ANAESTHESIA – DAY 3

- Anaesthesia for subspeciality management
- Blood therapy
- Fluid therapy
- Intensive care management
- Cardio-pulmonary resuscitation
SPECIALITY AND SUBSPECIALITY MANAGEMENT

MANAGEMENT OF COEXISTING DISEASES

1. Cardiovascular system:
   a. Ischemic heart disease (IHD)
      i. Defer elective surgery for 6 months (6 weeks for low risk)
      ii. Premedication → must
      iii. Induction - Etomidate / Thiopentone / propofol
      iv. Maintainance - 02 + N20 + Opioids (inhalational if LVEF is normal)
          + vecuronium.
      v. Reversal - No atropine
   
   b. Mitral stenosis (MS)
      i. No tachycardia
      ii. Spinal C/I graded epidural
      iii. GA -» A.O.C (anaesth of choice) -> Etomidate -> 02 + N20 + Isoflurane + vecuronium
c. Mitral regurgitation
   i. Avoid bradycardia and HT
   ii. GA > spinal / epidural
   iii. GA —→ 02 + N20 + isoflurane + vecuronium

d. Aortic stenosis (AS)
   i. Spinal / graded epidural - C/I
   ii. A.O.C → GA → Etomidate → 02 + N20 + isofluane (or opioids)

e. HYPERTENSION
   i. Controlled - spinal / epidural / GA
   ii. Uncontrolled —→ GA
   iii. Rule.out IHD
   iv. Avoid sympathomimetic drugs
f. HYPOTENSION (SHOCK)
   i. ↑BP to > 80-90 mmHg systolic
   ii. Ketamine -> O2 + N2o + Desflurane > 6%

g. RIGHT → LEFT SHUNT (HT PREFERRED)
   Ketamine O2 + N20 + Ketamine (infusion) + Pancuronium

h. LEFT RIGHT SHUNT (HYPOTENSION PREFERRED)
   Thiopentone / profofol —> 02 + N2o + isoflurane + vecuronium
   i
HEPATIC DISEASES
- Rule out coagulopathy
- No sedatives / hypnotics
- Fluids as per CVP
- Propofol / Thiopentone → O2 + N20 + Desflurane + Atracurium

RENAAL DISEASES
- Correct electrolyte balance
- Avoid sedative hypnotics
- Fluids as per CVP
- Propofol / Thiopentone O2 + N20 + Desflurane + Atracurium (Sch C/I)

BLOOD DISORDERS
- Anemia: Acceptable Hct for elective surgery should be 8 gm%.
- Hemophilia → Regional C/I, factor VIII > 30% (For dental 100%), GA - smooth intubation
- Thrombocytopenia → Minimum platelets 50,000 for surgery
- Sickle cell - Beirs block C/I
Respiratory System

**COPD / Asthma**

→ Regional preferred
→ Spinal epidural up to T8 level

i.v. Ketamine (Asthma) → O2+ N2o (C/I PHT) + halothane + steroid type muscle relaxant

**Neuro Muscular**

1. **Myesthemia gravis** - Regional > GA
   - No premedicacion with opioids/bzp. (respiratory compromised)
   - GA: Etomidate → O2+ N20 + desflurane/Isoflurane + mivacurium (or atracurium)
   - Resistance to Sch.

2. **Muscular dyshophies**
   - Regional >GA, No premedicacion
   - GA → Etomidate O2+N20 + desflurane/Isoflurane + mivacurium (OR atracurium)
   - Sch → C/I
MALIGNANT HYPERThERMIA

- Clinical syndrome observed during QA associated with rapidly temp, as great as 1 c/5 min.

Aetiology: Ryanodine receptor (caused on chromosome 19) is the calcium release channel of sarcoplasmic reticulum.

The abnormality of this receptor leads to excessive Ca2 ion, which can caused sustained cont.of muscle

Incidence

1 in 15,000 for pediatric and 1 in 40,000 for adults patients given GA with volatile anaesthetics and succinylcholine.
• Caused by

• Relaxants
  - Succinylcholine - most commonly Implicated drug
• Volatile anaesthetics
  - Halothane
  - May also be seen with
    • Enflurane
    • Isoflurane
    • Sevoflurane
    • Desflurane
    • Methoxyflurane
  - Lignocaine
Risk patients-
patients with conditions: Duchenne muscle dystrophy,
positive family history of malignant hyperthermia and
patients who develop masseter spasm after
succinylcholine

Clinical features
- High temperature (may go >109 deg F) - most sensitive but delayed sign.
- Increased Expired CO2 - most sensitive early sign
- Hyperkalemia - arrhythmias (Ventricular fibrillation is the most common cause of death)
- Severe metabolic acidosis (pH may be <7.0)
- Tachycardia, hypertension, sweating, muscle rigidly
- Edema, cerebral edema, DIC, pulmonary, edema
- Myoglobinuria leading to Renal failure
- Increased creatinine Kinase – Myoglobin
Treatment

Specific measure

-Dantrolene 2mg/kg to be repeated every 5 min. (to a max. of 10 mg/kg)

General measures

Stop all anesthetic agents
- hyperventilation with 100% O2
  - Control temperature
    - Ice cooling
      - Ice-cold i/v normal saline

Correct acidosis:
  - Soda bicarb, 2-4 mEq/kg
    - Monitor urine output
      - Fluids to prevent renal failure

  - Correct electrolyte abnormal
• Screening: Creatinine kinase is basic screening tool.

• Patients with elevated CK levels in normal resting conditions should be managed as susceptible and does not require further testing.

• Patients with normal CK levels should undergo muscle biopsy studies

• If muscle biopsy studies are negative then only the patient can be considered non susceptible.

• Anaesthesia for Patients Susceptible for Malignant Hyperthermia
  • i. Local or regional anaesthesia is preferred technique (but lignocaine should be avoided).
  • ii. Safe drugs for general anaesthesia are barbiturates, propofol (can delay or prevent malignant hyperthermia), narcotics, benzodiazepines, nitrous oxide, nondepolarizing muscle relaxants (can delay or prevent malignant hyperthermia).
  • iii. Mild hypothermia is beneficial
Endocrine

1. Diabetes mellitus
Continue oral hypoglycemics —> minor surgery Sv/rtch to insulin —> major surgery GA > RA (if associated neuropathy)
Avoid sympathomimetic agents (can cause hyperglycemia)

2. Hyperthyroidism
Make euthyroid
Continue medications
Thiopentone / isoflurane

3. Hypothyroidism
Make euthyroid / continue-medication
Ketamine / isoflurane.
Obesity

Preoperative
- Associated diseases like HT, IHD, and DM

- Higher risk of developing high output failure (cardiac output increases by 100ml/min to perfuse each kg of fat.)

- Decreased pulmonary compliance, sleep apnea syndrome

- Short neck - Difficult Airway management
- Initial loading doses of lipid soluble drugs (IV induction agents) are higher (large fat stores increases the volume of distribution) therefore they are given on actual weight basis.

- Since these drugs get accumulated so maintenance doses are given at delayed intervals.

- Water soluble drugs (muscle relaxants) have limited volume of distribution so they are given on ideal eight basis.

- MAC of inhalational agents is not changed in obesity
- metabolism of inhalational agents is increased in obese patients so agent with least metabolism i.e. desflurane is most preferred

- Post op CPAP/oxygenation
SPECIALITY MANAGEMENT

NEUROSURGICAL ANESTHESIA

- Head injury - Rule out cervical & basal skull fracture
- Decrease ict. (Hyperventilation / hyper osmotic drugs / Diuretics / steroids / posture/barbiturates / ventral puncture)
- Avoid premedication
- Monitoring - Capnography must (C02 at 30-32mmhg)
- Thiopentone / propofol —> O2 + N2o + isoflurane + Non depol (Sch C/I)
- No glucose solutions
• **OBSTETRIC ANESTHESIA**

• Caesarean section
  • →Full stomach (high risk of aspiration)
  • →Regional > GA, LA dose I 30-40% for spinal {prone for high spinal and hypotension (Ephedrine - vasopressors of choice, as it does not produce significant vasoconstriction in uteroplacental circulation so fetal circulation is least compromised.)}
  • GA →Rapid sequence induction
  • →Ketamine/thiopentone -→02 + N20 + opioids (after delivery) + isoflurane (low conc) Inhalational agents less than 0.5% uterine relaxation is not significant

• PIH - Anaesth. Of Choice. → Epidural (spinal-sudden hypotension, GA- increase aspiration and laryngeal edema)

• Painless labor
  • Start with cervical dilatation of 3 - 4 cm
  • Lumbar epidural (Ropivacaine/ bupivacaine + Fentanyl as infusion)
PEDIATRIC

GA -» sevoflurane / ketamine -» O2 + N2o + desflurane/ isoflurane + Atracurium

- Sub glottis narrowest part (uncuffed tubes)
- Intubation -» neutral / slightly flexed neck
- Magill (neonates)
- Prone for hypoxia

OCULAR

Peri bulbar >> Retrobulbar
Prevent oculocardiac reflex (bradycardia with manipulacion of ocular muscles particularly medial rectus)

GA —» Sch / Ketamine C/I

N2o C/I for RD if sulphurhexafluoroide is used
Adenotonsillectomy
- Increased chances of aspiration, bleeding and laryngospasm in post operative period

Micro-laryngeal surgery (MLS)
Increased chances of arrhythmias, aspiration, bleeding and laryngospasm in perioperative period

Techniques:
1. GA with paed. ETT (>95%)
2. GA with HFJV (high frequency jet ventilation)
3. Insufflations
4. Apnea technique

Bronchoscopy
Flexible - topical
Rigid
1. GA with high frequency jet ventilation (HFJV)
2. Insufflation
3. Apnea
ORTHOPEDICS
- Regional preferred / combined spinal epidural
- Prepare for fat embolism
- Tourniquet deflation (most crucial period)
- RA and Ankylosing spondylitis intubation with neck extension (flexion C/I)

ANESTHESIA FOR LAPAROSCOPY

Most preferred gas for laparoscopy is C02. Other gases which can be used are air, helium, oxygen, litrous oxide, argon (ideal gas)

Complications:
Cardiac

1) Decrease cardiac output (30-40%). Intraabdominal pressure should be 12-14 mmHg
2) Arrhythmia (C02 is coronary vasoconstrictor)
3) MI/ischemia
Respiratory

1) V/Q mismatch (basal atelectasis)

2) Pneumothorax (manage conservatively)-CO₂ rapid absorption

3) Pneumomediastinum, surgical emphysema of face and neck

4) CO₂ embolism

CNS

↑i.c.t.

Ischemic heart disease- absolute contra indication for lap procedures
DAY CARE SURGERY / OPP Anesthesia/ ambulatory anesthesia

Procedures:
1. Procedures not associated with post operative complications
2. Moderate duration procedures (up to 90 minutes)

Patient selection:
(1) ASA I or II, HI (With controlled disease x 3 months)
(2) No Age criteria (except prematurity)
(3) Accompanied by attendant

Pre anesthesia check up
Investigations - ASA I, <40 years male and < 50 years female – nil
> 40 years male and > 50 years female - ECG
➢ 60 years – RFT

➢ Fasting - same recommendations
Premedication. Reserved for very anxious patients

Monitoring: routine mandatory

GA:
- LMA > ETT
- Drugs: I/V agent - propofol
- Opioid - Alfentanil
- Inhalational - Desflurane
- Muscle relaxant – Mivacurium, atracurium
- Benzodiazepine - Midazolam

2. Total intravenous anesthesia (TIVA) [propofol + remifentanil as infusion]

Regional - All blocks can be given except- Supraclavicular ↑ chance of pneumothorax
- central neuraxial block prefer short acting drugs
  Long acting may cause prolonged urinary retention and residual paralysis
Fast track discharge preferred (OT to phase II)

**Discharge criteria**

1. No (or minimal) nausea
2. Pain (controllable on oral analgesics)
3. Well oriented
4. Accept liquids (not required now a days)
5. Able to void
6. Able to sit
7. No active bleeding
8. Vitals stable for 30 minutes
PAIN MANAGEMENT

Pain assessment: most commonly used – visual analogue scale

Others like CHEOPS {which includes - cry, facial expression, verbal response, torso (body position), touch (touching wound), legs (position)} or smiley scale is used for pain assessment in children

Chronic pain conditions
For neurolytic blocks radiofrequency ablation (most preferred) or 5% phenol and 100% alcohol are used
Complex regional pain syndromes (CRPS)
group of pain syndromes.  
**type I** -- reflex sympathetic dystrophies &  **type II** -- causalgia

Clinical features
1. abnormal response to pain
2. **Allodynia** (a non painful stimulus cause’s pain),
3. **Hyperpathia** (persistence of pain sensation after the end of stimulus),
4. **Hyperesthesia** (exaggerated response to any stimulus)
5. **Hyperalgesia** (exaggerated response to painful stimulus),
6. **Anesthesia dolorosa** (feeling of pain in anesthetized area)

Features of sympathetic over activity like burning pain, sweating, edema, decreased blood flow, hair loss, and limb weakness.

**Treatment**
Sympathetic blocks  -- (Chemical sympathectomy is carried with guanethedine- obsolete)
For upper limb - stallelate ganglion block
For lower limb - lumbar sympathetic block
NEUROPATHIC PAIN

most common DIABETIC neuropathy
Drugs - pregabelin (1st choice), gabapentin, amitryptiline

Trigeminal neuralgia

• D.O.C. Carbamazepine 200mg/day (max. of 1500mg)
• Other modalities: Radio frequency Ablation or Neurolytic blocks
• gasserian ganglion block- involvement of ophthalmic nerve not advisable for trigeminal neuralgia,
• Specific branch (mandibular, maxillary) is blocked depending on distribution of pain with radiofrequency(preferred), alcohol or phenol

Post herpetic neuralgia

- Intercostal s blocks

CANCER PAIN - opioids or blocks depending on feasibility pain scale
Acute pain management (post operative pain)

1. Opioids - can be given by i/v, i/m, oral, epidural (most preferred route), intrathecal, transdermal, transmucosal

2. NSAIDS

3. Patient controlled analgesia (PCA) The pain control and patient satisfaction achieved with patient controlled analgesia devices (PCA) is far more superior to analgesics given by staff.
Mechanical Ventilation:

Indications of mechanical ventilation
1. On the basis of blood gas analysis:
   - $p_{O2} < 50 \text{ mmHg}$ on room air or $< 60 \text{ mmHg}$ on $F_{I02}$ (inspired oxygen) $> 0.5$ (50%).
   - $p_{CO2} > 50 \text{ mmHg}$.
   - $p_{O2}/F_{I02} < 250 \text{ mmHg}$ (normal $> 400)$
   - $p_{(A-a)}O2$ gradient $> 350 \text{ mmHg}$ on 100% oxygen.

2. On the basis of pulmonary functions:
   Respiratory rate $> 35$/minute.
   Vital capacity $< 15 \text{ ml/kg}$.
   Dead space volume ($V_d/VT$) $> 0.6$ (60%).
   Peak negative pressure $< -20 \text{ cm H2O}$.
   Tidal volume $< 5 \text{ ml/kg}$.
3. Other

- Excessive fatigue of respiratory muscles.
- Loss of protective airway reflexes which makes patient vulnerable for aspiration.
- Inability to cough adequately.
- Mechanical ventilation of lungs is carried out by intubating the patient by nasal or oral route or through tracheostomy and connecting endotracheal or tracheostomy tube to ventilator.
Ventilators

1) Volume preset, time cycled (volume controlled): These delivers fixed present tidal volume at fixed interval —> Disadvantage Barotrauma

(2) Pressure preset, flow cycled (Pressure controlled): Disadvantage more chances of hypoventilation

(3) Dual mode
MODES OF POSITIVE PRESSURE VENTILATION

- Intermittent positive pressure ventilation\ controlled mode ventilation (CMV)
- 2. Assist control (AC)
- 3. Synchronized intermittent mandatory ventilation (SIMV)
- 4. Pressure support (PSV)
- 5. Pressure controlled ventilation (PCV)
- 6. Positive End expiratory pressure & continuous positive airways pressure (CPAP)
- 7. Inverse ratio ventilation (IRV)
- 8. Positive airway pressure during both cycles of respiration (fPiPAP)
- 9. Airway pressure release ventilation (APRV)
- 10. Dual mode- Bi-level volume guaranteed
Indications of PEEP/CPAP
- Pulmonary edema
- ARDS

Physiological changes
↓ venous return CO
↑ pulmonary A.'pressure—> ↑ RV load
↑ intrapleural pressure
↑ mediastinal pressure
↑ Dead space (normal alveoli are over distended)

So, best value of PEEP is at which p02 > 60mm/Hg
Shunt fraction is minimum & C.O. is minimally depressed
Weaving from Mech. Ventilation

1. Tidal volume > 5 ml/kg
2. vital capacity > 15 ml/kg
3. RR <25mt
4. Blood gas analysis-normal values
6. No tachycardia, HT
7. Rapid shallow breathing index (RSQI) = respiratory rate (breath per min.)/ tidal volume
   It is a very good predictor for weaning. Patients with RSQI less than 100 can be safely weaned while with more than 120 should remain on mechanical ventilation
S/E of positive pressure ventilation

Respiratory
- Pulmonary Barotrauma (7-10%)
  - Pneumothorax
  - Pneumomediastinum
  - Bronchopleural fistula
  - Pneumopericardium
  - Pneumoperitoneum

Cardiovascular
- ↓ C.O.
- ↑ R.V. strain

- **Renal & liver** dysfunction due to ↓ CO

- **GIT**: Stress ulcers
- **Infections**-Pulmonary
Complications of prolonged intubation

Airway edema
Sore throat.
Airway obstruction
Laryngeal ulcer, web
Tracheal stenosis, fibrosis

Complication due to inadequate ventilation

Hypoxia
Hyperoxia
Hypercarbia
Hypercarbia
Acidosis
Alkalosis
Now called as cardiopulmonary and cerebral resuscitation

Rhythm in arrest - VF (or pulseless VT) / Asystole / Pulseless electrical activity (Electromechanical dissociation)

Management

Line of management

2010 guidelines

C (Circulation) {30 compressions/18 sec.}—>A( airway) —>B (breathing)

For lay man

Hand only (only massage)

Done under:
1. Basic lift support (BLS) survey (numbered as 1,2,3,4)
3. Breathing - Bag & Mask
4. Circulation - Cardiac massage
5. Defibrillation (by automatic external defibrillators).
2. Advanced life support (ALS) survey (numbered as A, B, C, D)
A- Airway - instrument
B- Breathing - ETT/LMA/CT
C- Circulation - massage
D- Defibrillation - manual

Drugs

3. Post cardiac arrest care

**Airway**

Clear the oral cavity
(Tongue fall is the most common cause of airway obstruction)
Head tilt, chin lift
 jaw thrust for suspected cervical spine (but if necessary Head tilt, chin lift can be given as per 2010 guidelines)
Airways- Guedel, LMA or intubation (best)
Breathing
- Mouth to mouth or Mouth to nose, O2 delivered is 16%: no role as per 2010 guidelines
- Bag & mask
- Endotracheal intubation-best, LMA, CT
- Cricothyroidotomy

Airway management of cervical spine injury-best is ET INTUBATION with neck stabilization and in neutral position

Cardiac massage

Ratio of cardiac compression to breathing is 30:2 irrespective of no. of fesuscers with unprotected airway. After advanced airway (ETT/LMA/CT) - Compressions at 100 and breathing at 8 - 10 breaths / minute without synchronization
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<th>Section 5 / Cardiopulmonary Resuscitation</th>
<th>Resuscitation</th>
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<td>Infants (0 - 1 Year)</td>
<td>Children (1 - 14) medical (0-8)</td>
<td>Adults</td>
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<tr>
<td>Pulse check</td>
<td>Brachial</td>
<td>Carotid</td>
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<tr>
<td>Compression area</td>
<td>Mid sternum</td>
<td>Mid Sternum</td>
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<tr>
<td>Compression with</td>
<td>2-3 fingers</td>
<td>Heel of one hand</td>
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<tr>
<td>Depth</td>
<td>1 inch (no range, ( \frac{1}{2} ) - 1 inch)</td>
<td>1 ( \frac{1}{2} ) inch (no range, 1 - 1 ( \frac{1}{2} ) inch)</td>
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<tr>
<td>Rate</td>
<td>100 / mt</td>
<td>100 / mt</td>
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<tr>
<td>Ratio</td>
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<tr>
<td>Without advanced airway</td>
<td>15:2 (Two rescuers) 30:2 (one)</td>
<td>15:2 (Two resuscitors) 30:2 (one)</td>
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<tr>
<td>With advanced airway</td>
<td>100 compression with 8 - 10 breaths</td>
<td>100 compression with 8 - 10 breaths</td>
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<tr>
<td>With only breath</td>
<td>12 - 20 / minutes</td>
<td>12 - 20 / minutes</td>
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Monitoring performance of CPR:

Capnography, diastolic BP (intra arterial) and mixed venous oxygen saturation ETC02 < 10 mmhg, DBP < 20 mmhg and mixed venous oxygen saturation < 30% - indicates unsuccessful CPR.

For adults:

1. Assess responsiveness and scan for chest movements in 5-10 sec. (no looking, listening and feel for respiration - if unresponsive)

2. Activate EMS or emergency response team (Cause of cardiac arrest in adults should be considered as ventricular fibrillation until proved otherwise).

3. Assess circulation by palpating carotids in 5-10 sec if absent

4. Start cardiac massage - 30 compressions in 10 sec (approx)

5. Manage airway and breathing

6. Defibrillate as early as possible
For children

Difference in protocol is that for unresponsive victim perform

5 cycles of CPR (15:2) & then call for EMS because the cause of cardiac arrest in children should be considered Asystole until proved otherwise.

Management of shockable rhythm (ventricular fibrillation, pulseless ventricular tachycardia and polymorphic ventricular tachycardia)

Assess responsiveness

Call for help (Activate EMS)
Asses circulation and breathing

if absent give 30 compressions, 2 rescue breaths and start CPR in ratio of 30:2 without advanced airway or with compression rate of 100/min and ventilation with 8-10 breath/min with advanced
Cardiopulmonary Resuscitation

a. whenever possible defibrillation should precede intubation and IV access means defibrillation should not be delayed if ventilation is achieved with bag & mask

b. Recovered means Return of spontaneous circulation (ROSC) as judged by palpation of pulse or ETC02 > 40 mmHg. ROSC is the criteria to stop CPR, not the rhythm (even if sinus).

Management of non-shockable rhythms (asystole, pulseless electrical activity)

A. PULSELESS ELECTRICAL ACTIVITY (PEA)
(previously called as electromechanical dissociation (EMD). Any rhythm (even sinus) on ECG other than VF and VT without pulse is called as PEA
Causes are 5H and 5 T

**5H**

i. Hypovolemia (most common cause)
ii. hypokalemia/ hyperkalemia
iii. hypothermia
iv. hypoxia
v. hydrogen ion (acidosis)

**5 T**

i. Tension pneumothorax
ii. Tamponade (cardiac)
iii. Thrombosis (coronary, pulmonary)
iv. Tablets (drug overdoses)/ toxins (accidental)
v. Trauma
B. ASYSTOLE

Asystole is the terminal event of all arrhythmias. The prognosis of asystole is very poor as compared to ventricular fibrillation.

management of non-shockable rhythms

• Continue CPR and consider treatment of possible causes (5 H and 5T)

• Adrenaline 1 mg IV/ endotracheal and repeat every 2-3 minutes
• Vasopressin 40 Units after 1st or 2nd dose of adrenaline

• No response for 20 minutes

• Consider termination of efforts
As per 2010 guidelines atropine is no more recommended for asystole and PEA Average survival rate of hospital arrest 8-21%

1. C→A→B

2. No listening, looking and feel

3. BLS numbered 1,2,3, 4 and ACLS A,B,C,D

4. push harder

5. push faster

6. allow complete recoil after massage

7. avoid excess ventilation
8. uninterrupted cardiac massage- any procedure should not interrupt massage more than 10 sec., rotate compressor every 2 min.

9. no mouth to mouth

10. for common man- hands only

11. no atropine for Asystole and PEA

12. for infants and children defibrillate with pediatric attenuator if not available then only 2J/Kg (first shock) and 4J/Kg subsequent shocks

13. Capnography as routine- improve CPR if pco2 less than 10 and diastolic pressure less than 20

14. dopamine and adrenaline infusions are as good alternative to transcutaneous pacing for refractory bradycardia.
POST CARDIAC ARREST CARE

1. optimization of circulation (SBP > 90 mmhg)

2. optimization of ventilation (FT02 to maintain SP02 >94%)

3. Hypothermia (32-34 degree C) for comatose patients only

4. moderate glycemic control (blood sugar- 144- 180mg/dl or 8-10 mmol) not normal sugar levels.

5. Immediate percutaneous coronary intervention (PCI) if cause is MI (preferably within 90 minutes).

Drugs used for CPR

**Adrenaline** - Dose 1 mg to be repeated (0.01 mg/kg to be repeated)

Conc. 1:1000

Endotracheal dose 0.1 mg/kg (1:1000 for children & 1:10,000 for adults)

Vasopressin - 40 U i/v or i/o to replace 1st or 2nd dose of adrenaline

**Other EMERGENCY ROUTES**

1. **Endotracheal**

Drug which can be given endotracheal route

(1) Adrenaline
(2) Atropine
(3) Xylocard
(4) Naloxone
Endotracheal dose is 2.5 times of i/v dose to be diluted with 10 ml of saline in adults and 5 ml in children.

2. Intraosseous
useful now in all ages

Newer concepts in CPR

(1) Calcium C/I as routine

(2) Soda bicarbonate to be given only after ABG

Sodium bicarbonate 0.3 X body wt. X base deficit

(3) Intracardiac adrenaline not advocated

(4) Use of steroids only empirical
Cerebral protection

Modalities

Hypothermia

I\v agents- thiopentone, propofol

CCB-nimodipine, nicardipine

Sodium channel blockers-lignocaine, lamotrigine

Free radical scavenging agents

NDMA receptor blockers
BRAIN DEATH

Criteria

1. Rule out reversible causes of coma
2. Clinical test
   a. No spontaneous resp. even if pCO₂↑ to 60 mm Hg
   b. No spontaneous resp. on carinal stimulation
   c. Absent reflexes

1. Cough
2. Pupillary
3. Comenal
4. Pharyngeal
5. Laryngeal
6. Carinal

3. Two flat EEG
4. Absent evoked