Donor Factors Associated with Familial Consent for Organ Donation among Trauma Casualties: a 10-Year Retrospective Study

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ABSTRACT

Background: Consent rates for organ donation remain one of the most important factors determining the number of organs available for transplantation. Trauma casualties constitute a substantial part of the deceased organ donor pool and have unique characteristics that distinguish them from the general donor population. However, this group has not been extensively studied.

Objectives: To identify donor factors associated with positive familial consent for solid organ donation among trauma casualties.

Methods: This retrospective study included all trauma casualties who were admitted to the Rabin Medical Center, Beilinson hospital, during the period from January 2008 to December 2017, who were potential organ donors. Data collected included demographic features, the nature of the injury, surgical interventions, and which organs were donated. Data was collected from the Rabin Medical Center Trauma Registry.

Results: During the study period 24,504 trauma patients were admitted and 556 died over their hospital course. Of these 76 were potential donors, of whom 32 became actual donors and donated their organs. Two factors showed a statistically significant correlation to donation, namely female gender (P = 0.018) and Jewish religion of the deceased (P = 0.032).

Conclusions: Only a small group of in hospital trauma deaths were potential solid organ donors (13.7%) and less than half of these became actual donors. Consent rates were higher when the deceased was female or Jewish.

KEY WORDS: donor characteristics, factors affecting consent, organ donation, trauma casualties

Organ donation from both living and deceased donors remains the optimal therapy for patients with end-stage organ failure. Consent rates for organ donation remain one of the most important factors determining the number of organs available for transplantation. Understanding the factors influencing family decisions for granting or declining consent for deceased donation may lead to identifying modifiable factors associated with consent. These factors may be related to characteristics of the family [1-4] including cultural and religious factors [3,5,6], characteristics of the system such as the strategy used for the family approach for organ donation [2,7,8], or characteristics of the donor. The latter have been least studied and of these, most have examined the general donor population.

Trauma casualties make up a significant part of the deceased organ donor pool. Regarding the consent rate, this was found to be higher if the request for organ donation was made in a trauma center compared to a non-trauma center [9]. Other studies have shown that the consent rate was higher for patients who died from traumatic injury compared to other causes, such as cerebrovascular accidents or anoxic brain damage [2,3]. Indeed, trauma casualties differ, in particular regarding both age (typically younger) and gender (predominance of males). However, trauma casualties as a separate donor group have been little studied.

In the present study we identified donor factors associated with familial consent for deceased organ donation among trauma casualties.

PATIENTS AND METHODS

This retrospective study was conducted at the Rabin Medical Center (Beilinson Campus), Petah Tikva, Israel, which is one of six Level I trauma centers in Israel and where over 70% of all organ transplantations are performed [1]. The study included all trauma casualties who were admitted to the Rabin Medical Center and were declared dead by neurological criteria (neurologically determined death [NDD]) during their hospital course. Trauma casualties were defined as admissions due to acute injury from an external cause (penetrating or blunt). Eligibility criteria for organ donation include age < 80 years, no evidence of malignant disease, and the absence of certain infectious processes including human immunodeficiency viruses, tuberculosis, and intracellular viral infections. Potential donors were defined as those declared dead by a committee who met all eligibility criteria, whereas actual donors include those cases where organs were retrieved for transplantation. In addition,
organ procurement in Israel requires the consent of at least one next of kin, as long as no other next of kin objects.

Data were collected using the Rabin Medical Center Trauma Registry. Demographic data collected included age, gender, ethnicity, religious affiliation, mechanism of the injury, severity of injury, using the Injury Severity Score (ISS) for anatomical severity and Glasgow Coma Scale (GCS) for neurologic severity. In addition, the affected body regions, nature of any surgical interventions, outcome of family approach (i.e., whether consented or refused), and which organs were retrieved for transplantation were also noted. Data analysis was performed using the t-test for continuous variables and Chi-square for categorical variables. A P value of < 0.05 was considered significant. All results are given as the mean ± standard deviation.

RESULTS
During the study period 219 deceased potential organ donors were detected at the Rabin Medical Center, of whom 76 (76/219 [34.7%]) were trauma casualties and 143 (143/219 [65.3%]) died of causes other than trauma. The consent rate among trauma casualties was 42.11% (32/76) compared to 52.45% (75/143) among the non-trauma cohort (Figure 1). In total, 107 of the 219 deceased potential organ donors became actual donors (107/219 [48.86%]) and trauma casualties accounted for 29.9% (32/107) of them (Figure 2). Organs donated included kidneys (from 31 patients), livers (from 28 patients), lungs (from 22 patients), hearts (from 14 patients), and pancreases (from 7 patients).

DEMOGRAPHICS
Most potential organ donors in the trauma group were male (62 males, 14 females). The consent rate was significantly higher among females (10/14 females [71.4%] vs. 22/62 males [35.5%], P = 0.018). The mean age was 36 years ± 18.4. There was no significant difference between males and females (35.8 ± 17 vs. 36.7 ± 21.1 years, respectively). The median age was 31 years (31 years for males and 28.5 years for females), overall age range 1–72. There was no correlation between the age of the deceased and family consent for donation. Most of the potential organ donors were Jewish (54 Jews, 18 Muslims, 2 Christians, and 1 Buddhist. Data on the religion of one potential organ donor was missing). There was a statistically significant difference in the consent rate among the different religions (P = 0.032) with the highest consent rate among Christians (2/2 [100%]), followed by Jews (26/54 [48.15%]) and Muslim-Arabs (4/18 [22.22%]) (Table 1).

MECHANISM OF INJURY
The mechanism of injury was classified into four categories: motor vehicle collision, fall from height, assault, and other mechanisms of injury. Consent rates did not significantly differ among the different mechanisms of injury (P = 0.498) (Table 1).

We performed a subgroup analysis for the patients who were involved in a motor vehicle collision. There was no significant difference in consent rate whether the deceased was the driver, a passenger, a pedestrian, or a bicyclist (P = 0.272). There was no significant difference in consent rate whether death was caused by an accident, assault, or suicide (P = 0.742).

NEUROLOGICAL STATUS AND SEVERITY OF INJURY
Of the 76 potential donors only one had a GCS score at the scene of 15 and the rest had a score of 8 or below (severe head injury). Data regarding the GCS score at the scene of 9 potential donors was missing. The median ISS score of the potential donors was 38 (range 25–75) (Table 1).
All 76 potential organ donors presented with a head injury, which was isolated in 25 cases and combined with other injuries that involved the torso or pelvis in 45 cases. A combination of head and orthopedic injuries without involvement of the torso or pelvis was noted in six. There was no difference in consent rate among potential organ donors who had an isolated head injury compared to those who presented with other injuries (P = 0.137) [Table 1].

Twenty-seven of the 76 potential organ donors underwent a surgical intervention prior to their NDD declaration. Of these, 12 underwent only brain surgery, 11 had only abdominal/thoracic surgery, 3 underwent brain and abdominal/thoracic surgery, and one had only orthopedic surgery. There was no difference in consent rate between potential donors who were treated surgically and those who received no intervention (P = 0.811). In addition, there was no difference in consent rate when comparing those who had brain surgery to those who had other types of surgery (abdominal or thoracic surgery) (P = 0.142) [Table 1].

In this study, which to the best of our knowledge is the first of its kind in Israel, we showed that female gender and Jewish religion were the only donor factors associated with a higher familial consent for organ donation amongst trauma casualties. In contrast to previous studies [2-4,7], the consent rate in our study was significantly higher when the deceased was female (71.4% vs. 35.5% for males, P = 0.018). This finding may be explained by the combination of several findings demonstrated in previous studies. Previous studies have shown that women, when asked a priori, are generally more willing to donate their organs [3,10]. Other studies have shown that one of the most important factors affecting consent is the deceased wishes, which were expressed prior to the injury to his family and friends, regarding organ donation [2,4,10]. Thus, the higher consent rate when the deceased was a female, stands in line with the fact that women are more willing to donate their organs after death and the great impact the deceased wishes have on the family's consent to donation.

Regarding religion, the consent rate was higher among the Jewish population (48.15% vs. 22.22% among Muslim-Arabs, P = 0.032). The number of potential organ donors who belonged to other religions was too small to be analyzed. This finding is consistent with previous studies that have shown that consent rates are lower among minority groups [2,3,7,10,11]. This finding may also be explained by several key elements that characterize the Muslim-Arab population in Israel. Thus, most Muslim-Arabs are religious and previous studies have shown that the consent rate decreases [3,10] with increasing religious observance. In addition, Muslim-Arabs give more weight to religious authorities' views on organ donation [3,5,8,10,11]. In addition, families may refuse donation because of the concern that organ donation will delay the funeral [5]. Third, some groups are less exposed to and less aware of the concept of organ donation and its importance [10,11].

Previous studies have shown that the family's experience during the hospital stay and care had a significant effect on the consent rate. In this study, we found that the consent rate was significantly higher when the deceased was a female (71.4% vs. 35.5% for males, P = 0.018). This finding may be explained by the combination of several findings demonstrated in previous studies. Previous studies have shown that women, when asked a priori, are generally more willing to donate their organs [3,10]. Other studies have shown that one of the most important factors affecting consent is the deceased wishes, which were expressed prior to the injury to his family and friends, regarding organ donation [2,4,10]. Thus, the higher consent rate when the deceased was a female, stands in line with the fact that women are more willing to donate their organs after death and the great impact the deceased wishes have on the family's consent to donation.

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consent rate [2,7,8,12]. Some of these studies demonstrated a significant association between the consent rate and the measures that were taken to save the deceased’s life (surgical intervention vs. medical treatment and observation) [8,12]. In our study, however, there was no correlation between surgical intervention and consent rates. This finding implies that there may be other factors that affect the experience of the families during the hospital stay. One such factor may be the interaction between the family and the hospital staff [2,3,7]. Another factor may be the staff communication skills [2,3,7]. This emphasizes the importance of the role of the coordinators. One of the most important jobs of the coordinators is to dissociate any negative feelings regarding the hospital stay or care from the request for organ donation, that is in order to increase the chance of donation [7,8].

STRENGTHS AND LIMITATIONS
Our study has both limitations and strengths. The strength of our study may be due to the fact that the Rabin Medical Center is one of the six Level I trauma centers in Israel and accounts for over 70% of the organ transplantations in the country [1]. This fact may also be a bias due to higher awareness of the staff. In addition, our study has some limitations. First, although we have reviewed all trauma victims who eventually became potential organ donors over a 10-year period, our study population was still relatively small in size making statistical analysis difficult. Second, the study population included people of different origins (North and South America, Eastern and Western Europe, Africa, North Africa, and the Mediterranean region), different religions (Jews, Muslims, and Christians), and different levels of religious observance (orthodox, conservative, reform, traditional, and secular). This diversity could be both a limitation and a strength. Previous studies have shown that with increasing religious observance, the consent rate decreases [3,10]. However, in our study there were no data on the distribution of religious observance among the different religions. Thus, if one group (Christians, Muslims or Jews) had a greater proportion of orthodox (or secular) compared to the other groups, it might have affected the results. Nevertheless, this diversity is also a strength since it makes the conclusions of this study relevant to the general population in Israel and other countries worldwide.

CONCLUSIONS
Over the 10-year study period, only a small percentage of all in-hospital trauma deaths (13.7%) were potential solid organ donors and less than half became actual donors. Despite this, trauma casualties accounted for almost 30% of the deceased organ donations at Rabin Medical Center. Of all the donor factors studied, only female gender or Jewish religion were associated with higher consent rates. Understanding the factors influencing these family decisions might lead to identifying modifiable factors associated with consent to donate.

<table>
<thead>
<tr>
<th>Table 1. Consent to organ donation according to the deceased characteristics</th>
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<tr>
<td>Gender Male</td>
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<td>Female</td>
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<td>Religion Jewish</td>
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<td>Muslim</td>
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<td>Christian</td>
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<td>Other</td>
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<tr>
<td>Mechanism of injury Motor vehicle collision</td>
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<tr>
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<tr>
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<td>Other</td>
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<td>Only torso surgery</td>
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<td>Only orthopedic surgery</td>
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<td>Brain and torso surgery</td>
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**Capsule**

**Sequence of immunotherapy matters**

Immune checkpoint blockade is clinically successful in various cancer types, yet many treated patients relapse. Determining effective combination therapies that induce systemic antitumor immunity is crucial. Immune checkpoint blockade combined with local radiation can improve antitumor responses, but it remains unclear how the sequence of these therapies alters efficacy. Wei et al. used mouse tumor models to demonstrate that treatment with anti–PD-1 after stereotactic body radiation therapy (SBRT) elicited superior systemic antitumor immunity, abscopal effects, and protection compared with anti–PD-1 given before SBRT. These data were correlated with improved intratumoral CD8+ T cell responses and decreased CD8+ T cell death in local and distant tumors. This work provides preclinical rationale for giving anti–PD-1 after SBRT in patients with cancer. 

Sci Immunol 2021; 6: eabg0117

Eitan Israeli

**Capsule**

**Patterns and bottlenecks transmission and wider dissemination of corona variants**

A year into the severe acute respiratory syndrome coronavirus 2 pandemic, we are experiencing waves of new variants emerging. Some of these variants have worrying functional implications, such as increased transmissibility or antibody treatment escape. Lythgoe and colleagues have undertaken in-depth sequencing of more than 1000 hospital patients’ isolates to find out how the virus is mutating within individuals. Overall, there seem to be consistent and reproducible patterns of within-host virus diversity. The authors observed only one or two variants in most samples, but a few carried many variants. Although the evidence indicates strong purifying selection, including in the spike protein responsible for viral entry, the authors also saw evidence for transmission clusters associated with households and other possible superspreader events. After transmission, most variants fizzled out, but occasionally some initiated ongoing transmission and wider dissemination.

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Eitan Israeli

**Capsule**

**Kids armed with anti-coronavirus B cells**

It remains unclear whether B cell repertoires against coronaviruses and other pathogens differ between adults and children and how important these distinctions are. Yang et al. analyzed blood samples from young children and adults, as well as tissues from deceased organ donors, characterizing the B cell receptor (BCR) repertoires specific to six common pathogens and two viruses that they had not seen before: Ebola virus and severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Children had higher frequencies of B cells with convergent BCR heavy chains against previously encountered pathogens and higher frequencies of class-switched convergent B cell clones against SARS-CoV-2 and related coronaviruses. These findings suggest that encounters with coronaviruses in early life may produce cross-reactive memory B cell populations that contribute to divergent COVID-19 susceptibilities.

Science 2021; 372: 738

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