Intensive Care Med (1989) 15:260–265

Intensive Care Medicine

Description of various types of intensive and intermediate care units in France*

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Received: 13 May 1988; accepted: 3 August 1988

Abstract. The types of intensive care are multiple. The aim of this multicentric study was to describe activity of different ICUs using the same methods. 38 ICU were chosen by cooption, not randomization. Collected data concerned input (age, previous health status (HS), Simplified Acute Physiology Score or SAPS, Intensive Care Group (ICG), processes (TISS points), percentage of ventilated patients and pulmonary arterial lines and outcome (ICU death rate). The 3 ICG were: M = medical: all the none surgical patients; S = surgical patients operated in emergency setting during the week preceding or following ICU admission; E = surgical patients whose admission to ICU was scheduled at least 24 h before because of elective surgery. 3687 patients were studied, classified as follows: M = 2175; S = 885; E = 627. The first part of the results concerned the differences between the three ICG: inputs, processes and outcome were very different in the three groups M, S, E, particularly in the E (elective) group, where therapeutic level was higher for low SAPS and mortality lower for high SAPS. The second part of the results concerns the differences between the ICUs. Intermediate units had older, less severe, and mainly medical patients. Surgical patients had better previous health status, were younger and scheduled for 40%. TISS points were higher, mainly by a higher rate of ventilated patients and patients with pulmonary artery lines on the first day. Specialized units characteristics depended mainly on the ICG. For instance, patients of coronary units compared to post cardiac surgery patients were older, in better previous HS, had a low therapeutic level (13.5 TISS points versus 41.5) and a higher ICU death rate (10% versus 4%). We conclude that description of different units can be made by a limited number of criteria.

Key words: Intensive Care – Activity – ICU groups

The range of intensive care units (ICU) is very large: acute and intermediate, multidisciplinary and specialized, providing both active treatment and monitoring, treating both multiple and single organ failure patients.

The aim of this multicentric study was to describe the activity of various intensive care units in France using the same methods to define which patients were treated, what treatments were applied, what results were obtained.

Patients and methods

Thirty eight intensive care units (ICU) participated in the study, from five different areas: Ile de France, Nord-Pas de Calais, Bretagne, Nantes-Pays de Loire and Provence-Côte d'Azur. The units were choosen by cooption, not randomization. Twenty three units were located in university hospitals, and fifteen in community hospitals. Thirty three units were acute, treating patients with one or more organ system failure, and having a permanent (24 h/24) medical staff. There were four intermediate units, treating less severe patients, usually not requiring mechanical ventilation and without permanent medical staff: during the night, there are only nurses monitoring patients and a doctor is on call. Ventilators support is possible but usually ventilated patients are rapidly transferred to acute units. Among acute units, twenty one were multidisciplinary, thirteen specialized (Table 1).

For each patient, the following parameters were collected for the first 24 h of intensive care are: age, previous health status (3 months before), Simplified Acute Physiologic Score (SAPS), diagnosis and the intensive care group. The existing health status (HS) three months before hospitalisation was classified into 4 groups [4, 7]: A = good HS without any limitation; B = moderate limitation of activity; C = severe limitation; D = bedridden or institutionalized.

* This work was supported by a grant (no. 900650117) from the Caisse Nationale d'Assurance Maladie

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Table 1. Classification of the 38 intensive care units

Multidisciplinary (21)	*n*
Surgical[a]	3
Medical	9
Mixed	9
Specialized (13)	
Cardiac, surgical	4
Cardiac, medical	1
Digestive, surgical	2
Digestive, medical	2
Toxicologic	1
Neurosurgical	2
Burns	1
Intermediate units (4)	

[a] The surgical units have more than 75% of surgical patients (emergency or elective). The medical units have more than 75% of medical patients. The mixed units have intermediate percentages

The SAPS was proposed by Le Gall et al in 1983 [8, 9]. It consists of fourteen easily measured biological and clinical variables: twelve from the original APACHE [4] with the same weights (0 to 4), age of patient, with an assigned range of 0 to 4, and a fixed value of three assigned to ventilated patients.

The main diagnosis was defined for each patient according to the French classification [2]. This classification separates ICU diagnosis into fifteen classes: respiratory, cardiovascular, renal. Each class is divided in two parts: syndromes and failures on the one hand, diseases on the other hand. When one diagnosis was not sufficient, the physician could give a maximum of five diagnoses per patient.

Because it is difficult to assign a single diagnosis to ICU patients, another method was used to assign patients to different groups. Three ICU groups were defined: group M = medical; group S = surgical unscheduled; group E = surgical scheduled (usually elective). Surgical patients are those operated one week before or after entering ICU. ICU admission is considered as scheduled when decided more than 24 hours before. Medical patients are all the non surgical patients.

The processes were assessed in the first 24 h of ICU by the Therapeutic Intervention Scoring System (TISS) [1, 3]. In addition we used the division of TISS points in three distinct categories: those reflecting active treatment, ICU monitoring and standard care [5]. Active treatment encompasses 33 tasks that involve direct therapy using techniques unique to or best performed in an ICU such as ventilation. ICU monitoring includes eight tasks that are observational as opposed to therapeutic and that require either the facilities or the personal of a special care unit, such as pulmonary artery catheterisation. Routine care includes 39 tasks that are provided commonly to ICU patients but that can be and frequently are, performed in a standard hospital setting [5].

The ICU mortality was used for outcome measurement.

Results

The first part of the results concerns the differences between the three ICU groups. The second part concerns the differences between the types of ICU.

Figure 1 shows the mortality according to the SAPS in the three ICU groups. The distribution of ICU groups in the 3687 patients was: M = medical, $n = 2175$ (59%); S = surgical, unscheduled, $n = 885$ (24%); E = surgical, scheduled, $n = 627$ (17%). Global mortality rate was 19%. Nevertheless mortality depended mainly on the SAPS and the diagnosis,

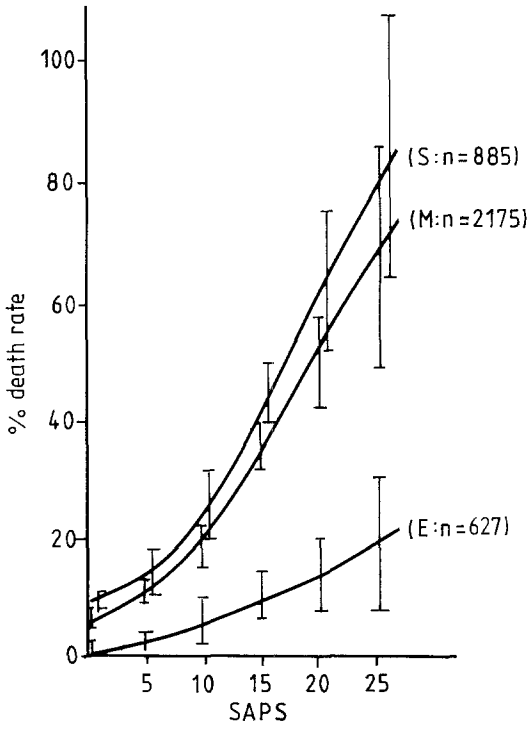

Fig. 1. Death rate according to the SAPS in the 3 ICU groups. *M*, medical; *E*, elective postoperative; *S*, emergency surgical

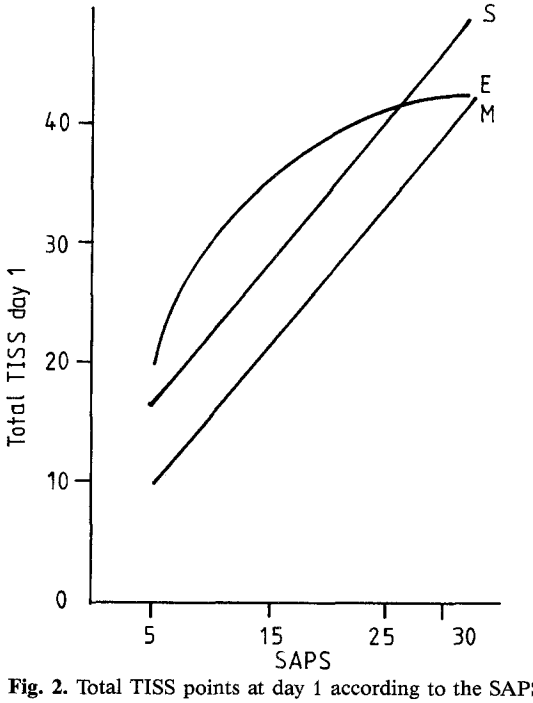

Fig. 2. Total TISS points at day 1 according to the SAPS in the 3 ICU groups. *M*, medical; *E*, elective postoperative; *S*, emergency surgical

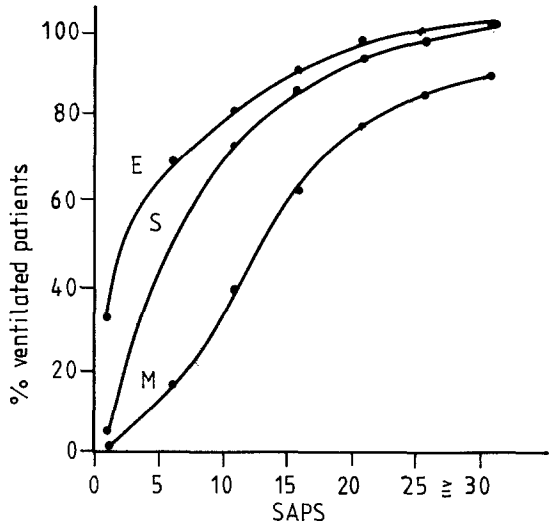

Fig. 3. Percentage of ventilated patients on the first day according to the SAPS in the 3 ICU groups. *M*, medical; *E*, elective postoperative, *S*, emergency surgical

which varies according to the ICU group: in medical patients mortality was 20%; in surgical patients, 27%; in elective surgical patient 5%. In each of these groups mortality was related to the SAPS, but for the same SAPS, mortality was very different according to the ICU group. For instance patients with a SAPS between 15 and 19 had a mortality rate of 35% if they were medical, 38% if surgical (N.S.) and 13% if scheduled surgical ($p<0.01$ between M and S or E group).

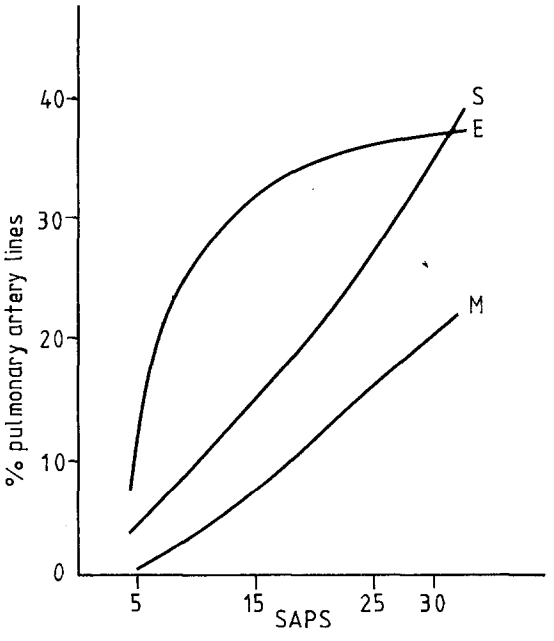

Fig. 4. Percentage of patients with a pulmonary arterial line according to the SAPS in the 3 ICU groups. *M*, medical; *E*, elective postoperative; *S*, emergency surgical

Figure 2 shows the total TISS of the first day according to the SAPS in the three ICU groups. When the SAPS was very low, less than 5 points, the therapeutic level was very low for medical patients, twice higher for all surgical patients. When SAPS increased, the therapeutic level increased linearly for medical patients (M group) and emergency surgical patients (S group). For elective surgical patients (E group), therapy increased abruptly until 35 points, then a slightly ascending plateau was observed. For the more severe patients (SAPS equal or more than 35 points), the therapeutic level was far higher for S patients (48.2±8 points) (1 SD) and E patients (43.7±20, NS), than for M patients (38.5±12, $p<0.05$ between M and S).

Figure 3 shows the percentage of ventilated patients according to the SAPS in the three ICU groups. Among low SAPS patients (0 to 4 points) 32% of scheduled surgical patients were ventilated compared to 0 in medical or unscheduled surgical patients. Indeed scheduled patients were often transferred in the ICU for a few hours or days of ventilation. When severity increased the percentage of ventilated patients increased to one hundred per cent in all surgical patients, 85% in medical patients.

Medical patients had usually less pulmonary catheters (7.5%) than S patients (15.5%) and E patients (30.7%). Figure 4 shows the percentage of patients with a Swan-Ganz catheter on the first ICU day according to the SAPS in the three ICU groups. For low SAPS patients, the percentage of Swan-Ganz was about 5%. It increased slowly in M and S group, and much faster in E group, up to 35% when SAPS was betwteen 11 and 14 points, then it was stable for higher SAPS.

The second part of the results concerns the differences between ICUs. Three comparisons of units are made in three tables (Table 2–4). In each table are noted four input parameters (percentage of patients

Table 2. Comparison of acute versus intermediate units (input parameters, processes parameters and outcome)

	Acute units	Intermediate units
Number of patients	3206	481
Previous HS (A)	*45*	*51*
Age (>75 y)	*25*	*10**
SAPS (pts)	13	9*
Medical	*54*	*84**
Surgical	*25*	*9**
Elective	*21*	*7**
TISS, total (pts)	28	14*
TISS, active & surveillance (pts)	15	7*
Ventilated	*56*	*0.5**
Pulmonary artery lines	*16*	*1.5**
ICU mortality rate	*21*	*12**

* $p<0.01$; percentages are in italics

Table 3. Comparison of the 3 types of multidisciplinary units (input parameters, processes parameters and outcome)

	Medical	Surgical	Mixed
Number of patients	900	300	206
Previous HS (A)	*42*	*60**	*47*
Age (>75 y)	*16*	*9**	*11*
SAPS (pts)	13	14	13.5
M – Medical	*88*	*14**	*55*
S – Surgical	*11*	*49**	*36*
E – Elective	*1*	*37**	*9*
TISS, total (pts)	27	29.5	28
TISS, active & monitoring (pts)	15	15.5	15
Ventilated	*56*	*75**	*59*
Pulmonary artery lines	*12*	*16*	*11*
ICU mortality rate	*25*	*20*	*23*

* $p<0.01$ between medical and surgical units; percentages are in italics

older than 75 years, percentage of patients with a previous normal HS, SAPS and distribution of patients in the three ICU groups), four parameters concerning processes (total TISS points, active and monitoring TISS points, percentage of ventilated patients, percentage of pulmonary arterial lines), one outcome parameter (ICU mortality rate).

Table 2 shows the differences between acute and intermediate units patients. These latter were older, since 25% were over 75 years, versus 10% in acute units. They were less severe, since SAPS was 9 points instead of 12 ($p<0.01$). Above all, they were mainly medical patients (84%) and 7% only were elective (E group). The total therapy was much lower, about half the acute units level (14 points versus 28). The active and monitoring TISS points were lower either. The highly specialized therapy (such as artificial ventilation) or monitoring (such as Swan-Ganz catheter) were very rare in intermediate units.

Table 3 shows the differences between three types of multidisciplinary units: medical (more than 75% of medical patients), surgical (more than 75% of surgical patients) or mixed.

When comparing surgical and medical ICUs, surgical multidisciplinary units admitted patients with a better previous HS (60% of patients had a normal HS 3 months before, versus 42%, $p<0.01$). The patients were younger (9% were older than 75 versus 16%) but severity of illness measured by SAPS was the same. Therapeutic intensity was about the same in the two types of units (29.5 points versus 27, NS). The proportion of ventilated patients was higher in surgical units (75% versus 56%, $p<0.01$), probably because they admitted more elective surgical patients (37% versus 1% in medical units), who were more often ventilated on the first day. These elective surgical patients had a lower death rate, which accounts for the higher immediate mortality in medical multidisciplinary units (25% versus 20%).

In mixed multidisciplinary units, the observed numbers and percentages were intermediate between medical and surgical units. The respective proportion of M, S, E patients (55, 36 and 9%) explains these results.

Table 4 shows the differences between specialized intensive care units. Comparing medical and surgical cardiac units, there were major differences. Regarding input parameters, the medical patients had a better previous HS (47% of normal versus 21%), were older (26% are older than 75 years versus 2%), and less severe (SAPS = 7 points). But above all the treatments were very different: while in coronary care units the total TISS points (13.5) were not different than in intermediate units, the total TISS in cardiac surgical units was very high (41.5 points). In these latter, the percentages of ventilated patients (90%) and patients with pulmonary artery lines (75%) were very high, but immediate death rate was very low (4%).

Between medical and surgical digestive units, the differences were less obvious. Input parameters (previous HS, age, SAPS) were about the same: the previous HS, specially among medical patients was bad. Therapeutic activity was higher in surgical units and death

Table 4. Specialized units

	Cardiac Medical	Cardiac Surgical	Digestive Medical	Digestive Surgical	Toxicology	Neuro-surgery	Burns
Number of patients	300	400	300	300	100	200	100
Previous HS (%)	47	21	35	50	93	59	82
Age (% > 75 years)	26	2	12	18	5	2	8
SAPS (pts)	7	10	10.5	12	10	11.5	8
Medical (%)	98	4	92	40	100	11.5	0
Surgical (%)	1	11	2	25	0	45	100
Elective (%)	1	85	0	35	0	43.5	0
TISS, total (pts)	13.5	41.5	16.5	21	19	24.5	22.5
Tiss, active & Monitoring (pts)	8	26	9	11	12	12.5	6
Ventilation (%)	4	90	19	49	62	37	14
Pulmonary artery lines (%)	6	45	1	21	2	0.5	0
Hospital mortality rate (%)	10	4	21	14	7	17	34

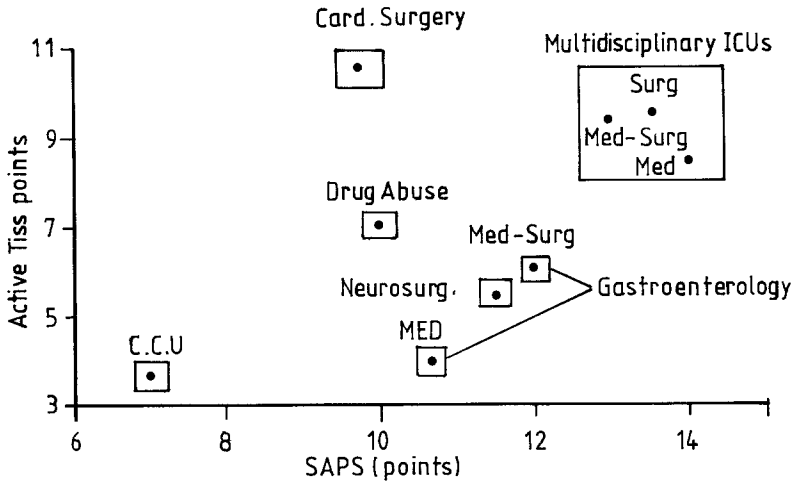

Fig. 5. Relationship between active TISS points and SAPS. *CCU*, coronary care units; *Med*, medical; *Surg*, surgical

rate was much higher in medical units (21% versus 14%).

The toxicologic ICU was very original: young patients with good previous HS, medium severity (SAPS = 10 points). Therapeutic activity was high (Total TISS = 19 points) and 62 patients per cent were ventilated. Survival rate was very high (93%).

In neurosurgical ICU, previous HS was often good (60% had a normal HS) and the old patients were very rarely admitted (only 2% are more than 75 years). Therapeutic activity was high and mortality was 17%.

The burns unit had young and previously healthy patients, receiving high TISS, but rarely ventilated. Death rate was very high (34%).

There is a strong correlation between specific intensive care activity measured by the active TISS points, and the severity of patients measured by SAPS, according to the various units [10]. Nevertheless, the intensity of care depends on the type of unit. Four groups of units can be described (Fig. 5). The first is made by coronary care units, with a low severity and therapeutic activity. The second one is made by post cardiac surgery units, with a high therapeutic level for a medium class severity. The third one is composed by other specialized units, with medium therapeutic level and higher severity. The last group is composed by multidisciplinary units, with high severity and therapeutic levels.

Discussion

To assess the activity of generalised or specialized ICUs, either acute or intermediate, the same tools can be used. Data concerning the patients, the processes and the outcome are necessary.

Concerning the patients characteristics (input), the proposed parameters (age, SAPS, previous health status) seem well adapted. Indeed, in the tables comparing differents types of ICU (Tables 2 to 4), the percentage of old patients, the previous health status, the severity measured by SAPS were very different and logically related to the type of care.

Case mix differences may account for differences in overall patients severity and accordingly differences in activity. The relationship between severity assessed by SAPS and mortality depends heavily on diagnosis, as shown in another study derived from the same data set [11].

It is, however, often difficult to give to ICU patients only one diagnosis. Our proposition to classify patients of intensive and intermediate units, in three groups of medical, surgical and elective patients is only a step: more clinical research is necessary to precise diagnosis or diagnostic groups.

The relative proportions of each of the 3 ICU groups were very different from one ICU to another. In intermediate units (Table 2), medical patients were predominant (84%). In acute units, the proportion of scheduled surgical patients was high (21%) but was only half the observed proportion in USA [6]. This proportion is obviously dependent on organisational differences.

The total TISS points increase with SAPS in each ICU group, but this may not be true for specific therapeutic items. For instance, the proportion of ventilated patients in the E group on the first day is high, even for patients with a low SAPS (Fig. 3). In surgical multidisciplinary units, the level of therapy was not statistically higher than in medical ones (Table 3), since total and active TISS points were about the same but the percentage of ventilated patients was higher (75% versus 56%).

In the same way, among specialized units, the proportion of ventilated patients was very high in cardiac surgery (90%), toxicology (62%) and digestive surgical (42%) but low in digestive medical (19%), burns (14%) and cardiac medical (4%). This latter percentage remains far higher than in intermediate units (0.5%). Availability of mechanical ventilation may differentiate intermediate from acute units but the

mean percentage of ventilated patients does not by itself permit a valid evaluation of ICU activity.

Scattering ICUs according to mean severity and active TISS points may help to understand differences in specific activities. Indeed other specific activities such as ICUs treating hematologic malignancies could be located in another situation in this digram.

The results were not analysed according to the localization of ICU in community or university hospital. Indeed, the choice of the participating centers was done by the organizing committee, depending on the motivation of the ICU directors for evaluation studies. The study design was therefore not aimed at seeking differences between university and community hospitals. Further studies should give some insight in that issue.

The outcome depends strongly not only on the SAPS but on the ICU group (Fig. 1). This explains the observed low mortality in intermediate units because mean SAPS was low, the lower mortality in surgical units, because the proportion of scheduled patients was higher, the very low mortality of cardiac surgical patients because a lot of them were elective. To judge therapeutic level on immediate mortality would be a mistake.

We conclude that the tool we used can help to describe heterogeneity of intensive care. To appreciate activity and outcome necessitates three types of information:

- severity of patients,
- measurement of therapeutic activity,
- diagnosis.

The percentage of medical, surgical and elective patients is an important information but is not sufficient to compare activities. Indeed, activity and severity depend on the diagnosis. An information on diagnosis remains mandatory to explain the differences between units.

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