

The Cost of Altruism: Patient Charges for Organ Donation After Traumatic Injury

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Abstract

OBJECTIVE: To determine the origin and extent of institutional charges incurred by lethally-injured patients while awaiting the diagnosis of brain death and organ procurement.

DESIGN: Retrospective review.

SETTING: Surgical Intensive Care Unit, Urban Tertiary Care Trauma Center.

PATIENTS: 31 lethally-injured patients awaiting the diagnosis of brain death and subsequent organ procurement.

INTERVENTIONS: None.

MAIN OUTCOME MEASURES: Itemized hospital financial and medical records were reviewed. Length of stay and major medical complications were abstracted and charges calculated for three overlapping time periods : total hospital stay, lethal injury stay (period following documentation of a "lethal injury" until a second brain death exam was performed), and brain death stay (period between the first and second brain death exams).

RESULTS: Multiple medical complications (3.2 ± 0.2) and interventions occurred in all patients awaiting the diagnosis of brain death. The mean length of lethal injury stay was 19 ± 2 hours; the mean length of brain death stay was 12 ± 1 hours. As a result, significant (lethal injury stay - \$20,902 \pm 1409 and brain death stay - \$16,645 \pm 1223) hospital charges were accrued. Even though a "lethal injury" had been documented, and care was targeted solely at maintaining organ function, these charges were not subsidized by the local organ procurement organization (OPO).

CONCLUSIONS: 1. Numerous medical complications are common in the traumatized patient awaiting the declaration of brain death. These require aggressive critical care interventions and management. 2. Significant hospital charges are accrued by patients for the care necessary prior to organ procurement. 3. OPOs must consider and enact reimbursement policy change to cover the cost of care before brain death is declared in all organ donors.

INTRODUCTION

More than 38,000 patients are currently awaiting organ transplantation.¹ Nearly 2000 additional patients die each year while on organ transplantation waiting lists.² A shortage of donor organs is primarily responsible for these staggering numbers. The altruistic spirit of donors and their families is cited as the major impetus for organ donation. In this regard, altruism is thought to bear little or no expense, and it is generally agreed that organ donation should add no financial burden to the family of an organ donor.³

Attempts to increase referrals to organ procurement organizations (OPOs) by enacting required request laws have been undertaken, but have largely had little impact on organ donation rates.⁴ Once a potential organ donor is identified and referred to an OPO, actual organ procurement rates continue to be suboptimal.^{5,6} Failure to obtain consent from the next of kin remains the single largest cause of

eligible organ procurement failure, with more than 40% of families refusing donation.⁵⁻⁷

Once the family has consented, the multiple physiologic derangements which the potential organ donor manifests require aggressive, labor intensive management in order to maintain organ function until legal brain death is declared and procurement can be undertaken. One recent review suggests that the medical failures to organ procurement may be largely preventable with invasive hemodynamic monitoring, aggressive rewarming, and liberal transfusion therapy.⁷ This high level of care necessary to sustain potential organ donors until legal brain death is declared (and the OPO assumes financial responsibility for care) is expensive, and to date has not been itemized and reported as a part of the cost of the organ procurement process. We investigated the origin and extent of institutional charges incurred by lethally-injured patients while awaiting the

medical and legal determination of brain death.

MATERIALS AND METHODS

With cooperation from the Delaware Valley Transplant Program (local OPO), traumatically injured organ and tissue donors cared for between 1991 and June 1995 at the University of Pennsylvania Medical Center (an urban Level 1 trauma center) were identified. OPO and medical records for these patients were reviewed. Demographic information, including age, sex, and mechanism of injury were abstracted. In addition, the timing of specific diagnostic studies and therapies (i.e. lab studies, radiographs, medications, transfusions) was recorded for concurrent financial analysis.

The presence or absence of specific major medical complications during the hospital stay was determined by medical record review.

Complications were defined as:

1. Cardiovascular Instability -need for blood pressure support with a vasopressor;
2. Cardiovascular Instability -need for invasive hemodynamic monitoring with a Swan Ganz catheter;
3. Anemia - need for transfusion of packed red blood cells;
4. Coagulopathy - need for transfusion of fresh frozen plasma or platelets;
5. Diabetes Insipidus - need for treatment with vasopressin infusion. Because of their depressed neurologic status, all patients were maintained on mechanical ventilation. Therefore, pulmonary complications were not thought to add significantly to charges, and the incidence of respiratory insufficiency was not calculated.

At the University of Pennsylvania, legal brain death is defined by

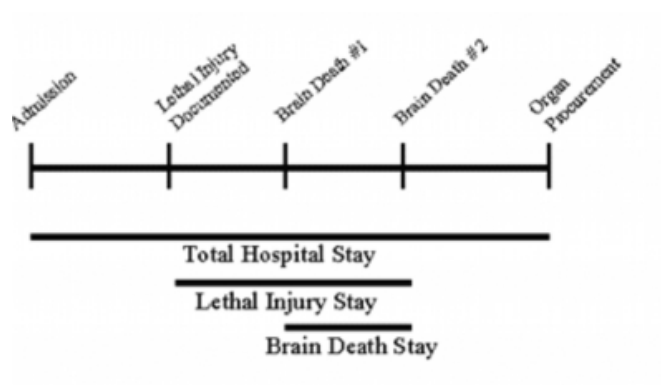
1. two neurologic examinations demonstrating lack of cortical and brainstem function performed twelve hours apart; or,
2. two neurologic exams performed six hours apart along with a confirmatory test (e.g. electroencephalogram) documenting lack of cortical function.^{8,9}

For each patient, the specific timing of the first and second brain death exams was recorded. In addition, the timing of medical record documentation of a “lethal injury” by the consultant neurosurgeon was noted. Finally, the exact time of organ harvest (or death) was recorded. Three overlapping time periods were subsequently identified for financial analysis (Figure 1):

1. Total Hospital Stay (THS) -the period from admission until organ harvest or death;
2. Lethal Injury Stay (LIS) -the period from documentation of a lethal injury until the second brain death exam or death; and
3. Brain Death Stay (BDS) - the period between the first and second brain death exams.

Figure 1

Figure 1



TIME PERIOD DEFINITION

Figure 1. Time line constructed for financial analysis. Time periods are defined in text.

Itemized financial records of all patients were reviewed concurrently with the medical record. The timing of diagnostic studies and therapeutic maneuvers was cross referenced with the itemized hospital bill. Individual item charges were then credited to specific time period(s) as described above. Of note, charges associated with diagnostic studies specifically ordered by (and billed to) the OPO during the LIS or BDS which were part of the donor evaluation process (e.g. echocardiography, hepatitis serology) were not credited as LIS or BDS charges, but only as THS charges. All charges from 1991 to 1993 were adjusted for inflation; the results therefore are presented in 1994 dollars.¹⁰

All data are displayed as mean standard error of the mean.

RESULTS

31 donors were identified between 1991 and June 1995. Demographic data are displayed in Table 1. Reflective of the urban trauma population, donors most commonly were young, African-American males who had sustained a gunshot wound to the head. 28 patients were declared brain dead, and went on to donate 4.1 +/- 0.2 organs/donor. 3 patients did not progress to brain death. All three patients expired in the intensive care unit, and subsequently were tissue donors. Because these three patients did not reach their second brain death examination, they were excluded from the BDS group, but still included in the THS and LIS groups.

Figure 2

Table 1

AGE	(years)	28 +/- 3
SEX	Male	22 = 71%
	Female	9 = 29%
RACE	African-American	19 = 61%
	White	11 = 35%
	Other	1 = 3%
MECHANISM OF INJURY	Penetrating	20 = 65%
	Blunt	11 = 35%

Length of stay was calculated for the three time periods defined. Mean total hospital stay from admission until organ procurement (or death) was 28 +/- 3 hours. Brain death was declared a mean of 19 +/- 2 hours after a lethal injury was first documented in the medical record, and 12 +/- 1 hours after the first brain death examination was performed.

Major medical complications during the hospital course were reviewed. One hundred percent of patients developed one or more major complications. A mean of 3.2 +/- 0.2 complications/patient were identified. (Table 2) Hypotension requiring intervention with one or more vasopressor agents was the most common of these complications. Hematologic complications (anemia and coagulopathy) requiring component therapy were also frequently noted.

Figure 3

Table 2

MEDICAL COMPLICATION	MEDICAL TREATMENT	N	%
Cardiovascular Instability	Vasopressor	27	87%
Cardiovascular Instability	Swan Ganz	9	29%
Anemia	Transfusion	25	81%
Coagulopathy	Transfusion	22	71%
Diabetes Insipidus	Vasopressin	14	45%

Itemized financial records of all 31 patients were reviewed. Charges for specific diagnostic studies and therapeutic maneuvers were identified. These charges were cross referenced with the medical record and individual charges were credited to specific time period(s). (Table 3) Mean charges for the total hospital stay, including organ procurement procedures, were \$63,027 +/- 5204. Mean charges accrued after a lethal injury was documented until brain death was declared were \$20,902 +/- 1409. Mean charges accrued during the brain death stay were \$16,645 +/- 1223.

Figure 4

Table 3

TIME PERIOD	N	CHARGES/PATIENT
Total Hospital Stay	31	\$63,027 +/- 5204
Lethal Injury Stay	31	\$20,902 +/- 1409
Brain Death Stay	28	\$16,645 +/- 1223

DISCUSSION

Throughout the United States, the shortage of organs has reached critical proportions, and despite national efforts to increase the supply, six patients a day die while awaiting solid organ transplantation.² Attempts to increase referrals to organ procurement organizations (OPOs) by enacting mandatory request laws have had minimal impact on organ donation rates.⁴ Once a potential organ donor is referred to an OPO, the failure to obtain consent from the next of kin remains the single largest cause of eligible organ procurement failure, with more than 40% of families refusing donation.⁵⁻⁷ Since 1990, firearms have surpassed motor vehicle crashes as the single largest cause of lethal traumatic brain injury.¹³ This trend is consistent with our findings. (Table 1) Unfortunately, individuals most likely to be involved in interpersonal firearm violence seem to come from families less likely to agree to organ donation when compared to the general population.^{14,15} Multiple efforts to

educate the population at large on the societal benefits of organ donation are underway, but still, the impetus to donate remains largely one based on altruism.

Throughout the hospitalization until organ procurement or cessation of life support, the potential organ donor manifests daunting medical challenges. Major medical complications were universal in this study population. A mean of 3.2 +/- 0.2 major complications/patient were identified. (Table 2) Hypotension requiring treatment with vasopressors and invasive hemodynamic monitoring was the most frequent complication. Hematologic abnormalities requiring blood component transfusion were also seen in over 80% of patients. Additional complications, such as hypernatremia, hypothermia, and respiratory insufficiency were also common. These results are consistent with other studies which have reported similar experiences during potential organ donor management.^{16,17,18} Of note, the incidence of coagulopathy reported in our series as well as other donor populations from trauma is higher than the incidence reported in the general organ donor population.^{16,18} This is most likely explained by the prevalence and nature of the lethal brain insult in the trauma population.

Unfortunately, 17-25% of potential organ donors are lost due to medical failure.^{5,7} One recent review suggests that the medical failures during the time leading to actual organ procurement may be largely preventable with early invasive hemodynamic monitoring, aggressive rewarming, and liberal transfusion therapy, all readily available in a modern critical care setting.⁷ This aggressive management, which is necessary to maintain organ function until legal brain death is declared and procurement can be undertaken, is extremely labor and resource intensive.^{5,7,16-19} As a result, significant costs are accrued and charges generated while awaiting the legal declaration of brain death.

In this study, the mean charge for total hospital stay, was \$63,027 +/- 5204. This total amount included charges accrued during initial evaluation in the trauma resuscitation area, during the intensive care unit stay, and during actual organ procurement. As is the national standard, all charges accrued after the patient was declared legally brain dead, as well as charges for diagnostic studies specifically ordered by the organ procurement organization (OPO) during the LIS or BDS which were part of the donor evaluation process (e.g. echocardiography, hepatitis serology), are the responsibility of the local OPO.²⁰ Charges accrued before the legal determination of brain death were not billed to the local

OPO. In this study, these included \$20,902 +/- 1409 in charges accrued after a lethal injury was documented but prior to the second brain death examination required by the hospital's policy for determination of brain death.⁸ More specifically, \$16,645 +/- 1223 in patient charges were accrued between the first and second brain death examinations.

The legal definition of brain death may vary from institution to institution and state to state. At the Hospital of the University of Pennsylvania, legal brain death is defined briefly by

1. two neurologic examinations demonstrating lack of cortical and brainstem function performed twelve hours apart; or,
2. two neurologic exams performed six hours apart along with a confirmatory test (e.g. electroencephalogram) documenting lack of cortical function.^{8,9}

In addition, a cerebral blood flow test (infrequently ordered at our institution) showing lack of cerebral blood flow may be used to declare legal brain death. Other definitions of brain death may dramatically shorten the brain death stay, thereby greatly reducing charges (and costs) generated during this time period. We are currently examining whether the charges associated with a cerebral blood flow study (and resultant shorter brain death stay) may actually result in a decreased total charge.

We specifically examined institutional charges, and not costs associated with the care of the potential organ donor. Charges are dollar amounts billed by health care providers and therefore have the advantage of being specific to an individual procedure and relatively easy to obtain.²¹ We were not able to study the professional (MD) charges, and recognize that a more complete picture would have been presented had we done so. Utilizing charges is somewhat misleading in that charges bear little relationship to costs, and are widely variable between institutions.²² However, charges may be related to costs in a proportional sense, and are therefore useful in measuring relative resource consumption.²¹ In addition, because this manuscript addresses issues pertinent to health care utilizers (the families of potential organ donors), as well as to health care providers, we felt that the examination of charges rather than costs was relevant.

Transplant costs can be broken down to include pre-transplantation (registration, evaluation), the transplantation itself (including organ acquisition), and post-transplantation (immunosuppression, complications).²¹ Financial responsibility for charges accrued during the lethal injury or brain death stays potentially falls into the realm of organ acquisition costs. The elements of organ acquisition costs currently include tissue typing, donor and recipient evaluation, donor care (post declaration of legal brain death), operating room services for organ harvest, surgeon fees, transportation, preservation supplies, and other miscellaneous costs. In 1994, the standard acquisition charge for a kidney, which represented the fee charged by an OPO for procurement of an organ intended for transplantation, was \$12,749.¹¹ Standard acquisition charges (SAC) for other solid organs were similar. (Table 4) In 1985, these charges were estimated to account for nearly 40% of the overall cost of kidney transplantation.²³ While these charges are significant, they currently represent less than 14% of the average amount billed for kidney transplantation, and less than 6% of the average billed for liver transplantation. (Table 4)

Figure 5
Table 4

ORGAN	SAC	RECIPIENT CHARGES
Kidney	\$12,749	\$92,700
Liver	\$15,403	\$280,200
Heart	\$13,651	\$222,700
Lung	\$13,528	\$265,100

Average standard acquisition charges (SAC) for individual organs, 1994.¹¹

Average total recipient charges for organ transplantation, 1994.¹²

Who should bear the cost accrued by organ donors before brain death is declared and the local OPO assumes financial responsibility? This is not an easy question to answer. Currently, these charges are either:

1. written off by the hospital;
2. referred to the appropriate public or private insurance provider; or

3. referred to the family of the organ donor.

If the care rendered to the potential organ donor during this time period is targeted solely at maintaining organ function, then one might argue that the charges be referred to the local OPO, and be passed on as part of the standard acquisition charge. Since the local OPO at the Hospital of the University of Pennsylvania reimburses 35% of the amount charged, this would equate to \$7316 for the lethal injury stay, or \$5826 for the brain death stay. With an average of 4.1 +/- 0.2 organs/donor being procured, this would translate into an increase in the standard acquisition charge of \$1421 (BDS) to \$1784 (LIS) for each organ. While this would represent nearly a 10 - 15% increase in the SAC for solid organs, the percent increase in the organ recipient bill would be quite small.

This study has several obvious shortcomings: small study size, retrospective descriptive nature, and the use of only institutional charge (as opposed to cost) data. In addition, we were not able to determine the ultimate outcome of these charges. Still, this study does point out that a large cost of care accumulates and is passed on to someone (taxpayer, hospital, insurance company, or family) in the process of supporting organs for transplantation. At the institutional level, brain death protocols should be designed to shorten brain death stays as much as medically, ethically, and legally possible. This would reduce costs, regardless of who ultimately subsidizes the process. For costs that do accrue during the determination of brain death, our proposal for reimbursement is provided as more of a question than an ultimate solution. This problem should be addressed by OPOs and the national organ procurement agency of the Department of Health and Human Services. These huge costs are currently not covered, and knowledge and fear of their impact on the families of potential organ donors may be a significant cause of failure to obtain consent from next of kin. Relieving families of this burden may enhance organ procurement rates.

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