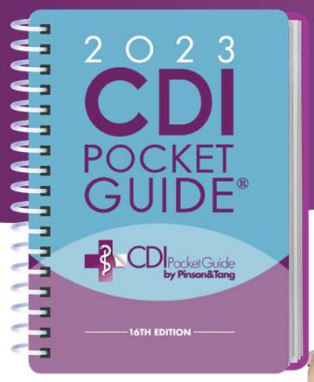
February 23, 2023



CDI Pocket Guide®

Acid/Base Disorders

Pinson&Tang

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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.

CDI Pocket Guide by Pinson&Tang

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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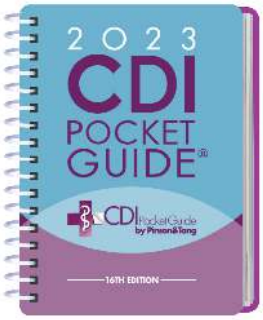
CDI Pocket Guide®



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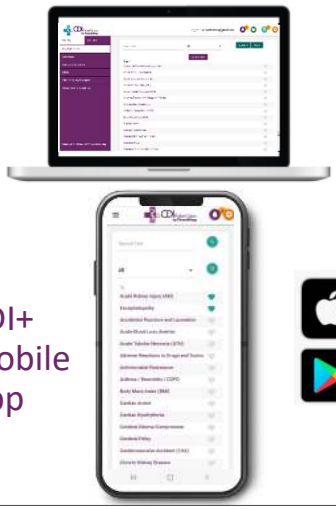

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Acid/Base Disorders

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Agenda

2023 CDI Pocket Guide®
Page 72-73

- 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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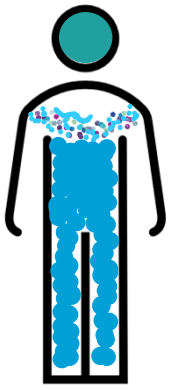
Human body is 60% water



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: pH < 7

Bases: pH > 7

Neutral: pH = 7

Human body normal range = 7.35-7.45

Acid/base balance is maintained by
- Respiratory system
- Kidneys
- Liver

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The pH Scale: Acids and Bases

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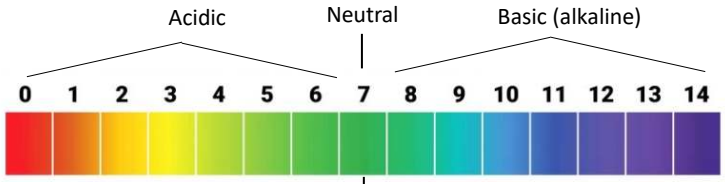
The pH scale measures how acidic or basic a substance is from 0 to 14

Physiologic pH normal range = 7.35-7.45



Stomach acid, lemon juice, coffee

Pure water, milk, saliva

Baking soda, ammonia, bleach

Body

Carbon dioxide
Acids: lactic, others

Bicarbonate
Lactate

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Acid/Base Balance

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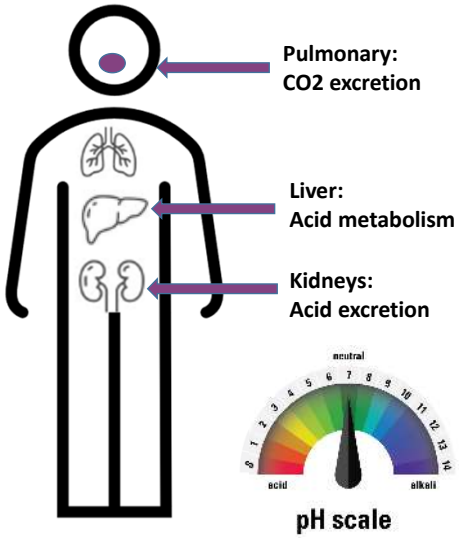
Adults generate large amounts of acids daily that must be:

- **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

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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 (> 55 VBG) + pH < 7.35 > 50 (> 55 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

Types:
1. **Metabolic acidosis**: includes lactic, anion gap, renal tubular
2. **Respiratory acidosis**
3. **Alkalosis:** Metabolic, Respiratory
4. **Mixed:** Acidosis & alkalosis (E87.4)

→ **Hypercapnic respiratory failure**

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Clinical Significance

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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).

- **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.

Lacticemia, excessive (see also Acidosis) **E87.20**

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.

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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 CO2/HCO3 < 22	IV fluids restore volume so the kidneys can restore metabolic balance
Vomiting	Lose hydrochloric acid (decreased chloride—> elevated bicarbonate)	Metabolic alkalosis: If HCO3/CO2 > 28	
Dehydration	Kidneys retain sodium bicarbonate	Metabolic alkalosis: If elevated CO2/HCO3 > 28	
Diabetic Ketoacidosis	Deficiency of insulin causes acidosis due to ketones	Acidosis: pH < 7.30 and HCO3/CO2 < 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 (pCO2) due to hypoventilation (hypercapnia)	Respiratory acidosis if pCO2 > 50. If with pH < 7.35 = Acute respiratory acidosis.	Improve ventilation (bronchodilators, steroids, respiratory therapy); O2 does not treat hypercapnia
Sepsis	Inadequate tissue oxygenation results in elevated lactate	Lactic acidosis: > 4, or > 2 + pH < 7.35 or AGAP > 12	Restore tissue oxygenation: IV fluids, O2; 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 CO2/HCO3 < 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

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BMP/Chemistry

Routine Chem	
Sodium	(L) 126
Potassium Level	(L) 3.1
Chloride	(L) 92
CO2	(L) 18
AGAP	(H) 16
BUN	* (!) 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

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	* (!) 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**
Criteria: 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 hypoxemic respiratory failure	Criteria: pCO2 > 50 + pH normal +/or elevated CO2/HCO3 Look for a chronic pulmonary condition May also have chronic hypoxemic respiratory failure Equivalent to compensated respiratory acidosis	Criteria: pCO2 > 45 Transient elevation of pCO2 Hypercapnia Does not meet the criteria for respiratory failure

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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.

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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 <u>does not</u> 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

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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 (bicarb)
- 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 not documented	Query for specific types based on criteria met when clinically significant and when adding the diagnosis code is impactful.
Acidosis is documented 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 documented	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 hypoxemic and hypercapnic.

Occurred in immediate postoperative period.

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

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Case Study #3

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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.

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.

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Case Study #4

Denial of E87.2, Acidosis

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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.

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.

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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 hypoxemic respiratory failure.

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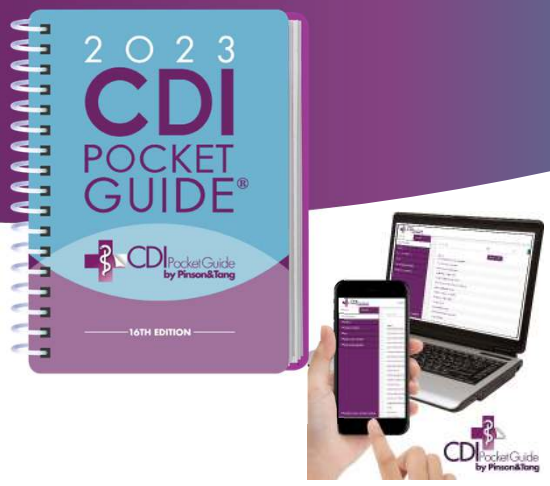
Contact us: *contact@pinsonandtang.com*



Q & A

THANK YOU!

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

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