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Bariatric surgery for the treatment of idiopathic intracranial hypertension

A review

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Object. The purpose of this study was to review the literature on the effectiveness of bariatric surgery for obese patients with idiopathic intracranial hypertension (IIH) with regard to both symptom resolution and resolution of visual deficits.

Methods. The published literature was reviewed using manual and electronic search techniques. Data from each relevant manuscript were gathered, analyzed, and compared. These included demographic data, pre- and postoperative symptoms, pre- and postoperative visual field deficits, bariatric procedure type, absolute weight loss, changes in body mass index, and changes in CSF opening pressure.

Results. Eleven relevant publications (including 6 individual case reports) were found, reporting on a total of 62 patients. The Roux-en-Y gastric bypass was the most common bariatric procedure performed. Fifty-six (92%) of 61 patients with recorded postoperative clinical history had resolution of their presenting IIH symptoms following bariatric surgery. Thirty-four (97%) of 35 patients who had undergone pre- and postoperative funduscopy were found to have resolution of papilledema postoperatively. Eleven (92%) of 12 patients who had undergone pre- and postoperative formal visual field testing had complete or nearly complete resolution of visual field deficits, and the remaining patient had stabilization of previously progressive vision loss. In 13 patients both pre- and postoperative CSF pressures were recorded, with an average postoperative pressure decrease of 254 mm H_2O. Changes in weight loss and body mass index varied depending on the reported postoperative follow-up interval.

Conclusions. The published Class IV evidence suggests that bariatric surgery may be an effective treatment for IIH in obese patients, both in terms of symptom resolution and visual outcome. Prospective, controlled studies are necessary for better elucidation of its role. *(DOI: 10.3171/2009.12.JNS09953)*

Key Words • **idiopathic intracranial hypertension** • **bariatric surgery** • **obesity** • **weight loss** • **treatment efficacy**

Idiopathic intracranial hypertension, also known as pseudotumor cerebri or benign intracranial hypertension, is a neurological syndrome that was first described in 1893 by Heinrich Quincke.[34] Patients with IIH usually present with symptoms of increased ICP such as headaches, transient visual obscurations, pulsatile tinnitus, diplopia, and/or vision loss.[51] Idiopathic intracranial hypertension is a diagnosis of exclusion. In addition to the symptoms and signs of increased ICP, patients must have no focal neurological findings (other than cranial nerve palsies), normal results on neuroimaging examination, a CSF opening pressure > 250 mm H_2O, and normal CSF cytology and chemistry.[5,41] Other potential causes of increased ICP, including medications, should be ruled out.[39,47] Ophthalmological examination, including perimetry, will reveal visual field deficits in > 90% of patients with IIH.[51] Papilledema is typically noted on funduscopy[51] but is not necessary for diagnosis.[28,38,43] Severe vision loss or blindness have been estimated to occur in up to 25% of patients with IIH, and constitutes the most serious adverse manifestation of this disease.[14]

Abbreviations used in this paper: BMI = body mass index; ICP = intracranial pressure; IIH = idiopathic intracranial hypertension; LP = lumboperitoneal; ONSF = optic nerve sheath fenestration; VP = ventriculoperitoneal.

Obesity and female sex are well-known risk factors for developing IIH. In population studies, Durcan et al.[17] and Wall and George[51] estimated that the incidence of IIH in the general population is 1 in 100,000. Among women 15–44 years of age the incidence is 3.5 in 100,000, and within the subgroup of women between 20 and 44 years of age who are 20% over their ideal body weight, the incidence is higher still; an estimated 19.3 in 100,000. The prevalence of obesity among IIH cohorts has ranged from 70.5 to 94%.[36,51] As the worldwide obesity prevalence increases,[16] the prevalence of IIH will no doubt rise as well.

A variety of medical and surgical treatments are currently used for patients with IIH, both to relieve symptoms and to preserve visual function. Medical therapies include oral medications, such as diuretics and corticosteroids, and weight loss through diet and exercise. Acetazolamide, a carbonic anhydrase inhibitor, decreases the rate of CSF production, but the effect is variable,[37] and to date there have been no published randomized clinical trials examining its efficacy among patients with IIH. Corticosteroids may have some efficacy for the treatment of patients with IIH who have acute vision loss,[26] but long-term administration can cause side effects to develop that preclude habitual use. The failure of medical therapy, development of acute or progressive vision loss, and the presence of intractable headache are all indications for surgical treatment.[5]

Surgical options for treating IIH include placement of LP or VP shunts, and ONSF. Placement of CSF shunts (VP or LP devices) is the most commonly performed surgical treatment for IIH, and its use has been rapidly rising within the US.[15] Both LP and VP shunts have been shown to improve IIH-related symptoms and visual deficits, but both are plagued by complications, particularly in obese patients, and often require revision surgery.[7,10,18,35] Optic nerve sheath fenestration is a procedure in which a surgical "window" in the optic nerve sheath is created to decrease CSF pressure around the optic nerve.[1] It has been shown to improve vision loss in patients with IIH,[44] and may produce better visual outcomes than either VP or LP shunts.[19] However, ONSF appears to have a lower rate of headache relief than CSF shunting,[4,18] is associated with a high failure rate,[44] and has a small but worrisome risk of devastating optic nerve injury.[50]

The surgical complications associated with CSF diversion procedures and ONSF, as well as the failure of either of these treatments to address the obesity that underlies IIH in many patients, have provided the impetus to search for better surgical treatment alternatives for IIH. A growing number of published case reports and case series suggest that bariatric surgery can improve or resolve IIH in obese patients.[3,11,20,24,25,29,30,32,46–48] In this paper we review the literature on the effectiveness of bariatric surgery for the treatment of IIH in obese patients, and we suggest that bariatric surgery be studied prospectively as a potential first-line surgical therapy in this patient cohort.

Methods

The online Medline database was searched for peer-reviewed journal articles with the following primary search keywords: "idiopathic intracranial hypertension," "benign intracranial hypertension," and "pseudotumor cerebri," as well as the following secondary associated search keywords: "weight loss," "bariatric surgery," and "gastric surgery." A review of any returned article's bibliography was also conducted to find any additional relevant literature. Case reports, case series, and prospective studies that reported on patients with a diagnosis of IIH who subsequently underwent bariatric surgery were examined. Only manuscripts that reported postoperative symptoms or visual outcome data were included. We found a total of 13 relevant manuscripts, nearly half of which were reports of single cases. Four manuscripts were written by the same primary author.[46–49] Two papers reported a total of 45 patients with IIH who underwent bariatric surgery, but did not specify any postoperative data on symptoms or vision loss, and therefore were excluded.[20,49]

The following data were gathered in the patients who were included: demographic information, length of clinical follow-up intervals, pre- and postoperative data on symptoms, signs, CSF pressures, body weights, BMIs, and types of bariatric surgery performed. Only 1 paper, a single case report, contained each of these pieces of data.[11] The remaining 10 had varying degrees of incomplete data.[3,24,25,29,30,32,42,46–48] If BMI was not specifically reported, it was calculated based on height/weight data when available. In papers in which multiple follow-up periods were reported, the shortest interval with the most complete data was chosen to be included. In studies with multiple patients, averages of the patient data points were calculated.

Results

A total of 62 patients diagnosed with IIH who underwent bariatric surgery were identified (Table 1). All of these patients had complete demographic data.[3,11,24,25,29,30,32,42,46–48] One patient was male,[25] and the remaining 61 (98%) were female. The average age was 30 years, excluding the case series reported by Michaelides et al.,[29] which only reported the median age.

Presenting symptoms were recorded in all 62 patients. Of these, 46 (74%) had headache, 50 (81%) pulsatile tinnitus, 11 (18%) transient visual obscurations, and 17 (27%) had vision loss. Results of preoperative funduscopy were reported for 58 patients,[3,11,24,25,29,30,32,42,46–48] and papilledema was documented in 42 (72%) in that subgroup. Visual field examination findings were reported for 39 patients,[3,11,24,25,30,32,42,47,48] with 25 (64%) in that subgroup experiencing preoperative deficits. Visual acuity testing was reported in 10 patients,[3,25,30,47] and 2 (20%) had decreased acuity.

Of 62 total patients, 55 (89%) underwent a primary or secondary Roux-en-Y gastric bypass procedure, 4 (6%) a primary gastroplasty procedure, and 3 (5%) a primary adjustable gastric banding procedure. Failure of primary gastroplasty occurred in 2 patients, after which a successful second surgery was performed using a Roux-en-Y bypass.[32,47] Postoperative follow-up intervals varied from 3 months to > 4 years. The BMIs were recorded or calculated pre- and postoperatively in 21 patients.[11,25,29,30,42] The postoperative BMI decrease ranged from 8.9 kg/m^2 at 3

TABLE 1: Literature review and summary of data in patients with IIH who underwent bariatric surgery*

Authors & Year	No. of Pts	Avg Age (yrs)	F/M	No. w/ Papilledema	No. w/ Visual Field Deficits	Bariatric Ops Performed	FU	Avg Δ BMI (kg/m^2)	Avg Δ Body Weight (kg)	Δ CSF Pressure (mm H_2O)	Improvement or Resolution of		
											Symptoms	Papilledema	Visual Fields
Noggle & Rodning, 1986	1	34	1:0	1 of 1	1 of 1	1 GP	3 yrs	NR	−64.0	NR	1 of 1	1 of 1	1 of 1
Amaral et al., 1987	1	24	1:0	1 of 1	1 of 1	1 RYGJB	6 mos	NR	−36.9	NR	1 of 1	1 of 1	1 of 1
Sugerman et al., 1995	8	33	8:0	4 of 8	7 of 8	8 RYGJBs	34 mos	NR	−57.0	−185	8 of 8	4 of 4	7 of 7
Sugerman et al., 1997	6	32	6:0	6 of 6	NR	5 RYGJBs, 1 LGB	<6 mos	NR	NR	NR	5 of 6†	NR	NR
Sugerman et al., 1999	24	34	24:0	12 of 24	13 of 24	23 RYGJBs, 1 LGB	1 yr	NR	−45.0‡	NR	23 of 24§	12 of 12	NR
Michaelides et al., 2000	16	34¶	16:0	12 of 12**	NR	13 RYGJBs, 3 GPs	varied	−17.0	−45.0	−198††	13 of 16	12 of 12	NR
Nadkarni et al., 2004	2	42	2:0	2 of 2	0 of 2	1 RYGJB, 1 LGB	1 yr	−21.6	−53.9	NR	2 of 2	2 of 2	NA
Lazcano-Herrera et al., 2005	1	42	1:0	1 of 1	NR	1 RYGJB	54 mos	NR	NR	NR	1 of 1	1 of 1	NR
Soto et al., 2005	1	30	1:0	1 of 1	1 of 1	1 RYGJB	3 mos	−8.9	−22.3	NR	1 of 1	NR	1 of 1‡‡
Chandra et al., 2007	1	16	1:0	1 of 1	1 of 1	1 RYGJB	6 mos	−9.3	−22.5	−380	1 of 1	1 of 1	1 of 1
Leslie et al., 2008	1	12	0:1	1 of 1	1 of 1	1 RYGJB	2 yrs	−23.0	−63.3	NR	NR	0 of 1	1 of 1 (stabilized)

* All patients were symptomatic. Abbreviations: Avg = average; FU = follow-up; GP = gastroplasty procedure; LGB = laparoscopic gastric banding; NA = not applicable; NR = not reported; Pts = patients; RYGJB = Roux-en-Y gastrojejunostomy bypass.

† One patient had surgery late and did not have significant weight loss at time of publication.

‡ Data in 4 patients were obtained < 1 year after surgery, and 1 patient was lost to follow-up at 7 months after surgery.

§ Symptom resolution within 4 months of surgery.

¶ Age was reported as the median.

** Twelve of 16 patients underwent funduscopic examinations pre- and postoperatively.

†† Four of 16 patients had both pre- and postoperative CSF pressure measurements.

‡‡ Visual field testing was performed at 8-month follow-up.

months to 23 kg/m^2 at 2 years. The average BMI decrease at follow-up was 16 kg/m^2. The mean body weight loss was recorded in 50 patients,[3,11,25,29,30,32,42,47,48] and ranged from 22.3 kg at 3 months to 64 kg at 18 months; the average weight loss in these patients at follow-up was 45.5 kg. The CSF opening pressure data were recorded preoperatively in 55 patients[11,24,25,29,30,42,46–48] and postoperatively in 10 patients.[3,11,29,47] The mean preoperative CSF pressure was 370 mm H_2O, with a range of 200–550 mm H_2O. Postoperative CSF pressures were obtained at widely varying follow-up intervals ranging from 6 to 34 months, with a mean of 153 mm H_2O. The mean change in pressure, from before to after surgery, was reported for 13 patients.[11,29,47] The mean decrease in CSF pressure ranged from 185 to 380 mm H_2O, and averaged 254 mm H_2O.

Postoperative clinical history was recorded for 61 patients; 56 (92%) had complete resolution or significant improvement of their symptoms. Of the 5 reported patients with IIH who failed to improve with bariatric surgery, 3 were considered to have pulsatile tinnitus as their primary symptom, and this failed to resolve despite each of the patients losing at least 23 kg of body weight.[29] Another patient failed to have a meaningful weight loss with bariatric surgery, and thus also failed to experience resolution of IIH symptoms.[46] One patient continued to have headache and pulsatile tinnitus after surgery, but no data or reasons were given to explain why this occurred.[48]

Funduscopy was performed postoperatively in 35 of the 42 patients with documented preoperative papilledema.[3,11,24,25,29,30,31,47,48] Of these 35 patients, 34 (97%) had complete papilledema resolution, whereas 1 patient continued to have chronic papilledema.[25] The time period between surgery and documented resolution of papilledema varied, in part based on the timing of follow-up examinations. Resolution of papilledema was reported to occur as soon as 6 months postoperatively in 2 patients,[3,11] after a body weight loss of 22.5 and 36.9 kg, respectively. Examination of visual fields postoperatively was performed in 12 of the 25 patients with preoperative visual field defects.[3,11,25,32,42,47] Complete resolution of visual field deficits occurred in 9 (75%), 2 (17%) had nearly complete resolution,[3,11] and 1 (8%) had stabilization without further vision loss.[25] The 2 patients with documented decreased visual acuity secondary to IIH[3,25] had significant acuity improvement at 6 and 36 months, respectively.

The CSF shunting or ONSF was performed prior to bariatric surgery in 11 patients (18%). Six patients had LP shunt placement,[29,46,48] 3 had VP shunt placement,[47,48] 1 had both VP and LP shunt placement,[11] and 1 had ONSF.[25] Of the 7 patients with LP shunt placement, documented shunt occlusion occurred in 2.[48] The 5 remaining patients had LP shunts that were documented as functioning, but that failed to provide long-term relief of IIH symptoms. Occlusion of VP shunts occurred in 3 patients,[11,47] 1 of whom underwent a VP shunt revision, with subsequent shunt failure. In 2 patients with VP shunts, significant intracranial injury occurred due to shunt placement, with residual neurological deficits.[47,48] An ONSF procedure was performed in 1 patient on an emergency basis for progressive vision loss, with only transient improvement in visual acuity, and progressive visual deterioration.[25]

Discussion

In 1974, Newborg[31] was the first to report the use of weight loss for the treatment of IIH. In this study, 9 obese patients with IIH were placed on a low-calorie rice diet. All 9 patients had resolution of IIH-associated symptoms and papilledema following a mean weight loss of 32 kg. Johnson et al.[21] studied the association between weight loss and papilledema improvement among 15 obese patients with IIH. Among 11 patients who managed to lose weight, there was a corresponding decrease in their papilledema severity. Ten (91%) of these 11 patients had complete papilledema resolution after an approximately 6% weight loss. The 4 patients who did not lose weight showed no improvement in papilledema grade.

Although it is recommended that all obese patients with IIH attempt weight loss through diet and exercise, long-term weight loss is difficult to achieve due to patient noncompliance. Bariatric surgery is a proven weight-loss method in the morbidly obese and is highly effective at reducing excess body weight over the long term.[8,27] It dramatically ameliorates many obesity-associated comorbidities,[6,8] and has a low morbidity and mortality rate.[9,12,40] The degree of weight loss following bariatric surgery can be quite substantial. The current weight-loss standard for bariatric procedures is sustained excess weight loss of > 50% and/or resolution of comorbidities.[20] In a large meta-analysis of 7588 morbidly obese patients who underwent bariatric surgery, a mean weight loss of 39.71 kg was reported.[9] In our current review, obese patients with IIH in whom weight loss data were reported had a mean body weight loss of 45.5 kg (Table 1).

The two primary outcomes to examine when evaluating the efficacy of bariatric surgery for obese patients with IIH are as follows: 1) the improvement or resolution of symptoms; and 2) the improvement or resolution of vision loss. In the current review we found that symptom improvement or resolution occurred in 92% of patients (those with reported symptom data), and improvement or resolution of vision loss occurred in 92% of patients (those with visual field data) (Table 1). This is comparable to the improvement in symptoms and vision loss seen in patients with IIH following CSF shunt placement.[18,22] However, the small number of published manuscripts (many of which are single case reports) on bariatric surgery for obese patients with IIH that contain complete symptom and visual data makes meaningful comparisons between treatments difficult. Also, the fact that single case reports are more likely to detail patient successes than failures may skew the improvement and/or resolution numbers for bariatric surgery more favorably.

Although bariatric surgery in obese patients with IIH may be an effective long-term solution for symptom relief, it may not be the best treatment option for those patients with acute or progressive vision loss. Because achieving significant weight loss in obese patients with IIH occurs over time, CSF shunting or ONSF may be the best first-line treatment for acute or rapidly progressive vision loss when immediate intervention is required to prevent permanent loss of vision.[2] Two of the patients reviewed in this paper had acute or progressive vision

loss, with ONSF[25] or VP shunt placement[11] prior to undergoing bariatric surgery. Unfortunately, the patient who underwent ONSF had only transient improvement of vision loss, whereas the patient who received the VP shunt eventually experienced shunt failure. Many of the patients who underwent bariatric surgery in this study had prior LP or VP shunt placement with subsequent shunt occlusion, or failure (despite patency) to relieve IIH symptoms and signs.[11,29,46–48] This suggests a possible role for bariatric surgery in those obese patients with IIH who fail to improve following CSF diversion procedures.

Many pathophysiological mechanisms have been postulated to explain the origins of IIH in obese patients.[5,33] One theory suggests that among these patients, increased intraabdominal pressure leads to an increase in pleural and cardiac filling pressures, which in turn increases central venous pressure, and ultimately decreases CSF absorption by reducing the pressure gradient between the dural venous sinuses and subarachnoid space.[46] This is supported by several papers that report an increase in dural venous pressures among obese patients with IIH.[23,30,46] Another theory suggests that occult cerebral sinovenous obstruction is present in at least some obese patients with IIH.[23] The fact that obesity is a known risk factor for venous thromboembolism[45] suggests that a hypercoagulable state may be involved. The involvement of hormonal factors is suggested by the lopsided ratio of females to males in cases of IIH reported both in this paper (only 1 male) and elsewhere.[36,50] Furthermore, among prepubertal children with IIH, there appears to be an equal ratio of females to males, with no clear obesity association.[13]

Conclusions

We have reviewed the published data on the efficacy of bariatric surgery for patients with IIH. The current literature consists of only Class IV evidence from both case reports and case series. The limited data that are available support the use of bariatric surgery in morbidly obese patients with IIH, both in terms of symptom and vision loss improvement. Whether bariatric surgery is the best surgical option for patients with acute IIH-related vision loss is unclear. Although CSF shunts and ONSF are effective procedures for treating patients with IIH, each of these options has a relatively high incidence of complications and disadvantages, especially when compared with surgically induced weight loss, and they do not alter the patients' most important underlying risk factor (obesity) or its associated comorbidities. We believe that the rising incidence of obesity-related IIH in the US merits a careful study of the efficacy of bariatric surgery, with pre- and postoperative ophthalmological examinations and CSF pressure measurements. Although a randomized controlled trial would be ideal, a prospective matched group cohort study or even a controlled trial would be useful to create a better understanding of the role of bariatric surgery in obese patients with IIH, and help guide management of this increasingly common problem.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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