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Adult respiratory distress syndrome: has there been a change in outcome predictive measures?

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Abstract

***Background* – Studies suggest that the mortality in adults with acute respiratory distress (ARDS) has not changed over the past two decades, despite the introduction of new therapeutic techniques and sophisticated ventilatory support devices. Mortality and physiological variables that might predict outcome in patients with ARDS were therefore assessed.**

***Methods* – A retrospective survey was undertaken in 41 patients with ARDS.**

***Results* – Mortality was 66%. Only the presence of sepsis predicted death.**

***Conclusion* – Mortality from ARDS is unchanged. Currently available severity scoring systems are not helpful in predicting outcome.**

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Acute respiratory distress was first described in adults (ARDS) in 1967, but controversy still surrounds its aetiology, clinical management strategies, and epidemiology.[1] The incidence of ARDS varies from 1000 to 15 000 cases per year in the UK, and between 50 000 and 150 000 cases per year in the USA. The syndrome continues to stimulate both basic and clinical research, which has resulted in the introduction of a number of new systems of ventilatory and pulmonary support including pressure controlled, inverse ratio ventilation (PC-IRV); high or ultra high frequency jet ventilation (UHFJV); intravenacaval oxygenation ("IVOX") and extracorporeal gas exchange (ECGE). The use of such expensive and invasive techniques, and the need to ration their application to those individuals most likely to benefit, has led to interest in the development of tools to predict outcome at the time of diagnosis. Standard critical care severity of illness scoring systems such as APACHE II and more specialised lung orientated systems such as the acute lung injury score (LIS), together with semiquantitative assessment of associated organ dysfunction, have been widely applied to this end, but their predictive power remains unproven. In a retrospective study the mortality of a group of patients with ARDS was examined with regard to physiological variables that might be predictive of death, severity scoring systems designed to aid in establishing prognosis at the time of diagnosis, and the possible role of new methods of ventilatory support in altering outcome.

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Methods

Data from a three year period to May 1993 were gathered retrospectively. ARDS was defined clinically by the presence of: (1) refractory hypoxaemia (ratio of arterial oxygen tension (Pao_2) to fractional inspired oxygen concentration (FIO_2 < 20 in SI units); (2) evidence of diffuse bilateral pulmonary infiltrates on chest radiography; (3) pulmonary artery occlusion pressure < 18 mmHg; and (4) presence of a clinical condition associated with ARDS. Other data compiled for each patient were taken from the first day of admission to the unit or, if already resident, the first day that ARDS was diagnosed. The results of routine laboratory tests, haemodynamic parameters and pulmonary physiological measurements were noted, as was the mode of ventilation employed at the time the lung injury was most severe.

All patients with ARDS had a pulmonary artery catheter in situ and were managed using modes of mechanical ventilation, an FIO_2, and inotropic agents sufficient to produce an oxygen delivery index of 600 ml/min/m^2. In non-survivors, postmortem confirmation of the diagnosis of ARDS was obtained whenever possible.

The severity of lung injury was calculated using the LIS.[1] Briefly, lung compliance, FIO_2, the degree of positive end expiratory pressure used, and a chest radiograph were scored numerically. Organ dysfunction and sepsis were as defined by Montgomery *et al*[2] except that the immature granulocyte count was unavailable and therefore not included. APACHE II scores were calculated from the worst values in the first 24 hours after the diagnosis of ARDS was made, or following transfer from another hospital. Data are mean (SE) unless otherwise indicated. Statistical analysis was performed using the Fisher's exact test or Student's *t* test and p values $\leqslant$ 0·05 were considered significant.

Results

Forty one patients (21 men) of mean age 35 (range 9–75) years with ARDS were identified, 20 of whom presented following elective surgery; 21 were referred from other hospitals. Postmortem data confirming a diagnosis of ARDS was available in 19 of the 27 non-survivors. Mean (SE) duration of ARDS by the time of data collection was 4·0 (1·2) days. Mortality for the group was 66%, distributed equally between the sexes. Total duration of hospital admission for non-survivors was shorter than that of survivors (27 (3·3) *v* 49 (11·4) days respectively, p < 0·05) (table).

Demographic and clinical characteristics of patient population

	Alive (n=14)	*APACHE score*	*Dead (n=27)*	*APACHE score*
Demographic characteristics:				
M:F	7:7		14:13	
Age (years)	38 (5·3)		42 (4·2)	
Duration of admission (days)	49 (11·4)*		27 (3·3)	
APACHE II	12·9 (1·1)		15·4 (0·9)	
Pao_2 (kPa)	9·7 (0·8)		9·1 (0·6)	
FIo_2 (%)	80 (4·7)		82 (3·3)	
Pao_2/FIo_2	12·6 (1·2)		11·5 (0·8)	
LIS	2·86 (0·1)		2·99 (0·1)	
Insult:				
Elective operations	7	14·4 (0·9)	13	14·2 (0·9)
Orthopaedic	1	13	0	
Cardiac	5	15	6	14·5
Thoracic	0		7	14
Abdominal	1	13	0	
Others	7	11·3 (1·9)	14	16·8 (1·5)
Gynaecological	1	13	0	
Obstetric	0		5	13·8
Trauma	5	11·8	2	15·5
Burns	0		1	14
Pneumonia	0		4	19
Pancreatitis	0		1	28
Chronic respiratory failure	0		1	14
Emergency bowel resection	1	8	0	

LIS = lung injury score. Values are mean (SE).
* $p < 0.05$.

Only the presence of sepsis ($p = 0.05$ Fisher's exact test) significantly predicted death. The number of systems in failure at the time of evaluation was not discriminatory in this regard. Neither APACHE II nor LIS accurately predicted outcome, although non-survivors who did not have elective surgery (n = 14) had a significantly higher mean APACHE II score (16·8) than the survivors with no surgical intervention (n = 6, score 10·3, $p < 0.05$ Fisher's exact test). All patients with primary lung problems died (n = 12; carcinoma of the bronchus n = 7, pneumonia n = 4, chronic airflow limitation n = 1), whether or not elective surgery had been performed. Similarly, no patients with ARDS following obstetric incidents (n = 5) survived.

Patients were ventilated using a number of different conventional (volume preset, non-inverse ratio, n = 15) and non-conventional (n = 26) techniques. Peak LIS was used to select the index point for the data used in the current study. Non-conventional modes were used as follows: PC-IRV (n = 11), UHFJV (n = 13), "IVOX" (n = 1), and ECGE (n = 1). No significant difference in mortality or APACHE II scores emerged between the conventional and non-conventional groups, nor between PC-IRV and UHFJV.

Discussion

This study revealed that (1) the mortality associated with ARDS has changed little in recent years despite the advent of new forms of ventilatory support; (2) only associated sepsis is important in determining outcome; and (3) both general and lung orientated severity scoring systems are unhelpful in discriminating survivors from non-survivors at presentation. Our mortality data are in agreement with most[2-6] but not all,[7] recent publications in which survival figures for patients with ARDS vary from 53% to 74%.

It is possible that the patient population referred to a tertiary centre such as ours might differ from those described in previous publications. Indeed, the severity of hypoxaemia in our population appears generally worse than those of the other series quoted above.[4,6] However, although over 50% of our patients were referred from other hospitals their mortality was better (59%) than that of the "resident" patients (74%).

The fact that the number of organ systems in failure at the time of data collection did not predict outcome might be considered surprising in view of data previously published by Knaus *et al.*[8] However, the physiological and laboratory parameters for organ dysfunction used here differ in many respects from the earlier study which did not incorporate haematological, hepatic, or gastrointestinal criteria. The presence of sepsis and possibly cardiovascular dysfunction seemed to be important in this regard. In previous series sepsis has been described as a leading cause of death in patients with ARDS[2,4,6] and cardiac dysfunction[2,7] to a lesser degree. In agreement with the current results, primary lung failure has also been described as an adverse prognostic sign.[7]

Studies of ARDS are frequently not comparable because of varying definitions and the inhomogeneity of patients, but the LIS offered the promise of greater compatibility between studies. In the current study, however, LIS could not be shown to predict outcome. The APACHE II score had limited value and was of most use in those patients who did not undergo elective operations. However, it was often scored relatively late in the admission (due to interhospital transfer) and its use in this respect is invalidated. No firm conclusions could be drawn regarding the possible influence of new techniques of ventilatory support on mortality. Absolute numbers were small and patients were not randomly divided into conventional and non-conventional treatment arms.

In conclusion, it appears that the mortality from ARDS remains high despite advances in ventilatory support techniques. In common with others, we have found sepsis to be an associated condition with adverse prognostic implications. Currently available severity scoring systems seem to be of limited use in predicting outcome.

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