Gastric Bypass in Diabetic Patients with Body Mass Index <35

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Statistics: worldwide prevalence of diabetes mellitus (DM) 2.8% in 2000; increased to 8.3% by 2011; 80% of deaths due to DM occur in low- to middle-income countries; 4.6 million died of DM in 2011; risk for cardiovascular disease 200 to 400 times greater in persons with DM; 55% of new end-stage renal disease in Asia due to DM

Gastric bypass (GB) in patients with DM and morbid obesity: Swedish obesity study — mortality decreased 80% in patients surgically treated for obesity; Utah study — mortality decreased 92% in surgically treated patients; morbid vs superobesity study — excellent DM control seen after GB in both groups; fat mass had no effect on resolution of diabetes; reasonable to determine whether metabolic surgery useful in persons with DM and body mass index (BMI) <35

Literature review: Lee study — hemoglobin (Hb) A1c 9.7% at baseline, 5.8% yr 1, and 5.9% yr 2 after surgery in patients with type II DM and BMI of 23 to 35; 55% to 57% of patients in complete remission; 90% improved to HbA1c <7%; improved glucose not explained by rise in glucagon-like peptide (GLP)-1 because insulin levels decreased; effect due to reduction of insulin resistance; studies by Hall and Wittgrove — patients with ≥10-yr duration of DM had reduced chance of postgastrostomy remission; Cohen study — 36 of 37 patients with type II DM had remission of metabolic syndrome after GB; Shah study — all patients experienced remission after GB despite average of 8.7 yr of severe DM; Huang study — Asian patients with higher BMI, younger age, and shorter duration of disease tended to have better response after GB; Wittgrove study (revised) — 14 patients with DM and BMI <35 treated with GB; patients did not lose excessive weight; 11 patients in remission at 1 yr; 3 had improvement without resolution (all of whom had DM >8 yr); however, some of 11 with remission had ≥8-yr duration of DM

Biliopancreatic Diversion vs Duodenal Switch

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Morbidity and mortality: duodenal switch (DS) operation combination of sleeve gastrectomy (SG) and GB; combination increases efficacy of operation; mortality close to that of GB; Buchwald study — morbidity rate 14% in patients with BMI <50 and 24% with BMI ≥50; risk for morbidity and mortality increases with higher BMI

Marceau studies: compared biliopancreatic diversion (BPD) to DS; 0.5% of DS operations reversed at 10 yr (higher for BPD); higher weight loss seen at 5 and 10 yr with DS; revisions — usually due to malnutrition and diarrhea after classic BPD; ≤4% of DS revised at 10 yr (1% because of malnutrition; 2.8% for insufficient weight loss [reason for most DS revisions]); pyloric antrum remains intact and common channel longer after DS surgery; 15-yr cohort — survival rate 92% (close to that of general population); 92% of patients with initial BMI <50 obtained BMI <35; 83% of patients with initial BMI ≥50 obtained BMI <40; resolution of comorbidities — 92% of DM, 90% of sleep apnea, and 88% of asthma resolved over 15 yr; operative mortality rate 1%; mortality rate 0% with laparoscopic surgery

Comparative studies: Chicago study — patients treated with DS had superior weight loss, compared with those treated with GB; Scandinavian study — superobese patients had longer operative times and longer length of stay after DS; BMI decreased from 54 to 55 to 38.5 after Roux-en-Y GB, vs 32.5 after DS; excess weight loss 75% after DS, vs 55% after GB; comorbidity study — 100% of DM resolved after DS, vs 60% resolution after GB; resolution of hypertension 68% vs 39% and of dyslipidemia 72% vs 26%; rate of gastroesophageal reflux disease (GERD) increased after DS due to SG; Inabnet study — 12-mo remission of DM 28% with gastric band surgery, 62% with GB, 52% with SG, and 74% with DS; better resolution of DM after DS surgery likely due to preservation of pylorus; dumping syndrome and severe hypoglycemia less common after DS, compared with GB; however, gastric emptying faster after DS, compared to normal controls; Cornell study — most operative candidates have ≥50% body fat; body fat decreased to 30% after GB, vs 25% after DS; body fat remained at 45% after band surgery; bowel habits study — no statistically significant difference seen in the median number of bowel episodes after DS vs GB; bone study — maintenance of calcium absorption and vitamin D levels preserves bone for 10 yr after DS; small cuff of duodenum preserved in DS allows absorption of calcium, iron, and other metals

Revision of DS: resleeving possible if weight loss inadequate; common channel can be lengthened to create enteroenterostomy


**When to Perform Sleeve Gastrectomy**

**Dr. Gagner**

**Background:** bariatric surgery population has high risk for reflux; *Suter study* — 36% of patients had preoperative symptoms of reflux; 53% had hiatal hernia at endoscopy; 31% had reflux esophagitis; elevated DeMeester score seen in 52%; lower esophageal sphincter (LES) pressure low in 17%; patients with hiatal hernias have a higher prevalence of GERD and daily vomiting after GB

**Sleeve gastrectomy:** look for and expose gastroesophageal junction to reveal presence of hiatal hernia, and repair if present; *contraindications* — severe reflux or Barrett esophagus; SG increases risk for continued reflux in these patients (Roux-en-Y GP more appropriate)

**Studies:** outcomes study — 76% of patients with morbid obesity had resolution of GERD after SG; *meta-analysis* — showed no consensus on resolution of GERD after SG; *Chilean study* — LES pressure decreased 3 mm Hg and volume decreased over 90% after SG; pressure increased ≥10 mm Hg inside sleeve; volume multiplied by 2.5, which relieves some GERD symptoms; *Carter study* — symptoms of GERD increased, then returned to baseline, after SG; *Cadire study* — de novo GERD appeared after 1 yr in 8% of patients treated with gastric band and in 21% of patients treated with SG; however, after 3 yr, GERD found in 21% of patients with gastric band and in 3% with SG (possibly due to distention and decrease in pressure inside sleeve over time)

**Hiatal hernia:** repair at time of SG prevents intrathoracic migration of sleeve; vague symptoms necessitate computed tomography (CT) to diagnose upward migration; *Freiburg study (Germany)* — sleeves that migrate do so by 2 mo after SG; smaller sleeves more likely to migrate; migration seen in sleeves with average volume of 127 mL, vs no migration with 217 mL; crura can be closed with sutures after sleeve repositioned; *Merchant study* — patients treated with SG and paraesophageal hernia repair had no recurrence of hiatal hernia or GERD; *manometry study* — GS increases LES pressure and protects against reflux

**Conclusion:** GS worsens GERD if LES incompetent, but improves GERD if LES competent

**Minimally Invasive Distal Pancreatectomy**

**Richard Mackey, MD, Director of Hepatobiliary and Pancreatic Surgery, St. Joseph Medical Center, Towson, MD**

**Background:** advantages to minimally invasive distal pancreatectomy (MIDP) include decreased morbidity, less need for transfusion, and shorter length of stay, compared to open pancreatectomy; disadvantages include need for advanced training, lack of certainty that MIDP oncologically equivalent to open surgery, and cost

**Variability:** MIDP performed laparoscopically, robotically, and with or without splenectomy; procedural techniques vary; current studies use international definition of fistula; robotic surgery increases costs; number and type of ports used vary

**Outcomes:** *Weber and Kooby studies* — show 85% success rate for MIDP; 30% to 50% of cases solid tumors; 50% to 60% of cases done for cystic disease; overall morbidity 40% in most series; length of stay significantly decreased with laparoscopic vs open surgery; decrease rate 20% to 30% (type B-C, 10%-18%)

**Robotic MIDP:** use of robots increasing in pancreatic surgery, but no randomized trials compare different techniques; use of robotic surgery increases rate of splenic salvage, compared with laparoscopic or open surgery; splenic salvage may reduce perioperative infections, cost, and length of stay; *Warshaw technique* (ligation of splenic vessels rather than dissection) faster, but results in higher complication rates; 0% to 6% of laparoscopic resections and ≤5% of robotic surgeries successfully completed; rate of splenic salvage 50%, 65%, and 95% in largest 3 studies; overall morbidity 10% to 35%; patients treated with robotic surgery have shorter length of stay; fistula rate 0% in Waters study; *Giulianotti study* showed laparoscopic and robotic surgery comparable to open surgery in number of lymph nodes harvested and negative margins; Waters study had similar results, but lower rate of lymph node retrieval; *cost* — Kang and Waters show robotic surgery ≤2.5 times more expensive than laparoscopic surgery (but data confounded by various factors)

**Laparoscopic vs open pancreatectomy:** *review study* — 1000 patients in 13 comparative studies reviewed; no overall difference seen in fistula rate or mortality; patients in laparoscopic arm had less blood loss, shorter length of stay, lower morbidity, and higher rate of splenic preservation

**Liver Transplantation**

**Charles Miller, MD, Director of Liver Transplantation, Transplantation Center, Cleveland Clinic, Cleveland, OH**

**Hepatic blood flow:** cardiac output (CO) and cardiac index generally high in patients undergoing transplantation of liver; hepatic flow accounts for 30% of CO in transplanted livers vs 25% in normal controls; liver grafts subjected to higher proportion of already-increased CO in cirrhotic patients; *hepatic artery buffer response (HABR)* — flow through portal vein increases 3-fold, while flow to hepatic artery diminishes; HABR causes relative vasospasm and decreased perfusion of hepatic arteries; ischemia, central lobular microvesicular steatosis, and infarction possible in severe cases; can cause compromise of bile ducts (tip of donor duct most sensitive to ischemia)

**Case example:** flow meter indicated portal blood flow to liver graft increased from ≤800 mL/min in donor to 2600 mL/min after transplantation to recipient; mean arterial flow 86 mL/min; clamping of portal vein increased hepatic artery flow to 381 mL/min; *HABR* probably due to severe washout of intrahepatic adenine (potent vasodilator) due to increased portal flow

**Ligation (or embolization) of splenic artery (SA):** increases hepatic artery flow (preserves graft) and likely prevents hepatic artery thrombosis; *case example* — angiography showed reversal of diastolic flow and resistive index (RI) of 1 (maximal value) before embolization; afterward, arterial flow normalized, with good diastolic flow; blood flow to portal vein reduced, which decreased RI and HABR; *study* — embolization of SA significantly decreased incidence of hepatic artery thrombosis; likely prevents ischemia and strictures of bile duct

**Portal vein in cirrhosis:** may be normal or thrombosed; large spleno-renal shunts may develop and cause encephalopathy, without ascites or other signs of portal hypertension; *Tzakis study* — hemiporto-caval transposition performed; liver reperfused from vena cava using portal vein; speaker’s group uses left renal vein for inflow via splenorenal shunt (associated with excellent outcomes)

**Piggyback technique:** complications may occur with placement of suprahepatic cava into hepatic vein; *case example* — tight stenosis and lack of hepatic vein drainage caused acute Budd-Chiari syndrome immediately after transplantation; *side-to-side cava-plasty* — performed with endogastrointestinal anastomosis stapler; cava from liver “piggybacked” in; results in triphasic venous outflow

**Radiofrequency Ablation for Liver Metastasis**

**Allan Siperstein MD, Chairman, Center for Endocrine Surgery, Cleveland Clinic, Cleveland**

**Procedure:** radio frequency ablation (RFA) performed by placing ablation catheter into lesion under ultrasonographic guidance; energy applied ablates lesion and rim of surrounding normal tissue; computer control creates even zone of ablation; 1-cm zone around lesion minimum requirement; laparoscopic approach provides precise targeting of RFA; 2 ports placed in right subcostal area (for camera and for ultrasonography probe); RFA catheter placed percutaneously in separate area; *follow-up* — CT done within 1 wk of surgery to ensure RFA defect covers area
Survival of colorectal patients; patients treated with RFA usually not candidates for resection and have failed chemotherapy (CTX); studies—median survival of patients treated with salvage CTX =1 yr; actual survival at 3 yr 20%, and 18% at 5 yr; RFA converts minority of patients into longer-term survivors; patients with <3 lesions have better survival, compared to patients with >3 lesions; effect of lesion size relatively minimal (local recurrence higher with larger lesions, but re-treatment results in survival similar to that with smaller lesions); carcinoembryonic antigen (CEA)—low level associated with better outcomes than high level; extrahepatic disease—effect relatively minimal (only small limited metastases treated); intra-abdominal metastases, limited at time of laparoscopy, do not obviate treatment.

RFA vs resection: comparison difficult due to differences in populations; Cleveland Clinic study—5-yr survival of patients undergoing RFA 17% to 18%, vs 60% for resection; risk factors in patients treated with RFA include worse comorbid disease, higher American Society of Anesthesiology physical status scores, extrahepatic disease in 22%, more lesions, higher CEA, higher incidence of synchronous disease, and higher local recurrence rates; however, selected patients with single <1 cm lesion had outcomes similar to those of patients who had resection; Hansen study—patients with RFA (who would be physically but not biologically resectable) had survival similar to patients with resection when Markov analysis used to correct covariants.

Suggested Reading


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  - Review written summary and suggested readings 35 minutes
  - Take posttest 10 minutes

- **Take posttest**
1. According to studies of patients with morbid obesity and diabetes mellitus (DM), all the following statements are true, except:
   (A) Treatment with gastric bypass (GB) decreases mortality rates
   (B) Hemoglobin A1c decreases after GB
   (C) Patients with greater fat mass have less resolution of DM
   (D) GB surgery markedly improves control of DM

2. According to studies of patients treated with GB, those with ______ generally have higher remission rates of DM.
   (A) Higher insulin levels (C) A and B
   (B) Shorter duration of DM (D) Neither A nor B

3. Most revisions of duodenal switch (DS) surgery are performed because the patient has:
   (A) Inadequate weight loss (C) Excess weight loss
   (B) Malnutrition (D) Diarrhea

4. According to studies that compared GB with DS, patients treated with DS experienced:
   1. More weight loss
   2. Less gastroesophageal reflux disease (GERD)
   3. Better resolution of hypertension and DM
   4. More severe hypoglycemia and dumping syndrome
   5. Significantly more bowel episodes
      (A) 1,3 (B) 2,4 (C) 1,2,5 (D) 3,4,5

5. Which of the following is associated with a higher risk for GERD symptoms after SG?
   (A) Repair of hiatal hernia at the time of SG (C) Postsurgical distention of the sleeve over time
   (B) Larger volume of the gastric sleeve (D) SG in patients with Barrett esophagus

6. Distal pancreatectomy performed by robotic surgery is associated with decreased _______, compared with open surgery.
   (A) Cost (B) Splenic salvage (C) Length of stay (D) All the above

7. The hepatic artery buffer response (HABR) causes _______ perfusion of hepatic arteries; HABR is reversed by ligation of the _______.
   (A) Increased; splenic artery (C) Increased; portal vein
   (B) Decreased; splenic artery (D) Decreased; portal vein

8. Patients with cirrhosis of the liver can present with encephalopathy due to large splenorenal shunts even if there are no other signs of portal hypertension.
   (A) True (B) False

9. There is no cut-off size at which liver tumors are considered too large to be treated by radiofrequency ablation (RFA).
   (A) True (B) False

10. All the following statements about patients with liver lesions treated via RFA are true, except:
    (A) Patients with <3 lesions have better survival, compared to those with >3 lesions
    (B) Retreatment of larger lesions results in similar survival as in patients with smaller lesions
    (C) Patients with low carcinoembryonic antigen (CEA) have better outcomes than those with high CEA
    (D) Extrahepatic disease, even if limited, obviates treatment with RFA

Answers to Audio-Digest General Surgery Volume 60, Issue 08: 1-D, 2-C, 3-B, 4-B, 5-D, 6-D, 7-C, 8-A, 9-B, 10-C