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The outcome of 29 patients with a diagnosis of small cell carcinoma of the lung admitted to the medical intensive care unit (MICU) from 1980 through 1984 was reviewed retrospectively. Respiratory failure was the most common admitting diagnosis (23 patients [80%]), followed by cardiopulmonary arrest (three patients [10%]), and hypotension (three patients [10%]). Only five patients survived to leave the MICU, and only two of these patients lived longer than two months after MICU discharge. Of the features examined, the absence of sepsis was the only statistically significant predictor of MICU survival. Treatment of the malignancy did not appear to alter the outcome even if endobronchial tumor was thought to be a contributor to respiratory failure.

The outlook of patients with small cell carcinoma of the lung admitted to the MICU is grim, and limitation of care should be considered in many of these patients. (Henry Ford Hosp Med J 1986;34:285-7)

Small cell carcinoma of the lung (SCLC) carries an overall poor prognosis for survival even though this tumor is frequently responsive to radiotherapy and chemotherapy. However, significant improvements in survival and control of local disease have been noted after treatment with these modalities. Intensive care unit patients with SCLC are frequently treated aggressively when a critical illness arises in the hope that definitive treatment of the cancer will assist in reversing the critical illness and/or offer the possibility of prolonged survival once the acute illness is overcome. To evaluate whether this optimistic outlook is justified, the outcome of patients with SCLC admitted to a medical intensive care unit was reviewed.

Materials and Methods

The medical records of all (29) patients with SCLC admitted to the medical intensive care unit (MICU) of a large teaching hospital from 1980 through 1984 were reviewed retrospectively. Besides basic demographic data, details such as extent and duration of disease, MICU admitting diagnosis, duration of survival, treatment, organ system impairment, and presence of sepsis were collected. In addition, duration of MICU stay and the total cost of hospitalization were reviewed. All patients died before this study was undertaken.

Organ system impairment was classified as described in a recent study on survival of patients with respiratory failure (1). Impairment of the hematologic system was defined as leukopenia, thrombocytopenia, hematologic malignancy, or coagulopathy. Central nervous system impairment included encephalopathy or coma, cerebral infarct, meningitis, seizures, or malignancy. Involvement of the gastrointestinal system included gastrointestinal hemorrhage, ascites, hepatic failure or impairment, bowel obstruction, or pancreatitis. Cardiovascular compromise included heart failure, clinically significant arrhythmia, myocardial infarction, or pericardial disease. Renal impairment included acute or chronic renal failure. Pulmonary involvement was considered present if the patient had respiratory failure, pneumonia, embolic disease, or chronic restrictive or obstructive lung disease. Respiratory/ventilatory failure was defined as the need for mechanical ventilation.

Sepsis was defined as the presence of any three of the following: temperature $> 39°C$, increase in pulse by 20 beats/minute without other cause, systolic blood pressure ≤ 80 without other reason, altered mental status without other cause, elevated WBC count ≥ 3000 above baseline or depression below 1000 total neutrophils, positive blood cultures for a pathogen, unexplained metabolic acidosis, or probable source for a systemic infection (ie, pneumonia).

The characteristics of MICU survivors and nonsurvivors were compared. The data were analyzed using Student's t test, Fisher's exact test, or the nonparametric Mann-Whitney test where appropriate. The multivariate technique used was a stepwise logistic regression.

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Table 1
Characteristics of MICU Survivors

Patient	Time from Initial Diagnosis to MICU Admission	MICU Stay	Primary MICU Admitting Diagnosis	No. of Organ Systems Impaired	Extent of Disease*	Survival Post MICU Discharge
1	45 days	6 days	Postoperative respiratory failure	2	E	48 days
2	36 days	6 days	Respiratory failure	2	E	58 days
3	290 days	2 days	Respiratory failure	3	L	8 days
4	211 days	3 days	Respiratory failure secondary to reexpansion pulmonary edema	1	E	189 days
5	0 days	3 days	Hypotension	4	E	120 days

*E = extensive, L = limited. Limited disease means confined to one hemithorax.

Results

From 1980 through 1984 29 patients (16 men and 13 women) with the diagnosis of SCLC were admitted to the MICU, accounting for 1% of patient admissions. The most common cause for MICU admission was respiratory failure (23 patients [80%]), followed by cardiopulmonary arrest (three patients [10%]), and hypotension (three patients [10%]). Overall MICU survival rate for patients with SCLC was 17% (5 of 29 patients) compared to a 73% survival rate for all medical admissions. Only four (17%) of the 23 patients presenting with respiratory failure survived to leave the MICU. No patient with cardiopulmonary arrest survived, and one patient with hypotension survived.

Of the five patients who survived to leave the MICU, one died within eight days, and two others died before two months had passed (at 48 days and 58 days, respectively) (Table 1). Two patients survived longer (> two months). One patient was admitted to the MICU after developing reexpansion pulmonary edema after thoracentesis and required a short period of mechanical ventilation (three days); he survived for six months after MICU discharge. The other patient was admitted with pneumonia and hypotension secondary to hypovolemia and never required mechanical ventilation; he survived for four months after MICU discharge.

Table 2
Mean Comparison of Features of MICU Nonsurvivors and Survivors

Variables	Nonsurvivors	Survivors	p Value	Significance*
Age	63.1	60.20	> 0.64	NS
Time from initial diagnosis to MICU admission (days)	112.5	116.40	> 0.96	NS
MICU stay (days)	15.5	4.0	> 0.79	NS
No. of organ systems impaired	2.7	2.4	> 0.60	NS
Total hospital cost	$36,210	$28,500	> 0.98	NS

*NS = not significant.

The characteristics of MICU survivors and nonsurvivors are outlined and compared in Table 2. Of the features compared, none showed a statistically significant difference between the two groups. There appeared to be an impressive difference in length of MICU stay between the two groups, but it did not achieve statistical significance. The number of organ systems impaired did not differ between the two groups.

Extent of disease was compared between survivors and nonsurvivors, and no difference was noted (Table 3). However, data on the extent of the disease were incomplete because many patients had been recently diagnosed and therefore were not completely staged when the catastrophic illness struck. Using a multivariate analysis, the absence of sepsis was the only significant covariant of survival ($p < 0.03$). None of the ten patients with a diagnosis of sepsis survived to leave the MICU. Neutropenia was present in five of the septic patients, and none survived despite recovery of the neutrophil counts in two patients.

All five MICU survivors received chemotherapy and/or radiation therapy either before or after MICU admission. Only two patients showed a clear-cut response to therapy. One patient was treated elsewhere after hospital discharge, and response data were unavailable. Two patients were treated extensively prior to MICU admission with no objective evidence of response. The one patient in this series who survived six months after hospital discharge showed no evidence of response to therapy.

Of the 24 patients who died in the MICU, eight patients did not receive treatment for SCLC. In five of these patients the diagnosis was made after MICU admission and shortly before or after death. In the other three patients the diagnosis was made only a few days before MICU admission (five, eight, and 13 days, respectively), and therapy had not yet been initiated. All

Table 3
Extent of Disease

Disease*	Survival: No	Survival: Yes	p Value
Extensive	8	4	> 0.65 (not significant)
Limited	6	1	

*Limited means confined to one hemithorax. All else is extensive.

three of these patients died within one day of MICU admission. All other patients (16) received chemotherapy. Several patients received radiation therapy as well. Nine of the 16 patients showed some evidence of response to therapy, and four of these patients had evidence of relapse prior to MICU admission. Seven patients either had no response to therapy or their response could not be determined. Seven patients who were treated with chemotherapy had received only one course prior to their death.

Of the 23 patients with respiratory failure, eight patients (35%) had tumor obstruction of major airways contributing to the respiratory failure. None of these patients survived to leave the MICU. Three patients received both radiation therapy and chemotherapy, only one of whom demonstrated any response prior to death. Of the two patients treated with laser photoresection in combination with chemotherapy and radiation therapy, one showed significant improvement in aeration of the previously obstructed lung. However, both patients died. One patient received chemotherapy alone, but died after one course with no evidence of response. Two patients were not treated: one refused therapy, and one was brain dead on arrival to the MICU.

The cause of death was unknown in all MICU survivors, two of whom were in nursing homes at the time of their deaths. In the MICU fatalities the most common cause of death was a terminal cardiac event (12 of 24 patients [50%]). Refractory hypotension was the cause of death in six patients, and brain death was the cause in two patients. Two patients had artificial life support withdrawn when they, along with the family and physician, felt such action was appropriate. Two patients died of refractory respiratory failure.

Discussion

In this five-year retrospective review the outcome of 29 patients with small cell carcinoma of the lung admitted to the MICU was discouraging. The majority of patients (23) presented with respiratory failure as their primary MICU diagnosis, yet only four of these patients survived to leave the MICU and only one of these four survived six months after discharge. As mentioned, this patient was unusual in that he had an acute reversible etiology for respiratory failure (reexpansion pulmonary edema). The results compare poorly with the overall outcome of patients requiring mechanical ventilation reported in other series (intensive care unit survival ranging from 30% to 75%) (2-7). However, the results are not too dissimilar from those reported for respiratory failure in cancer patients (1,8,9). Of note, none of the patients who had tumor obstruction of major airways contributing to respiratory failure survived to leave the MICU regardless of treatment.

None of the three patients who presented after cardiopulmonary arrest survived. A recent study demonstrated a 14% survival rate for cardiopulmonary arrest patients (10); however, the number of patients in the present series is too small for meaningful comparison. In our study, patients with evidence of sepsis did not survive regardless of whether they had neutropenia and even if the neutropenia subsequently resolved.

Clearly, it is difficult to draw firm conclusions from this study since the total number of patients is small and there is marked disparity in the size of the two groups compared (MICU survivors versus nonsurvivors). However, the results of this study suggest some important conclusions. Based on the experience in this hospital, it appears that the outcome of patients with SCLC admitted to the MICU is quite poor. Patients who survived to leave the MICU were few in number and their subsequent survival was short. Longer survivors ($\geq$ four months) had atypical self-limited problems, prompting MICU admission. Our study shows no evidence that treatment of patients with systemic chemotherapy, radiotherapy, or laser photoresection improved the outcome even if the tumor physically contributed to respiratory failure. All patients who suffered from sepsis or cardiopulmonary arrest died, and one would question if aggressive therapy in these patients is justified.

Protracted MICU care with little hope for extended meaningful survival can only contribute to patient suffering. More data are needed to draw firm conclusions, but based on this study it appears that most patients with SCLC gain little from MICU care. Limitations of care should be strongly considered in these patients unless definitively reversible causes of critical illness can be demonstrated.

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