conduction of anesthesia

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Types of anesthesia

- Local Anesthesia
- Regional Anesthesia
  - Spinal anesthesia : injected into the spinal fluid
  - Epidural anesthesia : outside the spinal column {epidural space}
- **General Anesthesia**

General anesthesia

- General anesthesia is a reversible state characterized by **loss of reception and perception of stimuli.** Important effects seen in general anesthesia are **sedation, reduced anxiety,** lack of awareness and amnesia, **skeletal muscle relaxation**, suppression of protective reflexes and **analgesia**

What is general anesthesia

Amnesia

Hypnosis

Analgesia

Immobility

General Anesthesia

Modern **General anesthesia** is based on the ability to provide adequate:

1. Hypnosis
2. Analgesia
3. Amnesia
4. some degree of muscle relaxation

during **surgical procedures** while maintaining the patient's **normal physiological functions.** (hemodynamic stability, oxygenation, ventilation, temperature

MODERN ANESTHESIA IS A COMBINATION OF

IV and inhaled agents for induction and maintenance

of anesthesia

- IV : Propofol , ketamine , Sodium Thiopental , etomidate ,

TIVA; total intravenous Anesthesia propofol + Rimefentanil

- INHALED : Sevoflurane (most commonly used inhaled agent / works rapidly and recovers rapidly)

2- **Muscle relaxants** (e.g. rocuronium, vecuronium , succinylcholine, cisatracurium/ Nimbix , atracurium).

3- **Analgesics** (e.g. opioid , fentanyl).

Preoperative preparation

- Preoperative evaluation for
    - Airway examination
    - Pt's medical condition
    - Medication
    - Laboratory data
    - Consultant notes
    - Last oral intake

- Preoperative hydration and correction of intravascular volume as needed:

  Intravenous access

  Fluid or blood transfusion as needed

- Prescribe preoperative medications as needed:

  e.g. Anxiety: Benzodiazepine: Midazolam

  Pain : Opioid or NSAID

  Increased gastric acidity: cimetidine, omeprazole

Ketamine Injection

Characteristics of Ideal General Anesthetics

- Rapid onset of action (e.g. propofol will produce unconsciousness in 30 seconds)
- **pleasant odor and non-irritant to the respiratory tract**.
- Minimal adverse effects on liver, heart, and other organs
- Should achieve the triad of anesthesia i.e. induce unconsciousness, analgesia , amnesia and preferably some degree of muscle relaxation

Maintenance

Increasing depth of anesthesia

Stage I	**Stage II**	**Stage III**	**Stage IV**
• Amnesia Loss of consciousness	• Delirium Injurious responses to noxious stimuli	• Surgical anesthesia Painful stimulation dose not elicit somatic reflexes or deleterious autonomic responses	• Overdosage Circulatory failure

Maintain homeostasis

- Vital signs
- Acid-base balance
- Temperature
- Coagulation
- Volume status

Maintain ventilation

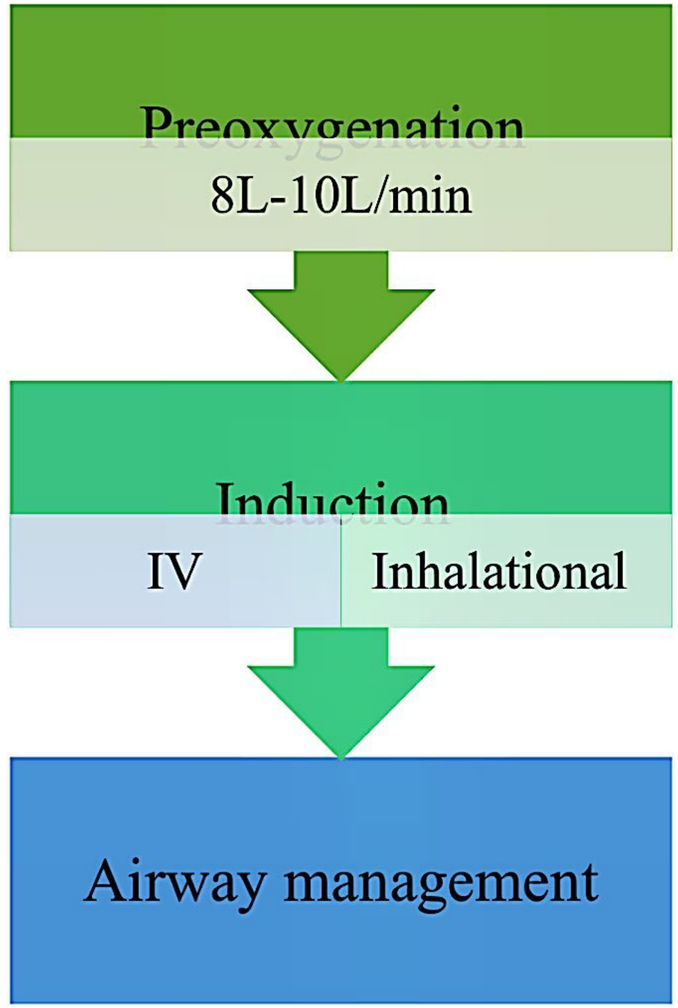
1. Spontaneous or assisted ventilation

2. Controlled ventilation

tidal volume: 10-12 ml/kg

respiratory rate: 8-10 breaths/min

Induction
let the pt go off to sleep



Induction techniques

- Intravenous: the most common method

- Inhalational: for special pt (as pt with difficult airway, pediatric pt)

- Intramuscular: rarely used, only used in uncooperative pts and young children.

INDUCTION

- This phase is between the time of administration of an anesthetic to the development of effective anesthesia[eg;LOC].
- Induction of anesthesia with an **intravenous agent** (e.g. propofol will produce unconsciousness in 30 seconds.

For achieving the depth of anesthesia, some drugs are added to the anesthetics either by inhalation or intravenous routes. For example, **neuromuscular blockers** like succinylcholine are administered to achieve sufficient muscle relaxation.

INDUCTION

- Once in circulatory system, they are transported to their biochemical site of action in central and autonomic system, where they exert their pharmacological function.

INDUCTION

- **Induction depends on how fast effective concentrations of the anesthetic drug reach the brain**
- **Onset of anaesthesia is faster with intravenous injection than with inhalation, taking about 10–20 seconds to induce total unconsciousness.**
- **Commonly used intravenous induction agents include propofol, sodium thiopental, etomidate, and ketamine.**

INDUCTION

- SEVOFLURANE is currently the most commonly used agent for **inhalational induction** because of the **rapid onset & recovery from it.**

INDICATIONS OF INHALITONAL INDUCTION

1. **Difficult IV access**
2. **Difficult Airway to maintain:**
   - Upper or lower Airway Obstruction (e.g. epiglottitis)
   - Bronchopleural fistula
   - Empyema.
3. **Young children.**

INHALITONAL INDUCTION

- Difficulties and complications :

1. Slow induction of anesthesia.
2. Airway obstruction and bronchospasm.
3. Laryngeal spasm .
4. Environmental pollution.

- Advantages over IV agents:

1. The depth of anesthesia can be rapidly altered by changing the concentration of the drug.
2. **Reversible**.
3. **Rapidly eliminated by exhalation.**

Maintenance

- It includes providing Continuous and sustained anesthesia.
- INHALITONAL:A mixture of oxygen, Sevoflurane, and nitrous oxide are commonly used agents for the maintenance of anesthesia.
- sevoflurane has some bronchodilatory effects that are valuable in preventing bronchospasm
- IV infusion: propofol

Maintenance

1. Inhalational agents: Sevoflurane, Isoflurane but also Halothane in a mixture of nitrous oxide 70% in oxygen.
2. IV anesthetic agents.
3. IV opioids (Fentanyl, Alfentanil, Remifentanil)
   (alone or combinations)

For special conditions :

Ephedrine – increase BP

Atropine – increase HR

Adrenaline – in case of Asystole

RECOVERY

- This is the time from the discontinuation of anesthetic until consciousness and reflexes return.
- The patient is monitored until return of normal physiologic functions.
- It usually takes about 45 minutes to an hour **to recover** completely **from anesthesia**. In some cases, this period may be longer depending on medications given during or **after surgery**.
- **recovery , depends on how fast the anesthetic drug diffuses from the brain**

IV ANESTHETICS

A. Advantages:

- Rapid onset.
- Depression of pharyngeal reflexes allows early insertion of Laryngeal mask airway (LMA).
- Anti-emetic and anticonvulsive properties.

B. Disadvantages:

- Venous access required.
- Risk of hypotension.
- Apnea common.
- Loss of airway control.
- Anaphylaxis.

INHALATIONAL ANESTHETICS

- Avoids venopuncture.
- Respiration is maintained.
- Slow loss of protective reflexes.
- End-tidal concentration can be measured.
- The depth of anesthesia can be rapidly altered by changing the concentration of the drug.
- Rapidly eliminated by
- Slow process.
- Potential excitement phase.
- Irritant and unpleasant, may induce coughing.
- Pollution.
- May cause a rise in ICP/IOP.

Inhalational Anesthetics

inhalational anesthetics are commonly used as an induction and maintenance agent. The speed of induction of anesthetic effects depends on factors like:

- **lipid Solubility ↑**
- **Inspired gas partial pressure ↑**
- **Ventilation rate ↑**
- **Pulmonary blood flow ↑**

- Induction depends on how fast effective concentrations of the anesthetic drug reach the brain.------

  Preoxygenation!!!

- While **recovery , depends on how fast the anesthetic drug diffuses from the brain.--------- diffusion hypoxia!!!**

- **Pre oxygenation** (think about between stage 1 and 2)
- Giving 100% O2 prior to intubation
- increase lung functional residual capacity
- Main mechanism : **Denitrogination** (washing Nitrogen out)
- Induction depends on how fast effective concentrations of the anesthetic drug reach the brain

- **Diffusion hypoxia**
- While recovering from N2O aneesthesia,
- Large quantities of this gas cross from the blood into the alveolus (down its concentration gradient)
- O2 and CO2 in the alveolus are **diluted** by this gas for a short period of time

PROCEDURE

1. The mask or hand is introduced gradually to the face from the side.

2. While talking to the patient & encouraging him to breathe deeply the anesthetist adjusts the mixture of gas flow & observes the patient's reaction.

3. initially N2O 70% in O2 is used.

4. immediate 8% sevoflurane in 70% nitrous oxide in oxygen.

PROCEDURE

5. Anesthesia deepened by gradual introduction of a volatile agent. (e.g. halothane1-3%).

6. A single breath technique for patients who are able to cooperate.

7. Observe the color of patient's skin ,pattern of ventilation, palpate peripheral pulses, monitor ECG& spO2.

8. Insertion of an oropharyngeal airway, a laryngeal mask airway or tracheal tube may be considered when anesthesia has been established

In young Children;

- Allow them to play with mask before connecting anesthetic tube.
- Delivery tube may be preferred.

Difficulties and Complications:

1. Airway obstruction
2. Laryngeal spasm

- Cause: **stimulation during light Anesthesia.**
- Treatment: **stop stimulation, gently deepen anesthesia >> 100%O2 is applied with face mask.**
- **If severe >> 100%O2 is applied with face mask, I.V. *suxamethonium*.**
- **suxamethonium** :succinylcholine, used to cause short-term paralysis as part of general anesthesia ,It is given either by injection into a vein or muscle.

Difficulties and Complications:

3. Bronchospasm

- Cause: **Allergy, smokers, Irritants, upper respiratory infection**
- Treatment: **increasing the depth of anesthesia** with additional induction agent or volatile agent, or by administering IV or endotracheal lidocaine (local anesthetic)1-2 mg/kg. **warming of gases, bronchodilators.**

4. Malignant hyperthermia:

- Cause: volatile Anesthetics(halothan, suxamethonium and local anesthetics are triggering substances).
- Treatment: Dantrolene IV(muscle relaxant that decrease excitation-contraction of muscles)

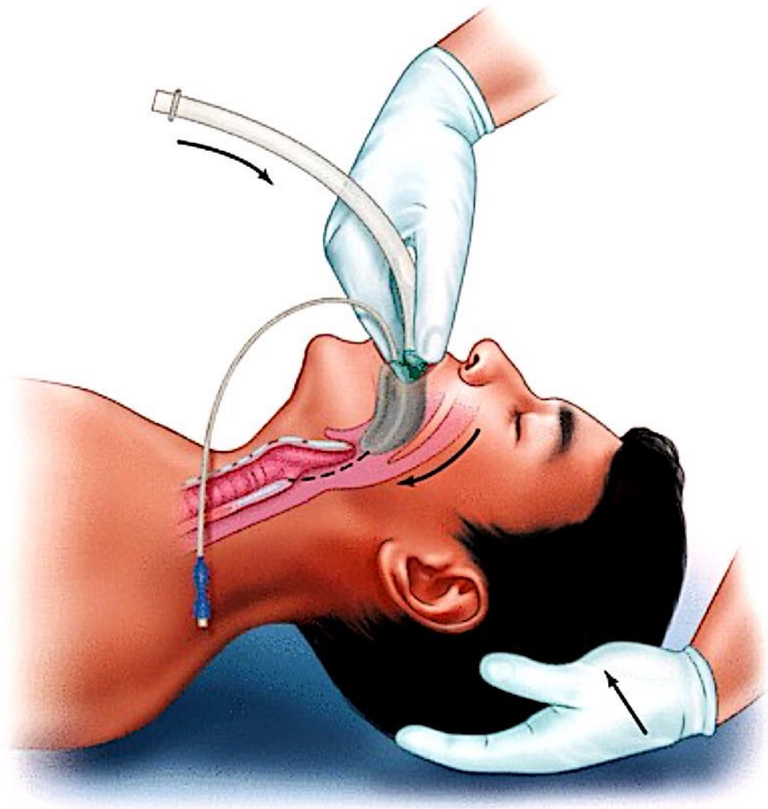
5.Raised intracranial pressure **(Inhalational to IV)**

Airway maintenance delivery of inhalation agents

1. Face Mask:

Airway maintenance delivery of inhalation agents

2. Laryngeal Mask (LMA)



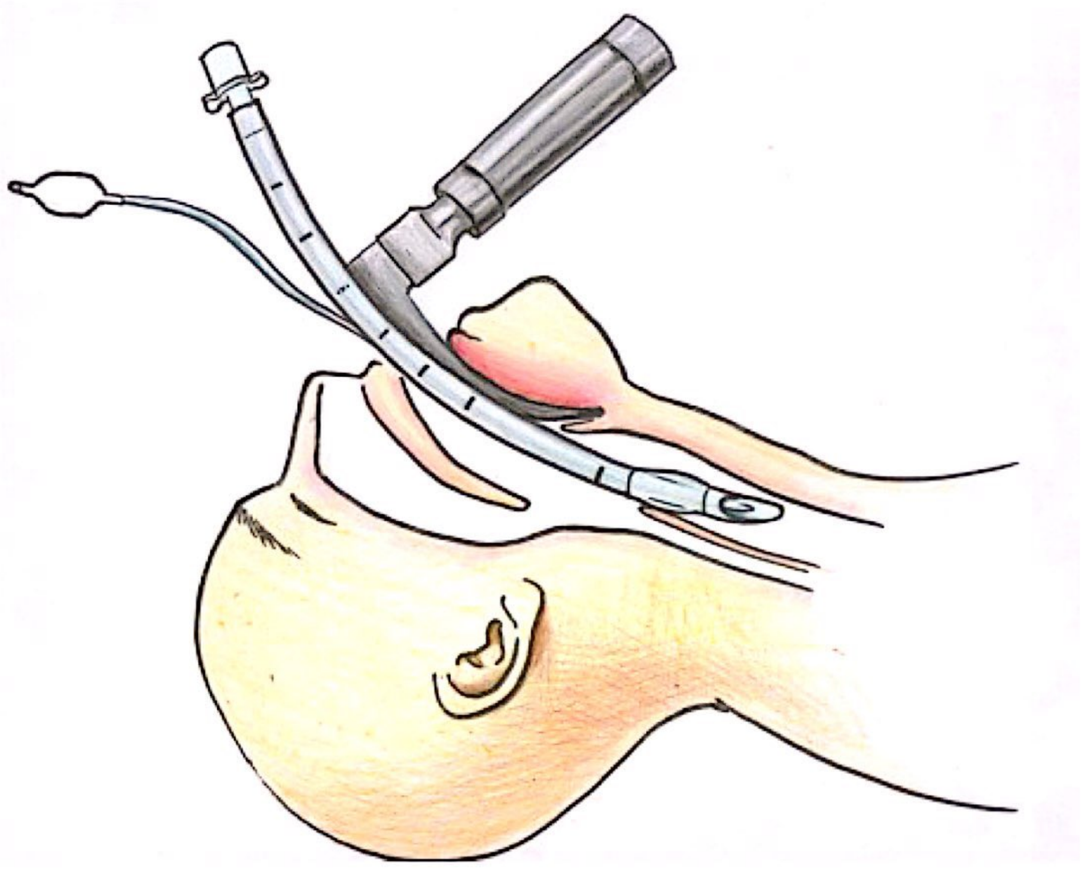
Indications of LMA:

a. Provide clear airway without the need to support a mask.
b. Avoid the use of tracheal intubation during spontaneous ventilation.
c. In a case of difficult intubation , to facilitate subsequent insertion of a tracheal tube

Contraindications of LMA:

a. Full stomach or any condition lead to delayed gastric emptying.
b. Possible regurgitation.
c. Surgical access is Impeded By the cuff of the LMA .
d. Thoracic surgery.

3. tracheal intubation.



➢ Preparation:

1. The anesthetist must check the availability and function of the necessary equipment.
2. should have a dedicated and experienced assistant.
3. laryngoscopes of the correct size are chosen.
4. patency of tracheal tube is checked

➢ Indications:

1. Provision of a clear airway .
2. Surgical procedures in which the anesthesiologist cannot easily control the airway (e.g., prone, sitting, or lateral decubitus procedures).
3. Head and neck operation (nasotracheal tube).
4. Protecting the respiratory tract from aspiration of gastric contents
5. 5. Suction of the respiratory tract.

6. Surgical procedures within the cranium, chest or abdomen.
7. Protecting a healthy lung from a diseased lung to ensure its continued performance (e.g. hemoptysis, empyema & pulmonary abscess).
8. Severe pulmonary and multisystem injury associated with respiratory failure (e.g., severe sepsis, airway obstruction, hypoxemia).
9. Positive-pressure ventilation

Table 2. Methods of Supporting the Airway

	Bag and Mask	Laryngeal Mask Airway (LMA)	Endotracheal Tube (ETT)
Advantages/ Indications	• Basic • Non-invasive • Readily available	• Easy to insert • Less airway trauma/irritation than ETT • Frees up hands (vs. face mask) • Primarily used in spontaneously ventilating patient	"The **5 P's**" • Ensures airway **P**atency • **P**rotects against aspiration • Allows **P**ositive pressure ventilation • Allows suctioning i.e. "**P**ulmonary toilet" • A route for **P**harmacological administration
Disadvantages/ Contraindications	• Risk of aspiration if ↓ LOC • Cannot ensure airway patency • Inability to deliver precise tidal volume • Operator fatigue	• Risk of gastric aspiration • PPV >20 cm H_2O needed • Limited TMJ mobility • C-spine or laryngeal cartilage fracture • Oropharyngeal, retropharyngeal pathology or foreign body	• Insertion can be difficult • Muscle relaxant usually needed • Laryngospasm may occur on failed intubation or extubation • Sympathetic stress due to intubation
Other	• Facilitate airway patency with jaw thrust and chin lift • Can use oropharyngeal/ nasopaharyngeal airway	• Does NOT protect against laryngospasm or gastric aspiration • Sizing (approx): 40-50 kg: 3 50-70 kg: 4 70-100 kg: 5	• Auscultate to avoid endobronchial intubation • Sizing (approx): Male: 8.0-9.0 mm Female: 7.0-8.0 mm Pediatric: (age/4) + 4 mm

Monitoring

Standard monitoring for GA

- Qualified anesthetist presence
- ECG
- NBP
- Pulse oximetry
- Capnograph

Monitoring of anesthesia

A) Routine monitoring technologies

1. Continuous Electrocardiography (ECG): monitor Heart rate and rhythm
2. Continuous pulse oximetry (SpO2): early detection of a fall in a patient's hemoglobin saturation with oxygen (hypoxemia)

3.Blood Pressure Monitoring (NIBP):

Non-invasive blood pressure regularly during the surgery

4. Agent concentration measurement

- Common anesthetic machines have monitors to **measure the percent of inhalational anesthetic** agent used (e.g. sevoflurane, isoflurane, desflurane, halothane etc.).
- The monitors also usually measure nitrous oxide and oxygen percentages.

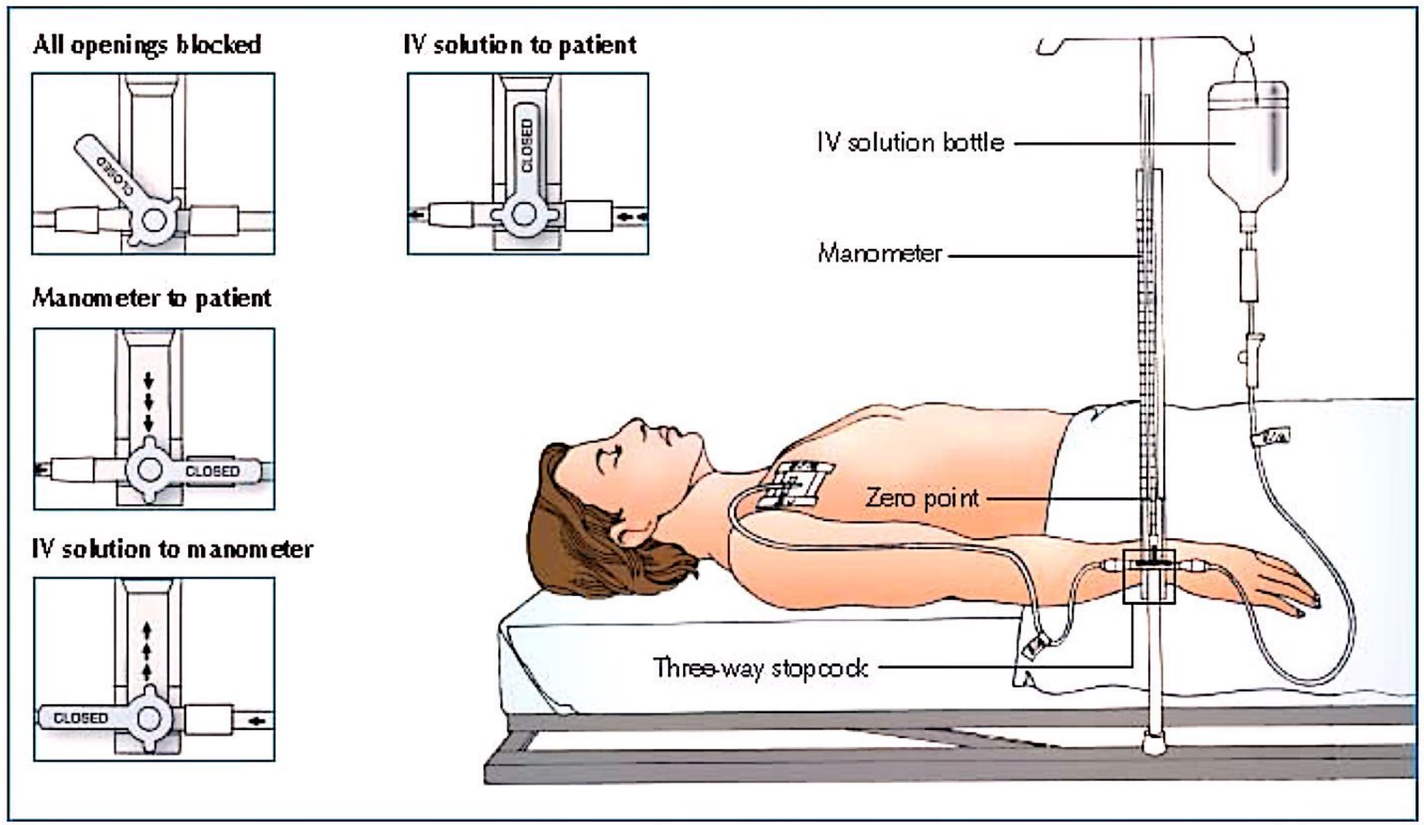
5. Carbon dioxide measurement (capnography):measures the amount of **carbon dioxide** expired by the patient's lungs in percent or mmHg, mmHg is usually used to allow the anesthesia provider to see more subtle changes in CO2. It allows the anesthetist to assess the **adequacy of ventilation**.

6. Temperature measurement:

   to discern **hypothermia** or **fever**, and to aid **early detection of malignant hyperthermia.**

**Central Venous Pressure monitoring (CVPM)

Monitors the preload (venous return)



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