



A closed model on intensive care leads to a superior outcome in critical surgical patients

PRO:

The intensive care units (ICUs) must be used in the most efficient way, as they usually are the most expensive part in the hospital. High quality and cost effective performance can best be achieved when responsibility and management are given to those who have the special expertise.

Who has special expertise?

The acute, life threatening challenges in critical care are most often complex deteriorations wherein many special problems converge and amplify each other, such as in severe sepsis, acute renal failure, hemodynamic shock and many others. Competent critical care of such complex deteriorations needs expertise which goes far beyond the knowledge and skills of one general specialty. Physicians with special expertise, educated and certified for critical care medicine (i.e. “intensivists”) are the experts for these problems¹.

In larger European hospitals, intensive care units (ICUs) are generally run as so-called “closed” units operating as functional entities with a competent on-site team (specialized physicians and nurses) under direct supervision of a full-time intensivist who is directly responsible for the treatment. Competent physicians maintain the service on-site around the clock. Internal management is well organized (“team model”) including implementation of quality improvement and education.

In this context, we are only considering ICUs in larger hospitals. In smaller hospitals the needs and the conditions are different.

The essentials of critical care

Critical care medicine is a highly proactive acute medicine. Today, there is good evidence that acute and timely effective reaction is mandatory for optimal outcome. The study of Rivers and co-workers² shows impressively that early goal-directed therapy (optimal adjustment of cardiac function and oxygen delivery within the first six hours) is significantly more effective in treating severe sepsis.

Another analysis of organ dysfunction data includes 1036 patients from the placebo arms of two large controlled sepsis trials³. Sequential Organ Failure Scores (SOFA) were analysed daily: Improvement of cardiovascular, respiratory, or renal function within the first 24 hours reduced the 28-day mortality significantly. This shows convincingly that a fast, effective reaction is mandatory for good outcome.

The advantage of intensivists

Critical care medicine can be more efficient, when experts especially competent for critical care (i.e. “intensivists”) are involved in the treatment⁴⁻¹⁰. Only two references shall be mentioned in detail:

The Maryland Health Services Cost Review Commission analysed the effect of having daily rounds by ICU physicians on clinical and economic outcomes after esophageal resection in 35 non-federal acute care hospitals¹¹. During the study period (1994-1998), 366 adult patients underwent esophageal resection. After adjusting for patient case-mix, the lack of daily rounds by an ICU physician was independently associated with a 73% increase in hospital length of stay and a 61% increase in total hospital cost.



*Hilmar Burchardi, MD
University of
Goettingen, Germany*

Furthermore, postoperative complications occurred more frequently. So, at least for high-risk surgical procedures, the participation of ICU expert physicians improves the quality of care and reduces costs.

By a meta-analysis from MEDLINE and EMBASE (1965 – 2001), Pronovost and co-workers¹² looked for the association between the ICU physician staffing and patient outcomes. In 26 relevant observational studies, they found that high-intensity ICU staffing, i.e. mandatory intensivist consultation or closed ICU (all care directed by intensivists), was associated with lower hospital mortality (in 16 from 17 studies, risk adjusted), lower ICU mortality (in 14 from 15 studies, risk adjusted), shorter hospital length of stay (LOS) (in 10 from 13 studies), and ICU LOS (in 14 from 18 studies), as compared to low-intensity ICU staffing (i.e. no intensivist consultation).

Timely action by the ICU team

Unstable critically ill patients may deteriorate very quickly, requiring constant surveillance and continuous titration of therapy. Good critical care is continuously capable of acting. This cannot be realized by regular rounds when physicians see their patients only intermittently. Communication problems may be crucial in such situations. Therefore, critical care must be provided by physicians who thoroughly know the actual problems of their patients, that means by physicians who are present in the ICU, continuously dedicated to critical care and not responsible for any other service in the hospital¹³. Thus, best critical care can only be provided by on-site physicians, within a multidisciplinary critical care team¹⁴. The best ICU model is the “closed unit”!

A consensus report from two task forces of the Society of Critical Care Medicine (SCCM) attempted to define a best practice model for the ICU¹⁵. Their conclusion was (amongst others):

- Timely and personal intervention reduces mortality and LOS, and decreases cost of care.
- When an intensivist occupies an administrative role in the ICU providing benchmarking, clinical research, and standardization of care, this may further reduce LOS, cost of care and treatment complications.

Their recommendations are:

- An ICU with a dedicated team (ICU nurses, intensivist, respiratory care practitioner, pharmacist^{10,16}), led by a full-time critical care-trained physician.
- The intensivist physician leading the ICU service should have no competing clinical responsibilities.
- ICUs with an exclusive critical care service and operating in the closed format may have improved outcomes.

There are good arguments for full-time, on-site specialists in the ICU¹⁷:

- Expert team on-site may be more effective in reducing mortality, length of stay, complications, and even costs (or more effective with higher expenses).
- Special expert consultation (e.g. clinical pharmacist or bacteriologist) is more effective when cooperating with a team.
- Standardized, optimized procedures and protocols can better be fulfilled by a closed team.
- Hygienic measures and other strategies of quality improvement can be better controlled in a closed team.
- A closed team can achieve uniform admission and discharge policies for the ICU.

The multidisciplinary approach

The closed unit concept is a multidisciplinary approach with specialized physicians (intensivists), specialised nurses, respiratory therapists, and other experts working together in a team under the supervision of full-time directors¹⁷. This multidisciplinary approach is characterized by:

- Medical and nursing directors with authority and co-responsibility for ICU management
- Medical, respiratory therapy and nursing collaboration in a team approach
- Use of standards protocols and guidelines to assure consistent approach to medical, nursing, and technical issues
- Dedication to coordination and communication for all aspects of ICU management
- Emphasis on practitioner certification, research, education, ethical issues, and patient advocacy.

The team dynamics in a multidisciplinary team is an essential precondition to ascertain the high quality of care, with the necessary reliability, promptness, and adaptation to the various demands. Creating a good team spirit depends very much on the social competence of the directors.

Multidisciplinary cooperation

But the concept of team care not only relies on the expertise of the ICU team. It is also necessary to include the admitting or primarily responsible physicians as well as the special expertise of other disciplines. So, the ICU team has the obligation to cooperate closely with the other physicians involved in the individual patient's care. This cooperation must be based on a well established mutual trust. Every care provider bears his/her own responsibility, but the providers must also learn from each other. Only then, the critical care service can be optimized providing better outcome at acceptable resource consumption, reduction of potential complications, and a shorter length of stay.

References

1. Guidelines Committee of SCCM. Guidelines for the definition of an intensivist and the practice of critical care medicine. *Crit Care Med* 1992; 20:540-542.
2. Rivers E, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, Peterson E, Tomlanovich M. Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med* 2001; 345:1368-1377.
3. Levy MM, Macias WL, Vincent JL, Russell JA, Silva E, Trzaskoma B, Williams MD. Early changes in organ function predict eventual survival in severe sepsis. *Crit Care Med* 2005; 33:2194-2201.
4. Carson SS, Stocking C, Podsadecki T, Christenson J, Pohlman A, MacRae S, Jordan J, Humphrey H, Siegler M, Hall J. Effects of organizational change in the medical intensive care unit of a teaching hospital: a comparison of 'open' and 'closed' formats. *JAMA* 1996; 276:322-328.

5. Ghorra S, Reinert SE, Cioffi W, Buczko G, Simms HH. Analysis of the effect of conversion from open to closed surgical intensive care unit. *Ann Surg* 1999; 229:163-171.
6. Hanson CW, Deutschman CS, Anderson HL, Reilly PM, Behringer EC, Schwab CW, Price J. Effects of an organized critical care service on outcomes and resource utilization: a cohort study. *Crit Care Med* 1999; 27:270-274.
7. Manthous CA, Amoateng-Adjepong Y, Al Kharrat T, Jacob B, Alnuaimat HM, Chatila W, Hall JB. Effects of a medical intensivist on patient care in a community teaching hospital. *Mayo Clin Proc* 1997;72:391-399.
8. Multz AS, Chalfin DB, Samson IM, Dantzer DR, Fein AM, Steinberg HN, Niederman MS, Scharf SM. A „closed“ medical intensive care unit (MICU) improves resource utilization when compared with an „open“ MICU. *Am J Respir Crit Care Med* 1998; 157:1468-1473.
9. Pronovost PJ, Jenckes MW, Dorman T, Garrett E, Breslow MJ, Rosenfeld BA, Lipsett PA, Bass E. Organizational characteristics of intensive care units related to outcomes of abdominal aortic surgery. *JAMA* 1999;281:1310-1317.
10. Clemmer TP, Spuhler VJ, Oniki TA, Horn SD. Results of a collaborative quality improvement program on outcomes and costs in a tertiary critical care unit. *Crit Care Med* 1999; 27:1768-1774.
11. Dimick JB, Pronovost PJ, Heitmiller RF, Lipsett PA. Intensive care unit physician staffing is associated with decreased length of stay, hospital cost, and complications after esophageal resection. *Crit Care Med* 2001; 29:753-758.
12. Pronovost PJ, Angus DC, Dorman T, Robinson KA, Dremsizov TT, Young TL. Physician staffing patterns and clinical outcomes in critically ill patients: a systematic review. *JAMA* 2002; 288:2151-2162.
13. Burchardi H, Moerer O. Twenty-four hour presence of physicians in the ICU. *Crit Care* 2001; 5:131-137.
14. American College of Critical Care Medicine of SCCM. Critical care services and personnel. Recommendations based on a system of categorization into two levels of care. *Crit Care Med* 1999; 27:422-426.
15. Brill R, Spevetz A, Branson RD, Campbell GM, Cohen H, Dasta JF, Harvey MA, Kelley MA, Kelly KM, Rudis MI, St Andre AC, Stone JR, Teres D, Weled BJ. Critical care delivery in the intensive care unit: defining clinical roles and the best practice model. *Crit Care Med* 2001; 29:2007-2019.
16. Leape LL, Cullen DJ, Clapp MD, Burdick E, Demonaco HJ, Erickson JI, Bates DW. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. *JAMA* 1999; 282:267-270.
17. Carlson RW, Weiland DE, Srivathsan K. Does a full-time, 24-hour intensivist improve care and efficiency? *Critical Care Clin* 1996; 12:525-551.