

# EMERGENCY MEDICINE **REPORTS**

Practical, Evidence-Based Reviews in Emergency Care

**AUGUST 23, 2015**

**VOL. 36, NO. 18**

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## **STATEMENT OF FINANCIAL DISCLOSURE**

To reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Farel (CME question reviewer) owns stock in Johnson & Johnson. Dr. Stapczynski (editor) owns stock in Pfizer, Johnson & Johnson, AxoGen, Walgreens Boots Alliance Inc., and Bristol Myers Squibb. Ms. Mark (executive editor) reports that her husband works for a company that creates advertising for Uroplasty. Dr. Schneider (editor), Dr. Adewale (author), Dr. Bookatz (peer reviewer), and Mr. Landenberger (editorial and continuing education director) report no financial relationships with companies related to the field of study covered by this CME activity.

**AHC Media**

## **The "Choosing Wisely"® Campaign: An Evidence-Based Review of the Recommendations: Part II**

*This issue finishes our discussion of the 10 ACEP recommendations for the Choosing Wisely® campaign. Three of them are a call for reduced imaging. The consequences from exposure to medical radiation are not precisely known; models from more intense exposures extrapolated to doses from medical use lead to estimates of increased cancer with wide confidence intervals. But even though its effect may be small, unnecessary exposure to radiation is to be avoided. Tools and alternatives to reduce radiographic imaging exist; these recommendations call upon us to use them.*

—J. Stephan Stapczynski, MD, Editor

### **Recommendation #7: Avoid CT pulmonary angiography in emergency department patients with a low pretest probability of pulmonary embolism and either a negative Pulmonary Embolism Rule Out Criteria (PERC) or a negative D-dimer.**

Pulmonary embolism is an important cause of serious morbidity and mortality, and it is second only to acute coronary syndrome as the cause of sudden death.<sup>1-3</sup> Despite the importance of identifying and promptly treating it, the clinical diagnosis is fraught with challenges and is sometimes unreliable because a significant proportion of patients with the disease are asymptomatic and lack obvious clinical signs.<sup>4</sup> Consequently, several decision rules (Wells, Geneva, Charlotte, and PERC) have been developed to risk-stratify patients. (See Tables 1 and 2.)

Whom to scan or not to scan is the question here. Obviously, physicians want to avoid tests that are unnecessary and minimize radiation exposure. Avoiding advanced imaging such as computed tomograph (CT) makes sense. Chest CT pulmonary angiography is a prime candidate for consideration, because it is estimated that about 12% of all emergency department patients with chest related complaints often receive CT imaging.<sup>5</sup>

Variation in clinical experience and CT utilization validates the need to use clinical decision tools to risk-stratify patients. However, not every patient fits neatly into a decision rule because of variation in symptoms and signs.<sup>4</sup> Clinical judgment and gestalt are still very useful, especially to identify low-risk patients. Utilizing the clinical decision rules coupled with clinician gestalt will decrease the amount of unnecessary CT pulmonary angiography performed in low-risk patients, with a consequential decrease in emergency department length of stay

## EXECUTIVE SUMMARY

- Use clinical judgment or a validated decision rule to risk-stratify patients with potential pulmonary embolism.
- In low-risk patients, utilize a high-sensitivity d-dimer or the PERC rule to exclude the need for imaging.
- Do not obtain lumbar radiographs for acute low back pain unless one of the red-flag criteria is present.
- Do not prescribe oral antibiotics in patients who meet clinical criteria for acute viral rhinosinusitis.
- Do not routinely obtain an abdominal CT scan in a patient with recurrent renal stone attacks.

(LOS), health care expenditure, risk of radiation exposure, and potential contrast-related complications.<sup>6</sup>

Are we performing too many CT scans to rule out pulmonary embolism? The answer is an emphatic yes.<sup>7</sup> Studies have shown that prescription drugs and diagnostic imaging are two rapidly growing components of the national health care expenditure (NHE).<sup>8,9</sup> In order to curtail the diagnostic imaging contribution to the NHE, physicians need to use decision rules in addition to their clinical acumen and gestalt, as well as adhere to the available guidelines.

A study conducted by Daniel et al<sup>10</sup> evaluated physicians' adherence to or utilization of the recommendations of the PIOPED II investigators. The study demonstrated that 54.5% of CT pulmonary angiography performed was not concordant with the PIOPED II investigators' recommendations. They concluded that non-adherence to the recommendations for CTPA was common and it exposes patients to increased risks, including potential false-positive diagnoses of pulmonary embolism.

Another study by Perelas et al<sup>11</sup> evaluated CT pulmonary angiography utilization in the emergency department, its diagnostic yield, and adherence to current guidelines. The diagnostic yield from this study was 9.4%, and this is consistent with average diagnostic yields of less than 10% from several other studies.<sup>5,12-14</sup> The term "avoidable imaging" was used in this study. The rate of avoidable imaging as a result of non-adherence to the guidelines was 49.5%. Several other studies<sup>10,14-15</sup> have demonstrated that the rate of avoidable imaging in the evaluation of pulmonary embolism ranges from 30-50%.

CT pulmonary angiography is unnecessary if the patient is determined to be low-risk, by either clinical judgment or

one of the validated decision rules (*see Table 1*), and undergoes further analysis by either a high-sensitivity d-dimer test or utilization of the PERC rule (*see Table 2*). The combination of a low-risk status and a d-dimer below the established threshold value or all 8 PERC criteria present identifies a patient for whom the harm from testing and treatment is greater than no testing.<sup>16-19</sup>

**Recommendation #8: Avoid lumbar spine imaging in the emergency department for adults with non-traumatic acute low back pain unless the patient has severe or progressive neurologic deficit or is suspected of having serious underlying condition (such as vertebral infection, cauda equina syndrome, or cancer with bony metastasis).**

Low back pain is a common presentation to the emergency department. It is the most common cause of global disability, with the prevalence and economic burden increasing as the population ages.<sup>20</sup> In the United States, it is the leading cause of disability in the population younger than 45 years old, and more than 26 million between the ages 20 of 64 years old experience frequent back pain.<sup>21</sup> Despite the preponderance of evidence-based recommendations and specific guidelines, routine imaging appears to be the norm.<sup>22-24</sup> As emergency physicians, this practice is of significant concern, especially when studies have shown that routine imaging has no impact on clinical outcome, and inadvertently exposes the patients to unnecessary radiation.<sup>25,26</sup>

It is important to understand the financial impact of the prevalence of "avoidable imaging" on the national

health care expenditure.

Low back pain is actually one of a few diagnoses for which available outcome data abound. An exhaustive meta-analysis study<sup>27</sup> was performed to answer the following clinical question: "in a patient with low back pain who does not have indications for a serious underlying condition, does routine immediate lumbar imaging result in improved patient outcome when compared with clinical care without immediate imaging?" The study concluded that available evidence does not show that routine lumbar imaging in patients without features indicating serious conditions improved outcome when compared to routine clinical care without imaging.

A concern with this approach is the potential to miss a malignancy. Both a retrospective study of 963 patients<sup>28</sup> and prospective study of 1170 patients<sup>29</sup> found that cancer is found in acute low back pain patients only if risk factors are present, such as history of cancer, weight loss, or signs of a systemic illness.

What are the available recommendations for lumbar imaging? In addition to 2007 recommendations by the American College of Physicians (ACP) and American Pain Society (APS), the American College of Radiology (*see Table 3*) in 2009 published consensus-based criteria on appropriateness of imaging for various low back pain scenarios that were consistent with the ACP/APS guidelines.<sup>30</sup>

This Choosing Wisely® recommendation has a significant amount of literature to support it. Taking the time to engage the patient in shared decision-making, and utilizing available guidelines to augment clinical judgment will put us in the frontline as a specialty that is deliberately engaging to help curtail the cost of health care.

**Recommendation #9: Avoid prescribing antibiotics in the emergency department for uncomplicated sinusitis.**

This recommendation addresses the overutilization of antibiotics in patients with sinusitis. Before delving into the scope of the problem, it's imperative to understand the prevalence and causes of sinusitis or rhinosinusitis (used interchangeably). Sinusitis is the inflammation of the lining of the paranasal sinuses that may manifest as nasal congestion, obstruction or blockage, facial pain and pressure, and anterior or posterior purulent rhinorrhea. According to the Centers for Disease Control, rhinosinusitis affects 1 in 7 adults in the United States, and its impact on productivity and quality of life is substantial.<sup>31</sup> The incidence increased from 11% (26 million) in 2007 to 13% (29.8 million) in 2010.<sup>32</sup> There are three broad categories of sinusitis: acute viral rhinosinusitis (AVRS), acute bacterial rhinosinusitis (ABRS), and chronic rhinosinusitis (CRS).<sup>33</sup> Viruses cause the majority of sinusitis, and only 0.5-2% of the disease is of bacterial etiology.<sup>34</sup>

Clinical differences between AVRS and ABRS are that for AVRS, the symptoms (rhinorrhea, congestion, facial pain or pressure) last less than 10-14 days, and the symptoms are not worsening. For ABRS, the symptoms last more than 10-14 days, symptoms increase or worsen after 5 days or within 10 days of initial improvement, or symptoms are particularly severe in the first 3-4 days of illness.<sup>33</sup>

Given that the majority of acute rhinosinusitis cases are caused by viruses, why is antibiotic use so pervasive? According to data from studies from the United States and United Kingdom, antibiotics are prescribed in 81% to 92% of acute rhinosinusitis.<sup>35,36</sup> A recently published study evaluating the use of guidelines and clinicians' feedback to curtail the use of antibiotics in sinusitis concluded that implementing guidelines coupled with sustained physician feedback was unable to reduce the proportion of sinusitis treated with antibiotics.<sup>37</sup> Another study by Pynnonen et al concluded that antibiotics continued to be overused in patients

**Table 1. Pulmonary Embolism Risk Stratification Tools**

Wells Score (simplified) <sup>1</sup>	Points
Clinical symptoms and signs of DVT	3
Alternative diagnosis is less like than pulmonary embolism	3
Tachycardia HR > 100	1.5
Immobilization for 3 days or surgery in previous four weeks	1.5
Previous, objectively verified DVT or PE	1.5
Hemoptysis	1
Malignancy – treatment for within past 6 months or palliative care	1
<i>Interpretation: low risk 0-1; intermediate risk: 2-5.5; high risk ≥ 6</i>	
Geneva Score (revised simplified) <sup>2</sup>	Points
Age 65 years or older	1
Previous DVT or PE	1
General anesthesia or fracture within one month	1
Active malignant condition or malignant condition that has been cured within past year	1
Unilateral lower limb pain	1
Hemoptysis	1
Pain on deep palpation of lower limb	1
Unilateral limb edema	1
Heart rate greater than 75 beats/min	1
<i>Interpretation: low risk 0-2; intermediate risk 3-4; high risk ≥ 5</i>	
Charlotte Rule (simplified version) <sup>3</sup>	Points
Age > 50 years OR HR > systolic BP	1
Surgery requiring general anesthesia in the preceding four weeks	1
Unilateral leg swelling (asymmetry on visual examination)	1
Hemoptysis	1
Unexplained room air pulse oximetry < 95%	1
<i>Interpretation: low risk 0-1; high risk ≥ 2</i>	
Abbreviations: DVT, deep venous thrombosis; HR, heart rate; PE, pulmonary embolism	
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3. Kline JA, Nelson RD, Jackson RE, Courtney DM. Criteria for the safe use of D-dimer testing in emergency department patients with suspected pulmonary embolism: A multicenter US study. <i>Ann Emerg Med</i> 2002;39:144-152.	

with mild sinusitis of short duration, and emergency medicine physicians prescribe more antibiotics when compared to family physicians.<sup>38</sup> Why is there continued antibiotic utilization in uncomplicated sinusitis? Is there evidence for the use of antibiotics in acute rhinosinusitis?

A recent Cochrane Database Systematic Review concluded that

while there is moderate evidence that antibiotics provide a small benefit for improved clinical outcome in uncomplicated sinusitis, about 80% of patients who were not treated with antibiotics improved within two weeks.<sup>39</sup> It is imperative to be cautious about this moderate antibiotic benefit. This benefit should be viewed in the context of high prevalence of adverse events.<sup>40</sup> Several

## Table 2. Pulmonary Embolism Rule-out Criteria (PERC) Rule

In patients determined to be low-risk, no further testing is necessary if all 8 criteria are present:

- Age < 50 years
- Pulse < 100 beats per minute
- SaO<sub>2</sub> ≥ 95% in room air
- No hemoptysis
- No exogenous estrogen use
- No prior venous thromboembolism
- No surgery or trauma requiring hospitalization within the past 4 weeks
- No unilateral leg swelling

Adapted from: Penalzoza A, et al<sup>19</sup>

## Table 3. American College of Radiology Consensus-based Criteria for Imaging Acute Low Back Pain ("red flags")

1. Recent significant trauma or milder trauma at age > 50 years
2. Unexplained weight loss, especially if insidious
3. Unexplained fever, history of urinary or other infection
4. Immunosuppression, diabetes mellitus
5. History of cancer
6. Intravenous drug use
7. Prolonged use of corticosteroids, osteoporosis
8. Age > 70 years
9. Focal neurologic deficit(s) with progressive or disabling symptoms, or cauda equina syndrome
10. Duration longer than 6 weeks
11. Prior surgery

Adapted from: Chou R, et al<sup>20</sup>

meta-analyses and systematic reviews of the treatment with antibiotics in mild to moderate sinusitis demonstrated that 63-80% of patients improved without antibiotics, compared with 71-90% improvement in patients treated with antibiotics. Most of the improvements occurred between 7-14 days, which correlates with the duration of untreated disease resolution. In all, the adverse effects of the antibiotics outweigh the benefit.<sup>41-44</sup>

The Infectious Diseases Society of America (IDSA) recommends antibiotics for rhinosinusitis meeting the following three criteria:

- onset of persistent symptoms or signs compatible with acute rhinosinusitis lasting > 10 days without any signs of improvement;
- onset of severe symptoms or signs (high fever > 39°C or 102°F, purulent nasal discharge, or facial pain lasting for

at least 3-4 consecutive days);

- and, lastly, worsening of symptoms characterized by new onset of fever, headache, or increase in nasal discharge after a typical upper respiratory infection (URI) that lasted 5-6 days after initial improvement.<sup>45</sup>

Recently, the American Academy of Otolaryngology-Head and Neck Surgery released an update to their 2007 guidelines. This guideline clearly stipulates the distinction between AVRS and ABRS and the indications for antibiotics. Rhinosinusitis deemed of viral etiology based on classification should be managed expectantly with symptomatic support. However, those patients who meet criteria for ABRS could either be managed with watchful waiting with close follow-up or antibiotics if close follow-up could not be guaranteed.<sup>46</sup>

Antibiotic utilization in mild sinusitis should be discouraged, and clinicians

should be familiar with the clear distinction between AVRS and ABRS to provide evidence-based care that curtails the misuse of antibiotics in acute uncomplicated rhinosinusitis.

**Recommendation #10: Avoid ordering CT of the abdomen and pelvis in young otherwise healthy emergency department (ED) patients (age < 50) with known history of kidney stones or ureterolithiasis, presenting with symptoms consistent with uncomplicated renal colic.**

Stones in the urinary tract is a common presentation to the emergency department. The emergency department visit rates for kidney stones increased from 178 to 340 visits per 100,000 individuals from 1992 to 2009.<sup>47</sup> It is estimated that the lifetime risk of stone formation in the United States exceeds 12% in men and 6% in women.<sup>48</sup> The American College of Radiology recommended CT scan as the first-line modality for investigating suspected kidney stones in the adult population.<sup>49</sup> Although this recommendation is for initial evaluation, this recommendation is designed to reduce CT imaging for recurrent stone episodes and lessen over-exposure to medical radiation.<sup>50,51</sup> According to a recent review of the National Hospital Ambulatory Medical Care Survey, an estimated 5-10% of emergency department visits for ureterolithiasis are repeat visits.<sup>47</sup> Most of the patients in this repeat visit category often receive repeat CT scans for diagnosis despite known history of kidney stones. This increased utilization carries an estimated health care expenditure of \$5 billion annually.<sup>52</sup>

What exactly is the yield of repeat CT scan in a patient with a history of kidney stones? A study evaluating the incidence of alternative diagnosis in patients with kidney stone with recurrent symptoms demonstrated that 81.8% had no change in treatment plan, and the diagnostic yield for alternative diagnosis was only 6.5%.<sup>53</sup> The American Urologic Association recommends that the initial imaging modality for patients with known history of

radiopaque ureteral or kidney stones who present to the ED with persistent symptoms should be renal ultrasound and KUB. However, if no hydronephrosis or stone was seen on KUB and renal ultrasound, and the patient has persistent symptoms, then a low-dose CT scan is indicated.<sup>54</sup>

## Summary

After reviewing the available evidence, the Choosing Wisely® campaign is wise indeed. Owing to variations in the level of experience, expertise, and clinical acumen, aligning practice patterns is almost impossible. However, to standardize the way emergency physicians practice medicine and become part of the solution to the health care escalating cost quagmire, getting with guidelines is the way to go. Although some of the guidelines or clinical decision systems may not be perfect, nor a one-size-fits-all for all patient populations, conforming with the recommendations with customization to each patient encounter will create some level of consistency in practice patterns.

Furthermore, involving the patients and families in their care by embracing shared decision-making to minimize unnecessary studies is in the future of emergency medicine practice. By engaging the patients and families, the emergency department experience of the visits is also improved. With the imminent CMS implementation of the Emergency Department Consumer Assessment of Healthcare Providers and Systems (ED CAHPS) or the Emergency Department Patient Experiences with Care (EDPEC) survey, the emergency physicians' compensation will likely be tied to this patient experience score in the near future. Engaging in shared decision-making now with patients and their families, avoiding unnecessary studies, and improving patients' experience will prepare the field of emergency medicine for these upcoming CMS surveys. Please choose wisely.

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## CME Questions

- The Wells, Geneva, and Charlotte pulmonary embolism tools are used for what purpose?
  - to establish the diagnosis of a pulmonary embolus
  - to exclude the possibility of a pulmonary embolus
  - to identify patients for whom a CT pulmonary angiogram is unnecessary
  - to stratify patients into risk categories for a pulmonary embolus
- What is the positive rate (pulmonary embolus identified) for CT pulmonary angiography as currently used in ED patients?
  - slightly less than 10%
  - 20%
  - 40%
  - > 50%
- Approximately what percentage of CT pulmonary angiograms obtained from ED patients can be considered avoidable?
  - < 10%
  - 10-20%
  - 30-50%
  - > 60%
- Which statement regarding low back pain is *not* true?
  - Low back pain is the leading global cause of disability.
  - The incidence of low back pain has remained stable over time.
  - Routine imaging is common.
  - Routine imaging has no impact on clinical outcome.
- According to the American College of Radiology Consensus-based Criteria, which of the following would *not* be an indication for lumbar spine imaging in a patient with acute low back pain?
  - to establish the diagnosis of a pulmonary embolus
  - to exclude the possibility of a pulmonary embolus
  - to identify patients for whom a CT pulmonary angiogram is unnecessary
  - to stratify patients into risk categories for a pulmonary embolus

- A. unexplained weight loss  
 B. unexplained fever  
 C. IV drug abuse  
 D. age > 60 years
6. Bacteria are causative agents in what percentage of acute rhinosinusitis cases?  
 A. < 2%  
 B. 5-10%  
 C. 15-20%  
 D. 30-40%
7. Which of the following clinical characteristics is *not* typical of acute bacterial rhinosinusitis when compared to acute viral rhinosinusitis?  
 A. Symptoms last longer than 10-14 days.  
 B. Symptoms increase in severity after the fifth day of illness.  
 C. Symptoms are not particularly severe the first 3 to 4 days of illness.  
 D. Symptoms can worsen within 10 days after initial improvement.
8. Which of the following is *incorrect* as it relates to IDSA recommendation for antibiotic use in sinusitis?  
 A. onset of persistent symptoms or signs compatible with acute rhinosinusitis lasting > 10 days without any signs of improvement  
 B. onset of severe symptoms or signs, such as high fever > 39 degrees or 102 degrees F  
 C. worsening of symptoms characterized by new onset of fever, headache, or increase in nasal discharge after a typical URI that lasted 5-6 days after initial improvement  
 D. presence of headaches, nausea, excessive tearing, ringing in ears, and vomiting
9. What is the estimated lifetime risk for renal stone formation in U.S. males?  
 A. < 2%  
 B. 5%  
 C. 12%  
 D. 20%
10. Which imaging modality does the American Urologic Association recommend for patients with a history of radiopaque renal stones who

present to the ED with acute flank pain?  
 A. CT scan  
 B. renal ultrasound and KUB  
 C. MRI  
 D. intravenous pyelogram (IVP)

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## EMERGENCY MEDICINE REPORTS™

(ISSN 0746-2506) is published every other week by  
AHC Media LLC, One Atlanta Plaza, 950 East Paces  
Ferry Road NE, Suite 2850, Atlanta, GA 30326.  
Telephone: (800) 688-2421 or (404) 262-7436.

**Editorial & Continuing Education  
Director:** Lee Landenberger

**Executive Editor:** Shelly Morrow Mark

**GST Registration No.:** R128870672

Periodicals Postage Paid at Atlanta, GA 30304 and at  
additional mailing offices.

**POSTMASTER:** Send address changes  
to **Emergency Medicine Reports**,  
P.O. Box 550669, Atlanta, GA 30355.

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# EMERGENCY MEDICINE REPORTS

## The “Choosing Wisely”® Campaign: An Evidence-Based Review of the Recommendations: Part II

### Pulmonary Embolism Risk Stratification Tools

Wells Score (simplified) <sup>1</sup>	Points
Clinical symptoms and signs of DVT	3
Alternative diagnosis is less like than pulmonary embolism	3
Tachycardia HR > 100	1.5
Immobilization for 3 days or surgery in previous four weeks	1.5
Previous, objectively verified DVT or PE	1.5
Hemoptysis	1
Malignancy – treatment for within past 6 months or palliative care	1
<i>Interpretation: low risk 0-1; intermediate risk: 2-5.5; high risk ≥ 6</i>	
Geneva Score (revised simplified) <sup>2</sup>	Points
Age 65 years or older	1
Previous DVT or PE	1
General anesthesia or fracture within one month	1
Active malignant condition or malignant condition that has been cured within past year	1
Unilateral lower limb pain	1
Hemoptysis	1
Pain on deep palpation of lower limb	1
Unilateral limb edema	1
Heart rate greater than 75 beats/min	1
<i>Interpretation: low risk 0-2; intermediate risk 3-4; high risk ≥ 5</i>	
Charlotte Rule (simplified version) <sup>3</sup>	Points
Age > 50 years OR HR > systolic BP	1
Surgery requiring general anesthesia in the preceding four weeks	1
Unilateral leg swelling (asymmetry on visual examination)	1
Hemoptysis	1
Unexplained room air pulse oximetry < 95%	1
<i>Interpretation: low risk 0-1; high risk ≥ 2</i>	
Abbreviations: DVT, deep venous thrombosis; HR, heart rate; PE, pulmonary embolism	
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1. Wells PS, Anderson DR, Rodger M, et al. Derivation of a simple clinical model to categorize patients probability of pulmonary embolism: Increasing the models utility with the SimpliRED D-dimer. <i>Thromb Haemost</i> 2000;83:416-420.	
2. Klok FA, Mos IC, Nijkeuter M, et al. Simplification of the revised Geneva score for assessing clinical probability of pulmonary embolism. <i>Arch Intern Med</i> 2008;168:2131-2136.	
3. Kline JA, Nelson RD, Jackson RE, Courtney DM. Criteria for the safe use of D-dimer testing in emergency department patients with suspected pulmonary embolism: A multicenter US study. <i>Ann Emerg Med</i> 2002;39:144-152.	

### Pulmonary Embolism Rule-out Criteria (PERC) Rule

In patients determined to be low-risk, no further testing is necessary if all 8 criteria are present:

- Age < 50 years
- Pulse < 100 beats per minute
- SaO2 ≥ 95% in room air
- No hemoptysis
- No exogenous estrogen use
- No prior venous thromboembolism
- No surgery or trauma requiring hospitalization within the past 4 weeks
- No unilateral leg swelling

Adapted from: Penaloza A, et al

### American College of Radiology Consensus-based Criteria for Imaging Acute Low Back Pain (“red flags”)

1. Recent significant trauma or milder trauma at age > 50 years
2. Unexplained weight loss, especially if insidious
3. Unexplained fever, history of urinary or other infection
4. Immunosuppression, diabetes mellitus
5. History of cancer
6. Intravenous drug use
7. Prolonged use of corticosteroids, osteoporosis
8. Age > 70 years
9. Focal neurologic deficit(s) with progressive or disabling symptoms, or cauda equina syndrome
10. Duration longer than 6 weeks
11. Prior surgery

Adapted from: Chou R, et al

Supplement to *Emergency Medicine Reports*, August 23, 2015: “The “Choosing Wisely”® Campaign: An Evidence-Based Review of the Recommendations: Part II.” Author: Ademola Adewale, MD, FAAEM, Assistant Program Director, Director of Research/Medical Simulation, Florida Hospital Emergency Medicine Residency, Orlando, FL.

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