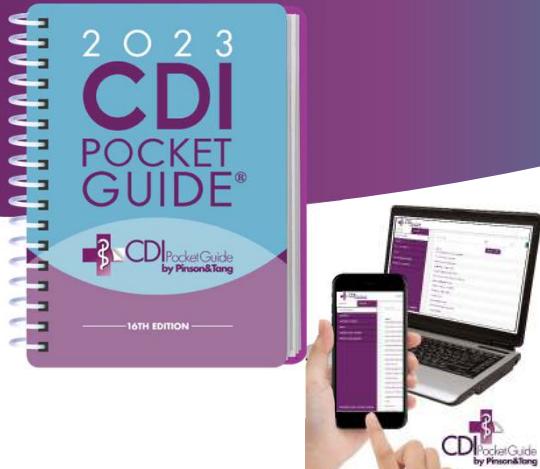


February 23, 2023



CDI Pocket Guide® Acid/Base Disorders

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About Us



Richard Pinson

MD, FACP, CCS, CDIP

Dr. Richard Pinson is a physician, educator, administrator, and healthcare consultant. He practiced Internal Medicine and Emergency Medicine in Tennessee for over 20 years having board certification in both.



Cynthia Tang
RHIA, CCS, CRC

Cynthia brings over 35 years of experience in coding and clinical documentation integrity, and health information management. For over 30 years she has traveled across the country implementing successful and sustainable coding and CDI programs in hundreds of hospitals.

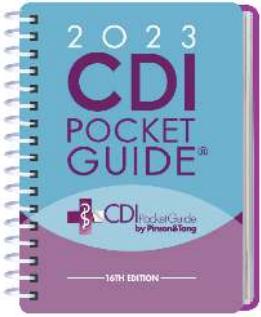


We created the **CDI Pocket Guide®** in 2008 because we wanted to provide this information to all hospitals, large or small. At the time, the only way to receive training in this field was with large-scale, expensive consulting projects. We thought we could bring this pocketful of information with the clinical criteria to identify important diagnoses to any individual who was interested in working in the CDI and coding field. Our CDI Pocket Guide® quickly became a best-selling book and an industry standard, and many consider it to be their CDI "bible".

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Acid/Base Disorders

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Agenda



Acid/Base Balance and Imbalance
Acid/Base Laboratory Tests and
Diagnostic Criteria



Respiratory Acidosis vs.
Hypercapnic Respiratory Failure
Documentation and Coding
When to Query



Case Studies
Q&A

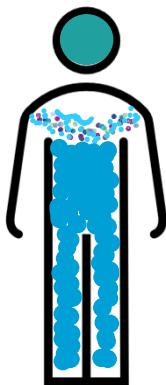
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Liquids: Acids and Bases

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Human body is 60% water



Organ	Water
Liver	85%
Kidneys	83%
Lungs	83%
Blood	83%
Heart	79%
Muscles	75%
Brain	75%
Pancreas	70%
Bones	22%

Most liquids are acids or bases:

Acids: $\text{pH} < 7$

Bases: $\text{pH} > 7$

Neutral: $\text{pH} = 7$

Human body normal range
 $= 7.35-7.45$

Acid/base balance is maintained by

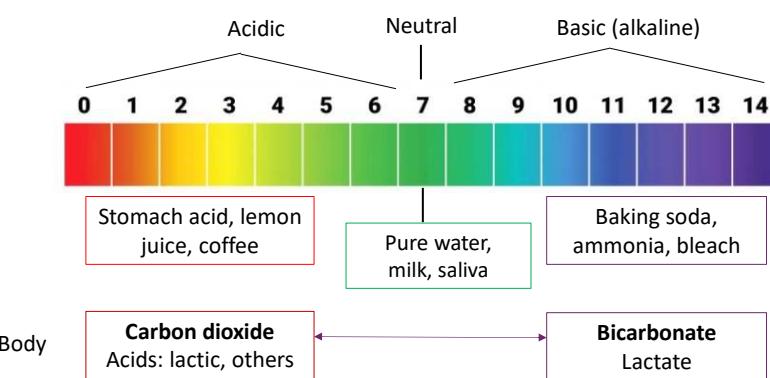
- Respiratory system
- Kidneys
- Liver

The pH Scale: Acids and Bases

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The pH scale measures how acidic or basic a substance is from 0 to 14

Physiologic pH normal range = 7.35-7.45



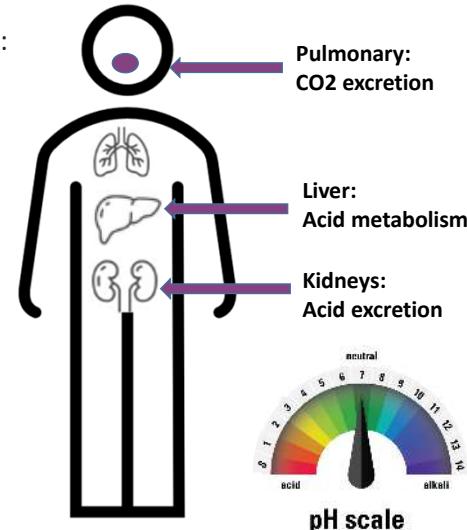
Acid/Base Balance

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Adults generate large amounts of acids daily that must be:

- **Expired:** Respirations
- **Excreted:** Urine
- **Metabolized:** Chemical reactions

Acid/base disorders are disturbances in the carbon dioxide-bicarbonate buffer system that **regulates pH**.



Why is this so important?

- Acid/base balance is important for normal metabolism.
- **Acids and bases must be balanced** to avoid fatal acidemia = the pH is so low that cells cannot function properly.

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Acid/Base Laboratory Tests

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BMP/Chemistry	Type	Description
CO2 (bicarbonate)	Base	Electrolyte that regulates pH. If low or high, may indicate acidosis or alkalosis.
Chloride	Neutral	Neutral electrolyte. If high can indicate acidosis.
Lactate/Lactic Acid	Base (weak), or Acid	Lactate is produced when cells are not receiving enough oxygen to meet the demand. Sodium lactate is weak base, lactic acid is an acid. If lactate high (>2), may indicate lactic acidosis.
Anion gap (AGAP)	Calculation	Calculation of four electrolytes: sodium, potassium, chloride, bicarbonate (CO2). If high, can indicate acidosis.
ABG / VBG	Type	Description
HCO3 (bicarbonate)	Base	Same as CO2. Electrolyte that regulates pH. If low or high, may indicate acidosis or alkalosis.
pH	Measurement	Measures the acidity or basicity of body liquids. If low or high, indicates acidosis or alkalosis.
pCO2	Acid	Carbon dioxide. If high or low, can indicate respiratory acidosis or alkalosis.

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Lab Indicators of Acidosis or Alkalosis				Pinson&Tang
BMP/Chemistry	Value	Indicates	Code	
CO2 (bicarbonate)	> 28 < 22	Metabolic alkalosis Metabolic acidosis	E87.3 E87.20-.22	
Chloride	> 106	Metabolic acidosis, NAGMA Renal tubular acidosis	E87.20-.22 N25.89	
Lactate/Lactic Acid	> 4 > 2 + pH < 7.35 or AGAP > 12	Lactic acidosis	E87.20-.22	
Anion gap (AGAP)	> 12	Acidosis (AGMA)	E87.29	
ABG / VBG	Value	Indicates		
HCO3 (bicarbonate)	> 28 < 22	Metabolic alkalosis Metabolic acidosis	E87.3 E87.20-.22	
pH	< 7.35 > 7.45 > 7.45 + pCO2 < 35	Acidosis Alkalosis Respiratory alkalosis	E87.20 E87.3 E87.3	
pCO2	> 45 > 50 (> 45 VBG) + pH < 7.35 > 50 (> 45 VBG) + pH normal < 35 + pH > 7.45	Respiratory acidosis Acute respiratory acidosis Chronic respiratory acidosis Respiratory alkalosis	E87.29 J96.02 J96.12 E87.3	Hypercapnic respiratory failure

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Clinical Significance		Pinson&Tang
Minimal increase or decrease in pH, pCO2, bicarbonate (CO2, HCO3) may not be clinically significant.		
Elevated lactate/lactic acid does not necessarily indicate acidosis which requires a significant elevation (> 4.0, or > 2.0 + pH < 7.35 or AGAP > 12).		
<ul style="list-style-type: none"> Lactate/lactic acid < 2.0 is normal and slight transient elevation may not be clinically significant. For example, a slightly elevated lactate of 2.2 on admission for which the lactate level is simply repeated. Excessive lacticemia is assigned to code E87.20, so must meet the above criteria for lactic acidosis and be clinically significant. 		<p>A clinically significant condition is one that meets the OCG Section III definition of a secondary diagnosis: clinical evaluation, treatment, diagnostic procedures, extended LOS, increased nursing care or monitoring.</p>

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Conditions That Cause Acid/Base Imbalance

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Condition	Causes	A/B Imbalance	Treatment
Diarrhea	Lose bicarbonate	Metabolic acidosis (NAGMA): If $\text{CO}_2/\text{HCO}_3 < 22$	IV fluids restore volume so the kidneys can restore metabolic balance
Vomiting	Lose hydrochloric acid (decreased chloride—> elevated bicarbonate)	Metabolic alkalosis: If $\text{HCO}_3/\text{CO}_2 > 28$	
Dehydration	Kidneys retain sodium bicarbonate	Metabolic alkalosis: If elevated $\text{CO}_2/\text{HCO}_3 > 28$	
Diabetic Ketoacidosis	Deficiency of insulin causes acidosis due to ketones	Acidosis: pH < 7.30 and $\text{HCO}_3/\text{CO}_2 < 18$, with glucose > 250 and marked elevation of serum ketones	IV fluids, insulin, correction of electrolyte imbalance, monitoring of response, etc.

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Conditions That Cause Acid/Base Imbalance

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Condition	Causes	A/B Imbalance	Treatment
COPD	Retention of carbon dioxide (pCO_2) due to hypoventilation (hypercapnia)	Respiratory acidosis if $\text{pCO}_2 > 50$. If with pH < 7.35 = Acute respiratory acidosis.	Improve ventilation (bronchodilators, steroids, respiratory therapy); O ₂ does not treat hypercapnia
Sepsis	Inadequate tissue oxygenation results in elevated lactate	Lactic acidosis: > 4, or $> 2 + \text{pH} < 7.35$ or AGAP > 12	Restore tissue oxygenation: IV fluids, O ₂ ; if severe acidosis, IV bicarbonate
Poisoning (aspirin)	Toxic to many metabolic processes results in increased acid production (salicylic acid)	Acidosis or metabolic acidosis: pH < 7.35 or $\text{CO}_2/\text{HCO}_3 < 22$	IV fluids, IV bicarbonate, dialysis if severe

Important: Elevated albumin, elevated phosphate, or conditions such as myeloma, may have an elevated anion gap without acidosis.

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Lab Indicators of Acidosis or Alkalosis

BMP/Chemistry

Routine Chem	
Sodium	(L) 126
Potassium Level	(L) 3.1
Chloride	(L) 92
CO2	(L) 18
AGAP	(H) 16
BUN	* (L) 74
Creatinine	(H) 1.91
BUN/Creat Ratio	(H) 38.7
GFR African American	(L) 41.30
GFR NonAfrican American	(L) 34.07
Glucose Level	(H) 434
Calcium	9.2
Total Protein	6.0
Albumin lvl	3.5
Globulin	2.5
A/G Ratio	1.4
Alk Phos	(H) 150
ALT	(L) 8.0
AST	(L) 9.0
Bili Total	0.40
Lactate	(H) 3.90

Patient diagnosed with pneumonia, sepsis, DKA

CO2 18 (< 22): metabolic acidosis
AGAP 16 (> 12): acidosis

Lactate 3.9 (> 2 + AGAP > 12): lactic acidosis

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Arterial Blood Gas (ABG)

Blood Gases	
BE Art	(L) -8.6
pH Art	7.39
pCO2 Art	(L) 24
pO2 Art	(L) 56
HCO3 Art	(L) 18.0
O2 Sat Art	91.2
FiO2 Art	21
Blood Gas Site	Radial
Alv Art DO2	(H) 64.0
Patient Temperature ABG	37.0
Fraction of Inspired O2 ABG	21

Why is pH normal? Patient has a respiratory alkalosis (breathing rapidly) causing low pCO2 (24) which neutralizes the pH.

Respiratory alkalosis + acidosis =
Mixed acid-base disorder

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Diabetic Ketoacidosis

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Deficiency of insulin causes acidosis due to ketones

Diagnostic Criteria

ALL of the following:

- Glucose > 250
- Acidosis: pH < 7.30
- HCO3 or CO2 < 18
- Serum Ketones: marked elevation

Urine ketones will also be elevated but not a diagnostic criterion. A presumptive diagnosis can be made when urine glucose and ketones are strongly positive but must have serum ketones to diagnose DKA.

Routine Chem	
Sodium	(L) 126
Potassium Level	(L) 3.1
Chloride	(L) 92
CO2	(L) 18
AGAP	(H) 16
BUN	* (L) 74
Creatinine	(H) 1.91
BUN/Creat Ratio	(H) 38.7
GFR African American	(L) 41.30
GFR NonAfrican American	(L) 34.07
Glucose Level	(H) 434
Calcium	9.2
Total Protein	6.0
Albumin lvl	3.5
Globulin	2.5
A/G Ratio	1.4
Alk Phos	(H) 150
ALT	(L) 8.0
AST	(L) 9.0
Bili Total	0.40
Lactate	(H) 3.90

Blood Gases	
BE Art	(L) -8.6
pH Art	7.39
pCO2 Art	(L) 24
pO2 Art	(L) 56
HCO3 Art	(L) 18.0
O2 Sat Art	91.2
FiO2 Art	21
Blood Gas Site	Radial
Alv Art DO2	(H) 64.0
Patient Temperature ABG	37.0
Fraction of Inspired O2 ABG	21

UA Dipstick	
UA Color	Yellow
UA Clarity	(A) Turbid
UA Spec Grav	1.016
UA Bili	Negative
UA pH	5.0
UA Urobilinogen	(A) 2
UA Blood	(A) 2+
UA Glucose	(A) 3+
UA Ketones	(A) Trace
UA Protein	(A) 1+
UA Nitrite	Negative
UA Leuk Est	(A) 3+

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Hypercapnic Respiratory Failure vs. Respiratory Acidosis

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Acute Respiratory Acidosis = Acute Hypercapnic Respiratory Failure	Chronic Respiratory Acidosis = Chronic Hypercapnic Respiratory Failure	Respiratory Acidosis
<p>Criteria: pH < 7.35 and pCO₂ > 50</p> <p>Look for a cause, a pulmonary condition or a condition that alters the respiratory center, brain hemorrhage, drug overdose</p> <p>Symptoms: Poor respiratory effort, low respiratory rate</p> <p>Often have hypoxemic respiratory failure</p>	<p>Criteria: pCO₂ > 50 + pH normal +/or elevated CO₂/HCO₃</p> <p>Look for a chronic pulmonary condition</p> <p>May also have chronic hypoxemic respiratory failure</p> <p>Equivalent to compensated respiratory acidosis</p>	<p>Criteria: pCO₂ > 45</p> <p>Transient elevation of pCO₂</p> <p>Hypercapnia</p> <p>Does not meet the criteria for respiratory failure</p>

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COPD with Compensated Respiratory Acidosis

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Coding Clinic 2010 First Quarter, p. 5

Question: What is the correct code assignment for a diagnosis of "compensated respiratory acidosis" in a patient with chronic obstructive pulmonary disease (COPD)?

Answer: Assign only code 496, Chronic airway obstruction, NEC, for the COPD. It would be inappropriate to separately report a code for compensated respiratory acidosis.

Patients with chronic obstructive pulmonary disease (COPD) may experience difficulty in regulating blood gas levels. PaO₂ may be low because oxygen is not effectively absorbed in the lungs. **PaCO₂ can be elevated** because of inefficient exchange of carbon dioxide in the lungs. Because of the increase in CO₂, the body's pH will decrease, resulting in respiratory acidosis. The kidneys can retain bicarbonate in order to compensate for the acidosis. This is referred to as "compensated respiratory acidosis," when the body's **pH level is maintained** within the normal range through compensatory mechanisms involving the kidneys or lungs.

This is specific guidance for a documented diagnosis of "compensated respiratory acidosis" in a patient with COPD.

If documented as respiratory acidosis, chronic respiratory acidosis, or chronic hypercapnic respiratory failure, assign the appropriate ICD-10 code.

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Documentation and Coding

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▪ Respiratory acidosis and hypercapnic respiratory failure: Code both?

ICD-10 classification:

E87.20  Acidosis, unspecified

Lactic acidosis NOS
Metabolic acidosis NOS
Code also, if applicable, respiratory failure with hypercapnia

E87.29  Other acidosis

Respiratory acidosis NOS
Excludes2: acute respiratory acidosis (J96.02)
chronic respiratory acidosis (J96.12)

▪ Chronic metabolic acidosis with CKD

Coding Clinic 2022 Fourth Quarter, p. 13: Clinic patient with CKD-4 with “chronic metabolic acidosis and progressive decline in kidney function,” prescribed oral sodium bicarbonate. Assign codes N18.4, CKD-4, and E87.22, Chronic metabolic acidosis.

Query Example: Good or bad?

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“Queries should only be generated when the clinical data fully supports the answer choice(s).”
2022 AHIMA/ACDIS Query Practice Brief.

H&P indicates respiratory acidosis (pCO₂ 57) in a patient presenting with acute exacerbation of severe COPD and acute on chronic diastolic heart failure. Respiratory therapy consulted and considering CPAP. Progress note day #2: “Hypercapnia improving (pCO₂ 49) with increased respiratory assist.”

Can you please further indicate the acuity of the respiratory acidosis?

1. Acute respiratory acidosis
2. Acute on chronic respiratory acidosis
3. Other (please specify): _____

The clinical data in this query does not support the answer choices.

No pH was included (although pCO₂ included) in the query which if low is indicative of “acute” respiratory acidosis.

If pH is normal, querying for “acute” respiratory acidosis would be inappropriate.

A pCO₂ of 49 also does not meet criteria for “chronic” respiratory acidosis.

“Considering CPAP”? If treated with CPAP, this should be included as a clinical indicator.

DO NOT QUERY FOR ACUTE RESPIRATORY ACIDOSIS IF DOES NOT MEET CRITERIA

Query Example: Acute Respiratory Acidosis

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“Queries should only be generated when the clinical data fully supports the answer choice(s).”
2022 AHIMA/ACDIS Query Practice Brief.

H&P indicates “respiratory acidosis” in a patient presenting with AECOPD and acute on chronic diastolic heart failure.

ABG (2/17): pH 7.32, pCO2 57, HCO3 32

RT note (2/18) CPAP started.

Progress note (2/19): “Hypercapnia improving (pCO2 49) with increased respiratory assist.”

Can you please further indicate the acuity of the respiratory acidosis?

1. Acute respiratory acidosis
2. Acute on chronic respiratory acidosis
3. Other (please specify): _____

Includes the clinical indicators that support acute on chronic respiratory acidosis:

- pH < 7.35 + pCO2 > 50 + elevated HCO3
- Chronic pulmonary disorder: Severe COPD
- Treatment with CPAP

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When to Query for Acid/Base Disorders

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IF ...	THEN ...
Patient meets criteria for acidosis that is <u>not documented</u>	Query for specific types based on criteria met <u>when</u> clinically significant <u>and</u> when adding the diagnosis code is impactful.
Acidosis is <u>documented</u> and meets criteria for any of the specific types of acidosis (metabolic, lactate, AGAP)	Code acidosis, E87.20 or E87.29. It is not necessary to query for a specific type of acidosis or acuity of metabolic acidosis since it doesn't make a difference.
Respiratory acidosis is <u>documented</u>	Do not query for “acute” unless it meets the criteria for acute respiratory acidosis/hypercapnic respiratory failure.



“When not to query: Queries are not necessary for every discrepancy or unaddressed documentation issue in accordance with an organization’s policy and procedure. Circumstances may include lack of business need, risk of query fatigue, or does not add to the clarity of the clinical picture.” 2022 AHIMA/ACDIS Query Practice Brief.

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Case Study #1

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44-year-old with history of stage III breast cancer s/p radiation and mastectomy now on monthly Leupron injections, asthma, HTN, HLD who presents with worsening SOB/DOE found to have new severely depressed EF 22% with acute systolic heart failure exacerbation.

VBG: pH 7.4, pCO₂ 55, pO₂ 43, HCO₃ 30.6, Lactic Acid 1.0.

BMP: Anion Gap 5-20, Chloride 103-108.

CXR: Diffuse bilateral interstitial opacities likely representing mild pulmonary edema. Probable small left pleural effusion. Diffuse bilateral interstitial opacities. Mild cardiomegaly.

ROS: Positive for fatigue and unexpected weight gain. Negative for chills, diaphoresis and fever. Respiratory: Positive for shortness of breath. Negative for cough, chest tightness and wheezing. GI: Positive for abdominal distention. Negative for abdominal pain, constipation, diarrhea, nausea and vomiting.

Providers are also documenting:

Respiratory acidosis

AGMA

Concurrent metabolic alkalosis

Hyperphosphatemia: has elevated PCO₂, delta of 8; suspected elevated phos plus contraction alkalosis contributing to acid base abnormalities; start low phos diet.

Question: Is it appropriate to query for the acuity of respiratory acidosis in this case?

It would not be appropriate to query for "acute" respiratory acidosis with a normal pH (7.4).

Assign code E87.4, Mixed disorder of acid-base balance, for **metabolic alkalosis with respiratory acidosis**.

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Case Study #2

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Patient admitted 1/25 for Mitral Valve Replacement.

POD #0 Documentation of respiratory acidosis immediately postop.

ABGs:

- 1/25 (1303-immediate post-op): pH 7.16, pCO₂ 80.3, PO₂ 73, 100% FIO₂
- 1/25 (2332): pH 7.32, CO₂ 45.9, PO₂ 67 on 36% FIO₂

Progress notes:

1/25: CVICU - **Respiratory acidosis**

- Extubated in OR to BiPAP. ABG with profound respiratory acidosis on FiO₂ 100%. CXR with atelectasis.
- BiPAP settings adjusted to 30/10 with improved ventilation and oxygenation. Repeat ABG.
- PE: Lung/Chest: Nonlabored. Symmetrical chest expansion

1/25: Anesthesia: The patient is not fully recovered due to prolonged sedation and is expected to recover in >2 hours.

O₂ Requirements: BiPAP used 1/25 from 1225-2305, 2LNC placed after BiPAP.

This patient has acute postoperative respiratory failure, both hypoxicemic and hypercapnic.

Occurred in immediate postoperative period.

Hypoxicemic and hypercapnic respiratory failure: pH 7.16, pCO₂ 80.3, pO₂ 73, on 100% oxygen.

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Case Study #3

66-year-old obese man with a history of CAD, HTN, HLD, LVH, DM2, CKD3, OSA presenting with weakness and dizziness. Home blood pressure 70/40 mmHg. Patient's wife reports the patient found out recently that he had been taking too much of his antihypertensive medications.

- CXR: mild interstitial edema.
- Pulmonary: symmetric chest rise, bilateral breath sounds clear, no crackles/wheezes/rales
- VBG on room air: **7.395/ pCO2 57.9/ HCO3 34.7 / BE 9.6**, Compensated respiratory acidosis
- Home Meds: Aspirin, Coreg (HTN), HydroChlorothiazide (HTN), Lisinopril (HTN), Spironolactone, Torsemide, Rosuvastatin, Potassium Chloride, Calcium with Vit D, Lantus

Problem List: Hypotension on chronic HTN, hyponatremia, hypokalemia, hypomagnesemia, hyperglycemia, CKD-3.

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Question: If a venous blood gas (VBG) is interpreted by the doctor as "compensated respiratory acidosis", should it be coded as "Acidosis, other E87.29"?

Yes, assign code E87.29, Other acidosis, for the compensated respiratory acidosis.

This meets criteria for chronic respiratory acidosis in a patient without COPD with normal pH and elevated pCO2 and HCO3. It is not necessary to query for acuity.

Case Study #4

Denial of E87.2, Acidosis

Patient is a 43-year-old obese female admitted for gastric sleeve surgery. Postop the patient's lab showed elevated anion gap of 18, CO2 20, and no PH level.

Documentation states: HAGMA, mild, likely due ketosis from reduced intake prior to and peri procedurally. Blood sugars not elevated. Encourage oral intake.

Patient meets criteria for acidosis with anion gap 18 (> 12) and CO2 20 (< 22), documented as HAGMA, and clinically evaluated and addressed.

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Denial Rationale:

The clinical evidence in the medical record did not support code E87.2 as a secondary diagnosis.

It was noted that the physician documented high anion gap metabolic acidosis in the discharge summary. In order to validate the diagnosis of metabolic acidosis the medical record should reflect the following: 1) **specific documentation of the condition** by the treating physicians, and 2) documentation of at least two of the following; a **low pH level, a low CO2 level, an elevated anion gap**. The patient was documented to have an anion gap of 18, a CO2 level of 20-23, and no pH level was documented.

Question

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With new guidelines, acute respiratory acidosis is coded to acute respiratory failure with hypercapnia. We have some debate among the team who feel that just because someone has acute respiratory acidosis does not automatically imply that they are clinically in acute respiratory failure. The suggestion is to code this condition as "other acidosis" when the provider documents acute respiratory acidosis.

How should we proceed with reporting when documentation states acute respiratory acidosis?

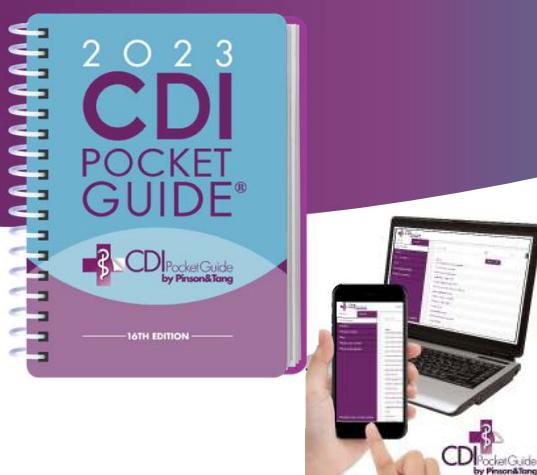
Must be clinically validated with the criteria for acute hypercapnic respiratory failure (see slide 15):

- pH < 7.35 and pCO₂ > 50
- Look for a cause, a pulmonary condition or a condition that alters the respiratory center, brain hemorrhage, drug overdose
- Symptoms: Poor respiratory effort, low respiratory rate

Often have hypoxic respiratory failure.

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Contact us: contact@pinsonandtang.com



Q & A
THANK YOU!

All attendees will receive an email with a CEU evaluation link within 24 hours following the webinar