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Continuous quality improvement in the ICU: general guidelines

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Introduction

Critically ill or injured patients are almost routinely admitted to the Intensive Care Unit (ICU) where continuous monitoring and life-support techniques are available and comprehensive treatment, as well as continuous care by trained physicians and nurses, can be provided. The ICU has become an integral part of hospital patient care. It is a complex organisation involving different disciplines, high technology and many diagnostic and therapeutic procedures. ICU costs are high and, despite continuously improving results, there is still a relatively high mortality rate.

Patient outcome, not limited to survival but also related to residual disability and quality of life, as well as the effectiveness of treatment and efficiency of intensive care (relating outcome to resource use) have become major issues. The quality of care provided has a significant impact on these variables and continuous improvement of the quality of intensive care is the challenge for the years to come. Quality may be viewed and defined in many differ-

ent ways. In the following some essential elements of ICU performance will be identified which may be used to develop tools which can help us to improve the quality of ICU practice.

Quality improvement

Quality improvement can be defined as the effort to improve the level of performance of key processes in the ICU. It involves the establishment of variables to evaluate the level of current performance, finding ways to improve that performance and implementing new and better methods. In its most general form, quality improvement has two components: a group of values about human and organisational performance and a set of problem-solving techniques, each employed at a given step of the problem-solving process [1]. Such steps could be: identification of a problem, precise definition of the problem, identification of all possible causes, assessment of root causes, development and implementation of a solution and monitoring the effectiveness of the solution, thus providing a feed-back. These steps are helpful as a method to improve performance. Improvement of quality should focus on *structure* i.e. organisational aspects of the ICU, on (medical and non-medical) *processes* in the ICU and on *outcome*, such as mortality rate, length of stay, readmission rate and utilization of resources.

Structure

An adequate organisation of the ICU helps to optimize the quality of care given. An adequate organisation includes the presence of an appointed qualified medical and nursing director and the full-time availability of intensive care physicians (also during evenings, nights and weekends). A well-trained intensive care staff with full responsibility for

patient care has important implications for ICU performance [2, 3]. Also, daily multidisciplinary meetings to discuss current patient problems, surveillance methods to monitor and minimize (iatrogenic) complications, structured meetings with other disciplines (e.g. radiology, pathology) are generally considered mandatory in a well organised ICU. The optimal documentation of patient data, adequate availability of quality equipment and an optimal personnel allocation are, in addition, important quality issues. This list can easily be extended.

It is essential that an ICU explicitly formulates the standards for its organisation on the basis of data from the literature. Implementation requires discussions and ultimately consensus between all members of the ICU staff. A good organisation of ICU management is mandatory. The managerial approach to intensive care has become more and more important, including annual assessment of objectives in terms of type and volume of patients, of a budget and of outcome objectives. A structured quality management system (as part of the organisation of the ICU) focusing on the optimal use of resources and optimal performance of the ICU is essential in the process of quality improvement.

Processes

Patient care in the ICU is associated with a large number of processes ranging from expert individual patient care to general procedures such as admission and discharge and maintenance of equipment. All these processes should ultimately subserve (when functioning well) optimal patient care and outcome as well as the adequate use of resources. However, in daily practice problems may arise in any of these processes, with negative influences on ICU performance. An important method to solve such problems is "trouble shooting" using structured problem identification by the ICU team. Examples of such problems are an unexpected increase in infectious complications or a sudden rise in costs. A process can then be started using the steps already mentioned (identify causes, find and implement solutions and monitor the effectiveness of the implemented change). Trouble shooting is an important method to improve performance, for which it is essential that the whole team becomes involved. In order to be effective a meticulous registration of e.g. infections, complications of procedures, near-accidents, costs, etc., is required.

Another approach is a systematic analysis of all processes in the ICU, including admission and discharge procedures, administrative procedures, procedures related to monitoring and life-support systems, etc. In depth description and analysis of all these processes, which is time-consuming but rewarding, can result in the identification of the crucial elements. The next step is to formulate global standards for these crucial processes. This means that standards are formulated such as: criteria for admission and

discharge are needed; a protocol is necessary for the maintenance of any piece of equipment and for what to do when there is equipment failure; a protocol is needed for invasive monitoring, etc. Some of these may seem self-evident, but a systematic analysis of current practice may reveal that much is missing. It is essential to be as comprehensive as possible. The formulation of global standards can be done in collaboration with other ICUs but each individual ICU has finally to design its own criteria and protocols. The analysis may also produce standards for organisation. By themselves these standards do not necessarily improve performance when implemented, but they provide an infrastructure for quality improvement.

A powerful tool to improve process quality is the implementation of audit techniques which may lead to the rapid establishment of in service guidelines. These include the formulation of medical professional standards for prevention and treatment, resulting in protocols and procedures related to direct patient care. In addition to promoting a high level of professional training, this may help to improve ICU performance. Once standards have been implemented a process of continuous evaluation is necessary to check whether the protocols are followed and to update them. This is part of the quality management system mentioned earlier.

It should be realized that the ICU is not an isolated island in the hospital and that the processes in the ICU are influenced by the process quality of its surrounding departments. Both within the ICU and with relation to other departments, the quality of communication is an essential element in process quality where much can be gained.

Outcome

The classical outcome variable is mortality rate, but others are becoming more and more important. An important method to assess outcome is the standardized mortality ratio using an index of severity (e.g. APACHE, SAPS, MPM), provided that the model is well calibrated and customized. This measure relates actual mortality to expected mortality. Also length of stay standardized for severity of illness and type of disease (for which at present no good standard is available) and unplanned readmission rates are important outcomes. The costs per surviving patient (i.e. costs of survivors related to total ICU costs) could be an extremely important outcome variable. In addition to mortality, the quality of life after ICU discharge is becoming an important outcome, but this is still very difficult to assess. All these measures can only be evaluated in comparison with other ICUs and data from the literature [4–6]. They are still in their infancy but extremely important in evaluating ICU performance. It should be realized, however, that at present there is still little convincing evidence demonstrating a link between variability of these outcome measures and quality of care.

Indicators of quality

ICU performance can be assessed by indicators of quality usually reflecting the overall efficacy of ICU treatment. Such indicators of quality could be:

- The incidence of nosocomial infections
- the complication rates of diagnostic procedures of invasive monitoring
- the unplanned readmission within 24 or 48 h after ICU discharge
- the postventilator survival after ICU discharge of COPD patients
- unplanned extubation or reintubation within 48 h
- the use of blood products or expensive drugs
- the effective cost per surviving patient
- acute renal failure developing after ICU admission, etc.

These examples of (potential) quality indicators, to which many others can easily be added, assess various aspects of ICU performance and have different implications. Nosocomial infections and iatrogenic complications directly re-

flect the quality of care and may be considered recognized indicators of quality. Others can, at present, only be considered as potential indicators and should be further explored. In particular, those related to the efficient use of resources will become more and more important.

It is important that every ICU formulates its indicators of quality as well as its standards to assess performance. The use of such indicators may help to identify problems and to develop methods to improve performance. Continuous measurement of the indicators is one method to assess an improvement of performance over time. The use of different indicators serves to assess both process and outcome quality and, if well standardized, these could become valuable tools for comparing one ICU with another. It should be part of the quality management system which should become an integral part of the ICU. Quality management comprises all the (continuous) measures to assess and improve quality related to the organisation, processes and outcome of the ICU.

References

1. Eagle CJ, Davies JM (1993) Current models of "quality" – an introduction for anaesthetists. *Can J Anaesth* 40:851–862
2. Reynolds HN, Haupt MT, Thill-Baharozian MC, Carlson RW (1988) Impact of critical care physician staffing on patients with septic shock in a university hospital medical intensive care unit. *JAMA* 260:3446–3450
3. Brown JJ, Sullivan G (1989) Effect on ICU mortality of a full-time critical care specialist. *Chest* 96:127–129
4. Rapoport J, Teres D, Lemeshow S, Gehlbach SA (1994) A method for assessing the clinical performance and cost-effectiveness of intensive care units: a multicenter inception cohort study. *Crit Care Med* 22:1385–1391
5. Pollack MM, Getson RP, Ruttimann UE et. al. (1987) Efficiency of intensive care. A comparative analysis of 8 pediatric intensive care units. *JAMA* 258:1481–1486
6. Smithies MN, Bihari D, Chang R (1994) Scoring systems and the measurement of ICU cost effectiveness. *Réan Urg* 3:215