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# Noncardiac inpatient has acute hypertension: Treat or not?

A retrospective study found more harm than benefit from treating elevated blood pressure in hospitalized noncardiac patients.

## PRACTICE CHANGER

Manage blood pressure (BP) elevations conservatively in patients admitted for noncardiac diagnoses, as acute hypertension treatment may increase the risk for acute kidney injury (AKI) and myocardial injury.

## STRENGTH OF RECOMMENDATION

**C:** Based on a single, large, retrospective cohort study.<sup>1</sup>

Rastogi R, Sheehan MM, Hu B, et al. Treatment and outcomes of inpatient hypertension among adults with noncardiac admissions. *JAMA Intern Med.* 2021;181:345-352.

## ILLUSTRATIVE CASE

A 48-year-old man is admitted to your family medicine service for cellulitis after failed outpatient therapy. He has presumed community-acquired methicillin-resistant *Staphylococcus aureus* infection of the left lower extremity and is receiving intravenous (IV) vancomycin. His BP this morning is 176/98 mm Hg, and the reading from the previous shift was 168/94 mm Hg. He is asymptomatic from this elevated BP. Based on protocol, his nurse is asking about treatment in response to the multiple elevated readings. How should you address the patient's elevated BP, knowing that you will see him for a transition management appointment in 2 weeks?

**E**levated BP is common in the adult inpatient setting. Prevalence estimates range from 25% to > 50%. Many factors can contribute to elevated BP in the acute ill-

ness setting, such as pain, anxiety, medication withdrawal, and volume status.<sup>2,3</sup>

Treatment of elevated BP in outpatients is well researched, with evidence-based guidelines for physicians. That is not the case for treatment of asymptomatic elevated BP in the inpatient setting. Most published guidance on inpatient management of acutely elevated BP recommends IV medications, such as hydralazine or labetalol, although there is limited evidence to support such recommendations. There is minimal evidence for outcomes-based benefit in treating acute elevations of inpatient BP, such as reduced myocardial injury or stroke; however, there is some evidence of adverse outcomes, such as hypotension and prolonged hospital stays.<sup>4-8</sup>

Although the possibility of intensifying antihypertensive therapy for those with known hypertension or those with presumed "new-onset" hypertension could theoretically lead to improved outcomes over the long term, there is little evidence to support this presumption. Rather, there is evidence that intensification of antihypertensive therapy at discharge is linked to short-term harms. This was demonstrated in a propensity-matched veteran cohort that included 4056 hospitalized older adults with hypertension (mean age, 77 years; 3961 men), equally split between those who received antihypertensive intensification at hospital discharge and those who did not. Within 30 days, patients receiving intensification had a higher risk of readmission (number needed to harm

[NNH] = 27) and serious adverse events (NNH = 63).<sup>9</sup>

The current study aimed to put all these pieces together by quantifying the prevalence of hypertension in hospitalized patients, characterizing clinician response to patients' acutely elevated BP, and comparing both short- and long-term outcomes in patients treated for acute BP elevations while hospitalized vs those who were not. The study also assessed the potential effects of antihypertensive intensification at discharge.

### STUDY SUMMARY

#### Treatment of acute hypertension was associated with end-organ injury

This retrospective, propensity score-matched cohort study (N = 22,834) evaluated the electronic health records of all adult patients (age > 18 years) admitted to a medicine service with a noncardiovascular diagnosis over a 1-year period at 10 Cleveland Clinic hospitals, with 1 year of follow-up data.

Exclusion criteria included hospitalization for a cardiovascular diagnosis; admission for a cerebrovascular event or acute coronary syndrome within the previous 30 days; pregnancy; length of stay of less than 2 days or more than 14 days; and lack of outpatient medication data. Patients were propensity-score matched using BP, demographic features, comorbidities, hospital shift, and time since admission. Exposure was defined as administration of IV antihypertensive medication or a new class of oral antihypertensive medication.

Outcomes were defined as a temporal association between acute hypertension treatment and subsequent end-organ damage, such as AKI (serum creatinine increase  $\geq 0.3$  mg/dL or  $1.5 \times$  initial value [Acute Kidney Injury Network definition]), myocardial injury (elevated troponin:  $> 0.029$  ng/mL for troponin T;  $> 0.045$  ng/mL for troponin I), and/or stroke (indicated by discharge diagnosis, with confirmation by chart review). Monitored outcomes included stroke and myocardial infarction (MI) within 30 days of discharge and BP control up to 1 year later.

The 22,834 patients had a mean (SD) age of 65.6 (17.9) years; 12,993 (56.9%) were

women, and 15,963 (69.9%) were White. Of the 17,821 (78%) who had at least 1 inpatient hypertensive systolic BP (SBP) episode, defined as an SBP  $\geq 140$  mm Hg, 5904 (33.1%) received a new treatment. Of those receiving a new treatment, 4378 (74.2%) received only oral treatment, and 1516 (25.7%) received at least 1 dose of IV medication with or without oral dosing.

Using the propensity-matched sample (4520 treated for elevated BP matched to 4520 who were not treated), treated patients had higher rates of AKI (10.3% vs 7.9%;  $P < .001$ ) and myocardial injury (1.2% vs 0.6%;  $P = .003$ ). When assessed by SBP, nontreatment of BP was still superior up to an SBP of 199 mm Hg. At an SBP of  $\geq 200$  mm Hg, there was no difference in rates of AKI or MI between the treatment and nontreatment groups. There was no difference in stroke in either cohort, although the overall numbers were quite low.

Patients with and without antihypertensive intensification at discharge had similar rates of MI (0.1% vs 0.2%;  $P > .99$ ) and stroke (0.5% vs 0.4%;  $P > .99$ ) in a matched cohort at 30 days post discharge. At 1 year, BP control in the intensification vs no-intensification groups was nearly the same: maximum SBP was 157.2 mm Hg vs 157.8 mm Hg, respectively ( $P = .54$ ) and maximum diastolic BP was 86.5 mm Hg vs 86.1 mm Hg, respectively ( $P = .49$ ).

### WHAT'S NEW

#### Previous research is confirmed in a more diverse population

Whereas previous research showed no benefit to intensification of treatment among hospitalized older male patients, this large, retrospective, propensity score-matched cohort study demonstrated the short- and long-term effects of treating acute, asymptomatic BP elevations in a younger, more generalizable population that included women. Regardless of treatment modality, there appeared to be more harm than good from treating these BP elevations.

In addition, the study appears to corroborate previous research showing that intensification of BP treatment at discharge



**Acute treatment of elevated BP in noncardiac inpatients was not beneficial, and treatment intensification at discharge did not improve BP control over the following year.**

did not lead to better outcomes.<sup>9</sup> At the very least, the study makes a reasonable argument that treating acute BP elevations in noncardiac patients in the hospital setting is not beneficial.

**CAVEATS**

**Impact of existing therapy could be underestimated**

This study had several important limitations. First, 23% of treated participants were excluded from the propensity analysis without justification from the authors. Additionally, there was no reporting of missing data and how it was managed. The authors' definition of treatment excluded dose intensification of existing antihypertensive therapy, which would undercount the number of treated patients. However, this could underestimate the actual harms of the acute antihypertensive therapy. The authors also included patients with atrial fibrillation and heart failure in the study population, even though they already may have been taking antihypertensive agents.

**CHALLENGES TO IMPLEMENTATION**

**Potential delays in translating findings to patient care**

Although several recent studies have shown the potential benefit of not treating asymptomatic acute BP elevations in inpatients, incorporating that information into electronic

health record order sets or clinical decision support, and disseminating it to clinical end users, will take time. In the interim, despite these findings, patients may continue to receive IV or oral medications to treat acute, asymptomatic BP elevations while hospitalized for noncardiac diagnoses. **JFP**

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**References**

1. Rastogi R, Sheehan MM, Hu B, et al. Treatment and outcomes of inpatient hypertension among adults with noncardiac admissions. *JAMA Intern Med.* 2021;181:345-352. doi: 10.1001/jamainternmed.2020.7501
2. Jacobs ZG, Najafi N, Fang MC, et al. Reducing unnecessary treatment of asymptomatic elevated blood pressure with intravenous medications on the general internal medicine wards: a quality improvement initiative. *J Hosp Med.* 2019;14:144-150. doi: 10.12788/jhm.3087
3. Pasik SD, Chiu S, Yang J, et al. Assess before Rx: reducing the overtreatment of asymptomatic blood pressure elevation in the inpatient setting. *J Hosp Med.* 2019;14:151-156. doi: 10.12788/jhm.3190
4. Campbell P, Baker WL, Bendel SD, et al. Intravenous hydralazine for blood pressure management in the hospitalized patient: its use is often unjustified. *J Am Soc Hypertens.* 2011;5:473-477. doi: 10.1016/j.jash.2011.07.002
5. Gauer R. Severe asymptomatic hypertension: evaluation and treatment. *Am Fam Physician.* 2017;95:492-500.
6. Lipari M, Moser LR, Petrovitch EA, et al. As-needed intravenous antihypertensive therapy and blood pressure control. *J Hosp Med.* 2016;11:193-198. doi: 10.1002/jhm.2510
7. Gaynor MF, Wright GC, Vondracek S. Retrospective review of the use of as-needed hydralazine and labetalol for the treatment of acute hypertension in hospitalized medicine patients. *Ther Adv Cardiovasc Dis.* 2018;12:7-15. doi: 10.1177/1753944717746613
8. Weder AB, Erickson S. Treatment of hypertension in the inpatient setting: use of intravenous labetalol and hydralazine. *J Clin Hypertens (Greenwich).* 2010;12:29-33. doi: 10.1111/j.1751-7176.2009.00196.x
9. Anderson TS, Jing B, Auerbach A, et al. Clinical outcomes after intensifying antihypertensive medication regimens among older adults at hospital discharge. *JAMA Intern Med.* 2019;179:1528-1536. doi: 10.1001/jamainternmed.2019.3007

**EXERCISE COUNSELING**

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2009;169:694-701. doi: 10.1001/archinternmed.2009.23

16. Lobelo F, Young DR, Sallis R, et al. Routine assessment and promotion of physical activity in healthcare settings: a scientific statement from the American Heart Association. *Circulation.* 2018;137:e495-e522. doi: 10.1161/CIR.0000000000000559
17. American College of Sports Medicine. *ACSM's Guidelines for Exercise Testing and Prescription.* 11th ed. Wolters Kluwer; 2021.
18. Sallis R. Developing healthcare systems to support exercise: exercise as the fifth vital sign. *Br J Sports Med.* 2011;45:473-474. doi: 10.1136/bjsm.2010.083469
19. Bardach SH, Schoenberg NE. The content of diet and physical activity consultations with older adults in primary care. *Patient Educ Couns.* 2014;95:319-324. doi: 10.1016/j.pec.2014.03.020
20. Martín-Borrás C, Giné-Garriga M, Puig-Ribera A, et al. A new model of exercise referral scheme in primary care: is the effect on adherence to physical activity sustainable in the long

term? A 15-month randomised controlled trial. *BMJ Open.* 2018;8:e017211. doi: 10.1136/bmjopen-2017-017211

21. Stoutenberg M, Shaya GE, Feldman DJ, et al. Practical strategies for assessing patient physical activity levels in primary care. *Mayo Clin Proc Innov Qual Outcomes.* 2017;1:8-15. doi: 10.1016/j.mayocpiqo.2017.04.006
22. US Preventive Services Task Force. Cardiovascular disease risk: screening with electrocardiography. June 2018. Accessed July 19, 2022. [www.uspreventiveservicestaskforce.org/uspstf/recommendation/cardiovascular-disease-risk-screening-with-electrocardiography](http://www.uspreventiveservicestaskforce.org/uspstf/recommendation/cardiovascular-disease-risk-screening-with-electrocardiography)
23. Reed JL, Pipe AL. Practical approaches to prescribing physical activity and monitoring exercise intensity. *Can J Cardiol.* 2016;32:514-522. doi: 10.1016/j.cjca.2015.12.024
24. Verschuren O, Mead G, Visser-Meily A. Sedentary behaviour and stroke: foundational knowledge is crucial. *Transl Stroke Res.* 2015;6:9-12. doi: 10.1007/s12975-014-0370