Bariatric surgery and Diabetes Mellitus Management; The current state of affairs

Gabriel I. Uwaifo, MD FACE FACP
Department of Endocrinology, Diabetes and Metabolism,
Ochsner Medical Center, LA
Presentation Outline

• Case summary
• What bariatric surgery entails and what it does not
• Bariatric surgery and diabetes mellitus; what the data shows
• Potential risks and complications
• How does bariatric surgery influence diabetes and glycemia; putative pathophysiology.
• Bariatric surgery and diabetes prevention vs cure
• The Louisiana perspective
• Future directions and perspectives
• Concluding remarks
• Bibliography
Case summary

- LS is a 46yr old African American gentleman with 16 yr history of type 2 diabetes, long standing morbid obesity and associated comorbidities including bilateral knee OA, OSAS erratically managed with CPAP therapy, HTN, hyperlipidemia with hypercholesterolemia, hyperuricemia without prior documented gouty arthropathy and NAFLD.
- He was seen at the LSUHSC COSMOS weight management program seeking assistance with long term weight management and possible bariatric surgery.
- He had no medical insurance other than the interim hospital sponsored medicaid insurance.
- His diabetes medications were NPH insulin with total daily dose of 100-120units BID, metformin 1g BID and glyburide 10mg BID.
- His BMI when he was seen for 48 and his prior HBA1cs over the preceding year had been in the 7.9-8.6 range with no documented retinopathy or neuropathy though he had mild microalabuminuria in the 40-60ug/g creatinine range.
Case summary continued

- Patient enrolled in the 12 week intensive lifestyle modification and dietary changes program and successfully lost 12% of his baseline weight with BMI at end of program of 42 and HBA1c of 7.5.
- He had elective RYGB and at 2 yrs post procedure has lost over 125 lbs with a BMI at last review of 27.
- His HBA1c remained in the 5.6-6.2 range on metformin alone.
- His microalbuminuria resolved though he remained on low dose ACEI.
- He was down to only one antihypertensive and reduced dose statin. He was no longer using CPAP.
- He developed a bakers cyst in his left knee for which he was having difficulty have elective orthopedic surgery for correction which made his ambulation difficult.
- He also had marked redundant skin especially in his upper limbs and anterior abdominal wall with associated episodes of intertrigo. He was in the process of seeking compassionate care exemption to get elective panniculectomy done at last follow up.
Global projections for the diabetes epidemic: 2010-2030 (millions)

World
2010 = 285 million
2030 = 438 million
Increase 54%

Bariatric Surgical and Procedural Interventions in the Treatment of Obese Patients with Type 2 Diabetes
Weight management in diabetes

- 80-90% of patients with T2DM overweight or obese*
- Some antihyperglycemic therapies contribute to weight gain
- Higher BMI increases mortality
- Modest weight loss (5-10% total body weight) can improve metabolic parameters

Bariatric surgery (aka metabolic surgery); what it is and what it is not

• The most common types of bariatric surgery include:
  • Laparoscopic adjustable gastric banding (LAGB)
  • Roux-en-Y gastric bypass (RYGB)
  • Sleeve gastrectomy
  • Biliopancreatic diversion with or without duodenal switch (BPD/DS)
• It does not include;
  • Large volume liposuction
  • Panniculectomy and pannunectomoy
  • Omentectomy
  • Gastric pacemakers (maestro system et al)
  • Gastric balloon placement (Reshape and the Orbera systems)
  • Endoluminal sleeve placement
  • Stomach pump system (Aspire-Assist system aka “Assisted bulimia” system).
Bariatric/Metabolic surgery; What it is and what it is not

Bilio-pancreatic diversion
Distal gastric bypass
Intragastriic balloon
Gastric stimulator

Malabsorptive
Restrictive + Malabsorptive
Restrictive
Vertical Banded Gastroplasty
Adjustable Gastric Band
Sleeve gastrectomy

Surgically Induced Weight Loss

Roux-Y Gastric bypass
Most Common Procedures

- **Lap Adjustable Gastric Band**
- **Roux-en-Y Gastric Bypass**
- **Gastric Sleeve**
Highlights: CDA Guidelines for weight management in diabetes

• Interdisciplinary weight management programs to prevent weight gain and achieve and maintain a lower, healthy body weight (Grade A, Level 1A).

• Recognize the effect of anti-hyperglycemic agents on body weight. (Grade D, consensus).

• Bariatric surgery may be considered when lifestyle interventions are inadequate in achieving healthy weights in patients with type 2 diabetes and class II or III obesity (Grade B, Level 2).

• Similar language is now included in the guidelines from the ADA, the EASD and the IDF.

• A recent consensus statement from all these organizations now include bariatric/metabolic surgery and a viable treatment option to be considered in obese patients with type 2 diabetes

Bariatric surgery: Which persons with obese type 2 diabetes should be considered?

- Bariatric surgery is an appropriate treatment for people with type 2 diabetes and obesity not achieving recommended treatment targets with medical therapies, especially when there are other major co-morbidities.

- Surgery should be an accepted option in people who have type 2 diabetes and BMI of 35 or more

- Surgery should also be considered as an alternative treatment option in persons with BMI 30 to 35 when diabetes cannot be adequately controlled by optimal medical regimen, especially in the presence of other major cardiovascular disease risk factors

- In Asian, and some other ethnicities of increased risk, BMI action points may be lower e.g. BMI 27.5 to 32.5
Bariatric surgery for obese adolescents with type 2 diabetes

- An Australian report* recommends surgery be considered if adolescents have BMI >40, or >35 with severe co-morbidities, are 15 years or over & can provide informed consent.

- This IDF position statement advises that only 2 procedures, Roux-en-Y gastric bypass & laparoscopic gastric banding are currently conventional bariatric surgical procedures for adolescents.

Factors to consider when choosing a procedure in obese patients with type 2 diabetes

• Expertise & experience in the bariatric surgical procedures

• Patient’s preference when the range of risks & benefits, the importance of compliance, & the effects on eating choices and behaviours have been fully described

• Patient’s general health & risk factors associated with higher peri-operative morbidity & mortality

• Duration of the diabetes

• The follow-up regimen for the procedure and the commitment of the patient to adhere to it
Bariatric Surgery Criteria *

• Age ≥ 18 years
• Body Mass Index (BMI) ≥ 40
• BMI ≥ 35 with significant co-morbidities
  – Heart disease, Type 2 diabetes, Hypertension, Sleep Apnea, GERD
• History of prior weight management attempts
• Motivation and engagement in lifestyle modifications

* Ontario Bariatric Network
Bariatric Surgery Exclusion Criteria *

• Active substance use, including nicotine and alcohol, <6 months prior to surgery.

• Medical or surgical conditions that may make surgery a high risk to perform.

• Severe or poorly controlled current psychiatric illness or undertreated symptoms.

* Ontario Bariatric Network
# Bariatric Surgery Outcomes

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Morbidity</th>
<th>Mortality</th>
<th>% EWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGB</td>
<td>10%</td>
<td>.05-0.1%</td>
<td>47%</td>
</tr>
<tr>
<td>RYGBP</td>
<td>27%</td>
<td>0.5%</td>
<td>62%</td>
</tr>
<tr>
<td>BPD</td>
<td>30%</td>
<td>1-3%</td>
<td>70%</td>
</tr>
<tr>
<td>SLEEVE</td>
<td>1%</td>
<td>0%</td>
<td>30-40%</td>
</tr>
<tr>
<td>BALLOON</td>
<td>4%</td>
<td>.03%</td>
<td>40%</td>
</tr>
<tr>
<td>IGS</td>
<td>1%</td>
<td>0%</td>
<td>23-40%</td>
</tr>
</tbody>
</table>
### Expected short-term weight loss following bariatric surgery

<table>
<thead>
<tr>
<th>Operative procedure</th>
<th>Excess weight loss (percent)</th>
<th>Time until weight stabilization (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric bypass</td>
<td>60 to 85</td>
<td>1 to 1.5</td>
</tr>
<tr>
<td>Adjustable gastric band</td>
<td>45 to 55</td>
<td>2</td>
</tr>
<tr>
<td>Sleeve gastrectomy</td>
<td>55 to 80</td>
<td>1 to 1.5</td>
</tr>
</tbody>
</table>

References:

Outcomes after Bariatric Surgery

• Weight loss
  – 52-77% excess body weight loss maintained at 10 yrs

• All cause mortality lowered 29-40%
  – CAD ↓49%, cancer ↓60%

• Diseases improved or remission (60-80%)
  – Diabetes, lipids, BP, liver disease, MSK pain
  – Sleep apnea resolves 95%

• Improved Quality of Life

Outcomes after Bariatric Surgery

Co-morbidity Reduction After Bariatric Surgery

- Migraines: 57% resolved
- Pseudotumor cerebri: 96% resolved
- Dyslipidemia, hypercholesterolemia: 63% resolved
- Non-alcoholic fatty liver disease: 90% improved steatosis, 37% resolution of inflammation, 20% resolution of fibrosis
- Metabolic syndrome: 80% resolved
- Type II diabetes mellitus: 83% resolved
- Polycystic ovarian syndrome: 79% resolution of hirsutism, 100% resolution of menstrual dysfunction
- Venous stasis disease: 95% resolved
- Gout: 72% resolved
- Depression: 55% resolved
- Obstructive sleep apnea: 74-98% resolved
- Asthma: 82% improved or resolved
- Cardiovascular disease: 82% risk reduction
- Hypertension: 52-92% resolved
- GERD: 72-98% resolved
- Stress urinary incontinence: 44-88% resolved
- Degenerative joint disease: 41-76% resolved

Quality of life improved in 95% of patients

Mortality: 89% reduction in 5-year mortality

Ochsner
Frank Riddick Diabetes Institute

Courtesy Cleveland Clinic
The Swedish Obese Subjects (SOS) Study
Study Overview

• The **Swedish Obese Subjects Study**: obese subjects treated with gastric surgery and contemporaneously matched, conventionally treated obese controls

• Surgically treated subjects enrolled for at least 2 years (4047 subjects) or 10 years (1703 subjects) had a **lower incidence of diabetes, hypertriglyceridemia, and hyperuricemia**; differences in the incidence of hypercholesterolemia and hypertension were not significant

• Bariatric surgery resulted in **long-term weight loss, improved lifestyle, and amelioration of some risk factors**
Weight Changes of subjects in the SOS Study over a 10-Year Period

Bariatric Surgery is associated with a Reduced Mortality: the SOS Study

30% lower risk of dying

MI: 25 in control group, 13 in the surgery group

Cancer: 47 in the control group, 29 in the surgery group

Sjostrom L NEJM 2007: 357-741-752
218 patients screened

- HbA1c > 7.0%
- BMI 27-43 kg/m²
- Age 20-60 years

150 randomized

50 Intensive medical therapy alone

50 Medical therapy plus gastric bypass

50 Medical therapy plus sleeve gastrectomy

2 Lost to follow-up

Population for 3-Year Analysis

- 40
- 48
- 49

91% retention
The Stampede study; Benefits of Bariatric Surgery for T2DM

• 150 patients randomized to intensive medical therapy, gastric bypass or sleeve gastrectomy for management of type 2 diabetes
• Average baseline A1C was 9.2% (diabetes >6.5, goal <7%)
• Followed for 12 months
**Stampede Trial: Benefits of Surgery for Type 2 Diabetes**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Medical Therapy (n=41)</th>
<th>Bypass (n=50)</th>
<th>Sleeve (n=49)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c&lt;6</td>
<td>12%</td>
<td>42%</td>
<td>37%</td>
<td>0.008</td>
</tr>
<tr>
<td>HbA1C&lt;6 without DM med</td>
<td>0%</td>
<td>42%</td>
<td>27%</td>
<td>0.003</td>
</tr>
<tr>
<td>% change in Tg</td>
<td>-14%</td>
<td>-44%</td>
<td>-42%</td>
<td>0.08</td>
</tr>
<tr>
<td>% change in HDL</td>
<td>11%</td>
<td>28%</td>
<td>28%</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*N Engl J Med 2012;366:1567-76*
## Primary and Secondary Endpoints at 36 Months

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Medical Therapy (n=40)</th>
<th>Bypass (n=48)</th>
<th>Sleeve (n=49)</th>
<th>P Value(^1)</th>
<th>P Value(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c ≤ 6%</td>
<td>5%</td>
<td>37.5%</td>
<td>24.5%</td>
<td>&lt;0.001</td>
<td>0.012</td>
</tr>
<tr>
<td>HbA1c ≤ 6% (without DM meds)</td>
<td>0%</td>
<td>35.4%</td>
<td>20.4%</td>
<td>&lt;0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>HbA1c ≤ 7%</td>
<td>40%</td>
<td>64.6%</td>
<td>65.3%</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Change in FPG (mg/dL)</td>
<td>-6</td>
<td>-85.5</td>
<td>-46</td>
<td>0.001</td>
<td>0.006</td>
</tr>
<tr>
<td>Relapse of glycemic control</td>
<td>80%</td>
<td>23.8%</td>
<td>50%</td>
<td>0.03</td>
<td>0.34</td>
</tr>
<tr>
<td>% change in HDL</td>
<td>+4.6</td>
<td>+34.7</td>
<td>+35.0</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>% change in TG</td>
<td>-21.5</td>
<td>-45.9</td>
<td>-31.5</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>% change in CIMT</td>
<td>0.048</td>
<td>0.013</td>
<td>0.017</td>
<td>0.36</td>
<td>0.49</td>
</tr>
</tbody>
</table>

\(^1\) Gastric Bypass vs Medical Therapy; \(^2\) Sleeve vs Medical Therapy
Change in HbA1c (%)

- Medical
- Sleeve
- Gastric Bypass

P<0.001
Change in Body Mass Index

Change in BMI (Kg/M²)

-12.0
-10.0
-8.0
-6.0
-4.0
-2.0
0.0
-12.0
-10.0
-8.0
-6.0
-4.0
-2.0
0.0
90 3 6 12 24 360 3 6 12 24 369

P=0.006

P<0.001

Ochsner
Frank Riddick Diabetes Institute
Percentage of Patients on Insulin

% Patients

Medical
Sleeve
Gastric Bypass

Baseline Month 3 Month 6 Month 12 Month 24 Month 36
Change in Quality of Life Measures
RAND-36

Ochsner
Frank Riddick Diabetes Institute

* <0.05  ** ≤0.001 (Compared to Medical)
Gastric Bypass and Type 2 Diabetes

• Impressive outcomes:

  – Metabolic – STAMPEDE trial of 150 moderately obese patients showed that 42% of patients with RNY had A1C < 6% compared to 12% of a medical therapy group

  – Metabolic outcomes are independent of weight loss

  – Reduced truncal fat and increased beta cell function

  – Improved insulin sensitivity

  – Reduction / elimination of medications: insulin, oral antihyperglycemics, antihypertensives, statins
### Patient factors/outcomes & resolution of type 2 diabetes from Kaiser permanente cohort study

<table>
<thead>
<tr>
<th></th>
<th>Improved</th>
<th>Resolved</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>33</td>
<td>158</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>48.2</td>
<td>47.8</td>
<td>0.724</td>
</tr>
<tr>
<td>Pre op BMI</td>
<td>51</td>
<td>50</td>
<td>0.270</td>
</tr>
<tr>
<td>Post op BMI</td>
<td>37</td>
<td>33</td>
<td>0.002</td>
</tr>
<tr>
<td>%EWL</td>
<td>42</td>
<td>62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration Diabetes</td>
<td>10.7</td>
<td>4.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Complications and Risks

ALL surgeries have a risk of death

• Studies show 0.2-2.0% mortality for RYGB
  – <2 deaths per 100 operations

• The most common causes of death:
  – Pulmonary embolism (blood clot in the lung)
  – Leak in staple lines made during surgery
# Complications and Risks

## Early complications
- Nausea / Vomiting
- Diarrhea / Dumping
- Heart and lung problems
- Blood Clots
- Stricture
- Blockage
- Leaks
- Infection
- Organ failure
- Death

## Later complications
- Constipation
- Nutrient deficiencies
- Protein malnutrition
- Hair loss
- Gallbladder disease
- Mental health problems
- Wound hernias
- Weight regain
- Anastomotic ulcers
Experience Matters as regards outcomes

Transforming Health Care, Harvard Business Review

Adult and adolescent bariatric Surgery numbers most resemble this.
Diabetes and Bariatric surgery; Pathophysiology

• Diabetes improvement starts rapidly after surgery, before significant weight loss has occurred.

• The mechanism for postoperative metabolic improvements has not been fully elucidated and may be, in part, independent of weight loss.

• This suggests that bariatric surgery may improve metabolic comorbidities even in patients who are not morbidly obese.
Foregut Theory

- Exclusion of the duodenum results in inhibition of a “putative” signal that is responsible for insulin resistance and/or abnormal glycemic control (T2DM)

Rubino et al., Ann Surg, 2006
The Hindgut Theory

- The more rapid delivery of undigested nutrients to the distal bowel upregulates the production of L-cell derivatives like GLP-1

Mason E. Obes Surg 2005 15, 459-461
# Peptides That Affect Food Intake

### Increase
- Agouti-related peptide
- Dynorphin
- Ghrelin **
- Melanin-concentrating hormone
- Neuropeptide Y
- Orexin A (Hypocretin)
- RF-2 peptides (arginine phenylalanine amide-2)
- Galanin-like-peptide

### Decrease
- α-MSH
- Corticotrophin-releasing hormone
- Bile acids**
- Peptide YY **
- Oxytocin
- Cholecystokinin **
- Cocaine-amphetamine regulated transcript
- Glucagon-like peptide-1**
- Leptin**
- Amylin
- Bombesin/GRP
- Obestatin (part of ghrelin)
- Nesfatin-1 (NEFA-NUCB2)
Bariatric surgery and diabetes prevention

- Bariatric surgery and prevention of type 2 diabetes in Swedish obese subjects.
- AU
- SO

BACKGROUND: Weight loss protects against type 2 diabetes but is hard to maintain with behavioral modification alone. In an analysis of data from a nonrandomized, prospective, controlled study, we examined the effects of bariatric surgery on the prevention of type 2 diabetes.

METHODS: In this analysis, we included 1658 patients who underwent bariatric surgery and 1771 obese matched controls (with matching performed on a group, rather than individual, level). None of the participants had diabetes at baseline. Patients in the bariatric-surgery cohort underwent banding (19%), vertical banded gastroplasty (69%), or gastric bypass (12%); nonrandomized, matched, prospective controls received usual care. Participants were 37 to 60 years of age, and the body-mass index (BMI; the weight in kilograms divided by the square of the height in meters) was 34 or more in men and 38 or more in women. This analysis focused on the rate of incident type 2 diabetes, which was a prespecified secondary end point in the main study. At the time of this analysis (January 1, 2012), participants had been followed for up to 15 years. Despite matching, some baseline characteristics differed significantly between the groups; the baseline body weight was higher and risk factors were more pronounced in the bariatric-surgery group than in the control group. At 15 years, 36.2% of the original participants had dropped out of the study, and 30.9% had not yet reached the time for their 15-year follow-up examination.

RESULTS: During the follow-up period, type 2 diabetes developed in 392 participants in the control group and in 110 in the bariatric-surgery group, corresponding to incidence rates of 28.4 cases per 1000 person-years and 6.8 cases per 1000 person-years, respectively (adjusted hazard ratio with bariatric surgery, 0.17; 95% confidence interval, 0.13 to 0.21; P<0.001). The effect of bariatric surgery was influenced by the presence or absence of impaired fasting glucose (P=0.002 for the interaction) but not by BMI (P=0.54). Sensitivity analyses, including end-point imputations, did not change the overall conclusions. The postoperative mortality was 0.2%, and 2.8% of patients who underwent bariatric surgery required reoperation within 90 days owing to complications.

CONCLUSIONS: Bariatric surgery appears to be markedly more efficient than usual care in the prevention of type 2 diabetes in obese persons. (Fundied by the Swedish Research Council and others; ClinicalTrials.gov number, NCT01479452.).

AD
- Institute of Medicine, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden.
- PMID
22913680

Similar findings reported from Kaiser permanente cohort study
Recommendations on diabetes management post bariatric surgery

• Surgery should be considered as complementary to medical therapies to reduce micro-vascular and cardiovascular risk

• Patients should be assessed and managed by experienced multi-disciplinary teams

• Glycaemic control should be optimised peri-operatively and should be closely monitored after surgery

• It should be recognised that a prolonged period of normalisation of glycaemic control has benefit for diabetes even if there is eventual relapse
Recommendations on diabetes management post bariatric surgery

• On-going and long-term nutritional supplementation and support must be provided to patients after surgery

• There should be a minimal accepted data set for pre-surgery and follow-up to allow audit of clinical programmes
  – Weight, blood glucose control, assessment for diabetes complications, laboratory measures and medications etc.

• All longitudinal studies should include quality of life as one of the outcomes
What To Discuss With Your Patients

- The possible benefits of bariatric surgery for patients with a body mass index between 30.0 and 34.9 kg/m² and with diabetes or IGT
- The possibility that the patient could be referred to a surgeon who would discuss the different types of bariatric surgery recommended for the patient
- The possible adverse effects of bariatric surgery
- Whether or not the specific bariatric surgery recommended for the patient would be covered by the patient's insurance and how that would impact the patient's decisionmaking
- Lifestyle changes that are necessary to fully benefit from bariatric surgery
- Nonsurgical treatment options for diabetes and other metabolic conditions
- The expected course of the patient's diabetes with continued nonsurgical therapy

The Louisiana perspective

Diabetes; 2014

- No Data
- <4.5%
- 4.5%–5.9%
- 6.0%–7.4%
- 7.5%–8.9%
- ≥9.0%

Obesity; 2016
The Louisiana perspective

• Inequity of access
• Bariatric surgery center of excellence locations and demographics
• HEADS UP study results and implications
• The LOSS study results and implications
• Ochsner resources; Bariatric surgery service center, wellness programs and supervise exercise resources, PT and OT services etc
• The role and place of the Pennington Biomedical Research Center
• The need for militant advocacy
Bariatric interventions for type 2 diabetes: research recommendations

- Establish better criteria than BMI for predicting benefit from surgery & define which patients benefit most from which procedures
- Studies needed to establish the benefit of surgery for persons with diabetes & **BMI less than 35**
- Studies are needed to establish the duration of the benefit of surgery
Bariatric interventions for type 2 diabetes: research recommendations

- Studies needed to establish the mechanisms of the success of surgery
- New techniques should be assessed rigorously for efficacy and safety and ideally their mechanisms
- Studies are needed to define the best regimens of diabetes management after bariatric surgery
- It will be important to develop profiles of those who are best candidates for surgery
- Randomised controlled trials are needed to evaluate and compare different bariatric procedures for the treatment of diabetes between themselves as well as emerging non-surgical therapies
Concluding remarks

- Elective bariatric surgery is now a prime time player in the therapeutic playing field of type 2 diabetes.
- While extensive long term follow up data is still limited these procedures have impressive impact on weight, glycemic control and associated comorbidities of the metabolic syndrome complex that are not matched by more traditional conservative medical interventions.
- Access to well trained bariatric surgeons and insurance coverage for these procedures remain major limiting factors in the firm integration of bariatric surgery as a diabetes treatment strategy nationally.
- Much still needs to be learnt about how and why bariatric surgery is so effective as a diabetes treatment strategy and which group of patients it would work best for.
- The best outcomes from bariatric surgery as a diabetes treatment intervention are seen in well coordinated multispecialty settings where there is close seamless interaction between the surgeon and other critical members of the patients clinical care team including the primary care provider, mental health specialist, dieticians, exercise therapists, primary care providers, endocrinologist/diabetologist and other uniquely relevant consultants like pulmonologist, cardiologist, GI-hepatologist and nephrologist.
Bibliography

Thank you very much for your kind attention!!!

Questions/comments???