Kandasamy, Dr Mangalakumar, Dr Venu, Dr Gowtham, Dr Saravanan, Dr Yuvaraja and Dr Ramaswamy chaired the sessions in the conference.

Over 150 postgraduates and consultants benefited from the live workshop.

Dr S. Murugananth and Dr J. Gerard Vinodh, Consultant nephrologists at Royal Care Super Speciality Hospital coordinated the event.

GLIMPSE

MRgFUS - Press Meet held at Hotel Hyatt Regency Chennai on 12.01.2023

Pengal Nalam _Monthly Health Camp Conducted by Royal Care at Kulathur on 25.01.2023

Republic Day Celebrations at Royal Care Premises on 26th January 2023

An update on Carotid Disease. CME Programme held at Hotel Gokulam Park Cbe on 28.01.2023

CRITICIMA - IMA AMS TNSB CRITICAL CARE Workshop held at Royal Care on 29.01.2023

World Cancer Day 04th February 2023 signature campaign held at Royal Care.

Basic Life Support (BLS) Training Program conducted for Kaniyur Toll Plaza staff at Royal Care Super Speciality Hospital on 06.02.203

Pengal Nalam Monthly Health Camp Conducted by Royal Care at Neelambur on 09.02.2023

08th March 2023 International Women's Day Celebration at Royal Care. Special Lecture by Mrs.Latha Sundaram MD Aram Foundation, Cbe.

International Women's Day 08 March 2023 Health Awareness program by Dr. Devi Gayathri at LRT Company Cbe.

SENTINEL LYMPH NODE BIOPSY IN EARLY-STAGE

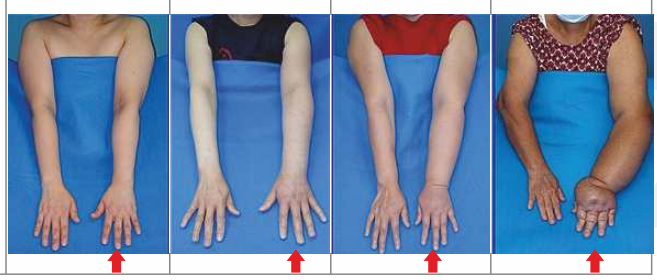
Dr. Shiva Kumar Kuppuswamy
MBBS, MS(Gen.Surg), M.Ch (Surgical Onco).,
Consultant Surgical Oncologist

"Treatment without Prevention is simply unsustainable" - Bill Gates

Lymphedema occurs when the load exceeds the transport capacity of the lymphatic system, which leads to the accumulation of protein-rich fluid (lymph) and fibro adipose tissue in the interstitium. Symptoms of lymphedema include limb swelling, skin changes, discomfort, and restricted range of motion. Breast cancer and its treatments are one of the most common causes of secondary peripheral lymphedema. The incidence of upper extremity lymphedema in breast cancer survivors ranges from 5 to 40 percent. Incidences in the higher range occur in patients who have undergone complete axillary dissection combined with radiation therapy.

Breast cancer-associated lymphedema (BCAL) is primarily due to obstruction of the lymphatic channels located in the axilla, most commonly from lymphadenectomy or radiation therapy, but can also occur as a result of infiltration of the lymphatic vessels by tumor cells (lymphangitic carcinomatosis).

Primary prevention of lymphedema in patients undergoing treatment for breast cancer relies on surgical techniques that limit node dissection (eg, sentinel lymph node biopsy) or, less commonly, techniques that repair or bypass injured lymphatics, and limit radiation exposure. Sentinel lymph node biopsy has been instrumental in decreasing the incidence of lymphedema. Clinically relevant lymphedema occurs in 5 to 9 percent of patients who undergo sentinel node biopsy alone compared with approximately 40 percent in patients undergoing axillary lymph node dissection. Using advanced radiation therapy (RT) techniques that limit radiation may also be helpful. Sentinel lymph node biopsy is a procedure used to detect the spread of cancer from the primary tumor to the lymph nodes. The sentinel lymph node is the first lymph node that cancer cells reach when they spread from the primary tumor. This node is most likely to contain cancer cells, and if the sentinel lymph node is cancer-free, it is unlikely that other lymph nodes are affected. During a sentinel lymph node biopsy, we will locate and remove the sentinel lymph node, which is usually located in the axilla. A small amount of blue dye or radioactive material is injected into the breast area near the primary tumor. This dye or radioactive material will travel through the lymphatic system and collect in the sentinel lymph node. The surgeon will use the dye or radioactive material to locate the sentinel lymph node and then remove it. The lymph node is then sent to a lab for a frozen section examination. If cancer cells are found in the sentinel lymph node, it may mean that cancer has spread to other lymph nodes and we proceed with formal axillary lymph nodal dissection.

Grade	Grade I	Grade II	Grade III	Grade IV
Circumferential Difference	10-19%	20-29%	30-39%	40-49%
Clinical Image				

Picture showing various grades of Lymphedema

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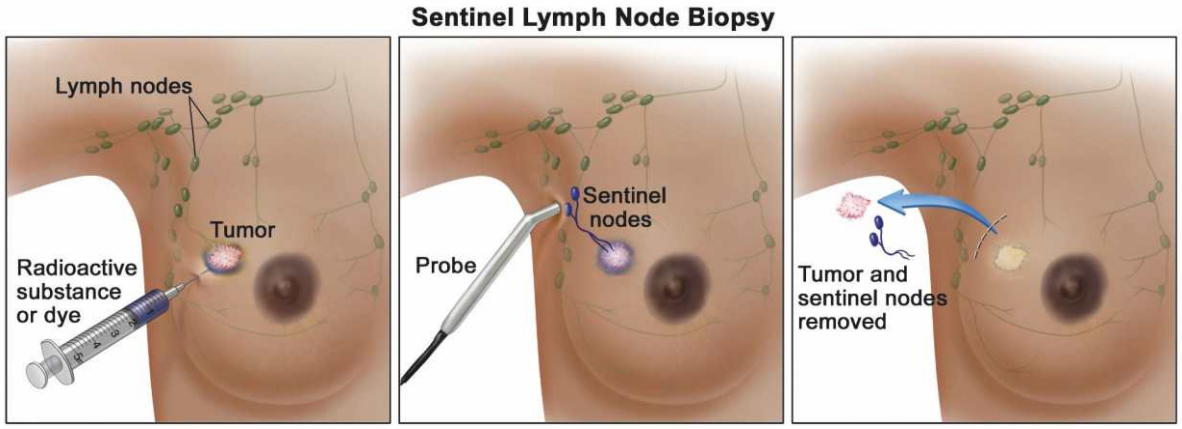
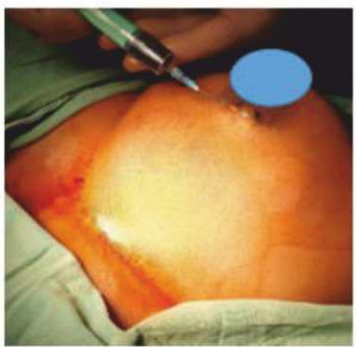
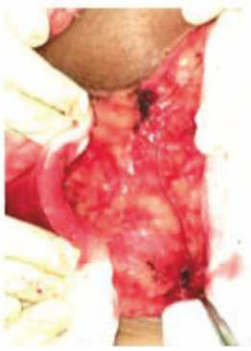
The following picture shows the principles of Sentinel Lymph node Biopsy.



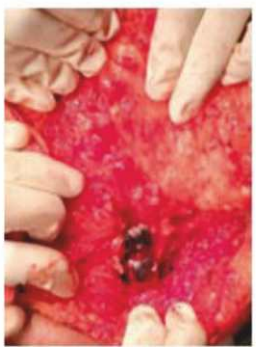
Images of some of the Sentinel Node Biopsies done by us are shown below



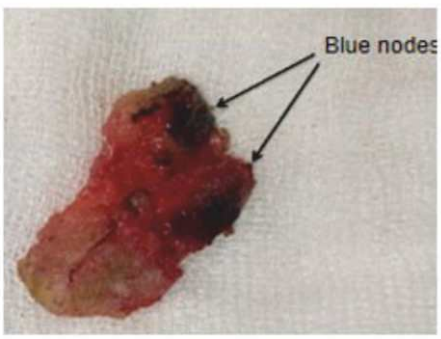
Peri Aeriolar Injection of Blue Dye



Lymphatics reaching Sentinel Node



Two Sentinel Nodes seen



Sentinel Nodes stained blue Biopsied

Same Sentinel Node being hot on Gama Probe

Congrats

Dr. N. Senthil Kumar
Consultant Radiologist
has been appointed as Coordinator for the public relations and communications committee of Indian Radiology and Imaging Association (IRIA) for the year 2023.

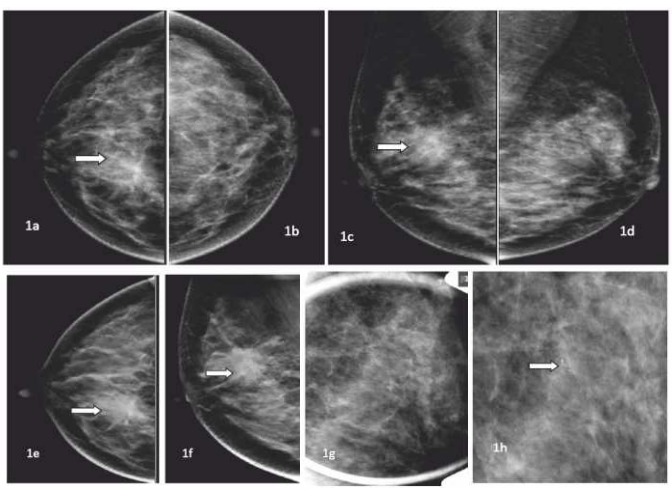
Importance of multimodality imaging in diagnosing BREAST CANCER in a young woman

- a pictorial assay with a case report.

Dr. P. Veena Shankari
MBBS, MD (Radiodiagnosis).,
Post-Doctoral Fellow in Breast Imaging and Intervention
Consultant Radiologist

40 year nulliparous on IVF came with a right breast lump for 1 year, imaging done elsewhere with ultrasound of both breasts revealed an irregular hypoechoic mass in the right breast for which biopsy was done and reported as sclerosing adenosis. The patient came with pain over the lump.

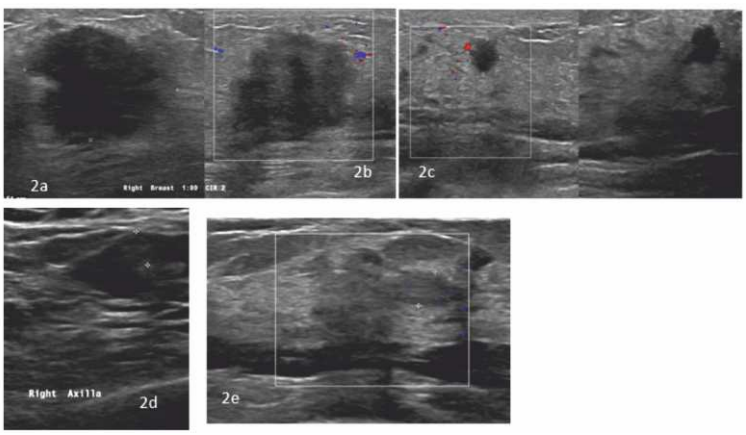
A digital x-ray mammogram was performed for both breasts with tomosynthesis, right breast showed an irregular spiculated high-density mass with adjacent architectural distortion seen in the upper inner quadrant (1a,c) which was clearly seen on tomosynthesis (1e,f). The mass shows a speck of calcification within and the left breast showed grouped amorphous calcification in the upper outer quadrant which was clearly seen on spot magnification views (1g,h).



Correlative ultrasound of both breasts was performed on which the right breast showed an irregular hypoechoic mass with spiculated margins seen at 1 O'clock position circle-2 measuring 2.5 x 1.8 x 2.4 cm (2a,b) and another similar appearing nodule seen at 1 O'clock position circle-2 measuring 7.1 x 5.6 x 5.9 mm (2c). The mass shows posterior acoustic enhancement with internal and peripheral vascularity.

Few prominent axillary lymph nodes with non-uniform cortical thickening were seen, the largest measuring 4 mm with preserved fatty hilum (2d).

Left breast ultrasound showed a heterogeneous non-mass area involving a 12-2 o'clock position with few dilated ducts showing internal echogenic contents with no suspicious vascularity (2e).



BI-RADS IVa for right breast mass was given and advised for re-biopsy and left breast BI-RADS IV was given advised stereotactic biopsy for left breast amorphous calcifications.

The patient came back for a dynamic contrast-enhanced MRI of both breasts, which revealed multiple masses as below:

Mass 1 - Irregular spiculated T1 and T2 hypointense mass which is showing adjacent architectural distortion seen at 12-1 o'clock of right breast measuring 2.2 x 2.8 x 3 cm. The mass shows diffusion restriction and shows enhancement in early phases and washout in delayed phases with type III curve images. The mass is ~ 7.5 mm from the pectoralis major muscle (3a,b).

Mass 2 – Similar appearing nodule is seen adjacent to the above-mentioned mass measuring 5.9 x 6.8 x 7.5 mm. The nodule is located approximately 1.1 cm from the nipple (3c).

Mass 3 –Similar appearing nodule is seen in the subareolar region ~ 8 mm from the nipple measuring 4 x 4.3 x 6 mm (3d).

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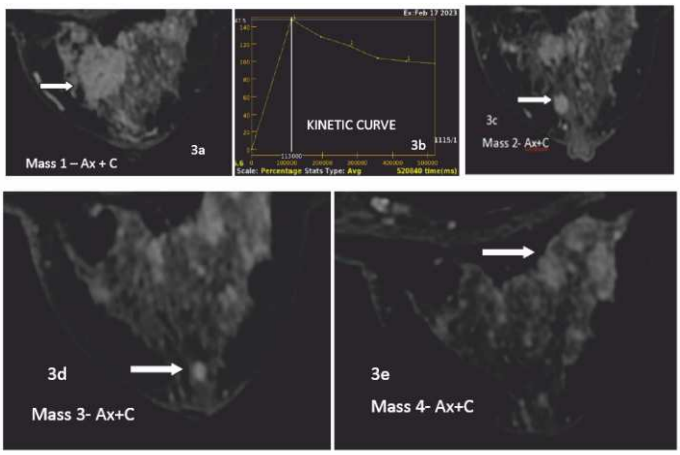
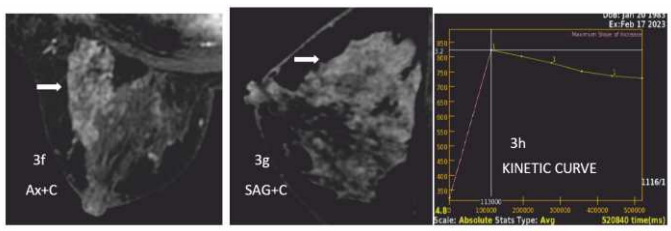


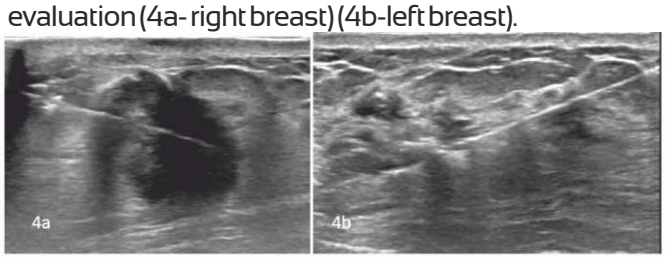
Mass 4 - Area of non-mass enhancement with clustered ring appearance seen involving the upper outer quadrant. This area shows diffusion restriction. On post-contrast images, there is a progressive enhancement (3e).

The left breast showed a suspicious area of nonmass enhancement seen in segmental distribution with clustered ring pattern involving predominantly upper outer quadrant involving 1 – 3 o'clock position. These areas showed diffusion restriction, and on post-contrast imaging, showed progressive enhancement for a span of 7.6 cm with extension up to the nipple with a type I kinetic curve. The area was seen to have suspicious continuity with the pectoralis muscle behind with subtle enhancement. (3f,g,h)



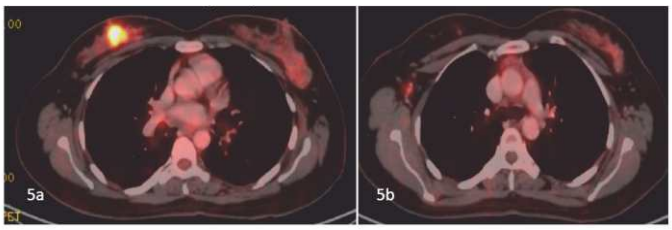
MRI was reported as irregular spiculated mass with enhancement and washout on post-contrast images – Right breast (BIRADS 5) & Suspicious nonmass enhancement in the segmental distribution in the upper outer quadrant of the left breast (BIRADS 4).

Ultrasound-guided biopsy was done from both breasts and core samples were sent for histopathological evaluation (4a- right breast) (4b-left breast).



Histopathology revealed right breast invasive breast carcinoma with ER, PR, HER-2 positive, and Ki 67 - 23% Histopathology of the left breast showed atypical ductal proliferation

Whole body PET scan was performed and showed uptake in the right breast mass with ipsilateral nodal metastasis (5a,5b)



the patient has been advised 4 cycles of neoadjuvant chemotherapy followed by right breast MRM with nodal clearance and close follow-up for left breast atypical proliferation.

Discussion:

Multimodality imaging of HER2-positive breast cancer before and after neoadjuvant chemotherapy provides varied accuracy and predictive value for estimating remaining disease compared with the standard of pathologic analysis, which is a consideration for treatment planning. The most common manifestation of HER2-positive breast cancer at mammography or US is an irregular mass with spiculated margins that often contain calcifications; at MRI, HER2-positive breast cancer may appear as a mass or as nonmass enhancement. HER2-positive breast cancers are often of intermediate to high nuclear grade at histopathologic analysis, with an increased risk of local recurrence and metastases and a poorer overall prognosis. women are now potentially able to undergo breast conservation therapy and sentinel lymph node biopsy versus mastectomy and axillary lymph node dissection. Thus, the radiologist's role in assessing the extent of local-regional disease and response to neoadjuvant treatment at imaging is important for surgical planning and adjuvant treatment. However, assessment of treatment response remains difficult, with the potential for different imaging modalities to result in underestimation or overestimation of disease to varying degrees when compared with surgical pathologic analysis. Breast MRI findings remain the best predictor of pathologic response.

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THERAPEUTIC PLASMA EXCHANGE (TPE)- A PROMISING TREATMENT MODALITY IN NEUROLOGICAL & NON- NEUROLOGICAL PATIENTS

Prof. Dr. P. Chinnaswamy
Ph.D., FICS., MAACC (USA).,
FIFCC (CLINICAL CHEM)., FNACB (USA).,
Chief of Laboratory Medicine
and blood bank

Dr. M.R. Jeeva Priya
M.D (Immuno-Hematology &
Blood Transfusion), DDVL.
Consultant Transfusion Medicine
and Blood Bank Medical Officer

INTRODUCTION:

Therapeutic plasma exchange (TPE) is an extracorporeal patient therapy involving the separation and removal of the plasma in the blood using a cell separator machine, in order to remove disease causing substances circulating in the plasma.

The cellular components (RBC,WBC, and platelets) are returned to the patient, along with a prescribed replacement fluid. The patient is connected to the machine using central vein preferably. The blood in the extra corporeal circuit is anticoagulated using citrate and the administration of this is controlled by the equipment and the operator. The machine separates the blood into its component parts allowing the plasma (containing the disease causing agent) to be drawn off and replacement fluid has to be added to the returning red and white blood cells.The purpose is to remove the agent in the plasma, such as an antibody, toxin or abnormal protein that are causing the clinical symptoms.

PRINCIPLE:

TPE is often used to modulate the level of circulating antibodies, antigen-antibody complexes, complement components, cytokines, abnormal plasma proteins, cholesterol-containing lipoproteins, plasma-bound toxins and drugs. Also it has an immunomodulatory effect beyond the removal of Ig which includes T-cell modulation with a shift from in the Th1/Th2 balance with a shift toward Th2, suppression of IL-2 and IFN-γ production.

CAUSATIVE AGENT	DISEASES
AUTOANTIBODY	TTP, Myasthenia Gravis, Neuromyelitis optica, Anti - GBM, ANCA associated Vasculitis Multiple Sclerosis, GBS, CIDP
AG-AB COMPLEX	HCV Vasculitis,SLE
ALLO ANTIBODY	Transplant sensitisation, Transplant rejection (humoral), Transfusion reaction
PARAPROTEINS	Waldenstrom's macroglobinemia, Hyperviscosity, Light chain neuropathy, Light chain glomerulopathy, Myeloma cast nephropathy
NON-Ig PROTEINS	FSGS
ENDOGENOUS TOXINS	Hyperlipidemia,Liver failure, Sepsis
EXOGENOUS POISONS	Amanita, Drugs
REPLENISHMENT	TTP(ADAMTS13), MPGN(complement factor H)

Methods & mechanism of plasma removal:

Methods available:

1. Centrifugal TPE (cTPE).
2. Membranous TPE(mTPE)

(By dialysis machine)

The best method used for TPE is by CENTRIFUGAL TPE METHOD.

Whole blood is pumped into a rapidly rotating separation chamber. Components separate into layers based upon their density, with the most dense element, RBCs, migrating the furthest from the axis of rotation and the least dense portion, plasma, layering closest to the axis of rotation. Intermediate layers, moving from the axis of rotation outward, are platelets, lymphocytes, and granulocytes. In TPE, the plasma layer is removed and discarded and the remaining cellular elements are mixed with a replacement fluid and returned to the patient.

Difference between Centrifugal TPE (cTPE) & Membranous TPE(mTPE)

PARTICULARS	cTPE	mTPE
1.Plasma Extraction ratio or Plasma removal efficiency (PRE : percentage of plasma removed vs. plasma processed)	Higher80% (75-85%)	Lower35% (30-50%)
2.Time duration (Set up,Priming, Procedure)	Less(102±25min)	More(157 ±25min)
3.Anticoagulation	Citrate(No risk of systemic anticoagulation)	Heparin(risk of systemic anticoagulation present)
4.Effectiveness for removal of High molecular weight substances(IgM),immune complexes	High	Low
5.Risk of hemolysis with high membrane pressure	Less	More

Ref:

1. Kes et al A randomized crossover study comparing membrane and centrifugal therapeutic plasma exchange procedures, Volume 56, December 2016 TRANSFUSION
2. Centrifugal and Membrane Therapeutic Plasma Exchange – A Mini-review : European Oncology & Haematology, 2018;14 (2) : 105–9

How much plasma is to be removed?

Routine practice is to exchange only **1-1.5 plasma volumes** during a TPE. For each 1-1.5 plasma volume exchanged, approximately 60%-70% of substances present in the plasma at the start of that plasma volume will be removed.

The efficacy of TPE depends on the Plasma Volume (PV) removed in relation to the patient's total PV, the distribution of the pathogenic substance removed between intravascular and extravascular spaces, and the synthesis and equilibrium rate of that substance between the compartments.

Replacement Fluids:

Examples of physiological fluids used for replacement during TPE include fresh frozen plasma (FFP), 5% human albumin solution (5% HAS), colloids (Gelofusine) and crystalloids (0.9% normal saline).

INDICATIONS

Guidelines on the Use of Therapeutic Apheresis in Clinical Practice– Evidence-Based Approach from the Writing Committee of the American Society for Apheresis (ASFA): J Clin Apher. 2019;34:171–354.

Categories - ASFA Guidelines

Category I : Disorders for which apheresis is accepted as first-line therapy, either as a primary standalone treatment or in conjunction with other modes of treatment.

Category II : Disorders for which apheresis is accepted as second-line therapy, either as a standalone treatment or in conjunction with other modes of treatment

Category III : Decision making should be individualized.

Category IV: Disorders in which published evidence demonstrates or

suggests apheresis to be ineffective or harmful.

INDICATION	ASFA CATEGORY	FREQUENCY OF PROCEDURES
NEUROLOGY		
1. Myasthenia Gravis	Cat-I- Acute-short term treatment Cat- II - Long term treatment	Daily/Every other day
2. Guillian Barre syndrome	Cat-I	Every other day- 5 to 6 cycles
3. Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP)	Cat-I	Every other day- 5 to 6 cycles
4. Chronic Inflammatory Demyelinating Polyradiculoneuropathy (CIDP)	Cat-I	2-3 cycles/week
5. Paraproteinemic demyelinating neuropathies IgG/IgA/IgM	Cat-I	Every other day- 5 to 6 cycles
6. N.Methyl-D-Aspartate receptor antibody encephalitis	Cat-I	Every other day- 5 to 6 cycles
7. Multiple Sclerosis-Acute attacks/Relapse	Cat-II	Every other day - 5 to 7cycles
8. Neuromyelitis optica spectrum disorder	Cat-II	Every other day- 5 to10 cycles
9. Paediatric Autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS) Exacerbation	Cat-II	Daily/Every other day - 3 to 6cycles
10.Voltage Gated K channel antibody related diseases	Cat II	Every other day- 5 to 7 cycles
11. Hashimoto's encephalopathy	Cat-II	Every other day- 3 to 9 cycles
12.Lambert Eaton myasthenic syndrome	Cat-II	Daily/Every other day - variable
13.Acute Disseminated encephalomyelitis (steroid refractory)	Cat-II	Every other day- 3 to 6 cycles
HEMATOLOGY		
1. Thrombotic thrombocytopenic purpura	Cat-I	Daily- variable
2. Hyperviscosity in hypergammaglobinemia Symptomatic/prophylaxis	Cat-I	Daily- 1 to 3 cycles
3.Catastrophic Anti-Phospholipid antibody syndrome	Cat-I	Daily/Every other day - variable
4.Hereditary hemochromatosis	Cat-I	Daily/Every other day- variable
5.Severe cold agglutinin disease	Cat-II	Daily/ Every other day- variable
6.Thrombotic microangiopathy-Complement mediated-Factor H auto antibodies	Cat-I	Daily- variable

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7. Cryoglobulinemia Symptomatic/severe	Cat-II	Every other day- 3 to 8 cycles
8. Thrombotic microangiopathy -Ticlopidine induced	Cat-II	Daily/Every other day - variable
9. HELLP Syndrome	Cat III	Daily-variable
10. Refractory Immune thrombocytopenia	Cat III	Every other day- 6 cycles

RHEUMATOLOGY

1. Vasculitis-ANCA associated	Cat-I	Daily/Every other day- 7-12 cycles
2.SLE-with Severe complications	Cat-II	Daily/Every other day - 3-6 cycles
3. Vasculitis due to HBV-Polyarteritis nodosa	Cat-II	Daily/Every other day- 9-12 cycles
4. Scleroderma	Cat III	1 -3 cycles/week

NEPHROLOGY

1. Renal Transplantation - i) ABO compatible - Desensitization for a) living b) deceased donor c) Antibody mediated rejection	a)Cat I, b)Cat III, c)Cat-I	Every other day - variable
ii) ABO- incompatible a)Desensitization -LD, b)Antibody mediated rejection	a)Cat I, b)Cat- II	
2.ANCA associated Rapidly Progressive Glomerulo - Nephritis (Cr > 5.7 mg/dl) and Dialysis dependence with DAH	Cat-I	Daily/Every other day - 7-12 cycles
3. Anti-Glomerular Basement Membrane Disease (Good-Pasture syndrome) - DAH, dialysis independence	Cat-I	Daily/Every other day- variable
4. Focal Segmental glomerulosclerosis	Cat-I	Daily/Every other day- variable
5.IgA Nephropathy-Crescentic, chronic progressive	Cat III	Every other day-6-9 cycles

OTHERS

1. TPE with adsorbant columns for treatment for familial hypercholesterolemia.	Cat-I	Every 1 -2 weeks
2.Wilson's disease - Fulminant	Cat-I	Daily/Every other day - variable
3.Thyroid storm	Cat-II	Daily/Every other day- variable
4.Drug overdosage	Cat-III	Every other day - variable
5.Refsum's disease	Cat-II	Every other day - variable
6.Mushroom Poisoning	Cat-II	Every other day - variable
7.Envenomation	Cat-III	Every other day - variable
8.Sepsis with multiorgan failure	Cat III	Every other day - variable
9. Pruritus due to hepatobiliary diseases	Cat III	Weekly-thrice
10.Hypertriglyceridemic pancreatitis-severe	Cat III	Every other day (1-3 cycles)
11. Acute liver failure	i.High volume TPE - Cat I ii.Routine TPE- Cat III	Every other day - variable
12. Complex regional pain syndrome - Chronic	Cat III	Every other day - 5 - 7 cycles
13. Severe pemphigus vulgaris	Cat III	Daily/Every other day - variable

Treatment Outcome :

TPE is a well-established treatment modality for many of the above said diseases and its exacerbation . Rebound overproduction of antibodies occurs because of sudden removal of antibodies from the circulation. So, concurrent use of immunotherapy is advisable along with TPE.

In a country like ours, cost of the therapy is an important factor while choosing treatment option. TPE is relatively cheaper mode of treatment as compared to IVIG. Although studies showed equal efficacy of IVIG and TPE , an expert consensus suggests that plasma exchange is more effective and works more quickly in the treatment of impending or manifest diseases.

Complications :

Although complication can occur, most of these are mild,rapidly recognized and reversed and are rarely serious.(4% to 6%)

1. Issues related to vascular access is common.

2.Symptomatic hypocalcemia due to citrate anticoagulation typically characterized by perioral and digital paresthesiae,nausea .Calcium supplementation may alleviate symptoms of citrate toxicity.

3. Allergic reactions are most common with plasma replacement characterised by urticaria and cutaneous flushing. Severe allergic reactions can involve the respiratory tract with dyspnea, and wheezing. Most allergic reactions respond quickly to IV diphenhydramine.

4.Hypotension during apheresis can be a sign of citrate toxicity, hypovolemia, or vasovagal, allergic, drug, or transfusion reaction.

5.TRALI/TACO are rare.

6. Bleeding due to coagulation factor deficiency is rare,unless replaced with only albumin.

7.Albumin-bound drugs are removed by TPE.Drugs should be administered after TPE procedure to avoid impairing their effectiveness.

TPE in Royal Care Super Speciality Hospital:

- Before the procedure, following parameters are checked- Complete Hemogram, blood urea, serum creatinine, liver function test, serum electrolytes, coagulation profile, and vital parameters.
- TPE consent is taken from the patient/patient's relatives before the procedure.
- TPE is performed using a Spectra Optia Apheresis system (Terumo Penpol) through

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central line access using 11.5 F double lumen dialysis catheter.

- The amount of plasma to be exchanged was determined by following formula: Estimated plasma volume (EPV) = (0.065 × weight [kg]) × (1 – Hematocrit as a fraction) (NADLER'S equation, 1962).
- TPE is done on alternate day basis for 8–10 days.
- The treating Consultant decides the number of cycles depending on the clinical outcome.
- Anticoagulation with citrate (ACD) is used systemically.
- Exchange of 1-1.5 PV given to the patients and replaced with Isotonic saline, albumin and fresh frozen plasma (FFP).
- Isotonic saline is used 30% and human albumin and fresh frozen plasma 70% are added to complete it. Albumin only issued for patients who experience adverse reactions with FFP.
- For every 15-30 minutes intervals, the blood pressure and pulse, changes in appearance, development of symptoms like light-headedness, nausea, paresthesia and overall status are closely monitored and untoward events are identified and reverted by rational interventions.
- The duration of procedure varies from one to three hours depending upon the amount of plasma exchange.
- All TPE procedures are carried out in ICU by blood bank technicians trained in TPE under the supervision of Consultant Transfusion medicine/blood bank medical officer .
- Indications for TPE, number of cycles , duration of each session, volume of plasma exchanged and patient tolerance to the procedure are systematically recorded.
- To avoid citrate toxicity, 10 ml of 10% calcium gluconate is infused throughout the procedure.
- After each session, outcomes in terms of clinical improvement is measured.

OTHER PROCEDURES DONE WITH THE SAME EQUIPMENT

RED CELL EXCHANGES

1. RBC Exchange for methemoglobinemia,Sickle cell disease(Cat-II),acute sickle cell crisis, removal of donor RBC from the bone marrow grafts in major ABO-incompatible allogeneic hematopoietic stem cell transplantation to avoid immediate hemolysis,severe infections with intraerythrocytic pathogens such as malaria (Cat III) or babesiosis

2. Erythrocytapheresis for polycythemia vera(Cat-I) and secondary erythrocytosis.(Cat-III)

STEM CELL COLLECTION

1. Mononuclear Cell (MNC) Collection

2. Continuous Mononuclear Cell Collection (CMNC)

3. Granulocyte (PMN) Collection

DEPLETION

1. Leukocytapheresis- White Blood Cell Depletion (WBCD)- initial management of leukostasis in patients with hyperleukocytosis in acute leukemias, particularly myeloid leukemias.(Cat-II)

2. Platelet Depletion- for severe thrombocytosis(Cat-II)

PROCESSING

Bonemarrow processing

Spectra Optia Apheresis system - For all therapeutic exchange procedures, Various cell collection and processing.

Rapid clinical outcome after 5 cycles of Therapeutic plasma exchange for Myasthenia gravis patient on crisis with respiratory failure

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- ENT, Head & Neck Surgery
- General & Laparoscopic Surgery
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