

## INCREASED DONOR RATE AT SESTRE MILOSRDNICE UNIVERSITY HOSPITAL

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*In memory of Tomislav Halapir, MD, the explantation team member, Department of Anesthesiology, Sestre milosrdnice University Hospital, deceased in 2008.*

**SUMMARY** – The rate of organ donation reflects the level of the respective society and country development. In Croatia, attempts have been made to increase this rate. As a consequence, the number of potential donors with confirmed brain death was observed to have steadily increased during the 2004-2008 period. Data on all potential donors where the confirmation procedure for brain death was completed were retrieved and analyzed. The percentage of donors out of all persons diagnosed with brain death and all deaths recorded at the Central Intensive Care Unit and at all Hospital departments was calculated. The mean number of organs *per* donor was also calculated. During the 2004-2008 period, the number of donors *per* brain death persons was 5/unknown, 6/10, 8/13, 11/13 and 18/20; mean age 51, 50, 39, 48 and 44; donor rate *per* Central Intensive Care Unit deaths 5.9%, 5.6%, 5.8%, 10.4% and 12.1%; donor rate *per* all hospital deaths 0.4%, 0.5%, 0.5%, 1.5% and 1.9%; and number of organs *per* donor 1.6, 2.4, 2.6, 3.0 and 2.7, respectively. Study results showed a steady increase in the number of donors and organs *per* donor at Sestre milosrdnice University Hospital during the 2004-2008 period. More intensive education should be organized at medical schools and for medical professionals to identify brain death persons and potential donors. In addition, mass media campaigns should improve public awareness and perception of the issue.

**Key words:** *Attitude to health; Health policy; Tissue and organ procurement – legislation and jurisprudence; Croatia; Sestre milosrdnice University Hospital, Zagreb*

### Introduction

The rate of organ donation reflects the level of the society and country development. Most religions support organ donation as an act of love and self-giving, some leave it to be an individual decision, and in Catholic Church, Pope John Paul II supported it:

“Organ donation after death is a noble and meritorious act and is to be encouraged as an expression of generous solidarity”. Donor rate is lowest in eastern European countries with 1-2 donors *per* million inhabitants (PMI). In 2007, donor rate was 1.7 PMI in Romania and 1.3 PMI in Bulgaria<sup>1</sup>. The highest rates were recorded in Spain (34 PMI), Belgium (28.12 PMI), Portugal (23.9 PMI) and Germany (15.9 PMI)<sup>1,2</sup>. In most European countries like Belgium, The Netherlands, Germany and Austria, donor rate decreased in 2008 as compared with 2007<sup>3</sup>.

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In Croatia, the rate of organ donation was 13.1 in 2007, to significantly increase in 2008 to 17.9 PMI<sup>4</sup>. However, it largely varies among hospitals, from 0.09 (8/84) donors *per* intensive care beds (ICB) at Zagreb University Hospital Center to up to 0.42 (18/42) *per* ICB at Sestre milosrdnice University Hospital<sup>3</sup>. Some hospitals (e.g., Dubrava University Hospital) show a constant rate of 0.4 (11/28) donors *per* ICB<sup>3</sup>. At Sestre milosrdnice University Hospital with 42 ICB and 853 acute hospital beds until 2003, identification of donors was sporadic, with less than one donor *per* year. Attempts have been made to increase this rate.

In national organ donation policies, legislative system regulates consent for donation<sup>5</sup>, and Croatia is a country with a presumed consent system. It means that it is not required to obtain a consent, either from the donor or from the next of kin; it is sufficient to verify that the deceased has not objected during lifetime to becoming a donor<sup>5</sup>, thus enabling larger pools of donor consent. Some authors have argued that the presumed consent system leads to a more effective procurement of donors<sup>6,7</sup>. Other policy measures are directed at optimizing the process of donor procurement. Examples of such measures are hospital programs like Donor Action<sup>8</sup>, or EDHEP<sup>9</sup>, or informing the public about the relevant aspects of organ donation. To optimize the process of donor procurement, Spain has developed an organizational model ("the Spanish model") with policy measures at the national, regional and hospital levels to address the importance of organ donation and to effectively convert potential donors into actual donors<sup>10</sup>. It means that a proactive donor detection program is performed by well-trained transplant coordinators, introduction of systematic death audits in hospitals, a combination of positive social atmosphere and adequate management of mass media relations, and adequate economic reimbursement for the hospital. In Croatia, these efforts have intensified over time. The Ministry of Health and Social Welfare has made some initiatives to adopt the Spanish model, primarily through providing special education of trained anesthesiologists in Transplant Procurement Management (TPM) in Barcelona. It was followed by establishing the position of hospital transplant coordinator, which enables proactive donor detection, organizing brain death diagnosis, and organizing donor management and organ viability at the level of priority in different services of specialty,

family approach for organ donation, and organizing organ retrieval, organization and preservation, and finally providing contact with the national coordinator for organ allocation. At Sestre milosrdnice University Hospital, the multidisciplinary team approach enabled publication of the protocols on diagnosing brain death and guidelines for use of confirmatory tests by professional societies according to legal standards<sup>11,12</sup>. Special training for the use of transcranial Doppler sonography (TCD) as a confirmatory test in cerebral circulatory arrest was organized for neurologists from all Croatian hospitals. At Sestre milosrdnice University Hospital, like in all other hospitals, hospital coordinator has a special role and thus certain authority. Taking active part in this role, the 'towards' principle was arranged, which means that patients suspected to be brain dead are transferred to the Central Intensive Care Unit (ICU), where a trained anesthesiologist takes care of them. The team for the management of patients suspected of brain death is fully dedicated to this role, putting participation in this process to the highest level of priority. The team for confirmation of brain death is taking dedicated part in this process. To stimulate such an approach, the resulting steady increase in the number of donors was presented every year at the Annual Meeting on Donor Detection.

In this article, we present the results of activities in the field of organ donation, which show constant increase in donor rate during the 2004–2008 period, as the result of proactive measures and positive social atmosphere and attitude towards brain death diagnosis that led to dedicated and proactive management.

## Methods

At Sestre milosrdnice University Hospital with 42 ICU beds and a quarter of million catchment population, a new concept to improve the rate of organ donation rate was launched in 2004. In the present study, data on all potential donors with the confirmation procedure for brain death completed were retrieved and analyzed. The study was approved by the Hospital Ethics Committee.

The patient demographic data and the cause of catastrophic brain injury leading to brain death were analyzed, including information obtained from the referring departments treating patients before brain

Table 1. Demographic data of patients that entered the process of brain death confirmation and paraclinical tests used for confirmation

	Number or donors/ number of brain death	Mean age (range) of brain death persons (yrs)	Sex distribution of brain death persons	Paraclinical test used to confirm brain death	Cause of brain death
2004	5/unknown	51 (donors)		TCD 100%	
2005	6/10 (60%)	50 (18-72)	Male 2 Female 4	TCD 66% Brain scintigraphy 17% AG 17%	Neurotrauma 1 Stroke 5
2006	8/13 (61%)	39 (18-72)	Male 8 Female 5	TCD 54% MSCTA 46%	Neurotrauma 10 Stroke 3
2007	11/13 (85%)	48 (20-76)	Male 6 Female 7	TCD 69% MSCTA 29% AG 8%	Neurotrauma 4 Stroke 9
2008	18/20 (90%)	44 (18-73)	Male 12 Female 8	TCD 39% MSCTA 61%	Neurotrauma 7 Stroke 13

TCD = transcranial Doppler; AG = angiography; MSCTA = multislice computer tomography angiography

herniation analysis. Paraclinical test(s) were used to confirm the diagnosis. According to the national guidelines in Croatia, the tests accepted for this procedure include conventional angiography, electroencephalography (EEG), evoked potentials, TCD, isotope angiography, technetium-99m hexamethylpropylene-amineoxime brain scan ( $^{99m}\text{Tc}$ -HMPAO), and since 2006 brain multislice computerized tomography angiography (MSCTA)<sup>11-14</sup>.

The percentage of donors according to the number of brain death persons, all deaths at Central ICU and at all Hospital departments was calculated. The mean number of organs *per* donor was also calculated. The number of family consents for organ donation and number of donated organs according to study years are also presented. Data are expressed as number and percentage.

## Results

Up to the year 2004, brain death was only sporadically confirmed, approximately once a year, at Sestre milosrdnice University Hospital. From 2004 to 2008, the number of patients diagnosed with brain death was on a constant increase (Table 1), with twofold increase recorded from 2005 to 2008. The rate of consent for organ donation increased from 60% in 2005 to 85%

in 2007 and 90% in 2008 (Table 1). In the beginning, TCD was the only paraclinical test used to confirming brain death. This service was restricted to a few experts and was available upon arrangement. With the introduction of MSCTA it became available for 24 hours a day. Since the results were often inconclusive, MSCTA had to be repeated, thus influencing the residual organ function. The appropriate confirmatory test was chosen according to test availability and patient condition, appreciating the restrictions in accordance with the test protocol. During the year 2008, TCD was out of service due to technical reasons, which resulted in reduced TCD testing (Table 1). Angiography and brain scintigraphy were organized as arranged, only on daily working services. Such an approach resulted in only few testing procedures.

Table 2 shows twofold increase in the rate of donors compared with the total number of deaths at Central ICU, from 5.6% in 2004 to 12.1% in 2008. In addition, a 5-fold increase was recorded in the rate of donors according to all Hospital deaths (Table 2). It was partially due to the increased number of referrals from Neurology Department (Table 3). In 2004, four out of five donors came from Neurology Department, and the number of patients suspected of brain death referred to Central ICU increased in the next years (Table 3).

Table 2. Number of donors according to number of deaths and number of organs per donor

	Number of donors/ number of brain death	Number of donors/number of deaths at Central ICU	Number of donors/number of all deaths at hospital	Number of organs <i>per</i> donor
2004	5/unknown	5.9%	0.4%	1.6
2005	6/10 (60%)	5.6%	0.5%	2.4
2006	8/13 (61%)	5.8%	0.5%	2.6
2007	11/13 (85%)	10.4%	1.5%	3.0
2008	18/20 (90%)	12.1%	1.9%	2.7

ICU = intensive care unit

There was a constant trend towards younger donor age (Table 1). The younger donor age resulted in the increased rate of multiorgan explantation in 2008 (Table 4). In 2008, there were 15 out of 18 (83%) multiorgan explantations. The mean number of explanted organs was highest in the youngest age group (4.2 organs from donors aged <30) (Table 4). The mean number of organs *per* donor decreased with the increasing donor age (Table 4).

## Discussion

Adoption of the Spanish model resulted in a 3.6-fold increase in the number of donors during the 2004–2008 period. A twofold increase was recorded in the number of diagnosed brain deaths from 2005 to 2008. Also, the rate of consent for organ donation increased

from 60% in 2005 to 90% in 2008. Publication of the protocols of diagnosing brain death<sup>12</sup> and guidelines for the use of confirmatory tests<sup>11</sup> by professional societies according to legal standards and their adoption contributed to positive attitude and implementation of the procedure at other hospitals<sup>15</sup>. However, other factors such as the presumed consent legislation for organ donation as the strongest factor influencing donation rates<sup>7</sup>, efficiency of the country's transplant coordination, resources and healthcare expenditure, percentage of the population with high-school/university education (influencing social demographics in donation rates) and religion (Catholicism having favorable attitudes towards organ donation) remained unchanged during the study period.

Adoption of the Spanish model also resulted in a higher number of suitable donors, which in turn

Table 3. Number of patients with catastrophic brain injury referred from other departments for suspected brain death

Year	Number of patients referred from other departments for suspected brain death	Cause of brain death
2004	Neurology 4	Hemorrhagic stroke 3 SAH 1
2005	Neurology 2	Hemorrhagic stroke 1 SAH 1
2006	Neurology 1	Hemorrhagic stroke 1
2007	Neurology 4	Hemorrhagic stroke 2 SAH 2
2008	Neurology 6	Hemorrhagic stroke 2 Ischemic stroke 1 SAH 3

SAH = subarachnoid hemorrhage

Table 4. Number of multiorgan explantation according to donor age (15/18; 83%)

Donor age (yrs)	Number of donors	Mean number of organs <i>per</i> donor
<30	5	4.2
30-40	2	2.5
40-50	4	2.8
50-60	4	1.3
>60	3	1.7

increased the number of organs *per* donor from 1.6 in 2004 to 3.0 in 2007 and in 2.7 in 2008; however, this trend was not recorded at all hospitals<sup>15</sup>. In 2008, the mean number of organs *per* donor was 4.2 in the group of donors younger than 30. This figure resulted from appropriate and aggressive donor management, thus ensuring proper organ viability, as reported elsewhere<sup>16,17</sup>. Such an aggressive management requires dedicated personnel to provide optimal treatment of profound physiologic disturbances associated with brain death. The use of these standardized and aggressive donor management protocols was shown to increase the number of transplanted organs and prevent the number of donors lost for medical failures. In such a management protocol, the shortest possible time to brain death diagnosis is crucial and it can only be achieved with 24-hour availability of noninvasive paraclinical tests. In most brain death persons, it was achieved by use of TCD, which showed the shortest time on cerebral circulatory arrest confirmation in the majority of testing procedures performed<sup>18</sup>.

In another survey explaining differences among hospitals in the number of organ donors, the multi-level regression analysis was used<sup>19</sup>. The potential explanatory variables were hospital-specific mortality statistics, donor policy and structural hospital characteristics. Of all donors, 81% came from one quarter of the hospitals, mainly large ones. A strong relationship was found between the number of donors and hospital-specific mortality statistics. Hospitals with a neurosurgery department had additional donors<sup>19</sup>. All these factors cannot explain differences in donor rates among different Croatian hospitals, since all large university hospitals like Zagreb University Hospital Center, Dubrava University Hospital, Split University Hospital Center and Sestre milosrdnice University

Hospital have similar hospital-specific mortality statistics and they all have neurosurgery departments.

Implementation of the Spanish model for organ donation and investing efforts in the procurement of donors had a favorable and greater impact on donor procurement at our Hospital as compared with other hospitals.

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#### Sažetak

### POVEĆANA STOPA DONIRANJA ORGANA U KLINIČKOJ BOLNICI SESTARA MILOSRDNICA

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Stopa donacije organa je mjerilo razvijenosti zemlje. Kako bi se ta razina povećala, u Hrvatskoj su poduzete određene mjere. Posljedično je zamijećen stalan porast potencijalnih donora u kojih je potvrđena moždana smrt. Prikazujemo stalan porast razine donora od 2004. do 2008. godine. Analizirani su podaci svih potencijalnih donora u kojih je proveden postupak potvrđivanja moždane smrti. Izračunat je postotak broja donora u odnosu na osobe u kojih je dijagnosticirana moždana smrt te u odnosu na sve umrle u Središnjoj jedinici intenzivnog liječenja i u cijeloj bolnici. Također je izračunat srednji broj doniranih organa po donoru. Od 2004. do 2008. godine broj donora na broj moždano mrtvih osoba je bio 5/ nepoznato, 6/10, 8/13, 11/13 i 18/20, dok je srednja dob bila 51, 50, 39, 48 i 44 godine. Od 2004. do 2008. godine broj donora na broj umrlih u Središnjoj jedinici za intenzivno liječenje je bio 5,9%, 5,6%, 5,8%, 10,4% i 12,1%, a na sve umrle u bolnici 0,4%, 0,5%, 0,5%, 1,5% i 1,9%. Srednji broj organa po donoru od 2004. do 2008. je bio 1,6; 2,4; 2,6; 3,0; 2,7. Od 2004. do 2008. godine vidljiv je stalan porast broja donora i broja doniranih organa u Kliničkoj bolnici "Sestre milosrdnice". Potrebno je provesti izobrazbu na Medicinskom fakultetu i među profesionalnim osobljem kako bi se prepoznale osobe s moždanom smrću i potencijalni donori. Također treba provesti kampanje u medijima kako bi se poboljšao stav javnosti u tom području.

*Ključne riječi: Odnos prema zdravlju; Zdravstvena politika; Nabavka tkiva i organa – zakonodavstvo i pravosuđe; Hrvatska; Klinička bolnica "Sestre milosrdnice"*