REBIRTH

DEPARTMENT OF CRITICAL CARE MEDICINE,
DR D.Y. PATIL MEDICAL COLLEGE,PIMPRI

CASE DETAILS

- 14 year old boy, no comorbidities, native place being Bihar
- History of Road traffic accident on 22nd June due to high speed bike skid, no helmet
- H/o loss of consciousness, bleeding from left ear and 4 to 5 episodes of vomiting
- Went to ABMH, got intubated in view of GCS of 5/15, received primary care and shifted to DYPMCH

Clinical examination details on arrival

- GCS : E1 M2 Vt
- Pupils : Right & Left both 4mm and NRTL
- Heart rate : 121/minute, BP :130/90mmHg
- SpO2 :100%, urine output : adequate
- ventilator settings: VC mode,FiO2 .4,PEEP 5
- Blood sugar level :138 mg/dL
- Temperature :98F
- CNS examination : (no sedation given)
  - -No spontaneous breathing
  - -Absent corneal,gag,cough reflexes,
  - - Doll's eye movements absent

Clinical examination contd..

- RS : B/L 4th and 5th Rib fractures,
  AEBE, clear
- P/A: Soft,non tender
- CVS :S1S2 Normal,no murmurs
- L/E : CLW over right parietal area,sutured,
  Left periorbital edema,
  B/L forearm abrasions,
  Left scapular ecchymosis
  Abrasions over right wrist 1 *1 cm,
  Abrasions over B/L medial malleoli

INVESTIGATIONS

- HEMOGRAM : Hb 11, WBC : 11,000, PLT 3lakh
- Sodium : 138, Potassium : 4
- Urea: 36, Creatinine :0.9
- Random BSL : 138 mg/dL,
- COVID rapid antigen : negative
- ABG : P:F = 452, pCO2 :34,Lactates 1.8,no acidosis
- HRCT thorax : GGOs in Rt upper lobe, CORADS 3,Consolidation ,? Aspiration changes in Right upper lobe
- USG FAST : no evidence of any trauma
- CT Brain and cervical spine : SDH, multiple contusions, mass edema with midline shift, no spine injury
- Xray of bilateral arms,forearms,PBH,legs: WNL

ICU management

- Absent Brain stem reflexes
- Patient was on mechanical ventilation,
- FiO2 :40%, SPo2 :99%,EtCo2 monitor attached
- 30 degree head high position
- USG guided Central line ,arterial line placed
- Hemodynamic parameters maintained
- Started on isotonic crystalloids, Inj Ceftriaxone , Levitracetam, mannitol, RT feeds
- TEAM APPROACH
- Family counselling done
- Observed closely for 6 hours and 1st apnea done-positive
- Informed to MSW and Administration

ICU management

- Inj Methylpred 1gm, Tab Thyroxine 300mcg given
- Mechanical ventilation continued
- Hemodynamics maintained
- BSL maintained between 140 to 180 mg/dL
- 2nd apnea done : positive
- Parents in acute grief, counseling done

CHALLENGES in this case

- Maintenance of brain dead organ donor for 7 days
- Maintaining hemodynamics for 7 days
- Maintaining metabolic parameters, electrolytes
- Ruling out COVID 19 infection
- Prevention of hospital acquired infections
- Counselling and consent for organ donation
- Coordination with ZTCC

REBIRTH NEWS

Organs donated by family of 14-year-old gifts life to six.

PUNE NEWS

Family of 14-yr-old brain-dead boy donates organs, Pune's first heart transplant this year

Pune: The city saw its first heart transplant of 2021 after the family of a 14-year-old boy decided to donate his multiple organs late on Wednesday night and saved lives of six persons

By Namrata Devikar

PUBLISHED ON JUL 01, 2021 08:54 PM IST

Hindustan Times

HT Image

Pune: The city saw its first heart transplant of 2021 after the family of a 14-year-old boy decided to donate his multiple organs late on Wednesday night and saved lives of six persons. It was the fifth organ transplant since June 1 this year in Pune city.

LEARNING POINTS

- ❖ DIAGNOSIS OF BRAIN DEATH
- ❖ MAINTAINANCE OF THE ORGAN DONOR
  - Hemodynamics
  - Endocrine system
  - Mechanical ventilation
- ❖ Medicolegal aspects
- ❖ Counseling

What is death?

- Various Descriptions :
  - "the heart is the principle of life…from which heat and life are dispersed to all parts…"
  - Death when the heart and circulation stopped

    Harvey, William. Exercitatio anatomica de motu cordis et sanguinis in animalibus. Francof.,1628

    Apnoea, unresponsiveness, immobility
  - Followed by decay
  - When 'life' or 'the spirit' departed from the body
- Immense cultural, religious, mystical significance

Brain death?

- The Death of the brain (persistent and irreversible), while the circulation persists.
- In 1959, Mollaret and Goulon coined the term on brain death “le coma dèèpasse.”
- In 1968, an ad hoc committee at Harvard Medical School reexamined the definition of brain death
- India : Transplantation of Human Organ Act (THOA-1994) legislation)

रजिस्ट्री सं० डी० एल०—(एन)04/0007/2003—11 REGISTERED NO. DL—(N)04/0007/2003—11

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY
भाग II — खण्ड 1
PART II — Section 1

Transplantation of Human Organs Act, (THOA) 1994, 2011, 2014

MINISTRY OF HEALTH AND FAMILY WELFARE
NOTIFICATION

New Delhi, the 27th March, 2014.

G.S.R. 218 (E).— In exercise of the powers conferred by section 24 of the Transplantation of Human Organs Act, 1994 (42 of 1994) and in supersession of the Transplantation of Human Organs Rules, 1995, except as respects things done or omitted to be done before such supersession, the Central Government hereby makes the following rules, namely:-

1. **Short title and commencement** — (1) These rules may be called the Transplantation of Human Organs and Tissues Rules, 2014.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions:** - In these rules unless the context otherwise requires,—

(a) "Act" means the Transplantation of Human Organs Act, 1994;

(b) "cadaver(s)", "organ(s)" and "tissue(s)" means human cadaver(s), human organ(s) and human tissue(s), respectively;

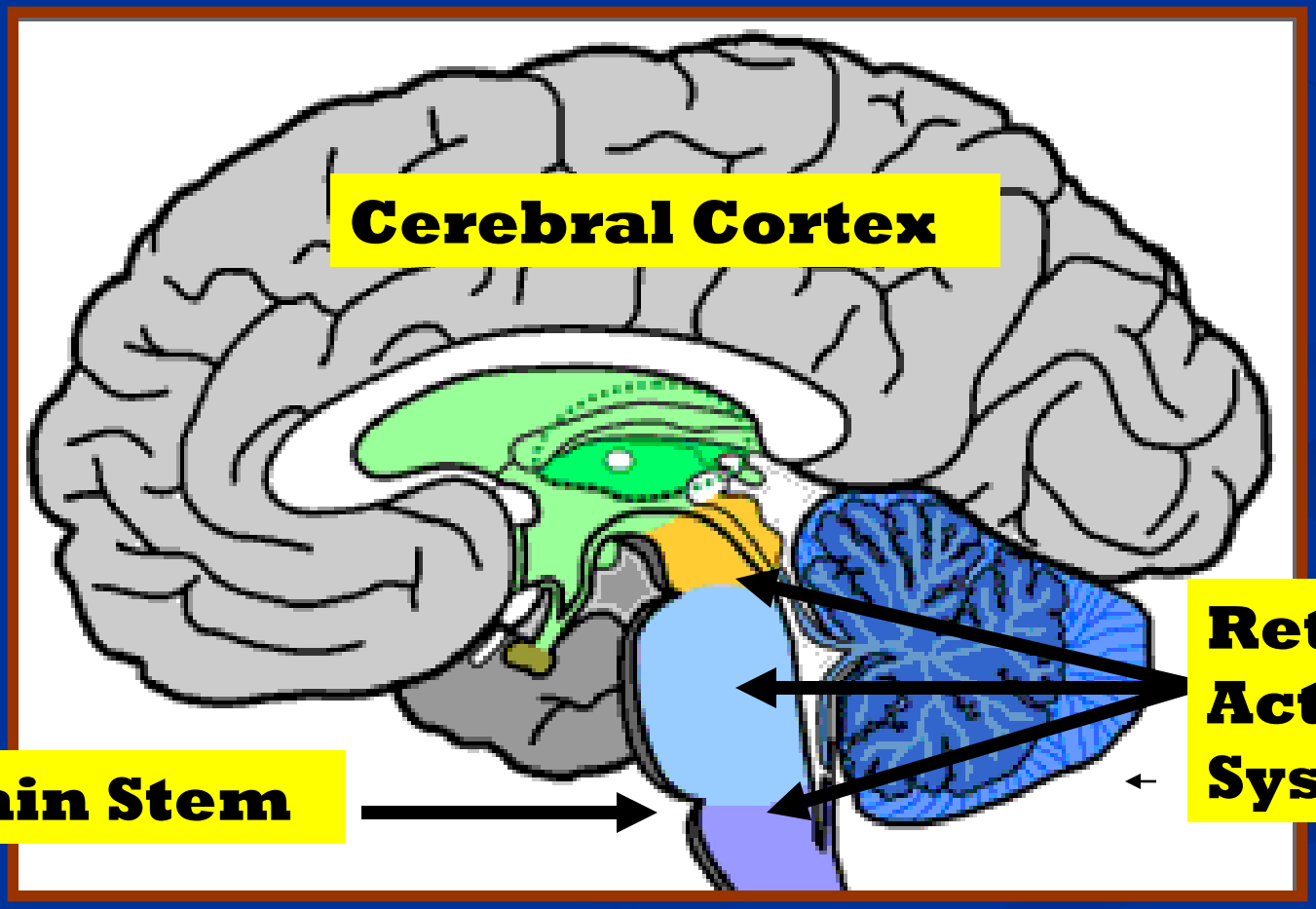
An Act to amend the Transplantation of Human Organs Act, 1994.

Definition of Deceased Person

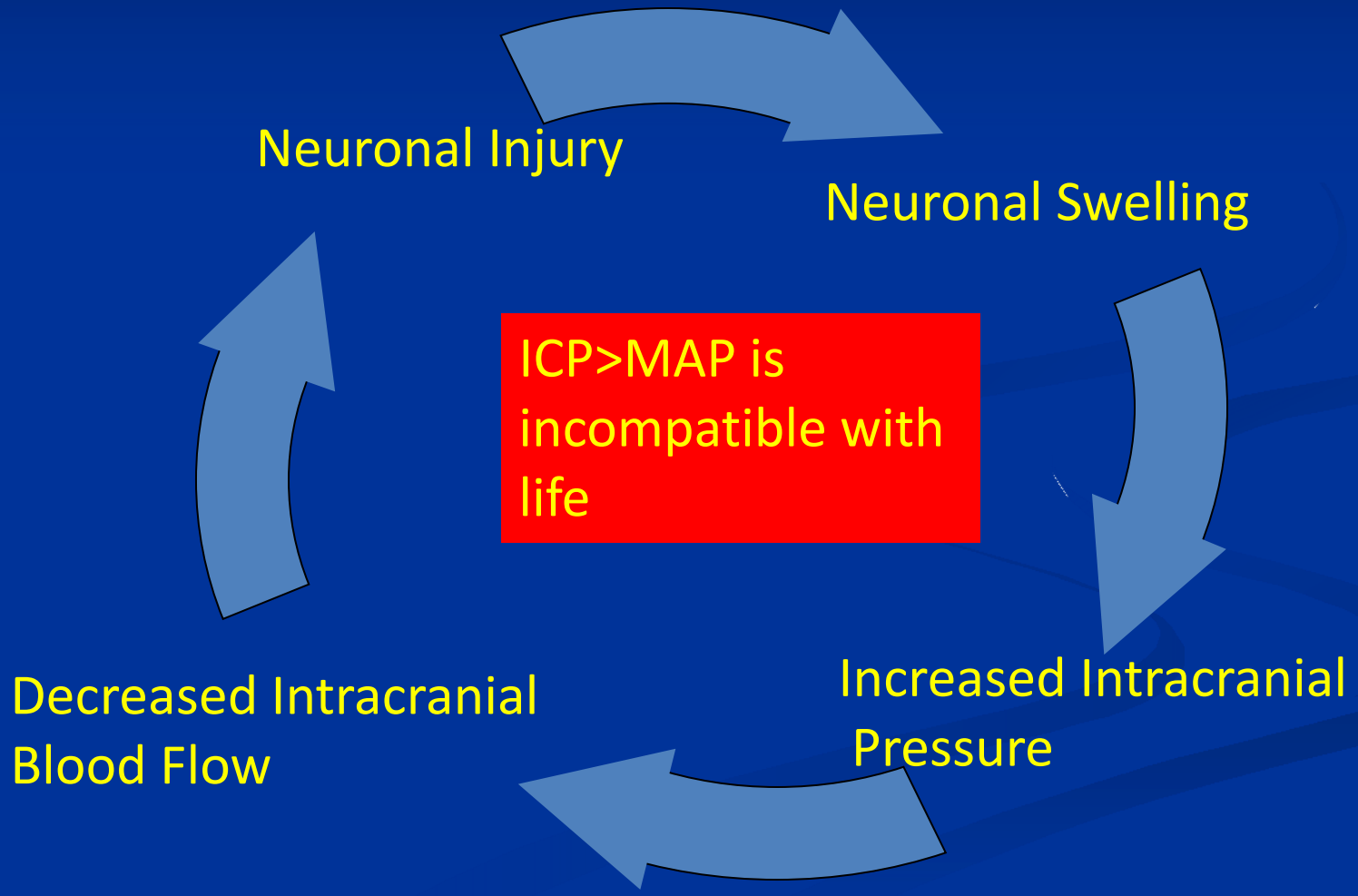
The Transplantation of Human Organs Act, 1994 (Central Act 42 of 1994)- 'Deceased person' means a person in whom permanent disappearance of all evidence of life occurs,

1. By reason of brain-stem death or
2. In a cardio-pulmonary sense at any time after live birth has taken place.
3. 'Brain-stem death' means the stage at which all functions of the brain stem have permanently and irreversibly ceased.

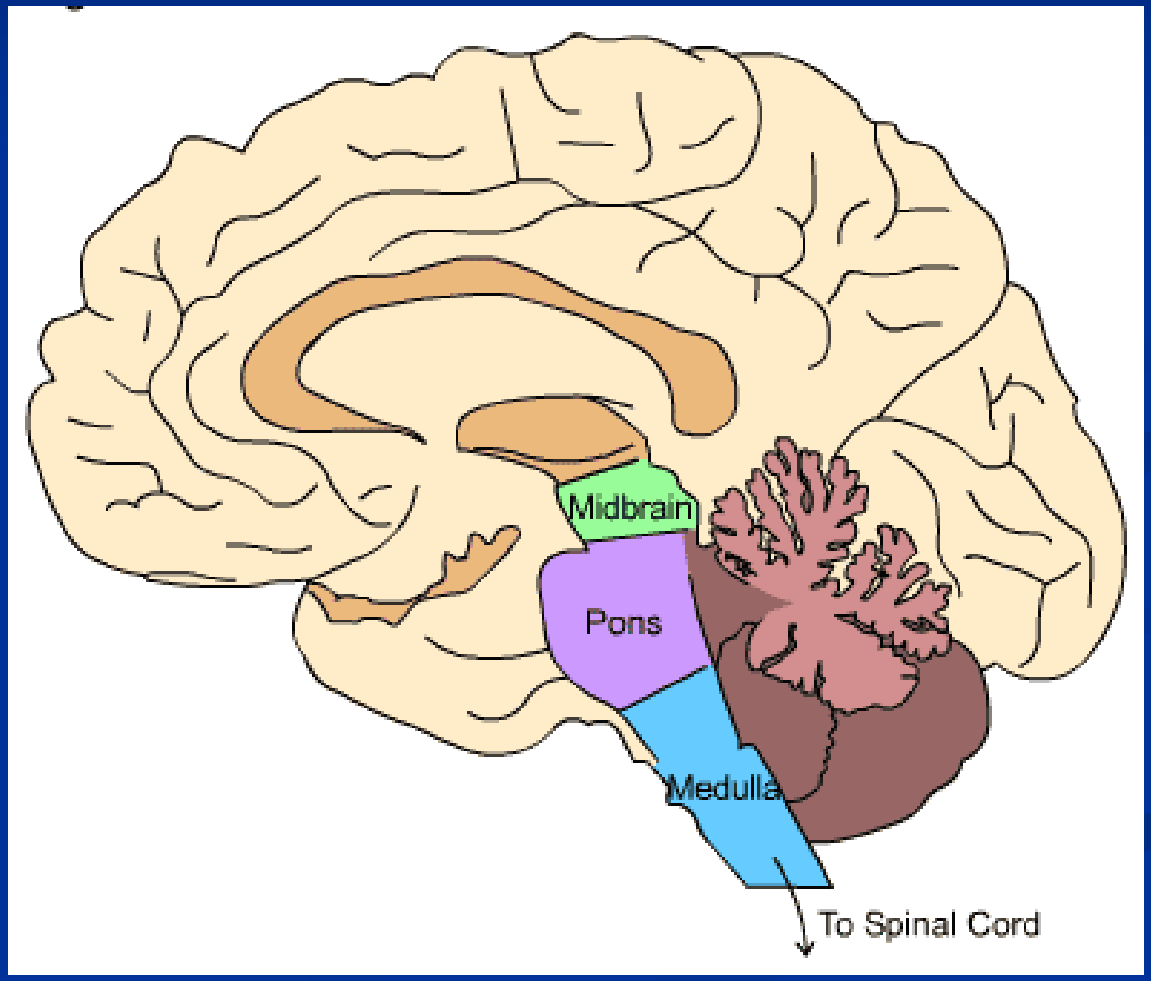
Normal Brain Anatomy



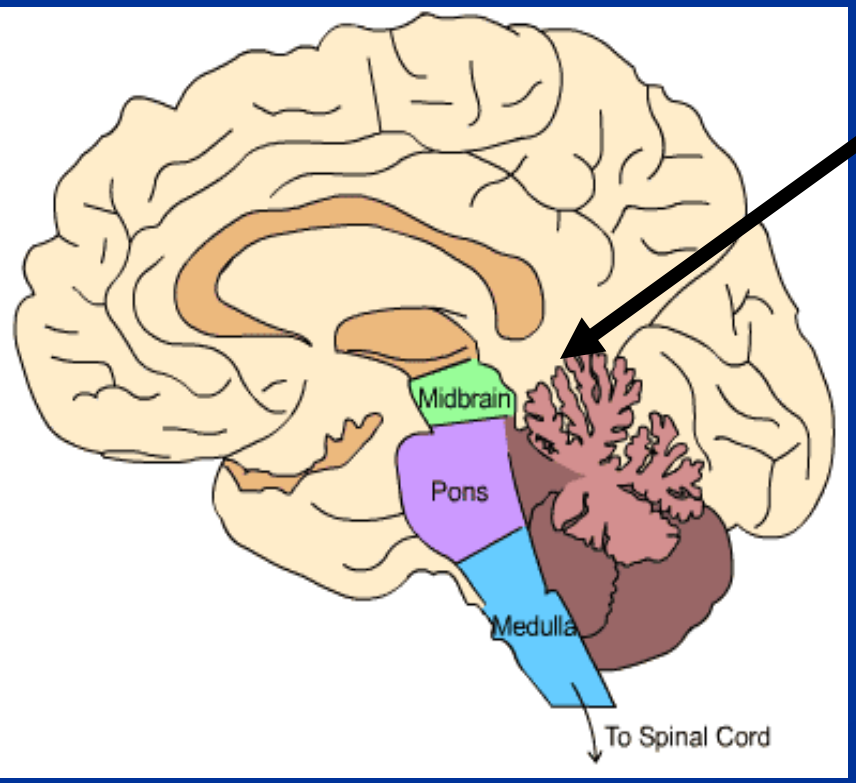
Mechanism of Brain Stem Death



Brain Stem



Brain Stem

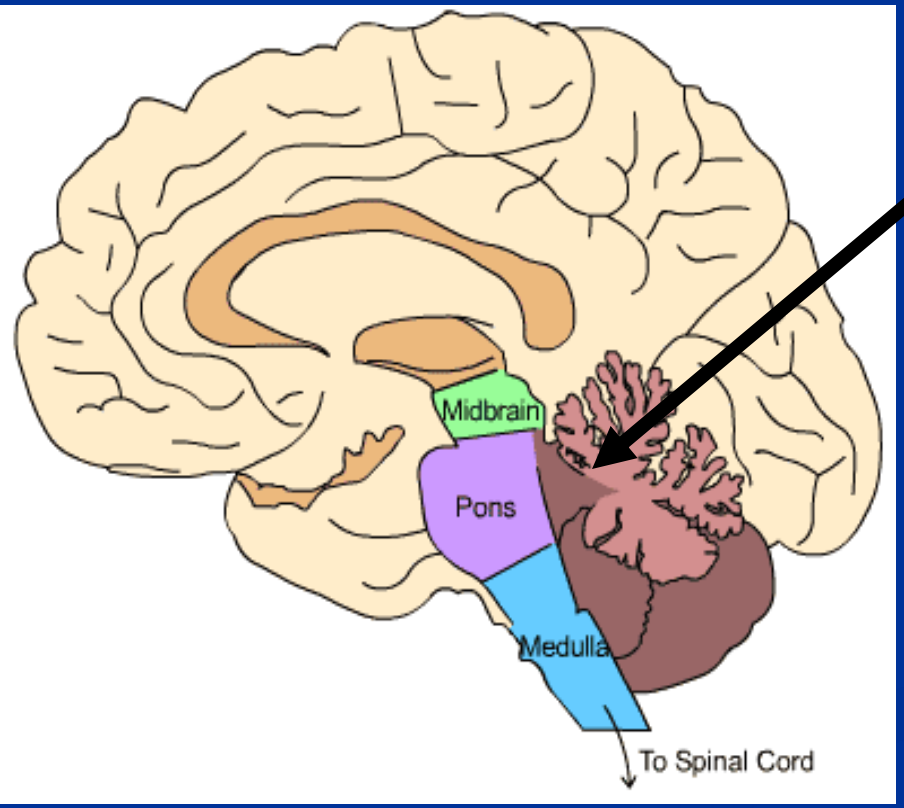


Midbrain

Cranial Nerve III

- pupillary function
- eye movement

Brain Stem

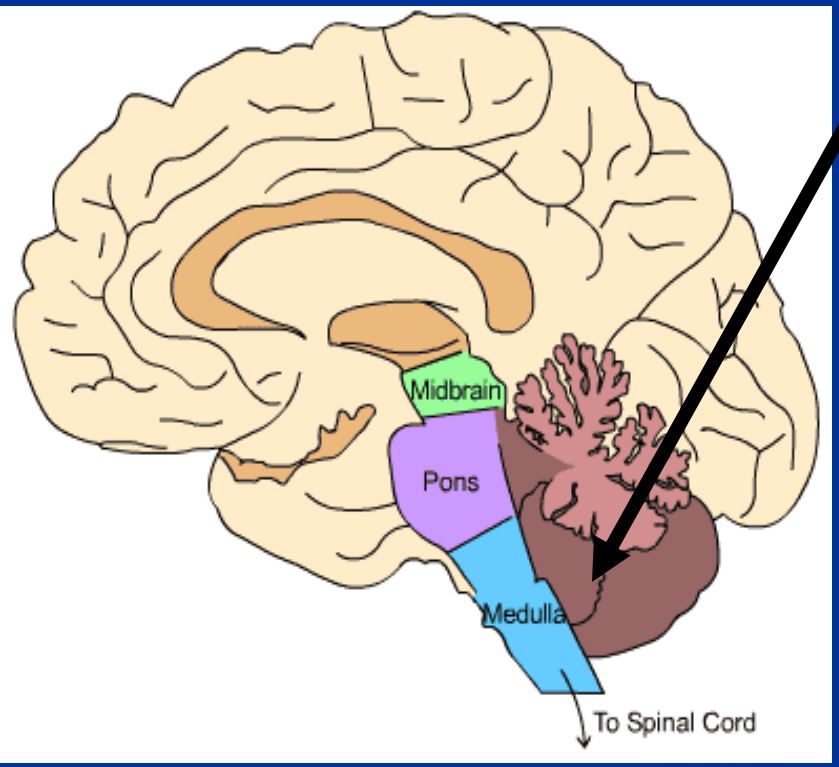


Pons

Cranial Nerves IV, V, VI

- conjugate eye movement
- corneal reflex

Brain Stem



Medulla

Cranial Nerves IX, X

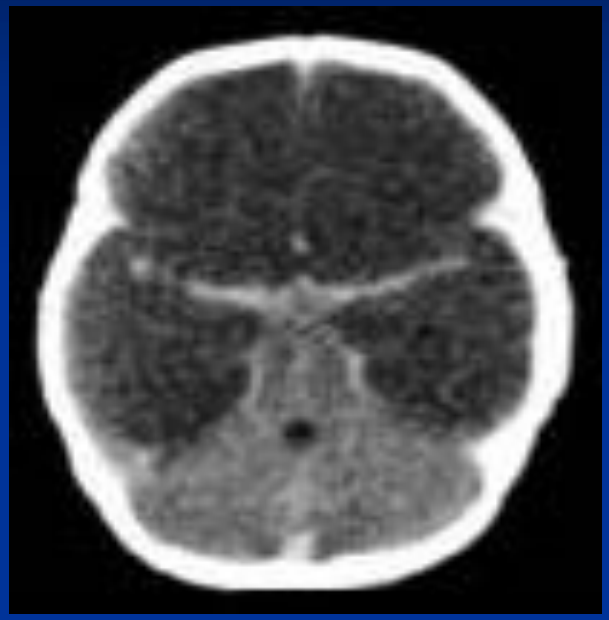
- Pharyngeal (Gag) Reflex
- Tracheal (Cough) Reflex

Respiration

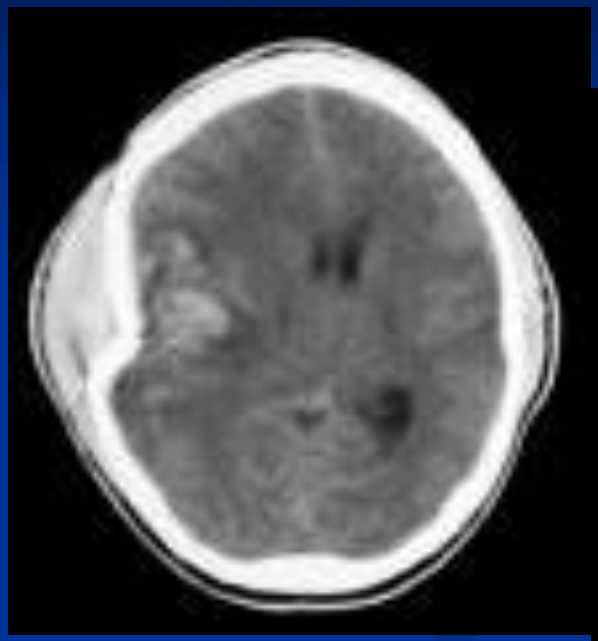
Always ask yourself- Is there a cause for the patient to be brain dead?

- potential cause for brain stem dysfunction?
- No obvious cause or if there is any doubt about the cause - be cautious in diagnosing brain death
- Make sure there are no confounders that mimic brain death

Few Possible Causes may progress to-Brain Death



Cerebral Anoxia



Trauma

Cerebral Hemorrhage

Look for confounders before proceeding for brain death verification

CONFOUNDING FACTORS:

- Severe hypothermia - core temperature of ≤32°C
- Severe hypotension (With or Without Vasopressors) - systolic blood pressure <100 mmHg
- Drugs - alcohol, poisoning, recent use of sedation or neuromuscular blocking agents
- Medical conditions - severe electrolyte abnormalities, hypoglycemia, acid–base abnormalities

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 (NOT a Part of THOA Act)

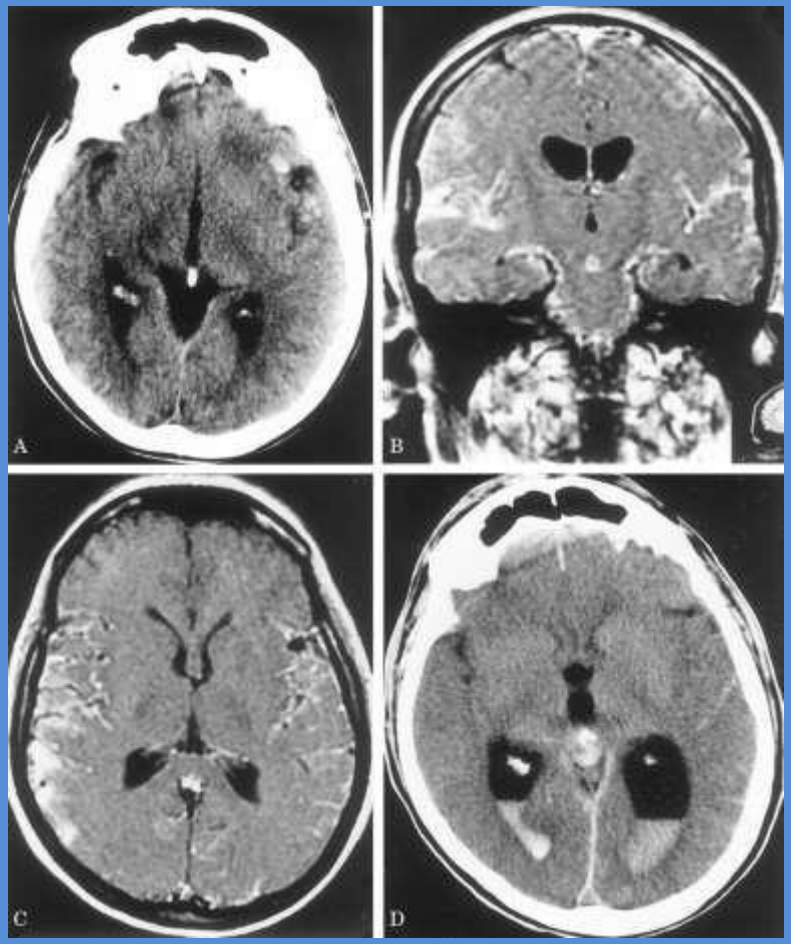
Who Does the Testing and When

- After 4- 6 hours of NO recordable brain Stem Signs by bed side Nurse and Doctors, provided pre conditions are met
- Testing is done by 2 Doctors not belonging to the retrieval and transplantation teams - at and interval of 6 hours apart. The doctors can be Neurologist, Intensivist, Neurosurgeon or an equally qualified doctor who is certified to be on the hospital brain death panel.

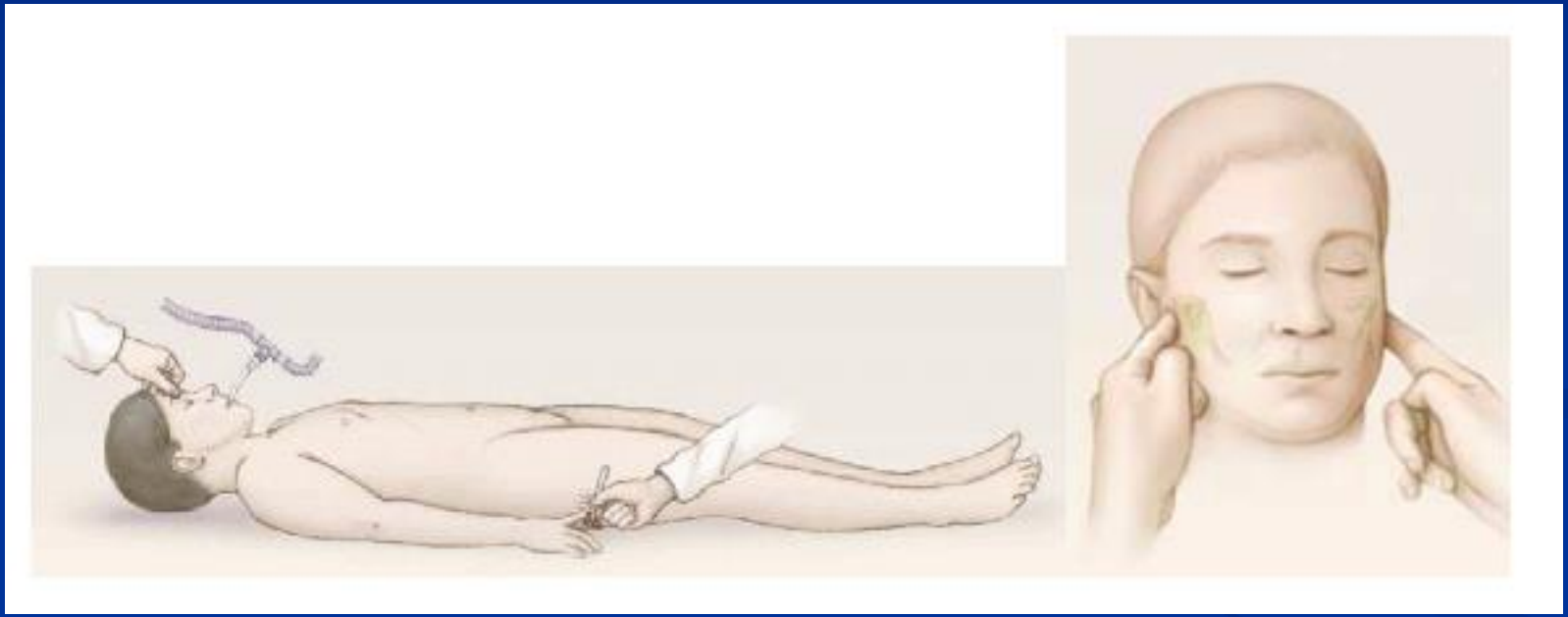
2 More persons observe the process and sign of the final document- Primary Physician and Hospital Administrator

Irreversible coma :

- *Evidence of an "acute CNS catastrophe" that is compatible with the clinical diagnosis of brain death*
- *Exclusion of complicating medical conditions that may confound the clinical assessment*
  - No severe electyrolyte, acid- base, or endocrine disturbance
  - No drug intoxication or poisoning
  - Core temperature >35 degrees celsius



Response to painful stimuli



Within cranial nerve distribution

Pupils response

- Brain dead: Mid-size (4-6mm), unreactive pupils (affecting both sympathetic and parasympathetic)
- Pre-existing pupilary abnormality Cataract ,eye surgery. limit the test

ABSENT BRAIN STEM REFLEXES

1. Corneal reflex
2. Cough reflex
3. Gag reflex
4. No ocular movement to cold caloric test

Documentation of apnea (apnea test)

Done only after

1. Documentation of coma
2. Documentation of absence of brain stem reflexes
3. Two Apnea tests six hours apart

Apnea Testing

- Prerequisites are:
  1. The core temperature needs to be > 35
  2. Systolic BP > 90 mmHg
  3. Patient should be euvolemic
  4. $PaCO_2$ ~ 40- mmHg
  5. PaO_2 ~ 200 mmHg (to guard against desaturation during apnea)

STEPS OF APNEA TEST

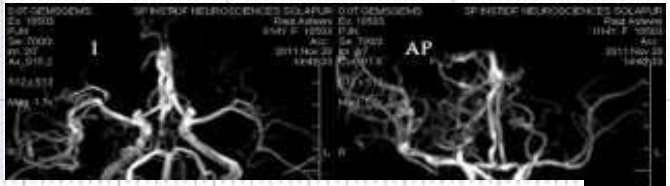
1.Pre-oxygenate patient with 100% oxygen for 15 minutes
2.Obtain an ABG
3.Disconnect patient from mechanical ventilation
4.Continue to oxygenate through a catheter placed in the trachea – Aim for saturation above 95%- use 6 -10 L/min of O_2
5.ABG is repeated within about 8–10 minutes
6.Increase in $PaCO_2$ (above 60mmHg or 20mmHg from base line) is considered as positive test
7.Stop apnea test anytime if arrythmia, hypotension, desaturation, spontaneous breathing movements are seen

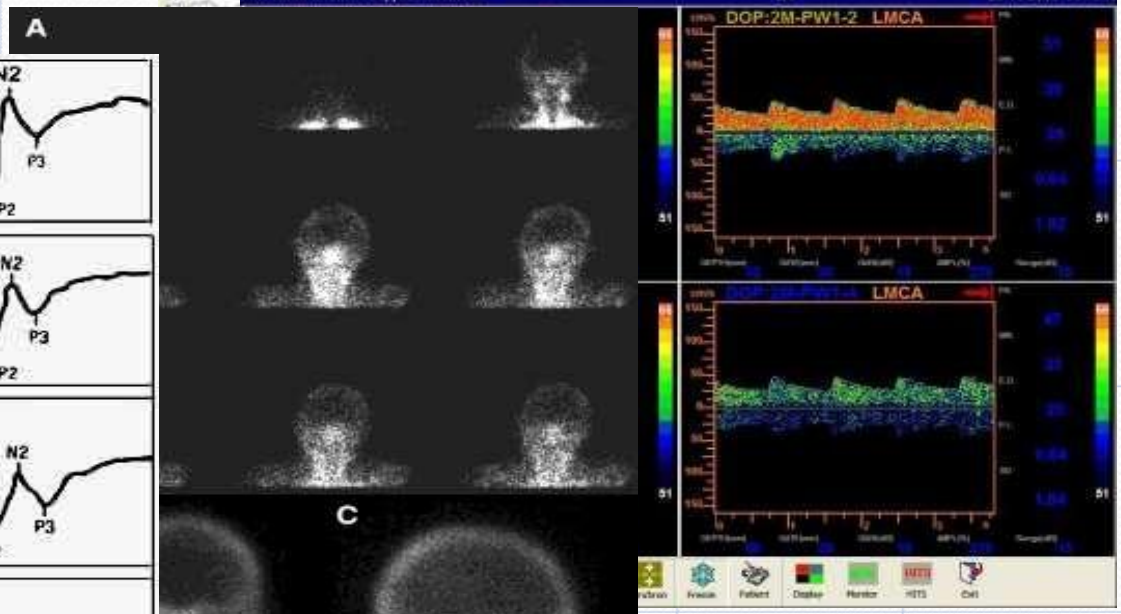
Confirmatory Tests- Not required in India and NO mention in THOA act

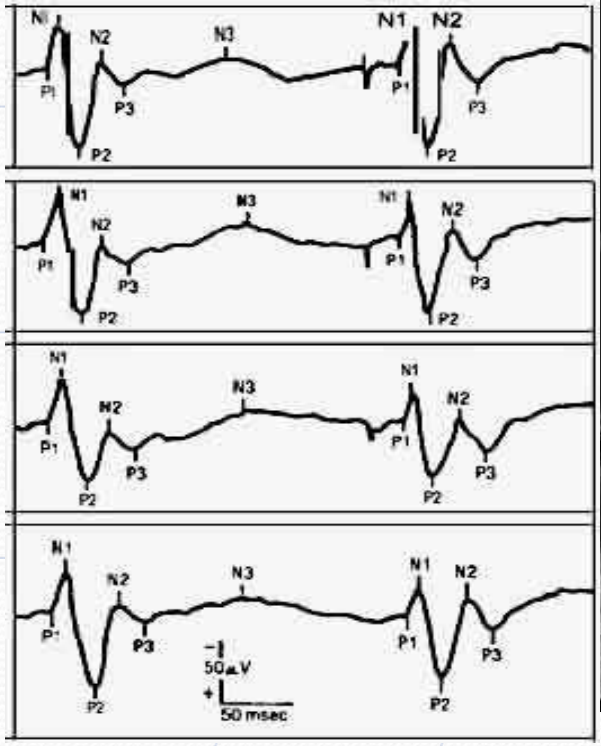
- These tests are optional in adults
- Recommended in children younger than 1 year
- Certain countries mandate these tests by law to confirm brain death
- The tests are
  - Cerebral angiography (conventional or CT)
  - Cerebral scintigraphy
  - Electroencephalography (EEG)
  - Transcranial Doppler (TCD) ultrasound

Ancillary Testing for Brain Death

- Cerebral angiography
- EEG
- TCD







Observations compatible and incompatible with brain death

Compatible:

- Spinal reflexes
- Sweating, blushing, tachycardia
- Normotension without pharmacologic support
- Absence of diabetes insipidus

Incompatible:

- Decerebrate or decorticate posturing
- Extensor or flexor motor responses to painful stimuli
- Seizures

COMMUNICATION

The ICU physician should communicate the confirmation of brain stem death to transplant coordinator who in turn can communicate to family and make request for the organ donation. Simultaneously, the administrators of the hospital and ZTCC should be communicated to stop the further billing once diagnosis of brain stem death is confirmed and family has consented for the organ donation.
Sensitive talks.

CONSENT

The deceased

The deceased wishes must be ascertained through hospital staff/relatives/donor coordinator (driving license, etc., wherein the provision for donation may be incorporated after notification of the THOA rules)

The surrogate decision-making authority includes:

1.Spouse

2.Son or daughter (18 years or over)

3.Parent.

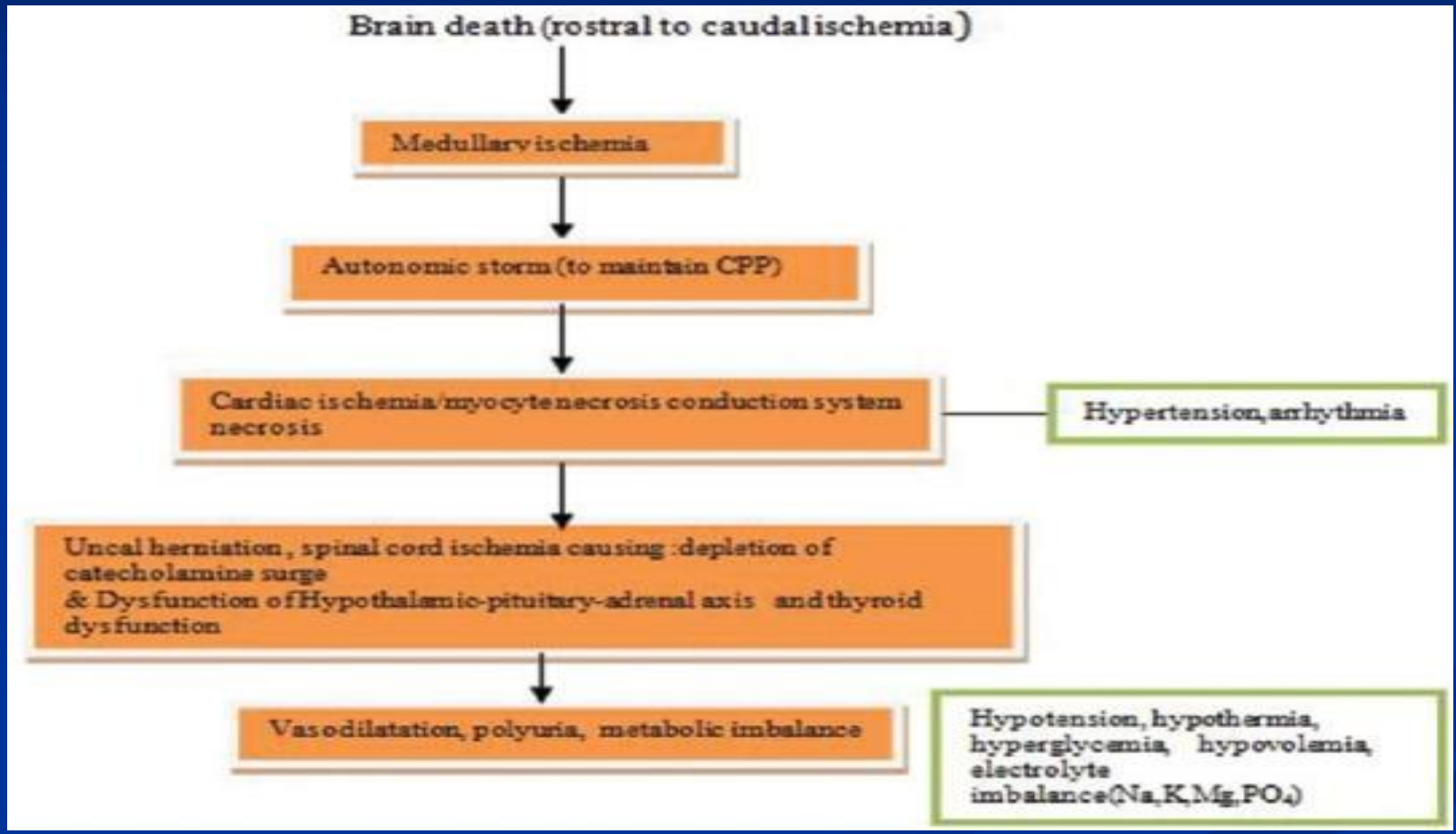
Medical Suitability for Organ Donation

Deceased donor organs	Age limit	Grading of recommendation
Kidneys	Up to 60 years old	Grade 2B
Liver	Up to 60 years old	
Kidney-pancreas	18-45 years old	
Pancreas	7 days to 50 years old	
Heart	45 years old	
Lungs	60-65 years old	

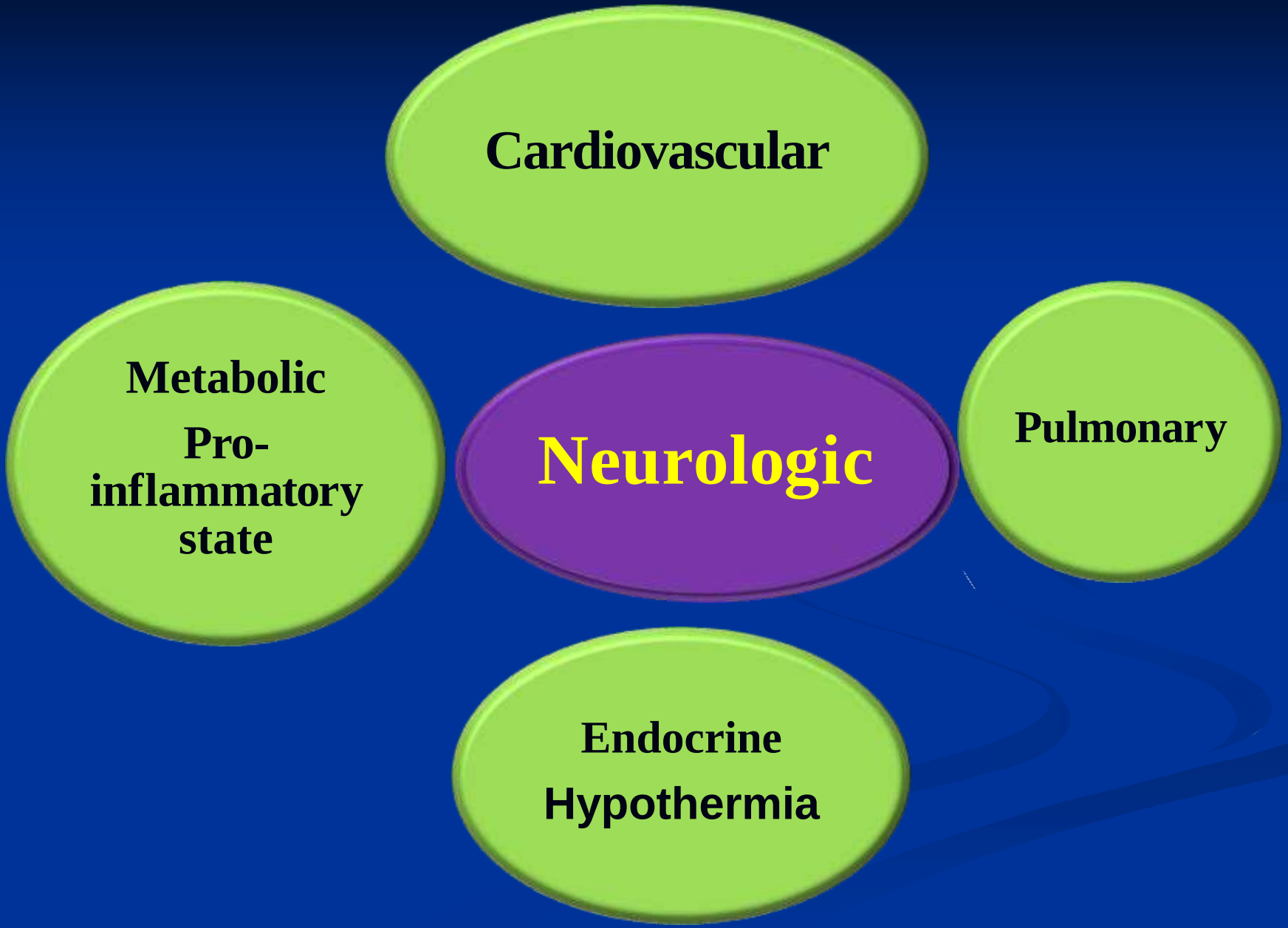
Exclusion criteria for organ donation:

1.Infection with human T-cell leukemia-lymphoma virus
2.Systemic viral infections (measles, rabies, adenovirus, parvovirus) and herpetic meningoencephalitis
3.Active malignant disease or a history of malignancy that poses a high risk for transmission irrespective of the apparent disease-free period (e.g. melanoma, choriocarcinoma).
4. Bacteremia or fungemia is not an absolute contraindication to donation.
5. Acute organ dysfunction, in particular acute renal failure, in a potential donor with prior renal function is not a contraindication to donation.

CARE OF ORGAN DONOR



Physiologic Changes with Brain Death



HEMODYNAMIC CHANGES

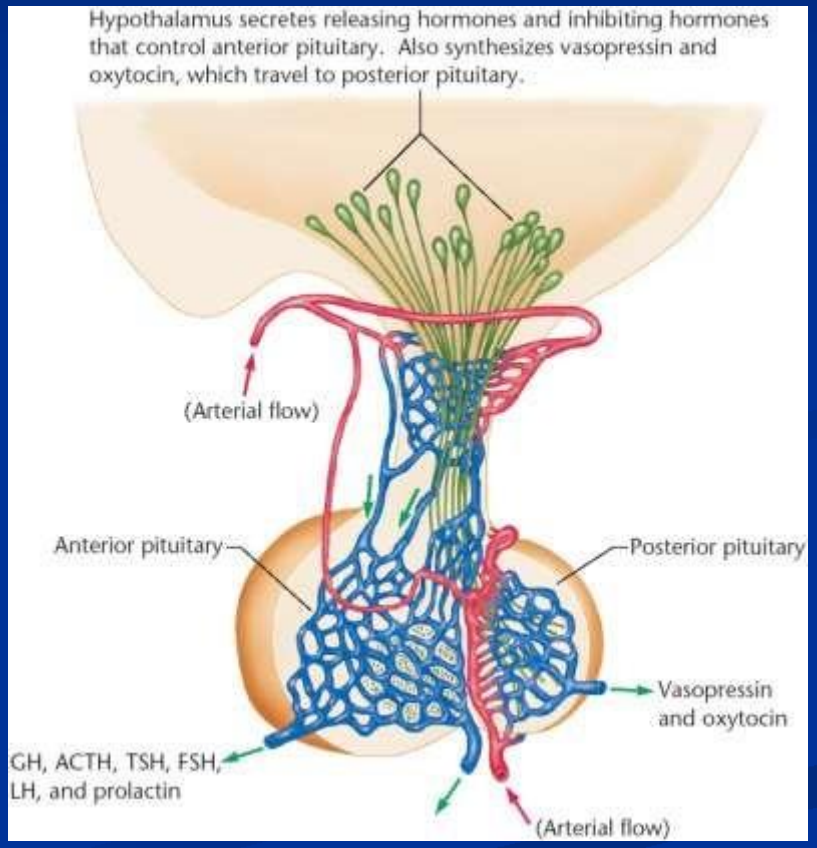
Myocardial dysfunction often occurs as a result of severe brain injury.The exacerbated stress response, i.e. “sympathetic storm,” results in hypertension, tachycardia, and arrhythmias. Though usually of short duration, it may lead to cardiac dysfunction, cardiac ischemia, myocardial and conduction system necrosis. Further, spinal cord ischemia is followed by deactivation of sympathetic storm and loss of cardiac stimulation. This leads to vasodilatation and cardiac dysfunction.

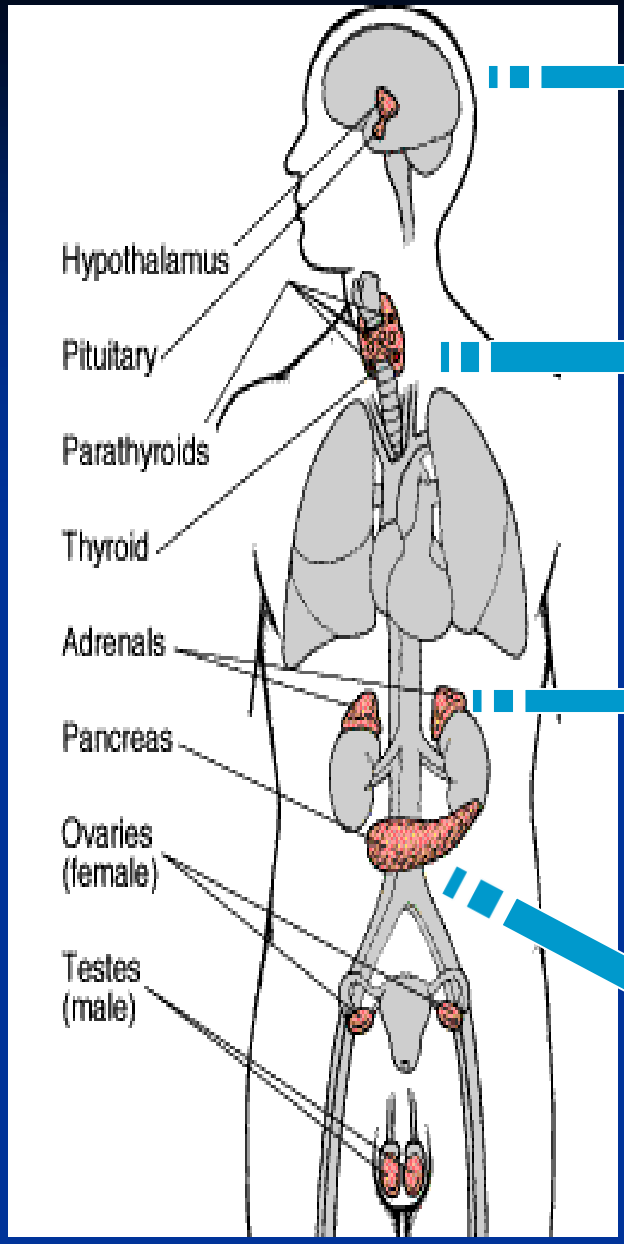
Other factors contributing to hypotension

Diuretics (mannitol)
hyperglycemia-induced osmotic diuresis,
DI, hypothermic “cold” diuresis,
inadequate fluid resuscitation and decreased oncotic pressure after crystalloid resuscitation,
ongoing blood loss,
rewarming of patient,
relative adrenal insufficiency as a result of trauma,
And
critical illness

‘Collateral damage’

- Hormonal
  - Diabetes insipidus
    - Hypovolaemia
    - Hypernatraemia
  - T3 / T4 reduces
  - ↓ACTH/ cortisol levels
  - Blood glucose
- Hypothermia





- 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

Metabolic changes with BD

- Hypernatremia
  - Caused by volume depletion, Diabetes insipidus
  - Na > 170 associated primary non-function (PNF) of graft liver
- Hyperglycemia
  - Caused by insulin resistance and gluconeogenesis
  - Glu > 200 associated with PNF of graft pancreas
  - Glu > 160 associated with PNF of graft kidney

Pulmonary Changes in BD

- Pulmonary edema
  - Neurogenic
  - Cardiogenic
  - Non-cardiogenic – capillary endothelial leak
  - Delayed alveolar fluid clearance
  - LPV should be used in all BD

Guidelines

Management of Potential Organ Donor: Indian Society of Critical Care Medicine: Position Statement

Rahul Anil Pandit, Kapil G. Zirpe[1], Sushma Kirtikumar Gurav[2], Atul P. Kulkarni[3], Sunil Karnath[4], Deepak Govil[5], Babu Abhram[6], Yatin Mehta[7], Abinav Gupta[8], Ashit Hegde[9], Vijaya Patil[10], Pradip Bhatacharya[11], Subhal Dixit[12], Srinivas Samavedan[13], Subhash Todi[14]

Management of hemodynamics

GOALS:

1. To maintain normovolemia and BP
2. Optimize cardiac output so as to maintain perfusion pressure of all organs with the use of the least amount of vasoactive support.

Hypertension & STORM:

Due to the transient nature of autonomic storm, antihypertensives are usually not required. If needed, short-acting antihypertensives such as esmolol, sodium nitroprusside, hydralazine, labetalol, or nitroglycerine should be used . Antihypertensive is not required for a long time.

Managing hypotension

1. Volume expansion
2. Vasopressors and inotropes
3. Hormonal replacement

WHICH FLUID ?

- Crystalloids with balanced salt content so as to avoid hypernatremia (concurrent DI) and hyperchloremic acidosis (when used as resuscitation target (Grade 1A).
- Administration of excessive intravenous fluids containing 5% dextrose may further complicate hyperglycemia and hypothermia
- Avoid colloids. Hydroxyethyl starches are contraindicated in organ donors because they can damage renal epithelial cells and cause early graft dysfunction in kidneys (Grade 1A)

- Albumin solutions (20%, 4%) may be considered to reduce the amount of volume given, although usually only moderately effective (Grade 2B). The high sodium content of albumin-based solutions needs to be taken into account
- The most commonly used fluids are Ringer's lactate, Plasmalyte-A, Ringer's acetate, and half normal saline (Grade 1A)
- Packed red cells should be transfused to achieve a hematocrit of 30% to maintain oxygen delivery

IONOTROPS AND VASOPRESSORS

- Vasopressin : 1.2 to 2.4 units/hour
- Noradrenaline : upto 0.05 mg/kg/min
- Dopamine : avoid

HORMONAL REPLACEMENT

1. Vasopressin 1 U bolus followed by an infusion of 0.5-4.0 U/h (desmopressin intranasal has a selective action on the V2 receptors and a half-life varying from 6 to 20 h)
2. Methylprednisolone: 15 mg/kg immediately after the diagnosis of brain death and 24th hourly thereafter.
3. Insulin infusion to maintain euglycemia

T_4 20 mcg bolus followed by infusions of 10 mcg/h. T_3 given as a 4-mcg bolus followed by an infusion of 3 mcg/h. T_4 improves hemodynamics and prevents cardiovascular collapse in hemodynamically unstable organ donors.

However, intravenous T_3 is generally not available. So, T_4 oral 300-400 mcg/8 hourly is suggested instead of T_3 (NOTTO).

Diabetes Insipidus (DI)

Acceptable urine output	30-200 ml/h
Dose	
Desmopressin	10 mcg/nasal puff; 1-2 nasal puffs every 4 h
Vasopressin	IV infusion at a dose of 0.5-2.0 U/h

IV: Intravenous

MONITORING

- Repeat bedside echocardiography (Grade 2A)
- Pulse pressure variation :dynamic fluid status (Grade 2B)
- Urine output 1-3 ml/kg/h (in the absence of polyuria due to DI or diuretics) (Grade 1A)
- Cardiac index >2.5 (note – high cardiac output state due to vasodilatory shock may be a confounder) (Grade 2B)
- Central venous oxygen saturation >70% (note – low basal metabolism due to brain death may be a confounder) (Grade 2B)
- CVP : 6 to 8 cm H20

RULE OF 100

Systolic arterial pressure >100 mmHg

Urine output >100 ml/h

PaO_2 >100 mmHg

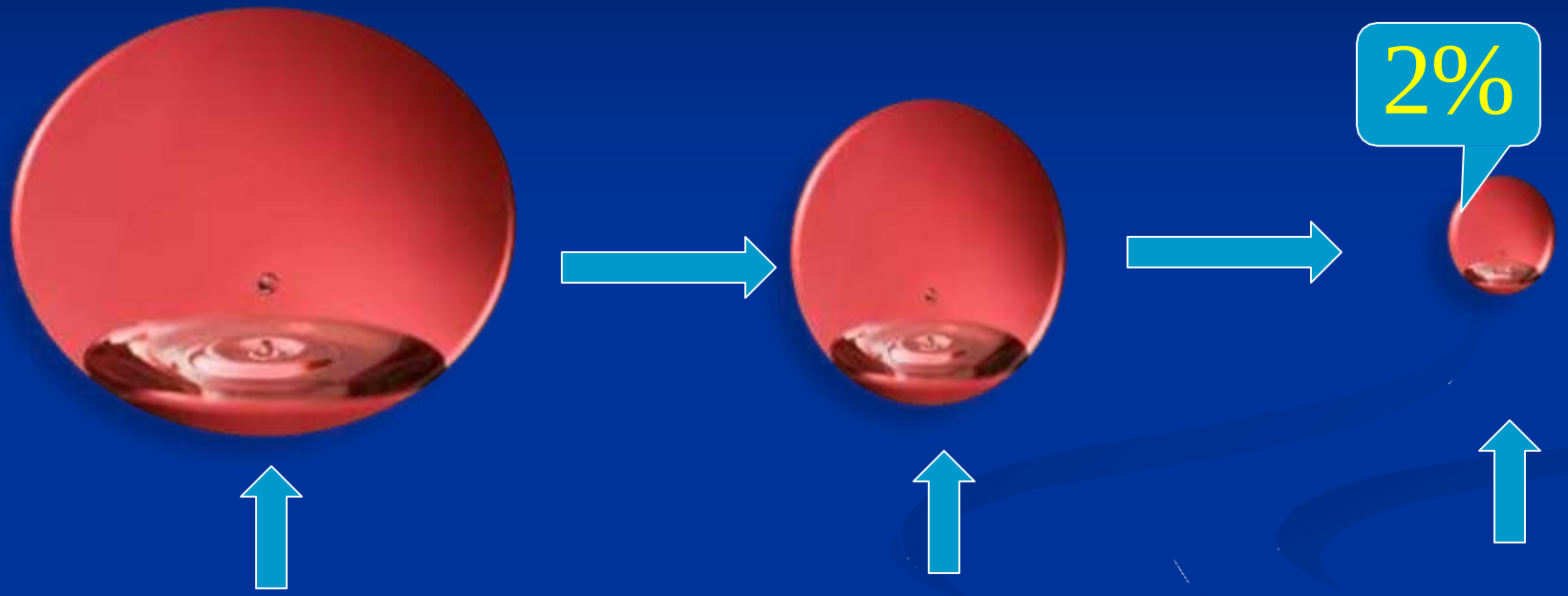
Hemoglobin concentration >100 g/L (10 g/dl)

Blood sugar 100 mg/dl

NUTRITION

Nutrition should be continued as per standard ICU protocol (Grade 1B).
Nutrition should be continued in patients awaiting consent for organ donation from the caregivers. Continuing enteral feeding in the potential donors may help in providing beneficial effects for organ functioning.

Huge Gap



In India around 2.5- 3 lakh patients die of liver failure due to cirrhosis

More than 25,000 require transplant every year

Only 500 liver transplants for Indian patients done per year

Total Statistics of Organ Transplantation@ Dr DY Patil Medical college,Pimpri

Year	Total statistics of organ transplantation & donation	
Since 2018 to till date	Total BSD declaration from 2018 to till date	35
	Total BSD converted into organ donation from 2018 to till date	27
	Total organ donation declined due to medical reason	5
	Total organ donation till date	22
	Total organs utilized from organ donation till date	72
	In-house organ utilization	40
	Organ shared with various hospitals through ZTCC, Pune	25
	Organ Received from various hospitals through ZTCC, Pune	7

TEAM WORK = DREAM WORK

Thank You

Questions