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Mechanical ventilation in critically ill cancer patients: outcome and utilisation of resources

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Abstract Intensive care is increasingly being used in the management of cancer patients. It is important that a disproportionate share of special care resources is not expended on futile care of terminally ill patients. A requirement for mechanical ventilation has been stated to affect survival in cancer patients. The objectives of this study were to determine our hospital utilisation of ICU facilities and the prospects of a successful outcome in cancer patients with a need for ventilatory support. The Norwegian Radium Hospital is a 400-bed cancer hospital with a 12-bed combined postoperative and intensive care unit (PO/ICU). For each patient admitted to the PO/ICU, patient data including diagnosis, therapeutic interventions, use of resources and outcome are entered in a computerised database. We reviewed all 10,051 patients admitted during a 5-year period, focusing on the patients receiving ventilatory support. There were 347 patients who were treated with mechanical ventilation, 228 patients only for a short period postoperatively after extensive surgery. A further 119 patients (mean age 68 years, mean SAPS 33.5) were treated with mechanical ventilation for more than 24 h or died during treatment in the ICU; 65 patients (55%) were admitted after elective surgery, 24 (20%) after surgical emergencies and 30 (25%) after medical emergencies. Metastatic disease was present in 59% of them. These 119 patients comprised 1.18% of all patients admitted to the PO/ICU, but utilised 28% of all resources. They included 34 patients (29%) who died during the ICU stay, while 69 patients (58%) were still alive after 6 months. The ICU mortality in different groups was: surgical patients 24%, gynaecological patients 9%, oncological patients 63%. The mortality in the age group >70 years was 15%. The role of ICU facilities, including mechanical ventilation, is important for optimal supportive care in cancer patients. Our results indicate that this treatment modality should not generally be restricted in critically ill cancer patients. The quality of life of the patients who survived should be of interest to those involved in further medical and ethical decisions concerning the level of care in the ICU.

Key words Cancer · Intensive care · Mechanical ventilation · Outcome · Allocation of resources

Table 1 The care grade scale from 1 to 5, with defined criteria for each. In the assessment of care grade both the degree of illness and factors influencing the workload demanded by the patient were considered

Care grade	Definition
1	No special therapeutic measures required. Several patients under observation by one nurse. Minor risk of developing need for intensive therapy
2	Closer observation necessary. Substantial risk of developing need for intensive therapy
3	Increasing need for stabilising therapy. Near-constant observation by one nurse. Nurse/patient ratio=1
4	Uninterrupted supportive treatment of disturbed vital organ function, i.e. mechanical ventilation
5	Intensive therapy of failing vital organ functions. More than one person present for therapy and control

Table 2 Characteristics of 119 patients who needed ventilatory treatment for more than 24 h or died during treatment (*SAPS* Simplified Acute Physiology Score)

Sex	Male	65
	Female	54
Age (years)	Mean	58.2
	SD	15.00
	Range	12–84
SAPS II score	Mean	33.5
	SD	13.20
	Range	15–64
Days on ventilation	Mean	6.43
	SD	9.87
	Range	0.1–60.7
Days in ICU	Mean	10.38
	SD	11.38
	Range	0.1–64.5
Admitting department	Surgery	89 patients
	Gynaecology	11 patients
	Oncology	19 patients
Type of admission	Elective surgery	65 patients
	Surgical emergency	24 patients
	Medical emergency	30 patients

Introduction

Intensive care is increasingly being used in the management of cancer patients [19, 22]. These patients have a high mortality rate [21]. Intensive care units (ICUs) and other high-technology labour-intensive hospital services have come under increased pressure to contain their costs while maintaining the delivery of high-quality medical care. It is thus important that a disproportionate share of special care resources is not expended on futile care of terminally ill patients. A necessary step is therefore the identification of patients who consume an unreasonable share of resources. It has been stated that mechanical ventilation affects survival in cancer patients [7, 10, 21]. However, studies regarding ICU utilisation and outcome in general hospitals may possibly not apply to ICUs in cancer centres [5, 22].

The objective of this study was to determine our hospital's utilisation of ICU facilities and the prospects of successful outcome in cancer patients with a need for ventilatory support.

Patients and methods

The Norwegian Radium Hospital is a 400-bed tertiary care academic cancer hospital with a 12-bed combined postoperative and intensive care unit (PO/ICU). Patients are admitted to the PO section for postoperative recovery and to the ICU section at the discretion of the anaesthesiologist on call for the purpose of supporting vital functions during acute failure in one or more organ systems or buying time for treatment of the underlying disease.

For each patient admitted to the PO/ICU, patient data, outcome and SAPS II (Simplified Acute Physiology Score) [13] for all patients staying 24 h or more or who died in the ICU were recorded. A comprehensive, computerised registration system developed by the Norwegian Association of Anaesthesiology, using the database system DataEase 4.5 (DataEase International) was used to collect all relevant data such as age, sex, duration of stay, diagnosis, therapeutic interventions and outcome.

The patient's need for observation, nursing and therapy, which also reflects the degree of illness, was assessed on a 24-h basis according to a care grade scale from 1 to 5 with defined criteria for each stage, as used by Løes et al. [15] (Table 1). The average care grade during the stay in the PO/ICU multiplied by the duration of stay in days gives the care product, which reflects the patient's requirement for intensive care. The sum of care products for all patients treated in the PO/ICU in 1 year can, therefore, be regarded as an expression of the total workload in the unit for that year.

Patients discharged alive from PO/ICU were followed up for 6 months after discharge. Data on mortality or survival were obtained from the Norwegian Cancer Registry.

Results

All 10,051 patients admitted to the combined PO/ICU during a 5-year period from September 1991 to September 1996 were entered into the database. This accounted for 6,932 patient days. The total utilisation of care grade resources was 16,541 units.

Our focus was on the 347 patients who needed ventilatory support. There were 228 patients who were mechanically ventilated only for a short time postoperatively after extensive surgical procedures, leaving 119 patients who needed ventilation for more than 24 h or died during treatment, who became the subjects of this study. Their general characteristics are shown in Table 2. At the time of admission, metastatic disease was known to be present in 59% of these patients, having been observed by CT or other investigation or at operation. The cancer diagnoses and causes of death are displayed in Table 3. These 119 patients accounted for only 1.18% of all admissions to the PO/ICU, but utilised 18% of total patient days and consumed 28% of all resources evaluated by the care grade scale.

Table 3 Cancer diagnosis and cause of mortality in 119 patients who needed ventilatory treatment for more than 24 h or died during treatment

Cancer diagnosis (no. of patients)		Cause of mortality (no. of patients)	
Ca of oesophagus	23	Multiple organ failure	11
Ca of rectum	12	Respiratory failure	9
Lymphoma/leukaemia	11	Haemorrhage	6
Ca of urinary bladder	7	Myocardial infarction	2
Ca of uterine cervix	6	Miscellaneous	6
Ca of testis	6		
Others	41		

The overall ICU mortality for the 119 patients was 29%. Mortality was 24% in surgical patients, 9% in the gynaecological patients and 63% in the oncological patients. Mortality in patients undergoing elective surgical procedures was 20%, while in those who underwent emergency surgery it was 33%. Mortality is shown in relation to different age groups in Table 4. Nine patients died within the first 24 h after admission to the PO/ICU, 3 from uncontrollable haemorrhage, 3 from septic shock, 2 from myocardial infarction and 1 from respiratory failure.

Of the 85 patients (of the 119 study subjects) discharged alive from the PO/ICU, 69 were alive after 6 months (Table 4, Fig. 1).

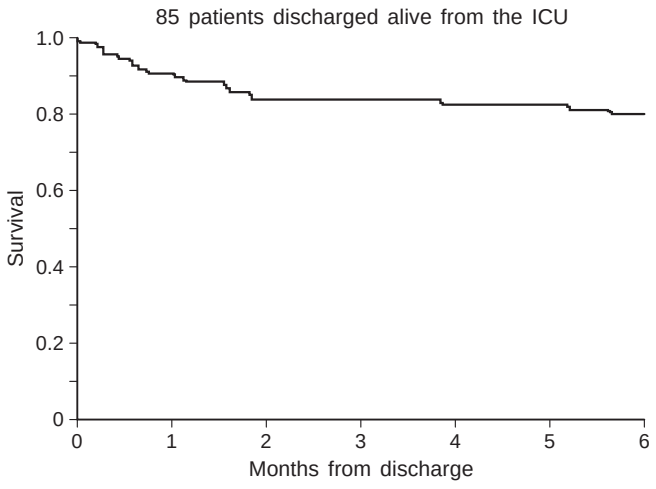

Fig. 1 Survival for 6 months in 85 of the 119 critically ill cancer patients needing mechanical ventilation who were discharged alive from the ICU

Discussion

The benefits of intensive care in general are difficult to describe, because no randomised clinical trials have been conducted in this area. Furthermore, information about intensive care of cancer patients is limited in the literature in comparison to other fields of cancer treatment or supportive care. However, the fact that rationing of intensive care medicine will result in loss of quality is beyond any reasonable doubt, and in cancer hospitals today there is no discussion about the necessity of having ICUs to manage cancer patients correctly.

Up to one-fourth of acute care hospitals and up to 10% of all health care costs are consumed in critical care units [9]. Physicians have long debated the problem of patient groups who consume a disproportionately large amount of societal resources and whose use of such resources is unlikely to result in a meaningful prolongation of life.

In our study, the 119 critical care patients who received mechanical ventilation utilised 28% of all resources evaluated by the care grade scale, although they accounted for only 1.18% of all admissions to the PO/ICU in the 5-year period. This reflects the fact that the majority of the patients in the combined PO/ICU have an uneventful recovery, and that 228 of the 347 patients needing artificial ventilation were treated only for a short time postoperatively after extensive surgical procedures.

Admissions to ICUs are not standard, but rather dependent on bed availability and severity of illness, and also on local traditions and experience. Therefore, comparison with data from other publications on use of ICU resources is difficult. The main reasons for admitting our patients to PO/ICU were postoperative recovery, critical complications of the cancer disease and its treatment and acute disease unrelated to cancer or its treatment. In general hospitals, patients with cancer and critical illness are considered to have an especially poor prognosis [11]. This applies particularly to patients with acute respiratory failure [7, 18, 21], leading to limitations in their critical care support [3, 12]. Schapira et al. [21] found that the majority of patients with solid tumours and haematological cancers admitted to the ICU died before discharge or, if they did survive the hospital admission, spent a minimal amount of time at home before dying. Paz et al. [18] found that survival rates following bone marrow transplantation were reduced from 86.7% to 3.6% for patients requiring mechanical ventilation, while Crawford and Petersen [8] found that respiratory failure requiring assisted mechanical ventilatory support occurred in 23% of marrow recipients and was associated with functional survival at 6 months in only 3%. In contrast, the overall mortality for the 119 ICU patients requiring mechanical ventilation in our study was 29%, and 69 of the 85 patients (81%) discharged alive from the ICU were still alive after 6 months. This is a satisfactory result in our opinion, especially taking into consideration that 59% of the patients were known to have metastatic disease at the time of admission to the ICU. This is more in agreement with results published by Polansky et al. [19] and Chalfin et al. [5]. However, the results of the above studies and of ours regarding mortality rates must be interpreted with caution, since they may have been influenced by unstated or open biases in admission and treatment decisions. Moreover, although the Nor-

Table 4 Characteristics, mortality, and survival in different age groups in 119 patients who needed ventilatory treatment for more than 24 h or died during treatment; 85 patients survived ICU stay

	Age(years)			
	<30	30–50	50–70	>70
No of patients (total)	8	25	60	26
Department				
Surgery	6	17	43	25
Gynaecology	0	2	8	0
Oncology	2	6	9	1
Type of admission				
Elective surgery	3	15	24	23
Surgical emergency	0	4	17	3
Medical emergency	5	6	19	3
SAPS II score (mean)	30	29	36	33
Mortality (%)	25	24	36	15
Six months survival of 85 ICU patients, no. (%)	5 (83)	17 (89)	29 (76)	18 (82)

wegian Radium Hospital is the only specialised cancer hospital in Norway, some patient groups are mostly treated at other regional hospitals, resulting in a selection bias of diagnostic groups with different prognosis. Finally, mortality at ICU discharge may be misleading, since many patients may die at home or on the ward soon after discharge. Mortality measured at 6 months, on the other hand, may be influenced less by the quality of care in the ICU than by the presence of underlying diseases. Often length of hospital or ICU stay is used as a proxy for resource consumption. However, adjustment for severity of illness is necessary for meaningful comparisons between institutions. Multipurpose scoring systems have been developed to evaluate performances and to compare ICUs. Most of these systems were developed with data from trauma patients rather than from patients with an underlying malignancy. Furthermore, SAPS and APACHE lose their discriminative power over time. Accuracy of prediction is maintained at an acceptable level only in patients with a limited stay in the ICU. Scoring systems with the aim of describing organ dysfunction/failure that develops during an ICU stay have also been developed [23, 24]. Although a precise interpretation of the consequences of failure in different organ systems is difficult, Brunet et al. [2] found that the advisability of the combination of mechanical ventilation and haemodialysis was questionable in patients with haematological malignancies, resulting in survival of less than 1%. It is important to be aware, however, that since different scoring systems are not entirely comparable, comparisons of centres treating critically ill cancer patients therefore have pitfalls and shortcomings.

The care grade scale used in this study is a standard tool in Norway for measurement of nursing workload in the ICU. Since this index has has not been widely used internationally, however, NEMS (nine equivalents of nursing manpower use score) [17] was recommended by the Norwegian Association of Anaesthesiology 2 years ago and implemented in our database. NEMS has been validated and behaves similarly to other therapeutic indices in measuring nursing workload in the ICU [17]. We have found a close relationship between the care grade scale and NEMS in our patients (unpublished data).

With the increase in the number of aged people, the demand for ICU treatment in this group will increase. There is a common belief that older patients cannot benefit from intensive care as much as younger ones [1, 5, 16]. However, our results demonstrate that the mortality of the older group was lower than that of the younger patients. This was also found by Chalfin et al. [5]. Even in terms of survival after discharge from the ICU, 6 months of follow-up revealed an acceptable outcome. Primary diagnosis and careful selection of patients may have been responsible for better overall outcome in the oldest age group. Also, in the patients under 70 years of age, there was a larger number of surgical and medical emergencies resulting in higher mortality. Chelluri et al. [6] concluded that age alone is not an acceptable predictor for ICU outcome. Age thus cannot be a reason for withholding ICU treatment, regardless of the fact that treatment in elderly patients more frequently requires major interventions and is more costly than treatment in younger patients. Recent publications demonstrate that critical care interventions can provide significant benefit to older patients, including the very old [4, 20]. Although a correlation between outcome and age is found in very few studies [6], it is still a factor included in both APACHE and SAPS.

There is no discussion about the necessity of having ICU to manage cancer patients correctly. However, decisions concerning the level of care in the ICU will necessarily involve medical as well as ethical considerations. Physicians have an ethical obligation to treat their patients in the most optimal way possible. Survival is not the only important factor in the justification of medical decisions; quality of life in relation to the cost is also significant. Care should be provided only when it is appropriate and when it is likely to contribute to a satisfactory quality of life, from the patients' perspective. Interventions beyond a certain point may be viewed not only as unnecessary but even as causing needless suffering [14]. Physicians must be able to resist the technological imperative to treat and

comprehend the ambivalence between medical care and ethics.

In conclusion, intensive care services, including the availability of mechanical ventilatory assistance, are important to improve care in critically ill cancer patients. Outcome in our group of cancer patients needing mechanical ventilation was favourable. Most patients were discharged home and most of these were alive after 6 months. The findings outlined in this study indicate that mechanical ventilation should generally not be restricted in critically ill cancer patients, and that age alone should not be a reason for withholding ICU treatment. The quality of life for the patients who survived should be of interest to those involved in further medical and ethical decisions concerning the level of care in the ICU.

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