Recognition and management of critically ill patient

Dr. Muddather A. Mohammed
Emergency physician
Introduction

• Many patients demonstrate concerning historical symptoms or physiologic signs hours before cardiopulmonary arrest.
• The objective of this lecture is to organize the approach of such patients.
introduction

• Approach to the critically ill Patient by “ABC, MOVIE” stands for:

Airway, Breathing, Circulation, Monitor, Oxygen, Vital Signs, IV, Exposure

• Should be first words to be remembered.
• THIS COMES BEFORE YOUR HISTORY and Complete physical exam. DESPITE WHAT THE BOOK SAYS
Airway

• is the patient protecting their away
  Hint: if they can talk to you, they are protecting and you can move on
• If unsure, ask a question
• If no response: Ask for help, assess for airway obstruction (foreign body, signs of stridor), noisy breathing, grunting, cyanosis remove foreign body
• Perform maneuvers as head tilt and chin lift or jaw thrust, use adjunct as oropharyngeal airway, LMA
• level of consciousness (GCS – “less than 8=intubate)
<table>
<thead>
<tr>
<th>Eye opening</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td>Response to verbal command</td>
<td>3</td>
</tr>
<tr>
<td>Response to pain</td>
<td>2</td>
</tr>
<tr>
<td>No eye opening</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Best verbal response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriented</td>
<td>5</td>
</tr>
<tr>
<td>Confused</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td>No verbal response</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Best motor response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Obey commands</td>
<td>6</td>
</tr>
<tr>
<td>Localizing response to pain</td>
<td>5</td>
</tr>
<tr>
<td>Withdrawal response to pain</td>
<td>4</td>
</tr>
<tr>
<td>Flexion to pain</td>
<td>3</td>
</tr>
<tr>
<td>Extension to pain</td>
<td>2</td>
</tr>
<tr>
<td>No motor response</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th></th>
</tr>
</thead>
</table>

The GCS is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters: best eye response (E), best verbal response (V), and best motor response (M). The components of the GCS should be recorded individually; for example, E2V3M4 results in a GCS score of 9. A score of 13 or higher correlates with mild brain injury; a score of 9 to 12 correlates with moderate injury; and a score of 8 or less represents severe brain injury.
Breathing

• (not your complete respiratory exam!)

• look, listen, feel. Use stethoscope.

• If they are talking, probably not a huge problem

• Look at symmetry, pattern, rate, use of accessory muscle of respiration.
Breathing Patterns

• Apnea – no breathing needs intubation and ambu-baging then may need ventilator.
• Bradypnea: sedative-hypnotics.
• Tachypnea: acidosis, sepsis.
• Cheyne-Stokes: apneas followed by hyperpneas that then decrease to apnea bihemispheric brain injury or brainstem injury.
• Kussmaul: rapid deep, breaths that typically seen in severe acidosis.
• For all give the appropriate oxygen support and treat the primary cause.
AMBU BAG
OXYGEN DELIVERY SYSTEMS

Device: Nasal Cannula
Flow: 1 - 6 L/min
FiO2: 25 - 40%
(~4% per L of flow)

Device: Face Mask
Flow: 5 - 10 L/min
FiO2: 40 - 60%

Device: Face Tent
Flow: 10 - 15 L/min
FiO2: ~40%

Device: Venturi Mask
Flow: 2 - 15 L/min
(based on valve)
FiO2: 24 - 60%
(precisely controlled)

Device: Non-Rebreather
Flow: 10 - 15 L/min
FiO2: 80 - 95%

Device: High Flow Nasal Cannula
Flow: up to 60 L/min
FiO2: 21 - 100%
Circulation

- Check pulse and blood pressure.
- Skin warmth, mottling
- Assess pulses for rate, volume, regularity, symmetry
- May relate to primary cardiovascular problem or secondary to metabolic issues, sepsis, hypoxemia, drugs
circulation

• If no pulse then --- CPR
• Check the rhythm on monitor and behave accordingly.
• IF there is pulse but in shock then 2 gauge 16 or 14 intravenous cannulae, start IV. fluid resuscitation and treat primary cause.
History

• Classically >90% diagnosis made on history
• In critically ill, patient may not give history! so take it from Collateral: nurses, care aides, family, friends, referral notes----.
History

- Rapid History: (SAMPLE)
  - Symptoms
  - Allergies
  - Medications
  - Past history
  - Last meal
  - Events surrounding
High risk patients

- Emergency admission - limited info
- Infants and young children
- Pregnant ladies.
- Advanced age – comorbidities, limited reserve
- Severe coexisting illnesses – mixed problems, limited reserve
- Recent major surgery
- Severe bleed, need for massive transfusion
- Deterioration on repeat assessment/fail to respond to treatment
- Immunodeficiency
- Combinations of above
Examination

• Re evaluation of vitals before examination.
• Head to toe examination
• Don’t forget the back
HEAD
- Inspect head-size, shape-still; upright; symmetric round; erect, medical no lesions; hard, smooth.

FACE
- Symmetry, features, expression, skin - tissues
- Temporal Artery
- Temporomandibular joint (have client open mouth)

ABLEND
- Heart rate
- Apical pulse
- Heart sounds
- LUBB, DUBB
- AORT

ABDOMEN
- Bowel sounds
- Inspect abdominal area - flat, distended, concave, convex
- Pupillary area in little circles along with percuss organs

LEG
- Edema

EYES
- Penile-pupils, equal, round, reactive, light, accommodation eyelids, eyelashes

NOSE
- External and internal nose: airflow

MOUTH
- Check teeth
- Check tongue
- Check gums
- Teeth, lips
- Moist pink mucous membrane

LUNGS
- Inhale, Exhale Phase
- Breath Sounds:
- Equality in Both Lungs:
- RR, Depth Character:
- Accessory Muscle Use

HANDS
- Check radial pulses
- Check capillary refill
- Check edema
- Check nail beds
- Shape
- Texture
- Color marking
- Dizziness

FEET
- Edema
- Check pedal pulses
- Check capillary refill
Basic Investigations

• CBC
• Blood sugar, electrolytes, urea, creatinine
• Cardiac markers
• Coagulation profile
• LACTATE
• CXR
• ECG
• OTHER INVESTIGATIONS ARE GUIDED BY HISTORY AND PHYSICAL EXAM
Put it all together
AND GIVE GOOD CARE TO YOUR PATIENT
LAB. CASE

- You are called to see a 65-year-old male WHO is disoriented, and has history of passage of Fresh bloody stool, his pulse is 130 bts/min, blood pressure 90/60 mmHg, O2 sat is 88%, respiratory rate is 20 br/min. GCS is 12/15. He has history of diabetes and hypertension.

1- Is this patient is critically ill and why?
2- How you will manage him?
DEFIBRILLATORS

Dr. Muddather A. Mohammed
Emergency physician
Objective

• To provide basic understanding about the Defibrillator Machine.

• understand the concept of the Defibrillator applications.

• perform and identify basic problems, errors and basic troubleshooting solutions.
Introduction

• Cardiac arrest occurs in more than 500,000 people annually in the United States
• Defibrillation is an important part of resuscitation that can change the outcome of this condition

Introduction

• Defibrillation: Defibrillation is a process in which an electronic device sends an electric shock to the heart to stop an extremely rapid, irregular heartbeat, and restore the normal heart rhythm.

• Defibrillator: A device that corrects an abnormal heart rhythm by delivering electrical shocks to restore a normal heartbeat.
## History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1899</td>
<td>Prevost and Batelli first introduced the concept of electrical fibrillation after noticing that large voltages applied across the animal's heart could convert ventricular fibrillation into a sinus rhythm.</td>
</tr>
<tr>
<td>1933</td>
<td>Hooker, Kouwenhoven and Langworthy published an account of successful alternating current (AC) internal animal defibrillation</td>
</tr>
<tr>
<td>1950s</td>
<td>Kouwenhoven was able to defibrillate dogs by applying the electrodes to the chest wall, that was the external electric defibrillator.</td>
</tr>
<tr>
<td>1956</td>
<td>Zoll defibrillated a human subject in the same manner.</td>
</tr>
</tbody>
</table>
## History

<table>
<thead>
<tr>
<th>Decade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s</td>
<td>Edmark and Lown et al found that direct current (DC) or pulse defibrillators were more effective and produced fewer side effects than AC defibrillator. The DC pulse waveform was further improved.</td>
</tr>
<tr>
<td>1970s</td>
<td>Experimental internal and external devices were designed to automatically detect ventricular fibrillation.</td>
</tr>
<tr>
<td>1980s</td>
<td>The first automatic internal defibrillator was implanted in human</td>
</tr>
<tr>
<td>Present times</td>
<td>A lot of improvements were introduced to the defibrillator with the aim of improving the survival rate of the cardiac arrested patient</td>
</tr>
</tbody>
</table>
Basics

Simplified schematic of defibrillator:

DC power supply (~5000 V)

Switch

Capacitor

Inductor

Patient impedance 50–150 Ω
Types

DEFIBRILLATOR

Manual

Automatic

EXTERNAL
INTERNAL
MONOPHASIC
BIPHASIC
CLASSIFICATION

• According to operation

1- Manual Defibrillator: Clinical expertise is needed to interpret the heart rhythm and decide whether to charge the defibrillator and deliver the shock to patient. Energy selection and delivery is given to the patient manually.
Manual defibrillator
2- Automated Defibrillator: These defibrillators are small, safe, simple and lightweight with two pads that can be applied to the patient. The defibrillator guides the operator step-by-step through a programmed protocol. It records and analyses the rhythm and instructs the user to deliver the shock using clear voice prompts, reinforced by displayed messages.
• According to site of application:
  1- External Defibrillator is the device which delivers the high energy shock to patients Heart externally on patient's chest by using a Defibrillator Paddle. The maximum energy deliver to the patient is about 360 Joules in Monophasic & 200 Joules in Biphasic Defibrillator.
External defibrillator
2- Internal defibrillator consist of sterilized internal Handle/Paddle through which shock is delivered directly to the heart.
Internal defibrillator

https://www.researchgate.net/publication/7024530_Emergency_department_thoracotomy_for_the_critically_injured_patient_Objectives_indications_and_outcomes
3-Implantable Cardioverter Defibrillator (ICD) If it detects an abnormally fast heart rhythm, it delivers a small electrical shock to the heart to convert the heart rhythm back to normal.
ICD
Out put wave form

Monophasic out put wave         biphasic out put wave
Joule

• It is the unit of energy delivered by the Defibrillator

• It means - “The energy released in one second by a current of one ampere through a resistance of one ohm”

• Also called as watt-second
The delivered energy is in the range of 50-360 joules and depends on:

- characteristics of patient
- patient’s disease
- duration of arrhythmia
- type of arrhythmia (more energy required for VF)
- type of the machine used
Lab 2
Electrodes in heart

Right atrium and ventricle

Implantable defibrillator inserted under skin
Defibrillator lect.2

Dr. Muddather A. Mohammed
Emergency physician
Areas of frequent defibrillator application

 Emergency department

 Anesthesiology

 Cardiology

 Operation theater

 Intensive care areas

 Ambulance services
STEPS OF USE AND APPLICATION
1. Manual Defibrillation (incase of shockable cardiac arrest rhythm)

- Switch 'ON' the Machine
- Wait for initialization and self test
- Make sure it is **NOT** in SYNC Mode
- Apply gel to the paddles
- Place them properly on the chest
...Cont

▪ Select 'ENERGY' to be delivered (energy in Joules)

▪ Press 'CHARGE' button

▪ Wait for Charging to complete. This is usually denoted by a continuous /long beep sound.

▪ Apply pressure to the paddles
...Cont

- Make sure that you and all the personnel are away from the patient
- Press both 'DISCHARGE' button simultaneously
- Observe patient and monitor ECG
- Resume CPR
- When finished, turn off and clean the paddles
2. Synchronization Mode (manual cardioversion for unstable tachyarrhythmia but with pulse)

- Wait for initialization and self test.
- Connect ECG leads.
- Select 'SYNC / CARDIOVERSION' mode.
- Check for sync marker on the QRS waveform.
- If possible sedate the patient and maintain airway.
Cont...

- Apply gel on the paddles and place it properly on chest.
- Select 'ENERGY' to be delivered (energy in Joules).
- Press 'CHARGE' button.
- Wait for the Charge to be completed. This is usually denoted by a continuous /long beep sound.
- Check that everybody and you is away from the patient.
- Press both 'DISCHARGE' button simultaneously and hold till energy is delivered.
Check patient condition and Heart rhythm

If required, cardiovert again

Monitor the patient

Switch off and clean the paddles
Steps in using AED

Step 1: Turn on the AED

Step 2: Attach electrodes
Attach defibrillation pads to the chest
1. Wipe the chest dry
2. Right side upper chest and left side lower chest

Step 3: Analyse rhythm
Push the analyse button

Step 4: Deliver the shock
If AED advises you to shock the person:
1. Make sure no one is touching the person
2. Tell everyone to stand clear
3. Push the 'shock' button
Paddle Placement

Anterior- Anterior

Place one paddle near the second or the third right sternal border and the other on the cardiac apex.
Paddle Placement

**Anterior-Posterior**

- One paddle on sternum and the other on the left infra-scapular region
Safety - General

- The Defibrillator generates High voltage. It must be operated by trained, professional and qualified personnel only.
- Never use defibrillator with improper grounding or electrical leak socket.
- Keep away the Defibrillator from any x-ray, Ultrasonic or other electronic instruments.
Cont.

- Check the patient lead wire, cable and paddles for any damage or mishandling, otherwise replace it immediately.

- Recommend using proper size and placement of recording paper.

- Clean the print head regularly for clear printout.
Cont.

- Don't use damaged patient cable.
- Confirm there is no ECG waveform because of electrical interference or defective patient cable. This may be misinterpreted as QRS in synchronize mode.
Safety - Defibrillation

- Excessive Gel can cause arcing of the current along the chest wall
- Defibrillation in the absence of an ECG rhythm to be avoided ('blind defibrillation')
\begin{itemize}
\item A shock can be accidentally delivered to other rescuers if no clear protocol followed.
\item If transthoracic impedance is high, a low energy shock (< 100 J) may fail to generate enough current to achieve successful defibrillation.
\end{itemize}
Alcohol should never be used as conducting material for paddles because serious burns can result.

Never discharge the Defibrillator in Air to check its performance.

Never discharge with paddles shorted.

Always clean the paddles after use.
The paddles used in the procedure should not be placed:
• on a woman's breasts
• over an internal pacemaker patients.

Before the paddle is used, a gel must be applied to the patient's skin
Skin burns from the defibrillator paddles are the most common complication of defibrillation.

Other risks include injury to the heart muscle, abnormal heart rhythms, and blood clots.
Cleaning the manual defibrillator

• Wash your hands and wear gloves
• Check the defibrillator for any damage.
• Clean and Disinfect all outside surfaces using isopropyl alcohol and be sure not to allow fluid into ports or battery connections.
• Remove gloves and wash hands.
• Check that the readiness indicator (battery charge) is showing green. Keep it in a clean, dry area.
TROUBLESHOOTING

• Attach the paddles if the monitor reads, "No paddles."

• Check to ensure that the leads are securely attached if the monitor reads, "No leads."

• Connect the unit to AC power if the message reads, "Low battery."
• Verify that the Energy Select control settings are correct if the defibrillator does not charge.

• Close the recorder door and the paper roll if the monitor message reads, "Check recorder".

Defibrillator Analyzer

Basic Functions

- Measures output energy
- Measures cardioversion delay time
- Simulates range of ECG waveforms
- Provides clinical training
E.C.G monitors attached to patient
Lect. I

Dr. Muddather A. Mohammed
Emergency physician
Introduction to the E.C.G

• 1924 - Noble prize – Einthoven for discovery of EKG
• It can provide evidence to support a diagnosis, but remember.....LOOK AT THE PATIENT NOT JUST THE PAPER or Monitor
• Is essential in the diagnosis of chest pain and abnormal heart rhythms
Principles of Electrocardiograph

- Electrocardiograph – is the instrument that records the electrical activity of the heart
- It works on the principle of Galvanometer
ECG MONITORING SYSTEMS

1. Three electrode monitoring system

2. Five electrode monitoring system

3. Ten electrode, twelve lead monitoring system.
Galvanometer
Basics of ECG Machine

ECG machine Block Diagram
CONDUCTION

1. SA Node
2. AV Node
3. Bundle of His
4. R/L Bundle Branches
5. Purkinje Fibers

SA Node
Internodal Pathway
AV Node
Bundle of His
Right Bundle Branch
Bachmann’s Bundle
Left Bundle Branch
Purkinje Fibers
Purkinje Fibers
ECG in relation to the conduction system
The heart at rest, no electrical activity, therefore no deflections from the isoelectric line. The SA node is building up to depolarize.
Threshold is reached and depolarization conducted through the atria. This produces a positive deflection.
As the atrium finishes depolarizing, the electrical impulse is channeled back to the AV node.

We call this first deflection the “P” wave and it denotes the depolarization of the atria.

The P wave, in a normal ECG is the first positive deflection off of the isoelectric line.
As the electrical charge travels through the AV node, there is no measurable electrical movement. Therefore the ECG tracing stays on the isoelectric line.

The PR interval is from the beginning of the “P” wave to the first deflection of the “QRS” complex. PRI should be between 0.12s – 0.20s.
QRS Complex

This complex is called the “QRS” complex and denotes the depolarization of the ventricles.

QRS complex - we see the depolarization travel through the ventricles.
The T wave after the QRS complex indicates the repolarization of the ventricles.
Segments and Intervals

- **Segment** – Straight line between waves
- **Interval** – wave + segment
ECG paper

• Specialty paper which imprints lines via a heated stylus
• Records at 25 mm/sec. (universal speed)
• Each manufacturer usually has its own style of paper
1 mV (10 mm high) reference pulse

One large 5 mm × 5 mm box represents 0.2 seconds (200 ms) time and 0.5 mV amplitude.

One small 1 mm × 1 mm block represents 40 ms time and 0.1 mV amplitude.
E.C.G monitors attached to patient
Lect. II

Dr. Muddather A. Mohammed
Emergency physician
ECG interpretation : step-by-step

• Rhythm
• Rate
• P – wave
• PR - interval
• QRS Complex
• ST Segment
• T wave
• Other ECG signs
1. ECG rhythm - usual rate between 60-100 bpm,
2. Every P wave must be followed by a QRS & every QRS is preceded by P wave.
3. P wave is upright in leads I and II
Irregular rhythm
Rate

lead II - rhythm strip. Look at number of large(squares) between 2 R waves

\[
\text{Rate} = \frac{300}{\text{number of BIG SQUARE between R-R}}
\]

This applied if the rhythm is regular
Rate = \frac{300}{3}

Rate = 100 \text{ beats/minute}
If irregular

- Count the number of R waves in a 6-second strip and multiply by 10. Not very accurate, used for a quick estimate.
P Wave

Depolarization of both atria

• Relationship b/w P & QRS - distinguish various arrhythmias

• Shape & duration of P - indicate atrial disease
P-WAVES PRESENT
(SINUS RHYTHM)
Abnormal p wave
PR INTERVAL

Onset of P wave to onset of QRS

- Normal = 0.12 - 2.0 sec
- Represents Atria to Ventricles conduction time

*Prolonged PR interval indicate AV block*
QRS COMPLEX

• Ventricular depolarization

• Normal duration = 0.08 - 0.12 sec

• ABNORMALITY Indicate ventricular disease
ST Segment

- Connects QRS complex & T wave
- should be on the iso-electrical line
Normal ST-segment
- “small to moderate” size +ve deflection wave after QRS complex

- It is $1/3^{rd}$ - $2/3^{rd}$ that of corresponding R wave
ECG Interpretation

Normal Sinus Rhythm

1. Heart rate 300/4 = 75 bpm ✓
2. Heart Rhythm regular ✓
3. P waves Present, upright, smooth, rounded, similar ✓
   P:QRS ratio 1:1 ✓
4. QRS complex 1.5 small boxes ✓
5. P-R interval 4 small boxes ✓

6. Normal ST segment
7. Normal T WAVE
QUESTIONS
E.C.G monitors attached to patient
Lect. III

Dr. Muddather A. Mohammed
Emergency physician
Normal Sinus Rhythm

Sinus node is the pacemaker, firing at a regular rate of 60 - 100 bpm. Each beat is conducted normally through to the ventricles.

**Regularity:** regular

**Rate:** 60-100 beats per minute

**P Wave:** uniform shape; one P wave for each QRS

**PRI:** .12-.20 seconds and constant

**QRS:** .08 to .12 seconds
Normal sinus rhythm
Sinus Bradycardia

Sinus node is the pacemaker, firing regularly at a rate of less than 60 times per minute. Each impulse is conducted normally through to the ventricles.

*Regularity:* The R-R intervals are constant; Rhythm is regular.

*Rate:* Atrial and Ventricular rates are equal; heart rate less than 60.

*P Wave:* Uniform P wave in front of every QRS.

*PRI:* PRI is between .12 -.20 and constant.

*QRS:* QRS is less than .12.
AV block
First Degree AV block

The only ABNORMAL finding is PR interval prolongation
SECOND DEGREE HEART BLOCK
Regularity: Irregular; the R-R interval gets shorter as the PRI gets longer.

Rate: Usually slower than normal

P Wave: Upright and uniform; some P waves are followed by QRS complexes.
PRI: Progressively lengthens until one P wave is blocked
QRS: QRS is less than .12
AV Block 2\textsuperscript{nd} Degree Type 2

\textit{Regularity}: If the conduction ratio is consistent, the R-R interval will be constant, and the rhythm will be regular. If the conduction ratio varies, the R-R will be irregular.

\textit{Rate}: bradycardia range

\textit{P Wave}: Upright and uniform; there are always more P waves than QRS complexes.

\textit{PRI}: PRI CONSTANT IN CONDUCTED BEATS

\textit{QRS}: QRS is less than .12
2nd Degree Heart Block

HEALTHY ECG

P-WAVE

PR INTERVAL

TYPE I

PR INTERVALS GRADUALLY ELONGATE UNTIL A P-WAVE IS COMPLETELY BLOCKED

TYPE II

PR INTERVALS are CONSISTENT, but SOME P-WAVES DON’T CONDUCT
Third Degree Heart Block

COMPLETE BLOCK BETWEEN ATRIA AND VENTRICLES

**Regularity:** Regular

**Rate:** Atrial rate is usually normal (60-100bpm); ventricular rate: 40-60 if the focus

**P Wave:** Upright and uniform; more p waves than QRS complexes.

**PRI:** No relationship between p waves and QRS complexes; p waves can occasionally be found superimposed on the QRS complex.

**QRS:** 12 seconds or greater if the focus is ventricular.
Asystole

The heart has lost its electrical activity. There is no electrical pacemaker to initiate electrical flow.

*Regularity:* Not measurable; there is no electrical activity.

*Rate:* Not measurable; there is no electrical activity.

*P Waves:* Not measurable; there is no electrical activity.

*PRI:* Not measurable; there is no electrical activity.

*QRS:* Not measurable; there is no electrical activity.
QUESTIONS
E.C.G monitors attached to patient
Lect. IV

Dr. Muddather A. Mohammed
Emergency physician
Normal Sinus Rhythm

Sinus node is the pacemaker, firing at a regular rate of 60 - 100 bpm. Each beat is conducted normally through to the ventricles.

*Regularity:* regular

*Rate:* 60-100 beats per minute

*P Wave:* uniform shape; one P wave for each QRS

*PRI:* .12-.20 seconds and constant

*QRS:* .04 to .1 seconds
Sinus node is the pacemaker, firing regularly at a rate of greater than 100 times per minute. Each impulse is conducted normally through to the ventricles.

*Regularly:* The R-R intervals are constant; Rhythm is regular

*Rate:* Heart rate greater than 100

*P Wave:* Uniform P wave in front of every QRS

*PRI:* PRI is between .12 -.20 and constant

*QRS:* Less is than .12
Atrial ectopic focus, a PAC (early beat). The signal originates from the atria.
Atrial Ectopic
Atrial fibrillation
SUPRAVENTRICULAR TACHYCARDIA
Atrial Fibrillation

The atria are so irritable that a multitude of foci initiate impulses, causing the atria to depolarize repeatedly in a fibrillatory manner. The AV node blocks most of the impulses, allowing only a limited number through to the ventricles.

*Regularity: irregular irregularity*

*P Wave:* In this arrhythmia the atria are not depolarizing in an effective way; instead, they are fibrillating. Thus, no P wave is produced.
Ventricular ectopic
Ventricular Ectopic
bigeminy
VENTRICULAR TACHYCARDIA
Ventricular Tachycardia

An irritable focus in the ventricles fires regularly at a rate of 150-250 beats per minute to override higher sites for control of the heart.

**Regularity:** This rhythm is usually regular,

**Rate:** rate range is 150-250 beats per minute.

**P Wave:** None of the QRS complexes will be preceded by P waves

**PRI:** Since the rhythm originates in the ventricles, there will be no PRI.

**QRS:** The QRS complexes will be wide, It is often difficult to differentiate between the QRS and the T wave.
VENTRICULAR TACHYCARDIA
Ventricular Fibrillation

Multiple foci in the ventricles become irritable and generate uncoordinated, chaotic impulses that cause the heart to fibrillate rather than contract.

**Regularity:** There are no waves or complexes that can be analyzed to determine regularity. The baseline is totally chaotic.

**Rate:** The rate cannot be determined since there are no discernible waves or complexes to measure.

**P Wave:** There are no discernible P waves.

**PRI:** There is no PRI.

**QRS:** There are no discernible QRS complexes.
ECG Changes: Ischemia

T-wave inversion (flipped T)
ST segment depression

Diagram showing normal T waves, inverted T waves, and depressed ST segment.
ECG Changes: Infraction

ST segment elevation of greater than 1mm in at least 2 contiguous leads
Heightened or peaked T waves
Deep Q-Wave
Aims and classification of patient monitoring.

Dr. Muddather A. Mohammed
Emergency physician
Introduction

• Monitor is a Latin word “monere” which means “to warn”

• monitoring is the observation of one or several medical parameters over time. It can be performed by continuously measuring certain parameters directly or by using a medical monitor.
Aim of Patient Monitoring

• The aim of patient monitoring is to give warning of early dangerous deterioration, so early treatment is given and complications are avoided.
Monitor parts

• Any monitor consists of following MAIN OR ESSENTIAL parts:
  
1) Sensor.
2) System for data collection and translation.
3) Display system

In addition to

1) System for interpretation.
2) Recording system
3) Alarm system
4) Wireless communication links
Classes of monitoring according to the level of device intervention.

<table>
<thead>
<tr>
<th>Class</th>
<th>sensor</th>
<th>data collect.</th>
<th>interpret.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Human</td>
<td>Human</td>
<td>Human</td>
</tr>
<tr>
<td>II</td>
<td>Device</td>
<td>Human</td>
<td>Human</td>
</tr>
<tr>
<td>III</td>
<td>Device</td>
<td>Device</td>
<td>Human</td>
</tr>
<tr>
<td>IV</td>
<td>Device</td>
<td>Device</td>
<td>Device</td>
</tr>
</tbody>
</table>
Invasiveness of monitoring devices

1. Non invasive e.g, ECG monitor, pulse oximeter
2. Invasive e.g, arterial line, central venous line
3. Highly invasive intracranial pressure monitoring.
Types of monitors according to parameters measured

1. Single parameter monitors
2. Multi parameters monitors
How to select monitor?

- **Depend on the following factors:**
  1) Aim.
  2) Experience.
  3) Type of anesthesia.
  4) Facilities & availability.
  5) Nature of surgery.
  6) Condition of the patient.
Main physiological parameters to be monitored in the ICU

1- ECG
2- Respiration e.g. O2 saturation
3- blood pressure
4- temperature.
Limitation of monitoring

- Delay.
- Danger.
- Decreased skill.
- Doubt of results.
- Distracting set up.
Questions
Oxygen Regulators

Dr. Muddather A. Mohammed
Emergency physician
**Oxygen Therapy**

**Definition:**

- **Oxygen** is a colorless, odorless, tasteless gas that is essential for the body to function properly and to survive.

- **Oxygen therapy** is the administration of oxygen at a concentration of pressure greater than that found in the environmental atmosphere.

- The air that we breathe contain approximately **21% oxygen**.
Purpose

- The body is constantly taking in oxygen and releasing carbon dioxide.

- If this process is inadequate, oxygen levels in the blood decrease, and the patient may need supplemental oxygen.

- The purpose is to increase oxygen saturation in tissues where the saturation levels are too low due to illness or injury.
INDICATIONS:

- ACUTE RESPIRATORY FAILURE
- ACUTE MYOCARDIAL INFARCTION
- CARDIAC FAILURE
- SHOCK
- HYPERMETABOLIC STATE INDUCED BY TRAUMA, BURNS OR SEPSIS
- ANAEMIA
- CYANIDE POISONING
- DURING CPR
- DURING ANAESTHESIA FOR SURGERY
OXYGEN – A PRESCRIBED DRUG

- MUST BE WRITTEN LEGIBLY BY THE DOCTOR
- PRESCRIPTION SHOULD BE DATED BY THE DOCTOR
- DOCTOR MUST INDICATE DURATION OF O2 THERAPY
- THE O2 % CONCENTRATION MUST BE PRESCRIBED
- THE FLOW RATE MUST BE PRESCRIBED
Sources of oxygen:

1- Oxygen cylinder

2- Oxygen wall outlet
• The “**Oxygen cylinder System**” is mainly composed of the oxygen cylinder and the oxygen regulator.

• Some important parts are:
• **Oxygen cylinder** – is a heavy metal cylinder that keeps the oxygen under pressure.
1- **Using oxygen cylinders:**

- The *oxygen* cylinder is delivered with a protective cap to prevent accidental force against the cylinder outlet.

- To release *oxygen* safety and at a desirable rate, a regulator is used.
Oxygen cylinder regulator
Oxygen cylinder regulator

- A reduction gauge that shows the amount of oxygen in the tank.

- A flow meter that regulates the control of oxygen in liters per minutes.

- Oxygen is moistened by passing it through a humidifier to prevent the mucous membranes of the respiratory tree from becoming dry.
Oxygen key
2- Wall – outlet oxygen:

• The oxygen is supplied from a central source through a pipeline.

• Only a flow meter and a humidifier are required.
Oxygen wall outlet
Flow gauge regulators

- Flow gauge regulators are pressure-reducing device that can depressurize the high-pressure gas in the cylinder
The flow gauge regulator has two dials that show gas flow and inlet pressure. It can maintain a stable outlet pressure under changing operating conditions of input pressure and output flow. Flow gauge regulator suitable high pressure, usually applying to anesthesia apparatus, respirator, and other medical gas equipment.
OXYGEN SAFETY PRECAUTIONS

Also, follow these guidelines:

■ Do not stand oxygen cylinders upright unless they are well secured. If the cylinder falls, the regulator or valve could become damaged or cause injury due to the intense pressure in the tank.

■ Do not use oxygen around flames or sparks, including smoking materials such as cigarettes, cigars and pipes. Oxygen causes fire to burn more rapidly and intensely.

■ If defibrillating, make sure that no one is touching or is in contact with the victim or the resuscitation equipment.

■ Do not use grease, oil or petroleum products to lubricate or clean the regulator. This could cause an explosion.

■ Do not drag or roll cylinders.

■ Do not carry a cylinder by the valve or regulator.
Questions ???
Monitoring and records in critically ill patient

Dr. Muddather A. Mohammed
Emergency physician
The accurate measurement of physiological observations is essential in detecting the deteriorating patient and reducing adverse events.

- All patients in acute care settings should have observations performed

- Observations should at least the following:
  - *Respiratory rate*
  - *Oxygen saturation*
  - *Heart rate*
  - *Blood pressure*
  - *Temperature*
  - *Level of consciousness*
Introduction

• Frequency of observations should be consistent with the condition of the patient, but at least once every 8 hours and documented in the monitoring plan, AND can be changed according to patient condition.

• Observation charts should display observations in graphic format
Common sings of deterioration

- Change in respiration (Rate or character)
- Change in heart rate (Brady or tachycardia)
- Decreased oxygen saturation.
- Change in blood pressure.
- Change in temperature.
- Altered level of consciousness.
**ADULT OBSERVATION CHART**
**EARLY WARNING SYSTEM (EWS)**

<table>
<thead>
<tr>
<th>Ward:</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>MET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DATE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TEMPERATURE X</strong></td>
<td>&lt;38.5</td>
<td>38.5</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td><strong>SYSTOLIC B/P ONLY V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PULSE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RR / MIN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SpO2%</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OXYGEN MODE**

- Unmonitored
- Low flow
- High flow
- Non-rebreather
- Ventilator

**PAIN SCORE** 0-10
- Alert
- Responds to voice
- Unresponsive

**EARLY WARNING SYSTEM SCORE**

- Temperature Score
- Systolic BP Score
- Pulse Score
- RR Score
- SpO2% Score
- AVPU Score
- EWMS Total Score

**INFORM**
- Medical review within 30 minutes and if after hours, inform CNS.

**ALERTED EWS**

- Total score 1-3: Inform shift coordinator and repeat observations in one hour.
- Total score 4-8: Medical review within 30 minutes and if after hours, inform CNS.
- Total score ≥ 7: 1 parameter in red box, met call.

**ALTED EWS**

- Mark as altered if meeting criteria.
Monitoring of respiratory function

• Important definitions:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnoea</td>
<td>Difficulty in breathing</td>
</tr>
<tr>
<td>Orthopnoea</td>
<td>Dyspnoea necessitating an upright, sitting position for its relief</td>
</tr>
<tr>
<td>Tachypnoea</td>
<td>Abnormally rapid rate of breathing (&gt;20 per minute)</td>
</tr>
<tr>
<td>Bradypnoea</td>
<td>Abnormally slow rate of breathing (&lt;12 per minute)</td>
</tr>
<tr>
<td>Hypoxia</td>
<td>Inadequate oxygen at cellular level</td>
</tr>
</tbody>
</table>
Assessment of ventilation adequacy

Hypoxaemia can affect the following:

- **Heart rate**: initially tachycardia (a non-specific sign), but severe hypoxaemia can cause bradycardia.

- **Skin colour**: initially pallor; hypoxia causes catecholamine release and vasoconstriction; central cyanosis is a late and often pre-terminal sign of hypoxaemia (if the patient is anaemic, severe hypoxaemia may not cause cyanosis).

- **Mental status**: agitation (an early sign), drowsiness, confusion and impaired consciousness at later stage.
PULSE OXIMETRY

• **Definition:**
It is a simple, non-invasive bedside method of measuring arterial oxygen saturation in peripheral blood vessels, expressed as $\text{SpO}_2$. It measures the extent to which haemoglobin is saturated with oxygen.
PULSE OXIMETRY

• The pulse oximeter probe consists of two light-emitting diodes (one red and one infrared) on one side of the probe. These emit red and infrared light via a relatively translucent area of the body.

• Then it detect the amount of light passing through the capillary bed. The ratio of infrared light absorbed by oxyhaemoglobin and the red light absorbed by haemoglobin provides the data used to calculate the SpO2.
Normal values for oxygen saturation

• Oxygen saturation targets in the acutely ill patient should be 94–98% or 88–92% in those patients at risk of hypercapnia, e.g. COPD. Lower levels sometimes accepted in certain clinical conditions
Procedure for pulse oximetry

The following preliminary points should be observed:

- Wash and dry hands
- Ensure that the probe is clean
- Remove nail varnish or artificial nails
- Explain the procedure to the patient.

Select an appropriate site: bed. These include finger (most popular), ear lobe, toe.
Apply the probe without pressure and take the reading when you have the pulse oximetry wave form.
Pulse oximeter waveform

- Normal Signal
- Low Perfusion
- Noise Artifact
- Motion Artifact
Cardiovascular monitoring

ECG MONITORING

- Electrocardiograph (ECG) monitoring is one of the most valuable diagnostic tools in modern medicine. It is essential if disorders of the cardiac rhythm are to be recognised, and can help with diagnosis and alert health-care staff to changes in a patient’s condition.

- Details of ECG abnormalities are already discussed in previous lectures.
Cardiovascular monitoring

ECG monitoring Procedure:

* Explain the procedure to the patient.
* Ensure adequate skin preparation.
* Use ECG electrodes that are in date, with moist gel sponge.
* Position ECG electrodes and select monitoring lead
* Set cardiac monitor alarms according to the patient’s clinical condition.
* Ensure that the ECG trace is accurate.
* Ensure that the cardiac monitor is visible to the staff.
Arterial blood pressure measurements

- Arterial blood pressure (ABP) is the force exerted by the circulating volume of blood on the walls of the arteries.
- Changes in cardiac output or peripheral resistance can affect the blood pressure. A patient with a low cardiac output can maintain a normal blood pressure by vasoconstriction, whereas a patient who is vasodilated may be hypotensive despite a high cardiac output, e.g. in sepsis.
Factors affecting accuracy of blood pressure measurements

- *Cuff width*: if this is too narrow the blood pressure reading will be falsely high whereas if it is too wide it will be falsely low.
- *Position of the arm*: the arm should be supported in a horizontal position at the level of the heart.
- *Deflating the cuff too quickly*: cuff should be deflated at 2–3 mm/beat.
CENTRAL VENOUS PRESSURE MONITORING

- Central venous pressure reflects right atrial filling pressure and aids assessment of right intraventricular volume and right side heart function.
- The normal CVP is 8–12 mmHg.
- A low CVP reading usually indicates hypovolaemia whereas a high CVP reading has a number of causes, including hypervolaemia, cardiac failure and pulmonary embolism.
CVP monitoring old and new method

SCALE

TRNSDUCER
Complications of Central venous line

- Malposition of the catheter or wire
- Carotid artery puncture
- Pneumothorax.
- Haemorrhage
- Infection
- Air embolus.
- Thrombosis
- Ventricular injury
- Cardiac arrhythmias
Neurological function monitoring

- Glasgow coma scale.
- Pupil shape, size, symmetry, and reaction to light.
- Intracranial pressure monitoring.

Use neuro-observation chart.
# Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Eye Opening</th>
<th>Verbal Response</th>
<th>Motor Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spontaneous</strong></td>
<td>Orientated</td>
<td>Obey commands</td>
</tr>
<tr>
<td>To sound</td>
<td>Confused</td>
<td>Localising</td>
</tr>
<tr>
<td>To pressure</td>
<td>Words</td>
<td>Normal flexion</td>
</tr>
<tr>
<td>None</td>
<td>Sounds</td>
<td>Abnormal flexion</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>Extension</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**Glasgow Coma Scale Score**

- **Mild** 13-15
- **Moderate** 9-12
- **Severe** 3-8
<table>
<thead>
<tr>
<th>NEUROLOGICAL OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GLASGOW COMA SCALE (GCS)</strong></td>
</tr>
<tr>
<td><strong>DATE:</strong></td>
</tr>
<tr>
<td><strong>TIME:</strong></td>
</tr>
<tr>
<td>EYES OPEN</td>
</tr>
<tr>
<td>RECORD OBSCURITY SERIES OF DOTS OR AS ASSIGNED</td>
</tr>
<tr>
<td>EYES CLOSED BY</td>
</tr>
<tr>
<td>DAVELISH = D</td>
</tr>
<tr>
<td><strong>BEST VERbal RESPONSE</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>ENDOTRACHEAL TUBE OR TRACHEOSTOMY = T</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CIRCLE SIZE INDICATE R + L</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>PUPIL SCALE</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

**Family Name:**

**Given Names:**

**Date of Birth:**

**Sex:**

**Room No:**

**Age:**

**Unit Record Number:**

**OR USE LABEL**
INTRACRANIAL PRESSURE MONITOR
THANK YOU
Monitors in central monitoring station

Dr. Muddather A. Mohammed
Emergency physician
Agenda

• Definition
• Components
• Capabilities.
• Functions.
Central monitoring station system definition

• The central monitoring station system is a smart monitoring management system that connects a series of patient monitors together and back to a central monitor and even to hospital system.
Components

• It consists of multiple bedside multi-parameter patient monitors connected via connecting cables or wireless connection to central nursing station and can be also connected to hospital server system.

• All parameters of the patients monitors can be displaced on the central station allowing real-time observation of patient parameters. In waveform and numbers.
Central monitoring station system capabilities

• It has the capacity to connect number of bedside units together which means that members of icu can complete a ward check at a glance with patients real time data displayed at central station.

• Medical staff can review up to 240 hours of patient data.

• It has a user friendly Windows style interface which is supported by a networking system with wire or wireless networking.
Central monitoring station system capabilities

• It also has the feature of data transfer to the hospital's clinical information system.
• makes information accessible through WorkStations, ViewStations, PC’s (CMS Viewer) and even smartphones (MobileViewer)
Functions of central monitoring station system

• Provides 240 hours of waveforms and trend data

• An entirely scalable solution with a variety of functions and display setups. Workstations allow users to view, edit, and interact with networked patient monitors.

• With CMS Viewer, clinicians can remotely access patient data from any PC or laptop.

• Real-time patient data can be viewed on a smartphone (iOS or Android) with the CMS Mobile app.

• Capability of activation of alarm display and record.
Functions of central monitoring station system

• Provides continuous real-time access and surveillance to patient monitoring data.
• Safe and secure central data store

• Up to 48-hour backup mechanism guarantees no loss of patient data.

• One CMS server supports up to 32 workstations, up to 128 monitoring devices.
THANK YOU
Monitors in central monitoring station II

Dr. Muddather A. Mohammed
Emergency physician
Display

• The main screen has three areas. At the top of the screen is the area displaying the system prompt information.
• The middle part is the main monitoring area.
• The bottom part is the system menu area.

Then different screens can be displayed according to the need
Drug Calculation

From the **Drug** drop-down list, you can select one to calculate its amount, liquid volume, concentration, etc.

- Drug A
- Drug B
- Drug C
- Drug D
- Drug E
- EPINEPHRINE
- HEPARIN
- ISUPREL
- LIDOCAINE
- NIPRIDE

Drug A, Drug B, Drug C, Drug D and Drug E are user-defined drugs.

The calculation procedure is listed below:

1. Confirm whether the patient type is correct and the weight is entered.
2. Select a drug to be calculated from the drug list.
3. Input correct parameter values under the direction of a doctor.
4. Select **Basic, Dose Type** and **Step** for titration table.
5. Click on the **Calc** button, the calculation result will be displayed in the drug parameter area and titration table.
Maintenance and safety

1- Read the manual prior to using the system.

2- The system should be used within temperature from +5°C to +40°C.

3- Keep the environment clean. Avoid vibration. Keep it far from corrosive reagents, dust areas, high-temperature and humid environment.
4- The user must check that the equipment, cables and transducers do not have visible evidence of damage that may affect patient safety or monitoring capability before use.

The recommended inspection interval is **once per week or less**. If damage is evident, replacement is recommended before using it.

5 - Turn off the system power before connecting or disconnecting any accessory to the system

6- do not operate the system if it is not operating normally or requires service.
7- Turn off the system power and remove the power cable before maintaining the system.

8- Preventive maintenance of the system including periodic cleaning and appearance checking can be finished by the user because this maintenance does not touch the interior.
9- Avoid using corrosive material to clean. Removing all dust from the exterior surface of the equipment with a soft cloth, slightly dampened with a mild detergent solution or cool disinfecter.

10- Avoid pouring liquids on the equipment while cleaning, and do not immerse any parts of the equipment into any liquids.
Alarm system and devices

Dr. Muddather A. Mohammed
Emergency physician
Introduction

• “One needs only to step onto any busy hospital unit to hear a cacophony of alarms. Alarms that are deactivated or ignored are a serious concern and have resulted in patient deaths. We need an interdisciplinary approach that addresses both false and non-actionable alarms to restore a safe care environment.”

Marjorie Funk, PhD, RN, FAHA, FAAN
Professor, Yale University School of Nursing
Definition of alarm

• English (‘to arms!’): from Old Frenchalarme, from Italian allarme, ‘to arms!’, to call for help.
• Medical alarm is a warning signal such as a loud noise or flashing light that gets your immediate attention
• Alarm system or device is the device that produces the alarm signal visual or audio or both.
Nurse call system

• Definition

It is a system that allow a patient to call or contact nursing staff and enables healthcare professionals to provide exceptional care.
Nurse call system

- It consists of
  1- Patient room devices as:
     bedside call station
     pillow speaker
     Call cord
     Bathroom station
     Code station
Nurse call system

2- Dome Light/Corridor Light

- The dome light is typically located outside of patient site.
- The dome light alerts staff to the correct location of where the call’s response.
- These lights use multi-colored LEDs to communicate a variety of different information to indicate the type of caregiver needed in the room.
Nurse call system

3- Nurse Console

• The nurse console is typically located at the local nursing station.
• The console receives all calls that are placed within the ward.
• It demonstrate patients needs as well as allowing staff to start workflows in organized manner.
Nurse call system
Medical devices alarms

Aim of medical devices alarms

- Alarms are intended to call the attention of caregivers to patient or device conditions that deviate from a predetermined ‘normal’ status.
Major sources of alarms

Types of clinical devices that alarm

- Ventilators: 46%
- Pulse Oximeter/Patient Monitor: 36%
- Infusion Pumps: 12%
- Feeding Pump: 3%
- Other: 3%

Types of patient monitor alarms

- BP: 43%
- SPO\textsubscript{2}: 33%
- ECG: 24%
- Other: 3%
Definition of Terms:

• **High Risk Clinical Alarms Condition**
  – A medical condition that is considered immediate life threatening to a patient if actions are not taken.

• **Critical Alarms**
  – Alarms on medical equipment are designed to alert staff to the presence of a life-threatening condition.
Non-Critical Alarms

- Alarms on medical equipment are designed to alert staff to the presence of a non-life threatening condition.

  • Low Risk: Non-life threatening but needs attention
  
  • Moderate Risk: Potential for harm if the issue causing the alarm is not acted upon.
Higher Priority Clinical Risk Alarms have been identified as follows:

1. BiPap
2. Cardiac Monitor
3. Fetal Monitors
4. IV Pumps, syringe pumps
5. Pulse Oximetry
6. Ventilators
Effective alarm management initiatives are built on coordinated strategies that combine staff training, evidence-based procedures and protocols, and appropriate monitoring and alarming technologies, which meet the needs of specific patient conditions.
Policy and Procedure on Clinical Alarms

1. Critical alarms on clinical monitoring and intervention systems will be maintained in the “on” position and will be sufficiently audible to the staff.

2. Non-critical alarm parameters will be set either to the default settings established by the manufacturer or as clinically warranted based on the patient’s condition.

3. Operational functionality of medical device alarms will be checked in according to the manufacturer instructions as part of the equipment’s biomedical preventative maintenance and repair program.
4. Staff training on proper operation of medical devices will include the identification and verification of critical alarms and settings.

5. A cross-disciplinary team that includes representation from clinicians, clinical engineering, information technology, and risk management will meet as needed.
Alarm fatigue

- Alarm fatigue may occur when the sheer number of monitor alarms overwhelms clinicians, possibly leading to alarms being disabled, silenced, or ignored.
Affects everyone

Patient and family
- Approximately 200 alarms in 24hrs
- Causes anxiety and constant room interruptions

ICU Nurses
- Approximately 1,000 alarms in a week
- Disrupts patient care, can reduce trust in alarms, delay in reaction time or reduce probability of responding
Thank you
Medical records

Dr. Muddather A. Mohammed
Emergency physician
RECORDS OF INTENSIVE CARE UNIT

Types

1. Paper based records.

2. Electronic medical records.
Paper based medical records

• The medical record is an account of the personal and medical history of the patient, findings of medical examination, results of diagnostic tests, treatment and nursing care, daily progress notes and charts also advice on discharge.
• Documentation in the ICU is carried out for a number of reasons. It ensures continuity of care and provides up-to-date patient status.
• The intensive care staff has to be highly skilled today due to technological advances and complex care of the critically ill patients.
• Also the documentation of care required are complex and time consuming
Principles of Record Writing

• clinical record is a legal document, it is essential that they should be written clearly, accurately, appropriately and legibly.

• All entries should be signed by the individual who writes them.

• Care to be taken, not to make any errors on the records. If anything is crossed out, it should be dated and initialed.
• Records should be written in chronological order as to date and time.
• When recording medications and treatments, note exact time and date on which they are carried out.
• Each page of the record should be properly identified with the name, age, I.P. No., O.P No., date etc.
• only standard abbreviations should be used.

• Records should be truthful, brief and complete. It should include all the services given to the patients, the observations made on the patient, charts, and the results of treatment etc.
Types of ICU Records

1-Patient records
for example
Bio data of the patient, Diagnosis, history, physical exam, investigations, Treatments & medications, Progress notes and Summary made at the discharge of the patient
# PATIENT INFORMATION FORM

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td></td>
</tr>
<tr>
<td>SS#</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>State</td>
</tr>
<tr>
<td>Zip Code</td>
<td></td>
</tr>
<tr>
<td>Home Phone #</td>
<td>Work Phone #</td>
</tr>
<tr>
<td>Birthdate</td>
<td>Male [ ] Female [ ] Marital Status</td>
</tr>
<tr>
<td>Insurance Information</td>
<td><em><strong>(Provide copies of cards)</strong></em></td>
</tr>
<tr>
<td>Primary Insurance</td>
<td>Pre-Cert/Ref #</td>
</tr>
<tr>
<td>Group Number</td>
<td>ID Number</td>
</tr>
<tr>
<td>Subscriber</td>
<td>Employer:</td>
</tr>
<tr>
<td>Birthdate</td>
<td>SS#</td>
</tr>
<tr>
<td>Relationship to Patient: [ ] Self [ ] Spouse [ ] Parent [ ] Other [ ]</td>
<td></td>
</tr>
<tr>
<td>Secondary Insurance</td>
<td>Pre-Cert/Ref #</td>
</tr>
<tr>
<td>Group Number</td>
<td>ID Number</td>
</tr>
<tr>
<td>Subscriber</td>
<td>Employer:</td>
</tr>
</tbody>
</table>
2- Nurse's and caring staff notes:

they are a record of treatments and measures carried out by the nurses and caring staff, their effects, the observations made on the patient. Observation should be as specific and objective as possible.
25 y/o white male admitted ambulant from GI clinic with diagnosis of duodenal ulcer. Presenting complaint was intermittent epigastric pain. Complains of "mild" pain at present. In no acute distress. TPR 98°-86-16, BP 106/72. Scheduled for elective surgery on 6 Nov 95

Sylvester Anderson, CPT ANC
3- Doctor's order sheet
The doctor's orders regarding the medication investigations, diet etc., are written on special sheets
<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>DOCTOR'S ORDER SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reminder: Date, time all orders. Print name & ID # under signature.

ONE SET OF ORDERS PER PAGE. MARK THROUGH BLANK LINES / SCAN ALL ORDERS

Physician's Signature

Print Name __________________________ I.D. #: ____________

SCANNED

Date: ____________ Time: ____________ Initials: __________________________
4- Graphic observation charts
On this the temperature, pulse and respirations are written in a graphic form so that a slight deviation from the normal can be noted. Other Information such as blood pressure, number of bowel movements, the body weight.
FIG. The temperature charts of two of the patients treated by Dr NH Chosky in Bombay in 1897: the patient in (a) recovered following three injections of plague antiserum, and the patient in (b) died without showing a response to the antiserum. The charts were donated to the Hong Kong Museum of Medical Sciences in 1996 by Mrs Ashburner, granddaughter of Dr James Lowson.
5- Intake and output chart. Patients on intravenous fluids or on the fluid diet, critically ill patients, post-operative patients, patients with oedema, patients having vomiting and diarrhoea, patients getting diuretics etc., should have their intake and output maintained and recorded on special chart.
# Fluid Balance Chart (#2)

**Ward:** ..................................................  
**Consultant:** ............................................  
**Patient's weight:** ........................................  
**Date Commenced:** ........................................  
**Refer to Guidelines if chart is predominantly used for input only (e.g. Rehab)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Intake: ml</th>
<th>Output: ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oral</td>
<td>IV (1)</td>
</tr>
<tr>
<td>24.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patient admitted to the ward here*

<table>
<thead>
<tr>
<th>Time</th>
<th>Intake: ml</th>
<th>Output: ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.00</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>07.00</td>
<td>SIPS</td>
<td></td>
</tr>
<tr>
<td>08.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09.00</td>
<td>SIPS</td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patient is being seen around now...

<table>
<thead>
<tr>
<th>Time</th>
<th>Intake: ml</th>
<th>Output: ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Total</th>
<th>Total Intake (A)</th>
<th>Output Measurement</th>
<th>Balance (A – D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>This must not be left blank</td>
</tr>
</tbody>
</table>

*Low urine output triggers EWS 4 if patients are having hourly urine measurement and urine output is less than 30ml/hr for 3 hours in a row OR if the patient is catheterised and urine output is found to be less than 120 ml's on four hourly emptying.*
6-Others

Reports of laboratory and imaging tests, ECG collection, Consent form for operations and anesthesia Reports of anesthesia, physiotherapy, and other special treatments.
Questions
Electronic Medical Record (EMR)

Dr. Muddather A. Mohammed
Emergency physician
Electronic medical records

• Is a medical record in digital format. It provides secure, real-time, patient information to aid clinical decision-making by providing access to a patient's health information. It is typically accessed on a computer over a network.
Purpose of EMR

- Provide the electronic equivalent of the patient chart
- Bring together all of the data about a patient into a single source
- Support patient care and improve its quality
- Support and enhance physician decision making
• In this system data entered digitally by 2 sources:
  1- Manually e.g. through keyboard.
  2- From other ICU devices as monitors, ventilators and others.
Electronic medical records

- The main differences from paper recording is
  1- It's more accurate, clear, real time.
  2- Less errors due to hand writing.
  3- Can be accessed by many stations at the same time.
  4- More secure.
  5- Can be accessed by remote stations as other hospital or mobile application for authorized personnel.
## Document Manager

<table>
<thead>
<tr>
<th>Patient #</th>
<th>Date</th>
<th>Last Name</th>
<th>First Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1234</td>
<td>02/15/2023</td>
<td>Smith</td>
<td>John</td>
<td>Medical Report</td>
</tr>
<tr>
<td>5678</td>
<td>03/10/2023</td>
<td>Johnson</td>
<td>Jane</td>
<td>Lab Results</td>
</tr>
<tr>
<td>9012</td>
<td>04/20/2023</td>
<td>Davis</td>
<td>Michael</td>
<td>Radiology Images</td>
</tr>
</tbody>
</table>

### Medical Images
- Chest
- Shoulder
- Knee Joint
- Hand
- Neck
- Shoulder

### Medical Reports
- Medical Report
- Lab Results
- Radiology Images
- Other Reports
- Clinical Overview
- Discharge Information
- Lab Results
- Ultra Sound
- CT Scan Chest
Data Security

What Is C,I,A

- **Confidentiality** (only the right people see it)
- **Integrity** (the information is what it is supposed to be – it hasn’t been changed)
- **Availability** (the right people can see it when needed)