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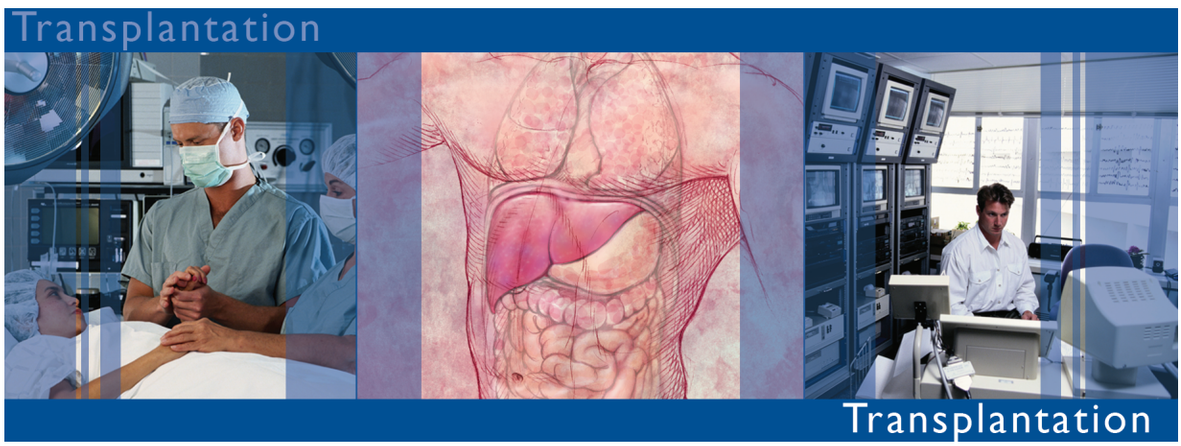
The Vancouver Forum

The Care of the Live Organ Donor
Lung, Liver, Pancreas and Intestine
Data and Medical Guidelines



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Introduction to Vancouver Forum

The burden and opportunity for successful organ transplantation is now regularly placed on the willingness of a well human being to provide at least one of these organs for transplantation: a kidney, a lobe of a lung, a segment of the liver, or a portion of their pancreas or intestine. The widespread acceptance of live organ transplantation is clearly counter to what historically had been a medical dictum to do no harm. Thus, the Forums in Amsterdam and Vancouver were conceived and developed because of the emerging hazards for those who are medically well and called on to donate an organ.

The goal of these Forums is to present definitive and timely statements regarding the responsibility of the transplant community for the live organ donor. And yet, these efforts are works in progress being made by a nucleus of transplantation professionals to promulgate an international standard of care. The ethics of a continuing practice of live organ transplantation demands an international recognition that prioritizes a sustained well-being of the donor and not the intended recipient. The person who gives consent to be a live organ donor should be competent, willing to donate free of coercion, medically and psychosocially suitable, fully informed of the risks and benefits as a donor, and fully informed of risks, benefits, and alternative treatment available to the recipient.

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A Report of the Vancouver Forum on the Care of the Live Organ Donor: Lung, Liver, Pancreas, and Intestine Data and Medical Guidelines

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An international conference of transplant physicians, surgeons, and allied health professionals was held in Vancouver, Canada, on September 15 and 16, 2005 to address the care of the live lung, liver, pancreas, and intestine organ donor. The Vancouver Forum was convened under the auspices of the Ethics Committee of The Transplantation Society. Forum participants included over 100 leaders in organ transplantation, representing many countries from around the world, including participants from the following continents: Africa, Asia, Australia, Europe, North and South America.

The objective of the Vancouver Forum was to develop an international standard of care for the live lung, liver, pancreas and intestinal organ donor. This Vancouver Forum followed a conference convened in Amsterdam on the care of the live kidney donor (*1*, *2*).

There were four organ specific work groups at the Vancouver Forum: lung, liver, pancreas and intestine. Each organ work group addressed the following topics in concert and reported their findings in a plenary presentation to all participants:

- The evaluation of the potential live donor
- Criteria of live donor medical suitability
- Operative events, donor morbidity and mortality
- Responsibility and duration of donor follow up.

The Vancouver Forum also provided an opportunity for the Ethics Committee of The Transplantation Society to address issues of informed consent, the responsibilities of the transplant team, live donor selection, autonomy and satisfaction, and procedural safeguards. An ethics statement of the Vancouver Forum pertaining to these issues will be published separately by the Ethics Committee of The Transplantation Society. The transplant community has a responsibility for the care of the live organ donor. The death of a live donor is a tragedy of immeasurable proportion that brings an ethical dimension distinct from the complications that might be experienced in a recipient.

Report from the Thoracic Group

Live donor lung transplantation generally involves three simultaneous operations: two donor lobectomies and a recipient bilateral pneumonectomy and lobar implantation. The use of live donors is occurring in cases in which the potential recipient mortality is high while awaiting for lung allografts from a deceased donor. With increasing experience however, the practice may expand to include elective patients (*3*, *4*).

I. Donor Evaluation

The goals of donor selection are to identify donors with excellent health, adequate pulmonary reserve for lobar donation and a willingness to accept the risks of donation without coercion (*5*, *6*). A preference is given for family members or unrelated individuals with emotional attachment to recipient and/or family. A preference is also given for a spouse or donor with "significant other" relationship to the potential recipient.

The necessity of two live lung donors for a single recipient also brings a consideration of both parents as donors for the potential recipient. An element of coercion can always exist between any potential donor and the recipient and/or the recipient's other siblings. "Stranger" or "Good Samaritan" donation remains controversial with caution required in the screening process to exclude active or uncontrolled psychiatric disorders or inappropriate motivation, and ensure the altruistic nature of the donation.

The donor evaluation is a multi-phased process that begins with the potential recipient and family providing the names of potential donors with basic health information and height, weight, age, relationship, and smoking history. A preliminary psychosocial evaluation of selected donors is performed to assess the desire to donate. This evaluation includes a determination of the donor motivation, pain tolerance, feelings regarding the possible death of the potential recipient (and the donor) and the ability of the potential donor to be separated from family responsibilities and career obligations. Consultation with appropriate authorities regarding postlobectomy employability and insurability (life, disability insurance) is required.

Prospective donors should be informed of the morbidity associated with lobectomy and the potential for mortality, as well as for potential negative recipient outcomes in regard to life expectancy and quality of life after transplantation.

II. Criteria of Live Donor Medical Suitability

The following are the eligibility criteria for living lobar lung donation:

- Age 18–60 years and able to give informed consent
- No active tobacco smoking or a significant smoking history

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- No active lung disease/previous ipsilateral thoracic surgery
- No identifiable risk for familial lung disease (i.e. familial forms of idiopathic lung disease or pulmonary artery hypertension)
- No cachexia (BMI <18 kg/m^2) or obesity (BMI ≥ 30 kg/m^2)
- ABO blood type compatibility with recipient
- Donor lobe size compatible with recipient hemithorax
- Normal pulmonary function and arterial blood gas results
- No conditions that significantly increase the risk of general anesthesia, surgery, and postoperative recovery
- No psychosocial, ethical issues, or concerns about donor motivation
- Not pregnant
- No active malignancy
- No active significant infection (HIV, hepatitis, acute CMV)

III. Operative Events, Donor Morbidity and Mortality

The standard operative live donor lung transplant procedure is for the recipient to undergo a bilateral pneumonectomy and for two live lung donors to provide the left lower lobe and the right lower lobe simultaneously to the recipient (*7*, *8*). Approximately 550 live lung donors constitute 98% of the global experience. The mean age was 38 ± 10 years (range 18–60 years). Sixty percent of the live lung donors have been male, 76% have been related to the recipient and 24% were unrelated. Of the related donors, 40% were parents, 29% siblings, and 15% uncle/aunt. The remainder were cousins 9%, 5% son/daughter, 1% nephew/niece, $<1\%$ grandparent, and 1% miscellaneous. Of the live donors that were unrelated to the recipients 74% were friends, 20% spouses, and 6% strangers.

To date there has been no reported peri-operative mortality of a lung donor. There have been life-threatening complications in 3 donors (0.5%) with an intra-operative ventricular fibrillation arrest (*1*) and two with a postoperative pulmonary artery thrombosis. The mean length of the initial hospitalization following the lung lobectomy has been 8.5 days (range 3–36). Approximately 4% of live lung donors have experienced an intraoperative complication that included ventricular fibrillation arrest (*1*), the necessity of a right middle lobe sacrifice 7 (1.3%), the necessity of a right middle lobe re-implantation 6 (1.1%), the necessity of a non-autologous transfusion PRBC's 5 (0.9%) and a permanent phrenic nerve injury (*1*). Approximately 5% (*27*) of donors experienced complications requiring surgical or bronchoscopic intervention. These complications included bleeding (*6*), bronchopleural fistula (*5*), pleural effusion (*5*), empyema (*2*) bronchial stricture (*2*), pericarditis requiring pericardiectomy (*2*), arrhythmias requiring ablation (*2*) and a chylothorax (*1*).

There were 14 (2.6%) live lung donors that were readmitted to the hospital because of a pneumothorax, an arrhythmia, empyema, pericarditis, dyspnea, pleural effusion, bronchial stricture, bronchopleural fistula, pneumonia, hemoptysis, and dehydration. The long term ($>$ one year) donor complaints of live lung donors include chronic incisional pain, dyspnea, pericarditis, and non-productive cough.

IV. Responsibility and Duration of Donor Follow Up

A constant awareness of the risk to the living donors must be maintained with any live donor organ transplantation program, and comprehensive short term follow-up should be mandatory. The Vancouver Forum Lung Group recommended that long term follow-up be strongly encouraged and funded by government/insurance authorities.

While the outcomes are well known in the recipient population, long-term consequences of live donor lobectomy have proven difficult to ascertain. Factors impeding long term follow-up include expense, distance from the transplant center, willingness of donors to participate, work load to the transplant center, and a general assumption that they are healthy. Many donors live far away from the transplant center and are reluctant to return for follow-up evaluation. The death of the recipient further exacerbates this situation.

Whether all donors have returned to their activities of daily living without restrictions is unknown. Responsibility for the care of the donor if complications occur varied widely among the centers represented within the Lung Group based on institution, country, and insurance system. In addition to the normal postoperative surgical clinic visit, recommended follow-up by the transplant center or the medical system in general ranged from one visit sometime between 3 months to one year, to multiple visits starting as early as three months and continuing generally through 1 to 3 years. Recommended testing in the follow-up also varied and included pulmonary function testing, 6-minute walk, chest radiography, quality of life surveys, and psychiatric evaluation.

Report from the Liver Group

A potential recipient should be determined to be a suitable candidate for liver transplantation prior to the assessment of the potential donor. A set of practice principles was developed for live donor liver transplantation (but these principles could also be considered appropriate for organ transplants from lung, pancreas and intestine donors).

Principles of Live Liver Donation

Live liver donation should only be performed if the risk to the donor is justified by the expectation of an acceptable outcome in the recipient.

The patient and graft survival of a live donor transplant should approximate the expected outcome for a recipient with the same disease etiology undergoing a deceased donor transplant.

- The indications for live donor liver transplantation should be the same as those established for deceased donor transplantation with the exception of institutionally-approved protocol studies that consider live donor transplantation preferential to liver transplantation from a deceased donor.
- Live donor liver transplantation should offer an overall advantage to the recipient when compared to waiting for an acceptable deceased donor organ to become available for transplantation. The decision to proceed with a live

donor liver transplant should be made after a careful analysis of the recipient risk to benefit ratio as it relates to severity of liver failure, quality of life and expected wait list time for a deceased donor.
- The estimated risk of mortality and morbidity currently associated with live donor right hepatectomy is 0.4% and 35% respectively. Since the risk to the donor is considerable, programs performing live donor liver transplantation should institute procedures and protocols that insure that donor mortality and morbidity is minimized.
- Concerning a pediatric recipient of a live liver donor (mostly parental), the patient and graft survival should be superior to the outcome for a recipient of the same disease etiology undergoing a deceased donor transplant.

Special Disease Indications for Live Donor Transplantation

Special disease entity considerations were addressed that have been considered controversial: hepatocellular carcinoma (HCC), hepatitis C virus infection (HCV), and fulminant hepatic failure (FHF).

Hepatocellular Carcinoma

HCC fulfilling the Milan criteria (classified as a single tumor less than 5 cm or 3 or fewer tumors, each no more than 3 cm) is an acceptable indication for live donor liver transplantation (*9*). Until further data are available on improved preoperative staging and long-term follow up, the contraindications for live donor liver transplantation in patients with tumors exceeding the Milan criteria should be the same as that for deceased donor transplantation.

Hepatitis C Virus Infection

HCV cirrhosis is an acceptable indication for live donor liver transplantation. Early transplantation for hepatitis C with either a live donor or deceased donor may not be beneficial because of the risk of disease recurrence and unpredictable outcome. Thus, the appropriate timing for transplantation in hepatitis C requires further investigation, even though a liver may be more readily available from a live liver donor.

Fulminant Hepatic Failure

FHF is an acceptable indication for emergency live donor liver transplantation. Centers performing live donor liver transplantation for FHF should have the capacity to expeditiously complete the donor evaluation and education process. The ability to perform a rapid evaluation of the potential donor including blood tests, electrocardiogram, chest x-ray, pulmonary function test, echocardiography, imaging studies of the liver, psychological assessment and evaluation by the ethical board in a 24 to 48 hr time period is considered optimal.

I. Donor Evaluation

The donor evaluation should be accomplished in a staged protocol that includes an independent donor advocate and a separate assessment of the recipient as a suitable candidate for a partial liver graft. The content of the donor evaluation should include:

- Initial screening of potential donors
- Complete history and physical examination
- Body weight and height (to calculate BMI)
- Laboratory testing
- No psychosocial, ethical issues, or concerns about the motivations of the donor. No active or uncontrolled psychiatric disorder.
- Imaging studies
- Possible preoperative donor liver biopsy

A complete history and physical examination including body weight and height should be obtained to exclude comorbidities that would significantly increase the donor risk. Biochemical donor evaluation should include: routine blood tests, serologies, a comprehensive coagulation profile and etiologic markers of liver disease. The donor should be screened for relevant endemic diseases that may have a detrimental effect on the donor (and possibly the recipient), e.g. asymptomatic schistomiasis and brucellosis.

The psychosocial/psychiatric evaluation should be conducted by a mental health care professional such as a psychiatrist, psychologist or social worker.

Appropriate radiologic imaging should be obtained preoperatively to assess liver volume and vascular anatomy. Biliary anatomy may be assessed either preoperatively or intraoperatively based upon the judgment of the surgical team.

Donor Liver Biopsy

A routine preoperative donor liver biopsy remains controversial (*10*, *11*). The use of the body mass index as a predictor of hepatic steatosis, and thus the need for a donor liver biopsy is not absolute. Accurate quantification of hepatic fat as a contraindication to donation may not be afforded by BMI and imaging studies alone.

The recommendation of the Vancouver Forum participants was to suggest that a donor liver biopsy be performed if blood specimen liver tests are abnormal and steatosis or other abnormalities are noted on imaging studies. A liver biopsy may be considered if the BMI >30 or in potential donors genetically related to a potential recipient with autoimmune hepatitis, primary sclerosing cholangitis or primary biliary cirrhosis.

II. Criteria of Live Donor Medical Suitability

The following are the eligibility criteria for live liver donation:

• Age

There is insufficient data to define the upper age limit for living liver donation. Based upon reported general surgery data and experimental regeneration data, a limit of 60 years has been considered appropriate. However, live donor liver transplantation has been performed successfully with donors aged >60 years. Minimal age is determined by ability to give legal consent.

• Relationship

Dr. Christoph Broelsch reported that German transplantation law requires living donors to be first or second degree relatives of recipients or have close emotional ties with them. This condition and the absence of any financial interest

for donation are evaluated by an ethical board. The Ethics Board in Germany is completely independent of the hospital evaluation team. A similar process exists in France. In Hong Kong, Doctors ST Fan and CM Lo reported that an application must be submitted to the Human Organ Transplant Board by the potential donor if the donor is not genetically related to the recipient (i.e. friends, in-laws), is a spouse of <3 years, or if the donor is genetically related but without proof of official documents (i.e. birth certificate or marriage certificate) to establish that relationship.

For many of Vancouver participants a genetic identity alone is not an essential criterion of suitability (versus sharing an emotional relationship). Otherwise, the use of a non-directed donor likely unknown to the potential recipient (now common in live donor kidney transplantation) was reported to be an unusual circumstance of live liver donation.

Body Mass Index

General surgical experience indicates that a high BMI (>30 kg/m^2) may increase the risk of surgical complications. However, a BMI of >30 may not affect graft quality and it is not an absolute contraindication to live liver donation.

Imaging

Volumetric imaging analysis may overestimate the actual liver volume by 10%. Donor safety requires a calculated remnant liver of at least 30% of the original liver volume with complete venous drainage. Vancouver Forum participants concluded that in the interest of recipient safety an estimated graft liver volume to recipient body weight ratio (GWBWR) of >0.8% should be achieved.

ABO Blood Type

Compatible ABO blood type is recommended; however, ABO incompatible blood type live donor transplants may be undertaken in special instances such as infants <1 year of age without the presence of isoagglutinins, and in emergency situations where no deceased donor allograft is available.

Liver Biopsy Results that Preclude Donation

Histological findings that should preclude living liver donation are:

- Portal or sinusoidal fibrosis
- Non alcoholic steatohepatitis (NASH)
- Steatosis >20% (only for right liver)
- Portal inflammation and necrotic-inflammatory changes.

Dieting is recommended for donors with steatosis. A repeated liver biopsy should be obtained after weight reduction.

• Laboratory Blood Tests

Blood tests results that confirm donor infection with HIV, HCV or HBV (HBsAg+) are a contraindication for living liver donation. Testing for serum HBV DNA is recommended in donors with detectable anti-HBc with or without anti-HBs. Laboratory testing for a preexisting hypercoaguable condition should be performed especially if the potential donor has a history of venous thrombosis.

III. Operative Events, Donor Morbidity and Mortality

• Thromboembolism

Thromboembolism prevention following live donor liver transplantation is strongly recommended. Further, the presence of any unexplained postoperative cardio-pulmonary symptoms requires a radiologic investigation to exclude pulmonary emboli.

• Autologous Blood

Storage of autologous blood is utilized by several institutions in the setting of right lobe donation. Technical progress has resulted in very low donor blood loss.

Recorded Complications

The following definition of a complication was developed by the Vancouver Forum liver work group for a live liver donor:

- The result of a procedure performed on the donor
- A deviation from the ideal course
- Induces changes in management of patients (diagnostic/therapeutic)
- Occurs during surgical performance or recovery from the procedure.

The incidence of complications associated with live liver donation varies widely since a uniform definition of what constitutes a complication has been lacking. The Vancouver Forum participants recommended the international use of the Clavien system to record and grade live donor complications by severity (Table 1) (*12*), as previously used to assess morbidity of donor (*13*) and recipient (*14*) liver transplantation patients. Recently, a revised version of this classification, using a similar therapy based system to grade com-

TABLE 1. Clavien classification of surgical complications adapted for live liver donors: grade

Definition of the complication
Grade 1: Non–Life-Threatenind Complications
Require interventions only at the bedside, postoperative bleeding of less than 4 units of packed red blood cells, never associated with prolongation of ICU or hospital stay longer than twice the median of the population in study.
Grade 2: No residual disability
2a: Require only use of medication or 4 or more units of packed red blood cells.
2b: Require therapeutic interventions, readmission to the hospital or ICU, or prolongation of regular ICU stay for more than 5 days.
2*ca*: Any potential donor who has an aborted surgery. Donor surgery does not result in transplantation.
Grade 3: Residual disability
3a: There is low risk of death that results in permanent but not progressive disability.
3b: There is lasting disability that is either difficult to control or has a significant risk of death or liver failure.
Grade 4: Liver failure or death
4a: Lead to liver transplantation.
4b: Lead to donor death.

TABLE 2. Survey of liver donor complications

21%: ELTR	14%: Brown et al.	28%: Lo CM
Death	Death (0.2%)	Bile leakage
Need for rehospitalization	Rehospitalization (8.5%)	Hyperbilirubinemia
Bile stricture or leak	Bile stricture or leak (6%)	Intra-abdominal collection
Liver insufficiency	Nonautologous blood transfusion (4.9%)	Small bowel obstruction
Pulmonary embolism	Need for reoperation (4.5%)	Biliary stricture
Major infection	Major infection (1.1%)	Portal vein thrombosis
Vascular		Pulmonary embolism
Major infection		Intra abdominal bleeding
		Pancreatitis
		Bleeding duodenal ulcer
		Incisional hernia
		Renal failure
		Gastric perforation
		Wound infection
		Gastric outlet obst.
		Pleural effusion
		Pneumonia
		Pressure sore
		Perineal nerve palsy

plications, was proposed, which may also serve to evaluate the outcome of live donors (*15*).

A list of donor complications reported in the United States, European and Asian experiences is listed in Table 2 (*16*, *17*). Right lobe liver donation is associated with an increased morbidity (ranging from 20–60%, overall approximately 35%) and more severe complications than that associated with left lobectomy or left lateral segmentectomy.

The overall incidence of complications in the recently reported NIH sponsored Adult-to-Adult Live Donor Liver Transplant (A2ALL) cohort study is provided in Table 3 (*13*). At the time of the Vancouver Forum, 1008 donor candidates have been evaluated, 402 went to operating room with the intent of being a live liver donor however only 385 donated. There were 606 not accepted for live donation based upon either donor or recipient reasons.

Estimated Worldwide Operative Donor Mortality

To date, approximately 6000–7000 live donor hepatic resections have been performed worldwide for the purpose of transplantation and the rate of catastrophic complications is estimated to be 0.4–0.6% (Table 4). There have been 14 live donor deaths, 2 donors have undergone liver transplantation secondary to operative complications from right lobe donation and 1 donor is in a persistent vegetative state after donation. Mortality approaches 0.5% for the right lobe donor in contrast to approximately 0.1% for left lobe donation.

IV. Responsibility and Duration of Donor Follow Up

Live donors should be followed postoperatively for at least 1 year after the hepatectomy. Thereafter, follow-up may be desired but may not be always feasible because the residence of the donor is remote to the transplant center. Donor health insurance may influence the feasibility of long-term follow up. The Vancouver Forum participants recommended that a registry of live donor complications be established and that donor deaths be reported to that registry. In the United States, the Organ Procurement and Transplant Network (OPTN) that is run by the United Network for Organ Sharing (UNOS) has recently made a live donor death or the necessity of a liver transplant following a donor hepatic resection a reportable event to the OPTN (*18*).

Several centers offering live donor adult liver transplantation are investigating the impact of donation on the donor's health and quality of life. Results from a survey sent to all individuals undergoing live liver donation in Japan through 2003 was presented at the Vancouver Forum by the Japanese Liver Transplantation Society. Of the 2667 live liver donors, 62% completed the survey with only half of the donors reporting complete recovery by 4 months postoperatively. Another 45% of donors reported near complete recovery with 90% of those individuals back to work or school. Only 3% of donors considered their recovery to be poor. A significant number of donors (40%) expressed anxiety regarding their future health. This anxiety was independent of the extent of liver resection since left lateral segment donors were equally concerned when compared with right lobe donors. Overall recipient mortality in this cohort was 17%. Of the recipients that died, 87% of their donor's were lost to follow-up.

The participants of the Vancouver Forum agreed that the transplantation community must continue to monitor the health and long-term outcome of the live liver donor. Financial disincentives to donation and the donor's ability to obtain and maintain health and life insurance must continue to be examined. The participants also considered an outcome that penalizes living donors for the act of donation to be unacceptable.

Report from The Pancreas Group

Patients with type 1 diabetes who are appropriate candidates for pancreas transplantation may be simultaneously

TABLE 3. A list of complications recorded in the Adult-to-Adult Live Donor Liver Transplant (A2ALL) study

A. Intraoperative Injury
  1. Bile duct
  2. Hepatic artery
  3. Portal vein
B. Biliary complications
  1. Bile leak/biloma
  2. Biliary stricture
C. Abdominal/GI
  1. Intra-abdominal bleeding
  2. GI bleeding
  3. Localized intra-abdominal abscess
  4. Ileus (delayed return of bowel function for >7 days)
  5. Bowel obstruction
  6. Re-exploration
D. Cardiopulmonary
  1. Myocardial infarction
  2. Congestive heart failure
  3. Pneumothorax (requiring chest tube)
  4. Pleural effusion (requiring thoracocentesis)
  5. Pulmonary edema
  6. Cardiopulmonary arrest
  7. Respiratory arrest
  8. Aspiration
  9. Pulmonary embolism
E. Wound Complications
  1. Dehiscence
  2. Hernia development
F. Liver-specific events
  1. Encephalopathy
  2. Ascites
  3. Liver failure
  4. Hepatic artery thrombosis
  5. Portal vein thrombosis
  6. IVC thrombosis
  7. Transplantation
G. General
  1. DVT
  2. Neuropraxia
  3. Infections
  4. Psychological: depression, suicide, other

TABLE 4. Estimated worldwide operative donor mortality

- 6000–7000 live donor hepatic resections
- Two donors have undergone liver transplantation secondary to operative complications from right lobe donation
- One donor is in a persistent vegetative state after donation
- Catastrophic complications (0.4–0.6%):
  - 14 deaths
  - 2 required liver transplant
  - 1 vegetative state

3 left liver	11 right liver
US 1	US 2
Brazil 1	Brazil 2
Germany 1	Germany 2
	France 1
	Japan 1
	Egypt 1
	China (HK) 1
	India 1

For the right liver donor, the mortality is up to 0.5%.
For the left liver donor, the mortality is 0.1%.

evaluated for suitable living segmental pancreas donors. Potential donors may undergo either segmental pancreas donation alone (for nonuremic or posturemic recipients) or simultaneous segmental pancreas and unilateral kidney donation (for uremic recipients). Once identified, potential donors will be subject to a thorough medical, metabolic and psychosocial screening. ABO and HLA cross-match compatibility is preferred but not mandatory. A segmental donor pancreatectomy can also be applied for islet isolation and allotransplantation (*19*, *20*).

I. Donor Evaluation

An initial screen will exclude donor candidates with a history of diabetes (including gestational), pancreatic disease, active or chronic infectious or malignant diseases. If a cross-match between the potential donor and recipient is negative, then a psychosocial evaluation would follow in the form of a screening interview by a social worker, with follow-up consultation with a staff psychiatrist/psychologist if deemed necessary. Caution is required in the screening process to exclude active or uncontrolled psychiatric disorders, and ensure the altruistic nature of the donation. Endocrinology consultation is done by a designated staff endocrinologist and a surgical consult by a designated donor surgeon.

Preoperative medical screening includes a detailed history and physical exam and the following laboratory investigations: complete blood count, serum electrolytes, blood coagulation profile, liver function tests, amylase, lipase, uric acid, hepatitis B and C profile, HIV testing, RPR, CMV IgG, EBV IgG, urine analysis; and a 12 lead EKG. Radiologic donor work-up includes chest x-ray and abdominal ultrasound, and after passing the metabolic and immunological tests (see below), an MRA/CTA to assess the anatomy of the pancreas and its vascular supply (*19*).

Additional tests specific for the live pancreas donor include preoperative metabolic screening of the live donor via the following:

1. Fasting glucose level (post 10- to 16-hr fast)
2. Hemoglobin A1c level

3. Oral glucose tolerance test (OGTT)

A >150 g carbohydrate diet is given for 3 days prior to the test and usual physical activity. After a 10 to 16 hr fast (water is permitted, smoking is not), a 75 g oral glucose load in 250–300 cc of water is given over 10 min. The end of the drink is time zero. Measurement of glucose and insulin is performed at the following intervals: −10, −5, 0, 15, 30, 60, 90, 120, 150, 180, 240 and 300 min.

4. Intravenous glucose tolerance test (IVGTT)

A >150 g carbohydrate diet is given for 3 days prior to the test and usual physical activity. After a 10 to 16 hr fasting period (water is permitted, smoking is not), the test is commenced between 0730 and 1000 hr.

A 0.5 g/kg dose (max. 35 g) of glucose is given IV over 3 minutes and 15 seconds. The end of the infusion is time zero. Glucose, insulin, glucagon and C-peptide are measured at the following intervals: –10, −5, 0, 1, 3, 4, 5, 10, 15, 20, 25 and 30 min.

Acute Insulin Response (AIR) to glucose is defined as the mean of the 3, 4 and 5 min insulin values following the glucose injection with the basal value subtracted. Glucose disposal rate (Kg) is defined as the slope of the natural log of glucose values between 10 and 30 min. after injection. First phase insulin release (FPIR) is defined as sum of insulin levels at 1 and 3 min.

5. Arginine stimulation test (AST)

At the 35 min mark of the above test, 5 g of arginine (arginine HCl 10%) IV push is given over 30 seconds. Zero time is at the end of the bolus. Measurement of glucose, insulin, glucagon and C-peptide is performed at the following intervals: 0, 2, 3, 4, 5, 7, 10, 25 and 30 min. Acute insulin response (AIR) to arginine is defined as the mean of the peak three insulin values between 2 and 5 min following the arginine injection with the basal value subtracted.

6. Glucose potentiation of arginine-induced insulin secretion (GPAIS)

About 60 min after the last blood draw in the above test, a glucose infusion (D20W) at 900 mg/min is started through an IV pump. The infusion is maintained for 70 min. At minute 60, 5 g of arginine (10% arginine HCL) IV is given over 30 seconds. The end of the bolus is time zero.

Measurement of glucose, insulin, glucagon and C-peptide is performed at the following intervals: 2, 3, 4, 5, 7 and 10 min. Acute insulin response at 900 mg/min glucose potentiation (AIR-900) is defined as the mean of the three peak insulin values between 2 and 5 min. with the basal value subtracted.

7. Insulin auto-antibodies (IAA)

Measured by fluid phase radio-assay incorporating competition with cold insulin and precipitation with polyethylene glycol.

8. GAD 65 auto-antibodies (GAA)

Measured in triplicate by radio-assay, using in vitro transcribed and translated recombinant human GAD (65-kDa isoform) and precipitation with protein A-sepharose.

9. Islet cell antigen 512 auto-antibodies (ICA512)

ICA512 is measured by radio-immunoassay in duplicate using a 96-well plate format using a recombinant ICA512 protein.

Based on the history and physical exam in combination with the screening tests the following criteria will have to be met, in order to be considered a potential live segmental pancreas donor.

II. Criteria of Live Donor Medical Suitability

General Inclusion Criteria

Male and female segmental pancreas donor volunteers should be between the ages of 18 and 60. However, some parental donors greater than 60 years of age would be acceptable in Japan. The difference regarding the age criterion in Asian countries may be necessitated because of the current lack of deceased donor alternatives.

The potential donor should be capable to provide written, informed consent; be mentally competent and be able to comply with the procedures and postoperative follow-up. Donor participation must be voluntary, without coercion and without financial incentives. The donor must also understand the nature of the procedure and the risks to his or her health. He/she must also be aware of the risks of recurrent disease in the donated graft.

Exclusion Criteria

Subjects meeting any of the following criteria should be excluded as a segmental pancreas donor:

- Age >60 Years
- First-degree relative (parents/siblings/children) with type 1 or type diabetes (other than the potential recipient).
- Less than 10 years discordant from the recipient's age at the time of onset of diabetes. Example: If recipient is diagnosed as diabetic at age 22, donor must be at least 32 years old.
- Patients with active or uncontrolled psychiatric disorders
- Body mass index >28 Kg/m^2.
- History of heavy smoking, obesity, hypertension, cardiac disease, cancer, gestational diabetes, alcoholism or excessive alcohol use, pancreatitis or peptic ulcer disease.
- Impaired glucose tolerance or diabetes by national diabetes group criteria
- Fasting blood glucose >110 mg/dl.
- Hba1c >6.0%.
- Any OGTT glucose levels >150 mg/dl.
- A glucose value >150 mg/dl during 75 g OGTT;
- 2-hour OGTT glucose >140 mg/dl (86).
- Glucose disposal rate <1% during IVGTT;
- Acute insulin response to glucose or arginine <300% basal insulin;
- Basal fasting insulin values >20 μU/ml;
- Elevated titer of islet cell antibodies;
- Clinical Evidence of insulin resistance;
- Evidence of >1 autoimmune endocrine disorder.

III. Operative Events, Donor Morbidity and Mortality

Donor segmental pancreatectomy (tail) can be done open or laparoscopically. With increasing experience, however, the laparoscopic approach may actually have shorter operative times, as less dissection is required compared to the open technique (*21*).

Intraoperative and Postoperative Donor Complications

- **Splenectomy**

A splenectomy may have to be performed in up to 15% of donors in case of insufficient collateral blood supply or bleeding. For that reason, all donors receive polyvalent pneu-

mococcal vaccine, hemophilus B and meningococcal vaccines 2 weeks prior to surgery.

- **Pancreatitis and pancreatic cyst(s), abscess or fistula**

The incidence of such complications is less than 5%.

- **General postoperative complications**

These include bleeding (with need for relaparotomy), prolonged ileus, pneumonia, DVT, wound infections, incisional hernia and others. The incidence of major general postoperative complications is less than 5%.

- **Esophageal/gastric varices**

A rare, late complication is the development of upper intestinal bleeding secondary to esophageal/gastric varices (without portal hypertension) from venous collateralization in patients in whom the spleen was left in. A splenectomy is then required and is curative.

- **Risk of developing diabetes**

If all criteria as assessed by the metabolic tests are met, the risk of the donor developing diabetes is less than 3% (*22*).

World Experience in Live Donor Segmental Pancreas Donation

At the University of Minnesota, there have been 130 live donor pancreas transplants performed between 1977 and 2005. The distribution of these transplants was as follows: 40% pancreas transplant alone (PTA); 25% pancreas after kidney (PAK), and 35% simultaneous live donor pancreas and kidney transplants (SPK). There are 20 PTA and PAK live donor grafts functioning between 10 and 20 years following transplantation.

There are 3 living donor SPK transplants with function greater than 10 years.

At the University of Illinois, Chicago, 9 living-donor simultaneous kidney and segmental pancreas bladder-drained transplants were performed between 1997 and 2004 (*23*). Eight out of nine pancreas grafts and all the kidney grafts have been working for one to eight years following transplantation. There was no report of a donor death.

There have been 5 live donor segmental pancreatectomies performed in Japan, (4 in Chiba and 1 in Osaka), 1 case of live donor islet cell transplantation in Kyoto and 2 live donor segmental pancreatectomies performed in Seoul, Korea. At the University of Minnesota, there had been 2 live donor islet transplants after kidney transplantation early in the center experience (1970s).

IV. Responsibility and Duration of Donor Follow Up

Immediate Postdonation Follow Up

The donor will have fasting and 2 hr postprandial blood sugar levels checked daily during hospitalization (*19*). The fasting and postprandial glucose levels should be determined monthly postdischarge. Blood glucose levels should be $<$110 mg/dl fasting and $<$140 mg/dl postprandial; above these levels will indicate the donor is in the diabetic range and in need of treatment. Glycosolated hemoglobin levels should be obtained annually; above the normal range will also indicate development of diabetes and need for treatment.

The donor will generally have a postoperative hospitalization of about 5 to 7 days. Postoperative care of the donor is similar to that of any patient undergoing major abdominal surgery. A nasogastric tube is left in place until bowel function returns. Hemoglobin levels are checked serially as well as serum amylase, lipase, and glucose. Persistently elevated amylase and lipase may suggest pancreatitis, a leak, or pseudocyst formation. Persistent or severe left upper quadrant pain should be investigated with CT and a splenic radionucleotide scan to assess the viability of the spleen. If the spleen appears infarcted, a splenectomy should be performed.

Donors are encouraged to maintain their body mass index of less than 28 kg/m^2 with dietary counseling, if necessary (for certain ethnic groups the BMI should be even lower) (*24*).

The Vancouver Forum participants recommended the establishment of a pancreas donor registry and database for lifelong follow-up. Although no donor deaths have been reported after segmental pancreatectomy, a world registry should capture all cases performed.

Report from the Intestinal Group

Live donor intestinal transplantation has been the focus of two working groups organized to provide a technology assessment of this new surgical technique. The first consisted of surgeons and physicians experienced and interested in live donor intestinal transplantation who met in Brussels in July, 2005 at the 9th International Intestinal Transplant Symposium. The Vancouver Forum was the second meeting under the auspices of The Transplantation Society.

Intestinal transplantation is intended for the treatment of patients with life threatening complications of intestinal failure. The most common life threatening complication of intestinal failure is liver disease. Over the past five years the results of intestinal transplantation have improved dramatically, the result of a variety of factors including advances in immunosuppression, improved surgical techniques and evolving center experience (*25*).

Live donor intestinal transplants are not experimental but this procedure should be regarded as an innovative and an evolving technology. Because of the evolving nature of this procedure, the Vancouver Forum participants recommended that centers performing live donor intestinal transplantation should submit their protocols for ethical review and report outcomes to an international registry.

The lack of deceased donors and the resources otherwise needed for long term parenteral nutrition are the advantages afforded to a recipient of a live donor intestinal transplant. Combined liver/intestine grafts from live donors may have particular advantages in small infants who have a high mortality on the waiting list (*26*, *27*). There are also immunologic advantages in the circumstance of identical twins (*28*). Whether HLA matching or reduced preservation times are truly beneficial is unproven and requires further study.

I. Donor Evaluation

Live intestinal donation should be voluntary without coercion. The potential donor should be in good health with

no underlying chronic medical illnesses that would increase the operative risk. There should be no history of intestinal surgery. Related donors (by HLA) must be excluded for potential recipients who have a genetic or familial intestinal disease. Caution is required in the screening process to exclude active or uncontrolled psychiatric disorders, and ensure the altruistic nature of the donation.

Donors are initially screened with an ABO blood type determination and in some instances with HLA as noted. Histocompatability testing by T cell cross match should be negative. If there are multiple potential donors, ABO blood group identity and HLA matching may guide donor selection, especially in the circumstance of a presensitized candidate for whom a cross match negative donor might be identified.

Following completion of these initial steps, the testing that is done for the live donor evaluation is as follows:

- Physical examination and psychosocial assessment
- Gastroenterological assessment
  D xylose and fecal fat absorption studies
  Screen for celiac sprue
- Laboratory tests
  CBC, PT/INR, PTT
  Liver chemistries, amylase, renal chemistries, random glucose
  Vitamin A, D, E, K, and B12
  Ammonia, alpha fetoprotein, lipid profile
- Infectious disease assessment
- Hepatitis screen, HIV, CMV (IgM and IgG)
- EBV (IgM and IgG), VZV (IgA EIA)
- Urinalysis and culture; stool culture
- CXR and EKG
- Imaging studies
- Abdominal CT scan, 3D angio CT scan
- Superior mesenteric artery angiogram.

If no obstacles to successful donation are identified during the workup imaging studies are ordered. Imaging studies of the abdomen are performed to rule out any underlying or occult pathology and typically this is accomplished with a CT or ultrasound. To delineate the vascular anatomy CT or MR angiography is performed. If a traditional angiogram is performed patients must be informed of the risks.

II. Criteria of Live Donor Medical Suitability

● Age

There is insufficient data to define the upper age limit for living intestine donation. Based upon reported general surgery data a limit of 60 years has been considered appropriate. Minimal age is determined by ability to give legal consent.

● Relationship

Living donors should be first or second degree relatives of recipients or should have close emotional ties with them. This condition and the absence of any financial interest for donation are evaluated by a physician team separate from the transplant program.

● Psychosocial Assessment

There should be no psychosocial, ethical issues, or concerns about the motivations of the donor or active or uncontrolled psychiatric disorders.

● Body Mass Index

General surgical experience indicates that a high BMI (>30 kg/m^2) may increase the risk of surgical complications. However, a BMI of >30 may not affect graft quality and it is not an absolute contraindication to live donation.

● ABO Blood Type

Compatible ABO blood type is recommended.

● Laboratory Blood Tests

A comprehensive metabolic panel should be obtained. Blood tests results that confirm donor infection with HIV, HCV or HBV (HBsAg+) are a contraindication for living intestine donation.

III. Operative Events, Donor Morbidity, and Mortality

The central caveat of the donor operation is to provide adequate length of intestine to the recipient to ensure enteral autonomy while preserving enough small bowel length in the donor. Some programs recommend small bowel decontamination the day prior to donation although there is little data to support this. The donor operation is performed through a midline incision. Most programs recommend the use of the live donor ileum (*29*, *30*). Jejunal grafts have been also used but the procedure is more technically demanding (*31*). At the time of surgery the small bowel is mobilized and the vascular anatomy of the distal small bowel is examined. Blood flow to the remaining donor small bowel (in particular, the branch of the ileocolic artery feeding the ileocecal valve) must be preserved. With the use of either translumination of the mesentery and/or direct manipulation, the vasculature of the terminal superior mesenteric artery (SMA) branches is assessed. The distal branch of the SMA is identified, the mesentery is scored and the terminal branch of the SMA is dissected free from it's take off of the ileocolic branch distally for about 2 centimeters. Alternatively the ileocolic artery can be used distal to the take-off of the right colic artery. The ileocolic artery may have advantages in the small donor (*29*). The segment of the superior mesenteric vein draining the graft is visualized next to the artery and is also dissected for approximately 2–3 centimeters.

The small bowel is measured. The standard procedure includes removal of approximately 150–200 centimeters of terminal ileum. It is essential to preserve at least two-thirds of the small bowel length in the donor. The distal 20–30 centimeters of donor ileum is preserved. The proximal distal end of the future allograft is stapled off, the blood vessels are

TABLE 5. Procedure-specific risk for the live intestinal donor

Short bowel syndrome
Small bowel obstruction
3 to 8%
3% mortality
Dysvitaminosis
Weight loss
Diarrhea

TABLE 6. List of the Vancouver Forum Participants

Abu-Elmagd	Kareem	University of Pittsburgh
Adcock	Lesley	Toronto General Hospital
Alabdulkareem	Abdulmajeed	Department of Hepatobiliary Sciences & Liver Transplantation
Aoe	Motoi	Okayama University
Barr	Mark L.	University of Southern California
Belghiti	Jacques	Hopital Beaujon, Paris University
Benedetti	Enrico	University of Illinois at Chicago
Berney	Thierry	Clinique do Chirurge Visceral
Bhandari	Mahendra	King George's Medical University
Bismuth	Henri	HepatoBiliary Center, Villejuif Cedex, France
Boggi	Ugo	Università di Pisa
Brand	Tracy	Canandian Council for Donation and Transplantation
Broelsch	Christoph	University Hospital of Essen
Brown, Jr.	Robert	Columbia University Medical Center
Capron	Alexander	World Health Organization
Chapchap	Paulo	Hospital Sirio Libanes and Hospital do Cancer
Cicalese	Luca	University of Massachusetts
Clavien	Pierre	Zentrum fur Klinische Forschung
Crawford	Michael	Liver Transplantation Unit, Royal Prince Alfred Hospital, Sydney, New South Wales
Cronin	David C.	Yale University
Dark	John	Freeman Hospital
Date	Hiroshi	Okayama University
Davis	R. Duane	Duke University Medical Center
Delmonico	Francis L.	Massachusetts General Hospital
Dew	Mary Amanda	University of Pittsburgh
Dib-Kuri	Arturo	The National Center of Transplants Mexico
Eghtesad	Bijan	The Cleveland Clinic Foundation
Emond	Jean C.	New York Presbyterian Hospital/Columbia
Fan	Sheung-Tat	University of Hong Kong Medical Center
Fazel	Iradj	Taleghani Hospital
Freise	Chris E.	University of California San Francisco
Friedewald	John	Northwestern Memorial Hospital
Fryer	Jonathan	Northwestern Medical Faculty Foundation
Fujimoto	Yasuhiro	Nagoya University Hospital
Garcia Valdecasas	Juan Carlos	Hospital Clinic, Barcelona, Spain
Ghobrial	Rafik Mark	The Dumont-UCLA Transplant Center
Ginns	Leo C.	Massachusetts General Hospital
Grant	David R.	The Toronto General Hospital
Greig	Paul	Toronto General Hospital/University of Toronto
Gruessner	Rainer	University of Minnesota
Gutmann	Thomas	University of Munich
Han	Duck-Jong	University of Ulsan
Hasegawa	Toshimichi	Osaka University Medical School
Hertl	Martin	Massachusetts General Hospital
Höckerstedt	Krister	Helsinki University Hospital
Humar	Abhinav	University of Minnesota
Hwang	Shin	Asian Medical Center, Korea
Ito	Toshinori	Osaka University Hospital
Jaffe	Bernard	Tulane University
Kamel	Refaat R.	Ain Shams University
Keown	Paul A.	Vancouver General Hospital
Keshavjee	Shaf	Toronto General Hospital
Khaghani	Asghar	Royal Bromptom
Klintmalm	Goran	Baylor Regional Transplant Inst. Univ Medical Ctr.
Lake	John	University of Minnesota
Langnas	Alan N.	University of Nebraska Medical Center
LaPointe Rudow	Dianne	New York Presbyterian Hospital/Columbia
Lo	Chung Mau	The University of Hong Kong Medical Centre
Marcos	Amadeo	University of Pittsburgh Physicians
Margreiter	Raimund	University Hospital Innsbruck
Matas	Arthur	University of Minnesota
Matsumoto	Shinichi	Kyoto University Hospital
Mc Alister	Vivian	University of Western Ontario
McDiarmid	Sue	University of California, UCLA Medical Center

TABLE 6. Continued

McMurdo	Lisa	New York State Department of Health
Merion	Robert	University of Michigan Health System
Millis	J. Michael	University of Chicago Hospitals
Munn	Stephen	Auckland Hospital
Olthoff	Kim M.	University of Pennsylvania
Otte	Jean Bernard	Université Catholique de Louvain
Park	Soon J.	Physician Foundation @CPMC
Picciano	Fil	The Transplantation Society
Pomfret	Elizabeth	Tufts School of Medicine
Pruett	Timothy L.	Strickler Family
Rahmel	Axel	University of Leipzig
Reyes	Jorge D.	University of Washington
Rizvi	S. Adibul Hasan	Sindh Institute, University of Karachi
Schenkel	Felicia A.	University of Southern California
Squifflet	Jean-Paul	University of Liege
Strueber	Martin	Hannover Medical School
Sutherland	David E.	University of Minnesota
Tibell	Annika	Karolinska University Hospital
Todo	Saturo	University Hokkaido
Villamil	Fred	Fundacion Favaloro
Waddell	Thomas K.	Toronto Gerneral Hospital
Wahlin	Staffan	Karolinska University Hospital in Huddinge
Wain	John C.	Massachusetts General Hospital
Wiesner	Russell	Mayo Clinic Rochester
Wood	Kathryn	President, The Transplantation Society
Woodhouse	Michael	Genzyme, Inc.
Wright	Linda	University Health Network, University of Toronto.
Yusen	Roger D.	Washington University
Zuckermann	Andreas	University of Vienna

clamped, and the portion of segment of small bowel is removed to the back table where it is flushed with preservation solution. Most programs are using University of Wisconsin solution.

There was one report of using only 60 centimeters of distal jejunum and proximal ileum which did not achieve nutritional autonomy. Another approach consisted of using a donor graft consisting of the distal ileum and ileocecal valve with a portion of the cecum. In this case, the donor had evidence of protracted diarrhea and dysvitaminosis.

The procedure specific risk for the live intestinal donor is given in Table 5. The risk of perioperative death is probably similar to the risk of general anesthesia, approximately 0.03%. It could be anticipated that following a small bowel resection about 3 to 5% of donors will eventually develop a small bowel obstruction (*30–38*). In large series the mortality rate for patients with small bowel obstruction is about 2%. This risk will exist for the lifetime of the patient. Whether HLA matching or reduced preservation times are truly beneficial is unproven and requires further study. Table 6

IV. Responsibility and Duration of Donor Follow Up

The World experience with live intestine donation is limited. According to the intestinal transplant registry as of March 31, 2005, 65 transplant centers have performed 1,292 intestinal transplants. Identified within that database there were 61 transplants where a living donor was the source of the organ. This was performed in a total of 16 transplant centers and there are currently 21 survivors of these living donor intestinal transplants. There were no donor deaths or long term morbid complications of intestinal donors reported at the Vancouver Forum.

The types of all intestine transplants performed to date include approximately 570 isolated small bowel transplants, 490 combined live and small bowel transplants, and 232 multi-visceral transplants. There are currently 658 survivors (*25*). Patient and graft survival was similar between live donor and deceased donor transplants. Nutritional autonomy and causes of graft failure and patient death were similar between both groups.

The center performing the donor procedure has a responsibility to ensure long term medical care of any procedure-related complication. The recommended minimum follow up schedule includes a postoperative visit at 2 and 4 weeks. There are several problems that can occur early in the postdonation period such as small bowel obstruction, diarrhea, weight loss and dysvitaminosis. Donors should be followed until all procedure-related symptoms have been resolved. The donor team needs to be wary of a B_{12} deficiency. B_{12} monitoring can be performed with serum levels at 6 months and annually for 3 years.

The long term risk of small bowel donation primarily involves of small bowel obstruction in the range of 1% to 5%. With the development of a complete small bowel obstruction there is approximately 1 to 2 % mortality rate.

The intestinal group made the following action plans and recommendations:

1. Creation of a donor registry in conjunction with the existing international intestinal transplant registry
2. Data collection to study effect of organ preservation time, and HLA matching results with next International Intestinal Transplant Registry Report
3. Collect and share with intestine transplant centers, the UNOS data on waiting list death /withdrawals for patients waiting for isolated intestine grafts

CONCLUSIONS

The mission of the Vancouver Forum is to convey an international concern for the well being of the live organ donor and to promulgate a reference of care by an internationally renowned group of experts. The decision to proceed with live donor transplantation should be made only after a careful analysis of the recipient risk to benefit ratio as it relates to etiology of disease, quality of life, expected morbidity and mortality on the waiting list. This decision will also be influenced by the availability and quality of any potential deceased donor organ.

The Vancouver Forum participants acknowledge the heroism of those living volunteers who have provided a life saving organ for a transplant recipient. The Forum participants also recognize the societal contribution that live organ donors have made by reducing the waiting list for transplantation of organs from deceased donors.

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REFERENCES

1. The Consensus Statement of the Amsterdam Forum on the Care of the Live Kidney Donor. *Transplantation* 2004; 78(4): 491–492.
2. A Report of the Amsterdam Forum on the Care of the Live Kidney Donor: Data and Medical Guidelines. *Transplantation* 2005; 79(6 Suppl): S53–S66.
3. Bowdish ME, Barr ML, Starnes VA. Living Lobar Transplantation. *Chest Surg Clin N Am* 2003; 13(3): 505–524.
4. Date H, Aoe M, Sano Y, et al. Improved survival after living-donor lobar lung transplantation. *J Thorac Cardiovasc Surg* 2004; 128(6): 933–940.
5. Schenkel FA, Barr ML, Starnes VA, et al. Living-donor lobar lung transplantation: donor evaluation and selection. *In* Norman DJ, Turka LA, eds. Primer on Transplantation. Moorestown, NJ: American Society of Transplantation, 2001.
6. Schenkel FA, Horn MV, Woo MS, et al. Screening potential donors for living donor lobar lung transplantation. *J Heart Lung Transplant* 2003; 22(1S): S86.
7. Bowdish ME, Barr ML, Schenkel FA, et al. A decade of living lobar lung transplantation: perioperative complications after 253 donor lobectomies. *Am J Transplant* 2004; 4(8): 1283–1288.
8. Battafarano RJ, Anderson RC, Meyers BF, et al. Perioperative complications after living donor lobectomy. *J Thorac Cardiovasc Surg* 2000; 120(5): 909–15.
9. Liu C, Frilling A, Sotiropoulos GC, et al. Living donor liver transplantation for recurrent hepatocellular carcinoma. *Transpl Int* 2005; 18 (7): 889.
10. Ryan C, Johnson L, Germin B, Marcos A. One hundred consecutive hepatic biopsies in the workup of living donors for right lobe liver transplantation. *Liver Transpl* 2002(12): 1114–22.
11. Rinella M, Abecassis M. Liver biopsy in living donors. *Liver Transpl* 2002; 18(12): 1123–1125.
12. Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery* 1992; 111(5): 518–526.
13. Olthoff KM, Merion RM, Ghobrial RM, et al. A2ALL Study Group. Outcomes of 385 adult-to-adult living donor liver transplant recipients: a report from the A2ALL Consortium. *Ann Surg* 2005; 242(3): 314–323.
14. Clavien PA, Sanabria J, Mentha G, et al. Complication and risk factors. *Ann Surg* 1992; 216: 618–626.
15. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004; 240(2): 205–213.
16. Brown RS Jr., Russo MW, Lai M, et al. A survey of liver transplantation from living adult donors in the United States *N Engl J Med* 2003 Feb 27; 348(9): 818–825.
17. Lo CM. Complications and long-term outcome of living liver donors: a survey of 1,508 cases in five Asian centers. *Transplantation* 2003;75(3 Suppl): S12–S15.
18. Delmonico FL, Graham WK. Direction of the Organ Procurement and Transplantation Network and United Network for Organ Sharing Regarding the Oversight of Live Donor Transplantation and Solicitation for Organs. *Am J Transplant* 2006; 6: 37–40.
19. Gruessner RWG. Living Donor Pancreas Transplantation. In: Transplantation of the Pancreas. Eds.: Gruessner, RWG and Sutherland, DER. Springer-Verlag, New York, 2004: 423–440.
20. Matsumoto S, Okitsu T, Iwanaga Y. Insulin independence after living-donor distal pancreatectomy and islet allotransplantation. *Lancet* 2005; 365(9471): 1642–1644.
21. Tan M, Kandaswamy R, Sutherland DE, Gruessner RW. Laparoscopic donor distal pancreatectomy for living donor pancreas and pancreas-kidney transplantation. *Am J Transplant* 2005; 5(8): 1966–1970.
22. Gruessner RWG, Sutherland DER, Drangstveit MB, et al. Pancreas transplants from living donors: Short-term and long-term outcome. *Transplant Proc* 2001; 33: 819–820.
23. Zielinski A, Nazarewski S, Bogetti D, et al. Simultaneous pancreas-kidney transplant from living related donor: a single-center experience. *Transplantation* 2003; 76(3): 547–552.
24. Robertson RP, Lanz KJ, Sutherland DE, Seaquist ER. Relationship between diabetes and obesity 9 to 18 years after hemipancreatectomy and transplantation in donors and recipients. *Transplantation* 2002; 73(5): 736–741.
25. Grant D, Abu-Elmagd K, Reyes J. 2003 report on the intestine transplant registry: a new era has dawned. *Ann Surg* 2005; 241(4): 607–613.
26. Testa G, Holterman M, John E, et al. Combined living donor liver/small bowel transplantation. *Transplantation* 2005; 79(10): 1401–1404.
27. Fryer J, Pellar S, Ormond D, et al. Mortality in candidates waiting for combined liver-intestine transplants exceeds that for other candidates waiting for liver transplants. *Liver Transpl* 2003; 9(7): 748–753.
28. Genton L, Raguso CA, Berney T, et al. Four year nutritional follow up after living related small bowel transplantation between monozygotic twins. *Gut* 2003; 52: 659–662.
29. Gruessner RW, Sharp HL. Living-related intestinal transplantation: first report of a standardized surgical technique. *Transplantation* 1997; 64(11): 1605–1607.
30. Testa G, Panaro F, Schena S, et al. Living related small bowel transplantation: donor surgical technique. *Ann Surg* 2004; 240(5): 779.
31. Jaffe BM, Beck R, Flint L, et al. Living-related small bowel transplantation in adults: a report of two patients. *Transplant Proc* 1997; 29(3): 1851–1852.
32. Ellozy SH, Harris MT, Bauer JJ, et al. Early postoperative small-bowel obstruction: a prospective evaluation in 242 consecutive abdominal operations. *Dis Colon Rectum* 2002; 45(9): 1214–1217.
33. Fraser SA, Shrier I, Miller G, Gordon PH. Immediate postlaparotomy small bowel obstruction: a 16-year retrospective analysis. *Am Surg* 2002; 68(9): 780–782.
34. Matter I, Khalemsky L, Abrahamson J, et al. Does the index operation influence the course and outcome of adhesive intestinal obstruction? *Eur J Surg* 1997; 163(10): 767–772.

35. Menzies D, Ellis H. Intestinal obstruction from adhesions—how big is the problem? *Ann R Coll Surg Engl* 1990; 72(1): 60–63.
36. Ellis H, Moran BJ, Thompson JN, et al. Adhesion-related hospital admission after abdominal and pelvic surgery: a retrospective cohort study. *Lancet* 1999; 353(9163): 1476–1480.
37. Fevang BT, Fevang J, Lie SA, et al. Long-term prognosis after operation for adhesive small bowel obstruction. *Ann Surg* 2004; 240(2): 193–201.
38. Miller G, Boman J, Shrier I, Gordon PH. Natural history of patients with adhesive small bowel obstruction. *Br J Surg* 2000; 87(9): 1240–1247.

The Ethics Statement of the Vancouver Forum on the Live Lung, Liver, Pancreas, and Intestine Donor

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The use of organs from live donors is an important component of transplantation today. The Ethics Committee of the Transplantation Society (TTS) has previously published a statement on ethical considerations pertaining to the live kidney donor (*1*). Evolving technologies have now allowed for the successful transplantation of organs from the live lung, liver, pancreas and intestine (extrarenal) donors. The Ethics Committee of TTS was convened at the Vancouver Forum to deliberate upon the use of live donors for extrarenal transplantation. The following is a summary of the committee's deliberations. We believe that live extrarenal donation should proceed within the context of the ethical principles established for live kidney donation. The physical and psychosocial welfare of a healthy donor must be put in context of the needs of the recipient and impact of the recipient's illness upon the donor. In principle, the Ethics Committee of TTS recommends that live lung, liver, pancreas and intestine donation should only be performed when the aggregate benefits to the donor-recipient pair (survival, quality of life, psychological, and social well being) outweigh the risks to the donor-recipient pair (death, medical, psychological, and social morbidities).

At the Vancouver Forum, emerging data pertaining to the aggregate risks and benefits of live lung, liver, pancreas and intestine transplantation provided more information regarding the factors that enter into the ethical decision to place a healthy person in harms way. It is now evident that live donors are the sole source of organs for transplantation in many societies; however the limited availability of information about outcomes for the donors and recipients mandates that live lung, liver, pancreas and intestine organ donation and transplantation must proceed with thoughtful independent oversight and transparency. As organs recovered from deceased donors offer substantial (and sometimes superior) benefits to potential recipients, with no risk to a healthy, live donor, efforts to maximize the use of organs from deceased donors must not be impeded by the development of live organ donation.

This consensus statement comes from the deliberations of the Ethics Group of the Vancouver Forum which was charged with defining the essential ethical elements of the process for the transplant center performing live lung, liver, pancreas and intestine donor. Special emphasis upon elements and issues of informed consent, assurance of donor autonomy and the patient selection process is included for clarity.

Responsibility of the Transplant Team Performing Live Donation

- Information about organ donation and transplantation should be provided repetitively to the prospective donor in order to facilitate the decision to proceed with live organ donation.
- Medical, psychological and social suitability should be determined after complete and thorough evaluation by a team that has the expertise to assess the suitability of an individual for organ donation.
- If medical conditions are identified in a prospective donor that need treatment (some may preclude donation), then the transplant team should counsel and encourage acquisition of medical care to treat such conditions.
- Recognizing that the donation process is stressful whether or not it proceeds, psychological support should be available throughout the evaluation and donation process.
- Live organ donation should be voluntary and the transplant team should make efforts to assure that the decision to donate is voluntary and has not been manipulated.
- Medical care for the donor should be provided until there is recovery from the donation procedure.
- Quality assurance/improvement procedures should be utilized to decrease risk during the donation process.
- The transplant center should facilitate the long-term follow-up and treatment of the donor with donation related acquired conditions.
- The transplant center should contribute to the general knowledge base by reporting complications and outcomes to registries and the medical community.
- The transplant center should work with appropriate authorities, agencies and insurance companies (as applicable) to minimize disincentives and penalties towards live organ donation.

A transplant center that performs live organ transplantation must implement procedural safeguards to enhance do-

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nor understanding, safety and autonomous decision-making. These are considered to be essential to the process of live organ donation, particularly for the live lung, liver, pancreas and intestine donor.

The essential procedural components include:

- Inclusion of health care professionals in the donation process, who are exclusively responsible to the donor's evaluation and welfare. Such an individual should not have direct contact with the recipient or be overtly influenced by concerns for the recipient.
- Repetition of the information pertaining to live donation, in recognition that informed consent is a process not an event.
- Psychosocial evaluation, to include the capacity of the donor to process information and give informed consent.

Additional safeguards may include:

- Reflection period after medical acceptance and decision to donate.
- Assessment of donor retention of information and understanding.
- External review committees.

Informed Consent

Informed consent from an individual is essential in the performance of live organ donation. The prerequisites for an individual to give informed consent are that

- The potential donor must have a cognitive capacity sufficient to make the decision to donate.
- The decision must be voluntary.
- The donor must receive and understand relevant and sufficient information about the procedure.

Informed consent is predicated upon the individual's receipt of adequate information about the evaluation process to become an organ donor and the donation procedure and possible consequences. The disclosure should include information about the associated risks, including but not limited to:

- The risk of death, reported worldwide and at the center where the procedure is proposed.
- Medical morbidities.
- Changes in health and organ function.
- Impact upon insurability/employability.
- Potential effects on family and social life.
- Psychological impact of donation and nondonation.

In addition, the potential donor should be given information about:

- The responsibility of the individual and health and social systems in the management of discovered conditions (such as the discovery during the evaluation process of HIV, tuberculosis or other transmissible diseases);
- Any specific recipient conditions which may impact upon the decision to donate; however, no information can be given to the potential donor until permission is obtained from the recipient;
- Expected transplant outcomes (favorable and un-favorable) for the recipient.
- Information on alternative types of treatments for the recipient, including deceased organ transplantation;
- The limited information available on extrarenal live donation results in uncertainty about donor and recipient outcomes;
- The request that the potential donor participate in long-term information gathering (registries) to increase the knowledge base.

Donor Autonomy

The decision to donate must be voluntary and the individual *must* be reassured that:

- The freedom to withdraw from the donation process at any time exists, without consequence and within a supportive environment;
- Medical and other reasons for not proceeding with donation will be kept confidential.

However,

- Donor consent and autonomy is necessary, but not sufficient to proceed to donation; medical evaluation and concurrence are essential;
- Donor autonomy does not overrule medical judgment and decision making.

Donor Selection

- Individuals who are legally incompetent or who lack the capacity for autonomous decision-making should not be donors. In the rare instance that these individuals might be considered as live organ donors, an independent advocate for the donor must be appointed using the mechanisms available within a particular society.
- In the event that non-directed or distant acquaintance live organ donation is entertained, special considerations to prevent donor exploitation should be made.
- Because many of the long-term consequences of extrarenal organ donation are not known, centers should consider long-term access to health care after the procedure as a prerequisite for donation.
- The donation process and follow-up should be cost neutral for the donor.

The use of healthy individuals to provide extrarenal organs for transplantation is predicated upon donor voluntariness and the aggregate benefit to the individuals outweighing the aggregate risk of adverse outcomes. Additional Ethics Committee recommendations are hampered by insufficient information pertaining to donor and recipient outcomes after live lung, liver, pancreas and intestine donation. As a consequence, procedural elements become paramount in the process in order to safeguard personal and system integrity, while minimizing the risk for exploitation of the donor. Voluntariness is predicated upon willingness to donate, with an understanding of the associated risks and benefits of the process. Without additional information relating to likely outcomes from extrarenal live donation, the informed consent process will be incomplete. There is a clear need for more information on short and long term consequences and risks associated with live donation of lung, liver, pancreas and intestinal organs. The transplantation community and the individual transplant team have a responsibility to collect and share data on donor outcomes in a consistent and comparable fashion. National, international and/or organizational donor registries should be established and maintained.

REFERENCE

1. The Consensus Statement of the Amsterdam Forum on the Care of the Live Kidney Donor. *Transplantation* 2004; 78(4): 491–492.