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Short- and long-term prognosis, functional outcome following ICU for elderly

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Abstract. Among 1532 ICU patients we analysed 295 elderly patients (19%) aged more than 70-years-old. We determined prospectively the immediate and subsequent one-year outcome with a study of the predictive value of their ICU admission parameters. Then we followed the ICU survivors over the year after discharge (1, 6, 12 months) by quality of life questionnaires. ICU mortality was 26.7%; SAPS was the only predictor of short term mortality. On ICU discharge, 216 elderly were followed at 1, 6, 12 months; the one-year cumulative mortality was 49% from ICU discharge, majority of deaths occuring over the first month. Age, previous health status and SAPS had a predictor value of one-year mortality for ICU survivors. 103 patients were alive at one year: 88% returned to home, 72% had a relatively good functional status allowing an independent life, and 82% had the same or improved functional status.

Key words: Intensive care – Outcome – Quality of life studies – Elderly – Evaluation

Outcome studies about short and long term survival rates among ICU patients are now well established. These data must be completed by quality of life studies [1–7]. The ultimate goal of intensive care is to obtain survival with an acceptable quality of life, not less than their pre-admission status. Elderly patients are increasing in the health care system, especially in intensive care. These patients are more likely to have chronic disease and poor health prior status. We examined prospectively outcomes of elderly patients aged more than 70 years and we sought to answer three questions: a) What is the survival rate over the year after ICU discharge among this group? b) What is their quality of life (residence, functional and health status) one year after? How they regain their previous status over the year (1, 6, 12 months)? c) What are the risk factors of short and long term survival?

Patients and methods

This prospective study was performed in 3 university hospitals and one community hospital (80 ICU beds) during the first 7 months of 1985. Of the 1532 consecutive admissions during this period who stayed in the ICU longer than 12 h, 295 were aged more than 70 years; 19% of the whole recruitment.

Admission data

Shortly after admission, we recorded age, sex, medical or surgical care, length of ICU stay, and simplified acute physiology score within the first day (SAPS) [8]. Information on pre-admission health status (PHS) [9] were obtained directly from the patient whenever possible and from the relatives when necessary. Patients were stratified into 4 groups based on their PHS. On the basis of a limited number of questions, the patient was placed into 1 of the 4 chronic health categories labeled A to D: (A) Prior good health, no functional limitation; (B) Mild to moderate limitation of activity because of a chronic medical problem; (C) Chronic disease producing serious but not incapaciting restriction of activity; (D) Severe restriction of activity due to disease, including persons bedridden or institutionalized due to illness. The patients admitted several times during the study, were followed only on their first admission, and their new ICU or hospital admissions were noted.

Follow-up evaluation

Each ICU survivor or in some cases his relatives were interviewed by a mailed questionnaire (90%) and if necessary by a telephone interview (10%), 1, 6 and 12 months after discharge with information about: 1 – condition (dead, alive or lost to follow up); 2 – residence (return to home, still or newly hospitalized); 3 – functional status (according to physician's opinion evaluated by recreation, alertness, home management, mobility and body care). For each period studied with these data, the patient was newly stratified into 1 of the 4 chronic health groups using the same classification. This new functional status (NFS) at each period was compared with the previous health status collected on admission. This way of comparison enabled us to define three groups of functional outcome: same, improved or worsened.

One-year prognosis

We studied the one-year post-discharge outcome among ICU survivors according to groups of age. Then we compared the one-year mortality in our population with data from the french epidemiologic institute

Table 1. Clinical data for each ICU

ICU Institution	1	2	3	4	Anova test
	$n = 30$	$n = 74$	$n = 69$	$n = 122$	
No. of ICU beds	8	20	22	30	
Age	76.5±4.3	75.5±3.8	75.4±4.8	77.5±4.9	*
SAPS	13.9±6.2	13.4±5.5	13.3±4.3	16±5.5	**
% elective surgery	25%	26.6%	21%	23%	NS
length of stay	8.2±12.2	10.7±13.4	22.6±33.5	14.7±28.9	*
ICU mortality	20%	28.9%	28.6%	25.4%	NS

ICU 2: community hospital, ICU 1, 3, 4: university hospital; *: $p<0.01$; **: $p<0.001$

(INSEE[1]) for the french elderly population. Finally ICU admission parameters were analysed among the post-discharged survivors (age, sex, PHS, SAPS). We tried to analyze if admission data were risk factors of the one-year prognosis.

Statistical analysis

Data were expressed as mean ± 1 SD. All comparisons with unpaired t-test (one way ANOVA test was used if 3 groups were compared) and the Fisher's exact test were reported significant at $p < 0.05$.

Results

Admission data

Among the elderly population, mean age was 76,4±4.55 years. Sex ratio was 1:1 male:female; 160 were medical patients (with 9 suicides), and 135 surgical patients (elective surgery $n = 70$, emergency and post operative complications $n = 46$, polytrauma $n = 19$). Distribution of PHS was: A $n = 39$, B $n = 152$, C $n = 88$, D $n = 18$. Mean SAPS was 14.5±5.3 points. Length of ICU stay was 14.8±25 days; excluding patients staying ≥ 60 days ($n = 12$), it was 10.7±12 days. Deaths in ICU accounted for 79 of the elderly patients, (26.7%). Clinical data for each unit are summarized in Table 1.

One-year outcome

216 patients were discharged from ICU. One-year after, 106 patients were dead (49%), 66 of them over the first month after ICU discharge. At one-year after discharge, 103 patients (47.7%) were alive and 7 lost to follow-up (3.3%) (Table 2).

Analysis of questionnaires: Patient's status 1, 6 and 12 months after discharge is summarized in Table 3. One-year functional outcome is detailed in Table 4; at 1 year. Three groups of functional outcome were defined: 11 patients improved (10.6%), 21 patients worsened (20.2%), and the 72 remaining kept the same status. Their clinical data are detailed in Table 5.

Analysis of short and long term risk factors (Table 6): During ICU stay ($n = 295$), of the admission data, only SAPS had a significant predictive value of ICU mortality. Among the ICU discharged patients ($n = 216$) age, PHS and SAPS were significantly associated with a higher risk of mortality within one year. The post discharge mortality over the year was analysed according to 4 groups of

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Table 2. Condition outcome among 216 ICU survivors: status for each period studied and one year cumulative outcome

Condition	Status for each period			One-year cumulative outcome
	1 month $n = 216$	6 months $n = 150$	12 months $n = 133$	$n = 216$
Died	66	17	20	103 (47.7%)
Lost to follow-up	2	3	7	7 (3.3%)
Survivors	148	130	106	106 (49%)

Table 3. Analysis of questionnaires (1, 6, 12 months)

	1 month	6 months	12 months
ICU Survivors	$n = 148$	$n = 130$	$n = 106$
no information	$n = 2$	$n = 4$	$n = 2$
Residence			
Return to home	82 (56%)	115 (91%)	88 (88%)
Hospitalized	64 (44%)	11 (9%)	12 (12%)
New functional status			
A	13 (9%)	25 (20%)	21 (20%)
B	38 (26%)	61 (48.5%)	51 (49%)
C	62 (42.5%)	29 (23%)	26 (25%)
D	33 (22.5%)	11 (8.5%)	6 (6%)
Functional outcome (PHS versus NFS)			
improved status	6 (4%)	16 (12.7%)	11 (10.6%)
same status	72 (49.5%)	92 (73%)	72 (69.2%)
worsened status	68 (46.5%)	18 (14.3%)	21 (20.2%)

Table 4. Variation of health status among the 106 one year survivors (2 patients missing). The dashed line is the "iso HS" line, indicating patient with the same Health Status (HS) 1 year later. Under the isoHS, health status is improved, above worsened

		One year later				
		A	B	C	D	
3 months before	A	19	2	1	0	22
	B	2	40	13	1	56
	C	0	9	12	4	25
	D	0	0	0	1	1
		21	51	26	6	104 iso HS

Table 5. Clinical data for each one year. Functional outcome

Clinical data	1-year functional outcome			
	Improved status $n = 11$	Same status $n = 72$	Worsened status $n = 21$	
Age	74.2 ± 4.1	74.4 ± 3.8	75.8 ± 3.6	NS
Medical/ surgical	45.5%/54.5%	60%/40%	35.5%/64.5%	NS
Elective surgery	67%	34.5%	36%	NS
P.H.S.				
A	0	19	3	
B	2	40	14	
C	9	12	4	
D	0	1	0	
SAPS	11.1 ± 3.6	12.92 ± 5.1	12.2 ± 3.7	NS

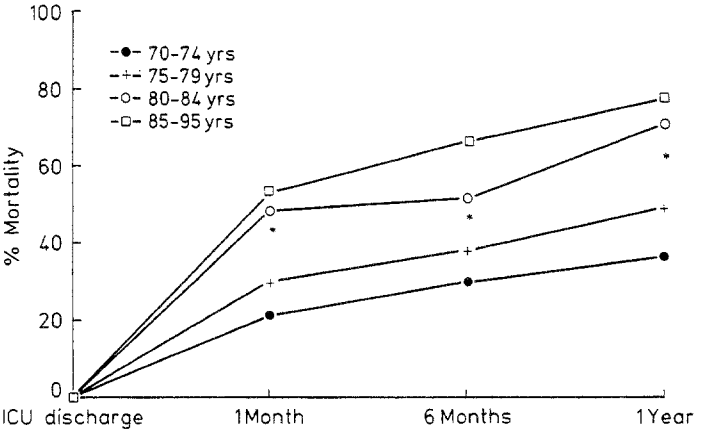

Fig. 1. One year cumulative mortality among ICU survivors according to groups of age (*: $p < 0.005$); deaths occurring in ICU are excluded

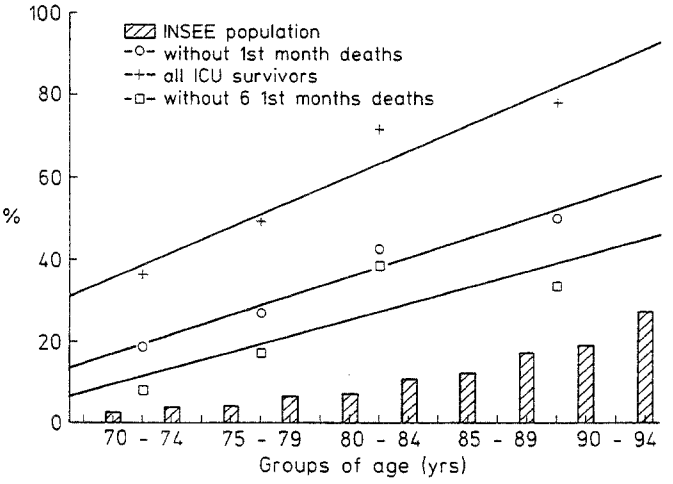

Fig. 2. Cumulative mortality over the year according to age: INSEE population versus ICU post discharged patients

age, for more than 70-years-old to more than 80-years-old (Fig. 1): Under 80-years-old 25% of them died within 1 month after discharge and 42.3% within one year after. Over 80-years-old, mortality at one month and at one year was 50% and 74% respectively.

Cumulative mortality over the year for the post-discharge patients, was compared with the data from INSEE, according to the same groups of age (Fig. 2). Mortality increased with age in both populations with a far higher mortality for the ICU post-discharge patients. From ICU discharge, mortality was 10-fold higher; excluding deaths occuring over the first month, it was 5-fold higher, and excluding the 6 first-month deaths, it remained 3-fold higher than the INSEE population.

Discussion

Definition of an elderly patient is very difficult. In the literature, a patient is considered as being elderly from ≥ 65 years old [3, 10, 17] to ≥ 75 years old [2, 4, 11, 12]. Age is an insensitive index to define them. We chose the threshold of more than 70-years-old [13, 14, 16]. Of the whole recruitment, we had 295 patients aged ≥ 70-years-old, coming from 4 different ICUs. There were no differences between each unit and between community and university hospitals, in relation to mean age, elective surgery and ICU mortality. SAPS was the same in 3 units but with an unexplained higher score in unit 4 despite the same mortality. There was a great difference in relation to length of ICU stay which was a great deal higher in unit 3 and 4; both units had 12 patients staying more than 60

Table 6. Influence of admission data on the short and longterm prognosis

Admission parameters	ICU stay $n = 295$			One year after ICU discharge[a] $n = 216$		
	Died $n = 79$		Survivors $n = 216$	Died $n = 103$		Survivors $n = 106$
Age	76.5 ± 4.2	NS	76.4 ± 5	77.9 ± 5.5	**	74.8 ± 4.1
70 – 79 yrs	58		168	69		94
> 80 yrs	21	NS	48	3	**	12
PHS						
A	9		30	7		23
B	44	NS	108	47	**	57
C	20		66	38		25
D	6		12	11		1
S.A.P.S	17.7 ± 5.5	**	13.3 ± 5.1	14.3 ± 5.3	*	12.5 ± 4.9

[a] 7 patients lost to follow up; ** $p < 0.001$; * $p < 0.02$; NS = non significant

days; excluding them, length of stay was the same at 10.7 days. It was explained by a higher chronic respiratory recruitment in unit 3, and a higher capacity of ICU beds in unit 4. Patterns of ICU discharge were nearly the same in each unit; patients in a terminal state were held in their ICU until they died.

Study of short- and long-term prognosis is dependent on the screening process determining patient admission [2], quantified by using simplified scores of severity of illness such as SAPS [8]. It is also dependent on the health status before admission allowing stratification of the patient's chronic condition, studied by PHS [9].

The one-year cumulative mortality from ICU discharge of 49% is in close agreement with long term survival studies showing a cumulative mortality from 44% [4, 14] to 69% [2, 5, 6]. The majority of deaths occured over the first month after ICU discharge. We studied, mortality and quality of life parameters at 3 fixed time intervals, from ICU discharge, namely 1, 6, 12 months. This dynamic evolution was more interesting from ICU discharge which is a fixed point, than hospital discharge in relation to variable delay of discharge.

Study of ICU mortality in relation to age showed no differences under or over 80-years-old. Not surprisingly, age had a long term outcome predictive value with a threshold of 80-years-old with a nearly double one-year mortality over 80-years-old compared to 70–79-years-old. We compared our results with the french elderly population [6]. The high one-month mortality among ICU survivors (66/103 deaths: 64%) explains the 10 fold rise of one-year mortality compared to the reference population. Even if we study mortality without the first month or first 6 months, it remains respectively 5 or 3 fold higher. Vang [12] found that mortality, for patients aged ≥ 75 years old, during the intensive care period was twice as high, and within 6 months after 4 times as high as the usual mortality rate.

Study of mortality in relation to clinical admission data showed SAPS as the only predictor of short term mortality. For long term mortality, in addition to age, previous health status had a strong effect on long term outcome. Surprisingly SAPS had, with a smaller level, a predictive value of 1 year mortality.

Most studies have focused on short and long term survival rates. In addition, it is also important to evaluate different aspects of quality of life. We chose a 1, 6, 12 months follow up to appreciate chronology of improvement. Like two other studies [7, 15] we found, for elderly patients, a stable outcome after the sixth month after ICU discharge, with nearly the same return to home rate, health and functional outcome at 6 and 12 months follow-up.

Although a high one-year mortality (49%), quality of life is not so bad among one-year elderly survivors. At 1 year, 88% were able to return to home, 70% were class A and B, and could live independently. Functional outcome study showed that among one-year survivors 11 patients were improved, 21 worsened and 72 had the same status as before ICU admission. Comparison of clinical admission data between these 3 groups showed no differences to explain improvement or aggravation. Using a comparable mode of evaluation, Legall [6] and Zaren [17] observed 62% and 73% respectively with an unchanged or improved health status 1 year after.

The relationship between previous and subsequent health status, with the same way of classification is a simple and dynamic index; in a previous study we observed in all groups of age the same functional outcome [7].

References

1. Goldstein RL, Champion EW, Thibault GE, Mulley AG, Skinner E (1986) Functional outcomes following medical intensive care. Crit Care Med 14:783–787
2. McLean RF, McBrowse-Intosh JD, Kunggy, Leung DMW, Byrick RJ (1985) Outcome of respiratory intensive care for the elderly. Crit Care Med 13:625–629
3. Zaren B, Hedstrand U (1987) Quality of long-term survivors of intensive care. Crit Care Med 15:743–747
4. Campion EW, Mulley AG, Goldstein RL, Barnett GO, Thibault GE (1981) Medical intensive care for the elderly, a study of current use, costs, and outcomes. JAMA 246:2052–2055
5. Cullen DJ, Keene R, Waternaux C, Kunsman JM, Caldera DL, Peterson H (1984) Results, charges and benefits of intensive care for critically ill patients: update 1983. Crit Care Med 12:102–106
6. Perrot D, Allaouchiche B, Coronel B, Motin J (1987) Devenir des sujets agés hospitalisés en réanimation. Réan Soins Intens Med Urg 3:141–144
7. Mahul Ph, Robert D, Ducreux JC, Auboyer C, Jospe R, Tempelhof G, Gaussorgues P (1987) Prognostic vital et fonctionnel à court et à moyen terme (un an) des malades de réanimation. Réan Soins Intens Med Urg 3:145–150
8. Le Gall JR, Loirat P, Alperovitch A, Glaser P, Granthil C, Mathieu D, Mercier P, Thomas R, Villers D (1984) A simplified acute physiology score for ICU patients. Crit Care Med 12:975–977
9. Knaus WA, Zimmerman JE, Wagner DP, Draper EA, Lawrence DE (1981) APACHE: acute physiologically based classification system. Crit Care Med 9:591–597
10. Nicolas F, Le Gall JR, Alperovitch A, Loirat P, Villers D (1987) Influence of patients age on survival, level of therapy and length of stay in intensive care units. Intensive Care Med 13:9–13
11. Smithies M, Bihari D, Catling J, Tinker J (1986) Intensive therapy in the elderly patient (abstract). Intensive Care Med 12:169
12. Vang J, Hakanssan S, Karlsson P (1986) Intensive care for the aged in a Swedish community hospital: a cost effectiveness analysis. Int J Technol Assess Health Care 1:893–900
13. Fedullo AJ, Swinburne AJ (1983) Relationship of patient age to cost and survival in a medical ICU. Crit Care Med 11:155–159
14. Grenrot C, Norberg KA, Hakansson S (1986) Intensive care of the elderly – retrospective study. Acta Anesthesiol Scand 30:703–708
15. Le Gall JR, Brun-Buisson C, Brunet P, Latornerie SJ, Chantereau S, Rapin M (1982) Influence of age, previous health status and severity of acute illness on outcome from intensive care. Crit Care Med 10:575–577
16. Mundt DJ, Gage RW, Lemeshow S, Pastides H, Teres D, Avrunin JS (1989) Intensive care unit patient follow-up. Mortality, functional status and return to work at six months. Arch Intern Med 149:68–72
17. Zaren B, Bergstrom (1989) Survival compared to the general population and changes in health status among intensive care patients. Acta Anaesthesiol Scand 33:6–12

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