Brigham and Women's Hospital
Founding Member, Mass General Brigham

Update in Hospital Medicine

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DISCLOSURES

I have no relevant financial relationships with ineligible companies.

OBJECTIVES

- Review evidence and recent guidelines for fluid management in sepsis
- Review data on initiation of SGLT2 inhibitors in acute HF
- Know what to do with GLP-1 RAs preoperatively
- Discuss anticoagulation/antiplatelet management in patients with stable CAD
- Review paradigm shift in treatment of inpatient hypertension
- Understand use of CRP to guide corticosteroids in CAP
- Learn what to do with incidental CAC seen on chest CT

Case 1

A 68-year-old woman presents to the ED with fever (39.2°C), tachycardia (HR 112), BP 82/48 mmHg, and lactate 4.8 mmol/L. She has a history of CHF (EF 35%) and CKD stage 3. Urinalysis shows leukocytosis and bacteriuria.

She has received 1 L of 0.9% normal saline in the ambulance.

Case 1

Which of the following is the best next step in fluid resuscitation for this patient?

A. Continue 0.9% normal saline and complete a 30 mL/kg bolus

B. Switch to lactated Ringer's solution for ongoing resuscitation

C. Administer 5% albumin 500 mL bolus

D. Administer 6% hydroxyethyl starch 500 mL bolus

E. Withhold further fluids and start norepinephrine

Case 1

Which of the following is the BEST next step in fluid resuscitation for this patient?

A. Continue 0.9% normal saline and give 30 mL/kg bolus

B. Switch to lactated Ringer's solution for ongoing resuscitation

C. Administer 5% albumin 500 mL bolus

D. Administer 6% hydroxyethyl starch 500 mL bolus

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Evidence of Mortality Benefit for Balanced Crystalloids

SMART trial secondary analysis (2019): 30-day mortality among sepsis patients 26.3% (balanced) vs. 31.2% (saline), P=0.01

CLOVERS trial secondary analysis (2025): LR vs. NS — adjusted HR for death 0.71 (95% CI 0.51–0.99)

Surviving Sepsis Campaign (SSC) 2026 Guidelines: balanced crystalloids over 0.9% saline for sepsis resuscitation (conditional recommendation, moderate certainty)
-Exception: Traumatic brain injury → use 0.9% saline
-Starches (choice D) are strongly recommended against due to harm (AKI, mortality)

Brown et al Am J Respir Crit Care Med. 2019 ; Gelbenegger et al, Crit Care Med 2025; SSC 2026 Guidelines (Crit Care Med 2026); Meyer Prescott, NEJM 2024

Restrictive vs Liberal Fluid Resuscitation

No significant mortality difference between restrictive and liberal strategies.

U shaped curve for under vs over resuscitation

- CLASSIC (n=1,554, septic shock): 90-day mortality 42.3% vs. 42.1% (P=0.46)

- CLOVERS (n=1,563, sepsis-induced hypotension): 90-day mortality 14.0% vs. 14.9% (P=0.61)

- Nearly all patients in both trials received ≥30 mL/kg — do not withhold initial resuscitation

- SSC 2026: Continue to suggest ≥30 mL/kg in first 3 hours; use adjusted body weight for BMI 30; reassess frequently

SSC 2026 Guidelines (Crit Care Med 2026); Meyer Prescott, NEJM 2024

Bottom Line: Fluid Resuscitation in Sepsis

Use balanced crystalloids (e.g., lactated Ringer's) over normal saline

Give ≥30 mL/kg in the first 3 hours; use adjusted body weight if BMI>30

Reassess frequently — neither "restrictive" nor "liberal" is clearly superior

Start norepinephrine early if hypotension persists — don't delay for more fluid

Exception: Don’t use balanced crystalloids in traumatic brain injury (use 0.9% saline)

Case 2

A 72-year-old man with known HFrEF (EF 30%) on lisinopril and metoprolol presents with worsening dyspnea, orthopnea, and 8 kg weight gain over 2 weeks. BP 108/68, HR 88, SpO2 92% on RA. BNP 2,400 pg/mL. He is started on IV furosemide.

Case 2

On hospital day 2, the patient is hemodynamically stable (SBP 106, no inotropes, no IV diuretic dose increase in 8 hours). Which of the following is the MOST appropriate next step?

A. Discharge the patient and start empagliflozin at the first outpatient visit

B. Start empagliflozin 10 mg daily now, while still hospitalized

C. Wait until the patient is euvolemic before starting empagliflozin

D. Start empagliflozin only if the patient has diabetes

E. Defer SGLT2 inhibitor initiation because eGFR is 38 mL/min

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Starting SGLT2 inhibitor in hospital

EMPULSE trial (n=530): In-hospital empagliflozin initiation → stratified win ratio 1.36 (95% CI 1.09–1.68; P=0.005)

Benefit regardless of EF or diabetes status

Greater decongestion: weight loss −1.97 kg at day 15 vs. placebo

Fewer serious adverse events in empagliflozin group (32.3% vs. 43.6%)

2024 ACC Expert Consensus Decision Pathway: SGLT2 inhibitors should be initiated during hospitalization once clinically stable

Stability criteria: SBP ≥100, no inotropes × 24 hr, no IV diuretic increase × 6 hr

Voors et al., Nat Med 2022 (EMPULSE); 2024 ACC ECDP (JACC 2024)

4 Pillars of GDMT for HFrEF

1. ARNI (or ACEi/ARB if ARNI not tolerated)

2. Beta-blocker

3. MRA (e.g., spironolactone)

4. SGLT2 inhibitor (e.g., empagliflozin, dapagliflozin) eGFR cutoff for HF=20 ml/min

- 2024 ACC ECDP emphasizes establishing all 4 pillars during hospitalization when possible

- Loop diuretics for symptom management, not disease-modifying therapy

Voors et al., Nat Med 2022 (EMPULSE); 2024 ACC ECDP (JACC 2024)

Bottom Line: Inpatient Management of HFrEF

Start SGLT2 inhibitors in-hospital once clinically stable — don't wait for outpatient follow-up

Benefit is independent of EF and diabetes status

Stability criteria: SBP ≥100, no inotropes ×24 hr, no IV diuretic increase ×6 hr. eGFR>20

Aim to establish all 4 pillars of GDMT before discharge

In-hospital initiation improves long-term adherence

Case 3

A 58-year-old woman with T2DM (A1c 8.5%), BMI 42, and OSA is admitted for elective bariatric surgery. She is currently on tirzepatide 10 mg weekly (last dose 5 days ago). You are consulted for perioperative management.

Case 3

What is the MOST appropriate perioperative management of this patient's tirzepatide?

A. Continue tirzepatide as scheduled — no perioperative risk

B. Hold tirzepatide for 24 hours before surgery

C. Hold tirzepatide for at least 1 week before elective surgery requiring general anesthesia

D. Switch to a daily GLP-1 RA formulation the day before surgery

E. Administer tirzepatide immediately postoperatively to prevent hyperglycemia

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Key Issues with GLP-1 RA before surgery

GLP-1 RAs delay gastric emptying → increased aspiration risk under anesthesia

- ASA 2023 Guidance:
  - Daily formulations: hold day of procedure
  - Weekly formulations: hold for 1 week prior
  - Consider holding longer with higher doses or significant GI symptoms
  - Don’t restart until patient is tolerating oral intake postoperatively

ASA 2023 Consensus Guidance; AACE 2025 Obesity Consensus Statement

Case 4

A 76-year-old man with atrial fibrillation (on apixaban 5 mg BID), hypertension, diabetes, and stable CAD (DES placed 2 years ago, no recent ACS) is admitted for elective hernia repair. His medication list includes apixaban, aspirin 81 mg daily, metoprolol, atorvastatin, and metformin. You are consulted by his surgical team for medical management.

Case 4

Based on current evidence, which of the following is the most appropriate long-term antithrombotic strategy for this patient with AF and CAD (>1 year post-DES)?

A. Continue apixaban + aspirin 81 mg indefinitely (dual pathway therapy)

B. Continue apixaban and change ASA to clopidogrel 75 mg

C. Discontinue apixaban and continue aspirin alone

D. Discontinue aspirin and continue apixaban monotherapy

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Stopping ASA in Stable CAD on DOAC

Key evidence from 2 landmark RCTs:

- AFIRE (NEJM 2019): Rivaroxaban monotherapy noninferior to dual therapy for efficacy (HR 0.72) and superior for bleeding (HR 0.59; P=0.01); stopped early due to excess mortality in combination group

- AQUATIC (NEJM 2025): First double-blind, placebo-controlled trial — stopped early for harm from aspirin

    CV death/MI/stroke/revasc: HR 1.53 (P=0.02)
    All-cause mortality: HR 1.72 (P=0.01)
    Major bleeding: HR 3.35 (P=0.001)

Even in high-risk patients with prior stents

Lemesle et al., NEJM 2025 (AQUATIC); Yasuda et al., NEJM 2019 (AFIRE)

In Stent Thrombosis

Stent thrombosis was extremely rare and not reduced by aspirin.

- AQUATIC: 1 stent thrombosis event in each group

- ADAPT AF-DES (NEJM 2025): NOAC monotherapy vs. NOAC + clopidogrel, 1 year post-DES

- Net adverse clinical events: 9.6% vs. 17.2% (HR 0.54)

- Major/clinically relevant bleeding: 5.2% vs. 13.2% (HR 0.38)

- 2023 ACC/AHA AF Guideline: OAC monotherapy recommended over OAC + antiplatelet in AF + chronic CAD 1 year post-revascularization

Lemesle et al., NEJM 2025 (AQUATIC); Lee et al., NEJM 2025 (ADAPT AF-DES)

Bottom Line: ASA + DOAC in Stable CAD

- Stop aspirin in patients on DOACs with stable CAD (1 year post-PCI)
- DOAC monotherapy reduces bleeding by ~40–60% without increasing ischemic events
- Even in high-risk patients with prior stents, aspirin added to DOAC causes harm (AQUATIC)
- Stent thrombosis is extremely rare 1 year after DES — and aspirin does not reduce this risk
- Review med lists on admission — stop unnecessary aspirin!

Case 5

A 78-year-old man with a history of hypertension (on amlodipine 10 mg and lisinopril 20 mg at home) is admitted for elective knee replacement. On postoperative day 1, the nurse pages you because his BP is 186/100 mmHg. He recently worked with PT. He is asymptomatic and appears comfortable.

Case 5

Which of the following is the MOST appropriate next step?

A. Administer IV hydralazine 10 mg now and recheck BP in 30 minutes

B. Administer IV labetalol 20 mg now for rapid BP control

C. Let him rest, make sure he is getting his home meds, and recheck BP in 30–60 minutes

D. Order a PRN IV hydralazine protocol for any SBP 180 mmHg

E. Obtain a stat CT head to rule out hypertensive emergency

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Asymptomatic HTN: Don’t Just Do Something, Stand There!

- 2024 AHA Scientific Statement: *Treating asymptomatic elevated BP in inpatients should generally be the exception, not the rule*

- First step: Verify BP measurement with proper technique, then address reversible causes (pain, anxiety, sleep deprivation, urinary retention, nausea)

- Check if home medications were held or not restarted (41% of patients on PRN antihypertensives were not receiving their home regimen)

- 30 minutes of rest is as effective as antihypertensive medications for transient elevations

- No evidence that asymptomatic severe hypertension progresses to hypertensive emergency

Bress et al., Hypertension 2024 (AHA Scientific Statement); Anderson et al., JAMA Intern Med 2023

Risks of Harm

VA target trial emulation study examined intensive BP treatment in hospitalized older adults (VA system):

- Population: Adults ≥65 years hospitalized for noncardiac reasons with ≥2 elevated inpatient BPs in first 48 hours

- Intensive treatment (≥1 dose new or IV antihypertensive in first 48 hr) occurred in 21% of patients

- Primary composite (death, AKI, stroke, troponin elevation, BNP elevation, ICU transfer) worse with intensive treatment : 8.7% vs. 6.9% (adjusted OR 1.28; 95% CI 1.18–1.39)

- Hypotensive episodes: 14.8% vs. 14.0% (adjusted OR 1.22; 95% CI 1.15–1.30)

- IV antihypertensives associated with even greater harm than oral agents

- Results consistent across all subgroups: age, frailty, outpatient BP control, and history of CVD

Bress et al., Hypertension 2024 (AHA Scientific Statement); Anderson et al., JAMA Intern Med 2023

Bottom Line: Don’t treat asymptomatic HTN

- Treat the cause — pain, anxiety, urinary retention, held home meds
- Restart home antihypertensives first — 41% of patients on PRN IV meds had home meds held
- 30 minutes of rest is as effective as antihypertensive meds for transient elevations
- Intensive inpatient BP treatment causes harm (OR 1.28 for adverse events)
- Do not use PRN IV hydralazine protocols for asymptomatic elevated BP
- Do not treat a single elevated reading — verify with proper technique and repeat after 30 minutes
- Caveat: Persistently elevated BP >180/110 with uncontrolled outpatient BPs and high CVD risk — may warrant escalation of oral treatment with close follow-up

Case 6

A 72-year-old male is admitted with CAP, PSI class IV, requiring 2 L nasal cannula. His CRP is 85 mg/L. What is the most appropriate approach to corticosteroids?

A. Start hydrocortisone 200 mg/day — he has severe CAP by PSI class
B. Start dexamethasone 6 mg daily — the COVID-era regimen now applies to all pneumonia
C. Withhold corticosteroids — his CRP is below the threshold associated with benefit, and steroids carry risks of hyperglycemia and readmission
D. Recheck CRP in 24 hours and start steroids if it rises above 200 mg/L
E. Start methylprednisolone 1 g IV daily for 3 days (pulse dose)

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Use of Corticosteroids in “Severe” CAP

- But what is the definition of “severe” and who actually benefits?

- First trial 2015 RCT (Torres), used CRP >150 mg/L as an enrollment criterion for steroids in severe CAP:
  - Treatment failure: 13% (methylprednisolone) vs. 31% (placebo), P=0.02
  - OR for treatment failure: 0.34 (95% CI 0.14–0.87)

- CAPE COD trial 2023: Landmark French study, hydrocort IV 200mg/d, severe CAP (some adm to ICU), 28d mortality reduction (6.2% vs 11.9%)

- Smit meta-analysis: 8 RCTs, 3,224 patients hospitalized with CAP
  - Pts with severe CAP (PSI IV–V) did NOT benefit more than those with less severe CAP (PSI I–III)
  - But CRP was the key effect modifier:
  - CRP **> 204 mg/L**: 30d mortality OR 0.43 (95% CI: 0.25–0.76, p= 0.026) 30d mortality reduced from 13.0% (placebo) to 6.1% (corticosteroid). CRP<204 mg: OR 0.98 (95% CI: 0.63–1.50) — no statistically significant change in 30d mortality
  - Corticosteroids were associated with hyperglycemia and readmission
  - Conclusion: the inflammatory response, not the PSI score, predicts steroid benefit in CAP

Smit et al., Lancet Respir Med 2025; Dequin et al., NEJM 2023 (CAPE COD) Torres et al., JAMA 2015

Bottom Line: CRP, steroids, and CAP

- Check baseline CRP on admission for all hospitalized CAP patients
- CRP >~200 mg/L: mortality benefit from adjunctive corticosteroids
- CRP ≤200 mg/L: No benefit only harm (hyperglycemia, readmissions)
- CRP is a better predictor of steroid benefit than severity scores (PSI, CURB-65)

Case 7

A 59-year-old man with no known cardiovascular disease is admitted for pneumonia. A non-contrast, non-ECG-gated chest CT is obtained to evaluate for complications. The radiologist reports bilateral lower lobe consolidation — but also notes "moderate coronary artery calcification." The patient's LDL-C is 142 mg/dL. He is not on a statin. His 10-year ASCVD risk by PCE is 9.2% (borderline-intermediate).

Case 7

What is the most appropriate next step?

A. Ignore the finding — non-gated CT cannot reliably assess coronary calcium
B. Order a dedicated ECG-gated cardiac CT for formal Agatston scoring before making any treatment decisions
C. Initiate high-intensity statin therapy based on the incidental finding of moderate CAC, without need for dedicated cardiac CT
D. Refer to cardiology before starting any medications
E. Recommend lifestyle modifications only and recheck lipids in 6 months

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Incidental CAC on non-gated chest CT: An independent predictor of CV events and death

Meta-analysis of 51,582 patients (mean follow-up ~4.3 years):
All-cause mortality: RR 2.13 (95% CI 1.57–2.90) with CAC present
Major adverse cardiovascular events (MACE): RR 2.91 (95% CI 2.26–3.93) with CAC present

Deep-learning algorithm study (Peng et al., JACC 2023, n=5,678):
DL-CAC ≥100 vs. CAC = 0:

- All-cause death: HR 1.51 (95% CI 1.28–1.79)
- Death/MI/stroke: HR 1.57 (95% CI 1.33–1.84)
- Death/MI/stroke/revascularization: HR 1.69 (95% CI 1.45–1.98)
- Predictive significance persisted after adjusting for traditional risk factors
- Only 26% of patients with DL-CAC ≥100 were on statins

Osborne-Grinter et al., Eur Radiol 2024; Peng et al., JACC 2023

Incidental CAC: ACC/AHA Guidelines

- Incidental CAC on routine non-gated chest CT is common but underreported
- Powerful, independent predictor of CV events and death — even after adjusting for traditional risk factors
- 2026 ACC/AHA Guidelines: Moderate/severe incidental CAC → high-intensity statin (LDL-C goal 70); mild CAC → moderate-intensity statin (LDL-C goal 100)
- Dedicated gated CT is NOT required before starting therapy for moderate/severe incidental CAC
- AI algorithms can now automate CAC scoring on non-gated CT with near-perfect accuracy

Bottom Line: Read the full CT report, if CAC present start statin, communicate in the discharge summary, and ensure outpatient follow-up with PCP or cardiology

2026 ACC/AHA Dyslipidemia Guidelines (JACC 2026); Parsa et al., JACC 2024

Take Home Messages

- Balanced crystalloids over normal saline for sepsis
- Start SGLT2 inhibitors in-hospital for acute HF
- Hold GLP-1 RAs before elective surgery
- Stop aspirin in patients on DOACs with stable CAD
- Don't treat asymptomatic inpatient hypertension
- In patients hospitalized with CAP, check CRP to guide corticosteroid use
- Start statin if incidental CAC seen on chest CT

MOC REFLECTIVE STATEMENT (BRIEF TAKE HOME NOTES FOR REFERENCE)

The proper resuscitation fluid used in sepsis matters, and the evidence favors balanced crystalloids such as lactated ringers over other fluid types. We can use CRP to guide decisions about corticosteroids in patients with severe CAP.

As hospitalists we should try to initiate GDMT for heart failure patients during the admission, particularly SGLT-2 inhibitors. We should also be cautious about timing when surgery is planned for patients on GLP1 receptor agonists. We should look for patients with stable CAD who are on a DOAC and ASA and stop the ASA when appropriate in collaboration with their outpatient providers, and if we identify incidental coronary calcium on CT we should start a statin and communicate with the outpatient team.

Please avoid treating asymptomatic HTN, particularly with IV medications!

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