Chapter 2
"Less Is More": The New Paradigm in Critical Care

The art of medicine consists of amusing the patient while nature cures the disease

Voltaire, French writer and historian (1694–1778).

What appears to be the world's first ICU was established at the Municipal Hospital of Copenhagen in December of 1953 by the Danish anesthesiologist Bjorn Ibsen during the polio epidemic of 1952–1953 [1]. The first patient admitted to the unit was a 43 year old man who had unsuccessfully attempted to hang himself. The patient had a tracheotomy performed and received manual positive pressure ventilation with 60 % oxygen in N_2O [2]. The first physician staffed ICU's in the US were developed in 1958 by Max Harry Weil and Herbert Shubin at the Los Angles County General Hospital and by Peter Safar in Baltimore [3, 4]. The introduction of the pulmonary artery catheter (PAC) in the early 1970s by Swan and colleagues became the monitoring tool that defined critical care medicine for the next four decades [5, 6]. The PAC became synonymous with critical care medicine. The era of the PAC resulted in a style of medicine that can best be characterized as aggressive. If some care is good, more care is even better. However almost all medical interventions be they invasive procedures, diagnostic tests, imaging studies, mechanical ventilation, surgery or drugs have some risk of adverse effects [7]. In some cases, these harms outweigh the benefits. This may be particularly so in ICU patients who are highly vulnerable and at an increased risk of iatrogenic complications [8]. Beginning in 1996 the safety and effectiveness of the PAC came into question [9]. Subsequent studies demonstrated that the PAC provided misleading ("physiologic variables") that could lead to inappropriate therapeutic interventions and that the use of the PAC did not improve patient outcome [10–12]. The PAC has now all but been abandoned [13]. In 2000 the ARDSnet group published their now landmark study which demonstrated that mechanical ventilation with low tidal volume of 6 mL/kg/IBW improved patient outcome as compared to the standard approach (12 mL/kg/IBW) [14]. The last decade has witnessed a slew of studies that have challenged conventional wisdom and which have led to a gentler, less invasive approach to the critically ill patient… this has led to the paradigm that "*Less may be More*" (*see list below*) [7, 8]. We now realize that our goal as intensivists is too be supportive and allow the body to heal itself while at the same time limiting the harm we cause with are arsenal of therapeutic and diagnostic weapons.

P.E. Marik, *Evidence-Based Critical Care*, DOI 10.1007/978-3-319-11020-2_2

Interventions for which less has been shown to be associated with better outcomes:

- Lower tidal volume and lower plateau pressures [14]
- Less blood [15, 16]
- Less invasive hemodynamic monitoring [13, 17]
- Lees fluids [18–20]
- Less insulin and less intensive glycemic control [21]
- Less antibiotics; de-escalation of empiric therapy and shorter course [22–24]
- Less sedation and less benzodiazepines [25–27]
- Less corticosteroids; 200 mg hydrocortisone (equ) daily for sepsis and COPD [28–31]
- Less CXR; no daily CXR [32, 33]
- Less oxygen; hyperoxia kills (COPD) and damages the brain and lungs [34–43]
- Less calories and protein; trophic feeds may be safe; less protein = less muscle breakdown [44, 45]
- Less antiarrhythmics; no prophylactic lidocaine in AMI [46]
- Less stress ulcer prophylaxis (=less *C. diff.* and less HAP) [47, 48]
- Less intense renal replacement therapy [49–52]
- Less blood pressure control (in ischemic stroke) [53, 54]
- NO dopamine [55–57]
- NO "supranormal" hemodynamic targets [58, 59]
- NO TPN [60, 61]
- NO diuretics for acute renal failure [62]
- NO hetastarch [63, 64]
- NO Activated Protein C [65]
- NO MRSA/MDRO screening and protective isolation [66–68]
- NO therapeutic hypothermia [69, 70]

References

1. Berthelsen PG, Cronqvist M. The first intensive care unit in the world: Copenhagen 1953. Acta Anaesthesiol Scand. 2003;47:1190–5.
2. Long DM. A century of change in neurosurgery at Johns Hopkins: 1889-1989. J Neurosurg. 1989;71:635–38.
3. Weil MH, Shoemaker WC. Pioneering contributions of Peter Safar to intensive care and the founding of the Society of Critical Care Medicine. Crit Care Med. 2004;32:S8–10.
4. Safar P, Dekornfeld TJ, Pearson JW, et al. The intensive care unit. A three year experience at Baltimore city hospitals. Anaesthesia. 1961;16:275–84.
5. Ganz W, Donosco R, Marcus HS, et al. A new technique for measurment of cardiac output by thermodilution in man. Am J Cardiol. 1971;27:392–6.
6. Swan HJ, Ganz W, Forrester J, et al. Catheterization of the heart in man with use of a flow-directed balloon-tipped catheter. N Engl J Med. 1970;283:447–51.
7. Grady D, Redberg RF. Less is more: how less health care can result in better health. Arch Intern Med. 2010;170:749–50.

8. Knox M, Pickkers P. “Less is More” in critically ill patients. Not too intensive. JAMA Intern Med. 2013;173:1369–72.
9. Connors AF, Speroff T, Dawson NV, et al. The effectiveness of right heart catheterization in the initial care of critically ill patients. JAMA. 1996;276:889–97.
10. Marik PE, Baram M, Vahid B. Does the central venous pressure predict fluid responsiveness? A systematic review of the literature and the tale of seven mares. Chest. 2008;134:172–8.
11. Harvey S, Harrison DA, Singer M, et al. Assessment of the clinical effectiveness of pulmonary artery catheters in management of patients in intensive care (PAC-Man): a randomised controlled trial. Lancet. 2005;366:472–7.
12. Sandham JD, Hull RD, Brant RF, et al. A randomized, controlled trial of the use of pulmonary-artery catheters in high-risk surgical patients. N Engl J Med. 2003;348:5–14.
13. Marik PE. Obituary: pulmonary artery catheter 1970 to 2013. Ann Intensive Care. 2013;3:38.
14. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. N Engl J Med. 2000;342:301–8.
15. Salpeter SR, Buckley JS, Chatterjee S. Impact of more restrictive blood transfusion strategies on clinical outcomes: a meta-analysis and systematic review. Am J Med. 2014;127:124–31.
16. Marik PE, Corwin HL. Efficacy of RBC transfusion in the critically ill: a systematic review of the literature. Crit Care Med. 2008;36:2667–74.
17. Marik PE. Non-invasive cardiac output monitors. A state-of-the-art review. J Cardiothorac Vasc Anesth. 2013;27:121–34.
18. Maitland K, Kiguli S, Opoka RO, et al. Mortality after fluid bolus in African children with severe infection. N Engl J Med. 2011;364:2483–95.
19. Hilton AK, Bellomo R. A critique of fluid bolus resuscitation in severe sepsis. Crit Care. 2012;16:302.
20. Marik PE. Early management of severe sepsis: concepts and controversies. Chest. 2014;145(6): 1407–18.
21. NICE-SUGAR Study Investigators, Finfer S, Chittock DR, Su SY, Blair D, Foster D, et al. Intensive versus conventional glucose control in critically ill patients: the NICE-sugar study investigators. N Engl J Med. 2009;360:1283–97.
22. Garnacho-Montero J, Gutierrez-Pizarraya A, Escoresca-Ortega A, et al. De-escalation of emperical therapy is associated with lower mortality in patients with severe sepsis and septic shock. Intensive Care Med. 2014;40:32–40.
23. Bouadma L, Luyt CE, Tubach F, et al. Use of procalcitonin to reduce patients’ exposure to antibiotics in intensive care units (PRORATA trila): a multicentre randomised controlled trial. Lancet. 2010;375:463–74.
24. Chastre J, Wolff M, Fagon JY, et al. Comparison of 8 vs 15 days of antibiotic therapy for ventilator-associated pneumonia in adults: a randomized trial. JAMA. 2003;290:2588–98.
25. Barr J, Fraser GL, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation and delirium in adult patients in the intensive care unit. Crit Care Med. 2013;41: 263–306.
26. Girard TD, Kress JP, Fuchs BD, et al. Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. Lancet. 2008;371:126–34.
27. Strom T, Martinussen T, Toft P. A protocol of no sedation for critically ill patients receiving mechancial ventilation: a randomised trial. Lancet. 2010;375:475–80.
28. Marik PE. Glucocorticoids in sepsis: dissecting facts from fiction. Crit Care. 2011;15:158.
29. Moran JL, Graham PL, Rockliff S, et al. Updating the evidence for the role of corticosteroids in severe sepsis and shock: a Bayesian meta-analytic perspective. Crit Care. 2010;14:R134.
30. Leuppi JD, Schuetz P, Bingisser R, et al. Short-term vs conventional glucocorticoid therapy in acute exacerbations of chronic obstructive pulmonary disease. The REDUCE randomized clinical trial. JAMA. 2013;309:2223–31.
31. Annane D, Bellissant E, Bollaert PE, et al. Corticosteroids in the treatment of severe sepsis and septic shock in adults: a systematic review. JAMA. 2009;301:2349–61.

32. Hejblum G, Chalumeau-Lemoine L, Ioos V, et al. Comparison of routine and on-demand prescription of chest radiographs in mechanically ventilated adults: a multicentre, cluster-randomised, two-period crossover study. Lancet. 2009;374:1687–93.
33. Kroner A, Binnekade JM, Graat ME, et al. On-demand rather than daily-routine chest radiography prescription may change neither the number nor the impact of chest computed tomography and ultrasound studies in a multidisciplinary intensive care unit. Anesthesiology. 2008;108:40–5.
34. de los Santos R, Seidenfeld JJ, Anzueto A, et al. One hundred percent oxygen lung injury in adult baboons. Am Rev Respir Dis. 1987;136:657–61.
35. New A. Oxygen: kill or cure? Prehospital hyperoxia in the COPD patient. Emerg Med J. 2006;23:144–46.
36. Austin MA, Wills KE, Blizzard L, et al. Effect of high flow oxygen on mortality in chronic obstructive pulmonary disease patients in prehospital setting: randomised controlled trial. BMJ. 2010;341:c5462.
37. de Jonge E, Peelen L, Keijzers PJ, et al. Association between administered oxygen, arterial partial oxygen pressure and mortality in mechanically ventilated intensive care unit patients. Crit Care. 2008;12:R156.
38. Cameron L, Pilcher J, Weatherall M, et al. The risk of serious adverse outcomes associated with hypoxaemia and hyperoxaemia in acute exacerbations of COPD. Postgrad Med J. 2012;88:684–9.
39. Rincon F, Kang J, Maltenfort M, et al. Association between hyperoxia and mortality after stroke: a multicenter cohort study. Crit Care Med. 2013;42:387–96.
40. Janz DR, Hollenbeck RD, Pollock JS, et al. Hyperoxia is associated with increased mortality in patients treated with mild therapeutic hypothermia after sudden cardiac arrest. Crit Care Med. 2012;40:3135–9.
41. Bellomo R, Bailey M, Eastwood GM, et al. Arterial hyperoxia and in-hospital mortality after resuscitation from cardiac arrest. Crit Care. 2011;15:R90.
42. Kilgannon JH, Jones AE, Parrillo JE, et al. Relationship between supranormal oxygen tension and outcome after resuscitation from cardiac arrest. Circulation. 2011;123:2717–22.
43. Davis DP, Meade W, Sise MJ, et al. Both hypoxemia and extreme hyperoxemia may be detrimental in patients with severe traumatic brain injury. J Neurotrauma. 2009;26:2217–23.
44. National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network, Rice TW, Wheeler AP, Thompson BT, Steingrub J, Hite RD, Moss M, Morris A, Dong N, Rock P. Initial trophic vs full enteral feeding in patients with acute lung injury. The EDEN randomized trial. JAMA. 2012;307:795–803.
45. Puthucheary ZA, Rawal J, McPhail M, et al. Acute skeletal muscle wasting in critical illness. JAMA. 2013;310:1591–600.
46. Sadowski ZP, Alexander JH, Skrabucha B, et al. Multicenter randomized trial and a systematic overview of lidocaine in acute myocardial infarction. Am Heart J. 1999;137:792–8.
47. Marik PE, Vasu T, Hirani A, et al. Stress ulcer prophylaxis in the new millennium: a systematic review and meta-analysis. Crit Care Med. 2010;38:2222–8.
48. Krag M, Perner A, Wetterslev J, et al. Stress ulcer prophylaxis versus placebo or no prophylaxis in critically ill patients. A systematic review of randomised clinical trials with meta-analysis and trial sequential analysis. Intensive Care Med. 2014;40:11–22.
49. VA/NIH Acute Renal Failure Trial Network, Palevsky PM, Zhang JH, O’Connor TZ, Chertow GM, Crowley ST, et al. Intensity of renal support in critically ill patients with acute kidney injury. N Engl J Med. 2008;359:7–20.
50. Bouman CS, Oudemans-van Straaten HM, Tijssen JG, et al. Effects of early high-volume continuous venovenous hemofiltration on survival and recovery of renal function in intensive care patients with acute renal failure: a prospective, randomized trial. Crit Care Med. 2002;30:2205–11.
51. Augustine JJ, Sandy D, Seifert TH, et al. A randomized controlled trial comparing intermittent with continuous dialysis in patients with ARF. Am J Kidney Dis. 2004;44:1000–7.

52. RENAL Replacement Therapy Study Investigators, Bellomo R, Cass A, Cole L, Finfer S, Gallagher M, et al. Intensity of continuous renal-replacement therapy in critically ill patients. N Engl J Med. 2009;361:1627–38.
53. He J, Zhang Y, Xu T, et al. Effect of immediate blood pressure reduction on death and major disability in patients with acute ischemic stroke. The CATIS randomzed clinical trial. JAMA. 2014;311:479–89.
54. Sandset ES, Bath PM, Boysen G, et al. The angiotensin-receptor blocker candesartan for treatment of acute stroke (SCAST): a randomised, placebo-controlled, double-blind trial. Lancet. 2011;377:741–50.
55. Chen HH, Anstrom KJ, Givertz MM, et al. Low-dose dopamine or low-dose nesiritide in acute heart failure with renal dysfunction. The ROSE acute heart failure randomized trial. JAMA. 2013;310(23):2533–43.
56. De Backer D, Biston P, Devriendt J, et al. Comparison of dopamine and norepinephrine in the treatment of shock. N Engl J Med. 2010;362:779–89.
57. Bellomo R, Chapman M, Finfer S, Hickling K, Myburgh J. Low dose dopamine in patients with early renal dysfunction: a placebo-controlled trial. Lancet. 2000;356:2139–43.
58. Hayes MA, Timmins AC, Yau E, et al. Elevation of systemic oxygen delivery in the treatment of critically ill patients. N Engl J Med. 1994;330:1717–22.
59. Gattinoni L, Brazzi L, Pelosi P, et al. A trial of goal-oriented hemodynamic therapy in critically ill patients. N Engl J Med. 1995;333:1025–32.
60. Casaer MP, Mesotten D, Hermans G, et al. Early versus late parenteral nutrition in critically ill adults. N Engl J Med. 2011;365:506–17.
61. Marik PE, Pinsky MR. Death by total parenteral nutrition. Intensive Care Med. 2003;29: 867–9.
62. Ho KM, Sheridan DJ. Meta-analysis of frusemide to prevent or treat acute renal failure. BMJ. 2006;333:420.
63. Perner A, Haase N, Guttormsen AB, et al. Hydroxyethyl starch 130/0.4 versus Ringers acetate in severe sepsis. N Engl J Med. 2012;367:124–34.
64. Gattas DJ, Dan A, Myburgh J, et al. Fluid resuscitation with 6% hydroxyethyl starch (130/0.4) in acutely ill patients: an updated systematic review and meta-analysis. Anesth Analg. 2012; 114:159–69.
65. Ranieri VM, Thompson BT, Barie PS, et al. Drotrecogin Alfa (activated) in adults with septic shock. N Engl J Med. 2012;366:2055–64.
66. Derde LP, Cooper BS, Goossens H, et al. Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomised trial. Lancet Infect Dis. 2014;14(1):31–9.
67. Harris AD, Pineles L, Belton B, et al. Universal glove and gown use and acquisition of antibiotic-resistant bacteria in the ICU. A randomized trial. JAMA. 2013;310(15):1571–80.
68. Huang SS, Septimus E, Kleinman K, et al. Targeted versus universal decolonization to prevent ICU infection. N Engl J Med. 2013;368(24):2255–65.
69. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33C versus 36C after cardiac arrest. N Engl J Med. 2013;369:2197–206.
70. Alderson P, Gadkary C, Signorini DF. Therapeutic hypothermia for head injury. Cochrane Database Syst Rev. 2004;4, CD001048.

http://www.springer.com/978-3-319-11019-6

Evidence-Based Critical Care
Marik, P.E.
2015, XXXIII, 835 p. 83 illus., 46 illus. in color., Softcover
ISBN: 978-3-319-11019-6