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Results of Laparoscopic Gastric Bypass in Patients with Cirrhosis

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Background: The safety and efficacy of bariatric surgery in patients with cirrhosis has not been well studied.

Methods: A retrospective review was conducted of patients with cirrhosis who underwent weight-loss surgery at a single institution.

Results: Out of a total of 2,119 patients who underwent laparoscopic Roux-en-Y gastric bypass (RYGBP), 30 patients (1.4%) with cirrhosis were identified. When compared with the entire cohort, patients with cirrhosis were significantly more prone to be heavier (BMI 53 vs 48), older in years (age 50 vs 45), more likely to be male (RR=1.3), and have a higher incidence of diabetes (70% vs 21%) and hypertension (67% vs 21%), $P<0.05$. The diagnosis of cirrhosis was made intra-operatively in 90% of patients. There were no perioperative deaths, conversions to laparotomy, or liver-related complications. Early complications occurred in 9 patients and included anastomotic leak (1), acute tubular necrosis (4), prolonged intubation (2), ileus (1), and blood transfusion (2). Mean length of hospital stay was 4 days (2-18). There was one late unrelated death and one patient with prolonged nausea and protein malnutrition. The average follow-up time was 16 months (1-48). For patients >12 months postoperatively (n=15), the average percent excess weight loss was 63±15%.

Conclusion: Laparoscopic RYGBP in the cirrhotic patient has an acceptable complication rate and achieves satisfactory early weight loss. Patients tend to be heavier, older, male and more likely to have diabetes and hypertension. Long-term studies are necessary to examine how weight loss impacts established cirrhosis.

Key words: Cirrhosis, morbid obesity, bariatric surgery, gastric bypass, outcomes, laparoscopy

Introduction

The safety and efficacy of bariatric operations in patients with cirrhosis are poorly documented. Morbid obesity is associated with non-alcoholic fatty liver disease (NAFLD) in nearly 100% of patients and, in 25%, a chronic inflammation of the liver resulting in steatohepatitis (NASH).[1] Some patients with NASH will insidiously develop progressive fibrosis and eventual cirrhosis with little clinical or laboratory findings.[2] There is little guidance to safe surgical management when surgeons discover cirrhosis unexpectedly at the time of a bariatric operation. A review of the literature reveals a remarkable paucity of reports that specifically address the clinical outcomes of weight loss surgery in cirrhotic patients. We hypothesize that performing a gastric bypass on patients with cirrhosis can be done with an acceptable complication rate while maintaining significant benefits. We report our experience with cirrhotic patients undergoing laparoscopic gastric bypass to delineate the typical characteristics, the operative feasibility, and the morbidity and mortality in this subset of patients.

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Methods

This study was performed with prior approval by the University of Pittsburgh Institutional Review Board and meets all HIPAA requirements. The study group consisted of all patients with cirrhosis who had undergone bariatric surgery from July 1997 to June 2003 at the University of Pittsburgh Medical Center. Patient data was collected prospectively, verified retrospectively and then entered into the University of Pittsburgh Bariatric Surgery Clinical database (Access, Microsoft, Inc). Data sources comprised office charts, hospital records, and individual patient interviews. All patients met the criteria for bariatric surgery proposed by the National Institute of Health Consensus Development Panel Report of 1991.[3]

A retrospective chart review was performed on all 2,119 patients who underwent gastric bypass between January 1997 and June 2003. Thirty patients who had cirrhosis during the time of their operation were identified. We excluded three other patients with cirrhosis who underwent laparoscopic adjustable banding. Cirrhosis was defined as grossly obvious micro- or macro-nodularity of the entire liver and was documented photographically in all patients (Figure 1). Our practice has been to proceed with the planned bariatric operation in all patients who had unexpected findings of compensated cirrhosis. We defined compensated cirrhosis as the lack of synthetic deficiencies, encephalopathy, ascites, obvious portal hypertension and a normal bilirubin. Patient outcomes were updated either through a recent (<6 month) office visit or a telephone interview.

Our operative procedure has evolved over the period of time studied. Our initial operative technique for the laparoscopic Roux-en-Y gastric bypass (RYGBP) was described in detail previously.[4] Our technique has undergone 3 major modifications since 1997. Patients numbers 1-150 received a 15-ml gastric pouch, a 12-14 mm diameter gastro-jejunal anastomosis using a 21-mm circular stapler (advanced through the esophagus), and a retro-colic, retro-gastric Roux-limb. Patients numbers 151-850 received a 15-ml gastric pouch, a 12-14 mm diameter gastrojejunal anastomosis *with a linear stapler*, and a retro-colic, retro-gastric Roux-limb. Patients numbers 851-1819 received a 15-ml gastric pouch, a 12-14 mm diameter gastro-jejunal anastomosis with a linear stapler, and *ante-colic, ante-gastric* Roux-limb (Figure 2). For all 3 techniques, Roux-limb length varied according to preoperative BMI (75 cm for BMI<50 and 150 cm for BMI≥50). Diabetic patients generally received a Roux-limb length of 150 cm regardless of their BMI.

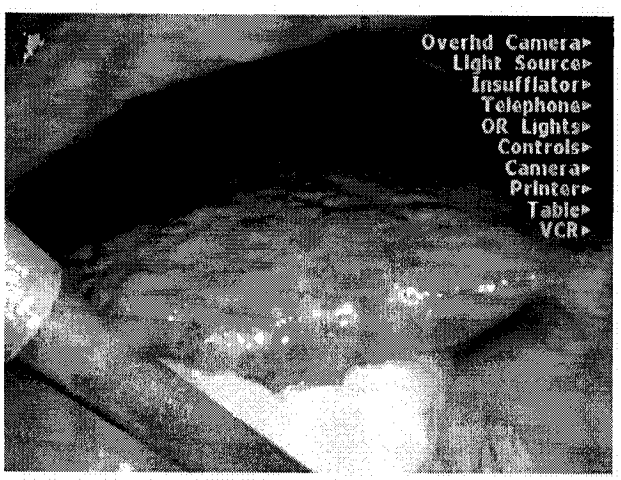

Figure 1. Photodocumentation of the typical patient with grossly obvious cirrhosis.

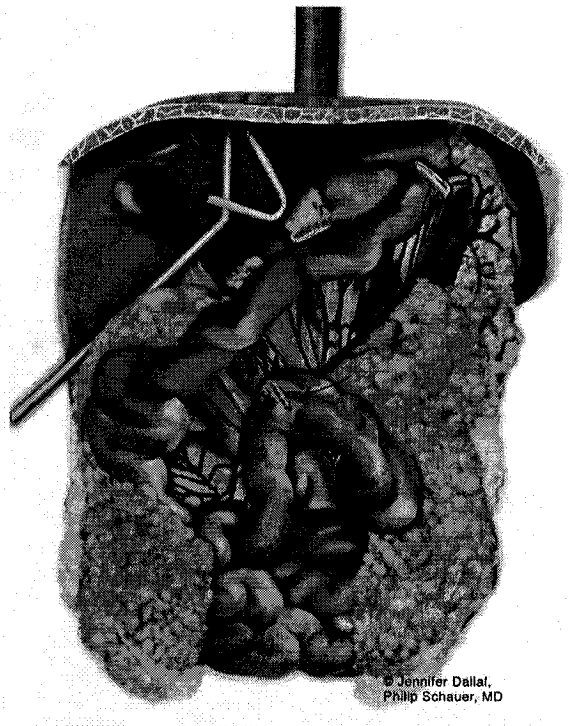

Figure 2. We perform an antecolic, antegastric RYGBP with a 15-ml gastric pouch and a two-layer gastrojejunostomy anastomosis using a linear stapler.

A staged approach was developed for high-risk super-obese patients with markedly elevated BMI. This consisted of performing a sleeve gastrectomy as a first stage, followed by the monitoring of patients' weight loss, then completing the second stage, being the laparoscopic RYGBP, after optimal weight and co-morbid conditions had been achieved. Sleeve gastrectomies were performed by placing a 50-Fr bougie along the lesser curve to create a tubularized stomach. The stomach lateral to the bougie was transected with a stapler and removed after mobilizing the greater curve. This operation is performed in high-risk patients with high BMIs in order to reduce co-morbidities, with an ultimate plan for conversion to a RYGBP after significant weight loss. Three patients underwent the sleeve gastrectomy in this series. One of these patients has had a subsequent gastric bypass and the remaining two patients are in the interim period.

Results

Demographics

As of June 2003, there were 2,119 laparoscopic gastric bypasses. Of these, 30 patients were identified as having cirrhosis (1.4%), 10 (33%) were male and mean age was 50 ± 7 SD years (30-59). The mean preoperative weight was 149 kg ± 28 (98-207) and the mean BMI was 52.6 ± 8.6 kg (33-73). Cirrhotic patients tended to be older, male, heavier and were more often diabetic and hypertensive (Table 1). Six had documented cirrhosis before the time of the operation. Two of these patients were referred to us after their open bariatric operations were aborted upon discovery of cirrhosis. Another patient was referred after the incidental finding of cirrhosis in the course of a splenectomy for thrombocytopenia. The other three patients had known hepatitis C. All patients were Child-Pugh class A.

Table 1. Patients with cirrhosis undergoing gastric bypass were heavier, older, more frequently male and more prone to have diabetes, hypertension

Demographic and Preoperative Data		
	All	Cirrhotics
No. of patients	2,119	30
Male : Female %*	25 : 75	33 : 67
Mean Age (years)*	45±8.6	50±7
Mean BMI (kg/m²)*	48.3±8.5	52.6±8.3
Patients with diabetes*	375 (20.6%)	21 (70%)
Patients with HTN*	57 (21%)	20 (67%)

*$P<0.05$ HTN = hypertension

Preoperative Co-morbidities and Laboratory Data

Twenty-one patients (70%) had diabetes and 20 had hypertension (67%). This compares with an incidence of 20 and 21%, respectively, in our general bariatric surgery population.

Preoperative transabdominal ultrasound, which is routinely performed in all patients, documented fatty liver disease in 73% of patients and normal liver morphology in the remaining 17%. Ultrasound examination did not diagnose cirrhosis in any patient. Furthermore, 23% of patients had normal liver function tests. Thrombocytopenia (platelet count<100) was noted in three patients. The remainder had only slight elevations of AST and/or ALT. No patients had hyperbilirubinemia, hypoalbuminemia, or coagulopathy.

Perioperative and Late-term Data

Twenty-seven laparoscopic RYGBPs and 3 sleeve gastrectomies (as a first stage to RYGBP) were performed. All operations were completed laparoscopically and there were no perioperative deaths. The duration of the operation averaged 4 hours. There was also a greater average blood loss, 290 mL (50-1,500) compared with 115 ml in our previously published cohort.[4]

Histologic features obtained from intraoperative liver biopsies are delineated in Table 2. In two patients with massive hepatomegaly, liver biopsy unexpectedly demonstrated cirrhosis even though the surgeon did not see obvious signs of cirrhosis. All patients had abnormal histology; however, the diagnosis of cirrhosis was only confirmed by Tru-Cut needle biopsy in 43%. The average length of hospital stay was 4±4 days (2-18, median=3), which was longer than our non-cirrhotic patients by 1 day on average. Early and late complication rates are enumerated in Tables 3 and 4. There were no late

Table 2. All patients had one or more findings consistent with non-alcholic liver disease. For unclear reasons, cirrhosis was diagnosed on Tru-cut biopsy in only 43% of patients despite obvious micro- or macro-nodular liver disease on visual inspection

Histologic Features	N/30 (%)
Steatosis	16 (63)
NASH	13 (43)
Fibrosis	26 (87)
Cirrhosis	13 (43)

NASH = non-alchoholic steatohepatitis.

liver-related complications such as ascites, encephalopathy, bleeding, infections or documented progression of liver dysfunction. No complications occurred in the three patients who had a sleeve gastrectomy. One of these patients underwent a subsequent RYGBP without complications.

There were 15 patients with >1-year follow-up. They lost on average 62% of their excess body weight (Table 5).

Table 3. Early postoperative complications were generally minor except for one leak that required re-operation and several transient episodes of acute tubular necrosis

Early Complication	N/30
Acute tubular necrosis	4
Anastomotic leak	1
Transfusion requirement	2
Prolonged ileus	1
Intubation beyond PACU	2

PACU = post anesthesia care unit

Table 4. Late complications were minor except for one death from esophageal cancer diagnosed 1 year after his gastric bypass

Late Complications	N/30
Death	1
Abdominal pain	3
Prolonged nausea	1
Protein malnutrition	1
Renal calculi	1
Marginal ulcer	2
Acute cholecystitis	1

NASH = non-alcoholic steatohepatitis.

Table 5. Only 15 patients have had follow-up >1 year

Follow-up data	
Mean follow-up	10 months±15 (1-48)
Mean weight loss*	118±50 lbs
Mean %excess weight loss	62.7%±14.9

*for those >1 year postoperatively.

Discussion

We have demonstrated that laparoscopic bariatric surgery can be safely performed in patients with Child-Pugh A cirrhosis. Although there seems to be a higher incidence of transient renal dysfunction, longer operative times and an increased potential for blood loss, the short- and long-term complications are relatively minor. Morbidly obese patients are at a particularly high risk for *unidentified* cirrhosis secondary to the nearly uniform presence of fatty liver disease, the inability to perform an adequate physical examination or imaging studies, and the non-specific laboratory findings.

NAFLD is found in some degree in all morbidly obese patients. NAFLD ranges in spectrum of severity from steatosis to steatohepatitis followed by fibrosis and cirrhosis (Table 6). NAFLD progresses in 28% of patients,[5] and liver-related disease is the second most common cause of death in these patients.[6] We found that 1.4% of the morbidly obese patients in our series had cirrhosis.

There are a number of well-established characteristics that patients with NAFLD have in common. Steatosis can be predicted by well-established risk factors: 1) ALT greater than twice normal; 2) AST>ALT; 3) central obesity; 4) diabetes; 5) hypertension; and 6) hypertriglyceridemia.[7,8] In fact, NAFLD seems to be part of the spectrum of disease associated with Syndrome X.[9] This study demonstrates the difficulty in the preoperative assessment and staging of NAFLD. Liver function tests were not sensitive nor specific. In addition, ultrasound and physical examination were unreliable (due to body habitus) and even liver biopsies underdiagnosed more than half of the patients with cirrhosis. Only three of 30 patients were known to have cirrhosis before any operative procedures – and all had hepatitis C. Thrombo-cytopenia was only encountered in three patients; however, this may be a spe-

Table 6. Grading and Staging of non-alcoholic fatty liver disease[14]

Grading for Steatosis	
Stage 1	33% of hepatocytes affected
Stage 2	33-66% of hepatocytes affected
Stage 3	>66% of hepatocytes affected
Grading for Steatohepatitis	
Stage 1	Mild Steatosis: predominantly macrovesicular, involves up to 66% of lobules Ballooning: occasionally observed; zone 3 hepatocytes Lobular inflammation: scattered and mild acute inflammation and occasional chronic inflammation Portal inflammation: none or mild
Stage 2	Moderate Steatosis; usually mixed macro and micro vesicular Ballooning: obvious and present in zone 3 Lobular inflammation: PMNs may be noted in association with ballooned hepatocytes; pericellular fibrosis; mild chronic inflammation may be seen Portal inflammation: mild to moderate
Stage 3	Severe Steatosis: typically involves >66% of lobules (panacinar); commonly mixed steatosis Ballooning: predominantly zone 3; marked Lobular inflammation: scattered acute and chronic inflammation; PMNs may be concentrated in zone 3 areas of ballooning and perisinusoidal fibrosis Portal inflammation: mild to moderate
Grading for Fibrosis	
Stage 1	Zone 3 perivenular, perisinusoidal, or pericellular fibrosis; focal or extensive
Stage 2	As above, with focal or extensive periportal fibrosis
Stage 3	Bridging Fibrosis: focal or extensive
Stage 4	Cirrhosis

cific indicator of cirrhosis and warrants further study.

We have demonstrated the higher incidence of diabetes and hypertension in cirrhotic patients just as in patients with NASH. Diabetes and hypertension were 3.5 times more likely to occur in cirrhotic patients when compared with our entire bariatric patient cohort. Although this is the first study to correlate the presence of cirrhosis with increasing age and weight, this finding is not unexpected. Men were at slightly higher risk for having cirrhosis (RR=1.3), although they sought bariatric surgery much less frequently than females.

There is no proven effective medical management of NAFLD. Current management consists mainly of weight loss and exercise, both modalities being relatively ineffective in the morbidly obese. Medications that have been recently shown to improve liver function include gemfibrozil, metformin, ursodiol, thiazolidinedione troglitazone and vitamin E.[5] There are several small prospective series demonstrating significant improvement in the histologic and clinical features of NAFLD after bariatric surgery with even resolution of severe fibrosis.[10-12] Whether patients with established cirrhosis can have stabilization in their liver function or even improvement in fibrosis is not known. Long-term follow-up of our patients with periodic biopsies and liver function studies may answer this question. Similar to alcohol-induced cirrhosis that stabilizes after abstinence, we hypothesize that caloric reduction may confer the same salutary effects.

The only other significant literature on cirrhosis and obesity is limited by reliance on surgeon self-reporting and documents a high rate of liver-related morbidities. Brolin et al[13] reported a series of patients established through a questionnaire mailed to bariatric surgeons. Those surgeons reported that 125 patients were found to have cirrhosis at the time of operation. A perioperative mortality rate of 4% was reported, with seven late deaths, mostly due to liver disease. In addition, Brolin reported on eight of his own patients who had cirrhosis at the time of operation from an overall series of 580 patients. Six underwent RYGBP, one had a jejuno-ileal bypass reversal, and the other a conversion of a VBG to RYGBP. Three deaths occurred, one early. Brolin reported a 1.4% incidence of unexpected cirrhosis in his own series of patients.[13] We found a lower morbidity rate in our series of patients. There was no mention in the report by Brolin's group whether any of the RYGBPs were done laparoscopically; however, we assume that the vast majority were open. We hypothesize that the minimally invasive approach is less likely to cause liver dysfunction than an open approach because of less blood loss, volume shifts and stress response.

An important finding that may impact future investigation of the NAFLD was the lack of good histologic correlation with gross pathology. In 67% of patients, core-needle biopsy failed to reveal cirrhosis, although 87% had varying degrees of fibrosis. Further investigation is necessary to determine whether there is an increased rate of sampling error in livers with massive steatosis. As well, we found no uniform reporting method from our pathologists. Clearly, visual identification of the hallmark of cirrhosis, nodularity, is the most accurate method in diagnosing cirrhosis. Although needle biopsy failed to reveal cirrhosis in some instances, we strongly believe that operative diagnosis is the gold standard.

Unfortunately, there are no preoperative determinants (including liver biopsy) that distinguished cirrhotic patients with specificity. Thus, bariatric surgeons need a heightened sense of awareness of the significant incidence of cirrhosis in their patients and have a management plan prepared. Many surgeons believe that there is such an excess risk in operating on patients with cirrhosis that elective bariatric operations either should not be offered or should be aborted upon incidental intra-operative diagnosis. Aranha et al[15] reported a 25% perioperative mortality-rate for those patients with cirrhosis who underwent open cholecystectomy. Rice et al[16] reported a 28% perioperative mortality-rate for patients with chronic liver failure who underwent nonhepatic surgery. Ziser et al[17] demonstrated that 733 cirrhotic patients undergoing a variety of surgical procedures had a 30-day mortality-rate of 11.6% overall and 8.4% for Child class A patients.

However, our data suggest that 30-day mortality for Childs A cirrhotics undergoing laparoscopic RYGBP can be low (0/30). Further, anecdotal reports of adverse outcomes in cirrhotic patients after bariatric surgery have further limited the surgeon's enthusiasm for offering a bariatric operation. With several reports of significant improvement in steatosis and even fibrosis after RYGBP, we believe that the risks of operating on a compensated cirrhotic patient is worthwhile, with potential benefit of stabilization of liver disease and perhaps even regression. We conclude that the *laparoscopic* RYGBP is a safe and appropriate approach for morbidly obese patients with well-compensated cirrhosis when performed by experienced bariatric surgeons.

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