How CPR Works

- Effective CPR provides 1/4 to 1/3 normal blood flow
- Rescue breaths contain 16% oxygen (21%)

Start CPR Immediately

- Better chance of survival
- Brain damage starts in 4-6 minutes
- Brain damage is certain after 10 minutes without CPR

Do Not Move the Victim Until CPR is Given and Qualified Help Arrives

- Threat of fire or explosion
- Victim must be on a hard surface
- Place victim level or head slightly lower than body

Survey The Scene, then: RAP

- R – Responsiveness, Tap shoulder and shout “Are you ok?”
- A - Activate EMS (if unresponsive), Call 122 or call for help
- P - Position on back
  - All body parts rolled over at the same time
  - Always be aware of head and spinal cord injuries

BLS (basic life support)

- A: Airway
- B: Breathing
- C: Circulation
- Goal: to support oxygenation, ventilation, and circulation until ROSC (return of spontaneous circulation) or ACLS intervention scan be initiated
- It does not include advanced interventions e.g ET tube or drug administration

Checking Vital Signs

A – Airway

- Open the airway
- Head tilt chin lift (For all victims unless cervical spine injury is suspected)
- Without head extension where cervical spine injury is suspected.
- jaw thrust

B – Check for Breathing

- Look, listen and feel for breathing
- No longer than 10 seconds
- If the victim is not breathing, give two breaths (1 second or longer)
  - Pinch the nose
  - Seal the mouth with yours
• Breathing: Mouth To Nose (when to use)
  o Can’t open mouth
  o Can’t make a good seal
  o Severely injured mouth
  o Stomach distension
  o Mouth to stoma (tracheotomy)

C - Compressions

• Locate proper hand position for chest compressions.
  o Place heel of one hand on center of chest between the nipples
• Using both hands, give 30 chest compressions
  o Count 1, 2, 3 …
• Depth of compressions: 1 .5 to 2 inches
• For children: ½ to 1/3 of chest depth and use 1 or 2 hands
• Hand Placement
  o Use the mid-nipple line for adults and children
  o Rock the heel of the hand off the chest, keeping fingertips on chest wall to maintain hand position.
• Cardiac Pump Component
  o Blood flow during CPR is due to direct compression of heart between the sternum and the spine
• (Thoracic Pump) Component
  o During chest compression, increased pressure in the chest, aided by one-way valves in the heart and veins, causes forward movement of blood through the circulatory system.
• Decompression Phase
  o The ribs and sternum act as a bellows.
  o As the chest expands, a vacuum is created.
  o Blood returns to the heart during this relaxation
  o This small, but important, vacuum (negative pressure)
    ▪ draws blood back into the chest toward the heart
    ▪ Increases blood flow into the chambers of the heart
  o The more blood that returns to the heart (preload), the more that is circulated forward (cardiac output) with the next chest compression.
    ▪ increases blood flow to the brain
    ▪ increases blood flow through the arteries of the heart
• Quality of CHEST COMPRESION EMPHYYSIS ON
  1. Push hard and push fast adequate depth rate of 100 compression per minute
  2. Allow full chest recoil equal compression and relaxation
  3. Minimal interrupted chest compression

CPR

• After 30 chest compressions give:
• 2 slow breaths
• Continue until help arrives or victim recovers
• If the victim starts moving: check breathing
When Can I Stop CPR?

- Victim revives
- Trained help arrives
- Too exhausted to continue
- Unsafe scene
- Physician directed (do not resuscitate orders)
- Cardiac arrest of longer than 30 minutes (controversial)

Why CPR May Fail

- Delay in starting
- Improper procedures (ex. Forget to pinch nose)
- No ACLS follow-up and delay in defibrillation
  - Only 15% who receive CPR live to go home
  - Improper techniques
- Terminal disease or unmanageable disease (massive heart attack)

Injuries Related to CPR

- Rib fractures
- Laceration related to the tip of the sternum Liver, lung, spleen

Complications of CPR

- Vomiting
  - Aspiration
  - Place victim on left side
  - Wipe vomit from mouth with fingers wrapped in a cloth
  - Reposition and resume CPR

ACLS (advanced cardiovascular life support)

- A: Airway
- B: Breathing
- C: Circulation
- D: Defibrillator
- Good ACLS begin with good basic life support
- High quality properly performed CPR will save lives
- ACLS is designed to minimize interruption with chest compression
- ACLS includes defibrillation, oxygen, drug therapy

Rescue Breathing During CPR with an Advanced Airway

- Airway secured (ET tube)
- Ventilations at 8-10 times per minute, or approximately every 6-8 seconds
- Do not pause for breaths

Two-Person Rescue Breathing with a BVM

- Maintain a tight, two-handed facemask seal.
- When it’s time to pause compressions to give breaths, the person doing chest compressions should reach over and squeeze the ventilation bag.
AED & Defibrillation

- **Cardiac arrest not witnessed by EMS:** Perform 5 cycles or 2 minutes of CPR before analyzing rhythm
- **EMS-witnessed Arrest:** Use AED first in adult victims when AED is immediately available
- Each cycle of CPR consist of:
  - 2 ventilation to 30 compression
  - 5 cycles in 2 minutes
  - Change provider in delivering compression every 5 cycles to avoid fatigue
  - Defibrillation: for greatest success deliver shock 5 sec. or less after last compression
  - no rhythm checks for two minutes following shock delivery
- Failure of first shock = resume the CPR defibrillator first shock= 90% successful
- CPR helps heart pump blood when post shock systole or PAE is likely to be present
- Manual defibrillation energy dose, manual monophasic = 360 j for adult manual biphasic = 150-200j
  the second dose should be the same or higher dose

CPR for Infants (Under 1 Year of Age)

- Same procedures (RAPAB) except:
  - Seal nose and mouth or nose only
  - Give shallow “puffs”

Give CPR

- Press sternum 1/2 to 1/3 depth of the chest
- Use middle and ring finger
- 30 compressions to 2
- If alone, resuscitate for 2 minutes then call 122

PARENTERAL NUTRITION

Nutritional Requirements

- Energy: Glucose
- Lipid
- Amino acids (Nitrogen)
- Water and electrolytes
- Vitamins
- Trace elements

General indication for PN

- Def.: a method of feeding patients by infusing a mixture of all necessary nutrients into the circulatory system, thus bypassing the GIT.
- The gut should always be the preferred route for nutrient administration.
- Therefore, parenteral nutrition is indicated generally when there is severe gastro-intestinal dysfunction (patients who cannot take sufficient food or feeding formulas by the enteral route).
Figure 7. Adult BLS Algorithm.
1. PULSELESS ARREST

- BLS Algorithm: Call for help, give CPR
- Give oxygen when available
- Attach monitor/defibrillator when available

Odd

2. Check rhythm

- Shockable

3. VF/VT

Give 1 shock
- Manual biphasic: device specific (typically 120 to 200 J)
- Note: If unknown, use 200 J
- AED: device specific
- Monophasic: 360 J
- Resume CPR immediately

4. Give 5 cycles of CPR* (Shockable)

5. Check rhythm

- Shockable

6. Continue CPR while defibrillator is charging
- Give 1 shock
- Manual biphasic: device specific
- AED: device specific
- Monophasic: 360 J
- Resume CPR immediately after the shock
- Consider antiarrhythmics: give during CPR (before or after the shock)
- Amiodarone (300 mg IV/IO once, then consider additional 150 mg IV/IO once) or lidocaine (1 to 1.5 mg/kg first dose, then 0.5 to 0.75 mg/kg IV/IO, maximum 3 doses or 3 mg/kg)
- Consider magnesium, bolting dose 1 to 2 g IV/IO for torsades de pointes
- After 5 cycles of CPR*, go to Box 5 above

7. Give 5 cycles of CPR* (Shockable)

8. Check rhythm

- Shockable

9. Not Shockable

Resume CPR immediately for 5 cycles
- When IV/IO available, give vasopressor
  - Epinephrine 1 mg IV/IO
  - Repeat every 3 to 5 min
  - May give 1 dose of vasopressin 40 U IV/IO to replace first or second dose of epinephrine

Consider atropine 1 mg IV/IO for asystole or slow PEA rate
- Repeat every 3 to 5 min (up to 3 doses)

10. Check rhythm

- Shockable

11. Give 5 cycles of CPR* (Shockable)

12. Check rhythm

- Shockable

13. Not Shockable

If asystole, go to Box 10
- If electrical activity, check pulse. If no pulse, go to Box 10
- If pulse present, begin postresuscitation care

During CPR

- Push hard and fast (100/min)
- Ensure full chest recoil
- Minimize interruptions in chest compressions
- One cycle of CPR: 30 compressions then 2 breaths; 5 cycles = 2 min
- Avoid hyperventilation
- Secure airway and confirm placement
- Rotate compressors every 2 minutes with rhythm checks
- Search for and treat possible contributing factors:
  - Hypotension
  - Hyperkalemia
  - Hypoglycemia
  - Hypothermia
  - Torsade de pointes
  - Tension pneumothorax
  - Thrombosis (coronary or pulmonary)
  - Trauma

Figure 7. ACLS Pulsless Arrest Algorithm.
Categories of PN

- If enteral feeding is completely stopped or ineffective, Total Parenteral Nutrition is used (TPN).
- If enteral feeding is just “not enough”, supplementation w/ Partial Parenteral Nutrition (PPN) is indicated.

INDICATIONS

- In well-nourished adults, 7 - 10 days of starvation with conventional intravenous support (using 5% dextrose solutions) is generally accepted.
- If the period of starvation is to extend beyond this time, or the patient is not well-nourished, Total Parenteral Nutrition (TPN) is necessary to prevent the potential complications of malnutrition.

Indications for TPN

- Short-term use
  - Bowel injury, surgery, major trauma or burns
  - Bowel disease (e.g. obstructions, fistulas)
  - Severe malnutrition
  - Nutritional preparation prior to surgery.
  - Malabsorption - bowel cancer
  - Severe pancreatitis
  - Malnourished patients who have high risk of aspiration

- Long-term use (HOME PN)
  - Prolonged Intestinal Failure
  - Crohn’s Disease
  - Bowel resection

Enteral versus parenteral nutrition

- As far as gastrointestinal failure is concerned, long term parenteral nutrition is a life-saving procedure.
- Enteral nutrition has the advantage over parenteral nutrition of lower % of infectious complications.
- Parenteral nutrition has been shown to lead to changes in intestinal morphology and function and an increase in permeability (with higher % of bacterial translocation)

Requirements:

Energy

- Basal energy requirements are a function of the individual's weight, age, gender, activity level and the disease process.
- The estimation of energy requirements for parenteral nutrition relies on predictive equations.
- Hospitalized adults require approximately 25-30 kcal/kgBW/day.
- However, these requirements may be greater in patients with injury or infection.

Energy Requirements

<table>
<thead>
<tr>
<th>Patient condition</th>
<th>Basal metabolic rate</th>
<th>Approximate energy Requirement (kcal/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No postoperative complications, GIT fistula without infection</td>
<td>Normal</td>
<td>25-30</td>
</tr>
<tr>
<td>Mild peritonitis, long-bone fracture, mild to moderate injury, malnourished</td>
<td>25% above normal</td>
<td>30-35</td>
</tr>
<tr>
<td>Severe injury or infection</td>
<td>50% above normal</td>
<td>35-45</td>
</tr>
<tr>
<td>Burn 40-100% of total body surface</td>
<td>Up to 100% above normal</td>
<td>45-80</td>
</tr>
</tbody>
</table>
Energy Sources: Glucose

- The most common source of parenteral energy supply is glucose, being:
  - Readily metabolized in most patients,
  - Provides the obligatory needs of the substrate, thus reducing gluconeogenesis and sparing endogenous protein.
  - 1 gm of glucose gives 4 Kcals.
- Most stable patients tolerate rates of 4-5 mg.kg-1.Min-1, but insulin resistance in critically ill patients may lead to hyperglycemia even at these rates, so insulin should be incorporated acc. to blood sugar levels.

Energy Sources: Lipid

- Fat mobilization is a major response to stress and infection.
- Triacylglycerols are an important fuel source in those conditions, even when glucose availability is adequate.
- Need to be restricted in patients with hypertriglyceridemia.
- Lipids are also a source for the essential fatty acids which are the building blocks for many of the hormones involved in the inflammatory process as well as the hormones regulating other body functions.
- Ideally, energy from fat should not exceed 40% of the total (usually 20-30%).
- Fat emulsions can be safely administered via peripheral veins, provide essential fatty acids, and are concentrated energy sources for fluid-restricted patients.
- They are available in 10, 20 and 30% preparations.
- Though lipids have a calorific value of 9Kcal/g, the value in lipid emulsions is 10Kcal/g due to the contents of glycerol and phospholipids.

Nitrogen

- Protein (or amino acids, the building blocks of proteins) is the functional and structural component of the body, so fulfilling patient’s caloric needs with non-protein calories (fat and glucose) is essential.
- Protein requirements for most healthy individuals are 0.8 g/kg/day.
- With disease, poor food intake, and inactivity, body protein is lost with the resultant weakness and muscle mass wasting.
- Critically ill patients may need as high as 1.5-2.5 g protein/kg/day depending on the disease process:
  - (major trauma or burn > infection or after surgery > standard)
  - The amount should be reduced in patients with kidney or liver disease.

Fluids and electrolytes

- 20–40 mL/kg - daily – young adults
- 30 mL/kg – daily – older adults
- Sodium, potassium, chloride, calcium, magnesium, and phosphorus (as per the table)
- Daily lab tests to monitor electrolyte status

Vitamins

- These requirements are usually met when standard volumes of a nutrient mix are provided.
- Increased amounts of vits are usually provided to severely ill patients.
- Vitamins are either fat soluble (A,D,E,K) or water soluble (B,C). Separate multivitamin commercial preparations are now available for both.
Trace minerals

- These are essential component of the parenteral nutrition regimen
- A multi-element solution is available commercially, and can be supplemented with individual minerals.
- may be toxic at high doses.
- Iron is excluded, as it alters stability of other ingredients. So it is given by separate injection (iv or im).
- minerals excreted via the liver, such as copper and manganese, should be used with caution in patients with liver disease or impaired biliary function.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Recommended dietary allowance (RDA) for daily oral intake (mg)</th>
<th>Suggested daily intravenous intake (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td>15</td>
<td>2.5-5</td>
</tr>
<tr>
<td>Copper</td>
<td>2-3</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Manganese</td>
<td>2.5-5</td>
<td>0.15-0.8</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.05-0.2</td>
<td>0.01-0.015</td>
</tr>
<tr>
<td>Iron</td>
<td>10 (males)-18 (females)</td>
<td>3</td>
</tr>
</tbody>
</table>

Application:

Initiation of Therapy

- TPN infusion is usually initiated at a rate of 25 to 50 mL/h. This rate is then increased by 25 mL/h until the predetermined final rate is achieved.

Administration

- To ensure that the solution is administered at a continuous rate, an infusion pump is utilized to administer the solution. In hospitalized patients, infusion usually occurs over 22-24 h/day. In ambulatory home patients, administration usually occurs overnight (12-16 h).

Monitoring

Policy: to monitor:

1- Efficacy: electrolytes (S. Na, K, Ca, Mg, Cl, Ph), acid-base, Bl. Sugar, body weight, Hb.
2- Complications: ALT, AST, Bil, BUN, total proteins and fractions.
3- General: Input- Output chart.
4- Detection of infection:
   - Clinical (activity, temp, symptoms)
   - WBC count (total & differential)
   - Cultures

Complications of TPN

- Sepsis
- Pneumothorax
- Air embolism
- Clotted catheter line
- Catheter displacement
- Fluid overload
- Hyperglycemia
- Rebound Hypoglycemia

Metabolic Complications

- Hyperglycemia (an elevated blood sugar): Associated with the infusion of excess glucose in the feeding solution or the diabetic-like state in the patient associated with many critical illnesses.
- It can result in an osmotic diuresis (abnormal loss of fluid via kidney), dehydration, & hyperosmolar coma.
- ttt: decrease the amount of infused glucose (to<4 mg/kg/min) OR insulin can be administered (either S.C. inj. or incorporation in the infusion bag).