Pancreas and Pancreas/Kidney Transplantation Guidelines

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Kidney Transplantation CPT Code: 00868
Pancreas Transplantation CPT Code: 007700

Please note that these guidelines may need modification according to the patient’s condition, surgical protocol, and clinical studies in progress. Please check with the attending anesthesiologist assigned to the case.

General information

Patients presenting as recipients for pancreas transplantation have severe Type-1 Diabetes Mellitus (insulin deficient, insulin requiring diabetes mellitus) with a history of multiple episodes of ketoacidosis. Patients with Type-1 diabetes mellitus and end-stage renal disease are candidates for combined kidney/pancreas transplants and require regular dialysis. Because of this the patient should have had dialysis shortly before surgery. Post-dialysis potassium levels are often low, and can cause digoxin toxicity. Hemoglobin levels in patients with end stage kidney disease can also be low, but require blood transfusion only if $\text{Hb} < 8.0 \text{ g/dl}$. Check CMV (cytomegalovirus) status of packed cells, and use PAL filter for all transfusions, if available. Especially in brittle diabetic patients, assess airway carefully, because neck movement may be severely limited. Don’t use limb with AV-fistula for vascular access or non-invasive blood pressure monitoring! Document location and viability of A-V-fistula on anesthesia record!
OR set-up

- General OR anesthesia cart
- Alaris infusion pump
- Blood warmer
- EKG
- ETCO₂
- Pulse oximeter
- Triple lumen CVP line
- (Arterial blood pressure monitoring : only if required)
- Albumin, 5%, 250 ml (1-2 bottles)
- Cisatracurium, 2-3 vials
- Fentanyl, 2 x 250 μg
- Hydromorphone, 2 x 2 mg
- NACl, 3-4 1000 ml bags. Avoid Lactated Ringer's and Plasmalyte because of their potassium content.
- Insulin infusion : 1 unit insulin / ml NACl
- Blood products : 4 units packed cells in house. At recirculation of pancreas graft, blood loss can be 400 ml.
- Mannitol, 12.5 g, i.v.-solution (for combined Pancreas/Kidney transplant only, from nurses cart)
- Frusemide, 100 mg, i.v.-solution (for combined Pancreas/Kidney transplant only, from nurses cart)

Preoperative patient management in the holding area

As soon as the patient has arrived in the holding area give :

- **20 G peripheral venous access line** in limb without AV-fistula !
  Cefazolin 2g iv, if > 120kg then give 3g. For penicillin allergy, give Levofloxacin 750mg IV
  For history of MRSA colonization or infection, ADD weight-based vancomycin dose:
    50-70kg = 1g
    71-100kg = 1.5g
    >100kg = 2g
- It takes antibiotics only 1 minute to be distributed throughout the blood circulation, but 30-60 minutes to diffuse to the skin !
- Metoclopramide, 10 mg, i.v. for gastroparesis in Type-1 Diabetes Mellitus patients
- Midazolam, 2 mg, i.v. to lower anxiety

The patient may arrive in the holding area with the following medication :
  Acetaminophen, 650 mg, po/pr/ng (if not already given on the floor)
  Diphenhydramine, 50 mg, iv (if not already given on the floor)
  Methylprednisolone, 500 mg, iv
  Thymoglobulin (ATG), 1.5 mg/kg (dose rounded to nearest 25mg) iv; start infusion in OR via CVP line 1 hour after methylprednisolone has been given.
Preoperative patient management in OR

Protect limb with AV-fistula! General anesthesia is the anesthetic technique of choice. In combined pancreas/kidney transplants, hypotension – even transient – should be avoided to prevent decrease in perfusion of AV-fistula and transplanted kidney.

- TED stockings and thromboguards on lower legs

After standard general induction of anesthesia:

- Foley catheter
- NG tube
- Insert triple lumen CVP line in (right) internal jugular vein. Use SonoSite!
- Arterial line (in limb without AV-fistula!) is only necessary in patients with cardio-vascular problems. Blood sugars can be checked with blood from the CVP line using blood glucose strips. Blood glucose strips are reliable and much cheaper than a blood gas analysis!

Intraoperative patient management

As soon as the patient is asleep and the internal jugular vein triple lumen CVP line has been placed, give:

- Methylprednisolone, 500 mg, i.v.
- Thymoglobulin (ATG), 1.5 mg/kg i.v.-infusion over 12 hours (start 1 hour after methylprednisolone has been given)

<table>
<thead>
<tr>
<th>Class</th>
<th>Methylprednisolone</th>
<th>Thymoglobulin (ATG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraindications</td>
<td>Hypersensitivity to drug</td>
<td>Allergy to rabbit proteins</td>
</tr>
<tr>
<td></td>
<td>Systemic fungal infections</td>
<td>Acute viral illness</td>
</tr>
<tr>
<td>Adverse Effects</td>
<td>Hyperglycemia</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>Edema</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulmonary edema</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tachyarrhythmia</td>
</tr>
</tbody>
</table>

General anesthesia can be provided as inhalation anesthesia (O2/air/volatile agent or O2/volatile agent).

No N2O to prevent inflation of intestines!

The total fluid requirement of the patient is generally 3-4 liters, 250-500 ml of which should be albumin 5%. For the rest use only NACL and avoid Lactate Ringer’s and Plasmalyte because of their potassium content.
# Insulin Infusion Guidelines

Start insulin infusion according to algorithm to keep serum glucose levels 70-100 mg/dl. The concentration of the insulin infusion is 1 unit insulin / ml NACL. If despite the insulin infusion, the serum glucose levels remain > 360 mg/dl, give additional insulin boluses until serum glucose levels decrease to < 360 mg/dl.

<table>
<thead>
<tr>
<th>Blood Glucose (mg/dL)</th>
<th>Insulin Infusion Rate (units/hr)</th>
<th>IV Infusion rate (ml/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>70-109</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>110-119</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>120-149</td>
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<tr>
<td>150-179</td>
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<td>180-209</td>
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<td>3</td>
</tr>
<tr>
<td>210-239</td>
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<td>4</td>
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<td>240-269</td>
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<td>270-299</td>
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<td>300-329</td>
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<tr>
<td>330-359</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>&gt; 359</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

- Prior to pancreas graft recirculation, **draw glucose level every 30 minutes**
- After pancreas graft recirculation, draw blood glucose level every 10 minutes for one hour
- After 1-hour post recirculation of pancreas graft, draw blood glucose level every 30 minutes until end of case

If the patient receives a combined pancreas/kidney transplant, the kidney will be transplanted first. **Check potassium levels** by taking venous blood gas samples!

If hyperkalemia (K+ > 6 mmol/l) should occur, the treatment options are:

- CaCl₂, 500-1000 mg, slowly i.v. (if K+ is very high; unless patient is on digoxin)
- NaHCO₃ (dosage depends on severity)

Shortly before recirculation of transplant kidney, give:

- Mannitol, 12.5 g, i.v. (ask surgeon for right timing)
- Frusemide, 100 mg, i.v. (ask surgeon for right timing)

**Postoperative patient management**

- After surgery, the patient will be extubated and transferred first to PACU, and then to ICU.
- Postoperative pain management is provided by PCA loaded with hydromorphone.
Pancreas & Pancreas/Kidney Transplantation Guidelines

FLOW CHART

OR set-up

___ General OR anesthesia cart in OR
___ Alaris infusion pump
___ Blood warmer
___ EKG
___ ETCO₂
___ Pulse oximeter
___ Triple lumen CVP line
___ Arterial blood pressure monitoring (if required)

___ Albumin, 5%, 250 ml (1-2 bottles) in OR
___ Blood products: 4 units packed cells in house.
___ NACL, 3000-4000 ml in OR

___ Insulin infusion: 1 unit insulin / ml NACL in OR

___ Cisatracurium, 2-3 vials
___ Fentanyl, 2 x 250 μg
___ Hydromorphone, 2 x 2 mg
___ Mannitol, 12.5 g, i.v.-solution in OR (for combined Pancreas/Kidney transplant only)
___ Frusemide, 100 mg, i.v.-solution in OR (for combined Pancreas/Kidney transplant only)

Preoperative patient management in the holding area

___ 20 G peripheral venous access line established

___ Cefazolin 2g (if >120kg give 3g). For penicillin allergy, give Levofloxacin 750mg IV
   For history of MRSA colonization or infection, ADD weight-based vancomycin dose:
   50-70kg = 1g
   71-100kg = 1.5g
   >100kg = 2g
___ Midazolam, 2 mg, i.v. given
___ Metoclopramide, 10 mg, i.v., given
___ Ranitidine, 50 mg, i.v., diluted to 20 ml, given
___ Acetaminophen, 650 mg, po/pr/ng (if not already given on the floor)
___ Diphenhydramine, 50 mg, iv (if not already given on the floor)
**Preoperative patient management in OR**

Before induction of general anesthesia:
- TED stockings and thromboguards put on lower legs

After standard induction of general anesthesia:
- Foley catheter inserted and secured
- NG tube inserted
- Triple lumen CVP line inserted in (right) internal jugular vein. Use Site rite if necessary!
- Arterial line (if required) inserted (in limb without AV-fistula!)

**Intraoperative patient management**

- Methylprednisolone, 500 mg, i.v.
- Thymoglobulin (ATG), 1.5mg/kg i.v (dose rounded to nearest 25mg) -infusion over 12 hours (start 1 hour after methylprednisolone has been given)

Shortly before recirculation of transplant kidney:
- Mannitol, 12.5 g, i.v., given. Ask surgeon for right timing!
- Frusemide, 100 mg, i.v., given. Ask surgeon for right timing!