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AACN

# Essentials of Critical Care Nursing

POCKET HANDBOOK

Marianne Chulay  
Suzanne M. Burns

SECOND EDITION

AACN Essentials of Critical Care  
Nursing—Pocket Handbook

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Second Edition

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# Preface

Given the complexity of critical care practice today, it's impossible for even experienced clinicians to remember all the information required to give safe and effective care to critically ill patients. Clinicians frequently need to use a variety of clinical resources to verify drug information, normal laboratory and physiologic values, ECG and hemodynamic monitoring information, emergency algorithms, and other essential facts of patient management.

To save time and avoid frustration, clinicians often create their own "pocket guides" by cutting and pasting together information from a variety of sources so they always have a quick reference source available. The *AACN Essentials of Critical Care Nursing Pocket Handbook* is designed to provide busy clinicians with

an easy to use resource that can, literally, be kept in their pockets. The pocket handbook contains selected tables and figures from the textbook, *AACN Essentials of Critical Care Nursing*, and includes items that clinicians are most likely to need at their fingertips:

- Critical care drug tables (common vasoactive drugs, neuromuscular blocking agents, antiarrhythmics, IV medication guidelines)
- Normal values table for laboratory tests and physiologic parameters
- Lists of assessment components
- Cardiac rhythms: ECG characteristics and treatment guides including sample rhythm strips

- 12-lead ECG changes in acute myocardial ischemia and infarct
- Troubleshooting guides for hemodynamic monitoring equipment
- Indications for mechanical ventilation
- Weaning assessment tool
- Chest x-ray interpretation

We hope this pocket book will, indeed, be placed in your pocket and assist you in making a difference in the lives of the patients and families you encounter.

*Marianne Chulay  
Suzi Burns*

*To our critical care nursing colleagues around the world whose wonderful work and efforts ensure the safe passage of patients through the critical care environment.*

# NORMAL VALUES

# 1

Section

► 1.1 Normal Values Table / 2

# 1.1 ► Normal Values Table

Abbreviation	Definition	Normal Value	Formula
BSA	Body surface area	Meters squared (m <sup>2</sup> )	Value obtained from a nomogram based on height and weight
C(a - v)O <sub>2</sub>	Arteriovenous oxygen content difference	4-6 mL/100 mL	$C(a - v)O_2 \text{ (mL/100 mL or vol \%)} = CaO_2 - CvO_2$
CaO <sub>2</sub>	Arterial oxygen content	Will vary with hemoglobin concentration and Pao <sub>2</sub> on air from 19-20 mL/100 mL	$CaO_2 \text{ (mL O}_2\text{/100 mL blood or vol \%)} = (\text{Hb} \times 1.39) SaO_2 + (PaO_2 \times 0.0031)$
CI	Cardiac index	2.5-3.0 L/min/m <sup>2</sup>	$CI \text{ (L/min/m}^2\text{)} = \frac{\text{cardiac output (L/min)}}{\text{body surface area (m}^2\text{)}}$
CK	Creatinine kinase	<150 mcg/L	
CK-MB	Creatinine kinase MB band	<10 ng/mL or <3% of total	
CO	Cardiac output	4-6 L/min	CO = Stroke volume × heart rate
CvO <sub>2</sub>	Mixed venous oxygen content	Will vary with CaO <sub>2</sub> , cardiac output, and O <sub>2</sub> consumption from 14-15 mL/100 mL	
CVP	Central venous pressure	2-8 mm Hg	
dp/dt	First time derivative of left ventricular pressure	13-14 seconds	
EDC	Effective dynamic compliance	35-45 mL/cm H <sub>2</sub> O women 40-50 mL/cm H <sub>2</sub> O men	$EDC \text{ (mL/cm H}_2\text{O)} = \frac{\text{tidal volume (mL)}}{\text{peak airway pressure (cm H}_2\text{O)}}$
EDV	End-diastolic volume	50-90 mL	
EF	Ejection fraction	70%	$\text{Ejection fraction} = \frac{SV}{EDV}$

## 1.1 ► Normal Values Table (continued)

Abbreviation	Definition	Normal Value	Formula
FRC	Functional residual capacity	2400 mL	
HR	Heart rate	60-90 beats/min	
IF	<i>Inspiratory force</i>	75-100 cm H <sub>2</sub> O	
LVSW	Left ventricular stroke work	8-10 g/m/m <sup>2</sup>	$LVSW = SI \times MAP \times 0.0144$
MAP	Mean systemic arterial pressure	> 70 mm Hg	$Map\ estimate = \frac{(Systolic + 2\ Diastolic)}{3}$
O <sub>2</sub> availability	Oxygen availability	550-650 mL/min/m <sup>2</sup>	$O_2\ availability\ (mL/min/m^2) = CI \times CaO_2 \times 10$
O <sub>2</sub> extraction ratio	Oxygen extraction ratio	0.25	$O_2\ extraction\ ratio = \frac{C(a-v)O_2}{CaO_2}$
P(A - a) <sub>O<sub>2</sub></sub>	Alveolar-arterial oxygen gradient	25-65 mm Hg at FiO <sub>2</sub> = 1.0	$P(A - a)_{O_2}\ (mm\ Hg) = PA_{O_2} - Pa_{O_2}$
P(A - a) <sub>O<sub>2</sub></sub>	Mean partial pressure of oxygen in alveolus	104 mm Hg	
P(A - a) <sub>CO<sub>2</sub></sub>	Partial pressure of carbon dioxide in alveolus	40 mm Hg	
Paco <sub>2</sub>	Partial pressure of carbon dioxide in arterial blood	35-45 mm Hg	
PAD	Pulmonary artery diastolic	5-12 mm Hg	

## 1.1 ► Normal Values Table (continued)

Abbreviation	Definition	Normal Value	Formula
Pao <sub>2</sub>	Partial pressure of oxygen in arterial blood	Will vary with patient's age and the FiO <sub>2</sub> . On room air: 80-95 mm Hg. On 100% O <sub>2</sub> : 640 mm Hg	
PAS	Pulmonary artery 54 systolic pressure	16-24 mm Hg	
PCWP	Mean pulmonary capillary wedge pressure	5-12 mm Hg	
Pvco <sub>2</sub>	Partial pressure of carbon dioxide in mixed venous blood	41-51 mm Hg	
PvO <sub>2</sub>	Partial pressure of oxygen in mixed venous blood	Will vary with the FiO <sub>2</sub> , cardiac output, and oxygen consumption from 35-40 mm Hg	
PVR	Pulmonary vascular resistance	120-200 dynes/s/cm <sup>5</sup> 1.5-2.5 mm Hg	$\text{PVR } 5 = (\text{dynes/s/cm}^5) = \frac{(\text{PA [mm Hg]} - \text{PCWP [mm Hg]}) \times 79.9}{\text{cardiac output (L/min)}}$
Qs/Qt	Right-to-left shunt (percentage of cardiac output flowing past nonventilated alveoli or the equivalent)	5%-8%	$\text{Qs/Qt}(\%) = \frac{0.0031 \times \text{P(A - a)}_{\text{O}_2}}{\text{C(a - v)}_{\text{O}_2} + (0.0031 \times \text{P[A - a]}_{\text{O}_2})} \times 100$ Valid only when arterial blood is 100% saturated

## 1.1 ► Normal Values Table (continued)

Abbreviation	Definition	Normal Value	Formula
R or RQ	Respiratory quotient	0.8	$RQ = \frac{V_{CO_2}}{VO_2}$
RVSW	Right ventricular stroke work	51-61 g/m/m <sup>2</sup>	$RVSW = SI \times MPAP \times 0.0144$
SaO <sub>2</sub>	Percentage of oxyhemoglobin saturation of arterial blood	96%-100% (air)	
SI	Stroke index	35-50 mL/m <sup>2</sup>	$SI \text{ (mL/min/m}^2\text{)} = \frac{\text{stroke volume}}{\text{body surface area}}$
SV	Stroke volume	50-100 mL/beat	$SV \text{ (mL/beat)} = \frac{\text{cardiac output (mL)}}{\text{heart rate}}$
SvO <sub>2</sub>	Percentage of oxyhemoglobin saturation of mixed venous blood	70-80% (air)	
SVR	Systemic vascular resistance	900-1200 dynes/s/cm <sup>5</sup> 10-15 mm Hg (mm Hg × 80 = dynes/s/cm <sup>5</sup> )	$SVR \text{ (TPR) (dynes/s/cm}^5\text{)} = \frac{(\text{MAP [mm Hg]} - \text{CVP [mm Hg]}) \times 79.9}{\text{cardiac output (L/min)}}$
Troponin I	Troponin I	<0.4 ng/mL	
Troponin T	Troponin T	<0.1 ng/mL	

## 1.1 ► Normal Values Table (continued)

Abbreviation	Definition	Normal Value	Formula
VC	Vital capacity	65-75 mL/kg	
VCO <sub>2</sub>	Carbon dioxide production	192 mL/min	
V <sub>D</sub>	Dead space	150 mL	$V_D/V_T = \frac{P_{aCO_2} - P_{ECO_2}}{P_{aCO_2}}$
V <sub>D</sub> /V <sub>T</sub>	Dead space to tidal volume ratio	0.25-0.40	
VO <sub>2</sub>	Oxygen consumption	115-165 mL/min/m <sup>2</sup>	$O_2 \text{ extraction ratio} = \frac{C(a-v)O_2}{CaO_2}$
V <sub>T</sub>	Tidal volume	6-8 mL/kg	

*Adapted from: Hall J, Schmidt G, Wood L. Principles of critical care. 3rd ed. New York: McGraw Hill, 2005; cover tables I-IV.*

# ASSESSMENT

# 2 Section

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## 2.1 ► Summary of Prearrival and Admission Quick Check Assessments

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### Prearrival Assessment

- Abbreviated report on patient (age, gender, chief complaint, diagnosis, pertinent history, physiologic status, invasive devices, equipment, and status of laboratory/diagnostic tests)
- Complete room setup, including verification of proper equipment functioning

### Admission Quick Check Assessment

- General appearance (consciousness)
  - Airway:
    - Patency
    - Position of artificial airway (if present)
  - Breathing:
    - Quantity and quality of respirations (rate, depth, pattern, symmetry, effort, use of accessory muscles)
    - Breath sounds
    - Presence of spontaneous breathing
  - Circulation and Cerebral Perfusion:
    - ECG (rate, rhythm, and presence of ectopy)
    - Blood pressure
    - Peripheral pulses and capillary refill
    - Skin, color, temperature, moisture
    - Presence of bleeding
    - Level of consciousness, responsiveness
  - Chief Complaint:
    - Primary body system
    - Associated symptoms
  - Drugs and Diagnostic Tests:
    - Drugs prior to admission (prescribed, over-the-counter, illicit)
    - Current medications
    - Review diagnostic test results
  - Equipment:
    - Patency of vascular and drainage systems
    - Appropriate functioning and labeling of all equipment connected to patient
  - Allergies
-

## 2.2 ► Summary of Comprehensive Admission Assessment Requirements

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### **Past Medical History**

- Medical conditions, surgical procedures
- Psychiatric/emotional problems
- Hospitalizations
- Medications (prescription, over-the-counter, illicit drugs) and time of last medication dose
- Allergies
- Review of body systems (see Table 1-7)

### **Social History**

- Age, gender
- Ethnic origin
- Height, weight
- Highest educational level completed
- Occupation
- Marital status
- Primary family members/significant others
- Religious affiliation
- Advance Directive and Durable Power of Attorney for Health Care
- Substance use (alcohol, drugs, caffeine, tobacco)
- Domestic Abuse or Vulnerable Adult Screen

### **Psychosocial Assessment**

- General communication
- Coping styles
- Anxiety and stress
- Expectations of critical care unit
- Current stresses
- Family needs

### **Spirituality**

- Faith/spiritual preference
- Healing practices

### **Physical Assessment**

- Nervous system
- Cardiovascular system
- Respiratory system
- Renal system
- Gastrointestinal system
- Endocrine, hematologic, and immune systems
- Integumentary system

## 2.3 ► Suggested Questions for Review of Past History Categorized by Body System

Body System	History Questions	Body System	History Questions
Nervous	<ul style="list-style-type: none"> <li>• Have you ever had a seizure?</li> <li>• Have you ever fainted, blacked out, or had delirium tremens (DTs)?</li> <li>• Do you ever have numbness, tingling, or weakness in any part of your body?</li> <li>• Do you have any difficulty with your hearing, vision, or speech?</li> <li>• Has your daily activity level changed due to your present condition?</li> <li>• Do you require any assistive devices such as canes?</li> </ul>	Renal	<ul style="list-style-type: none"> <li>• Have you had any change in frequency of urination?</li> <li>• Do you have any burning, pain, discharge, or difficulty when you urinate?</li> <li>• Have you had blood in your urine?</li> </ul>
Cardiovascular	<ul style="list-style-type: none"> <li>• Have you experienced any heart problems or disease such as heart attacks or strokes?</li> <li>• Do you have any problems with extreme fatigue?</li> <li>• Do you have an irregular heart rhythm?</li> <li>• Do you have high blood pressure?</li> <li>• Do you have a pacemaker or an implanted defibrillator?</li> </ul>	Gastrointestinal	<ul style="list-style-type: none"> <li>• Has there been any recent weight loss or gain?</li> <li>• Have you had any change in appetite?</li> <li>• Do you have any problems with nausea or vomiting?</li> <li>• How often do you have a bowel movement and has there been a change in the normal pattern? Do you have blood in your stools?</li> <li>• Do you have dentures?</li> <li>• Do you have any food allergies?</li> </ul>
Respiratory	<ul style="list-style-type: none"> <li>• Do you ever experience shortness of breath?</li> <li>• Do you have any pain associated with breathing?</li> <li>• Do you have a persistent cough? Is it productive?</li> <li>• Have you had any exposure to environmental agents that might affect the lungs?</li> <li>• Do you have sleep apnea?</li> </ul>	Integumentary Endocrine Hematologic Immunologic	<ul style="list-style-type: none"> <li>• Do you have any problems with your skin?</li> <li>• Do you have any problems with bleeding?</li> <li>• Do you have problems with chronic infections?</li> <li>• Have you recently been exposed to a contagious illness?</li> </ul>

## 2.3 ► Suggested Questions for Review of Past History Categorized by Body System *(continued)*

<b>Body System</b>	<b>History Questions</b>	<b>Body System</b>	<b>History Questions</b>
Psychosocial	<ul style="list-style-type: none"><li>• Do you have any physical conditions which make communication difficult (hearing loss, visual disturbances, language barriers, etc)?</li><li>• How do you best learn? Do you need information repeated several times and/or require information in advance of teaching sessions?</li><li>• What are the ways you cope with stress, crises, or pain?</li><li>• Who are the important people in your “family” or network? Who do you want to make decisions with you, or for you?</li><li>• Have you had any previous experiences with critical illness?</li><li>• Have you ever been abused?</li><li>• Have you ever experienced trouble with anxiety, irritability, being confused, mood swings, or suicide attempts?</li><li>• What are the cultural practices, religious influences, and values that are important to the family?</li><li>• What are family members’ perceptions and expectations of the critical care staff and the setting?</li></ul>	Spiritual	<ul style="list-style-type: none"><li>• What is your faith or spiritual preference?</li><li>• What practices help you heal or deal with stress?</li><li>• Would you like to see a chaplain, priest, or other type of healer?</li></ul>

## 2.4 ► Ongoing Assessment Template

<b>Body System</b>	<b>Assessment Parameters</b>	<b>Body System</b>	<b>Assessment Parameters</b>
Nervous	<ul style="list-style-type: none"> <li>• LOC</li> <li>• Pupils</li> <li>• Motor strength of extremities</li> </ul>	Gastrointestinal	<ul style="list-style-type: none"> <li>• Bowel sounds</li> <li>• Contour of abdomen</li> <li>• Position of drainage tubes</li> <li>• Color and amount of secretions</li> <li>• Bilirubin and albumin values</li> </ul>
Cardiovascular	<ul style="list-style-type: none"> <li>• Blood pressure</li> <li>• Heart rate and rhythm</li> <li>• Heart sounds</li> <li>• Capillary refill</li> <li>• Peripheral pulses</li> <li>• Patency of IVs</li> <li>• Verification of IV solutions and medications</li> <li>• Hemodynamic pressures and waveforms</li> <li>• Cardiac output data</li> </ul>	Endocrine, hematologic, and immunologic	<ul style="list-style-type: none"> <li>• Fluid balance</li> <li>• Electrolyte and glucose values</li> <li>• CBC and coagulation values</li> <li>• Temperature</li> <li>• WBC with differential count</li> </ul>
Respiratory	<ul style="list-style-type: none"> <li>• Respiratory rate and rhythm</li> <li>• Breath sounds</li> <li>• Color and amount of secretions</li> <li>• Noninvasive technology information (eg, pulse oximetry, end-tidal CO<sub>2</sub>)</li> <li>• Mechanical ventilatory parameters</li> <li>• Arterial and venous blood gases</li> </ul>	Integumentary	<ul style="list-style-type: none"> <li>• Color and temperature of skin</li> <li>• Intactness of skin</li> <li>• Areas of redness</li> </ul>
Renal	<ul style="list-style-type: none"> <li>• Intake and output</li> <li>• Color and amount of urinary output</li> <li>• BUN/creatinine values</li> </ul>	Pain/discomfort	<ul style="list-style-type: none"> <li>• Assessed in each system</li> <li>• Response to interventions</li> </ul>
		Psychosocial	<ul style="list-style-type: none"> <li>• Mental status and behavioral responses</li> <li>• Reaction to critical illness experience (eg, stress, anxiety, coping, mood)</li> <li>• Presence of cognitive impairments (dementia, delirium), depression, or demoralization</li> <li>• Family functioning and needs</li> <li>• Ability to communicate needs and participate in care</li> <li>• Sleep patterns</li> </ul>