

NON INVASIF VENTILATION (NIV)

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FKUI – RS Persahabatan

Ventilasi noninvasif → teknik ventilasi mekanik → tanpa memerlukan pipa trakea pada saluran napas

Ventilasi mekanik :

- **Invasif**
- **noninvasif**

INDIKASI VENTILASI NON INVASIF

- Peny. Paru kronik berat
- Hipoventilasi nokturnal → disfungsi saraf otot, abnormaliti dinding dada
- Penyakit paru obstruktif kronik
- Disfungsi diafragma
- Gagal napas akut
- Kondisi penderita → sulit penyapihan

Gagal napas kronik

- Memperbaiki parameter fisiologik
- Menurunkan tindakan intubasi
- Menurunkan komplikasi
- Menurunkan mortaliti
- Keuntungan pada PPOK → mengoreksi
hipoventilasi nokturnal → perbaikan
sensitiviti CO₂

GAGAL NAPAS KRONIK

- a. Tanda dan gejala distress pernapasan akut
- b. Gangguan pertukaran gas / AGD
 - PaCO₂
 - pH
 - PaO₂/FiO₂ <200
 - Sat O₂ <90%

FUNGSI PARU DAN SISTEM PERNAPASAN

Fungsi paru → bagian sistem respirasi,
pertukaran gas pada :

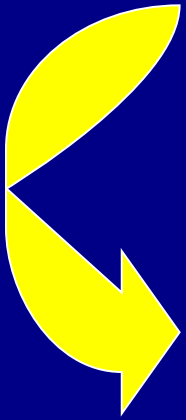
- Ventilasi
- Difusi
- Perfusi

Pertukaran O_2 dari luar tubuh & CO_2 dari dalam tubuh →

- Kerja mekanik otot-otot bantu napas
- Perubahan tekanan intrapleura & intra pulmoner

Inspirasi → diafragma turun & iga terangkat
→ akibat kontraksi :

- M. sternokleidomastoideus
- M. serratus
- M. skalenus
- M. interkostalin eksternus



Toraks membesar dari anteroposterior,
lateral & ventral

Peningkatan volume tersebut →

- Penurunan tekanan intrapleura – 4 mmHg
→ - 8 mmHg
- Penurunan tekanan intra pulmoner 0 mmHg
→ - 2 mmHg

Menyebabkan udara mengalir ke paru




Fungsi mekanik pergerakan udara masuk & keluar → ventilasi

Peningkatan PaCO_2 dan penurunan pH → merangsang ventilasi

Penurunan PaO_2 → merangsang kemoreseptor pusat pernapasan

Ventilasi tidak berjalan normal →
diperlukan bantuan ventilasi :

- Invasif
- Noninvasif



Ventilator mengambil alih pertukaran gas
diparu

Bantuan ventilasi memberikan udara dengan tekanan tertentu → ke dalam saluran napas → meningkatkan tekanan trasnpulmoner → inflasi paru

Ekspirasi terjadi karena :

- Elastik rekoil
- Otot-otot bantu napas

NIV

- VENTILASI TEKANAN NEGATIF
- VENTILASI TEKANAN POSITIF

VENTILASI TEKANAN NEGATIF

Memberikan tekanan negatif pada dinding toraks saat inspirasi

Alat yang digunakan: *Body ventilator*

anggota tubuh hingga batas leher dimasukkan dalam suatu chamber yang bertekanan negatif

Alat ini pertama kali diperkenalkan oleh John Dalziel pada tahun 1838

Beberapa penelitian menunjukkan pemberian *negative pressure* intermiten pada gagal napas kronik dan akut → tidak memberikan keuntungan

Negative pressure sudah tidak digunakan secara luas karena memberikan rasa tidak nyaman untuk pasien, efektifiti tidak adekuat, obstruksi jalan napas atas

VENTILASI TEKANAN POSITIF

Pemberian ventilasi tekanan positif →
membuat tekanan positif pada saluran napas
→ sehingga udara masuk ke paru

Ventilasi tekanan positif noninvasif melalui hidung atau sungkup muka → gagal napas atau kronik.

Penggunaan Noninvasif Positive Pressure Ventilation (NPPV) → tergantung sistem ventilator yang digunakan & dirancang sehingga efektif → nyaman oleh penderita → kebocoran udara dapat dikurangi

MODE VENTILASI NONINVASIF

- Ventilasi mekanik control (Controlled Mechanical Ventilation / CMV)
- Assit / Control Ventilation
- Assist Spontaneous breathing (pernapasan spontan yang dibantu)
- Continuous Positive Airway Pressure (CPAP)
- Bilevel pressure support
- Propostional Assist Ventilation (PAV)

Continuos Positive Airway Pressure (CPAP)

- Pasien gagal napas akut → mengoreksi hipokseミア
- Aliran generator → akan mempertahankan tekanan yang diinginkan melalui siklus pernapasan

Langkah Awal Pemakaian CPAP

- Gejala klinis, tanda vital, oksimetri, masker yang sesuai
→ menghindari kebocoran.
- Tekanan awal dimulai → tekanan rendah → bertahap ditingkatkan sampai:
 - toleransi pasien tercapai, penurunan skor sesak dan frekuensi napas

Tekanan diberikan mulai dari 5 cm H₂O

Bi Level Pressure Support (BiPAP)

Pressure support + CPAP → Bi level Pressure Support

BiPAP:

IPAP 3 – 5 cm H₂O

EPAP 10 – 15 cm H₂O

dinaikkan bertahap

Alat yang digunakan untuk mengalirkan udara (interface) :

- Keping mulut (mouthpiece)
- Sungkup hidung
- Sungkup oronasal dan sungkup muka penuh

Keping Mulut

- Penggunaan pada penyakit neuromuskular dinding dada, pasca bedah sulit ekstubasi
- Risiko yang mungkin terjadi
 - Pneumonia aspirasi
 - Perburukan maloklusi gigi
 - Gangguan otot temporo mandibula
 - Kebocoran udara melalui hidung dan mulut
- Digunakan tidak rutin



Sungkup hidung

- Berbentuk segitiga atau *coneshaped* → terbuat dari plastik
- Memberikan tekanan disekitar rongga hidung → iritasi kulit dan ulserasi
- Ukuran sungkup yang sesuai → mengurangi rasa tidak nyaman



Sungkup oronasal dan sungkup muka penuh

- Sungkup yang menutupi hidung, mulut dan sebagian wajah
- Pilihan terbaik untuk gagal napas akut yang berat
- Penurunan PaCO_2 lebih cepat → terjadi peningkatan VT dan ventilasi permenit
- Kebocoran udara → rendah



Tubing for Tracheostomy






KONTRA INDIKASI NIV

- Pembedahan saluran napas atas dan muka → luka bakar atau trauma
- Bedah gastrontestinal atas
- Sekret banyak
- Hipoksemia mengancam nyawa
- Confusio / agitasi

MONITORING

- Evaluasi klinis
- AGDA
- Saturasi oksigen
-  **Pemberian obat**
 - Fisioterapi
 - Makan

KESIMPULAN

- NIV → tehnik ventilasi mekanik tanpa memerlukan pipa trakea pada saluran napas
- NIV → memperbaiki parameter fisiologik, menurunkan komplikasi, intubasi, mortaliti
- Interface → keping mulut, sungkup hidung, sungkup oronasal dan sungkup muka penuh

TERIMA KASIH



Terima Kasih

Bilevel Accessories

Heat & Moisture Plus Bacterial Filter



24 hour use

NON INVASIVE VENTILATION (NIV)

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NIV

- Noninvasive ventilation → technique in mechanical ventilation → doesn't need ETT in airway
- Mechanical ventilation :
 - Invasive
 - Noninvasive

INDICATIONS OF NIV

- Severe chronic pulmonary disease
- Nocturnal hypoventilation → neuromuscular dysfunction, chest wall abnormality
- Chronic obstructive pulmonary disease
- Dysfunction of diaphragm
- Acute respiratory failure
- Patient's condition → difficulty in weaning

CHRONIC RESPIRATORY FAILURE

- Revise physiologic parameter
- Reduce intubation performed
- Reduce complication
- Reduce mortality
- Benefit in COPD → corrected nocturnal hypoventilation → revise CO₂ sensitivity

LUNG FUNCTION AND RESPIRATORY SYSTEM

- Lung function → part of respiratory system, gaseous exchanger in:
 - Ventilation
 - Diffusion
 - Perfusion

- Exchanges O_2 from outer body and CO_2 from inner body →
 - Mechanical work of accessory muscles and suprasternal
 - Change of intrapleura and intrapulmonar pressure

■ Inspiration → diaphragm decrease & costae increase → due to contractions of:

–M. sternocleidomastoideus

–M. serratus

–M. scalenus

–M. intercostales externus

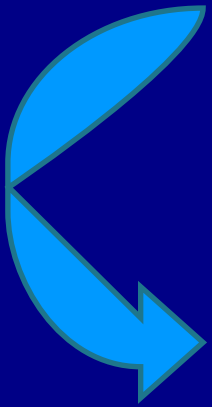


Thoracic space expanding from anteroposterior, lateral & ventral

- Mechanical function of air movement in and out → ventilation
- Increasing of CO₂ and decreasing of pH → stimulate ventilation
- Decreasing of PaO₂ → stimulate chemoreceptor of respiratory center

■ Ventilation not going along normally
→ need of ventilation support:

- Invasive
- Noninvasive



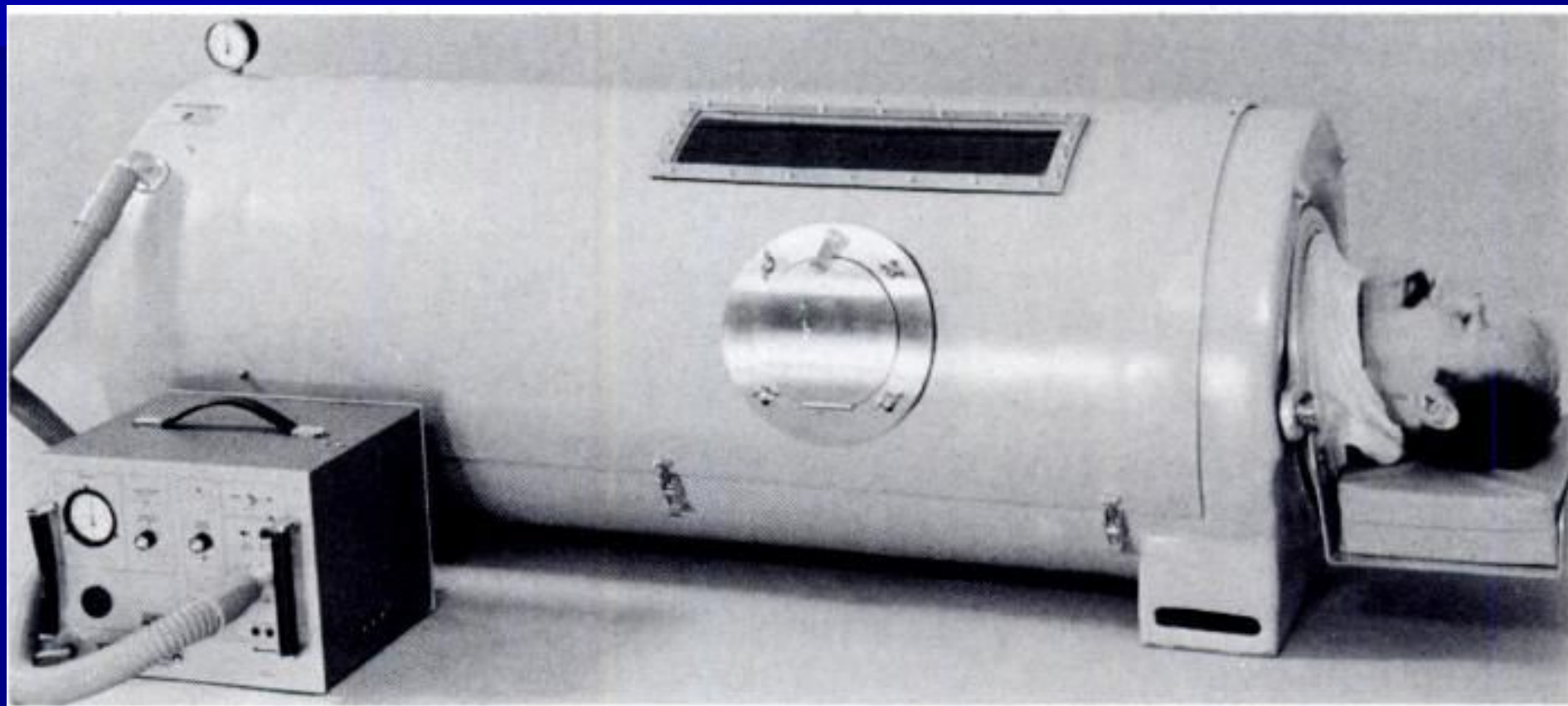
Ventilator replace gaseous
exchanger at the lung

- Ventilation support give air with certain pressure → into airway → increase transpulmonary pressure → lung inflated
- Expiration occur due to:
 - Elastic recoil
 - Accessory muscles

NEGATIVE PRESSURE VENTILATION

- Give negative pressure on the thoracic wall during inspiration
- Device in use : Body ventilator
 - Consists of a horizontal metal tank with side porthole
 - The body of the patient was enclosed in an iron box or cylinder and the patient's head protruded out of the end and negative pressure is generated
- First conceived by Dalziel in 1838

BODY VENTILATOR



Chest 1986;90;897-905

- Several studies shown giving the intermittent negative pressure in acute and chronic respiratory failure → no benefit
- Negative pressure has not use widely since it uncomfortable for the patients, inadequate effectively & cause upper obstruction airway

POSITIVE PRESSURE VENTILATION

- Giving ventilation positive pressure → generate positive pressure in airway → air into the lung
- Noninvasive positive pressure ventilation through the nose or face mask → respiratory failure or chronic

- Use of Noninvasive Positive Pressure Ventilation (NPPV) → depend on system of ventilator that use and program to become effective → comfortable to the patients → reduce leak

MODE OF NON INVASIVE VENTILATION

- Controlled Mechanical Ventilation (CMV)
- Assist/Control Ventilation
- Assist Spontaneous Breathing
- Continuous Positive Airway Pressure (CPAP)
- Bi-level Pressure Support
- Proportional Assist Ventilation (PAV)

CONTROLLED MECHANICAL VENTILATION

- Give support ventilation → no effort from the patients
- Inflate pressure, tidal volume, respiratory frequency → setting

ASSIST/CONTROL VENTILATION

- No effort to breath
- Like CMV → breathing is determine by volume setting
- Patient could breath → no machine inhibition but the machine controlled breathing

ASSISTED SPONTANEOUS BREATHING

- Spontaneous breathing → work of breath triggered at ventilator on or off
- Pressure setting → Pressure support
- Work of breath failed → no breathing controlled by machine

CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)

- Acute respiratory failure → corrected the hypoxemia
- Generator flow → maintained desired pressure through respiratory cycle

BI-LEVEL PRESSURE SUPPORT

- Pressure support + CPAP → Bi-level Pressure Support

PROPORTIONAL ASSIST VENTILATION (PAV)

- Alternative technique → flow or volume independently
- Repair patient's comfortable and repair compliance

INTERFACE DEVICE

- Mouthpiece
- Nose mask
- Oronasal mask
- Full mask

MOUTHPIECE

- Use for neuromuscular disease, post surgery that hard to extubation
- Risk may occur:
 - Aspirated pneumonia
 - Teeth malocclusion worsening
 - Temporo mandibula muscle disturbances
 - Air leak through nose and mouth
- Unroutine use

MOUTHPIECE



NOSE MASK

- Triangle shapes or cone shaped → plastic
- Giving pressure around nostril → irritated and ulceration the skin
- Fitting the mask size → reduce uncomfortable

NOSE MASK







NIV CONTRA INDICATIONS

- Upper airway surgery and face → combustion or trauma
- Upper gastrointestinal surgery
- Lot of secret
- Life threatening hypoxemia
- Confusion / agitated

MONITORING

- Clinical evaluation
- Blood gas analysis
 - 1-2 hour after performed
 - 4-6 hour after initial examination
 - No improvement → considering invasive ventilation
- Oxygen saturation
- NIV could rested during:
 - Give the medicine
 - Eat
- Before released → BGA or spirometry

USE OF NIV

- Acute respiratory failure
 - Hypoventilation → increasing of PaCO₂, hypoxemia
 - NPPV could be performed since at the ER
 - Reduce length of stay

SEVERE ACUTE ASTHMA

- At all severe acute asthma → face mask
NVVP → more effective → improvement of
blood gas analysis more quickly

SLEEP APNEA

- Alveolar hypoventilation → using Intermittent Positive Airway Pressure (IPAP, CPAP < Bi Level Posture Airway Pressure)