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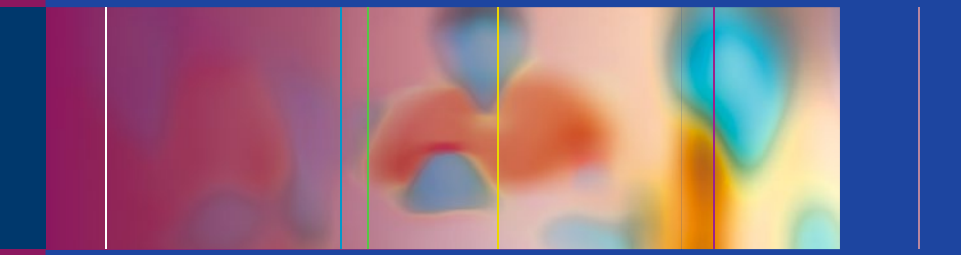

Nursing in Critical Care Setting

An Overview from Basic to Sensitive Outcomes

Springer

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Irene Comisso
University Anesthesia and Intensive Care Unit
University Hospital S. Maria della Misericordia
Udine, Italy

Stefano Bambi
Emergency and Trauma ICU
University Hospital Careggi
Florence, Italy

Matteo Manici
Anesthesia, Intensive Care and Hub Pain Service
University Hospital of Parma
Parma, Italy

Alberto Lucchini
General Intensive Care Unit - San Gerardo Hospital – ASST Monza
University of Milano-Bicocca
Milan, Italy

Gian Domenico Giusti
Intensive Care Unit
University Hospital of Perugia
Perugia, Italy

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Dedication and Acknowledgements

The Authors wish to dedicate this manuscript to their families and beloved ones, and thank them for the important support given during the editing.

Thanks to all the components of our working groups. They daily collaborate with us , often providing us inspiration and precious suggestions. Also, thanks to the collaborators, who helped us in editing the manuscript.

A special thought is directed to our nursing students. They are the future of our profession, and we wish them to keep working with passion and curiosity lifelong.

Finally, this manuscript originated from our patients and their families. By this publication, we wish to give nurses a tool to improve patients' care, always keeping the person we care for as the main focus of our job.

The Authors' Group

Preface

In May 2015, me and two co-authors were contacted by Springer's editor, offering to travel this route. We accepted with enthusiasm, but at the same time with several perplexities. We decided to enlarge the group, and started working to define essential concepts to be considered within the manuscript. Day by day, the project gathered consistency, and the path we wanted to offer to readers became clear in our minds.

Nursing care in ICU is complex and requires continuos competences and knowledges update. As in other contexts, both basic and advanced competences can be found in ICU care. The book is directed to students and newly employee ICU nurses, but also to experienced ones. We aimed to underline the importance of basic aspects in ICU nursing, in the past often disregarded in favor of more technical approaches. In our advice, today's ICU nurse is a very complex professional. Technical, assessment, relational, team working competences are all required to face daily challenges. This is what we tried to offer within this book, together with the consciousness that it only constitutes a part of a larger view.

The author's group comes from different ICU experiences around Italy. Trying to get an advantage of it, we networked each other, giving mutual supervision to the forthcoming

contents. At the end of this travel, I think we all somehow grew up from the professional point of view, and learned more.

Our wish is to give a similar feeling to our readers.

Irene Comisso and the Authors' Group

Contents

Part II Basic Care in ICU

Contributors

Giacomo Alemanno, R.N. Vascular Surgery, Kent and Canterbury Hospital, East Kent Hospital University Foundation Trust, Canterbury, UK

Stefano Bambi, R.N., M.S.N., Ph.D. Emergency & Trauma ICU, University Hospital Careggi, Florence, Italy

Giovanni Becattini, R.N., M.S.N. Nursing Service-Siena Urban Area, AUSL South Eastern Tuscany, Italy

Irene Comisso, R.N., M.S.N. University Anesthesia and Intensive Care Unit, University Hospital S. Maria della Misericordia, Udine, Italy

Stefano Elli, R.N. General Intensive Care Unit, San Gerardo Hospital, ASST Monza, Monza, Italy

Christian De Felippis, R.N. Adult Intensive Care Unit, Glenfield Hospital, University Hospital of Leicester-NHS Trust, Leicester, UK

Francesca Ghillani Research Fellow, Oxford Institute of Population Ageing, University of Oxford, Oxford, UK

Gian Domenico Giusti, R.N., M.S.N. Intensive Care Unit, University Hospital of Perugia, Perugia, Italy

Alberto Lucchini, R.N. General Intensive Care Unit, San Gerardo Hospital, ASST Monza, University of Milano-Bicocca, Milan, Italy

Matteo Manici, R.N., M.S.N. Anesthesia, Intensive Care and Hub Pain Service, University Hospital of Parma, Parma, Italy

Giovanni Mistraletti, M.D., Ph.D. Department of Pathophysiology and Transplantation, University of Milan, Milan, Italy

Alessandra Negro, R.N. Vita-Salute San Raffaele University, Milan, Italy

IRCCS San Raffaele Hospital, Milano, Italy

Margherita I. Nuzzaco, R.N. Intensive Care Unit, Kent and Canterbury Hospital, East Kent Hospital University Foundation Trust, Canterbury, UK

Angela Peghetti, R.N., M.S.N. Nurse Staff. Nurse Department, AOU "S.Orsola Malpighi", Bologna, Italy

Michele Pirovano, R.N., M.S.N. AREU Regional Emergency System-IT, Milan, Italy

Claudio Torbinio, R.N. Trauma Centre, Emergency Department, Ancona Hospital, Province of Ancona, Italy

Introduction

ICU caring underwent a constant development during the last 15 years, with the introduction of new standard treatments. At the same time, ongoing problems are challenging healthcare workers, whilst others are announced as decisive ones for future years.

In this process, the importance of technology increased, but at the same time humanising caring and end of life related dilemmas gathered growing consideration.

Nowadays, ICU generally set themselves up as most complex specialistic level of care, mainly belonging to surgical, trauma or respiratory pathways. General ICUs developed within peripheral areas, whilst specialistic ones belong to second or third level hospitals and are characterised for advanced treatments, for which they are considered referral centres (such as for ECMO or solid organs transplants).

Another visible trend in ICU refers to mortality. In the past, ICUs were considered as the last possible step during hospital stay, moving forward the care limit with consequent high mortality rates. Today's ICUs have often lower mortality rates, compared to other hospital facilities, but advancements in diagnosis and organ support claim a structured reflection about limits of care.

At the same time, mean patients- age increased. Elderly, previously screened for ICU eligibility, are now usually

assisted in these contexts, and require specific consideration for age-related problems and needs.

ICU stay often occupies an early stage during hospitalisation, followed by less critical and invasive approaches. Therefore, performances-evaluation should overcome traditional measurements, such as mortality and length of stay, and start looking upon specific nursing care outcomes and quality of life indicators, often disregarded because too simple.

Care outcomes, including those related to nursing, became therefore a central issue. In fact, the quality-of-life concept together with life-saving approaches, spread the debate about ethical considerations. At the same time, focus on nursing techniques in critical care settings should be matched with a renewed scientific approach to basic care problems.

"Back to basics" becomes therefore the fil rouge of the entire manuscript, deepening the concepts of basic nursing applicable in the whole critical care (including High dependency Units). This philosophy, together with the ABCDEF bundle, approaches a new tendency in patients care, hopefully early belonging to the whole care pathway during hospitalisation.

Modern nursing deals with such development, claiming for a more specific definition of competences belonging to the profession and for the development of certification systems. Consequently, building a professional portfolio of activities and performances could help to develop and maintain nurses-education and develop standards of care.

Further considerations concern the role of management in ICU. Clinical and technological complexities, together with required knowledge and competences and multidisciplinary approaches, solicit an expert management. Within organisational challenges, the entire set of competences

should always be granted. Therefore, a flexible nurse-to-patient ratio could be one of the mail solutions to guarantee specific clinical interventions in a dynamic organizational contex.

This manuscript is mainly oriented towards two main groundings of nursing care: assessment and outcomes. Patients assessment in ICU cannot forget technological-based information collection, that, together with clinical observation, represent the common nursing asset. At the same time, nursing care approaches are moving toward definition and evaluation of outcomes-related problems, thus giving a new dimension and dignity to the nursing diagnosis concept. In these situations, the border between medical and nursing competences becomes sometimes very thin. Nevertheless, the authors defined to approach such topics mainly from nursing point of view, only briefing touching upon medical issues. In this paradigm, we choose to face emerging nursing care aspects, with an evidence based approach.

The wish is to keep alive and strengthen critical thinking, and spread curiosity for a novel approach to nursing problems.

Enjoy reading!

Giovanni Becattini

Part I
Assessment and Monitoring in ICU

Chapter 1
Monitoring Patients: What's New in Intensive Care Setting?

Matteo Manici and Claudio Torbinio

1.1 Introduction

Monitoring ("to monitor") is a term that involves the observation, actions, measuring, and understanding of many human activities in time. The origin of the word "monitoring" comes from the Latin *monitor*, *-oris*, derived from the verb *monēre* (literally, to warn) and means a continuous or repeated observation, measurement, and evaluation of health and/or environmental or technical data for defined purposes, in accordance with predetermined programs in space and time. Monitoring can be implemented using comparable methods for the detection and collection of data [1]. The term originated in industrial environment, to indicate the continuous control of an operating machine, with appropriate instruments which measure some characteristic parameters (speed, consumption, production, etc.). The original meaning was later expanded: from the machine to the whole process, for an operational structure, and also human resources. Monitoring is widespread used in technical and in social sciences, with the general meaning of "data collections" significant for context.

Historically, monitoring started as a physiological measurement problem (Table 1.1) and probably will end up as an overall

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Table 1.1 Short history of physiological data measurements [2]

When	*Who*	What
1625	*Santorio*	Measurement of body temperature with spirit thermometer. Timing pulse with pendulum. Principles were established by Galileo. These results were ignored
1707	*Sir John Foyer*	Published pulse watch
1852	*Ludwig Taube*	Course of patient's fever measurement. At this time temperature, pulse rate, and respiratory rate had become standard vital signs
1896	*Scipione Riva-Rocci*	Introduced the sphygmomanometer (blood pressure cuff)
1900	*Nikolaj Sergeevič Korotkov*	Applied the cuff with the stethoscope (developed by Rene Laennec—French physician) to measure systolic and diastolic blood pressures
1900	*Harvey Cushing*	Applied routine blood pressure in operating rooms
1903	*Willem Einthoven*	Devised the string galvanometer to measure ECG (Nobel Prize 1924)
1939–1945		World War II: development of transducers
1948–1950	*George Ludwig*, *Ian Donald*, *Douglass Howry*, *and Joseph Holmes*	Pioneers of ultrasounds in health science
1950		The ICU's were established to meet the increasing demands for more acute and intensive care required by patients with complex disorders
1953		Danish patients with poliomyelitis received invasive mechanical ventilation

Table 1.1 (continued)

When	*Who*	What
1963	*Hughes W. Day*	Reported that treatment of post-myocardial infarction patients in a coronary care unit reduced mortality by 60%
1968	*Maloney*	Suggested that having the nurse record vital signs every few hours was "only to assure regular nurse-patient contact"
Early 1970s		Bedside monitors built around bouncing balls or conventional oscilloscope
1972	*Takuo Aoyagi*	Developed a pulse oximeter based on the ratio of red to infrared light absorption in blood. After obtained an US patent, oximetry became clinically feasible
1973	*Jeremy Swan and William Ganz*	Pulmonary artery balloon flotation catheter starts advanced hemodynamic study
1990s		Computer-based patient monitors; systems with database functions, report-generation systems, and some decision-making capabilities

assessment of intensive care unit (ICU) patient. This chapter has an introductory function for the first section: the concept of generality of instrumental monitoring, the monitoring carried out through applying scales at patient's bed, to propose a new monitoring model for ICU patient.

ICUs are very different, such as medical and surgical wards, because of different staff availability (especially nurses) and expertise, skills, technologies, and environments. Monitoring activity involves the entire ICU staff (nurses, physician, respiratory therapists and rehabilitation therapists, dietitians) and is

based on different operational models implemented in several countries around the world. Nurses, wherever present 24 h a day, often act as liaison between the various staff components, ensuring security, continuity, and harmony and coordinating and communicating all aspects of treatment and care the patient needs. Nurses also provide continuous monitoring and caring for patients and equipment and for their interactions [3].

1.2 Instrumental Monitoring

Technology is extremely pervasive and is continuously increasing in ICU. It is commonly used in a multitude of tools for monitoring and supporting patient's vital functions: the brain, lung, heart, and kidney. The widespread use of electronic monitoring and support to vital function has probably helped to prevent errors and to improve outcomes [4].

The monitoring tools are able to detect multiple parameters, such as continuous electrocardiogram (ECG), end-tidal carbon dioxide $(EtCO)_2$, various measurements of peripheral oxygen saturation (SpO_2), cardiac output, and intracranial and cerebral perfusion pressure. The supporting devices can affect the respiratory system (noninvasive mechanical ventilation), circulatory (pacemakers, intra-aortic balloon pump, ventricular devices), cardiorespiratory (extracorporeal membrane oxygenation—ECMO), and kidney (continuous renal replacement therapy (CRRT) and slow low-efficiency daily dialysis (SLEDD)). All these supporting systems contextually also provide monitoring parameters (e.g., the ventilator). Understanding the functions of the devices commonly used in ICU can help in caring for patients in critical conditions [5].

The monitoring technique in intensive care has risks and benefits. Intensive monitoring provides a high data value and information, but it can increase some risks of complications.

For example, intensive monitoring could be useful in acute medical interventions aiming to maintain the essential variables within a narrow physiological range and improve the outcome in people with acute stroke [6] (Fig. 1.1).

At the same time, continuous monitoring can increase unnecessary medical interventions and limit patient's mobility, thus increasing the risk of complications related to forced immobility as bedsores, stasis pneumonia, deep vein thrombosis (DVT), thromboembolism (TE), and pain [7].

All recorded data must be evaluated in the clinical context. The value of data must be compared with the accuracy of the instrument, its need for calibration, artifacts, and fictitious events (such

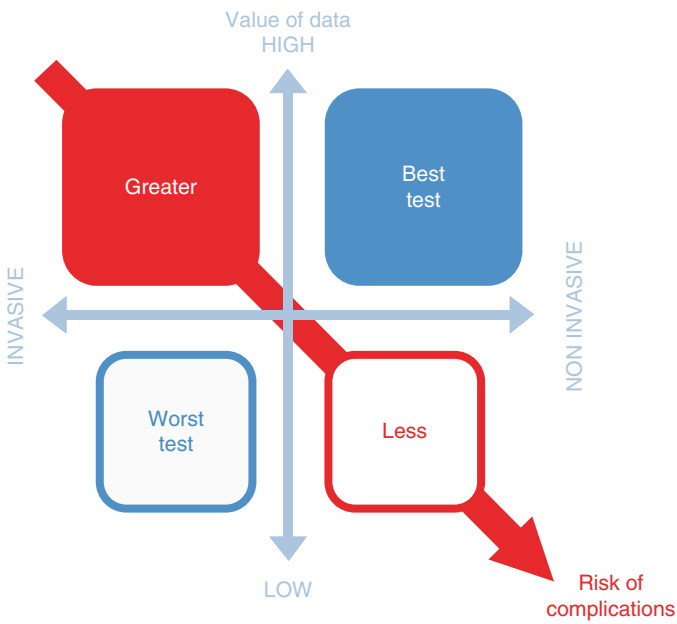

Fig. 1.1 Conceptual framework-related value of data

as a cough during ventilation). As told it is essential to treat patients and their disease instead of numbers. All monitored parameters must be considered in relation to the disease as the best method to treat the same.

In medical literature there are many studies concerning the false alarm rates in the critical patient monitoring. These studies show more than 90% of ICU alarms are false flags. In many cases, these are caused by measurement errors and by patient's movement. The majority of ICU alarms have no real clinical impact on patient care [8].

A too sensitive monitoring can create "panic" within the team. Staff alarm fatigue can determine inadequate and routine alarm settings. Alarms settings should be tailored on patients individual clinical needs and targets [9]. However, the biggest danger is given by turning off the alarms without understanding events actually occurring to patients. Alarm management is a part of the skills that intensive care staff need to learn at the beginning of their professional careers.

1.3 Monitoring and Scales

Through the use of a variety of assessment scales (mono-dimensional or multidimensional, according to the complexity of the construct they want to observe), it is possible to obtain measures of many functional states that cannot be described by any instrumental monitoring systems.

Some aspects have been carefully studied by many authors such as pain, sedation, delirium, and state of consciousness. Other authors made comparisons between tools to determine their adequacy in psychometric characteristics, becoming recommended in international guidelines [10].

An example of the use of scales (and their variations) is represented by functional evaluation. ICU patients frequently experience prolonged immobilization and tend to lose their functional ability. In these patients functional skills assessment during ICU stay and prior ICU discharge becomes crucial to prevent damage from immobility. Many scales have been used for the evaluation of functional abilities, impairments, and/or patients' disabilities. The extent of these outcomes includes different measurement scales. The choice of the right one will depend on the specific cohort of patients, the diagnosis, the stage of rehabilitation, and the available measure sets [11]. These scales are summarized in Table 1.2. Their applicability in ICU environments (including the follow-up period) is indicated in the last column.

1.4 Bedside Monitoring: An Overview

The ICU monitoring is a component of critical area skill set, featuring as neurological monitoring, respiratory, hemodynamic, renal, hepatic, and nutritional. Each function can be both assessed using validated tools and/or instrumental monitoring [12–14].

The rating scales are mostly developed in the assessment of psychosocial functions (neurologic evaluation, pain, sedation, and delirium) and the instrumental monitoring for detection of biological parameters (respiration, hemodynamics, temperature, and metabolism).

The main monitoring variables "to read and feel" are summarized in Table 1.3.

A useful example of the effectiveness of the interpretation of monitoring takes us outside the ICU with Early Warning Score (EWS) in the National Early Warning Score (NEWS) variants and Modified Early Warning Score (MEWS) (Table 1.4). The basic

Table 1.2 Functional assessment scales in the ICUs [11], modified with permission

Scale	Description	Interpretation	Applicability in ICU setting
Functional Status Score for the ICU (FSS-ICU)	Consists of three preambulation categories (rolling, supine to sit transfer, and unsupported sitting) and two ambulation categories (sit to stand transfers and ambulation)	• Rating: 1 (total dependent assistance) to 7 (complete independence) scale • Score: 0–35 (0 score: unable to perform a task due to physical limitations or medical status)	++
4P questionnaire	Evaluates physical and psychosocial problems following ICU recovery	• 4P: patients, physical, psychosocial, and problems • 4P comprises 53 items: 16 physical items, 26 psychosocial items, and 11 follow-up ICU care items, scored on a 5-point Likert scale measuring level of agreement from “strongly agree” to “do not agree at all”	++

Physical Function ICU Test (PFIT)	Used with critically ill patients who may not be able to mobilize away from the bedside, employing four domains	• Amount of assistance for sit to stand, rated from 0 (no physical assistance required) to 3 (assistance of three people required) • Strength for shoulder flexion and knee extension (rated on the Oxford Muscle Test Scale) • Marching in place (number of steps taken and the time required to complete these steps) • An upper extremity endurance task of arm elevation to 90° shoulder flexion (number of times both upper extremities are lifted above 90° of shoulder flexion)	++

(continued)