

牙科麻醉學
Dental anesthesiology

Peri-op management of anesthesia

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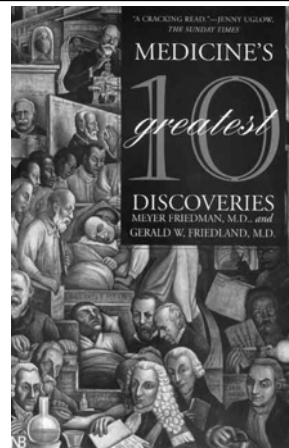
Dept. of Anesthesiology, Mackay Memorial Hospital

學習目標

- 正確評估口腔疼痛問題及行為管理
- 全身性潛在疾病併發之處理及預防

資料來源

1. Handbook of local anesthesia Stanley F. Mclamed 1997 4th ed. Mosby
2. Handbook of local anesthesia Stanley F. Mclamed 1995 3th ed. Mosby 3. Sedition



1. Modern Human Anatomy
2. Circulation of Blood
3. Bacteria
4. Vaccination
5. **Surgical Anesthesia**
6. X-ray Beam
7. Tissue Culture
8. Cholesterol
9. Antibiotics
10. DNA

麻醉醫師 No. 1

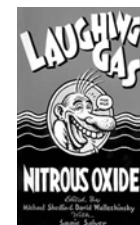
華陀 (Hua-Tou 141-212 AD)

- 史書記載的第一位麻醉醫師
- **“麻沸散”**: 曼陀羅花一斤、生草烏、香白芷、當歸、川芎各四錢、天南星一錢。史上第一次使用的全身麻醉劑。

Nitrous Oxide : First Anesthetic Gas

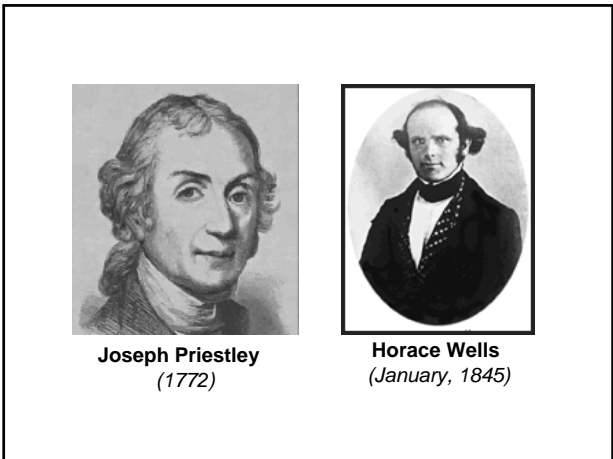
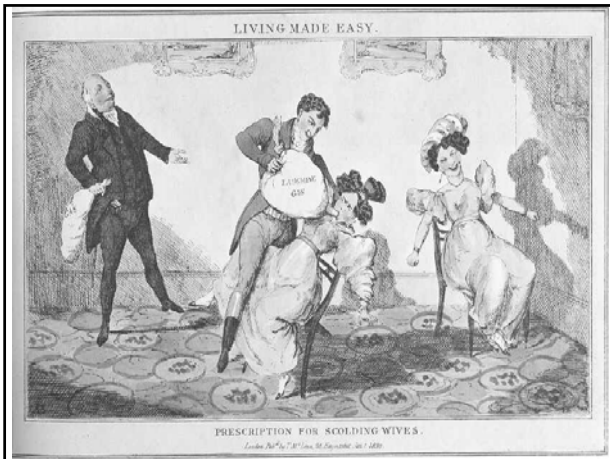
- Joseph Priestley 1772

早期歐美在宴會中，使用此種氣體，使賓客在恍惚的意識下，情緒上更覺得愉快，故稱為笑氣。



“I am sure the air in heaven must be this wonder working gas of delight”

- Robert Southey

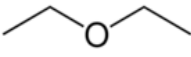
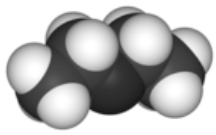



Joseph Priestley
(1772)

Horace Wells
(January, 1845)

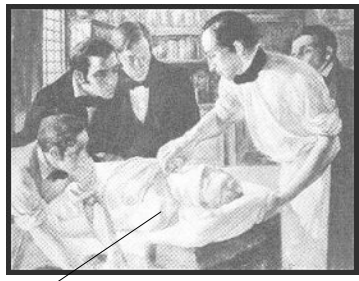
Ether (Diethyl Ether)

$C_2H_5OC_2H_5$




Crawford Long



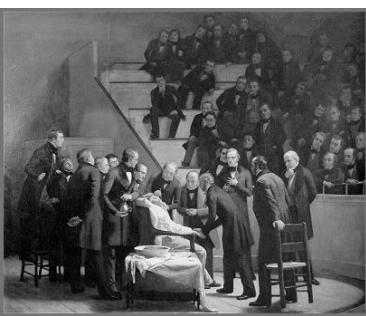
The first use of ether for anesthesia

(March 30, 1842)

James N. Venable 小J



William Morton



(October 16, 1846)

麻醉深度 (Depth of anesthesia)

- 第一階段：止痛期 (Analgesia)
干擾脊髓視丘徑路 (Spinothalamic tract) 感覺傳導，病人喪失疼痛感覺；病人意識清醒可以交談。
- 第二階段：興奮期 (Excitement)
譫妄及暴力激烈行為，血壓不規則地上升，呼吸的速率增加。
- 第三階段：外科手術期 (Surgical Anesthesia): 規律呼吸及骨骼肌放鬆，眼球不再運動且瞳孔大小固定。此時最適合手術的進行。
- 第四階段：延髓麻痺期 (Medullary Paralysis): 呼吸中樞及血管運動中樞被嚴重地抑制，可以迅速致死。

麻醉 (Anesthesia)

- 全身麻醉 (General Anesthesia)
 - 痛覺消失 (analgesia)
 - 失去記憶 (amnesia)
 - 進入無意識狀態 (reversible consciousness loss)
 - 肌肉放鬆 (relaxation)
 - 壓抑不必要的反射
- 區域麻醉 (Regional Anesthesia)
 - 痛覺消失 (analgesia)
 - 肌肉放鬆 (relaxation)
 - 壓抑不必要的反射

Perioperative management of anesthesia

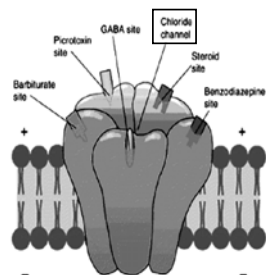
- Anesthetic agents
- Monitoring in anesthesia
- Management of co-existing diseases
- Post-operative pain management

Intravenous Anesthetic Agents

GABAergic agents

► Schematic illustration of a GABA_A Receptor, with its Binding Sites

- Major tranquilizer
 - Barbiturates: thiopental, thiamylal, pentobarbital
 - Propofol
 - Etomidate
- Minor tranquilizer
 - Benzodiazepines: diazepam, midazolam, lorazepam



Gamma-aminobutyric acid (GABA)

Barbiturates

- Mechanisms:
 - Enhance inhibitory neurotransmitters mediated by GABA
- “Anesthesia Induction”: rapid onset, short duration
- Decrease BP; Elevate HR; Peripheral vasodilatation
- Myocardial contractility (±); cardiac output (±)
- Respiratory depression
- Reduce cerebral oxygen consumption
- Brain protection from focal ischemia
- Antianalgesic effect

Benzodiazepines

- Diazepam, midazolam
- Mechanisms
 - Facilitate GABA receptor binding
- “Sedation”
- Minimal cardiovascular depressant effects
- Mild respiratory depression
- Reduce CBF and ICP
- Antegrade amnesia
- Mild muscle-relaxant property
- Slower onset and recovery

Propofol

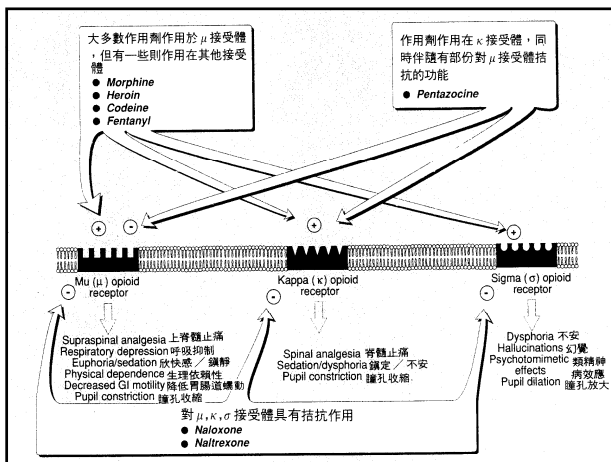
- Mechanisms
 - Facilitate inhibitory neurotransmission mediated by GABA
- Not water-soluble: Oil-in-water emulsion
- Anesthesia induction: rapid onset, short duration
- Anesthesia maintenance: total intravenous anesthesia (TIVA)
- Decreased BP, SVR, cardiac contractility, and preload
- Bradycardia
- Respiratory depression; apnea with induction dose
- Depression of upper airway reflex (LMA placement)
- Decreased CBF and ICP

Ketamine

- N-methyl-D-aspartate (NMDA) receptor antagonist
- Dissociative anesthesia: dissociate the thalamus from the limbic cortex
- “Anesthesia induction”
- “Analgesia”
- Inhibition of the reuptake of norepinephrine
- Increased BP, HR, and CO
- Central stimulation of sympathetic nervous system
- Bronchodilation
- Increased saliva secretion
- Increase ICP, CBF, and oxygen consumption

Opioids

- Morphine, meperidine, fentanyl, sufentanil
- “Analgesia”
- Agonists of opioid receptors
- Mu-opioid receptor
 - Supraspinal analgesia, respiratory depression, physical dependence, muscle rigidity
- Kappa-opioid receptor
 - Sedation, spinal analgesia
- Sigma-opioid receptor



Inhalational Anesthetic Agents

- Anesthesia induction
- Anesthesia maintenance
 - Reversible loss of consciousness
 - Analgesia
 - Amnesia
 - Paralysis
- Minimum alveolar concentration (MAC)
 - 反應腦中麻醉藥物的分壓
 - 統計平均值(30-55歲人類1大氣壓力下)
 - 1 MAC \approx ED50; 1.3MAC \approx ED90

Effects of Anesthetic Gases on Ion Channels

Ion Channel	Behavioral or Physiological Processes Affected	Effect on Ion-Channel
Ligand-gated ion channels- “inhibitory postsynaptic receptors”		
GABA _A receptors	Increased activity results in anxiolysis, sedation, amnesia, myorelaxation, and anticonvulsant activity	Enhancement
Glycine receptors	Inhibitory receptor for spinal reflexes and startle responses	Enhancement
Ligand-gated ion channels- “excitatory synaptic receptors”		
Neuronal nicotinic Ach receptors	Memory, nociception, autonomic functions	Inhibition
Serotonin type 3 receptors	Arousal, emesis	Inhibition (weak)
Glutamate receptors	Perception, memory, learning, nociception	Inhibition

(Stachnik et al., 2006)

Agent	Year Introduced	Halogen	MAC (%) ^a	Blood:Gas Partition Coefficient
Diethyl ether	1844	NA	NA	NA
Nitrous oxide	Early 19th century	NA	104	0.47
Halothane	1956	Fluorine, chlorine, bromine	0.77	2.5
Enflurane	1972	Fluorine, chlorine	1.68	1.8
Isoflurane	1981	Fluorine, chlorine	1.15	1.4
Desflurane	1992	Fluorine	6.0	0.42
Sevoflurane	1995	Fluorine	2.05	0.69

(Stachnik et al., 2006) 智製

Sevoflurane

- Low blood gas solubility coefficient (0.69)
 - Rapid induction/recovery
 - Nonpungent
 - Inhalation induction
 - Emergence agitation
 - Compound A production
 - Renal toxicity with sevoflurane: a storm in a teacup?
- (Gentz et al., Drugs, 2001)

Desflurane

- Molecular structure similar to isoflurane.
- The most volatile, least potent inhalation agent.
- Low blood gas solubility coefficient (0.42)
- Rapid induction/recovery
- Airway irritability
- Resistant to biodegradation
- Carbon monoxide production
- Sympathomimetic properties

Monitoring in Anesthesia

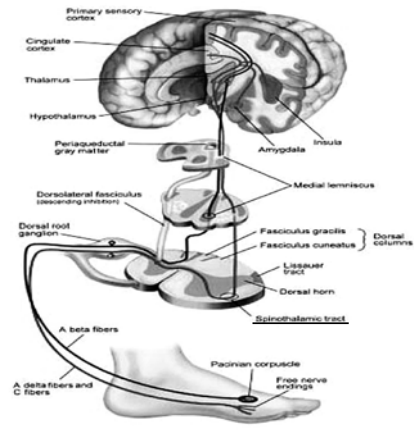
- Cardiovascular monitoring:
 - BP: NIBP, A-line
 - ECG: HR, rhythm
 - Cardiac performance: CO, CI, SV, SVI
 - Intravascular volume: CVP, PCWP
 - Vascular tonicity: systemic vascular resistance (SVR)
- Pulmonary function monitoring:
 - Minute ventilation: respiratory rate, tidal volume
 - Peak airway pressure
 - End-tidal CO₂
 - Tissue oxygenation: SpO₂, PaO₂, PaCO₂,

Monitoring in Anesthesia

- Consciousness monitoring:
 - HR, BP, respiration, pupil size/light reflex
 - MAC (minimal alveolar concentrations)
 - EEG, BIS, AEPI
- Body temperature
- Urine output
- Blood sugar
- Coagulation
- Blood loss volume
- Fluid intake-output balance
- Acid-base balance: pH, BE

Co-existing diseases

- Cardiovascular diseases:
 - Hypertension, hypotension, myocardial ischemia, arrhythmia
 - Congestive heart failure
- Lung diseases: COPD, Asthma, pneumonia
- CNS diseases: stroke
- Liver diseases: hepatitis, liver cirrhosis, fatty liver
- Kidney diseases: renal insufficiency, renal failure/hemodialysis
- Metabolic/Endocrine diseases: DM, hyperthyroidism, etc.
- Other diseases: Infection; coagulopathy; anemia



Post-op pain control

- Systemic opioids
 - Intravenous opioids: nurse-control, patient-control (PCA)
 - Intramuscular opioids
 - Subcutaneous opioids
- Systemic NSAIDs
 - Intravenous opioids: nurse-control, patient-control (PCA)
 - Intramuscular NSAIDs
- Intra-spinal opioids/local anesthetics
 - Epidural PCA
- Conduction block
 - Infusion of local anesthetics

Summary

- Introduction of dental anesthesiology
- Pharmacology of local anesthetic and Clinical Notes in Local Anesthesia
- Peri-op management of anesthesia
- General Anesthesia and Sedation
- Anesthesia and Co-existing Diseases
- ACLS and Airway Management
- ACLS
- Local Anesthesia In Dentistry
- 身心障礙者之門診麻醉 sedation in dentistry