Bedside Diagnosis in the Intensive Care Unit

Is Looking Overlooked?

Thomas S. Metkus[1] and Bo Soo Kim[2]

[1]Division of Cardiology and [2]Division of Pulmonary and Critical Care Medicine, Johns Hopkins Hospital, Baltimore, Maryland

Abstract

Bedside diagnosis, including but not limited to the physical examination, can be lifesaving in the setting of critical illness and is a core competency in both medical school and at the postgraduate level. Data as to the clinical usefulness of bedside diagnosis in the modern intensive care unit (ICU) is sparse, however, and there are no clinical guidelines addressing performance, interpretation, and usefulness of the bedside assessment in critically ill patients. Bedside assessment and physical examination are used in a heterogeneous manner across institutions and even across ICUs within the same institution, which has implications for medical education, patient care, and the overuse/misuse of diagnostic testing. In this commentary, we review the existing data addressing bedside diagnosis in the ICU, describe various models of bedside assessment use in the ICU based on our clinical practice and on the limited evidence base, share our practical "checklist-based" approach to bedside assessment in the critically ill patient, and advocate for more formal study of physical examination and bedside assessment in the ICU to enhance clinical practice.

Keywords: bedside diagnosis; critical care; patient–physician relationship; clinical skills; technology

(Received in original form May 12, 2015; accepted in final form July 23, 2015)

Correspondence and requests for reprints should be addressed to Thomas S. Metkus, M.D., Johns Hopkins Hospital–Cardiology, 1800 Orleans Street, Zayed 7125, Baltimore, MD 21287. E-mail: thomas.metkus@gmail.com

Ann Am Thorac Soc Vol 12, No 10, pp 1447–1450, Oct 2015

DOI: 10.1513/AnnalsATS.201505-271OI
Internet address: www.atsjournals.org

You can observe a lot just by watching.
—Yogi Berra

A 64-year-old man was seen on rounds in the intensive care unit (ICU) on Postoperative Day 5 from aortic valve replacement. His course included postoperative atrial fibrillation. Before rounds, he had been examined by multiple members of the ICU team, who described him as "confused." On examination, he had a left facial droop; 3/5 left hand, arm, and leg strength; and left-sided neglect. Given that his neurologic examination was normal 3 hours previously, acute neurology consultation and neuroimaging were obtained, confirming right middle cerebral artery occlusion. Urgent catheter-based thrombectomy was performed with improvement in symptoms. Ultimately, he was discharged with minimal deficit.

A 73-year-old woman was admitted to the medical ICU for hypotension and shock. White cells were visualized on urine microscopy and a working diagnosis of urosepsis was made. Her hypotension was refractory to multiple pressors. On examination, she had a narrow pulse pressure with the blood pressure 76/60 mm Hg, and the jugular venous pressure was elevated to greater than 20 cm H_2O. The femoral and radial pulses disappeared completely with spontaneous inspiration, constituting significant pulsus paradoxus. Urgent transthoracic echocardiogram confirmed large pericardial effusion with tamponade. The patient underwent pericardiocentesis with resolution of shock and hypotension.

Physical examination and bedside diagnosis remains a cornerstone of patient evaluation and is a core competency in medical school and postgraduate medical education curricula. As the previous anecdotes illustrate, a bedside assessment can be lifesaving in the setting of critical illness. Nonetheless, data as to the usefulness of physical diagnosis in the ICU are sparse, and to our knowledge no professional society guidelines provide a framework for bedside assessment in the ICU.

The authors' clinical experience practicing in a variety of ICUs across multiple institutions reflects that physical examination in the ICU is used in a very heterogeneous manner. This heterogeneity has implications for medical education, patient outcomes, and the overuse/misuse of diagnostic testing. In this commentary, we review the existing data addressing physical examination in the ICU, describe various models of physical examination usage in the ICU based on our clinical practice and on the limited evidence base, share our practical "checklist-based" approach to physical examination in the critically ill patient, and advocate for more formal study of physical examination in the ICU to enhance and inform practice. We

consider physical examination to include classic bedside maneuvers of auscultation, palpation, and percussion while the broader term "bedside assessment" also includes inspection of the bedside monitors such as the telemetry monitor and ventilator.

Philosophy and Usefulness of the Physical Examination

Current opinion regarding the usefulness of the physical examination in general is mixed. A. Verghese and others have argued that the physical examination remains valuable in the era of advanced technology both for its diagnostic value as well as its importance in facilitating the doctor–patient relationship (1). There is little published advocacy for the physical examination in the ICU. Half of surveyed physicians believed the physical examination was of limited use in the critical care setting (2), and a review of 30 textbooks of clinical examination found that none of these references had specific sections devoted to physical diagnosis of the critically ill patient (3).

This lack of enthusiasm may be related to the fact that the published test characteristics of specific physical examination maneuvers are poor: the test characteristics of clinical assessment of the jugular venous pressure, for example, were moderately helpful at best for identifying high filling pressures (4, 5), and physical examination did not predict fluid responsiveness (6). Similarly, lung auscultation performed poorly to identify pleural effusion and consolidation compared with bedside ultrasound (7) and the presence of bilateral breath sounds was not useful in excluding mainstem bronchus intubation (8).

A major challenge in performing studies of the test characteristics of physical examination maneuvers is that many such studies do not control for the experience of the examiner. J. D. Sapira referred to this flaw as the Law of Chopin—"I can't play Chopin at all, but others can play his music very well" (9). If studies of physical examination maneuvers do not involve the most experienced examiners with demonstrated competence in the technique under study, the results would underestimate the diagnostic performance of the maneuver in expert hands.

In contrast, other data suggest that specific physical findings have clinical impact. The simple presence of abnormal vital signs suggests an impending critical event (10). This may seem obvious, yet such an assessment depends on accurate measurements. For example, the recorded respiratory rate differs substantially from the actual rate in up to one-third of cases (11). Hearing "gurgling breath sounds" predicts subsequent development of pneumonia (12), and the simple bedside "gestalt" of respiratory distress can predict the need for intubation independent of vital signs (13). Delirium has received increased attention as a marker of adverse prognosis in the ICU, but its identification requires accurate diagnosis by CAM-ICU (confusion assessment method for the intensive care unit) or other bedside metrics (14).

Data as to clinical outcomes associated with physical diagnosis are virtually nonexistent. A single small study, which did not include ICU patients, identified 26 of 100 patients admitted to a general medical service, examined by a senior clinician, and who had identifiable, actionable physical findings that altered the course of diagnosis and treatment (15).

Physical Diagnosis in the Modern ICU

In part reflecting this ambiguous and low-quality evidence base, the manner in which bedside diagnosis is used in the modern ICU is variable across institutions and even across different ICUs in the same institution. Conducting a thorough physical examination in the modern ICU presents a unique challenge—for example, difficulty in repositioning patients; clinical instability; the presence of bulky dressings, lines, and tubes; ECG monitors; and high levels of ambient ICU noise (16) represent common barriers to physical diagnosis.

A systematic approach to PE in the ICU has been advocated (17); however, there is a paucity of data describing practice patterns. One survey study described that ICU residents, medical students, and nurses were the most likely members of the team to examine their patients, whereas more than half of surveyed ICU attendings and fellows "sometimes or never" examined their patients (2). Other data collected to assess the content of patient rounds excluded ICU patients, focusing on medical ward patients, but noted that little time is spent teaching physical diagnosis skills (18–20) with no specific data addressing how much time is spent examining patients to provide clinical care.

Our anecdotal experience observing use of PE across multiple ICUs and multiple institutions is likewise heterogeneous. In some ICUs all patients are examined by all physicians, nurses, providers, and students together while on rounds. In other ICUs, junior trainees examine patients before rounds and report their findings, which may or may not be verified by a senior examiner.

The documented physical examination in the era of electronic medical records seldom reflects exclusively the note author's own examination. In 2006, 25% of electronic patient charts in a sample from the Veterans Affairs system contained a physical examination generated by copy–paste (21). This problem has worsened: a more recent analysis suggests that three-quarters of electronic notes written by critical care attendings contain greater than 20% copied information (22). We were unable to find reliable estimates as to the frequency of attesting to or copy–pasting a physical examination not personally performed, but such a practice would have clinical consequences, represent a lost teaching opportunity, and constitute fraudulent billing (23). Certainly, some material in cloned notes—including carefully cultivated past history—can be invaluable, but copy–paste should be performed thoughtfully, purposefully, and carefully.

Attending physicians sometimes examine all patients sequentially before rounds, after rounds, during rounds, or not at all. Sometimes new patients and acutely ill patients are examined as a team, whereas other patients' examinations are deferred. Patients on contact isolation precautions or patients off the unit during rounds for tests or procedures are often examined with a different level of detail, if at all, compared with patients who are not. For example, one study suggested that although only 73% of patients in standard hospital rooms were examined by the attending physician (itself a suboptimal percentage), only 35% of patients in contact isolation were examined by the attending physician (24). No standard approach to bedside diagnosis in the ICU exists, and there is no consensus on which physical examination maneuvers are useful, which team members should conduct the examination,

and when in the context of the ICU workday the daily physical examination should be performed.

Our Approach and the Future

We believe there is substantial value to a comprehensive physical examination and bedside assessment in the ICU, notwithstanding the paucity of data. The "ICU bedside assessment" is defined very broadly in that it includes an assessment, not only of the patient's body, but also of all implanted devices, access sites, surgical incisions, monitors, and waveforms such as those on the ventilator and telemetry, and even the presence or absence of family and visitors at the bedside, their mood, and countenances.

Our approach to the physical examination reflects regional anatomy and is "checklist-based" as described in Table 1. We believe that such an examination is clinically useful, as the vignettes at the article's introduction reinforce. A thorough examination with the entire care team provides an opportunity for multidisciplinary teaching, learning, and collaboration. Bedside diagnosis in the ICU allows for proper contextualizing of data from hemodynamic monitors and radiologic images that can yield misdiagnosis if interpreted in isolation (25). Such an examination increases time at the bedside, which could improve patient and family satisfaction with ICU care. The bedside "laying on of hands" provides a humanizing, grounding counterpoint, for patients, families, and physicians and providers alike, to the dehumanizing effects of critical care and high-technology, high-intensity medicine.

We acknowledge that our enthusiasm for the physical examination in the ICU may be misplaced—we simply don't have the data. Could it be that patients who are examined more thoroughly have more "incidentalomas" discovered, with higher rates of diagnostic tests ordered, more travel out of the ICU, more complications, and worse outcomes? The use of bedside ultrasound is increasing for cardiac (26), lung (27), and abdominal imaging. It is likely that bedside ultrasound will continue integration into the bedside diagnostic milieu, and we anticipate that interest in bedside diagnosis will increase as a result.

Table 1. Focused approach to physical diagnosis in the intensive care unit*

General appearance	Assess the general appearance, nutritional status, comfort level, and clinical "gestalt" of the patient
Head	Inspect the pupils for symmetry and test response to light; look for facial asymmetry. Inspect the nares and oropharynx for bleeding. Inspect the lips, mouth, and tongue for ulceration or lesions. Ensure that the endotracheal tube and enteral tubes are well secured without pressure ulcer or skin damage. Note any loose teeth or caries
Neck	Assess the jugular venous pressure. Inspect any vascular catheter entry sites
Chest	Palpate for subcutaneous air in a ventilated patient. Inspect use of accessory muscles of respiration including diaphragm motion and paradox. With the stethoscope listen for breath sounds bilaterally. Listen for heart sounds, noting second sound splitting, murmurs, rubs, and gallop rhythms
Upper extremities	Assess symmetry of the upper extremities. Inspect all venous and arterial lines. Assess for mottling and peripheral perfusion
Abdomen	Note the pattern of diaphragmatic motion with respiration. Assess for distension and tympany. Palpate for rigidity or involuntary guarding. Assess for liver and spleen enlargement, for masses and for bruits and bowel sounds
Lower extremities	Assess any vascular access sites and palpate pedal pulses. Assess for mottling and peripheral perfusion. Assess for peripheral edema
Neurologic system and mental status	Pupils and facial symmetry were assessed previously. Assess whether the patient can follow commands and whether all four extremities move equally. Assess the plantar response and withdrawal to pain stimuli. Assess delirium using CAM-ICU or other validated metric
Devices and incisions	All surgical sites and device entry sites, including ET tube, vascular access, chest and enteral tubes, and urinary catheters should be assessed. The character and amount of urine in the Foley bag should be noted
Posterior	Examination performed when patient is turned. Pressure ulcers should be inspected. Edema often collects in the rump and lower back due to patient body position
Monitors and waveforms	The ventilator (mode, pressures, minute ventilation, and waveforms), hemodynamic monitor output (venous pressure, arterial pressure tracing), telemetry output, and vital signs, as well as any other bedside monitors, should be inspected for qualitative and quantitative abnormalities
Rest of the room	The presence and mood of the patient's family members or visitors should be considered

Definition of abbreviations: CAM-ICU = confusion assessment method for the intensive care unit; ET = endotracheal.

*This examination proceeds by region of the body and takes only minutes for an experienced examiner. Certain components may not be relevant to all ICU patients and ICU populations, and other physical examination maneuvers may be needed in specialty ICUs such as transplant, neurologic, or burn ICUs. The checklist should be modified to suit the clinical circumstances.

Thus, there is yet more impetus for high-quality data as to the usefulness of bedside diagnosis.

We envision a randomized controlled trial wherein one arm is randomized to clinicians completing a daily standard physical diagnosis/bedside assessment checklist while the other group is randomized to usual care. End points would include total costs of care during the ICU stay, ICU length of stay, ICU-related complications, caregiver and patient and family satisfaction, and mortality. Such a trial would be easily

conducted within the residency training programs of most academic ICUs. In advance of generating data from such a trial, guidelines and expert opinion from our medical societies addressing the role of the physical examination in the ICU could be helpful. In conclusion, we believe that even in the modern ICU, the physical examination retains value and merits further scholarly work. We can learn a lot by watching. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

Acknowledgment: The authors acknowledge Dr. Henry Fessler, M.D., for helpful comments on the manuscript.

References

1 Verghese A. Culture shock—patient as icon, icon as patient. *N Engl J Med* 2008;359:2748–2751.
2 Vazquez R, Vazquez Guillamet C, Adeel Rishi M, Florindez J, Dhawan PS, Allen SE, Manthous CA, Lighthall G. Physical examination in the intensive care unit: opinions of physicians at three teaching hospitals. *Southwest J Pulm Crit Care* 2015;10:34–43.
3 Cook CJ, Smith GB. Do textbooks of clinical examination contain information regarding the assessment of critically ill patients? *Resuscitation* 2004;60:129–136.
4 Cook DJ, Simel DL. The rational clinical examination: does this patient have abnormal central venous pressure? *JAMA* 1996;275:630–634.
5 McGee SR. Physical examination of venous pressure: a critical review. *Am Heart J* 1998;136:10–18.
6 Saugel B, Kirsche SV, Hapfelmeier A, Phillip V, Schultheiss C, Schmid RM, Huber W. Prediction of fluid responsiveness in patients admitted to the medical intensive care unit. *J Crit Care* 2013;28:537.e1–9.
7 Lichtenstein D, Goldstein I, Mourgeon E, Cluzel P, Grenier P, Rouby JJ. Comparative diagnostic performances of auscultation, chest radiography, and lung ultrasonography in acute respiratory distress syndrome. *Anesthesiology* 2004;100:9–15.
8 Brunel W, Coleman DL, Schwartz DE, Peper E, Cohen NH. Assessment of routine chest roentgenograms and the physical examination to confirm endotracheal tube position. *Chest* 1989;96:1043–1045.
9 Sapira JD. Usefulness of physical examination in detecting the presence or absence of anemia. *Arch Intern Med* 1990;150: 1974–1975.
10 Lighthall GK, Markar S, Hsiung R. Abnormal vital signs are associated with an increased risk for critical events in US veteran inpatients. *Resuscitation* 2009;80:1264–1269.
11 Krieger B, Feinerman D, Zaron A, Bizousky F. Continuous noninvasive monitoring of respiratory rate in critically ill patients. *Chest* 1986;90: 632–634.
12 Vazquez R, Gheorghe C, Ramos F, Dadu R, Amoateng-Adjepong Y, Manthous CA. Gurgling breath sounds may predict hospital-acquired pneumonia. *Chest* 2010;138:284–288.
13 Tulaimat A, Gueret RM, Wisniewski MF, Samuel J. Association between rating of respiratory distress and vital signs, severity of illness, intubation, and mortality in acutely ill subjects. *Respir Care* 2014;59: 1338–1344.
14 Reade MC, Finfer S. Sedation and delirium in intensive care. *N Engl J Med* 2014;370:1567.
15 Reilly BM. Physical examination in the care of medical inpatients: an observational study. *Lancet* 2003;362:1100–1105.
16 Darbyshire JL, Young JD. An investigation of sound levels on intensive care units with reference to the WHO guidelines. *Crit Care* 2013;17: R187.
17 Neligan P. Critical care medicine tutorials. 2001–2002 [accessed 2015 April 6]. Available from: http://www.ccmtutorials.com/problems/clinical/03_exam.htm
18 Miller M, Johnson B, Greene HL, Baier M, Nowlin S. An observational study of attending rounds. *J Gen Intern Med* 1992;7:646–648.
19 Roy B, Castiglioni A, Kraemer RR, Salanitro AH, Willett LL, Shewchuk RM, Qu H, Heudebert G, Centor RM. Using cognitive mapping to define key domains for successful attending rounds. *J Gen Intern Med* 2012;27:1492–1498.
20 Stickrath C, Noble M, Prochazka A, Anderson M, Griffiths M, Manheim J, Sillau S, Aagaard E. Attending rounds in the current era: what is and is not happening. *JAMA Intern Med* 2013;173:1084–1089.
21 Thielke S, Hammond K, Helbig S. Copying and pasting of examinations within the electronic medical record. *Int J Med Inform* 2007;76: S122–S128.
22 Thornton JD, Schold JD, Venkateshaiah L, Lander B. Prevalence of copied information by attendings and residents in critical care progress notes. *Crit Care Med* 2013;41:382–388.
23 Sheehy AM, Weissburg DJ, Dean SM. The role of copy-and-paste in the hospital electronic health record. *JAMA Intern Med* 2014;174: 1217–1218.
24 Saint S, Higgins LA, Nallamothu BK, Chenoweth C. Do physicians examine patients in contact isolation less frequently? A brief report. *Am J Infect Control* 2003;31:354–356.
25 Paige M, Bickler PE. Falsely low pulse oximetry values in patients receiving docetaxel (Taxotere). *Anesth Analg* 2004;99:622–623.
26 Wiley B, Mohanty B. Handheld ultrasound and diagnosis of cardiovascular disease at the bedside. *J Am Coll Cardiol* 2014;64: 229–230.
27 Doerschug KC, Schmidt GA. Intensive care ultrasound: III. Lung and pleural ultrasound for the intensivist. *Ann Am Thorac Soc* 2013;10: 708–712.