LIFE after DEATH

HLT CASE REPORT

CRITICAL CARE ASPECTS

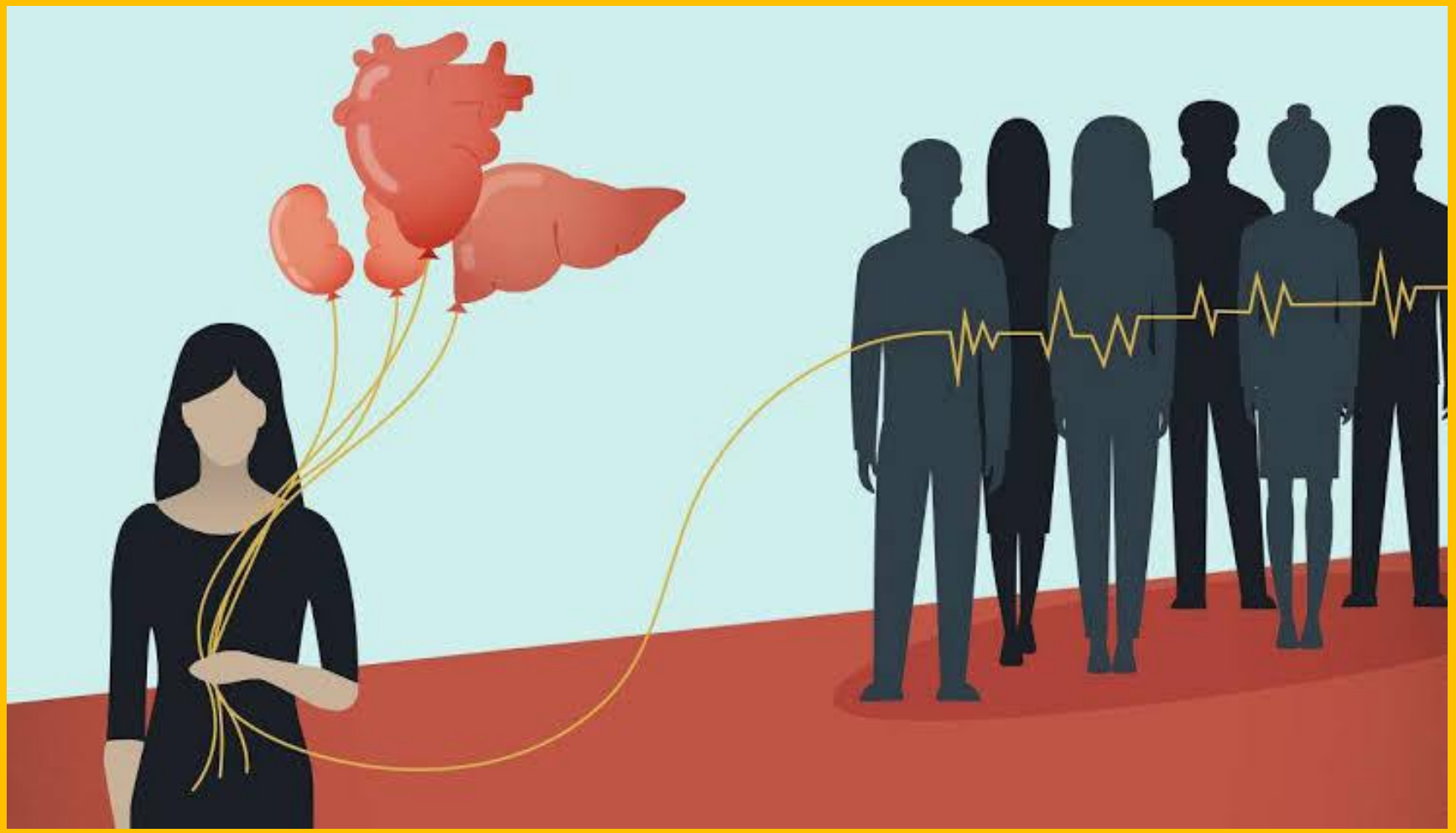
Department of Critical Care Medicine

The Indian EXPRESS
JOURNALISM OF COURAGE

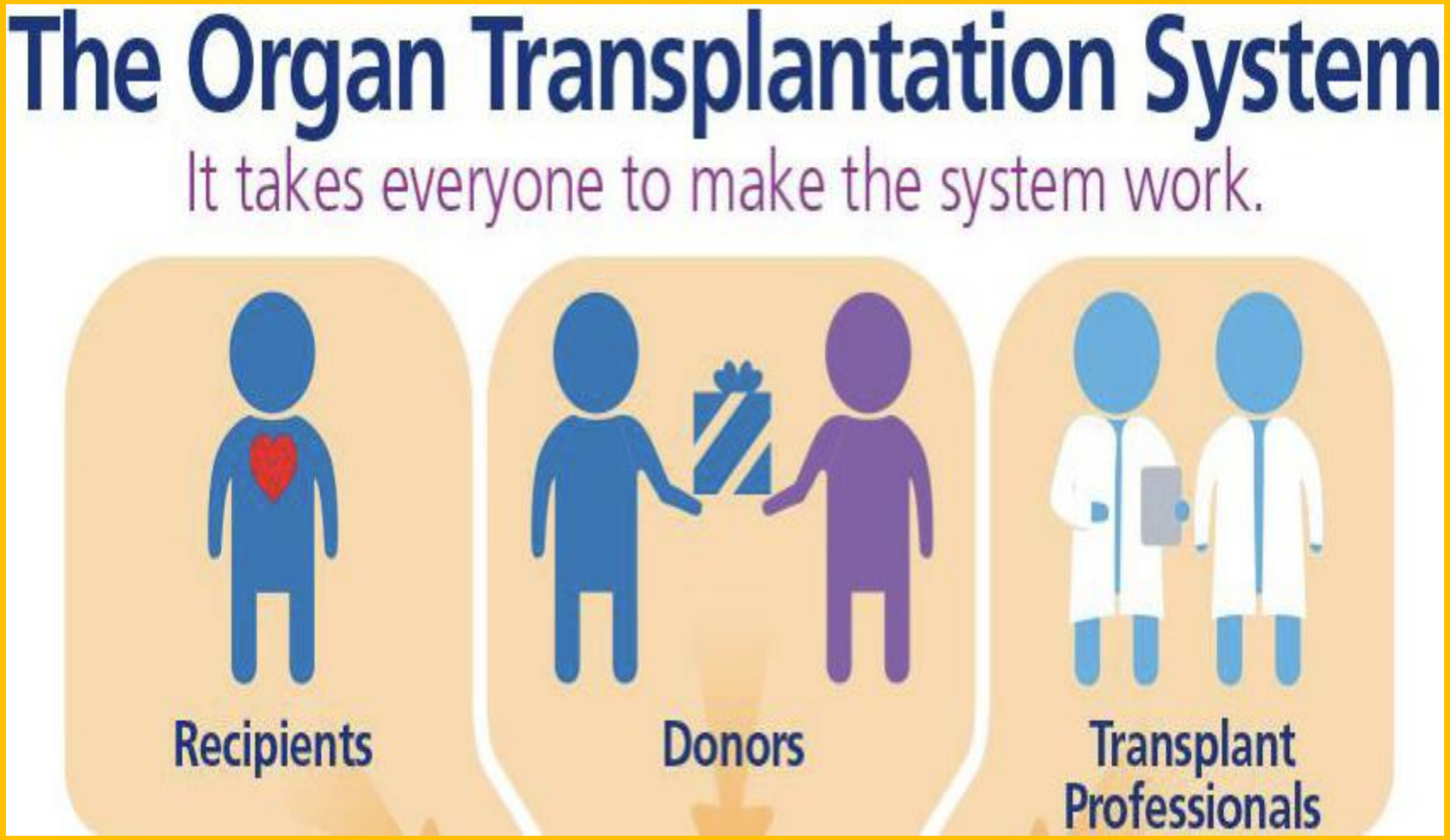
Pune: Dr DY Patil Hospital successfully performs simultaneous heart-lung transplant

The 37-year-old patient's heart and lungs were replaced with the organs of a 27-year-old brain-dead woman

DONOR - RECEPIENTS



Ultimate GIFT - LIFE



DONOR

- 23/F
- Intracranial Bleed
- Best medical treatment
- Succumbed to Brain Death

Brain Death Criteria

- Brain death is established by documentation of

1. Irreversible coma
2. Irreversible loss of brain stem reflexes
3. Cessation of respiratory centre function

or

4. Demonstration of cessation of intracranial blood flow

Gift of life

- Transplant co-ordinators counselled relatives
- Thanks to relatives
- Choosing organ donation
- Gifted life through organs


NOTTO
National Organ & Tissue Transplant Organisation
DGHS, Ministry of Health & Family Welfare, GOI


SUPPORT ORGAN DONATION

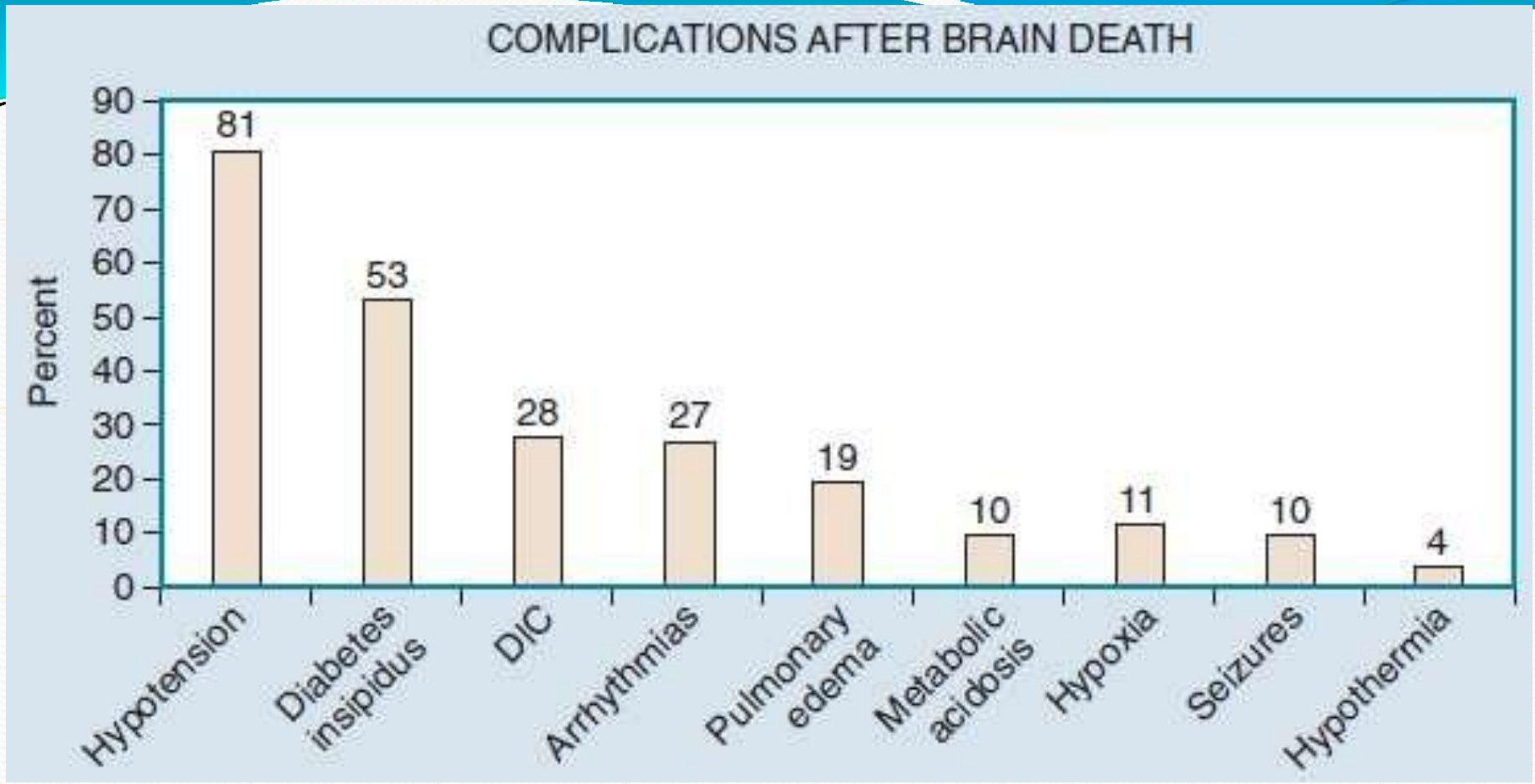
ZTCC

PUNE

DONOR OPTIMISATION

- Critical care team worked with interdepartmental coordination - 24 * 7

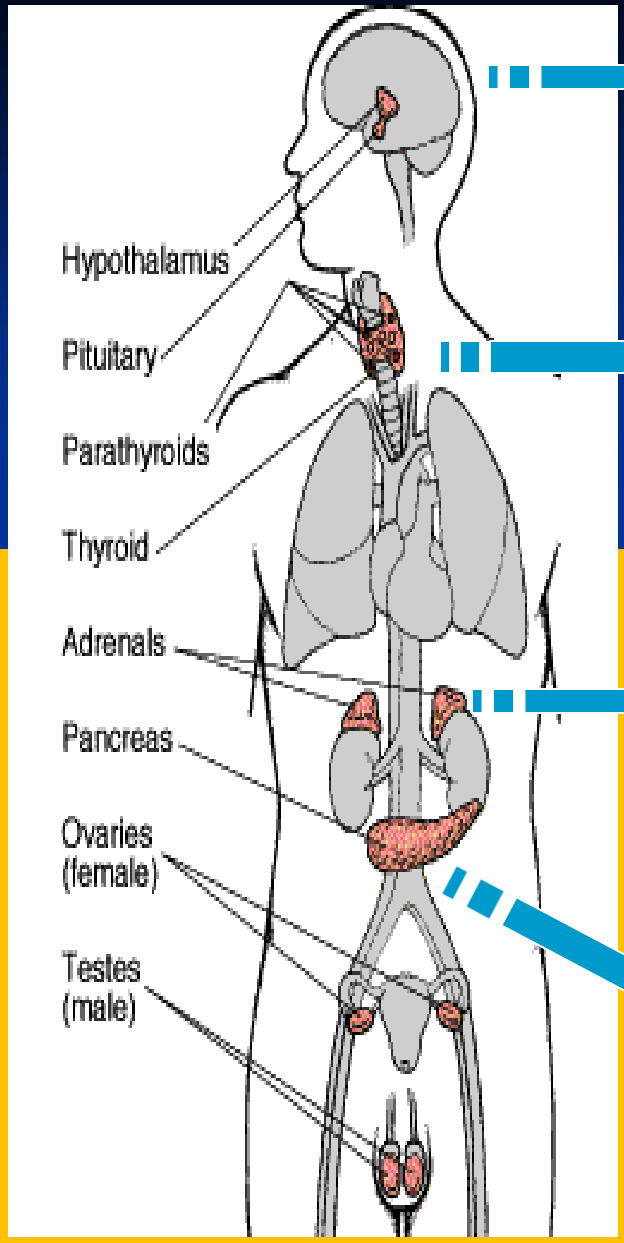
- To ensure Donor organs in pristine condition - Herculian task



Adapted from Smith M. Physiologic changes during brain stem death-lessons for management of the organ donor. J Heart Lung Transplant 2004;23:S217-22.

RULE OF 100

- Systolic arterial pressure > 100 mmHg
- Urine output > 100 ml/h
- PaO2 > 100 mmHg
- Hemoglobin > 10 g/dl
- Blood sugar > 100 mg/dl



- Failure of hypothalamo-pituitary axis
- Decline in plasma hormone concentration
- ADH, TSH

- Impaired TSH secretion
- Impaired peripheral conversion of T4
- Reduced T3- progressive loss of cardiac contractility
- Increased anaerobic metabolism

- Hypoadrenalism
- Impairs donors stress response
- Cardiovascular collapse

- Decreased insulin secretion
- Hyperglycaemia

ENDOCRINE CHANGES

HORMONAL REPLACEMENT

- Methylprednisolone: 15 mg/kg immediately after the diagnosis of brain death and 24th hourly

- Thyroxine: 300 mcg 8 hourly

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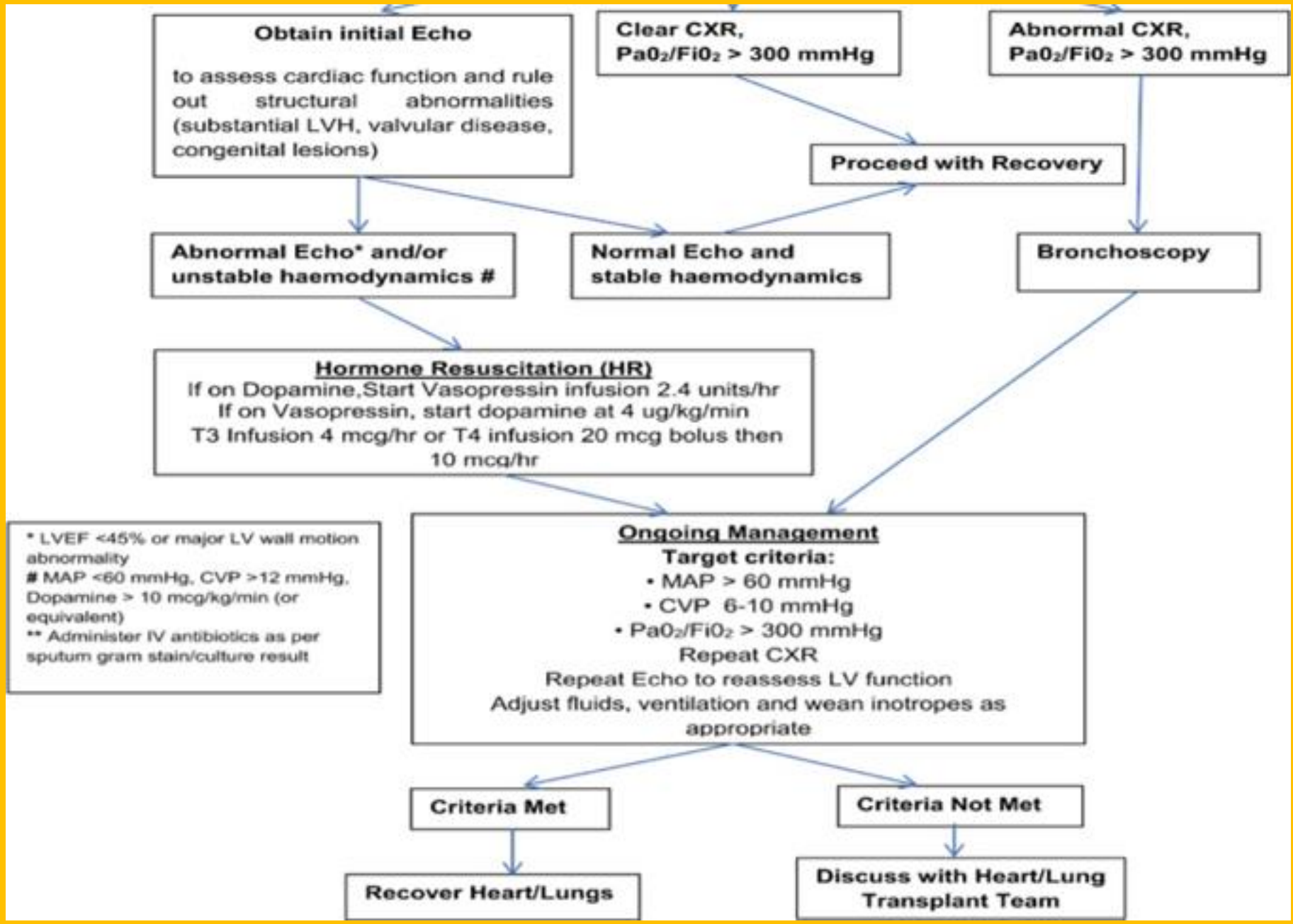

- HEART & LUNGS will be considered for transplant only if the specific criteria is met.

- CRITICAL CARE TEAM worked relentlessly to ensure that this criteria is met.

Table 2 Acceptable Heart Donor Criteria

Characteristics	Description
Age	Less than 55 years
Echocardiogram	Ejection fraction 55%–65%; posterior left ventricular wall thickness <11 mm; septal wall thickness <11 mm; absence of any valvular disease, damage, and/or vegetations; no wall motion abnormalities
Normal left heart catheterization	For age 40 years or greater or other indication (i.e., cocaine use history)
Donor-recipient weight	This is used for size matching; 20% mismatch in weight is acceptable. Programs often select a range of acceptable size match for donor and recipient. Studies have shown that kg for kg body weight., a female heat has 10% less muscle mass than a male heart. Most programs would require a larger donor and preferably male donor for a redo sternotomy recipient, the presence of pulmonary hypertension or LVAD and/or TAH explant recipient.
Gender	Males tend to be larger. When considering accepting a female donor heart for a male recipient, female size should be 10% larger in height and weight.

Abbreviations: LVAD, left ventricular assist device; TAH, total artificial heart.

Table 3 Acceptable Lung Donor Criteria

Characteristics	Description
Donor PAO_2/FIO_2 ratio	Ratio > 400 (FIO_2 = 1.0, PEEP = 5—8 cm H_2O)
Donor age	Less than 55 years
Smoking history	<20 pack-year
Chest radiograph	Normal chest radiograph without infiltrate
Bronchoscopy	Normal bronchoscopy without significant secretions
Sputum	Absence of organisms on sputum gram stain

Abbreviation: PEEP, positive end-expiratory pressure.


HUMAN
ORGAN
FOR TRANSPLANT

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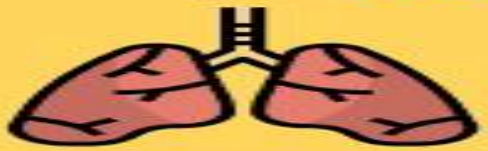
ORGAN TIMEFRAMES

Each organ has a different timeframe between recovery and recipient transplant.

HEART

4–6 HOURS

LUNGS



4–6 HOURS

LIVER

8–12 HOURS

KIDNEY

24–36 HOURS

ADDITIONAL TIMEFRAMES:

CORNEA - 48 HOURS
INTESTINES - 8-16 HOURS
PANCREAS - 12-18 HOURS
TISSUE - STORED UNTIL NEEDED

Recipient

- Age / sex : 37 years / female
- Diagnosis : Lymphangioleiomyomatosis (LAM), severe PAH(Systolic PAP - 80 mmhg)
- Blood group : A positive

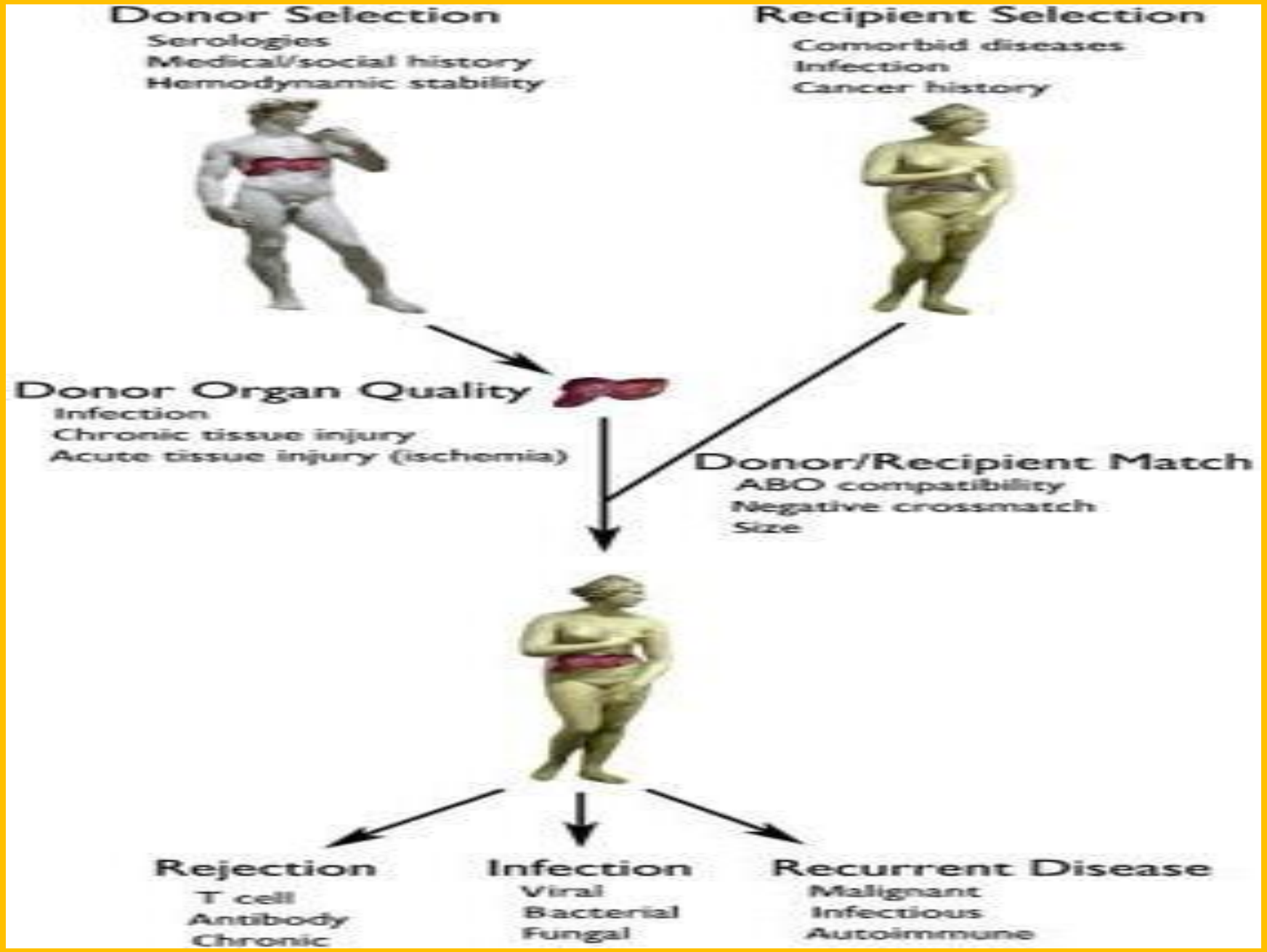
HISTORY

- 37 years, female with LAM, severe PAH on medical therapy and continuous oxygen support. Pre heart and lung transplant evaluation was performed for her and reports were discussed in multi-disciplinary team meeting and recommended for combined heart and bilateral lung transplantation.

- **PAST MEDICAL HISTORY:** Not significant
- **FAMILY HISTORY:** NIL
- **EXPOSURE HISTORY:** NIL
- **SUBSTANCE ABUSE HISTORY:** NIL
- **INTOLERANCE:** NIL
- **OCCUPATIONAL HISTORY**: Employee in Bank.

Evaluation of potential recepient

- Evaluatiion by multidisciplinary team
- Assessment of comorbidities (DM, CAD, Renal or Hepatic dysfunction, uncontrolled Systemic HTN)
- Exclude systemic sepsis and malignancy.
- Whether psychologically appropriate for transplant and post transplant care
- Any pre-transplant surgery required
- Evaluation of organ specific criteria for transplantation
- Optimise recepient condition prior to transplantation


Donor Selection
Serologies
Medical/social history
Hemodynamic stability
Recipient Selection
Comorbid diseases
Infection
Cancer history
Donor Organ Quality
Infection
Chronic tissue injury
Acute tissue injury (ischemia)
Donor/Recipient Match
ABO compatibility
Negative crossmatch
Size
Rejection
T cell
Antibody
Chronic
Infection
Viral
Bacterial
Fungal
Recurrent Disease
Malignant
Infectious
Autoimmune

HLT done on 20 August 2022

POST-OP CHALLENGES

1) Hemodynamic instability

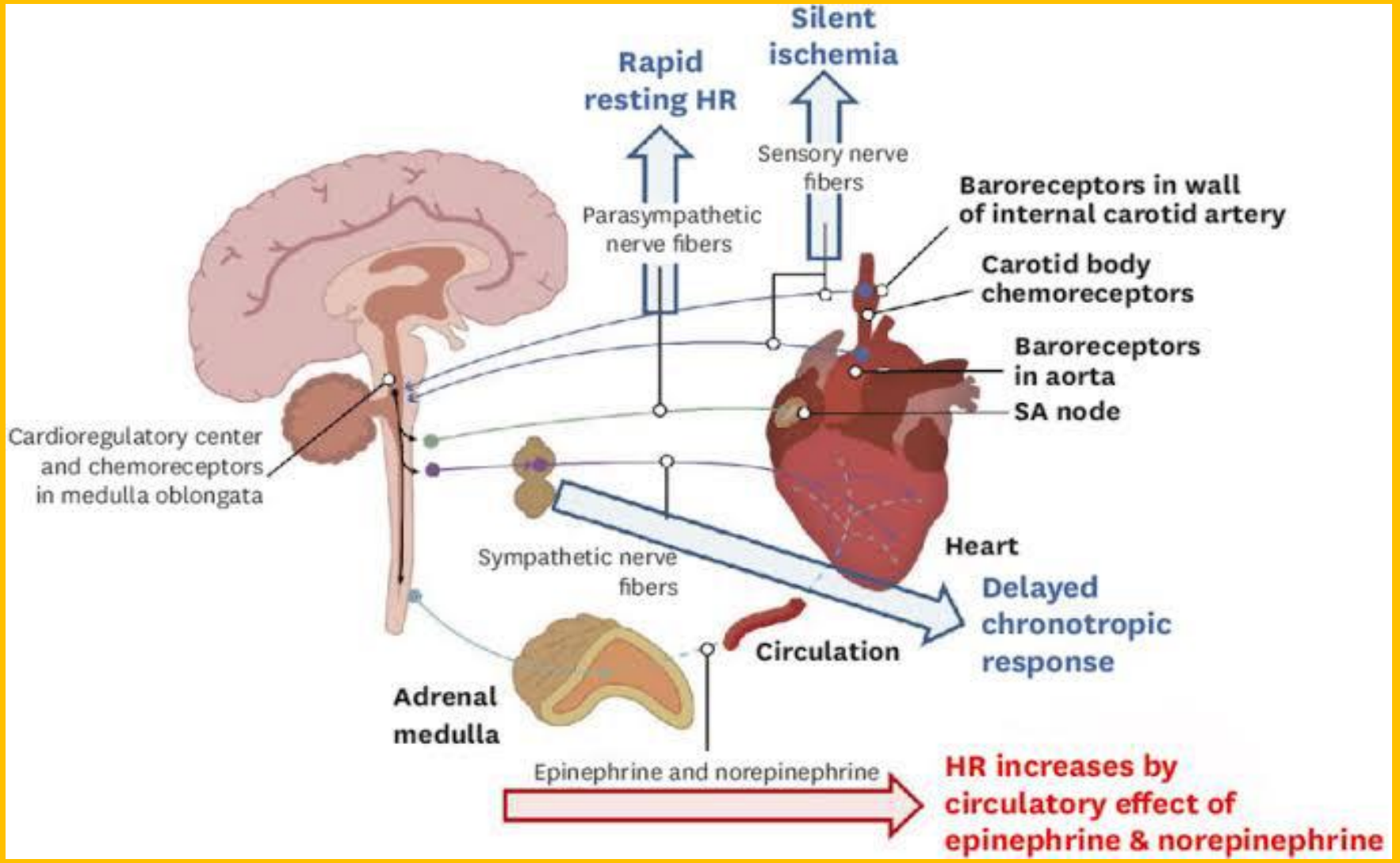
2) Biventricular dysfunction

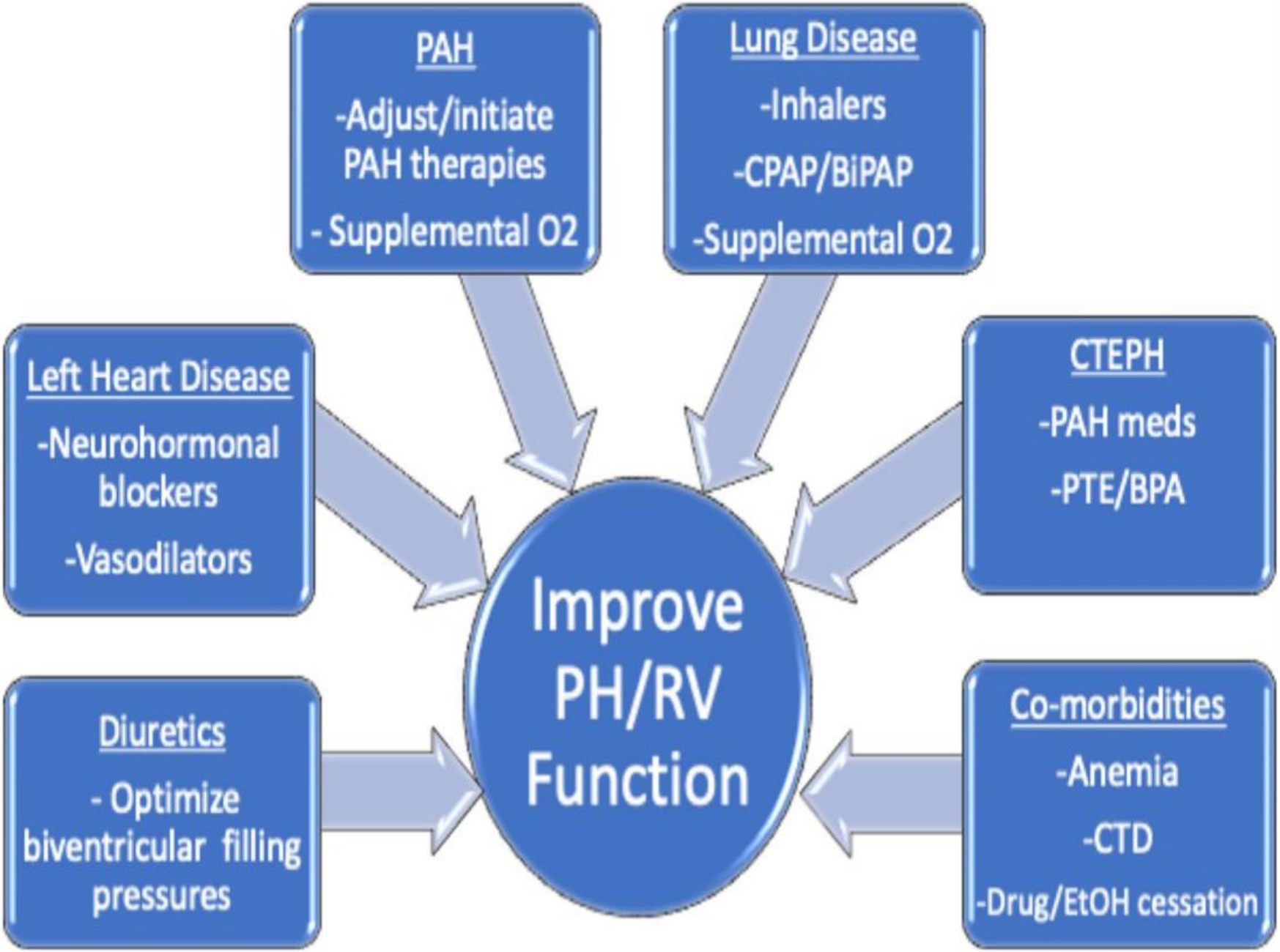
3) Infection

4) Optimization of immunosuppression

5) Overall wellbeing

Denervated Heart

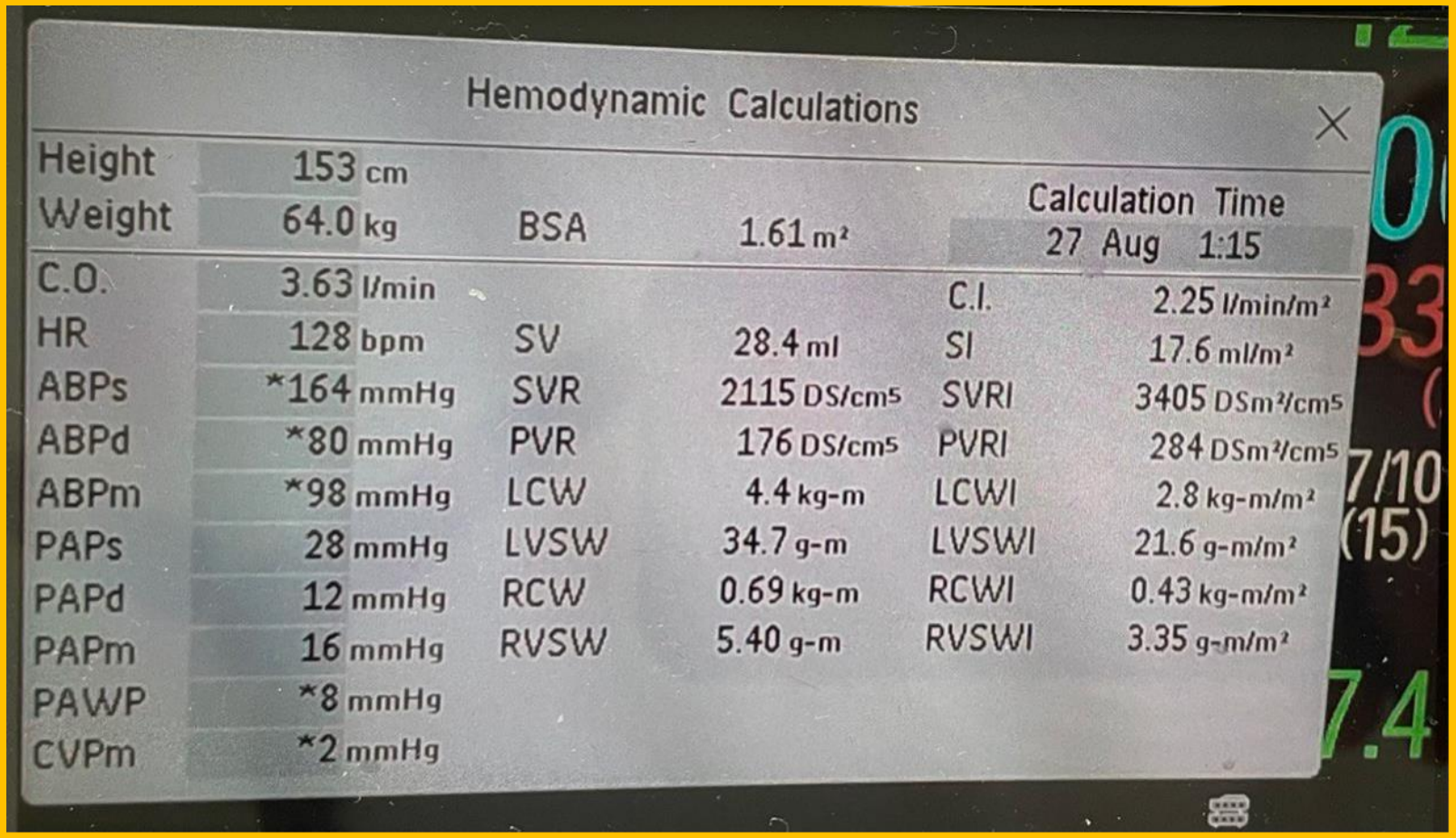



PAH
-Adjust/initiate PAH therapies
- Supplemental O2
Lung Disease
-Inhalers
-CPAP/BiPAP
-Supplemental O2
Left Heart Disease
-Neurohormonal blockers
-Vasodilators
CTEPH
-PAH meds
-PTE/BPA
Improve PH/RV Function
Diuretics
- Optimize biventricular filling pressures
Co-morbidities
-Anemia
-CTD
-Drug/EtOH cessation

- Advanced hemodynamic monitoring – Echo, PA catheter

- Optimize IV volume & pre-load:
  >Hypervolemia: fluid restriction, judicious diuresis
  >Hypovolemia: gentle IVF bolus
  >Adequate urine output

PA catheter derived variables



Hemodynamic Calculations

Height	153 cm			Calculation Time	
Weight	64.0 kg	BSA	1.61 m²	27 Aug 1:15	
C.O.	3.63 l/min			C.I.	2.25 l/min/m²
HR	128 bpm	SV	28.4 ml	SI	17.6 ml/m²
ABPs	*164 mmHg	SVR	2115 DS/cm⁵	SVRI	3405 DSm²/cm⁵
ABPd	*80 mmHg	PVR	176 DS/cm⁵	PVRI	284 DSm²/cm⁵
ABPm	*98 mmHg	LCW	4.4 kg-m	LCWI	2.8 kg-m/m²
PAPs	28 mmHg	LVSW	34.7 g-m	LVSWI	21.6 g-m/m²
PAPd	12 mmHg	RCW	0.69 kg-m	RCWI	0.43 kg-m/m²
PAPm	16 mmHg	RVSW	5.40 g-m	RVSWI	3.35 g-m/m²
PAWP	*8 mmHg				
CVPm	*2 mmHg				

Table 4 Optimal Perioperative Hemodynamic Goals

- MAP > 60-65 mm Hg
- SBP > 90 mm Hg
- SpO2 > 92%
- RAP 5-10 mm Hg
- Mean PAP < 35 mm Hg[a]
- PVR/SVR ratio < 0.5[a]
- PCWP < 18 (for WHO Group 2 PH)
- CI ≥ 2.2 liter/min/m2[b]

CI, cardiac index; MAP, mean arterial pressure; MPAP, mean pulmonary arterial pressure; PCWP, pulmonary capillary wedge pressure; PVR, pulmonary vascular resistance; SBP, systolic blood pressure; SpO2, systemic pulse arterial oxygen saturation; RAP, right atrial pressure; SVR, systemic vascular resistance.

- Hemodynamic instability: Tackled with multiple inotropes & vasopressors (noradrenaline, adrenaline, vasopressin)

- IABP was inserted on POD-2

- Patient's LVSF gradually improved and IABP was removed on POD-6

- Gradually inotropes were weaned & stopped (arterial line removed) on POD-9.

INFECTIONS

- INFECTIONS: occur on a time scale
- Risk : Lung > LIVER > HEART > KIDNEY
- IMMUNOSUPPRESSION : increases risk
- DONOR: source of infection

TIMELINE OF INFECTIONS

< 1 MONTH	1-6 MONTHS	> 6-12 MONTHS
• PRE- EXISTING INFECTIONS • NOSOCOMIAL • DONOR • BACTERIAL INFECTIONS – MORE C0MMON	• MAXIMAL IMMUNOSUPPRESSION • OPPORTUNISTIC INFECTIONS	• COMMUNITY-ACQUIRED INFECTIONS

- Early infectious workup – important
- Blood, BAL, Urine – C/S
- Broad spectrum Antibiotics initially
- Tapered based on C/S reports

- Anti-viral prophylaxis (CMV) : IV Ganciclovir- f/b- oral valganciclovir

- Anti-fungal prophylaxis (Candida, Aspergillus)

- sepsis, septic shock - from POD - 1
- High grade fever, tachycardia, hypotension
- Rising procalcitonin levels, TLC
- Tackled with adequate antimicrobial coverage
- Donor’s BAL C/S & Recipient's BAL C/S isolated candida species – Dual Antifungal therapy

- ceftazidime+ avibactam, aztreonam, polymixin b, meropenem, teicoplanin
- trimethoprim + sulphamethoxazole
- vangyancyclovir
- micafungin, voriconazole

Bronchoscopy

- To ensure recipient's airways & lungs remain clear & infection-free
- Challenging: critical post-transplant period
- Carried out 7 bronchoscopies: vigilant monitoring & timely interventions

Optimization of Immunosuppression

- Triple immunotherapy:

- Steroids
- Tacrolimus (calcineurin inhibitor)
- Mycophenolate mofetil (anti-metabolite)

- Tac levels were done on alternate days, and maintained within therapeutic range.

Psychological support

- Joyful environment, positive talks, videos, calling family members
- Had to deal with anxiety issues especially in the near discharge period - change of enviroment
- Reassurance, guidance, round the clock help, whatsapp group

TEAM WORK

- **CARDIOVASCULAR THORACIC SURGERY**
- **RESPIRATORY MEDICINE**
- **ANAESTHESIA**
- **CARDIOLOGY**
- **MICROBIOLOGY**

- NURSING STAFF
- PHYSIOTHERAPY
- RESPIRATORY THERAPY
- DIETICIAN
- ICU ATTENTANDS

CRITICAL CARE TEAM - Dual Role

- 1) Ensured that the brain-dead donor's organs were kept in pristine condition before transplant
- 2) Keeping HLT recepient physically and psychologically stable , till her discharge.

- HUGE THANKS > HOSPITAL MANAGEMENT
- FOR UNCONDITIONAL SUPPORT & PROVIDING ALL FACILITIES
- BEST PERI-OPERATIVE CARE

REBIRTH

- THANK YOU !