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Emergency Medicine Research:

Creating Evidence to Improve Safety and Effectiveness of ED Patient Care



CAEP 2014
CAPITALIZING
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de l'Hôpital d'Ottawa



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***No Conflicts of interest to
declare***

***Thank You:
Dr Ian Stiell***



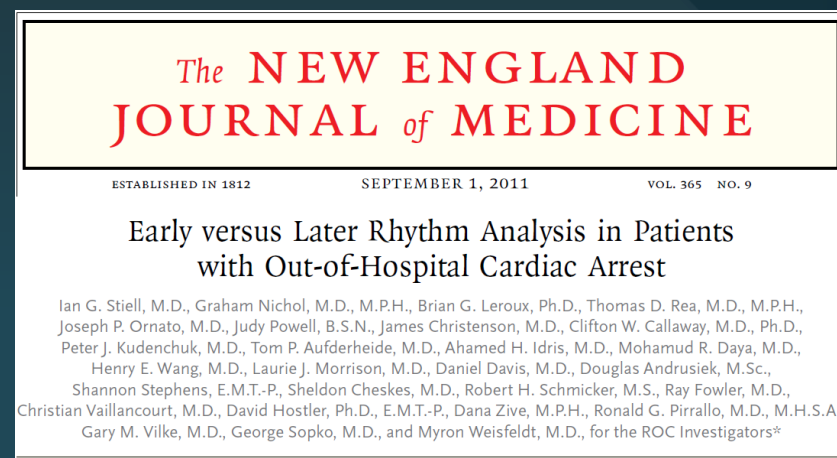
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Emergency Medicine Research:

Total Peer-Reviewed Publications = 275

21 x 1st Author Journals with Impact Factor >10:

- › 5 New Engl J Med
- › 2 Lancet
- › 9 JAMA
- › 3 BMJ
- › 2 Circulation



U of Ottawa EM Research: Improving Patient Care in the ED

- › **1. Inefficiency and Variation**
 - › Decision Rules: Ankle, Knee, CT head, C-spine

- › **2. Safety**
 - › Risk Scales: HF, COPD, Headache, TIA, Syncope

- › **3. Effective Therapy**
 - › Cardiac Arrest: Clinical trials
 - › Recent-onset atrial fibrillation (RAFF)

Canadian C-Spine Rule

Variation (N=6,855)
CMAJ 1997

Derivation (N=8,924)
JAMA 2001

Validation (N=8,283)
NEJM 2003

Implementation (N=11,648)
BMJ 2009

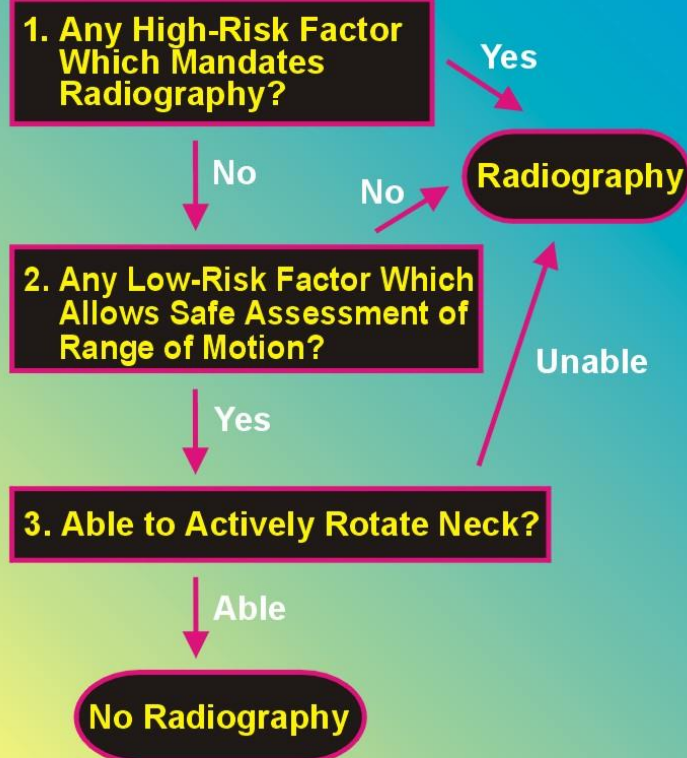
Uptake (N=1,150)
Acad EM 2008

Paramedics (N=1,949)
Ann EM 2009

ED Nurses (N=3,633)
CMAJ 2010

The Canadian C-Spine Rule

3 Questions



Implementation of the Canadian C-Spine Rule: prospective 12 centre cluster randomised trial

Ian G Stiell, professor and chair,¹ senior scientist,⁴ Catherine M Clement, research program manager,⁴ Jeremy Grimshaw, full professor,⁴ Robert J Brison, professor,⁶ Brian H Rowe, professor and research director,⁵ Michael J Schull, associate professor,⁷ Jacques S Lee, assistant professor,⁷ Jamie Brehaut, assistant professor,² scientist,⁴ R Douglas McKnight, clinical associate professor,⁹ Mary A Eisenhauer, associate professor,⁸ Jonathan Dreyer, research director and professor,⁸ Eric Letovsky, associate professor,⁷ Tim Rutledge, associate professor,⁷ Iain MacPhail, emergency medicine physician,⁹ Scott Ross, emergency medicine physician,⁵ Amit Shah, assistant professor,⁸ Jeffrey J Perry, associate professor,¹ scientist,⁴ Brian R Holroyd, professor and department head,⁵ Urbain Ip, emergency medicine physician,⁹ Howard Lesiuk, associate professor,³ George A Wells, professor^{2,4}

N=11,648

Reduced imaging

No adverse outcomes



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Canadian C-Spine Rule

For alert (GCS=15) and stable trauma patients where cervical spine injury is a concern.

1. Any High-Risk Factor Which Mandates Radiography?

Age $\geq$ 65 years
or
Dangerous mechanism*
or
Paresthesias in extremities

Rule Not Applicable If:

- Non-trauma cases
- GCS < 15
- Unstable vital signs
- Age < 16 years
- Acute paralysis
- Known vertebral disease
- Previous C-spine surgery

No

Yes

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?

Simple rearend MVC**
or
Sitting position in ED
or
Ambulatory at any time
or
Delayed onset of neck pain***
or
Absence of midline c-spine tenderness

No

Radiography

Unable

Yes

3. Able to Actively Rotate Neck?

45° left and right

Able

No Radiography

* Dangerous Mechanism:

- fall from elevation $\geq$ 3 feet / 5 stairs
- axial load to head, e.g. diving
- MVC high speed ($>100\text{km/hr}$), rollover, ejection
- motorized recreational vehicles
- bicycle struck or collision

** Simple Rearend MVC Excludes:

- pushed into oncoming traffic
- hit by bus / large truck
- rollover
- hit by high speed vehicle

*** Delayed:

- i.e. not immediate onset of neck pain



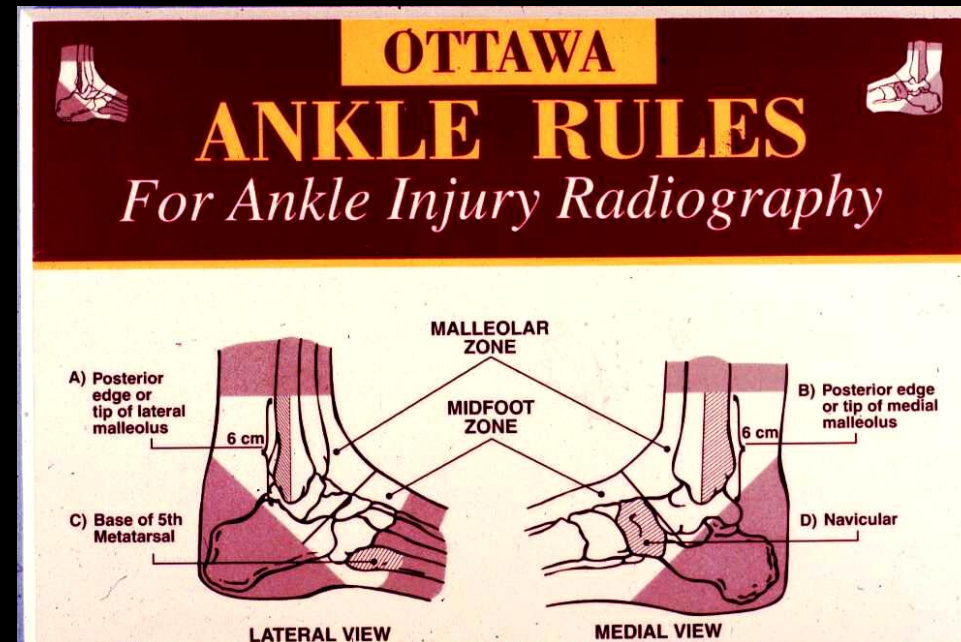
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Accuracy of Ottawa ankle rules to exclude fractures of the ankle and mid-foot: systematic review

Lucas M Bachmann, Esther Kolb, Michael T Koller, Johann Steurer, Gerben ter Riet

BMJ 2003

- Meta-analysis of 27 studies
- Pooled LR negative 0.08



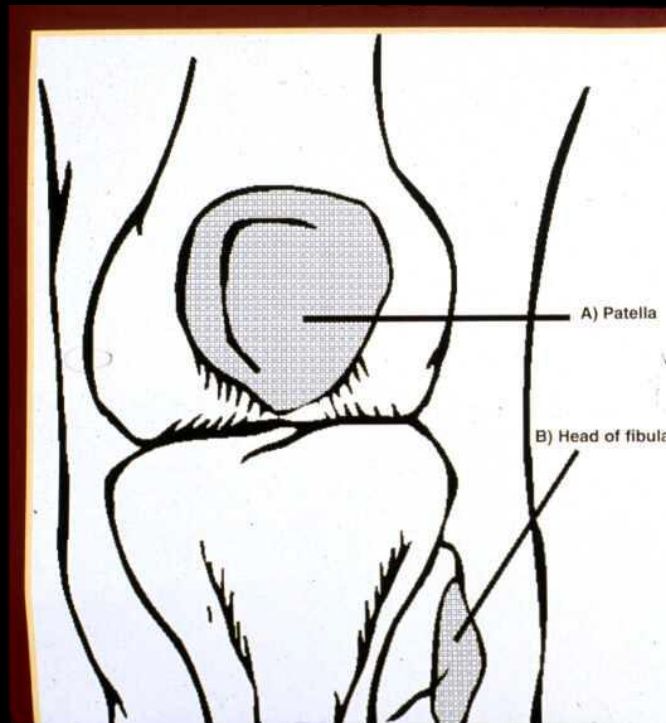
The Accuracy of the Ottawa Knee Rule To Rule Out Knee Fractures

A Systematic Review

Ann Int Med 2004

Lucas M. Bachmann, MD, PhD; Sophie Haberzeth, MD; Johann Steurer, MD, MME; and Gerben ter Riet, MD, PhD

- Meta-analysis of 6 studies
- Pooled LR negative 0.05



A knee x-ray series is only required for knee injury patients with any of these findings:

1) age 55 or older

OR

2) isolated tenderness of patella*

OR

3) tenderness of head of fibula

OR

4) inability to flex to 90°

OR

5) inability to bear weight both immediately and in the emergency department (4 steps)**

Canadian CT Head Rule

Variation (N=1,699)

Annals EM 1997

Derivation (N=3,121)

The Lancet 2001

Validation (N=2,707)

JAMA 2005

Implementation (N=4,531)

CMAJ 2010

Canadian CT Head Rule

CT head is only required for minor head injury patients with any one of these findings:

High Risk (for Neurological Intervention)

1. GCS score < 15 at 2 hrs after injury
2. Suspected open skull fracture
3. Any sign of basal skull fracture
4. Vomiting ≥ 2 episodes
5. Age ≥ 65 years

Medium Risk (for Brain Injury on CT)

6. Amnesia before impact ≥ 30 min
7. Dangerous mechanism (pedestrian, blunt object, fall from elevation)

Patient Safety: Adverse Outcomes after Discharge

- › Heart Failure
- › COPD
- › Headache
- › TIA
- › Syncope



ED Administration

Adverse events among patients registered in high-acuity areas of the emergency department: a prospective cohort study

Lisa Anne Calder, MD, MSc;^{*} Alan Forster, MD, MSc;[†] Melanie Nelson, RN;^{*} Jason Leclair, MD;^{*} Jeffrey Perry, MD, MSc;^{*} Christian Vaillancourt, MD, MSc;^{*} Guy Hebert, MD;^{*} A. Adam Cwinn, MD;^{*} George Wells, PhD;[‡] Ian Stiell, MD, MSc^{*}



Ottawa COPD Risk Scale

CMAJ

RESEARCH

Clinical characteristics associated with adverse events in patients with exacerbation of chronic obstructive pulmonary disease: a prospective cohort study

Can Med Assoc J 2014

Ian G. Stiell MD MSc, Catherine M. Clement RN, Shawn D. Aaron MD, Brian H. Rowe MD MSc, Jeffrey J. Perry MD MSc, Robert J. Brison MD MPH, Lisa A. Calder MD MSc, Eddy Lang MD, Bjug Borgundvaag MD PhD, Alan J. Forster MD MSc, George A. Wells PhD

b) Chest x-ray has any pulmonary congestion	1
c) Hemoglobin < 100 g/L	3
d) Urea $\geq$ 12 mmol/L	1
e) Serum CO ₂ $\geq$ 35 mmol/L	1

Total Score (0 - 16): _____



RESEARCH

Sensitivity of computed tomography performed within six hours of onset of headache for diagnosis of subarachnoid haemorrhage: prospective cohort study

Jeffrey J Perry¹ associate professor of emergency medicine and of epidemiology and community medicine¹, Ian G Stiell professor and chair department of emergency medicine¹, Marco L A Sivilotti associate professor of emergency medicine and of pharmacology and toxicology², Michael J Bullard professor of emergency medicine³, Marcel Émond assistant professor⁴, Cheryl Symington research coordinator¹, Jane Sutherland research coordinator⁵, Andrew Worster associate professor⁶, Corinne Hohl assistant professor⁷, Jacques S Lee assistant professor⁸, Mary A Eisenhauer associate professor⁹, Melodie Mortensen research coordinator¹, Duncan Mackey associate professor³, Merrill Pauls associate professor¹⁰, Howard Lesiuk consulting neurosurgeon¹¹, George A Wells professor biostatistics and epidemiology¹²

Sensitivity of CT for SAH

- › If CT done less than 6 hours after onset of headache: 100% sensitivity
- › After 6 hours: 85.7% sensitivity

JAMA 2013

Original Investigation

Clinical Decision Rules to Rule Out Subarachnoid Hemorrhage for Acute Headache

Jeffrey J. Perry, MD, MSc; Ian G. Stiell, MD, MSc; Marco L. A. Sivilotti, MD, MSc; Michael J. Bullard, MD; Corinne M. Hohl, MD, MHSc; Jane Sutherland, MEd; Marcel Emond, MD, MSc; Andrew Worster, MD; Jacques S. Lee, MD, MSc; Duncan Mackey, MD; Merrill Pauls, MD; Howard Lesiuk, MD; Cheryl Symington, RN, ENCC; George A. Wells, PhD

← Editorial page 1237



Box 2. The Ottawa SAH Rule

For alert patients older than 15 y with new severe nontraumatic headache reaching maximum intensity within 1 h

Not for patients with new neurologic deficits, previous aneurysms, SAH, brain tumors, or history of recurrent headaches (≥ 3 episodes over the course of ≥ 6 mo)

Investigate if ≥ 1 high-risk variables present:

1. Age ≥ 40 y
2. Neck pain or stiffness
3. Witnessed loss of consciousness
4. Onset during exertion
5. Thunderclap headache (instantly peaking pain)
6. Limited neck flexion on examination



ORIGINAL RESEARCH CONTRIBUTION

Acad Emerg Med 2012

An International View of How Recent-onset Atrial Fibrillation Is Treated in the Emergency Department

Carly Rogenstein, MD, Anne-Maree Kelly, MD, Suzanne Mason, MBBS, FRCS, FCEM, MD, Sandra Schneider, MD, Eddy Lang, MD, Catherine M. Clement, RN, and Ian G. Stiell, MD, MSc, FRCPC

Abstract

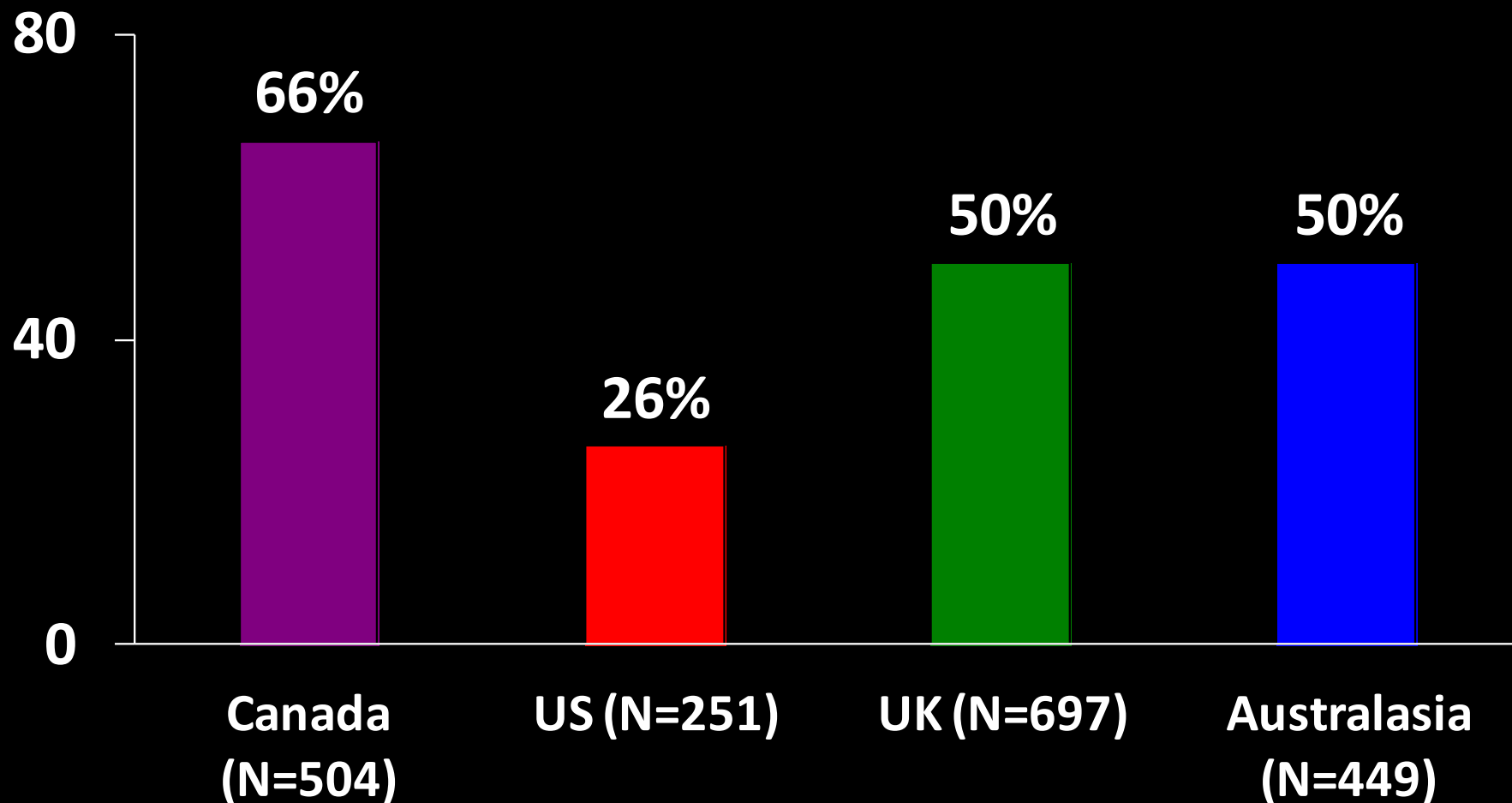
Objectives: This study was conducted to determine if there is practice variation for emergency physicians' (EPs) management of recent-onset atrial fibrillation (RAF) in various world regions (Canada, United States, United Kingdom, and Australasia).

Methods: The authors completed a mail and e-mail survey of members from four national emergency medicine (EM) associations. One prenotification letter and three survey letters were sent to members of the Canadian Association of Emergency Physicians (CAEP; Canada—1,177 members surveyed), American

*Survey of 1,917 ED physicians
Canada, U.S.A., U.K., Australasia*

% Attempt Rhythm Control for RAFF Patients (N=1,904)

Attempt to convert to sinus rhythm (%)



EM Advances

Association of the Ottawa Aggressive Protocol with rapid discharge of emergency department patients with recent-onset atrial fibrillation or flutter

Ian G. Stiell, MD, MSc;* Catherine M. Clement, RN;† Jeffrey J. Perry, MD, MSc;*
Christian Vaillancourt, MD, MSc;* Cheryl Symington, RN;† Garth Dickinson, MD;*
David Birnie, MD;‡ Martin S. Green, MD‡

IV Procainamide → electrical cardioversion

N=628

Discharged home - 97%

Discharged in NSR - 90%

Median length of stay - 4.9 hrs



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Canadian Journal of Cardiology 27 (2011) 38–46

Society Guidelines

Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Management of Recent-Onset Atrial Fibrillation and Flutter in the Emergency Department

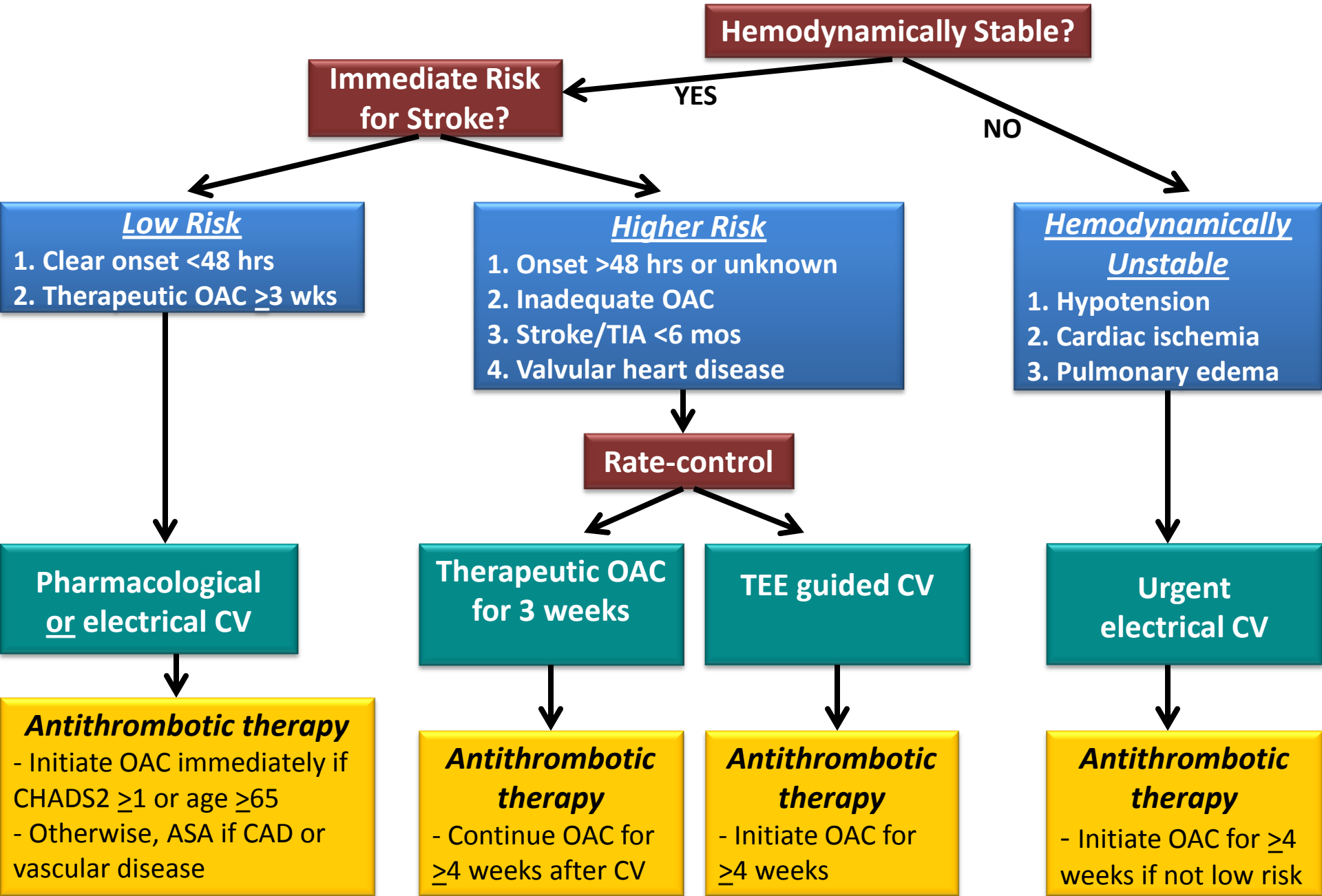
Ian G. Stiell, MD, MSc,^a Laurent Macle, MD, FRCPC,^b and the CCS Atrial Fibrillation Guidelines Committee^c

^a Department of Emergency Medicine, Ottawa Hospital Research Institute, University of Ottawa, Ottawa, Ontario, Canada

^b Department of Medicine, Electrophysiology Service, Montreal Heart Institute, Université de Montréal, Montreal, Québec, Canada

^c For a complete listing of committee members, see Gillis AM, Skanes AC. Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Implementing GRADE and achieving consensus. *Can J Cardiol* 2011;27:27-30.

Stroke Prevention and Rhythm-control for Recent-onset AF/AFL





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Emergency Medicine Research:

Good Patient Care Requires Good Evidence



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Ottawa Heart Failure Risk Scale

Ottawa Heart Failure Risk Scale

<u>Items</u>	Acad EM 2013	<u>Points</u>
1. History		
a) Stroke or TIA		1
b) Intubation for respiratory distress		2
2. Examination		
a) Heart rate on ED arrival ≥ 110		2
b) SaO ₂ < 90% on arrival		1
c) Heart rate ≥ 110 during 3-minute walk test		1
3. Investigations		
a) ECG has acute ischemic changes		2
b) Urea ≥ 12 mmol/L		1
c) Serum CO ₂ ≥ 35 mmol/L		2
d) Troponin I or T elevated to MI level		2
e) BNP $\geq 5,000$ ng/L (NT-ProBNP)		1
<u>Total Score (0 - 15):</u>		_____



A Prospective Cohort Study of Patients With Transient Ischemic Attack to Identify High-Risk Clinical Characteristics

Jeffrey J. Perry, Mukul Sharma, Marco L.A. Sivilotti, Jane Sutherland, Andrew Worster, Marcel Emond, Grant Stotts, Albert Y. Jin, Wieslaw J. Oczkowski, Demetrios J. Sahlas, Heather E. Murray, Ariane MacKey, Steve Verreault, George A. Wells and Ian G. Stiell

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Effective Therapy: Poor Survival in Cardiac Arrest

High Dose Epi (N=650)
NEJM 1992

ACD CPR (N=1,784)
JAMA 1996

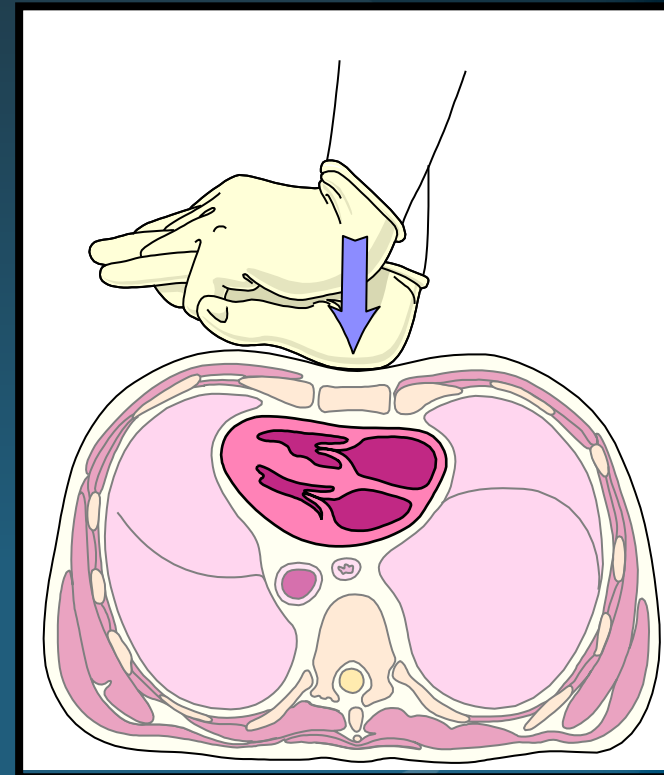
OPALS II - Rapid Defib (N=6,331)
JAMA 1999

Vasopressin (N=200)
Lancet 2001

Quality of Life (N=268)
Circulation 2003

OPALS III - ACLS (N=5,638)
NEJM 2004

Analyze Later vs Early (N=9,933)
NEJM 2011



1. Cardiac Arrest II benefit of rapid defibrillation

JAMA 1999

2. Cardiac Arrest III benefit of ALS

NEJM 2004

3. Respiratory benefit of ALS

NEJM 2007

4. Trauma benefit of ALS

CMAJ 2008

N Engl J Med 2004;351:647-56

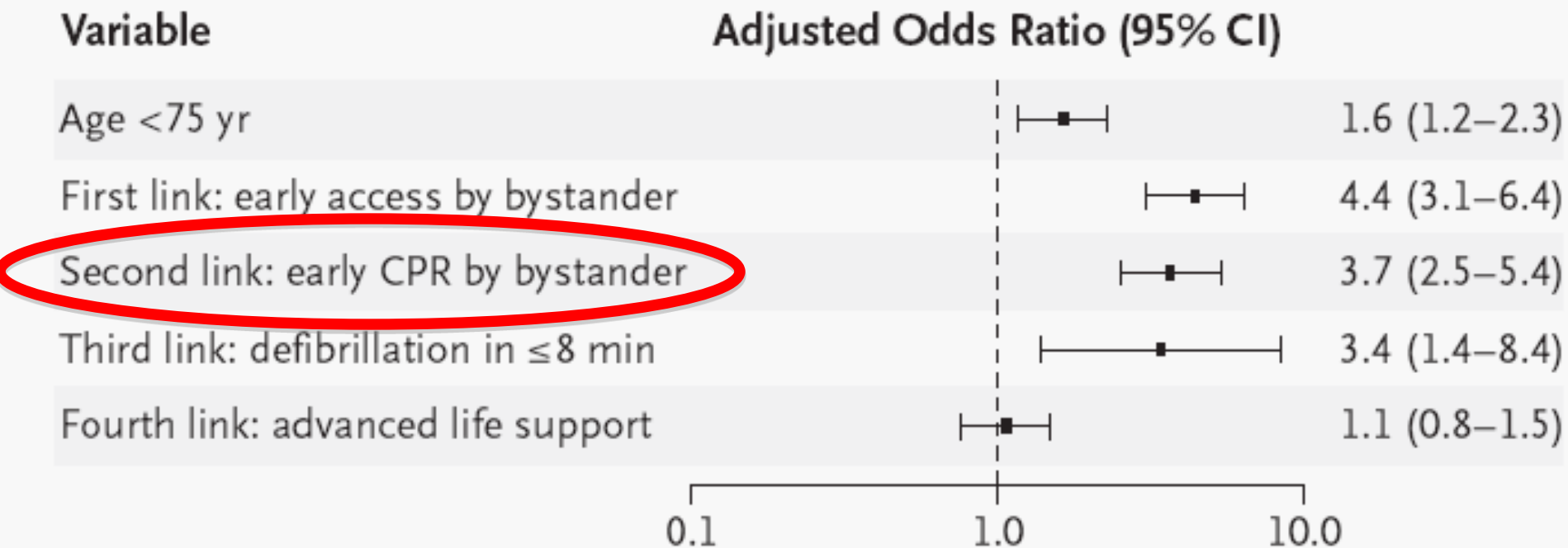


Figure 1. Odds Ratios for Survival to Hospital Discharge Associated with Selected Factors.

Resuscitation Outcomes Consortium



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Early versus Later Rhythm Analysis in Patients with Out-of-Hospital Cardiac Arrest

Ian G. Stiell, M.D., Graham Nichol, M.D., M.P.H., Brian G. Leroux, Ph.D., Thomas D. Rea, M.D., M.P.H., Joseph P. Ornato, M.D., Judy Powell, B.S.N., James Christenson, M.D., Clifton W. Callaway, M.D., Ph.D., Peter J. Kudenchuk, M.D., Tom P. Aufderheide, M.D., Ahamed H. Idris, M.D., Mohamud R. Daya, M.D., Henry E. Wang, M.D., Laurie J. Morrison, M.D., Daniel Davis, M.D., Douglas Andrusiek, M.Sc., Shannon Stephens, E.M.T.-P., Sheldon Cheskes, M.D., Robert H. Schmicker, M.S., Ray Fowler, M.D., Christian Vaillancourt, M.D., David Hostler, Ph.D., E.M.T.-P., Dana Zive, M.P.H., Ronald G. Pirrallo, M.D., M.H.S.A., Gary M. Vilke, M.D., George Sopko, M.D., and Myron Weisfeldt, M.D., for the ROC Investigators*

Ottawa COPD Risk Scale

<u>Items</u>	<u>Points</u>
1. History	
a) Coronary bypass graft	1
b) Peripheral vascular disease intervention	1
c) Intubation for respiratory distress	2
2. Examination	
a) Heart rate on ED arrival ≥ 110	2
b) Too ill to ambulate after ED treatment (SaO ₂ < 90% or HR ≥ 120)	2
3. Investigations	
a) ECG has acute ischemic changes	2
b) Chest x-ray has any pulmonary congestion	1
c) Hemoglobin < 100 g/L	3
d) Urea ≥ 12 mmol/L	1
e) Serum CO ₂ ≥ 35 mmol/L	1
<u>Total Score (0 - 16):</u>	_____