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Improving donor identification with the Donor Action programme

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Abstract The increasing demand for organs for transplantation entails a consensual need for enhancement of organ procurement activity. As organ donors reside mainly in hospital intensive care units (ICUs), the Donor Action programme is aimed at identifying critical areas in ICUs, in order to improve the first step of organ donation. The purpose of this paper is to analyse the problem of identification of potential donors by means of a chart revision of patients who died in 14 ICUs in the Emilia-Romagna region between 1 July 1998 and 31 December 2000. All deaths and patients with severe brain insult (score on Glasgow Coma Scale (GCS) = 3/15) were assessed by the local transplant co-ordinators together with a professional at the Transplant Reference Centre. Brain death diagnoses and potential donor referrals were therefore assessed in the study period, which was subdivided into five semesters. Of the 3,056 deaths reported in 30 months, 1,248 were due to severe brain damage (GCS score = 3). Brain death diagnosis (BD) was performed in 509 patients (40.8%). Although we applied the same parameters over the whole length of the study, we observed a significant increase in BDs (from 87 in the first semester to 125 in the last, 30.5% to 53.0% of the patients with GCS 3 ($P = 0.003$, χ^2 for trend = 16.072), in spite of a slight decrease in the total number of deaths and in the total number of patients with GCS score = 3 (from 649 to 587, and from 44% to 41%, respectively). Study population characteristics could have contrasted with rather than facilitated our results: age and gender did not change significantly, whilst cause of death showed a significant reduction in trauma and an increase in cerebrovascular incidents over the whole length of the study. We can conclude that the more careful assessment of patients dying in ICUs, by the Donor Action programme, significantly contributed to the improvement of BDs observed in the study period. Therefore, Donor Action seems to be an efficient quality control programme to improve identification of potential donors, the first stage of organ procurement.

Keywords Brain death · Organ procurement · Organ donors

Introduction

Organ transplantation has proved to be a successful therapy for the treatment of end-stage organ failure. Since 1902, when the first successful experimental kidney transplantation was performed by Emerich Ullmann [9], surgical techniques, organ preservation, immunosuppressive therapy, histocompatibility testing, and knowledge of the pathogenesis of allograft rejection [5] have improved. However, the persisting obstacle against full development of organ transplantation remains organ shortage. Although the supply of available cadaveric organs for transplantation has increased, the demand continues to grow at an accelerating rate.

The enhancement of organ procurement is the basic step towards alleviating the gap between organ supply and patients on waiting lists [6]. Since organ donors are predominantly resident in hospital intensive care units (ICUs), better knowledge of the procedures in each critical care unit could help in identifying weak areas along the donation pathway and in assessing the real potential organ donation pool of a region.

With this aim, the Emilia-Romagna region incorporated the Donor Action programme (DA), which is an international initiative, the result of three organisations with great experience in organ procurement: the Organización Nacional de Trasplantes (Spain), The Eurotransplant Foundation (The Netherlands) and The Partnership for Organ Donation (USA). The programme provides tools and guidelines to assist hospitals and critical care units in assessing and improving their donation potential [20]. To date, 17 countries participate in such programmes, and the available collected results from the experience of eight countries show an average increase of 53% in donation rates after 1 year of implementation of the DA methodology [16].

Material and methods

In the Emilia-Romagna region, an area with 4 million inhabitants, there are 13 main hospitals with 14 ICUs (13 for adults and one for paediatric patients). There are 134 ICU beds, 65 of which are assigned to six hospitals with a neurosurgery department. DA was installed as a quality control programme to evaluate organ procurement in the Emilia-Romagna region. The study period was 30 months, from 1 July 1998 to 31 December 2000.

All patients with severe brain insult as defined by a Glasgow Coma Scale (GCS) value of 3/15, GCS score = 3), who were admitted to, and died in, ICUs, were assessed by the local transplant co-ordinators. The co-ordinators entered the medical-chart data into a local network that connected all ICUs to the Transplant Reference Centre in real time. The accuracy of the data and the maintenance of homogeneous criteria among all the hospitals taking part in the study were guaranteed by continuous controls through the professionals at the Transplant Reference Centre, who verified the compilation of the schedules from each ICU through weekly contacts with the transplant co-ordinators and the ICU staff.

The study period was subdivided into five semesters, and every 6 months the following parameters were evaluated:

1. The number of patients with severe brain damage (GCS = 3)/ total number of deaths in ICU.
2. The number of brain death diagnoses (BDs)/patients with GCS = 3.

The baseline characteristic of the study population, such as age, gender, and cause of death, were also assessed every 6 months.

Statistical analysis was performed with the Statistical Package for the Social Sciences software (SPSS). Significance of the bivariate analyses was evaluated by means of cross-tabulations with Student's and χ^2 tests. Probability values at $P < 0.05$ were considered statistically significant.

Results

During the 30 months of the study 3,056 deaths were globally evaluated in 14 ICUs. Of these, 1,248 (40.8% of all deaths) were due to severe brain damage, (GCS = 3). BD was performed in 509 patients (40.8% of GCS = 3; Table 1).

The demographic characteristics of the study population, age and gender, remained stable in the analysed periods. In particular, the age of the patients did not show any significant variations during the study period. The mean age of the participants was 57.7 ± 21.5 years in the first semester, 60.0 ± 20.4 in the second, 57.7 ± 20.1 in the third, 60.4 ± 20.3 in the fourth, and 57.6 ± 19.4 in the last; P = not significant (NS). Masculine gender was prevalent in all semesters (male/female = 176/104, 165/110, 125/76, 138/110, and 134/101 in the first, second, third, fourth, and fifth semester, respectively (P = NS). Only in the first semester was trauma the main cause of death. In the others, it was cerebrovascular incident,

Table 1 Total deaths (*TDs*), percentage of severe brain damage (GCS = 3) and BDs during the study period

Year (semester)	TDs	GCS = 3	% GCS = 3/TDs	BD diagnosis	% BD/GCS = 3*
1998 (2nd)	649	285	43.9	87	30.5
1999 (1st)	654	275	42.0	91	33.1
1999 (2nd)	573	202	35.3	88	43.6
2000 (1st)	593	248	41.8	118	47.6
2000 (2nd)	587	238	40.8	125	53.0
Total	3,056	1,248	40.9	509	40.8

*$P = 0.003$, χ^2 16.072 for trend

with a significant reduction in trauma, and an increase in cerebrovascular incidents over the entire length of the study ($P < 0.0001$, χ^2 24.334 for trend) (Table 2).

The number of evaluated deaths was 649, 654, 573, 593 and 587 in each period; the percentage of patients with severe brain damage was 44, 42, 35, 42 and 41, respectively. BD was performed in 87 patients in the first semester, 91 in the second, 88 in the third, 118 in the fourth and 125 in the fifth (respectively, 31%, 33%, 44%, 48%, and 53% of participants with severe brain damage). A significant increase in BDs was therefore observed from the beginning to the end of the study, from 31% to 53% ($P = 0.003$, χ^2 16.072 for trend), in spite of a slight decrease in the number of total deaths and patients with GCS score = 3 (Table 1). A consensual enhancement of potential donor referrals was also observed. Organ donor referrals to the Transplant Reference Centre has increased from 84 to 112 ($P = 0.008$, χ^2 13.779 for trend) since the implementation of the DA project. (Table 3).

Table 3 Referrals of potential organ donors from the implementation of the DA programme

Year (semester)	Total deaths	Potential donors referrals*
1998 (2nd)	649	84
1999 (1st)	654	78
1999 (2nd)	573	83
2000 (1st)	593	107
2000 (2nd)	587	112

*$P = 0.008$, χ^2 13.779 for trend

Discussion

The first indisputable prerequisite for a patient to be considered as a potential organ donor is the brain death diagnosis. Brain death is not a specific primary diagnosis, rather, it represents the end state of neurological deterioration. Brain death per se did not exist before the establishment of intensive care facilities during the 1950s and 1960s for long-term ventilatory support of comatose patients [17]. Mollaret et al., in 1967 [13], and Goulon et al. [7] observed that many "comatose" patients in these units showed no evidence of brainstem or cortical function and ultimately died, despite maximal haemodynamic supportive care. Since these observations, attempts have been made to define this clinically recognisable state of absence of function of the central nervous system that was inevitably followed by cardiovascular death. Brain death was defined by total and irreversible damage of cerebral and brain stem functions, and the following step was to outline criteria to identify this condition. The Ad Hoc Committee of the Harvard Medical School proposed the first set of such brain death criteria, which were introduced to the medical community in 1968 [1]. These criteria were validated by several investigators in prospective studies on comatose patients [14, 18] and today they still help intensive care physicians to identify promptly the haemodynamically unstable patients who would develop cardiac arrest within a relatively short time, despite continued full cardio-respiratory support [10].

The GCS is a proven, valid parameter for the prediction of patient outcome. Patients with severe head injury and GCS score below 6 present a high risk of early death [3, 8, 15]. Therefore, the monitoring of patients with GCS = 3 in ICUs can be a useful tool to identify promptly those patients likely to develop brain death.

Identification of potential donors is crucial if we are to increase organ procurement [4]. We hypothesise that a greater awareness of the characteristics of the department concerned could help in improving organ donation. The compilation of DA reports permitted the scheduling all deaths in every emergency department involved, so assessing the donation potential of each hospital. The consequent evaluation of the daily activities of departments where potential donors are hospitalised could also facilitate the recognition of critical areas in the donation process.

Results from other countries that have incorporated the programme support this theory. In two Spanish hospitals, the detection of potential donors increased from 81% to 98%, because no donors were lost because of in-hospital organisational problems or incorrect medical suitability [2]. Moreover, a 33% increase in

Table 2 Changes in demographic characteristics of the study population during the study period (*CVA* cerebrovascular accident)

Year (semester)	Age (years)*		Gender*			Cause of death**		
	Mean	SD	M	F	Unknown	CVA	Trauma	Others
1998 (2nd)	57.66	21.49	176	104	5	87	115	83
1999 (1st)	60.03	20.42	165	110	0	107	76	92
1999 (2nd)	57.71	20.13	125	76	1	100	74	28
2000 (1st)	60.38	20.26	138	110	0	127	78	43
2000 (2nd)	57.62	19.36	134	101	1	127	66	43

*P not significant; **$P < 0.0001$ (χ^2 24.334 for trend)

donation rates was sustained over 2 years during the development of the DA program in those ICUs [21]. The collected results of eight countries showed an average increase of 53% in donation rates after one year of running the DA programme [16]. We also observed, in the course of our study, an increase in brain death identification from 30.5% to 53.0% ($P=0.003$), over the whole period. We also observed an increase in the number of potential donors referred, from 84 to 112 ($P=0.008$) to the Transplant Reference Centre since the implementation of the DA programme.

We could hypothesise that this increase in the number of brain death identifications, and consequently in potential donor referrals, could have been influenced by some changes in the population baseline characteristics, but we did not find any significant changes, such as age and gender of our study population (Table 2). Regarding cause of death, we observed a prevalence of traumata only in the first semester of the study, whilst in the subsequent periods we observed a constant and significantly increasing prevalence of cerebrovascular incidents. We do not have any scientific explanation for this spontaneous change in this specific characteristic of our study population. Maybe the introduction of mandatory helmet use for motorcyclists reduced the number of cranial traumata, and the ageing of the general population could justify the significant increase in cerebrovascular accidents. Whatever the reason, the trend changes in the cause of death of our study population could not have influenced our results. One would, on the contrary, expect trauma patients to be more readily identified as brain dead, considering the historical preference to "choose" potential donors without cardiovascular organ damage, the latter being frequently the case in patients with cerebrocardiovascular incidents. Had cause of death influenced brain death identification, it would have increased the number of brain deaths in the first semesters; however, we had, on the contrary, a lower percentage of brain death identifications in these semesters. We observed, moreover, a slight reduction in the total number of deaths and of patients with GCS = 3 over the whole length of the study, thus raising the percentage of diagnosed brain deaths in spite of a reduction in the potential source of brain death itself. This clearly stresses the power of the DA programme to increase donor potential. The DA programme helps to improve the identification of potential donors by gaining more information on each death in an ICU and increasing the number of BDs, resulting in an increase in potential organ donor identification.

Nevertheless, the introduction of new organisational models in the organ donation practice of the Emilia-Romagna region could also have contributed to better donor source identification [19]. The Emilia-Romagna region has installed a transplant co-ordinator in each ICU since 1995 [11, 12]. Their specific skills in organ donor identification, maintenance, and family approach could have contributed to the increase in BDs and, consequently, to potential donor identification. We observed, furthermore, from 1995 to 1998, a slight increase in organ donor identification activity. This increase was more significant between 1998 and 2000, a period in which the DA programme was incorporated, together with the transplant co-ordinator activity.

In conclusion, we can state that through a higher identification rate of potential donors, the Donor Action programme significantly contributed to the improvement of the organ procurement activity in our region.

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