Update In Hospital Medicine

Victor E. Collier MD, FACP

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Goal

- Review some interesting and possibly practice changing studies in hospital medicine from the 12-18 months

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Resources

- Society of Hospital Medicine Annual Meeting 2017
- Journal of Hospital Medicine
- Journal Watch
- ACP Hospitalist
- The Hospitalist
- Annals for Hospitalists

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Topics

- Venous Thromboembolism
- Contrast Nephropathy
- Oxygen use in ACS
- Outcomes based on physician age and gender
- Bacteremia
- Five-second rule

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Case #1

- 54 year old healthy male is admitted to the hospital for a right lower extremity DVT. No recent travel or surgery. No recent hospitalization.
- ROS negative
- No medications
- No family history of VTE
- No tobacco, alcohol or recreational drug use, malpractice lawyer
- Normal colonoscopy and PSA 3 months prior
- Exam:
  - T 98.2 P 90, BP 134/80, RR 14, Sat 98% RA
  - Comprehensive exam is remarkable only for RLE swelling
- Data: US RLE proximal DVT, Cr 0.8, HgB 14.2, PTT normal, LFTs normal, UA nl, CXR NAD
- You diagnose him with an unprovoked DVT and start him on rivaroxaban

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Case #1

What additional work-up would you do in the hospital prior to discharge?

A. CT chest, abdomen and pelvis to screen for malignancy
B. Thrombophilia work-up now
C. CT of chest, abdomen and pelvis and a thrombophilia work-up now
D. Discharge the patient on rivaroxaban for a minimum of 3 months with consideration of outpatient thrombophilia work-up

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Journal of HOSPITAL MEDICINE www.journalofhospitalmedicine.com

CHOOSING WISELY©: THINGS WE DO FOR NO REASON

Inpatient Inherited Thrombophilia Testing

Christopher M. Petrilli, MD[1,*†], Lauren Heidemann, MD[1†], Megan Mack, MD[1,2], Paul Durance, PhD[3], Vineet Chopra, MD, MSc[1,2]

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J Thromb Thrombolysis. 2016; 41: 154–164. PMCID: PMC4715840
Published online 2016 Jan 16. doi: 10.1007/s11239-015-1316-1

Guidance for the evaluation and treatment of hereditary and acquired thrombophilia

Scott M. Stevens,✉ Scott C. Woller, Kenneth A. Bauer, Raj Kasthuri, Mary Cushman, Michael Streiff, Wendy Lim, and James D. Douketis

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Do not perform thrombophilia testing at the time of VTE diagnosis or during the initial 3-month course of anticoagulant therapy.

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Forgo thrombophilia testing when…

- A patient has a provoked venous thromboembolic event
- You do not intend to discontinue anticoagulation (ie, anticoagulation is indefinite)
- The patient is in the acute (eg, inpatient) setting
- The patient is on anticoagulants that may render test results uninterpretable
- The patient is pregnant or on oral contraceptives
- Use of alternative patient characteristics and laboratory markers to predict venous thromboembolism recurrence may be an option.

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ORIGINAL RESEARCH

Patterns and Appropriateness of Thrombophilia Testing in an Academic Medical Center

Nicholas Cox, PharmD[1*], Stacy A. Johnson, MD[1,2], Sara Vazquez, PharmD[1], Ryan P. Fleming, PharmD, BCPS[1], Matthew T. Rondina, MD[1,4], David Kaplan, MD[1,2], Stephanie Chauv, PharmD[3], Gabriel V. Fontaine, PharmD[3], Scott M. Stevens, MD[2,5], Scott Woller, MD[2,5], Daniel M. Witt, PharmD, BCPS, FCCP[1,4]

[1]University of Utah Health Care, Salt Lake City, Utah; [2]Department of Medicine, University of Utah School of Medicine, Salt Lake City, Utah; [3]GRECC, George E. Wahlen VAMC, Salt Lake City, Utah; [4]Molecular Medicine Program, University of Utah, Salt Lake City, Utah; [5]Intermountain Healthcare, Salt Lake City, Utah; [6]Department of Pharmacotherapy, University of Utah College of Pharmacy, Salt Lake City, Utah.

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Thrombophilia Testing

- Retrospective cohort study
  - July 1, 2014 – December 31, 2014
- Patients > 18 years of age who had thrombophilia testing during an ER or inpatient visit
- 163 patients
  - 1451 thrombophilia tests

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Thrombophilia Testing

- Main Measurement: Proportion of tests associated with minimal clinic utility
  - Discharged before results available
  - Test type not recommended
  - Testing in situation associated with decreased accuracy
  - Duplicate testing
  - Testing following a provoked thrombotic event

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Testing Characteristics

Characteristic	Tests n = 1451
Tests by hospital service, n (%)	
Neurology	597 (41)
Internal Medicine	293 (20)
Obstetrics and Gynecology	227 (16)
Neurosurgery	151 (11)
General Surgery	139 (10)
Physical Medicine and Rehabilitation	23 (2)
Psychiatry	11 (1)
Family/Preventative Medicine	5 (<1)
Orthopedic Surgery	5 (<1)
Tests per patient, mean (SD)	8.9 (6.0)
Tests ordered as part of a panel of tests, n (%)[a]	1150 (79)
Days from admission to time test ordered, mean (SD)	2.7 (5.7)

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Indication for Testing

Indication[a]	Tests, n (%) n = 1451	Patients, n (%) n = 163
Ischemic stroke	726 (50)	57 (35)
Cryptogenic or other etiology	496 (34)	40 (25)
Cerebral venous sinus thrombosis[b]	154 (11)	11 (7)
Basilar artery thrombosis	41 (3)	2 (1)
Cardioembolic origin	33 (2)	4 (2)
Venous thromboembolism	298 (21)	35 (21)
Deep vein thrombosis	147 (10)	16 (10)
Pulmonary embolism	103 (7)	13 (8)
Other[a]	54 (4)	7 (4)
Pregnancy related[a]	215 (15)	41 (25)
Nonstroke arterial thrombosis[a]	49 (3)	5 (3)
History of thrombophilia[c]	44 (3)	10 (6)
Unclear	13 (1)	4 (2)
Other[a]	219 (15)	27 (17)

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Results

TABLE 4. Clinical Utility of Thrombophilia Testing

Characteristic	Tests, n (%) n = 1451	Patients, n (%) n = 163
Tests occurring in situations associated with minimal clinical utility	911 (63)[a]	126 (77)[a]
Test type not recommended by guidelines or by University of Utah Health Care Thrombosis Service physicians	417 (29)	71 (44)
Discharged before test results available	381 (26)	65 (40)
Receiving anticoagulant therapy at time of test[a]	230 (16)	71 (44)
Acute thrombosis at time of test[a]	218 (15)	40 (25)
Provoked thrombotic events[a]		
Thrombosis occurred while pregnant, <6 weeks postpartum, or while on estrogen-containing medications	137 (9)	12 (7)
Thrombosis occurred <3 months following major surgery	119 (8)	8 (5)
	18 (1)	4 (2)
Duplicate testing	41 (3)	14 (9)
Pregnant, <6 weeks postpartum, or on estrogen-containing medications at time of test[a]	29 (2)	11 (7)

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Results

- 77% of testing met criteria for minimal clinical utility
- 9% of tests were positive
- 1% of patients had anticoagulation initiated because of testing
- 1% of patients had documentation of clear genetic counseling

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Discussion

- Limitation: Retrospective, large referral center, relied on provider notes and documentation
- Bottom line: Most testing done inpatient was of minimal clinical utility

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Some Reasons Not to Test

- Many thrombophilia tests are inaccurate in the setting of acute VTE and/or anticoagulation,
- Results of testing often do not influence management
- Testing in most cases is not cost-effective
- Testing may result in inappropriately prolonged anticoagulation courses
- Testing may results in unnecessary involvement of inpatient consultants.
- A positive test result may lead to unnecessary patient anxiety

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How Do We Fix It

- Provider education
- Hard Stops in EMR
- Removing/limiting use of thrombophilia panels
- Requiring specialty consultation prior to testing

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Case #1

What additional work-up would you do in the hospital prior to discharge?

A. CT chest, abdomen and pelvis to screen for malignancy
B. Thrombophilia work-up now
C. CT of chest, abdomen and pelvis and a thrombophilia work-up now
D. Discharge the patient on rivaroxaban for a minimum of 3 months with consideration of outpatient thrombophilia work-up

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Case #1 Part 2

- Patients is admitted 12 months later for a CAP. He is treated successfully with guideline based therapy and on the day of discharge wants to discuss his rivaroxaban. He has seen and heard a lot on TV and radio about rivaroxaban and bleeding risk. He and his wife are concerned about this risk. After discussion he is adamant about stopping the medication or at a minimum reducing the dose.
- Bleeding risk assessment: Low Risk

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Which of the following would you you recommend?

A. Stop rivaroxaban with no additional therapy
B. Decrease the dose of rivaroxaban to 10 mg daily
C. Stop rivaroxaban and start aspirin 100 mg daily
D. Change rivaroxaban to warfarin with a goal INR 2-3

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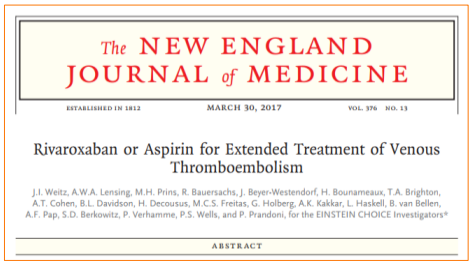
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 30, 2017 VOL. 376 NO. 13

Rivaroxaban or Aspirin for Extended Treatment of Venous Thromboembolism

J.I. Weitz, A.W.A. Lensing, M.H. Prins, R. Bauersachs, J. Beyer-Westendorf, H. Bounameaux, T.A. Brighton, A.T. Cohen, B.L. Davidson, H. Decousus, M.C.S. Freitas, G. Holberg, A.K. Kakkar, L. Haskell, B. van Bellen, A.F. Pap, S.D. Berkowitz, P. Verhamme, P.S. Wells, and P. Prandoni, for the EINSTEIN CHOICE Investigators*

ABSTRACT

Study Specifics

- Randomized, double-blind, phase 3 study
- 3396 patients with venous thromboembolism:
  - Rivaroxaban 20 mg daily
  - Rivaroxaban 10 mg daily
  - Aspirin 100 mg daily
- All patients had completed 6-12 months of anticoagulant
- Sponsored by Bayer Pharmaceuticals.

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Study Specifics

- Inclusion
  - >18 years of age
  - Completed 6-12 months of therapy of guideline based therapy
  - No interruption of therapy for > 7 days
- Exclusion:
  - Contraindication to continued anticoagulant therapy
  - Required extended anticoagulant therapy at therapeutic doses or antiplatelet therapy.

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Outcomes

- Primary efficacy outcome
  - Composite of symptomatic, recurrent fatal or nonfatal venous thromboembolism and unexplained death for which pulmonary embolism could not be ruled out.
- Secondary Outcomes
  - Myocardial infarction, ischemic stroke, systemic embolism, venous thrombosis in locations other than the deep veins of the lower limbs, and death from any cause.

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Safety Outcomes

- Primary
  - Major bleeding
- Secondary
  - Clinically relevant non-major bleeding, a composite of major or clinically relevant non-major bleeding, and non-major bleeding that led to study-drug interruption for more than 14 days.

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Major Bleeding

- Overt bleeding with:
  - Drop in the Hgb level of 2 g/dl
  - Transfusion of 2 or units of red cells
  - occurred in a critical site
  - contributed to death.

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Non-Major Bleeding

- Overt bleeding that did not meet the criteria for major bleeding but required:
  - Medical intervention
  - Unscheduled contact with a physician,
  - Interruption or discontinuation of the study drug
  - Discomfort or impairment of activities of daily living

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PATIENTS

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Index event — no. (%)			
Isolated deep-vein thrombosis	565 (51.0)	565 (50.1)	577 (51.0)
Isolated pulmonary embolism	381 (34.4)	381 (33.8)	366 (32.4)
Both deep-vein thrombosis and pulmonary embolism	155 (14.0)	179 (15.9)	181 (16.0)
Index event asymptomatic or unconfirmed	6 (0.5)	2 (0.2)	7 (0.6)
Classification of index venous thromboembolism — no. (%)			
Provoked	666 (60.2)	647 (57.4)	663 (58.6)
Unprovoked	441 (39.8)	480 (42.6)	468 (41.4)

Approximately 40% of patients in each study arm had an unprovoked DVT

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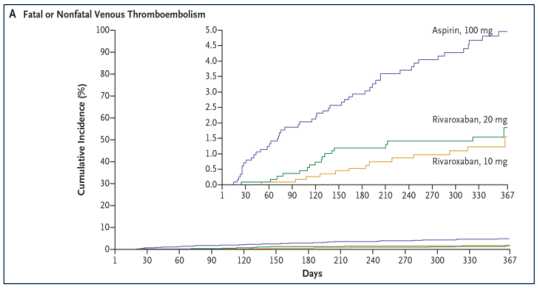

Aspirin 4.4% Rivaroxaban 10 mg 1.2%

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Bleeding

Study Drug and Dose	Major Bleeding %	Clinically Relevant Non-Major Bleeding %
Rivaroxaban 20 mg	0.5	2.7
Rivaroxaban 10 mg	0.4	2.0
Aspirin 100 mg	0.3	1.8

DISCUSSION

- NNT to prevent recurrent VTE in comparison to aspirin
  - 33 with 20 mg dose
  - 30 with 10 mg dose
- No statistically significant increase in risk of of major or non-major bleeding

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Limitations

- Excluded patients with indications for ongoing anticoagulation so unsure of benefit of lower dose rivaroxaban in this population

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Current Guidelines

- Unprovoked DVT
  - 3 months if high bleeding risk (IB)
  - Extended therapy (no scheduled stop date) if low or moderate bleeding risk (2B)
  - Aspirin recommended if stopping anticoagulant therapy

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Which of the following would you you recommend?

A. Stop rivaroxaban
B. Decrease the dose of rivaroxaban to 10 mg daily
C. Stop rivaroxaban and start aspirin 100 mg daily
D. Change rivaroxaban to warfarin with goal INR 2-3

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Take Home Point

- Consider low dose rivaroxaban as an option when stopping anticoagulation in patients with DVT
- Especially those with an unprovoked event

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Case #2

- A 64 year old female with a PMH of Hypertension and G3bA1 CKD presented to the ER with acute onset of pleuritic chest pain and shortness of breath. Non-massive hemoptysis. She did undergo right total knee arthroplasty 3 weeks ago.
- Physical Exam: T 99.4 HR 108, RR 22, BP 104/60, O2 Sat 92% on RA
- CHEST: CTA bilaterally
- CV: Regular, S1 and S2, no M/R/G, no elevated JVP
- EXT: No edema or asymmetry
- Wells score = 6
- CR 1.6, eGFR 44, CXR NAD

Case #2

- What is most appropriate next step in the management of this patient?
  - A. CT angiography
  - B. Anticoagulation and V/Q Scan on Monday when tech is available
  - C. D-Dimer

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Contrast Nephropathy

- Risk ranges from 1-20%
- Reasons for discrepancy
  - Varying definitions of contrast induced nephropathy
  - Differences in rates of contrast nephropathy for procedures vs. CT
  - Differing characteristics of patients populations
  - Routine use of low-osmolar contrast vs. prior prior use of high-osmolar contrast

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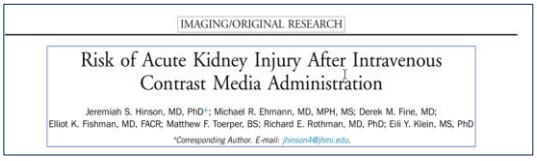

IMAGING/ORIGINAL RESEARCH

Risk of Acute Kidney Injury After Intravenous Contrast Media Administration

Jeremiah S. Hinson, MD, PhD*; Michael R. Ehmann, MD, MPH, MS; Derek M. Fine, MD; Elliot K. Fishman, MD, FACR; Matthew F. Toerper, BS; Richard E. Rothman, MD, PhD; Eili Y. Klein, MS, PhD

*Corresponding Author. E-mail: jhinson4@jhmi.edu.

Annals of Emergency Medicine 2016
http://dx.doi.org/10.1016/j.annemergmed.2016.11.021

Study Specifics

- Single-center retrospective cohort study
- 17,934 ED visits for patients who underwent:
  - Contrast-enhanced CT
  - CT without contrast
  - No CT
- 5-year period (2009 to 2014)

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Study Specifics

- Logistic regression modeling and odds ratios with and without propensity-score matching
- Independent association between contrast administration and primary and secondary outcomes.

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Outcomes

- Primary outcome
  - Incidence of AKI
- Secondary Outcomes
  - New chronic kidney disease, dialysis, and renal transplantation at 6 months

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Inclusion Criteria

- 18 years and older
- CT with or without contrast enhancement
- Serum Cr level measured in the 8 hours before CT
- A second Cr level measured 48 to 72 hours after CT

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Exclusion Criteria

- Serum Cr level less than 0.4 mg/dL
- Serum Cr ≥4.0 mg/dL
- Insufficient serum Cr level data
- A history of renal transplant or ongoing or previous dialysis
- An ED visit in the 6 months before the study start date,
- A CT scan performed in the 6 months preceding the index ED visit
- A contrast-enhanced CT performed within 72 hours of ED departure

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Definitions

- Contrast Nephropathy
  - Increase in serum creatinine level ≥ 0.5 mg/dL
  - ≥25% increase over baseline serum Cr level
  - Timing 48-72 hours after CT
- AKI
  - KDIGO Guidelines

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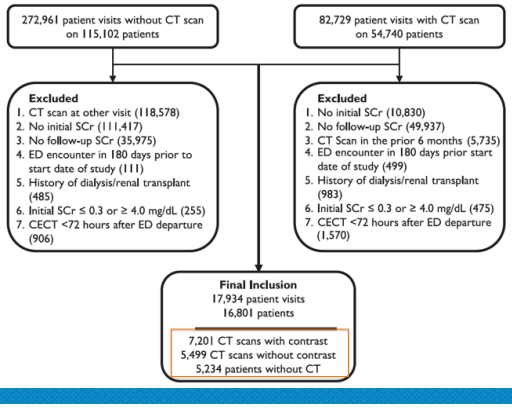

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Table 3. Risk of acute kidney injury after intravenous contrast administration with subgroup analysis stratified by initial estimated glomerular filtration rate.

eGFR subgroup, mL/min per 1.73 m²	CECT	Unenhanced CT	No CT	Contrast vs No Contrast	CECT vs Unenhanced CT[a]	Contrast vs No Contrast (Propensity-Score Matched)[b]	CECT vs Unenhanced CT (Propensity-Score Matched)[c]
	Rate of AKI by CIN Criteria (%)[d]			ORs of AKI by CIN Criteria (95% CI)[d]			
Overall	766/7,201 (10.6)	559/5,499 (10.2)	569/5,234 (10.9)	1.01 (0.92–1.12)	1.05 (0.94–1.18)	0.99 (0.98–1.00)	1.00 (0.98–1.01)
>90	510/4,127 (12.4)	261/2,039 (12.8)	304/2,360 (12.9)	0.96 (0.84–1.09)	0.96 (0.82–1.13)	1.00 (0.98–1.02)	1.00 (0.98–1.02)
60–89	179/2,176 (8.2)	111/1,337 (8.3)	133/1,374 (9.7)	0.81 (0.74–1.11)	0.99 (0.77–1.27)	1.01 (0.99–1.03)	1.01 (0.98–1.03)
45–59	59/575 (10.3)	66/714 (9.5)	59/589 (10.0)	1.06 (0.76–1.47)	1.09 (0.75–1.57)	1.02 (0.99–1.06)	1.02 (0.98–1.06)
30–44	12/241 (5.0)	57/768 (7.4)	44/550 (8.0)	0.63 (0.34–1.17)	0.65 (0.34–1.24)	1.00 (0.95–1.04)	0.96 (0.90–1.01)
15–29	6/78 (7.7)	53/599 (8.8)	27/345 (7.8)	0.90 (0.38–2.13)	0.86 (0.36–2.07)	0.99 (0.91–1.07)	1.03 (0.95–1.11)
<15	0/4	9/42 (21.4)	2/16 (12.5)				

No difference in Risk of AKI between contrast and non-contrast enhanced CT

Only 18 patients with a GFR <45 underwent a contrast enhanced CT

Limitations

- Did not account for nephron-protective or nephron-toxic interventions performed after the patient left the ER
- Most patients with GFR >45
- Significant selection bias
  - ER doctors less likely to order CT in those they felt were at high risk

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IMAGING/SYSTEMATIC REVIEW/META-ANALYSIS

Acute Kidney Injury After Computed Tomography: A Meta-analysis

Ryan D. Aycock, MD, MS*; Lauren M. Westafer, DO, MPH; Jennifer L. Boxen, MLS, MA; Nima Majlesi, DO; Elizabeth M. Schoenfeld, MD, MS; Raveendhara R. Bannuru, MD, PhD

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http://dx.doi.org/10.1016/j.annemergmed.2017.06.041

Outcomes

- Primary Outcome
  - Development of AKI in individuals receiving contrast enhanced CT compared with those who had a contrast enhanced CT
- Secondary Outcomes
  - Renal replacement therapy
  - All cause mortality

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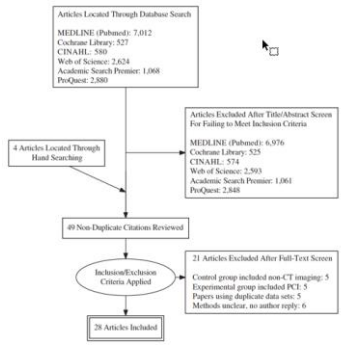

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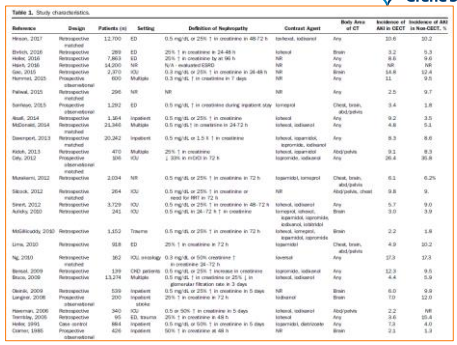

Table 1. Study characteristics.

Reference	Design	Patients (n)	Setting	Definition of Nephropathy	Contrast Agent	Body Area of CT	Incidence of AKI in CECT	Incidence of AKI in Non-CECT, %
Hinson, 2017	Retrospective matched	12,700	ED	0.5 mg/dL or 25% ↑ in creatinine in 48-72 h	Isovue, iodixanol	Any	10.6	10.2
Ehrlich, 2016	Retrospective	289	ED	25% ↑ in creatinine in 24-48 h	Isovue	Brain	3.2	5.3
Heiler, 2016	Retrospective	7,863	ED	25% ↑ in creatinine by at 96 h	NR	Any	8.6	9.0
Hsieh, 2016	Retrospective	14,200	NR	N/A - evaluated ESRD	NR	Any	NR	NR
Gao, 2010	Retrospective	2,370	ICU	0.3 mg/dL or 25% ↑ in creatinine in 24-48 h	NR	Brain	14.8	12.4
Hummel, 2015	Prospective observational	600	Multiple	0.3 mg/dL ↑ in creatinine in 7 days	NR	Any	11	9.5
Palwal, 2015	Retrospective matched	296	NR	NR	NR	Any	2.5	9.7
Sorhaye, 2015	Prospective observational	1,282	ED	0.5 mg/dL ↑ in creatinine during inpatient stay	Iomeprol	Chest, brain, abd/pelvis	3.4	1.8
Abaß, 2014	Retrospective	2,164	Inpatient	0.5 mg/dL or 25% ↑ in creatinine	Isovue	Any	9.2	3.5
McDonald, 2014	Retrospective matched	21,340	Multiple	0.5 mg/dL ↑ in creatinine in 24-72 h	Isovue, iodixanol	Any	4.8	5.1
Davenport, 2013	Retrospective matched	20,242	Inpatient	0.5 mg/dL or 1.5 ↑ in creatinine	Isovue, isoamidol, iopromide, iodixanol	Any	8.3	8.6
Kolski, 2013	Retrospective	470	Multiple	25% ↑ in creatinine	Isovue, isoamidol	Abd/pelvis	9.1	8.3
Gay, 2012	Prospective observational matched	306	ICU	↓ 33% in mGFR in 72 h	Isoamidol, iodixanol	Any	26.4	35.8
Mueskens, 2012	Retrospective	2,034	NR	0.5 mg/dL or 25% ↑ in creatinine in 72 h	Isoamidol, iomeprol	Chest, brain, abd/pelvis	6.1	6.2%
Silcock, 2012	Retrospective matched	264	ICU	0.5 mg/dL or 25% ↑ in creatinine or need for RRT in 72 h	NR	Abd/pelvis, chest	9.8	9.
Sirenl, 2012	Retrospective	3,729	ICU	0.5 mg/dL or 25% ↑ in creatinine in 48-72 h	Isovue, iodixanol	Any	5.7	9.0
Ashley, 2010	Retrospective	241	ICU	0.5 mg/dL in 24-72 h ↑ in creatinine	Iomeprol, iohexol, ioperamid, ioprornide, iodixanol, iodimidol	Brain	3.0	3.9
McGillicuddy, 2010	Retrospective	1,152	Trauma	0.5 mg/dL or 25% ↑ in creatinine in 72 h	Isovue, iomeprol, ioperamid, ioprornide	Brain	2.2	1.8
Lima, 2010	Retrospective	918	ED	25% ↑ in creatinine in 72 h	Ioperamid	Chest, brain, abd/pelvis	4.9	10.2
Ng, 2010	Retrospective matched	362	ICU, oncology	0.3 mg/dL or 50% creatinine ↑ in creatinine 24-72 h	Isovist	Any	17.9	17.5
Bensal, 2009	Retrospective	139	CKD patients	0.5 mg/dL or 25% ↑ increase in creatinine	Ioprornide, iodixanol	Any	12.3	9.5
Bruce, 2009	Retrospective	13,274	Multiple	0.5 mg/dL ↑ in creatinine or 25% ↓ in glomerular filtration rate in 2 days	Isovue, iodixanol	Any	4.4	5.9
Davies, 2009	Retrospective	539	Inpatient	0.5 mg/dL or 25% ↑ in creatinine in 5 days	NR	Brain	6.0	9.9
Langlois, 2008	Prospective observational	200	Inpatient stroke	25% ↑ in creatinine in 72 h	Iodixanol	Brain	7.0	12.0
Haseman, 2006	Retrospective	340	ICU	0.5 or 50% ↑ in creatinine in 5 days	Isovue, iodixanol	Abd/pelvis	2.2	NR
Tremblay, 2006	Retrospective	95	ED, trauma	25% ↑ in creatinine in 48 h	Isovue	Any	3.6	10.4
Heiler, 1995	Case control	864	Inpatient	0.5 mg/dL or 50% ↑ in creatinine in 5 days	Ioprornide, diatrizoate	Any	7.3	4.0
Cramer, 1995	Prospective observational	426	Inpatient	50% ↑ in creatinine at 48 h	NR	Brain	2.1	1.3

Incidence 2.1-26%

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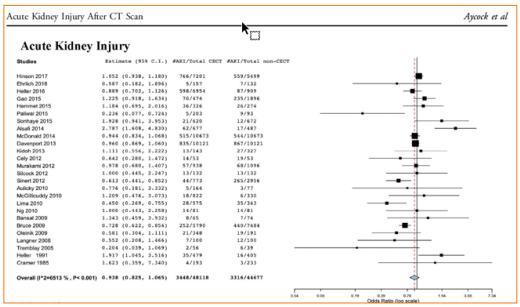

NO DIFFERENCE BETWEEN CONTRAST AND NON-CONTRAST CT

Results

- NO difference in the rates of renal insufficiency, need for dialysis, or mortality between patients receiving contrast-enhanced CT versus those receiving non-contrast CT

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Limitations

- Observational data
- Most retrospective
- Selection bias
- Heterogeneity of included studies
  - Type of contrast
  - Setting
  - Patient population
  - Definitions of AKI

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Strengths

- Large dataset
- Multiple patient populations
- Given the unlikelihood of a randomized controlled trial this is likely the best data we will get

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Key Point

- Only included patients undergo CT with contrast NOT other contrast procedures (angiography)

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ACR Guide on Contrast Media

- At the current time, there is very little evidence that IV contrast material is an independent risk factor for AKI in patients with eGFR ≥30 mL
- Therefore, if a threshold for CIN risk is used at all, 30 mL / min/1.73m2 seems to be the one with the greatest level of evidence

ACR Manual on Contrast Media – Version 10.3 / May 31, 2017

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Take Home Points

- We may have overestimated the risk of post-contrast AKI
- No real cutoff for GFR
  - Data and ACR suggest those with GFR <30 may be at greatest risk
    - Radiology. 2013 Sep;268(3):719-28
- Individual patient risk and the indication for the test should be your guide
  - Suspect PE in patient with GFR 45 → CTA angiogram

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Case #2

- What is most appropriate next step in the management of this patient?
  A. **CT angiography**
  B. Anticoagulation and V/Q Scan on Monday when tech is available
  C. D-Dimer

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Case #3

- 72 year old present with 4 hours of chest pain. Pain relieved with 3 NTG
- O2 saturation 98% on RA
- EKG: NSR, NS ST-T wave changes
- Troponin 2.4

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Case #3

- Should this patient be given supplemental oxygen?
  A. Yes
  B. No
  C. Maybe

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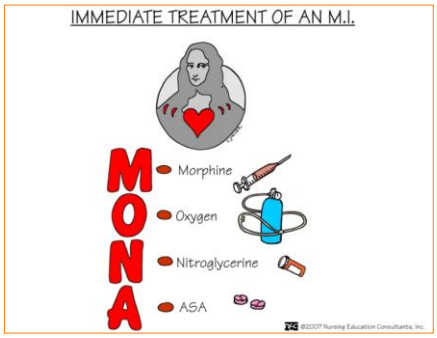

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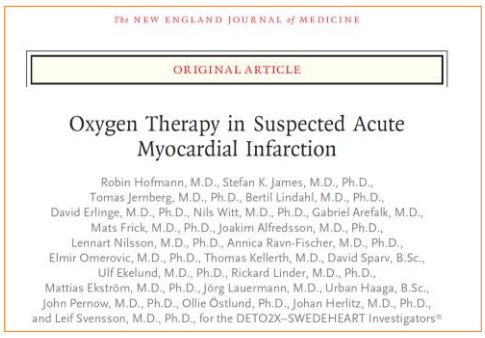
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Oxygen Therapy in Suspected Acute Myocardial Infarction

Robin Hofmann, M.D., Stefan K. James, M.D., Ph.D., Tomas Jernberg, M.D., Ph.D., Bertil Lindahl, M.D., Ph.D., David Erlinge, M.D., Ph.D., Nils Witt, M.D., Ph.D., Gabriel Arefalk, M.D., Mats Frick, M.D., Ph.D., Joakim Alfredsson, M.D., Ph.D., Lennart Nilsson, M.D., Ph.D., Annica Ravn-Fischer, M.D., Ph.D., Elmir Omerovic, M.D., Ph.D., Thomas Kellerth, M.D., David Sparv, B.Sc., Ulf Ekelund, M.D., Ph.D., Rickard Linder, M.D., Ph.D., Mattias Ekström, M.D., Ph.D., Jörg Lauermann, M.D., Urban Haaga, B.Sc., John Pernow, M.D., Ph.D., Ollie Östlund, Ph.D., Johan Herlitz, M.D., Ph.D., and Leif Svensson, M.D., Ph.D., for the DETO2X–SWEDEHEART Investigators*

Published Online August 28, 2017. DOI: 10.1056/NEJMoa1706222

Trial Specifics

- Registry-based, multiple center, open label randomized clinic trial
- Patient with suspected MI with an O2 saturation > 90%
  - Supplemental oxygen 6 liters per minute for 6-12 hours
  - Ambient air
- Primary endpoint:
  - Death from any cause within one year of randomization

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Trial Specifics

- Inclusion criteria
  - >30 year of age
  - Symptoms suggestive of MI for <6 hours
  - O2 sat of 90% or higher
  - ECG indicating ischemia or elevated troponin levels
- Exclusion
  - Ongoing oxygen therapy
  - Presentation with cardiac arrest

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Variable	Oxygen Group (N = 8011)		Ambient-Air Group (N = 8128)		P Value
	Value among Patients with Data Available	No. (%) of Patients with Missing Data	Value among Patients with Data Available	No. (%) of Patients with Missing Data	
Median duration of oxygen therapy (IQR) — hr	11.64 (6.03–12.02)	243 (7.3)	—	—	
Received oxygen outside the protocol because of development of hypoxemia — no. (%)	62 (1.9)	0	254 (7.7)	0	<0.001
Median oxygen saturation at end of treatment period (IQR) — %	99 (97–100)	569 (17.2)	97 (95–98)	563 (17.0)	<0.001
Procedures — no. (%)					
Coronary angiography	2797 (84.5)	0	2836 (85.5)	0	0.26
PCI	2183 (65.9)	0	2246 (67.7)	0	0.13
CABG	96 (2.9)	24 (0.7)	110 (3.3)	28 (0.8)	0.51
Median duration of hospital stay (range) — days	3.0 (0–68)	0	3.0 (0–95)	0	0.87
Medication — no. (%)					
Intravenous diuretic	309 (9.3)	30 (0.9)	322 (9.7)	38 (1.1)	0.58
Intravenous inotrope†	46 (1.4)	33 (1.0)	70 (2.1)	42 (1.3)	0.02
Intravenous nitroglycerin	252 (7.6)	32 (1.0)	221 (6.7)	44 (1.3)	0.14
Aspirin	2758 (83.3)	54 (1.6)	2803 (84.5)	55 (1.7)	0.16
$P2Y_{12}$ receptor inhibitor	2445 (73.8)	53 (1.6)	2463 (74.2)	54 (1.6)	0.62
Beta-blocker	2702 (81.6)	54 (1.6)	2752 (82.9)	52 (1.6)	0.13
Statin	2782 (84.0)	53 (1.6)	2765 (83.3)	55 (1.7)	0.46
ACE inhibitor or ARB	2586 (78.1)	53 (1.6)	2557 (77.1)	55 (1.7)	0.32
Calcium blocker	519 (15.7)	52 (1.6)	547 (16.5)	54 (1.6)	0.36
Diuretic	607 (18.3)	53 (1.6)	615 (18.5)	53 (1.6)	0.82
Complications — no. (%)					
Reinfarction	17 (0.5)	34 (1.0)	15 (0.5)	33 (1.0)	0.72
New-onset atrial fibrillation	94 (2.8)	33 (1.0)	103 (3.1)	32 (1.0)	0.53
Atrioventricular block, second-degree or third-degree	46 (1.4)	30 (0.9)	58 (1.7)	30 (0.9)	0.24
Cardiogenic shock	32 (1.0)	27 (0.8)	37 (1.1)	27 (0.8)	0.54
Cardiac arrest	79 (2.4)	28 (0.8)	63 (1.9)	28 (0.8)	0.17
Death	53 (1.6)	28 (0.8)	44 (1.3)	26 (0.8)	0.35

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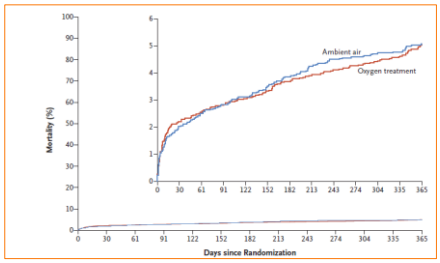
Results



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Results

Timing and End Point	Oxygen Group (N = 3311)	Ambient-Air Group (N = 3318)	Hazard Ratio (95% CI)	P Value
365 Days after randomization				
Death from any cause — no. (%)	166 (5.0)	168 (5.1)	0.97 (0.79–1.21)	0.80
Rehospitalization with myocardial infarction — no. (%)	126 (3.8)	111 (3.3)	1.13 (0.88–1.46)	0.33
Composite of death from any cause or rehospitalization with myocardial infarction — no. (%)	275 (8.3)	264 (8.0)	1.03 (0.87–1.22)	0.70
30 Days after randomization				
Death from any cause — no. (%)	73 (2.2)	67 (2.0)	1.07 (0.77–1.50)	0.67
Rehospitalization with myocardial infarction — no. (%)	45 (1.4)	31 (0.9)	1.46 (0.92–2.31)	0.11
Composite of death from any cause or rehospitalization with myocardial infarction — no. (%)	114 (3.4)	95 (2.9)	1.19 (0.91–1.56)	0.21
During hospital stay				
Median highest measured level of highly sensitive troponin T (IQR) — ng/liter[a]	946.5 (243.0–2884.0)	983.0 (225.0–2931.0)	—	0.97

Key Point

- No beneficial effect of oxygen treatment with respect to all-cause mortality at 1 year

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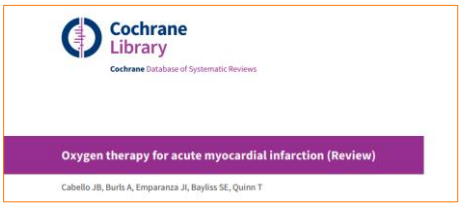

There is no evidence from randomised controlled trials to support the routine use of inhaled oxygen in people with AMI, and we cannot rule out a harmful effect

December 2016

Other Data

- AVOID trial STEMI
  - Larger myocardial infarcts in patients assigned to oxygen group
  - Circulation 2015;131:2143-50
- SOCCER Trial
  - Oxygen had no effect on infarct size
  - Eur J Emerg Med November 13, 2016 Epub

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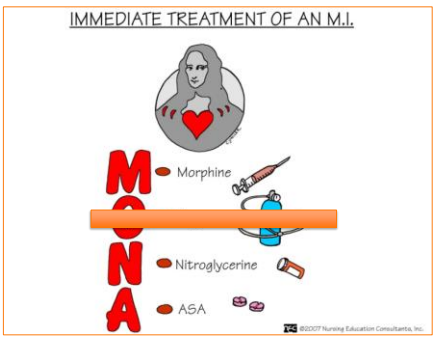

Take Home Point

- Newer data suggest that oxygen therapy in non-hypoxemic patients with AMI does not improve outcomes

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Provider and Outcomes

Research

JAMA Internal Medicine | Original Investigation

Comparison of Hospital Mortality and Readmission Rates for Medicare Patients Treated by Male vs Female Physicians

Yusuke Tsugawa, MD, MPH, PhD; Anupam B. Jena, MD, PhD; Jose F. Figueroa, MD, MPH; E. John Orav, PhD; Daniel M. Blumenthal, MD, MBA; Ashish K. Jha, MD, MPH

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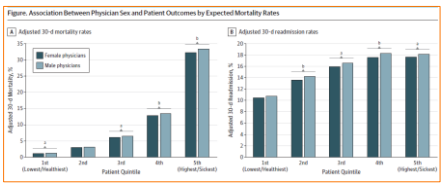
Result



Women physicians had lower 30 day mortality and readmission rates

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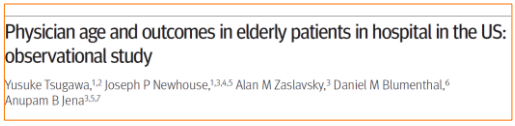
Provider and Outcomes


Physician age and outcomes in elderly patients in hospital in the US: observational study

Yusuke Tsugawa,[1,2] Joseph P Newhouse,[1,3,4,5] Alan M Zaslavsky,[3] Daniel M Blumenthal,[6] Anupam B Jena[3,5,7]

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Provider and Outcomes

- Older physicians had higher mortality than patients cared for by younger physicians
- Exception: Physicians treating high volumes of patients
  - >201 admissions per year
  - 1.08 admission per day if working a 7 on and 7 off model

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Case #3

- 64 year old admitted for cellulitis on IV cefazolin who has been afebrile for 48 hours spikes a T to 102.1
- Blood cultures on admission were negative
- He has normal food consumptions and no shaking chills
- Should be get blood cultures on this patient?

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Journal of Hospital Medicine Vol 11 | No 5 | May 2016

Our Reflex

FEVER → BLOOD CULTURE

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Study Specifics

- Prospective cohort study at VA medical center
- Included all hospitalized patients on a medical service for whom a blood culture was obtained
- Main Outcomes:
  - Rate of true positive blood cultures
  - Predictors of true positive blood cultures

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TABLE 1. Clinical Characteristics of the Cohort

Clinical Characteristic	Total, n = 363 (%)	True Positive Blood Cultures, n = 14 (%)	*P* Value
Mean age, y	70.4	73.9	0.4
Male sex	350 (96%)	14 (100%)	1
White race	308 (85%)	11 (79%)	0.7
Location prior to admission			
Community	276 (76%)	11 (79%)	1
Hospital	51 (14%)	1 (7%)	0.7
Long-term care facility	36 (10%)	2 (14%)	0.6
Comorbidities			
Diabetes	136 (37%)	5 (36%)	1
Malignancy	100 (28%)	4 (31%)	1
Alcohol abuse	89 (25%)	2 (14%)	0.5
Cirrhosis	31 (9%)	1 (7%)	1
End-stage renal disease	21 (6%)	1 (7%)	1
Active drug use[a]	16 (4%)	1 (7%)	0.5
Catheter[b]	93 (26%)	3 (21%)	0.8
Recent hospitalization[c]	145 (40%)	6 (43%)	1
History of MRSA colonization	72 (20%)	5 (36%)	0.16
Cultures drawn in emergency department	69 (19%)	6 (43%)	0.03

NOTE: Abbreviations: MRSA, methicillin-resistant staphylococcus aureus. [a]Documented in admission note. [b]Includes urinary and central venous catheters. [c]Within 90 days of current hospitalization.

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Results

TABLE 2. Rates of True Positive, False Positive, and True Negative Blood Cultures

	Total, n (%)	True Positive, n (%)	False Positive, n (%)	True Negative, n (%)
Per patient	363	14 (3.8)	13 (3.6)	336 (92.6)
Per blood culture episode	487	16 (3.4)	13 (2.7)	438 (93.9)
Per blood culture order	576	21 (3.6)	13 (2.3)	542 (94.1)
Rates per blood culture order				
Physician-selected indication, n = 530				
Fever	136 (25.9)	3 (2.2)	3 (2.2)	130 (95.6)
Fever and additional indication(s)	110 (22.2)	5 (4.2)	3 (2.5)	110 (93.2)
Fever and leukocytosis	50 (9.4)	4 (8.0)	3 (6.0)	43 (86.0)
Leukocytosis	55 (9.4)	2 (4.0)	0 (0)	48 (96.0)
Follow-up previous positive	60 (11.3)	7 (11.7)	0 (0)	53 (88.3)
Working diagnosis, n = 576				
Pneumonia	101 (17.5)	0 (0)	4 (3.9)	97 (96.0)
Endocarditis	97 (16.8)	12 (12.3)	1 (1.0)	84 (86.6)
Urinary tract infection[a]	95 (16.4)	5 (5.3)	2 (2.1)	88 (92.6)
Other infection[b]	46 (8.0)	0 (0)	0 (0)	46 (100)
Skin and soft-tissue infection	39 (6.8)	1 (2.6)	0 (0)	38 (97.4)
Neutropenic fever	28 (4.9)	0 (0)	0 (0)	28 (100)
Sepsis	27 (4.7)	0 (0)	0 (0)	27 (100)
Fever[c]	19 (3.1)	1 (5.5)	1 (5.5)	16 (88.9)
Bone and join infection	15 (2.6)	1 (6.7)	0 (0)	14 (93.3)
Postoperative fever	9 (1.6)	0 (0)	0 (0)	9 (100)
Noninfectious diagnosis[d]	101 (17.5)	1 (1.0)	5 (5.0)	95 (94.1)
Antibiotic exposure				
Yes	354 (61.5)	5 (1.4)	5 (1.4)	344 (97.1)
No	222 (38.6)	16 (7.2)	8 (3.6)	198 (89.1)
Previous documented positive culture via chart review				
Yes	155 (26.9)	9 (5.8)	2 (1.3)	144 (92.9)
No	421 (73.1)	12 (2.9)	11 (2.6)	398 (94.5)

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Physician-Selected Indications

Indication	LR of a True Positive Culture
Fever	0.6 (0.2-1.7)
Fever and Leukocytosis	1.1 (0.5-2.4)
Leukocytosis	1.1 (0.3-4.0)
Fever and Other Indications	1.1 (0.5-2.4)
Follow-up of Previous Positive Culture	**3.4 (1.8-6.5)**

Diagnosis

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Diagnosis	LR for True Positive Blood Culture	LR for False Positive Blood Culture
Pneumonia	0.1 (0.0-1.9)	1.8 (0.8-4.1)
Bacteremia/Endocarditis	**3.7 (2.5-5.7)**	0.5 (0.1-3.0)
UTI	1.5 (0.7-3.2)	0.9 (0.3-3.4)
Non-infectious Diagnosis	0.3 (0.0-1.8)	**2.3 (1.1-4.6)**

Recent Antibiotic Exposure

Recent Antibiotic Exposure	LR for True Positive Blood Culture	LR for False Positive Blood Culture
Yes	**0.4 (0.2-0.8)**	0.6 (0.3-1.2)
No	**2.1 (1.6-2.7)**	1.6 (1.0-2.5)
No with Fever	**2.4 (1.2-4.0)**	0.8 (0.2-3.6)
No with fever and leukocytosis	**5.6 (1.8-18.2)**	0.4 (0.1-2.6)

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Putting It All Together

- Increased likelihood of TRUE positive
  - Follow-up of previous positive cultures
  - Diagnosis of bacteremia/endocarditis
  - Lack of prior antibiotic exposure
    - Odds ratio increases with fever, and fever with leukocytosis
- Decreased Likelihood of TRUE positive culture
  - Previous exposure to antibiotics

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A Few Scenarios

- No antibiotics, fever and leukocytosis
  - Likelihood ratio 5.6
  - Assuming a true positive rate of 3.6% the probability of a positive culture would be 17.3%
- Treated for pneumonia already on antibiotics
  - LR 0.4
  - Probability of a true positive culture 1.5%

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Limitations

- Based on physician chosen indication which may not correlate with actual clinical picture
- No evaluation of harm of not ordering a blood culture
- Did not assess the value of a true negative blood culture
- VA hospital
- Patients on general medical ward

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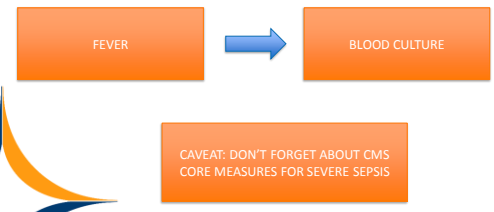
Our Reflex Might Be Wrong



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CMS Measures for Severe Sepsis

- Measure serum lactate
- **Obtain BLOOD CULTURES prior to antibiotics**
- Administer Antibiotics
- Repeat serum lactate if initial >2

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Take Home Point

- Yield of blood cultures in the inpatient setting is low
- In the end you have to weigh the low true positive rate against the consequence of missing a blood stream infection and/or a core measure

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ORIGINAL RESEARCH

A Simple Algorithm for Predicting Bacteremia Using Food Consumption and Shaking Chills: A Prospective Observational Study

Takayuki Komatsu, MD, PhD[1*] and Erika Takahashi, MD[1*], Kentaro Mishima, MD[1], Takeo Toyoda, MD, PhD[2], Fumihiro Saitoh, MD[3], Akari Yasuda, RN[4], Joe Matsuoka, PhD[5], Manabu Sugita, MD, PhD[1], Joel Branch, MD[6], Makoto Aoki, MD[7], Lawrence M. Tierney, Jr, MD[8], Kenji Inoue, MD, PhD[9]

[1]Department of Emergency and Critical Care Medicine, Juntendo University Nerima Hospital, Tokyo, Japan; [2]Department of Internal Medicine, Nerima General Hospital, Tokyo, Japan; [3]Department of General Medicine, Ozumi Health Cooperative Hospital, Tokyo, Japan; [4]Department of Nursing, Juntendo University Nerima Hospital, Tokyo, Japan; [5]Juntendo Clinical Research Support Center, Juntendo University School of Medicine, Tokyo, Japan; [6]Department of General Internal Medicine, Shonan Kamakura General Hospital, Kanagawa, Japan. [7]Consultant to Sakura Seiki Co Ltd, Tokyo, Japan; [8]Department of Internal Medicine, University of California San Francisco, San Francisco, California; [9]Department of Cardiology, Juntendo University Nerima Hospital, Tokyo, Japan. *Both authors contributed equally to this work.

Journal of Hospital Medicine Vol 12 | No 7 | July 2017

Study Specifics

- Prospective multicenter observational study
- Three hospitals in a large Japanese city
- 1943 patients age 14-96 who have blood cultures drawn from April 2013 to August 2014
- Excluded patients with anorexia-inducing conditions

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Study Specifics

- Looked at meal consumption immediately prior to the blood culture
  - Normal defined as >80%
- Looked for history of shaking chills

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TABLE 1. Characteristics of Patients[a]

	True Bacteremia (n = 221)	Non-Bacteremia (n = 1626)	*P* value
Age (y)	71.5 ± 14.9	68.1 ± 17.7	<.01
No. (%) of women	113 (51.1)	734 (45.1)	.14
Vital signs			
Body temperature (°C)	38.4 ± 1.2	37.9 ± 1.0	<.01
Heart rate (bpm)	102 ± 19.5	92.7 ± 19.3	<.01
Systolic blood pressure (mm Hg)	136.8 ± 28.5	137.9 ± 24.4	.55
Respiratory rate (breaths/min)	22.4 ± 6.5	20.7 ± 6.2	<.01
Laboratory data			
White blood cell counts (× 10^3 WBC/μL)	12.1 ± 8.5	10.3 ± 1.4	.06
C-reactive protein (mg/dL)	11.6 ± 9.6	7.3 ± 6.9	<.01
No. (%) of patients administered antibiotics	37 (16.6)	452 (27.6)	<.01
Degree of chills, No. (%)			
No chills	136 (61.5)	1378 (84.7)	<.01
Mild chills	25 (11.2)	123 (7.6)	.054
Moderate chills	8 (3.6)	45 (2.8)	.48
Shaking chills	52 (23.5)	80 (4.9)	<.01
Degrees of food consumption, No. (%)			
Low	174 (78.3)	790 (48.6)	<.01
Moderate	33 (14.8)	273 (16.8)	.49
High	14 (6.3)	563 (34.6)	<.01

[a]Plus-minus values are mean ± standard deviation (SD).

Bacteremia group:

1) Higher T, HR, RR, and CRP
2) Shaking chills = 23% vs. 4.9%
3) Low food consumption = 78% vs. 48.6%

Results

TABLE 2. Components of Predicting True Bacteremia Identified by Multiple Logistic Regression Method

Variables	OR (95% CI)	*P* value
Gender (female vs male)	1.4 (1.0-1.9)	.036
Heart rate >90 bpm	1.5 (1.1-2.1)	.021
Body temperature <36ºC or >38ºC	1.8 (1.3-2.6)	<.01
Systolic blood pressure <90 mmHg	3.1 (1.6-5.7)	<.01
White blood cell counts <4 or 12 × 10^3 WBC/μL	1.6 (1.2-2.3)	.003
C-reactive protein >10.0 mg/dL	2.2 (1.6-3.1)	<.01
Chills shaking chills vs negative shaking chills	5.6 (3.6-8.6)	<.01

NOTE: Abbreviations: CI, confidence interval; OR, odds ratio.

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Results

- Pre-test probability of true bacteremia was in all patients
  - 2.4%
- Pre-test probability of bacteremia in those with shaking chills and low food consumption
  - 47.7%

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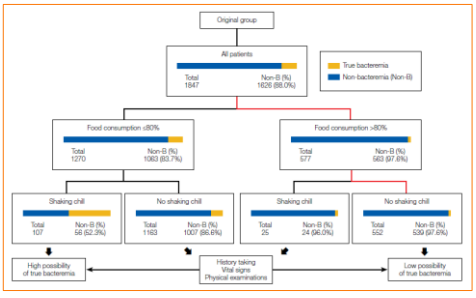

Take Home Points

- Shaking chills and low food consumption were associated with a higher probability of true positive blood cultures
- Simple bedside assessment that may increase the yield of blood cultures in hospitalized patients

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Case #4

- In patients with S. Aureus bacteremia which of the following measures improve mortality?

A. Appropriate antibiotics
B. Echocardiography
C. ID Consultation
D. All of the above

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JAMA Internal Medicine | Original Investigation

Association of Evidence-Based Care Processes With Mortality in *Staphylococcus aureus* Bacteremia at Veterans Health Administration Hospitals, 2003-2014

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Study Specifics

- Retrospective observational cohort study
- All patients admitted to the VA hospital who had S. aureus bacteremia from 2003-2014
- 36,868 patients in 124 hospitals
  - 19325 MRSA
  - 17543 MSSA

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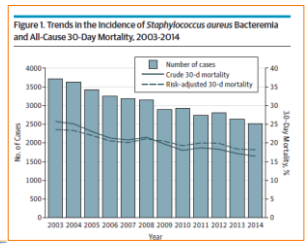
Results



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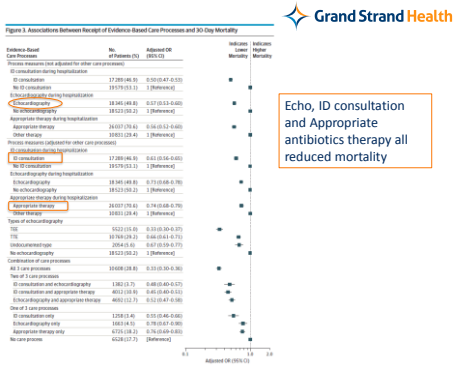

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Echo, ID consultation and Appropriate antibiotics therapy all reduced mortality

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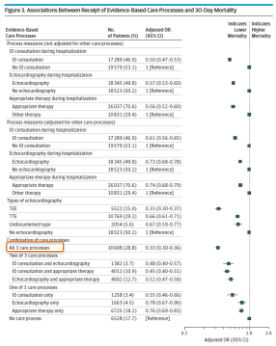

Figure 3. Associations Between Receipt of Evidence-Based Care Processes and 30-Day Mortality

Evidence-Based Care Processes	No. of Patients (%)	Adjusted OR (95% CI)
Process measures (not adjusted for other care processes)		
ID consultation during hospitalization		
ID consultation	17 289 (46.9)	0.50 (0.47-0.53)
No ID consultation	19 579 (53.1)	1 [Reference]
Echocardiography during hospitalization		
Echocardiography	18 345 (49.8)	0.57 (0.53-0.60)
No echocardiography	18 523 (50.2)	1 [Reference]
Appropriate therapy during hospitalization		
Appropriate therapy	26 037 (70.6)	0.56 (0.52-0.60)
Other therapy	10 831 (29.4)	1 [Reference]
Process measures (adjusted for other care processes)		
ID consultation during hospitalization		
ID consultation	17 289 (46.9)	0.61 (0.56-0.65)
No ID consultation	19 579 (53.1)	1 [Reference]
Echocardiography during hospitalization		
Echocardiography	18 345 (49.8)	0.73 (0.68-0.78)
No echocardiography	18 523 (50.2)	1 [Reference]
Appropriate therapy during hospitalization		
Appropriate therapy	26 037 (70.6)	0.74 (0.68-0.79)
Other therapy	10 831 (29.4)	1 [Reference]
Types of echocardiography		
TEE	5523 (15.0)	0.33 (0.30-0.37)
TTE	10 769 (29.2)	0.66 (0.61-0.71)
Undocumented type	2054 (5.6)	0.67 (0.59-0.77)
No echocardiography	18 523 (50.2)	1 [Reference]
Combinations of care processes		
All 3 care processes	10 608 (28.8)	0.33 (0.30-0.36)
Two of 3 care processes		
ID consultation and echocardiography	1382 (3.7)	0.48 (0.40-0.57)
ID consultation and appropriate therapy	4012 (10.9)	0.45 (0.40-0.51)
Echocardiography and appropriate therapy	4692 (12.7)	0.52 (0.47-0.58)
One of 3 care processes		
ID consultation only	1258 (3.4)	0.55 (0.46-0.66)
Echocardiography only	1663 (4.5)	0.78 (0.67-0.90)
Appropriate therapy only	6725 (18.2)	0.76 (0.69-0.83)
No care process	6528 (17.7)	[Reference]

Indicates Lower Mortality | Indicates Higher Mortality

0.5 1.0 2.0

Adjusted OR (95% CI)

Combining ID consultation, echo and appropriate antibiotics markedly reduced morality (OR 0.33)

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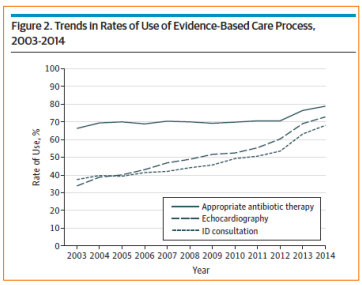

Discussion

- Definitely some limitations with VA population and retrospective observational study
- However compelling data to suggest these process improve overall mortality

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Take Home Point

- The following measures should likely be standard in S aureus bacteremia
  - Appropriate antibiotics
  - Echo
  - ID consult

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Applied and Environmental Microbiology

Longer Contact Times Increase Cross-Contamination of *Enterobacter aerogenes* from Surfaces to Food

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ABSTRACT

Bacterial cross-contamination from surfaces to food can contribute to foodborne disease. The cross-contamination rate of *Enterobacter aerogenes* on household surfaces was evaluated by using scenarios that differed by surface type, food type, contact time (<1, 5, 30, and 300 s), and inoculum matrix (tryptic soy broth or peptone buffer). The surfaces used were stainless steel, tile, wood, and carpet. The food types were watermelon, bread, bread with butter, and gummy candy. Surfaces (25 cm^2) were spot inoculated with 1 ml of inoculum and allowed to dry for 3 h, yielding an approximate concentration of 10^7 CFU/surface. Foods (with a 16-cm^2 contact area) were dropped onto the surfaces from a height of 12.5 cm and left to rest as appropriate. Posttransfer, surfaces and foods were placed in sterile filter bags and homogenized or massaged, diluted, and plated on tryptic soy agar. The transfer rate was quantified as the log percent transfer from the surface to the food. Contact time, food, and surface type all had highly significant effects ($P < 0.000001$) on the log percent transfer of bacteria. The inoculum matrix (tryptic soy broth or peptone buffer) also had a significant effect on transfer ($P = 0.013$), and most interaction terms were significant. More bacteria transferred to watermelon (~0.2 to 97%) than to any other food, while the least bacteria transferred to gummy candy (~0.1 to 82%). Transfer of bacteria to bread (~0.02 to 94%) was similar to transfer of bacteria to bread with butter (~0.02 to 82%), and these transfer rates under a given set of conditions were more variable than with watermelon and gummy candy.

IMPORTANCE

The popular notion of the "five-second rule" is that food dropped on the floor and left there for <5 s is "safe" because bacteria need time to transfer. The rule has been explored by a single study in the published literature and on at least two television shows. Results from two academic laboratories have been shared through press releases but remain unpublished. We explored this topic by using four different surfaces (stainless steel, ceramic tile, wood, and carpet), four different foods (watermelon, bread, bread with butter, and gummy candy), four different contact times (<1, 5, 30, and 300 s), and two bacterial preparation methods. Although we found that longer contact times result in more transfer, we also found that other factors, including the nature of the food and the surface, are of equal or greater importance. Some transfer takes place "instantaneously," at times of <1 s, disproving the five-second rule.

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The Study

- Four surfaces
  - Tile, Stainless steel, wood and carpet
  - Surfaces with inoculated with 1 ml of fluid containing Enterobacter aerogenes
- Four foods
  - Watermelon, gummy candy, bread, bread with butter
- Contact times
- <1 s, 5 s, 30 s, 300 s

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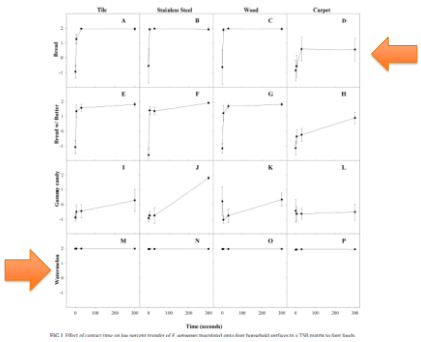

Bottom Line

- Don't trust the 5 second rule especially with watermelon

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What Did We Learn

- Think at least twice before doing a thrombophilia work-up in the hospital
- Consider low dose rivaroxaban after stopping full anticoagulation for DVT
- Recognize that the risk of contrast nephropathy in patients with GFR >30 is not as high as we might think
- Do not routinely give oxygen to non-hypoxemic patients admitted with ACS
- Choice your physician carefully
- Do not routinely reflex to culture in patients who "spike" while hospitalized
- Consider echo and ID consultation in addition to appropriate antibiotics in patients with S. aureus bacteremia
- Do not rely on the 5 second rule

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