Difficult and Prolonged Weaning: The Italian Experience

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47.1 Introduction

In Italy, the implementation of pulmonologist centers working as step-down units for the management of patients discharged from intensive care units (ICUs) as a result of difficult or prolonged weaning from invasive mechanical ventilation (IMV) largely coincides with the birth and growth of respiratory ICUs (RICUs) [1–7].

In the past 15 years, a crucial role has been played by the educational and political activities of the Italian Hospital Pulmonologist Association (AIPO) that has captured the interest of intensive care and rehabilitation pulmonologists in respiratory critical medicine and has achieved at the institutional level the recognition of RICUs as specialized units for the management of respiratory system failure. Among the main catalysts that stimulated the dissemination of Italian RICUs, in addition to the popularity of noninvasive ventilation (NIV) for the treatment of acute respiratory failure (ARF) and acute-on-chronic respiratory failure (ACRF), we should consider the increasing need for specialized areas devoted to weaning [1–7]. According to the AIPO definition [1, 2], an RICU is a specialized setting where monitoring and mechanical ventilation, preferentially but not exclusively performed in a noninvasive manner, could be provided to treat ARF/ACRF, or where patients with prolonged or difficult weaning from IMV, or candidates for decannulation, may be admitted. Like the Task Force of the European Respiratory Society [8], the AIPO document [2] identifies three different levels of care for RICUs (intensive, intermediate, monitoring) depending on the amount of structural and human resources available and on the complexity of the interventions provided.

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47.2 Mission

The mission of RICUs that function as weaning centers [9] is crucial in the context of clinical governance of ARF/ACRF because they work as a strategic node for (1) the quick discharge of critically ill patients from the ICU, where they failed repeated attempts of disconnections from the ventilator, to these units dedicated to weaning with an optimization of the limited health resources; (2) the achievement of a greater rate of success in totally or partially liberating ventilator-dependents patients from IMV through protocol-driven, multidisciplinary, intensive rehabilitative interventions; and (3) the delicate transitional process at home of chronically critical patients (e.g., with chronic obstructive pulmonary disease (COPD), end-stage heart failure, advanced neuromyopathy, pluri-comorbidities, postsurgical sequelae), thanks to the activation of integrated pathways between hospital and territory.

47.3 Second AIPO Census of the RICU

The latest data depicting an Italian "snapshot" of pulmonologists' activity on difficult/prolonged weaning may be extrapolated from the last national survey on the RICUs conducted by the AIPO at the end of 2007 [5, 6]. Compared with the first census performed in 1997, the second survey showed that, over the past 10 years, there has been an increase not only in the number of RICUs but also in their efficiency, as the admissions for monitoring have been reduced only in favor of those for active interventions (i.e., mechanical ventilation, weaning and decannulation). The weaning activity of the Italian RICU has more than doubled in the past decade as the admissions for problems of weaning have increased from 8 to 19 % [5, 6] (Fig. 46.1a). These data refer to patients who were transferred from ICUs after failing one or more attempts at disconnection from the ventilator for at least 7 days; these patients belong to the categories of "difficult" and "prolonged" weaning, which are correlated with greater rate of mortality and higher health costs compared with those belonging to the "simple" weaning category [10].

The 2007 AIPO survey has clearly shown that the different attitude of the Italian RICUs in performing weaning activities depends essentially on two factors: (1) the level of respiratory care available (intensive, intermediate, monitoring) and (2) the type of location (acute care hospital , rehabilitative Institute). Concerning the first aspect, weaning-correlated problems have been the cause of admission in 25 % of cases in RICUs providing higher levels of assistance (intensive and intermediate) versus 10 % of the admissions observed in the monitoring units (Fig. 46.1b). As regards the second aspect, the survey has shown that the RICUs located in the acute care hospitals (80 % of the total surveyed units) work largely as step-up units for supporting NIV patients with ARF/ACRF transferred from emergency departments and general wards, whereas they function less frequently as step-down units for difficult-to wean patients coming from ICUs. Conversely, the RICUs set up within rehabilitative centers (20 % of the total surveyed units) work primarily as step-down units of intermediate level in favor of the ICUs belonging to the surrounding acute

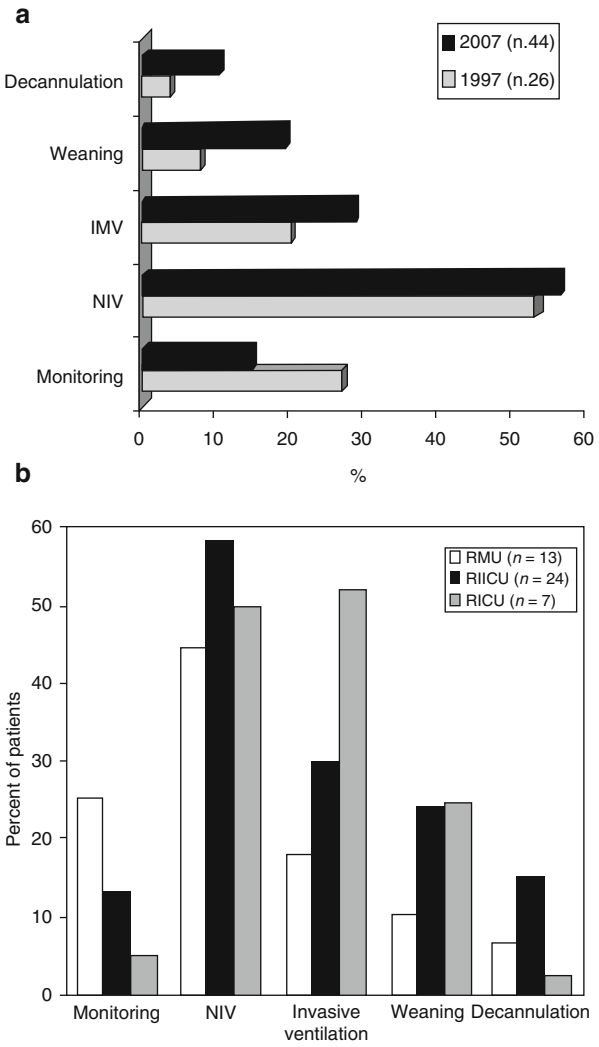

Fig. 47.1 (**a**) Interventions performed in the Italian RICU according to the two national surveys in 1997 and 2007. Differences for each intervention were statistically significant (p <0,05) between 1997 and 2007 (Modified from [14]). (**b**) Distribution of interventions in the surveyed RICUs in 2007 according to the level of care (modified from [5]). Differences between the three levels of RICU care were statistically significant for all interventions (p <0.05) except weaning in RIICUs vs RICUs. *RMU* respiratory monitoring unit, *RIICU* respiratory intermediate intensive care unit, *RICU* respiratory intensive care unit

care hospitals. These RICUs act as weaning and rehabilitative centers for prolonged invasively ventilated patients, most of them having a tracheostomy tube [5, 6]. In accordance with these data is the 1-year experience of one expert RICU showing a rehabilitative vocation that analyzed the interventions performed on 96 patients: 65 % of them came from ICUs and 42 % of them were admitted for prolonged

weaning [11]. Likewise, according to a retrospective study [12] including more than 3,000 patients in the period 1990–2005 in five Italian RICUs working as step-down units, the management of prolonged weaning was the cause of the admission in 66 % of cases.

47.4 Models

In Italy, there are two main organizational patterns for the management of patients with prolonged weaning within the pulmonologist's rehabilitative critical area (Fig. 46.2).

The first clinical pathway involves the transfer of ventilator-dependents patients into the eight RICUs with "rehabilitative attitude" where long-term (>30 days) multidisciplinary interventions may be applied. The role played by these units is oriented first to recovering as much as possible of the patient's functional autonomy, from ventilation to neuromotor activities, and, then, to activate home-care programs for patients who remain partly or totally dependent on mechanical ventilation [12–14]. The weakness of this model is due to the small number of these rehabilitative RICUs scattered throughout the national territory and their location in institutions lacking ICU facilities. The latter may have negative implications for safety in case of multiorgan deterioration of the patient during the weaning process.

The second clinical option is based on the transfer of patients with difficult/prolonged weaning into the 36 RICUs located inside acute care hospitals, where the strategy followed to achieve the maximum ventilatory autonomy could be applied for a shorter period of time (<30 days) [5, 14]. In case of failure of further weaning attempts in these acute RICUs, patients could be transferred, if one is available in their regional area, to a rehabilitative RICU. Otherwise, the length of stay in the acute RICU is likely to be extended with the consequence of a reduced turnover of beds available for the admission of new ARF/ACRF patients. The integrated sequential activity of a RICU located in an acute care hospital with that of a weaning center implemented in a close rehabilitative center was the

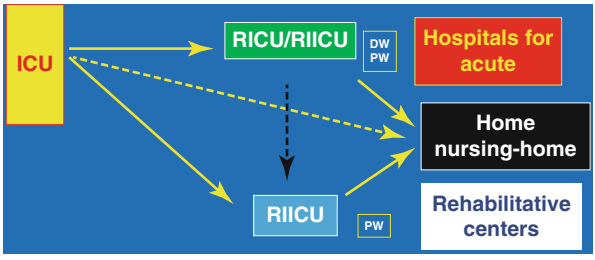

Fig. 47.2 Different clinical models for the care of patients with weaning problems in Italy. *ICU* intensive care unit, *RIICU* respiratory intermediate intensive care unit, *RICU* respiratory intensive care unit, *DW* difficult weaning, *PW* prolonged weaning

subject of a pilot experience in Tuscany. In a sample of 49 tracheostomized ventilator-dependent patients who were transferred from the ICU to the acute RICU of the same hospital, the passage from the second to the third step of care improved the success rate of weaning from 67.3 to 79.6 % with a positive economic impact [13].

The number of RICUs surveyed nationwide being, unfortunately, still insufficient, a third clinical option involves a prolonged stay of yet unweaned patients in the ICU with negative consequences in terms of efficiency of the resource management system.

47.5 Resources

The importance of allocating enough human resources in a weaning center is highlighted by the finding of a very high nursing workload required to manage patients with weaning problems during the first 2 days of admission into an Italian rehabilitative RICU [15]. Unfortunately, the "snapshot" of the Italian RICUs has clearly pointed out that, in the last decade, there has been a contraction in the amount of human resources, in terms of doctor- and nurse-to-patient ratio, albeit without a significant variation in the instrumental resources for monitoring and mechanical ventilation [5, 6] (Fig. 46.3). Moreover, despite the important role of respiratory physiotherapy in critically ill patients, surprisingly, the physiotherapist-to-patient ratio in the RICUs surveyed in 2007 was less than 1:11 for all levels of care units, a value that is lower than the ratio of 1:6 recommended by the AIPO document [2]. Similar results emerged from a retrospective multicenter study conducted in five rehabilitative RICUs [12]. According to this analysis, the reduced doctor-to-patient ratio observed from 1990 to 2005 was associated with a prolonged length of stay, a lower rate of weaning success, and fewer patients dischargeable to home.

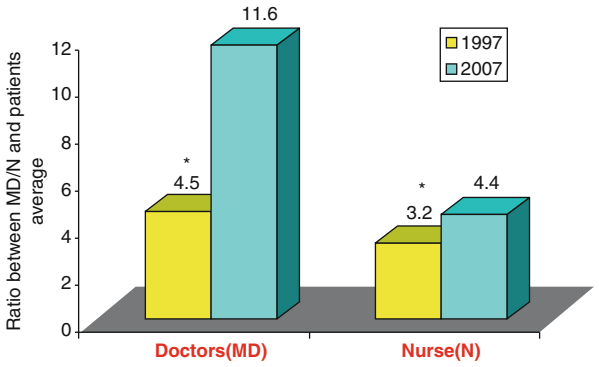

Fig. 47.3 Changes in the average ratio between medical doctors (MD) and nurses (N) to patients in RICUs according to the two national surveys in 1997 and 2007 (Modified from [6]) (* p <0.005 1997 vs 2007)

47.6 Diseases

The AIPO survey highlighted that the pattern of diseases treated in the Italian RICUs changed from 1997 to 2007, with a contraction of the admissions for acute exacerbation of COPD, largely treated with NIV, in favor of an increase in patients with ventilatory decompensation in neuromuscular diseases and severe hypoxemia de novo, who are more likely to require IMV and tracheostomy [5, 6]. Similarly, the experience of some rehabilitative RICUs showed an increase in admissions for neuromuscular diseases, mainly due to problems of weaning, and a significant increase in the impact of comorbidity [12]. Another type of patient referred more often to Italian RICUs for difficult/prolonged weaning is one with postoperative ARF, often complicating cardiac surgery, which represents a quarter of the total number of admissions of a typical step-down unit [11].

47.7 Training

Training and expertise of the team working in an RICU are the crucial ingredients for achieving the success of the treatments, with the inclusion of weaning from IMV. A recent survey of the respiratory intensive care unit study group of AIPO [16] showed that the professional education pathway of the pulmonologist in terms of RICU procedures is disappointing during the postgraduate course. According to the data from this survey, the training for most of the procedures required in the RICU (NIV, intubation, bronchoscopy, chest drainage, etc.) coincides with the employment of the pulmonologist in the hospital. These are the same procedures pulmonologist use to deal with difficult/prolonged weaning. The same survey [16] showed that about 20 % of the nurse staff working in the RICUs had never received any training course and more than 20 % of them had never attended a course of retraining. Other worrying concerns are the limited use (in less than 20 % of cases) of weaning protocols in more than 40 % of the sample interviewed [16].

Conclusions

The Italian "snapshot" of the current role of the pulmonologist in the clinical care of patients with prolonged/difficult weaning brings forth the following points:

1. The the growth of RICUs has stimulated the interest of Italian pulmonologists in critical respiratory medicine and, hence, weaning strategies.
2. There is insufficient training of medical and nursing staff in RICU procedures resulting from a still-inadequate university educational program.
3. The heterogeneous mission of the Italian RICUs results from the prevalent "rehabilitative" or "acute" vocations, location, human resources, organizational and structural models, and integration with the territory.
4. Regional networks need to be set up according to the logic of hubs and spokes that are able to create sequential links between the various existing structures

to optimize the limited health-care resources and direct them toward the common goal of giving the best response in terms of expertise and rapid solutions to patients with weaning problems.

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