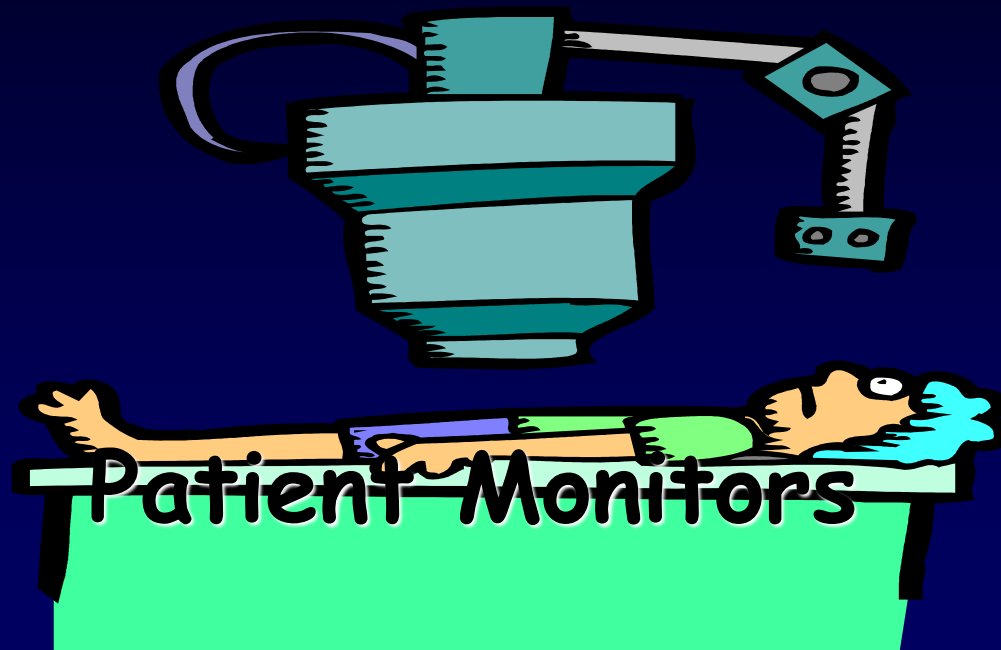


การเฝ้าระวังผู้ป่วย ในระหว่างให้ยาระงับความรู้สึก



ทำไมต้องมีการเฝ้าระวังผู้ป่วย ?



How to Monitor



Clinical monitoring

Equipment

Interpretation

Judgment

ASA standards for basic monitoring



Standard I

Qualified anesthesia personnel

Standard II

Adequate Oxygenation, Ventilation,
Circulation, Temperature

Oxygenation



Clinical monitoring

Pulse oximetry

Oxygen analyzer

Arterial blood gas

Clinical monitoring

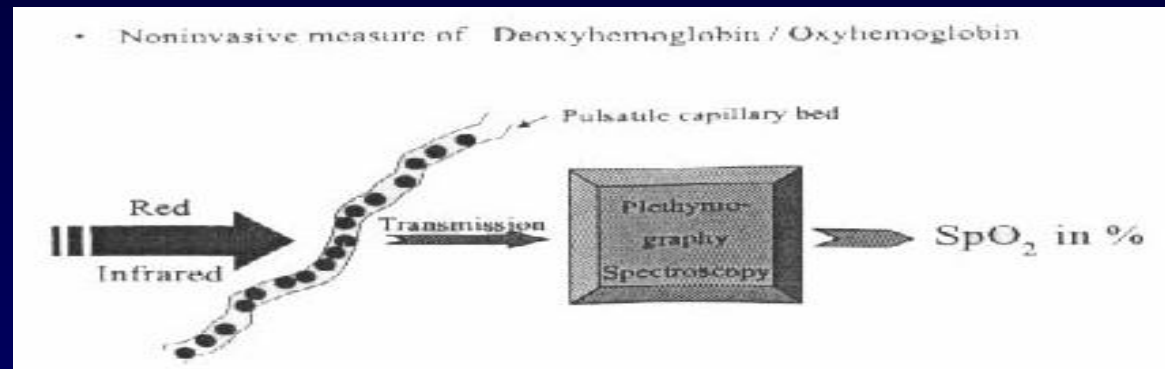
- สีของผิวหนัง, ริมฝีปาก, เล็บมือ
 - สีของเลือดในบริเวณผ่าตัด

Pulse Oximetry

หลักการ

HbO₂ → infrared light (960 nm)

Reduced Hb → red light (660 nm)

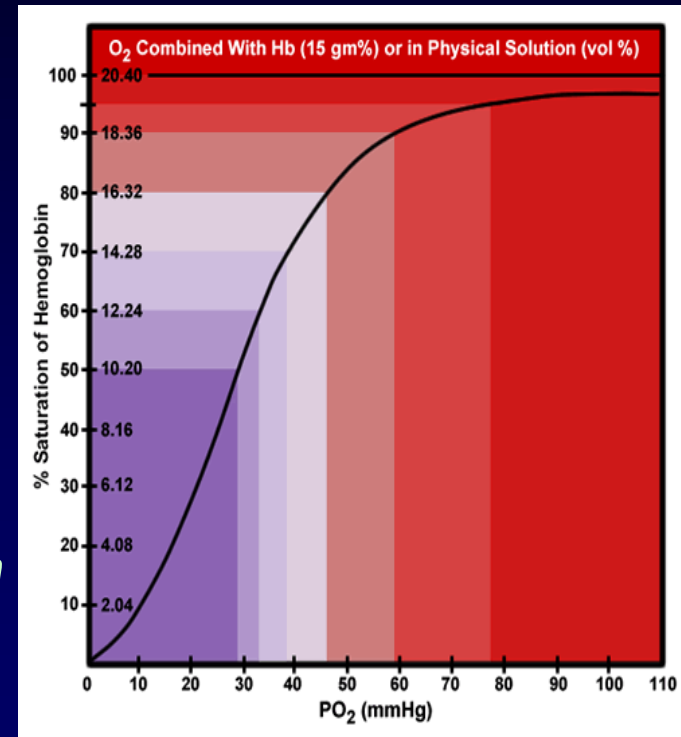


$$SaO_2 = \frac{HbO_2 \times 100}{HbO_2 + \text{Reduced Hb}}$$

Pulse Oximetry

ความสัมพันธ์ระหว่าง S_aO_2 กับ P_aO_2

S_aO_2	P_aO_2
90%	60 mmHg
95%	80 mmHg
97.5%	100 mmHg



Pulse Oximetry

ความสัมพันธ์ระหว่าง S_aO_2 กับ S_pO_2

S_pO_2 70-100%

S_aO_2 ต่างกัน $\pm 2-3\%$

$S_pO_2 < 80\% \rightarrow P_aO_2$

ข้อจำกัดของ pulse oximetry

Hypotension,
Hypothermia,
Vasoconstriction,
Venous pulsation,

Carboxyhemoglobin,
Methemoglobin,

ข้อจำกัดของ pulse oximetry

Methylene blue (85%),
Nail polish

Movement,
Shivering,
Ambient light,
Electrocautery

Ventilation



Clinical monitoring

Precordial stethoscope

Esophageal stethoscope

Volume measurement

Airway pressure

Capnography

Clinical monitoring



Pattern of ventilation

Chest movement

Reservoir bag

Breath sound

Airway pressure



High
pressure:

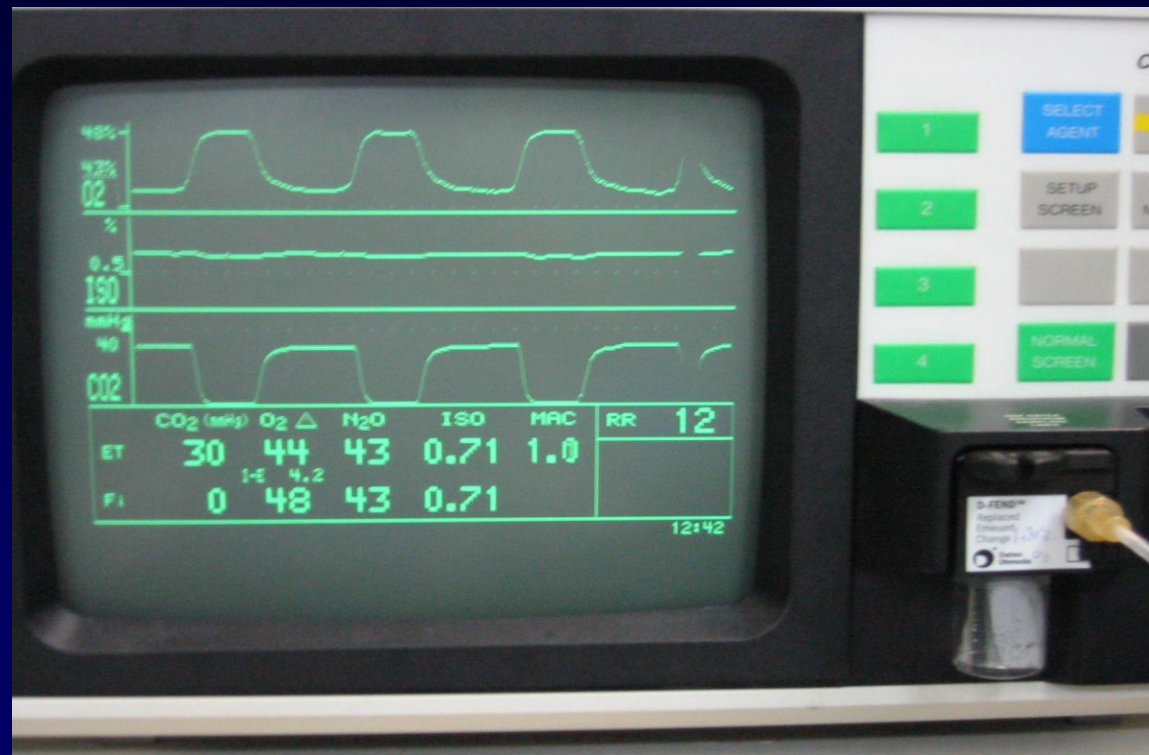
- Obstruction
- Pneumothorax
- Bronchospasm

Low
pressure:

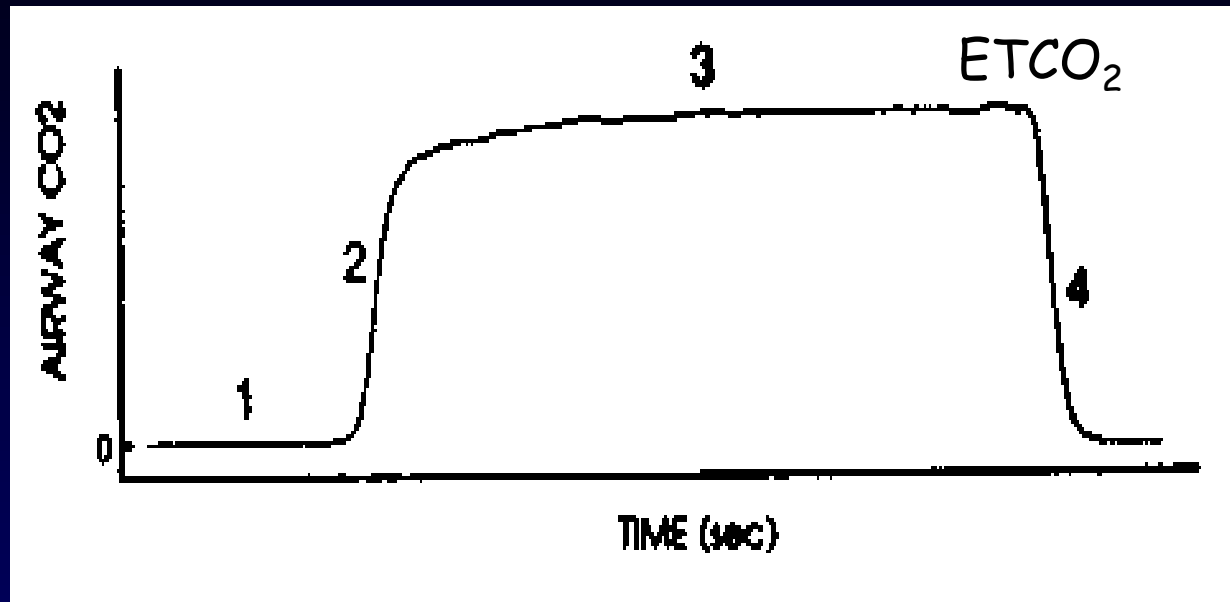
- Disconnection
- leak

Capnography

วัดความเข้มข้นของ CO_2 ในลมหายใจ



Capnography



$ETCO_2 < P_aCO_2$ 5 - 10 mmHg

Capnography



ประโยชน์

- ตำแหน่งของ ET tube
- ปรับเปลี่ยน ventilation
- Rebreathing, MH, emboli
- เต็ม relaxant

Circulation



Clinical monitoring

Blood pressure

Electrocardiography

Central venous pressure

Clinical monitoring



- Skin, lips, conjunctiva
- Pulse, Heart sound
- Capillary refill
- Warm / Cold extremities
- Blood loss
- Urine output

Arterial Blood pressure

SBP $\pm 20\%$ of normal BP

DBP > 40 mmHg

$$MAP = \frac{(SBP) + 2 (DBP)}{3}$$

> 70 mmHg

Arterial Blood pressure

ปัจจัยที่มีผลต่อ BP

Sampling site (ตำแหน่งที่วัด)

BP ขา > แขน 10-20 มม.ปรอท

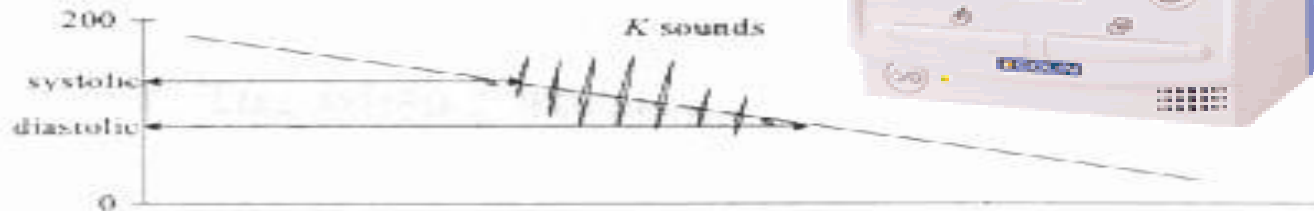
Peripheral vascular disease

Arterial Blood pressure

Non-invasive blood pressure (NIBP)



Auscultatory method



Oscillometric method



Non-invasive blood pressure

ขนาดของ cuff



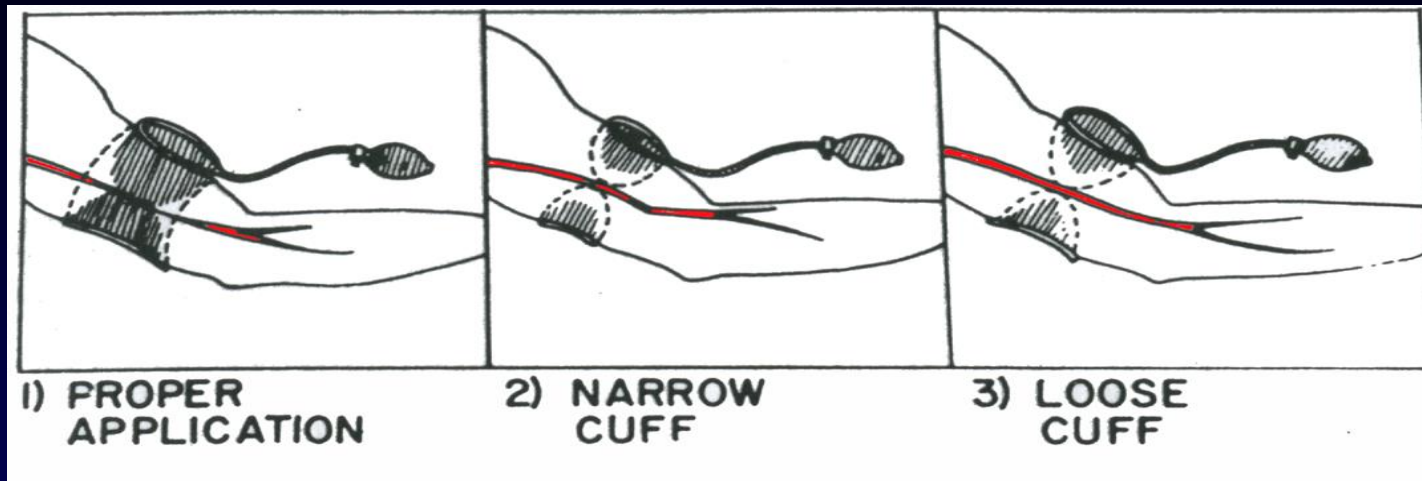
กว้าง $1/2 - 1/3$ ของเส้นรอบวง

หรือ $>20\%$ ของเส้นผ่าศูนย์กลาง

ของแขน/ขา

ยาว $>1/2$ ของเส้นรอบวงของแขน/ขา

Non-invasive blood pressure



Falsely high BP

too small / loose fitting cuff
extremity is below heart level

Non-invasive blood pressure

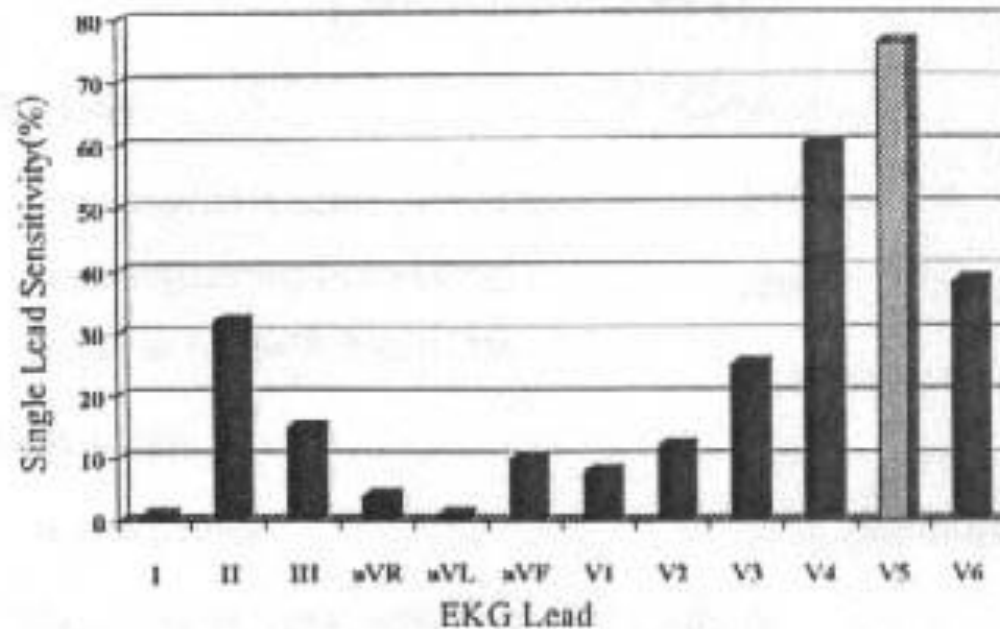
Falsely low BP

too large cuff

extremity is above heart level

following quick deflation

Electrocardiography



Lead V5 : most sensitive for detection anterior and lateral wall ischemia

Lead II : best monitoring P wave ----> Dx dysrhythmias

Electrocardiography

Lead II → Dysrhythmia
Inferior wall ischemia

Lead V_5 → Anterior & lateral
wall ischemia

Modified V_5 → CS_5 , CM_5 , (
Selector switch on Lead I)

Central venous pressure

- บอกถึง volume status ของร่างกาย
- เป็นแนวทางในการให้สารน้ำ
- ควรวัดในช่วง end-expiration
- ระดับศูนย์ตรงกับ midaxillary line

Central venous pressure



Low CVP

- Hypovolemia
- Increase venous capacitance

High CVP

- RV failure
- Pulmonary embolism
- Cardiac tamponade

Depth of anesthesia



- Response to command
- Perspiration & Lacrimation
- Pupillary response
- Ventilatory pattern
- Muscle tone & Movement

Neuromuscular blockade



Clinical monitoring

Peripheral nerve stimulator

tracheal intubation

incremental dose

reversal of NMB

depo./non-depolarizing block

Temperature



Hypothermia

- Dysrhythmia ($< 33^{\circ}$ VF)
- Coagulopathy
- Delayed awakening
- Postoperative shivering

Temperature



Hyperthermia

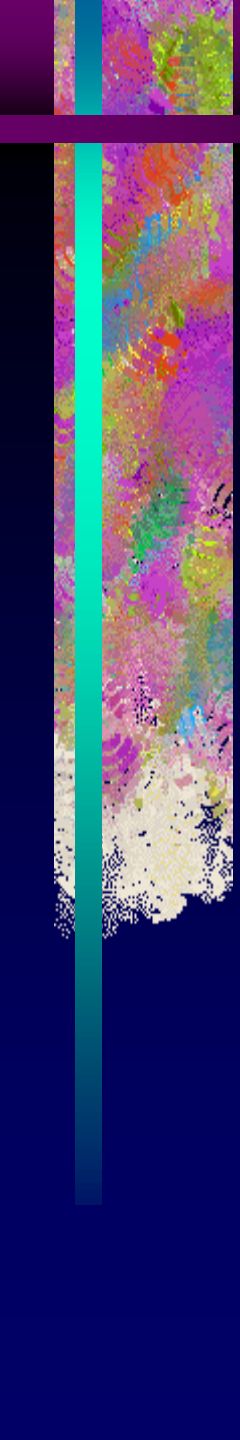
- Malignant hyperthermia
- Thyrotoxicosis
- Sepsis
- Over warming

Temperature

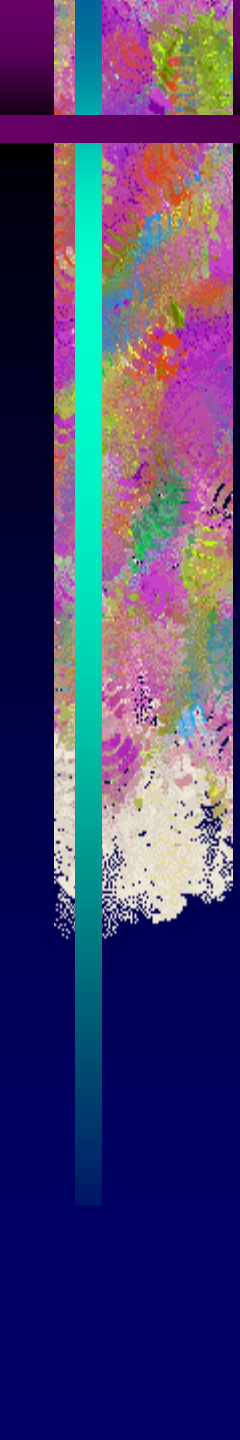


Core temperature

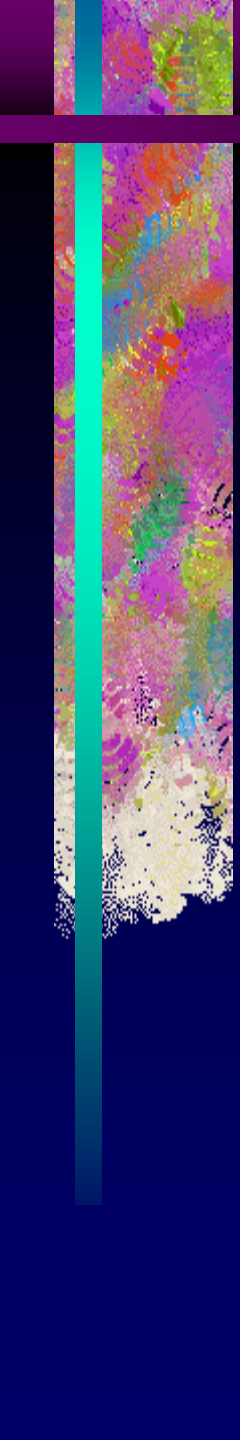
- Nasopharynx
- Tympanic membrane
- PA catheter
- Bladder
- Rectum



If there were
only one monitor,
which one
would you choose?

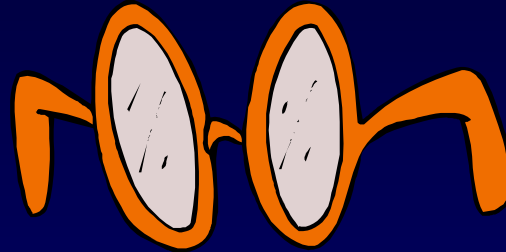


There is no reason
to practice anesthesia
with only one monitor,
but more monitoring
does not necessarily
lead to better care.



Don't let the monitors
divert you from
“hands-on and eyes-on
care of the patient
and
the surgical procedure”.

Do you monitor enough ?



Case Discussion (1)

A 45-year-old woman had a known history of diabetes for 30 years. Her diabetes was controlled with regular crytralline insulin, 35 units/day.

She was scheduled for emergency for tubo-ovarian abscess.

Blood glucose was 350 mg/dl.

What would you monitor this patient?

Case Discussion (1)

Essential monitors

- NIBP
- EKG
- Pulse oximeter
- Blood sugar
- Urine output

Non-essential monitors

- Et CO₂
- Temperature