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Article

Identification of the Interaction Patterns between Adult to Adult Living Liver Transplant Recipients and Donors during the Preoperative Hospitalization Period and Associated Factors[1)]

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Living donor liver transplantation (LDLT) inevitably requires the following condition; i.e., it needs both a recipient and a donor who will undergo surgery at the same time for the same purpose. The objective of this study was to identify the physical and psychosocial conditions of recipients and donors in the immediate preoperative period and the patterns of interaction between recipients and donors. We employed an exploratory descriptive study design that analyzed both quantitative and qualitative data. The study included 9 recipient–donor pairs at one University Hospital. The variability in the severity of cirrhosis in the recipients had an impact on not only the recipients' psychosocial condition, but also the donors' psychosocial condition, and consequently on their interaction pattern. The 3 characteristic patterns of interaction were identified as: the "comrade/bond", "self-will reinforcement", and "avoidance" types of interaction. The identified patterns of preoperative recipient–donor interaction in this study will hopefully contribute to reducing the embarrassment and distress of nurses and to encourage them to actively intervene with recipients and donors.

key words: liver transplantation, living-related donor, interaction pattern, preoperative period

Introduction

Liver transplantation in Japan has always depended on living donors, and in the West, a shortage of brain-dead donors means that an increasing number of living donor liver transplantations (LDLT) are being performed (Horiuchi, 2012). Living donor organ transplantation involves excising an organ from a healthy living person and thus, from an ethical perspective, necessarily requires the donor's voluntary decision to donate as well as the donor's safety. Among the different types of organ transplantation from living donors, liver transplantation is associated with a particularly high degree of surgical invasiveness for the donor, with some fatal cases being reported (Strong, 2006; Trotter, Rene, Lo, & Kenison, 2006). Adult-to-adult LDLT is an especially high-risk procedure involving extensive hepatectomy and is associated with safety issues that remain to be solved (Clavien, Dutkowski, & Trotter, 2009). This type of transplantation has also been associated with postoperative complications or sequelae and has an impact on returning to normal life. (Ghobrial, Freise, Trotter, Tong, Ojo, Fair, Fisher, Emond, Koffron, Pruett, Olthoff, & AZALL, 2008).

In Japan, although no laws or regulations are in place regarding living donor organ transplantation, the Japan Society for Transplantation guidelines state that only the patient's blood relatives can be living donors (Fujita, Matsui, Monden, & Akabayashi, 2010). This leaves patients waiting for a living donor transplant and their family with no other choice but to find a donor candidate within the family. Thus, having little real choice, donor candidates within the family decide to become a donor (Fujita, Akabayashi, Slingsby, Kosugi, Fujimoto, & Tanaka, 2006).

Living related donor liver transplantation naturally requires that there is both a recipient and a donor and it provides a unique situation where the two individuals undergo surgery at the same time for the same purpose. Previous studies have shown that do-

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nors decide to donate their organs and undergo surgery in order to save the recipient's life and that the recipients are not only thankful for this, but also express sorrow for the donor (Watanabe & Inoue, 2011) and experience an emotionally chaotic situation (Forsberg, Bäckman, & Möller, 2000). However, previous studies have considered only the recipient's or the donor's view about the other, and no studies to date have considered the interactions that occur between them.

Therefore, the objective of this study was to characterize the patterns of interaction between LDLT recipients and donors in the immediate preoperative period, during which time their anxiety appears to peak and, by identifying the factors associated with each pattern, provide insights into suitable nursing interventions.

Methods

1. Study design

Physical condition can be measured quantitatively using a physical assessment tool, whereas for psychosocial factors—in particular, motivation and decision making regarding the impending operation—no specialized tool has been developed for living donor organ transplantation. Moreover, no study has examined the interactions between living organ transplant recipients and their donors. With the aim of characterizing the physical and psychosocial conditions of recipients and donors waiting for surgery and the patterns of interaction between them, we employed an exploratory descriptive study design that analyzed both quantitative and qualitative data (Creswell & Plano, 2007).

2. Subjects

The study included 9 recipient–donor pairs scheduled to undergo LDLT surgery at University Hospital A, one of the highest volume centers for LDLT in Japan. Inclusion criteria recipient-donor pairs were required to: 1）be more than 20 years of age; and 2）speak Japanese in daily life. Patients in a state of unconsciousness due to fulminant hepatitis or hepatic encephalopathy and emergency cases were excluded.

3. Data collection

Data was collected from February 2010 to March 2012. The physical and psychosocial conditions of the recipients and donors were investigated during the preoperative hospitalization period. A participant observation survey was conducted during the period in which both the recipient and donor were admitted so as to understand the actual status of the recipient–donor relationship/interaction and characterize the interaction patterns between them. During the survey, the author went in and out of the recipient's and donor's rooms to observe their interactions with each other. After the date of discharge of each subject as determined by the physician, we conducted a semi-structured interview. The interview took approximately 60 min and was tape-recorded (Table 1).

Table 1 Interview guide

Recipient
Please tell me how you feel after surgery?
Did you have any time to spend with the donor during the hospitalization?
What did you talk about with the donor?
Were you influenced by spending time with the donor? How did it affect you?
Donor
Please tell me how you feel after donate?
Did you have any time to spend with recipient during the hospitalization?
What did you talk about with the recipient?
Were you influenced by spending time with the recipient? How did it affect you?

4. Parameters for the Assessment

1） Attributes and social background

Age, sex, ABO blood group, occupation, family structure, relationship between recipient and donor, and preoperative interaction status.

2） Hospitalization situation

Number of hospitalization days before surgery.

3） Physical condition

(1) Recipient

ⅰ Condition of liver

Medical records were reviewed for the primary disorder leading to the decompensated cirrhosis and for the severity of cirrhosis, which was assessed by Child-Pugh and Model for End-Stage Liver Disease (MELD) scores. The Child-Pugh score is used to assess the prognosis of cirrhosis (Pugh, Murray-Lyon, Dawson, Pietroni, & Williams, 1973), and determine the required strength of the necessity of liver transplantation. The MELD score is an essential tool for determining the eligibility for liver transplantation. Liver transplantation in a patient with a MELD score ≥25 is associated with poor postoperative sur-

vival outcome and should preferably be performed in patients with scores of 15–25 (Uemoto, 2010).

ii General condition

Eastern Cooperative Oncology Group (ECOG)-performance status (PS) was determined.

(2) Donor

i Condition of liver

The type of graft was investigated by medical record.

ii General condition

ECOG-PS and previous medical history were examined.

4) Psychosocial condition

Since there are no psychosocial parameters, specialized for liver transplant recipients and living donors, we conducted in-depth interviews. In the interviews, subjects were asked about the process by which they decided to undergo surgery, changes in their feelings during the process and their recognition to LDLT.

5. Analysis

1) Patients' basic attributes, background, and admission status

The data on the patients' basic attributes and background were summarized for each item and presented with basic statistics.

2) Assessment of psychological condition (willingness for surgery) and identification of associated factors

The interview results were coded and categorized into prompting and dissuading factors to the subjects' decision to undergo surgery. The recipients' willingness to undergo LDLT was classified based on the presence/absence of dissuading factors into the high and low willingness groups. In the same way while the donors' willingness for donation was classified into the high and low willingness groups. In addition, to identify the relationship between willingness for surgery and physical condition, the physical parameter such as Child-Pugh score, MELD score, ECOG-PS were assessed using the Mann–Whitney U test. $p<.05$ was considered significant.

3) Identification of interaction patterns and associated factors

The data from participant observation surgery were coded and categorized in the same manner as for the interview data. From among the categories, those relating to the recipients' or donor's behavior or actions against their counterpart were extracted to identify their interaction patterns. For each interaction pattern, characteristics common to all subjects showing the interaction pattern were extracted to identify the factors associated with the pattern.

The qualitative data analysis results were confirmed by researchers who had experienced in performing qualitative studied.

6. Ethical considerations

This study was approved by the Ethics Committee of Kyushu University Graduate School of Medical Science (approval no. 21–97). The researcher provided verbal and written explanations concerning the purpose and procedures of the study to the candidates before or on the day of admission and obtained written consent from them.

Results

1. Attributes and social background of recipients and donors (Table 2)

Subjects were 4 male and 5 female recipients and 4 male and 5 female donors. Mean age was significantly higher in the recipients (51.2±13.1 years) than in the donors (35.0±8.7 years) ($p=.007$). Among the donors, 8 (89%) were engaged in some kind of work and the remaining donors were house-wives. Thus, all donors played a certain social role or took leave from work to cover the period while hospitalized for surgery. The parent–child relationship accounted for 7 pairs of the recipient–donor relationships (78%) and siblings accounted for 2 pairs (22%). All livers except for one from a mother to her son were donated from a younger to an older family member. Blood type was identical or compatible in 8 pairs (89%), and the procedures were covered by Health Insurance.

2. Preoperative condition of the recipients

1) Physical condition

All had decompensated cirrhosis, with an underlying cause of chronic hepatitis C in 5 (56%) recipients, primary sclerosing cholangitis in 2 (22%), and suspected autoimmune hepatitis in 2 (22%). The mean Child-Pugh score was 10.8±1.9, with 7 (78%) recipients classified as grade C (score 10–15), the worst grade, and 2 (22%) classified as grade B (score 7–9), the second worst grade. The mean MELD score was 18.9 ± 5.5. Furthermore, a significant pos-

Table 2 Demographic characteristics of recipients and donors

Relationship (age)		Occupation		Marital status		Frequency of the interaction in daily life
Recipient	Donor	Recipient	Donor	Recipient	Donor	
Father (50)	Son (23)	Self-employed	Conpany employee	Married	Single	Live together
Father (53)	Son (26)	Self-employed	Self-employed	Married	Single	Live together
Mother (60)	Daughter (33)	Unemployed	Housewife	Married	Married, have children	Live near
Mother (64)	Daughter (35)	Unemployed	Conpany employee	Married	Single	Meet a few times a year
Mother (68)	Daughter (36)	Unemployed	Conpany employee	Married	Single	Live together
Mother (50)	Son (27)	Unemployed	Conpany employee	Married	Married, have children	Live near
Son (23)	Mother (48)	Conpany employee (Leave of absence)	Peasant	Single	Married, have children	Live together
Brother (47)	Sister (44)	Conpany employee (Leave of absence)	Public emplyee	Single	Married, have children	Meet a few times a year
Sister (46)	Brother (43)	Unemployed	Peasant	Married	Married, have children	Meet a few times a year

Table 3 Correlation between physical condition and preoperative hospitalization period

	Age	Child-Pugh score	MELD score	ECOG-PS	Days
Child-Pugh score	.197	—			
MELD score	.243	.815**	—		
ECOG-PS	.489	.678*	.646	—	
Days	.466	.637	.748*	.870**	—

Note. MELD＝Model for End-Stage Liver Disease; ECOG-PS＝Eastern Cooperative Oncology Group-performance status; Days＝Number of hospitalization days before surgery.
*$p<.05$, **$p<.01$

itive correlation was noted between the Child-Pugh score and ECOG-PS; the higher the severity of cirrhosis, the more impaired the activities of daily living. Three patients (33%) developed ascites at levels as high as 1,000 ml, 4,800 ml, and 5,600 ml. The mean preoperative hospitalization period was 7.3 ± 3.0 days, which was significantly and positively correlated with MELD score and ECOG-PS (Table 3).

2) Psychosocial condition

None of the recipients had severe hepatic encephalopathy, and all were able to communicate with donors and investigators without problems. The data on the recipients' psychosocial conditions were collected through an informal interview during participant observation and a postoperative semi-structured interview, then coded and classified into factors prompting and dissuading the recipient in his or her decision to undergo living-donor liver transplantation (Table 4). The process by which re-

Table 4 Prompting and dissuading factors for the recipients' decision to undergo living-donor liver transplantation (LDLT) and their preoperative psychosocial condition

Code	*n* (%)
Promoting factors for the decision to undergo LDLT	
Worsening of the primary disease and physician's proposal of LDLT	9 (100)
Offer of donation from the donor	7 (78)
Experiencing physical deconditioning	6 (67)
Family's encouragement for decision making	5 (56)
Dissuading factors for the decision to undergo LDLT	
Hesitation to undergo LDLT	5 (56)
Temporary acceptance of life expectancy	2 (22)
Preoperative psychosocial condition	
Being relieved by making a decision to undergo surgery	9 (100)
Anxiety over the limit of life (fear of death)	4 (44)

Note. LDLT＝Living donor liver transplantation.

cipients decided to undergo surgery varied: 4 (44%) made a decision immediately after the donor's offer, while the remaining 5 (56%) recipients were initially "hesitant to undergo living-donor liver transplantation".

3) Effects of recipients' physical and psychosocial conditions on their willingness to undergo surgery

The recipients' willingness to undergo LDLT was classified using the codes for preoperative psychosocial condition. Four recipients without any of the dissuading decision-making factors were classified during Perioperative hospitalization period as the high willingness group, while 5 recipients with any one or more of the dissuading factors were classified at the same time as the low willingness group.

In terms of underlying diseases, 2 recipients (20%) with chronic hepatitis C exhibited variable levels of willingness for surgery, those with primary sclerosing cholangitis were generally unwilling to undergo transplantation, and those with suspected autoimmune hepatitis were generally willing to undergo transplantation.

A comparison of Child-Pugh score, MELD score, ECOG-PS, ascites volume, and age between the high and low willingness groups revealed that the MELD score was the only parameter showing a significant difference, being significantly higher in the high willingness group ($p=.27$, Mann-Whitney U test) (Table 5).

3. Preoperative condition of donors

1) Physical condition

Grafts were collected from the right lobe of 6 (67%) donors, the left lobe of 2 (22%) donors, and the posterior segment of 1 (11%) donor. All donors underwent cholecystectomy in conjunction with liver lobectomy. All were admitted to the hospital after the recipient. The mean preoperative hospitalization period was 3.7±1.1 days.

2) Psychosocial condition

The data on the process by which the donors decided to donate their liver were coded in the same way as for the recipients and classified into prompting and dissuading factors for the donor's decision to undergo organ donation (Table 6). In all cases, another donor candidate aside from the selected donor was present within the family, but 7 donors reported "I am the only one that can help the recipient."

3) Effects of recipients' physical condition on donors' willingness to donate

Using the data obtained through participant observation and interviews, we classified the donors' willingness to donate their liver into the high and low willingness groups (Table 7).

Six donors without any of the dissuading factors for the decision to be a donor during Perioperative hospitalization period were classified as the high willingness group. While 3 donors with any one or

Table 5 Comparison of recipients' physical factors and age by their willingness to undergo surgery

	Willingness		*p*	
	High ($n=4$)	Low ($n=5$)		
Physical factor				
Child-Pugh score	11.5±0.6	10.2±2.8	.304	NS
MELD score	23.0±2.9	15.6±4.9	.027*	
ECOG-PS	2.3±1.3	1.3±1.3	.258	NS
Ascites	300±476	2080±2862	.788	NS
Psychosocial factor				
age	50.8±6.4	51.6±17.6	.389	NS

Note. MELD=Model for End-Stage Liver Disease; ECOG-PS=Eastern Cooperative Oncology Group-performance status.
*$p<.05$.

Table 6 Prompting and dissuading factors for the donors' decision to donate and their preoperative psychosocial condition

Code	*n* (%)
Prompting factors for the decision to be a donor	
Being informed of the life expectancy of the recipient	9 (100)
Being aware that the transplantation is the only viable option	8 (89)
Seeing physical deconditioning in the recipient	7 (78)
I am the only one that can help the recipient	7 (78)
I can't force anyone else to be a donor	6 (67)
Established closeness to the recipient	6 (67)
Perception of the recipient's preparedness for surgery	6 (67)
Dissuading factors for the decision to be a donor	
The presence of another donor candidate	3 (33)
The lack of the recipient's preparedness for surgery	2 (22)
Preoperative psychosocial condition	
Being happy to see that the recipient and other family members are relieved	6 (67)
Being ready for surgery without major anxiety	4 (44)

Table 7 Comparison of donors' physical and psychosocial factors by their willingness to donate (%)

	Willingness	
	High $n=6$	Low $n=3$
Physical Factor		
Right lobe hepatectomy	4 (67)	2 (67)
Extended left hepatic lobectomy	1 (17)	1 (33)
Left lateral lobe hepatectomy	1 (17)	0
Psychosocial Factor		
Sex		
Female	2 (33)	3 (100)
Male	4 (67)	0
Occupation		
Have	5 (83)	3 (100)
None	1 (17)	0
Relationship with recipient		
First-degree	5 (83)	2 (67)
Second-degree	1 (17)	1 (33)
Frequency of the interaction with recipient		
Live together or near	5 (83)	1 (33)
Meet a few times a year	1 (17)	2 (67)

Table 8 Comparison of recipients' physical factors and age by donors' willingness to donate

	Donors' willingness		p	
	High $n=6$	Low $n=3$		
Physical factor				
Child-Pugh score	11.7±1.2	9.0±2.6	.068	NS
MELD score	20.3±2.2	16.0±9.5	.515	NS
ECOG-PS	2.2±1.2	0.67±1.2	.111	NS
Psychosocial factor				
age	54.5±8.1	44.7±20.6	.319	NS

Note. MELD＝Model for End-Stage Liver Disease; ECOG-PS＝ Eastern Cooperative Oncology Group-performance status.

more of the dissuading factors were classified at the same time as the low willingness group.

We then examined the relationships between the donors' willingness to donate their liver and the recipients' physical condition (Table 8). The recipients of the donors with high level willingness for donation had a mean Child-Pugh score, MELD score, ECOG-PS, and age were higher than the other groups. However, there was statistically not a significant difference.

4. Patterns of recipient-donor interaction and associated factors

In all pairs, the recipient and the donor were first- or second-degree relatives. Therefore, in all pairs, a certain recipient-donor interaction was observed at varying frequencies during the preoperative hospitalization period. The results of participant observation and postoperative semi-structured interviews revealed 3 characteristic patterns of interaction: the "comrade/bond", "self-will reinforcement", and "avoidance" types of interaction (Table 9).

Table 9 Preoperative interaction patterns

[Interaction]	pattern description
[Comrade/bond type] 2 Pairs (22%)	
	The donor assists the recipient with eating
	The donor assists the recipient with taking medicine
	The donor takes the recipient to the test room
	The donor prepares necessary surgery documents for the recipient
	The donor checks with the recipient if all the necessary documents are in place
	The donor checks with the recipient if all the necessary items for surgery are in place
	The donor tries to alleviate the recipient's guilt
	The donor and recipient encourage each other to be ready for surgery
[Self-will reinforcement type] 3 Pairs (33%)	
	The recipient re-conveys his or her preparedness for surgery to the donor
	The recipient re-asks the donor about his or her willingness to donate liver
	The donor asks if donating their liver makes his or her parent happy
	The donor emphasizes to the recipient the significance of donating his or her liver
	The donor asks the recipient to be nice to him or her after surgery is completed
[Avoidance type] 4 Pairs (44%)	
	I don't know what we will talk about if we meet immediately before surgery
	I see no need to talk about surgery again with him or her

The "comrade/bond" interaction pattern is characterized by a substantial length of time shared by the recipient and donor in which they encourage each other to be prepared for surgery during the preoperative hospitalization period. The "self-will reinforcement" interaction is used by recipients and donors trying to find factors that reinforce their decision to undergo surgery through interacting with each other. The "avoidance" type refers to the pattern of interaction in which the recipient and donor intentionally avoid talking about the surgery, even though they are in the hospital waiting for it to happen.

Table 10 Patterns of recipient-donor interaction and associated factors

Interaction patterns	Factor				
	Physical	Psychosocial			
	Recipient's conditions	Recipient's willingness	Donor's willingness	Relationship between recipient and donor	Frequency of the interaction in daily life
[Comrade/bond type]	Child-Pugh Grade C MELD 22, 23	High	High	Parent and Child	Living near
[Self-will reinforcement type]	Child-Pugh Grade C MELD 14, 17, 19	Low	High	Parent and Child	Living together
[Avoidance type]	Child-Pugh Grade C MELD 20, 27	High	—	Sibling	Meet a few times year
	Child-Pugh Grade B MELD 10, 11	Low	Low	Parent and Child	—

Note. MELD＝Model for End-Stage Liver Disease.

We then attempted to identify the factors associated with each pattern (Table 10). Regarding the "comrade/bond" interaction pattern, both recipients had liver cirrhosis corresponding to Child-Pugh grade C and were willing to undergo surgery. Moreover, unlike other recipients, they conveyed to their donors their strong will to live and willingness to undergo surgery. The donors perceived the recipients' strong will and consequently showed high-level willingness to donate their liver.

Regarding the factors associated with the "self-will reinforcement" interaction, all of the recipients had severe liver cirrhosis corresponding to Child-Pugh grade C but were unwilling to undergo surgery, while all donors showed high willingness to donate, respectively. All 3 pairs were child-to-parent donation cases, and all children were unmarried and lived with their parents. This interaction pattern involves subtle and complex aspects, such as trying not to offend each other's feelings, and is likely to exist between two people with a small psychological distance between each other. Based on these observations, the recipient's unwillingness—despite severely impaired liver function—to undergo surgery because of hesitation to create a surgical wound on the donor, who is close to the recipient, was identified as a factor associated with the "self-will reinforcement" interaction. The recipients reinforced their decision by hesitantly confirming the donors' willingness to donate. On the other hand, the donors who had lived with the recipients had first decided to become a donor after seeing the recipients' suffering, although with varying levels of willingness. However, after seeing an indecisive recipient who had not made up his or her mind even immediately before surgery, the donors started doubting their decision and then actively tried to find the meaning of donation through conversations with the recipient to keep their decision from being undermined.

The "avoidance" type refers to the pattern of interaction in which the recipient and donor intentionally avoid talking about the surgery, even though they are in the hospital waiting for it. The pairs which preoperative interaction status was "meet a few times a year" showed this pattern. Further the pairs which recipient and donor willingness were low also showed this pattern.

Discussion

The processes by which the recipients and donors decided to undergo LDLT and their physical and psychosocial conditions during the preoperative hospitalization period were variable.

Recipient- and donor-related factors

As expected from the fact that liver transplantation is indicated for patients with end-stage liver disease, all recipients had decompensated cirrhosis. Liver transplantation is recommended when the estimated survival rate after transplantation is higher than that without transplantation, which corresponds to a Child-Pugh score ≥7 (i.e., Child-Pugh grade B or higher) or a MELD score ≥15 (Murray & Carithers, 2005). All the recipients in the present study had cirrhosis for which liver transplantation is recommended, but the severity of cirrhosis was vari-

able. This variability in the severity of cirrhosis, a physical factor, among recipients had an impact on not only the recipients' psychosocial condition, but also the donors' psychosocial condition, and consequently on their interaction pattern.

The Child-Pugh score and the Child-Pugh grade based on this score are consistent with the severity of the recipient's subjective symptoms. In this study, only those recipients classified as Child-Pugh grade C experienced physical deconditioning, which influenced their willingness for surgery. As the severity of cirrhosis advanced, the recipients suffered more from physical deconditioning, creating a sense of crisis in their own life. Patients for whom no alternative treatment is available other than liver transplantation tend to have a strong fear of death and pin their last hopes on liver transplantation to escape from thoughts of losing their life (Watanabe & Inoue, 2011). The varying severity of cirrhosis among the recipients also influenced the donors' psychosocial condition. A higher severity of cirrhosis among the recipients was associated with a higher willingness among donors to donate, leading to increased willingness for surgery among both parties.

All donors were in good health without any physical problems. One of the characteristic features found in the donors was varying levels of willingness to donate. According to the criteria described by Yi (2003), suggesting that about half of them underwent surgery with ambivalent feelings. Yi also reported that although more than half of the donors' decisions were voluntary, not all of the donors voluntarily decided to donate their liver. Although based on nearly 10 years of observations, Yi's results suggest that the distribution of willingness levels for living organ donation is similar among countries.

The major factors influencing the donor's willingness to donate were the severity of the recipient's cirrhosis and the donor's awareness of it. Specifically, if the donor was in frequent contact with the recipient in daily life, he or she was more likely to see the recipient's suffering and tended to be willing to donate.

It has been suggested that cultural background also influences the donors' decision-making process. This is especially important in countries of collectivist cultures, such as Japan, where strong involvement of the family and a strict moral sense of duty can pressurize donors (Schulz & Kroencke, 2011). However, Papachristou, Walter, Frommer, & Klapp, who carried out a similar study in different countries, also showed that LDLT donors decide to donate their liver not because they were totally convinced, but rather based on a feeling of resignation (Papachristou et al., 2010). These findings reveal that the donor's decision to donate is not always voluntary, despite it being considered an essential aspect of living-donor organ transplantation.

Patterns of recipient–donor interaction during the preoperative hospitalization period and their implications for nursing

1) The "comrade/bond" pattern

Those donors showing the "comrade/bond" interaction pattern gave priority to saving the recipient's life, while their recipients also considered transplantation as a collaborative effort with the donor. Hayashi, Noma, & Uehara (2007) showed that when the donor's decision to donate liver is voluntary, both the donor and recipient have lower levels of state anxiety and a higher QOL (quality of life), with a positive correlation between the two factors. The present study provided more specific illustrations of this situation. The "comrade/bond" interaction pattern was seen when the limit to the recipient's life was approaching, when the recipient wished to continue living, and when the donor really wanted to save the recipient's life.

Since the ultimate goal of recipients and donors showing this interaction pattern is to save the recipient's life, the donor's grief over failing to achieve this goal as a result of surgery is immeasurable. Recipients showing this interaction pattern tend to have severe cirrhosis and may thus have a poor postoperative outcome. Therefore, psychological care should be provided for donors showing this interaction pattern, especially when the recipient has a poor postoperative outcome.

2) The "self-will reinforcement" pattern

The "self-will reinforcement" pattern was associated with the recipient's low level of willingness for surgery. These recipients' decision to undergo transplantation was based on the donors' and other family members' wishes to save and extend the recipient's life. The recipients expressed these factors as "an offer of donation from the donor" and "family's encouragement for decision making."

Donors are asked by physicians of multiple

specialties about their intention for organ donation before being admitted to the hospital. None of the donors expressed hesitation to medical professionals or investigators during the preoperative period on donating their liver. Nevertheless, at the postoperative interview, some of them mentioned the dissuading factors behind their decision, such as "the presence of another donor candidate" and "the lack of the recipient's preparedness." Under complex circumstances, donors voluntarily give their consent to donate based on a strong sense that they are the only ones who can save the recipients (Muto, 2007). A stepwise decision-making model consisting of decision making followed by its reinforcement and resolution has been proposed (Fujita et al., 2006). The "self-will reinforcement" interaction pattern appears to represent a specific behavior in the reinforcement step of the decision-making process. Floor nurses should not rely on doctors, coordinators, or psychiatrists to confirm the donor's intention before admission, but should continue to carefully observe the donor until surgery and provide necessary support for their decision making.

3) The "Avoidance" pattern

This pattern of interaction is a "chat about safety" type of behavior, meaning that they behaved so as to avoid negative repercussions no matter what were to happen. This behavior was observed in both willing and unwilling donors, and this interaction pattern was used to avoid an unusual relationship with each other, as shown by the bewildered comments such as "I do not know what to talk about" or "I see no need to talk about surgery again". Weng, Huang, Wang, Chang, Tsai, & Lee (2012) studied the coping style of living liver transplant donors and reported that they maintain peace of mind by avoiding information. It is possible that the donors in the present study also took on the "avoidance" interaction to reduce stress by trying as much as possible not to think about the surgery. This suggests that for those recipients and donors showing the "avoidance" interaction, nurses should not force them to interact with each other, but rather seek to reduce the preoperative stress and anxiety by serving as a third person who expresses the thoughts and feelings that the donor and recipient cannot directly convey to each other.

The present study involved 2 pairs of sibling-to-sibling transplantation, both of whom showed the "avoidance" interaction pattern. Adachi (2004) commented that once having families of their own, siblings tend to interact with each other less frequently. Consequently, inconvenient truths, such as the presence of financial reward, forced donation, and pressure, are hidden and unlikely to be revealed. Nurses should therefore confirm the donor's willingness and decision-making process and closely observe the interactions between the recipient and donor in the hospital. If the two parties show "avoidance" patterns, nurses should share this information with the doctor and transplantation coordinator to re-confirm the appropriateness of carrying out LDLT.

A trustful relationship between patients and medical staff is particularly important in living-donor organ transplantation (Rhodes, 2003). At the same time, nurses who are directly involved in living-donor liver transplantation and aware of the importance of the recipient–donor relationship tend to be embarrassed and distressed by the difficulties in coping with problems between recipients and donors (Hayashi et al., 2013). The identified patterns of preoperative recipient–donor interaction in this LDLT study will hopefully contribute to reducing the embarrassment and distress nurses experience and encourage them to actively intervene between recipients and donors.

Study limitations and future tasks

First, this study was conducted at a single hospital, and participant observation for each patient required a large amount of time for data collection, limiting the total number of recipient–donor pairs included in the study to 9. Second, all the included recipient–donor pairs were blood relatives. Future studies should collect data on interaction patterns between non-blood relatives such as spouses.

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