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Original article

Association between attention deficit hyperactivity disorder and outcomes after metabolic and bariatric surgery: a nationwide propensity-matched cohort study

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Abstract

Background: The risks and benefits of metabolic and bariatric surgery for patients with attention deficit hyperactivity disorder (ADHD) remain to be investigated.
Objective: The aim of this study was to assess short- and long-term outcomes after metabolic and bariatric surgery in patients with previous ADHD compared with matched control individuals.
Setting: Registry based.
Methods: This 2-staged matched-cohort study included all adults with a body mass index of ≥30 kg/m^2 who underwent primary Roux-en-Y gastric bypass or sleeve gastrectomy from 2007 until 2017 registered in the Scandinavian Obesity Surgery Registry. Patients with prescribed medication for ADHD were matched with control individuals without ADHD with a follow-up of up to 11 years after surgery.
Results: Among 1431 patients with ADHD and 2862 control individuals (mean body mass index, 42 kg/m^2; mean age, 35 years), no difference in weight loss or follow-up attendance over 2 years was seen. ADHD was associated with a higher risk for early postoperative complications (odds ratio [OR] = 1.31; 95% confidence interval [CI], 1.05–1.63), self-harm (hazards ratio [HR] = 1.39; 95% CI, 1.11–1.75), and substance abuse (HR = 1.34; 95% CI, 1.16–1.55), while associations with overall mortality (HR = 1.42; 95% CI, .99–2.03), major adverse cardiovascular and cerebrovascular events (HR = 1.93; 95% CI, .98–3.83), and effects on obesity-related diseases were uncertain. ADHD was associated with a lower health-related quality of life in all aspects before surgery. These differences increased for mental and obesity-related aspects but remained unchanged over time for physical aspects.
Conclusions: Compared with patients without ADHD, patients treated pharmacologically for ADHD experience similar weight loss and remission of obesity-related diseases without an increased risk for serious complications but report a lower health-related quality of life and have an increased risk of substance abuse and self-harm. This further emphasizes the need for close follow-up care for this group of individuals (Surg Obes Relat Dis 2022;■:1–9.)

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Attention deficit hyperactivity disorder (ADHD) is present in 2%–5% of the adult population [1,2], with increased prevalence among persons with obesity [1], including individuals pursuing metabolic and bariatric surgery (MBS) [3,4]. Symptoms of ADHD have been found to be twice as common in Swedish patients seeking MBS compared with the general population [5]. Individuals with ADHD have been shown to have greater difficulty adhering to treatment protocols and weight control [6], which, in turn, could lead to a reduced adherence to treatment recommendations after MBS.

A recent systematic review on the impact of ADHD on outcomes after MBS including a total of 492 patients found no difference in body mass index (BMI) loss after surgery but observed decreased postoperative follow-up for individuals with ADHD compared with individuals without ADHD [7]. A recent nationwide cohort study from Sweden reported greater risk for delayed discharge but no difference in risk of reoperation 30 days after Roux-en-Y gastric bypass (RYGB) [8]. However, the extent to which individuals with ADHD present with a higher risk for postoperative complications or fewer improvements in obesity-related disorders remains to be investigated. This is a critical limitation because characteristics (e.g., poor organization, lack of monitoring skills, and impulsivity) and factors (poor health behaviors) associated with ADHD [9] may have a negative impact on the outcome after MBS.

The aim of this study was to assess the short- and long-term safety and efficacy outcomes after MBS in a nationwide sample of patients with ADHD compared with matched control individuals without ADHD.

Methods

This study was conducted using record linkage of the Scandinavian Obesity Surgery Registry (SOReg) with nationwide Swedish health registers using the unique personal identity number assigned to each Swedish resident. SOReg is a national quality registry reporting preoperative, intraoperative, and follow-up data 6 weeks and 1, 2, 5, and 10 years after surgery. The registry covers virtually all MBS procedures in Sweden at present and has so far been reported to have very high acquisition and internal validity [10]. The cross-linkage included the Swedish Prescribed Drug Register, established in 2005, including all dispensed prescription drugs classified according to the World Health Organization Anatomical Therapeutic Chemical (ATC) classification system and the mandatory National Patient Register containing valid inpatient and outpatient hospital care data since 1987 [11]. The Total Population Register, continually updated by Statistics Sweden, provided data on emigration/immigration and dates of birth/death [12].

Inclusion and exclusion criteria

To represent the national study population, adults $\geq$18 years of age with a BMI of $\geq$30 kg/m^2 who underwent non-revisional primary RYGB or sleeve gastrectomy between 2007 and 2017 were considered for inclusion.

Study population and intervention

ADHD was defined as previously dispensed prescriptions of central acting sympathomimetics (ATC code: N06BA), which cover the major drugs used in Sweden for the treatment of ADHD (i.e., methylphenidate: N06BA04; amphetamine: N06BA01: dexamphetamine: N06BA02; atomoxetine: N06BA09; and lisdexamfetamine: N06BA12) [13]. During the study period, methylphenidate was recommended as the first-line pharmacologic treatment for ADHD and represented 70%–90% of all ADHD medication prescriptions during 2016 [14]. Only physicians specialized in psychiatry or neurology and responsible for ADHD treatment are authorized to prescribe the medication in Sweden, which supports the idea that prescription of ADHD medications is a valid indicator of an ADHD diagnosis [15].

Patients with preoperative pharmacologic treatment for ADHD were matched (1:2) with control individuals without previously dispensed prescriptions of an ADHD medication or a previous diagnosis of behavioral and emotional disorders with onset usually occurring in childhood and adolescence (International Classification of Diseases, 10th revision [ICD-10] code: F90–98) who also underwent MBS. The propensity-score matching was stratified by surgical method and included (nearest function) sex, age, BMI, sleep apnea, hypertension, type 2 diabetes, dyslipidemia, chronic obstructive pulmonary disease (COPD), cardiovascular disorder, disposable income, previous substance abuse, education, year of surgery, surgical access, and surgical center. To compare patients with ADHD with a control group unmatched for covarying conditions related to ADHD, a post hoc match was conducted as a 1:2 propensity-score matching (nearest function) including sex, age, year of surgery, and surgical center stratified by surgical method (see Supplementary Files).

The surgical technique for the laparoscopic RYGB was highly standardized during the study period with an antecolic, antegastric RYGB with a small gastric pouch (<25 mL), an alimentary limb of 100 cm, and a biliopancreatic limb of 50 cm. The surgical technique for the laparoscopic SG was less standardized but routinely performed using a 32–36F bougie, starting the resection ≤5 cm from the pylorus and ending the resection 1 cm from the angle of His.

Covariates

Age, sex, disposable income, ethnic origin, and educational level were based on individual data from the Total Population Register and Statistics Sweden. Disposable income (total taxable income minus taxes and other negative transfers) was indexed to the 2019 consumer price index and divided into quartiles based on the indexed disposable incomes of all patients undergoing MBS in Sweden. Ethnic origin was divided into 3 categories based on country of birth and parents' country of birth. Educational level was divided into 3 groups based on the highest completed education level at the time of surgery: primary (≤9 years of schooling), secondary (completed 11–12 years of schooling), and higher education (completed college or university degree).

Baseline BMI and the presence of sleep apnea, depression, diabetes, dyslipidemia, and hypertension were based on data from the SOReg and defined as a condition receiving active treatment (e.g., continuous positive airway pressure and pharmacologic treatment, respectively) at the time of surgery. Previous substance abuse, COPD, and cardiovascular co-morbidity were based on combined data from the SOReg, the National Patient registers, and the Prescribed Drugs register. Cardiovascular co-morbidity was defined as a previous diagnosis of heart failure (ICD-10: I50); acute myocardial infarction or angina pectoris (ICD-10: I20–22); or atrial fibrillation, flutter, or other tachycardia (ICD-10: I47–48). COPD was defined as hospital admission for COPD or a complication of COPD with COPD as a secondary diagnosis in the national patient register for in-hospital care (ICD-10: J44) or a prescription of an anticolinergic drug (ATC code: R03BB), a long-acting beta-2 antagonist (ATC codes: R03AC12–18), or a combination of these (ATC code: R03AL) indicating moderate to severe COPD [16]. Substance abuse was defined as a previous hospital admission or outpatient care at a specialist clinic for substance abuse (ICD-10: F10–16 or prescription of ATC code: N07BB) at any time before surgery.

Outcome and follow-up

Outcome measures were early postoperative complications (occurring within 30 days of surgery), postoperative follow-up attendance, weight change from baseline (before preoperative weight reduction) to the follow-up at 2 years after surgery, changes in obesity-related disease (i.e., type 2 diabetes, hypertension, and dyslipidemia) and health-related quality of life (HRQoL), major adverse cardiovascular event (MACE), and late complications (self-harm and substance abuse), as well as overall mortality. Early postoperative complications were defined as specific complications requiring a prolonged hospital stay, readmission, or intervention. A serious postoperative complication was defined as a complication requiring intervention under general anesthesia resulting in organ failure or death (≥IIIb on the Clavien–Dindo scale [17]), with information available for patients who underwent surgery from January 1, 2010. Obesity-related metabolic disease was defined as active pharmacologic treatment for type 2 diabetes, hypertension, and dyslipidemia during a 12-month period (follow-up year ± 6 months). HRQoL was assessed using the 36-Item Short Form Health Survey (SF-36/RAND) [18] and Obesity-related Problems (OP) scale [19]. MACE was defined as the first occurrence of unstable angina (ICD-10: I20.0), acute myocardial infarction (ICD-10: I21–22), cerebrovascular event (ICD-10: I60, I61, I63, or I64), fatal cardiovascular event (cause of death ICD-10: I01–78, excluding I30), or unattended sudden cardiac death (ICD-10: R96.0, R96.1, R98, and R99). Self-harm was defined as the first admission or treatment for self-inflicted serious injury or intoxication (ICD-10: X60–84) or a cause of death caused by self-induced injury (ICD-10: X60–84) or injury of unclear intent (ICD-10: Y10–34). Substance abuse was defined as hospital admission or a visit to a specialist clinic for substance abuse (ICD-10: F10–16) or a prescription of drugs for alcohol abuse (ATC code: N07BB).

Participants were followed after surgery until emigration, death, or end of follow-up (December 31, 2019, for all endpoints, except for mortality, for which follow-up ended on December 31, 2020), whichever came first.

Statistics

Postoperative weight loss is presented as change in BMI (BMI loss = initial BMI – postoperative BMI), total weight loss (TWL= 100 × weight loss/preoperative weight), and excess BMI loss (EBMIL = 100 × [initial BMI – postoperative BMI]/[initial BMI – 25]). Categorical data are presented as numbers (n) and percentages (%), continuous variables as mean ± standard deviation, or median with interquartile range (IQR) as appropriate. The balance between the matched groups was evaluated by calculating the standardized difference. A standardized difference of >.1 was considered as residual imbalance. Binary outcomes were evaluated using logistic regression, with odds ratios (ORs) with 95% confidence intervals (95% CIs) as measures of association. Occurrence of long-term outcomes was estimated as incidence rates (IRs) and further evaluated using Cox regression with hazard ratios (HRs) and 95% CIs as measures of association. Time to negative long-term outcomes was estimated and visualized using the Kaplan-Meier method. Continuous outcomes were evaluated using the *t* test or Mann-Whitney *U* test as appropriate. SPSS version 25 (IBM, Armonk, NY) and R version 4.0.0 (R Core Team, Vienna, Austria) were used for statistical analyses.

Ethics

This study was approved by the National Ethics Board in Sweden (reference no.: 2020-03005).

Results

During the study period, 59,815 patients meeting the inclusion criteria were identified. Mean age was 41 ± 11.1 years; mean BMI was 41.9 ± 5.5 kg/m^2; and 76% were women (Supplementary Table 1). Before surgery, 1431 individuals (2.4%) received pharmacologic treatment for ADHD. The propensity-score match resulted in 2 groups without any clinically relevant difference in baseline characteristics (Table 1).

Follow-up

Follow-up attendance with registration of weight was available at 1 year for 1158 individuals (80.9%) in the ADHD group and for 2397 individuals (83.8%) in the control group. The corresponding numbers at 2 years were 826 (57.7%) and 1668 (58.3%), respectively. During the study period, 25 patients emigrated and 122 died, resulting in median follow-up times for mortality of 6.2 years (IQR, 4.6–8.3 years) and 6.2 years (IQR, 4.5–8.1 years), respectively. Median follow-up times for other endpoints (i.e., co-morbidities, MACE, self-harm, and substance abuse) were 5.2 years (IQR, 3.6–7.3 years) and 5.2 years (IQR, 3.6–7.1 years), respectively.

Weight

Massive weight loss was seen in both groups without relevant differences at 1 year (BMI loss in the ADHD group,

Table 1
Baseline characteristics

Characteristic	ADHD (n = 1431)	Control group (n = 2862)	Standardized difference
Age (yr)	34.8 ± 11.1	35.0 ± 10.9	.018
BMI (kg/m^2)	41.8 ± 5.6	41.8 ± 5.7	.004
Sex, n (%)			
Male	354 (24.7)	667 (23.3)	.033
Female	1077 (75.3)	2195 (76.7)	.033
Co-morbidity, n (%)			
Hypertension	214 (15.0)	423 (14.8)	.005
Type 2 diabetes	118 (8.2)	207 (7.2)	.038
Sleep apnea	120 (8.4)	238 (8.3)	.003
Dyslipidemia	94 (6.6)	177 (6.2)	.016
Depression	742 (51.9)	1515 (52.9)	.020
COPD	52 (3.6)	107 (3.7)	.005
Cardiovascular disease	48 (3.4)	82 (2.9)	.029
Previous substance abuse, n (%)	306 (21.4)	590 (20.6)	.020
Income, n (%)			
Q1	711 (49.7)	1388 (48.5)	.024
Q2	359 (25.1)	777 (27.1)	.046
Q3	195 (13.6)	415 (14.5)	.026
Q4	166 (11.6)	282 (9.9)	.055
Education, n (%)			
Primary	482 (33.7)	982 (32.4)	.028
Secondary	727 (50.8)	1502 (52.5)	.034
Higher	222 (15.5)	432 (15.1)	.011
Ethnicity, n (%)			
Swedish-born, Swedish descendent	1269 (88.7)	2544 (88.9)	.006
Swedish-born, non-Swedish descendent	76 (5.3)	142 (5.0)	.014
Born outside of Sweden	86 (6.0)	176 (6.1)	.004
Surgical method, n (%)			
Gastric bypass	1122 (78.4)	2244 (78.4)	0
Sleeve gastrectomy	309 (21.6)	618 (21.6)	0
Surgical access, n (%)			
Laparoscopic	1418 (99.1)	2833 (99.0)	.010
Converted	4 (.3)	10 (.3)	0
Open	9 (.6%)	19 (.7%)	.012

BMI = body mass index; COPD = chronic obstructive pulmonary disease; Q = quartile; ADHD = attention deficit hyperactive disorder.

There were no missing values for any of the variables listed in this table.

13.6 ± 4.2 kg/m^2 versus 13.5 ± 4.2 kg/m^2; *P* = .630; EBMIL, 84.8% ± 27.2% versus 84.0% ± 25.1%; *P* = .413; TWL, 32.3% ± 8.8% versus 32.1% ± 8.4%; *P* = .424) or 2 years after surgery (BMI loss in the ADHD group, 13.5 ± 5.0 kg/m^2 versus 13.6 ± 4.8 kg/m^2; *P* = .471; EBMIL, 84.1% ± 29.1% versus 84.0% ± 26.5%; *P* = .940; TWL, 32.1% ± 10.3% versus 32.3% ± 9.6%; *P* = .621).

Early postoperative complications

Postoperative complications were more common in the ADHD group than in the control group (OR = 1.31; 95% CI, 1.05–1.63), while no major difference was seen in serious complications or (OR = 1.29; 95% CI, .91–1.83) or specific complications (Table 2).

Mortality, MACE, and obesity-related disease

During the study, there were 50 deaths among patients with ADHD (IR = 5.42; 95% CI, 4.11–7.15/1000 person-years; HR = 1.42; 95% CI, .99–2.03; *P* = .059) and 72 deaths in the control group (IR = 3.83; 95% CI, 3.04-4.82/1000 person-years). A MACE occurred for 16 patients with ADHD (IR = 2.05; 95% CI, 1.26–3.35/1000 person-years; HR = 1.93; 95% CI, .98–3.83; *P* = .058; Fig. 1A) and 17 individuals in the control group (IR = 1.06; 95% CI, .66–1.71/1000 person-years). There was no statistically significant difference in remission of other obesity-related co-morbid diseases between patients with and without ADHD (Fig. 1D–F).

Self-harm

A self-harm event occurred for 122 patients with ADHD (IR = 16.23; 95% CI, 13.59–19.28/1000 person-years; HR = 1.39; 95% CI, 1.11–1.75; *P* = .005; Fig. 1B) and 182 individuals in the control group (IR = 11.75; 95% CI, 10.16–13.59/1000 person-years). Attending follow-up at 1 year after surgery was associated with a reduced risk for later self-harm for patients with ADHD (HR = .56; 95% CI, .38–.82; *P* = .003) as well as for control individuals (HR = .45; 95% CI, .33–.62; *P* < .001) when compared with those not attending follow-up.

Substance abuse

Postoperative substance abuse disorder was reported for 299 patients with ADHD (IR = .12; 95% CI, .11–.14/1000 person-years; HR = 1.34; 95% CI, 1.16–1.55; *P* < .001; Fig. 1C) and 467 individuals in the control group (IR = .09; 95% CI, .08–.10/1000 person-years). Attending follow-up at 1 year after surgery was associated with a reduced risk for substance abuse for patients with ADHD (HR = .65; 95% CI, .50–.84; *P* = .001) as well as for control individuals (HR = .53; 95% CI, .43–.65; *P* < .001).

Table 2
Intra- and early postoperative complications for patients with attention deficit hyperactive disorder and matched control individuals

Complication	ADHD, n (%)	Control group, n (%)	*P* value*
Intraoperative	33 (2.3)	70 (2.4)	.778
Bleeding	10 (.7)	28 (1.0)	.359
Bowel injury	14 (1.0)	27 (.9)	.912
Other intraoperative complication	9 (.6)	15 (.5)	.665
Postoperative†	141 (10.2)	222 (8.0)	.018
Bleeding	26 (1.9)	41 (1.5)	.331
Leak/intra-abdominal abscess	24 (1.7)	45 (1.6)	.785
Bowel obstruction/stricture	26 (1.9)	31 (1.1)	.048
Abdominal wall complication	12 (.9)	33 (1.2)	.348
Marginal ulcer	8 (.6)	12 (.4)	.522
Cardiovascular complication	0 (.0)	2 (.1)	1.000
Pulmonary complication	12 (.9)	14 (.5)	.166
DVT/PE	4 (.3)	2 (.1)	.099
Urinary tract infection	7 (.5)	12 (.4)	.739
Abdominal pain	26 (1.9)	38 (1.4)	.208
Dehydration/malnutrition	13 (.9)	19 (.7)	.376
Other complication	16 (1.2)	29 (1.0)	.741
Serious postoperative	53 (4.0)	83 (3.1)	.157

ADHD = attention deficit hyperactive disorder; DVT = deep vein thrombosis; PE = pulmonary embolism.

* Based on univariable logistic regression or Fisher test when appropriate.

† Each patient can suffer from >1 specific complication.

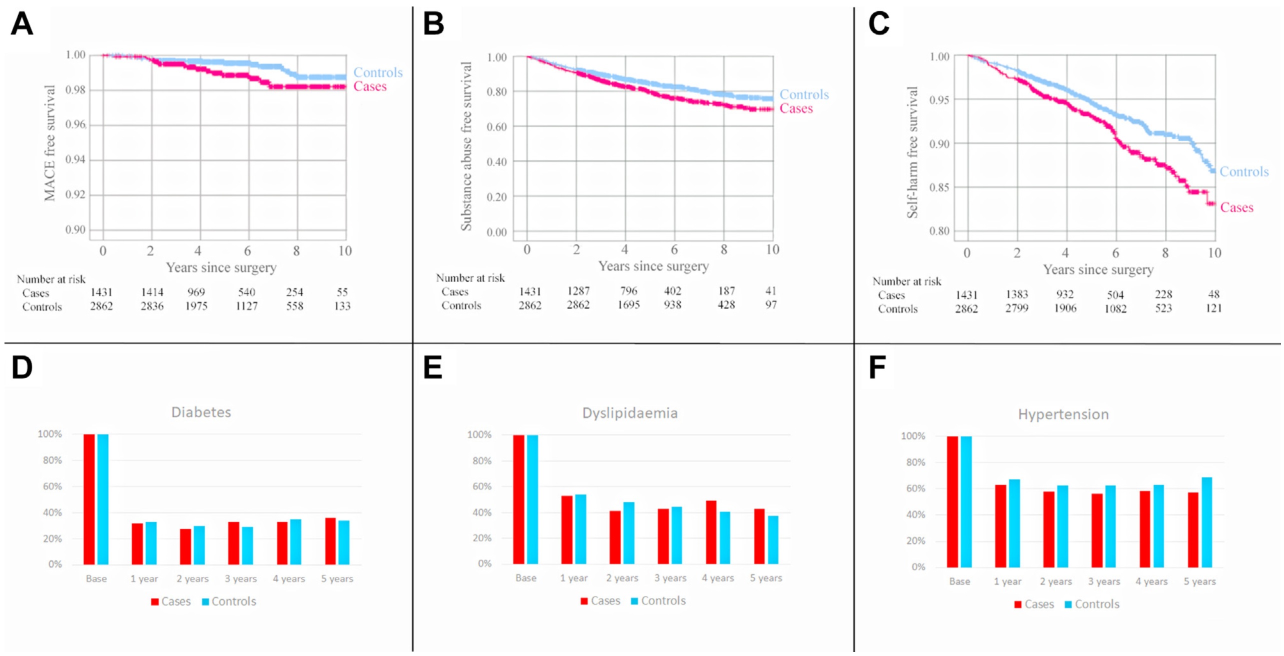

Fig. 1. Medium- and long-term outcomes after metabolic and bariatric surgery for patients with attention deficit hyperactivity disorder and matched control individuals. (A) Major adverse cardiovascular event–free survival up to 10 years after surgery. (B) Substance abuse–free survival up to 10 years after surgery. (C). Self-harm–free survival up to 10 years after surgery. (D). Pharmacologic treatment for diabetes up to 5 years after surgery for patients with diabetes at baseline. (E) Pharmacologic treatment for dyslipidemia up to 5 years after surgery for patients with dyslipidemia at baseline. (F) Pharmacologic treatment for hypertension up to 5 years after surgery for patients with hypertension at baseline.

Health-related quality of life

Patients with ADHD reported lower an HRQoL in all aspects before surgery. These differences remained unchanged with a tendency toward a reduced difference over time for the physical aspects of HRQoL (in particular physical role and physical function; Fig. 2) but increased for the mental aspects and obesity-related problems over time (Table 3, Fig. 2).

Post hoc matching

The study group was generally younger with a lower socioeconomic status than the average patient operated on in Sweden [20]. When compared with a control group unmatched for covarying conditions related to ADHD, patients with ADHD more often had sleep apnea, depression, previous substance abuse, a lower level of education, and a lower income and were more often born in Sweden by Swedish-born parents. Patients with ADHD had a higher risk of early postoperative complications and reported a lower HRQoL at all points in time, in particular for the mental dimension of the SF-36/RAND and for obesity-related problems (see Supplementary Files).

Discussion

In this nationwide matched-cohort study, patients receiving pharmacologic treatment for ADHD experienced similar weight loss results and comparable effects on metabolic co-morbidities after MBS compared with matched control individuals with a small increased risk for nonserious postoperative complications. The risks for self-harm and substance abuse were increased, particularly in patients who did not attend follow-up appointments.

ADHD has been associated with obesity and has been reported to be more prevalent in individuals with a BMI >40 kg/m^2. In a recent meta-analysis, the mean rate of ADHD in patients seeking MBS was found to be 20.9%, with a range of 7%–38% [7]. This contrasts with the prevalence of ADHD in this study (2.4%). This discrepancy might be attributed to differences in the definition of ADHD. While our definition of ADHD (i.e., pharmacologic treatment) is considered a valid indicator of ADHD diagnoses [15], medication is currently reserved for patients in whom other supportive interventions have failed, indicating that our proxy for ADHD identifies more severe cases [14] compared with studies in which the diagnosis was based on clinical assessment and testing. Therefore, the results may not be representative for patients who remain undiagnosed or who do not receive treatment.

In agreement with previous studies, we found no difference in the weight outcomes over 2 years after surgery for patients with ADHD compared with patients without ADHD [7]. It has been proposed that a deficient inhibitory control associated with ADHD could predispose patients to abnormal eating patterns and inattention may lead to poor planning, which can be associated with difficulties in

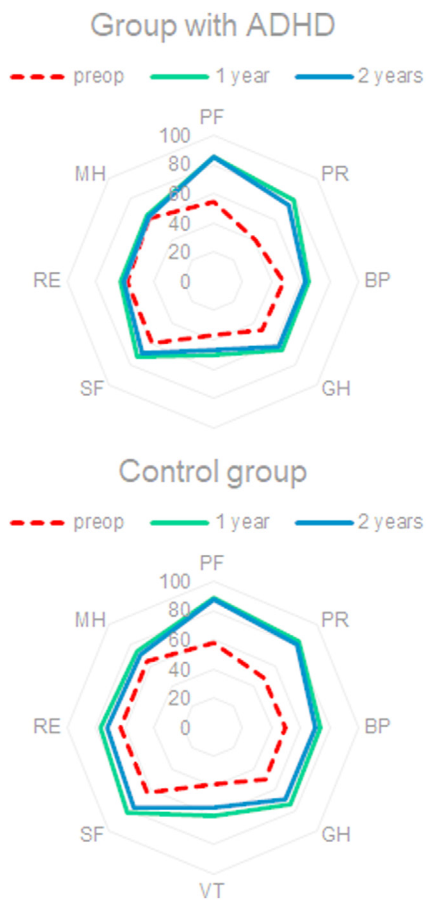

Fig. 2. Spider diagrams for the 8 health-related quality-of-life dimensions of the 36-Item Short Form Health Survey (SF-36/RAND) at baseline and 1 and 2 years after surgery for individuals with and without attention deficit hyperactive disorder. The mental domains are located to the left side and physical domains to the right side.

adhering to regular eating patterns [21], both of which are cornerstones of post-MBS treatments. Yet these proposed difficulties do not seem to be associated with a poorer weight outcome in the medium term. We believe that this demonstrates the robust nature of the 2 studied MBS procedures, although the appetite-suppressive effects of ADHD medication may impact weight results as well.

The overall risk for early postoperative complications was slightly higher for individuals with ADHD and seems to be mainly associated with an increased risk for bowel obstruction or stricture. The reason behind this is not clear but might be associated with a difficulty in adhering to early postoperative recommendations regarding food intake. More important, no difference was seen in serious complications such as reoperation, multiorgan failure, or death.

ADHD is mainly diagnosed in adolescence, and a significant proportion of the medical literature on MBS outcome in patients with ADHD pertains to adolescents [22]. As these individuals progress to adulthood, there is a need for information on the well-being of these individuals after MBS in adulthood. The prevalence of prior depression and substance abuse was higher in the individuals with ADHD who underwent MBS. Even after careful adjustment for measured covariates via matching, there was an increased risk for postoperative self-harm and substance abuse, particularly for individuals not attending follow-up visits. There was no difference in the physical domain of HRQoL, but individuals with ADHD scored worse with regard to the mental domains. These domains are highly influenced by psychological variables and stress management, factors that may be negatively influenced by ADHD [23].

After MBS, patients are at an increased risk of substance abuse and self-harm [24,25], but the risk in patients with ADHD seems to be even greater. Because depression, common in ADHD, is associated to an increased risk of self-harm and suicide [26], it is not clear whether the increased risk can be attributed to surgery or to the ADHD diagnosis. The increased risk for self-harm and substance abuse was associated with a lack of follow-up visits. Previous studies have shown that follow-up visits improve outcomes after MBS [27,28]. However, follow-up rates with the patients' surgical team seem to be low [29]. Additionally, MBS may alter drug absorption [30], which may impact medical treatment effects of ADHD. This, in combination with the increased risk of self-harm and reduced mental HRQoL, further emphasizes

Table 3
Health-related quality of life estimated before and after surgery for patients with ADHD and matched control individuals

Source	Baseline	*P* value	1-yr Follow-up	*P* value	2-yr Follow-up	*P* value
RAND-36, PCS						
ADHD group, mean ± SD	34.6 ± 10.75	<.001	49.7 ± 10.83	.014	48.8 ± 11.36	.057
Control, mean ± SD	36.2 ± 11.04		50.9 ± 10.14		50.1 ± 10.86	
RAND-36, MCS						
ADHD group, mean ± SD	40.4 ± 13.08	.036	38.9 ± 15.46	<.001	37.6 ± 15.50	<.001
Control, mean ± SD	41.5 ± 13.04		44.8 ± 13.48		42.4 ± 14.76	
OP						
ADHD group, median (IQR)	79.2 (62.5–91.7)	.004	20.8 (4.2–50.0)	<.001	29.2 (5.7–54.2)	<.001
Control, median (IQR)	75.0 (58.3–87.5)		16.7 (0–37.5)		16.7 (4.2–45.8)	

ADHD = attention deficit hyperactive disorder; RAND-36 = research and development-36; PCS = physical components summary score; SD = standard deviation; MCS = mental components summary score; OP = Obesity-related Problems scale; IQR = interquartile range.

the need for specialized long-term follow-up for individuals with ADHD who undergo MBS.

Despite the strengths of the large nationwide study population and the use of high-quality data from several sources of high validity and degree of completeness, this study has several limitations. First, this is an observational study. Despite matching of the groups at baseline, there could still be differences based on uncontrolled factors leading to residual confounding/biased results. We therefore need to be cautious regarding causality. The matching was balanced, but because inclusion was based on a diagnosis of ADHD and pharmacologic treatment, individuals with ADHD without medical treatment would be missed. In addition, the fact that individuals with ADHD and co-occurring psychiatric disorders may not be considered for MBS limits generalizability to the most severe forms of ADHD. Furthermore, details of medication doses and adherence to treatment were not considered in the study, suggesting a need for further studies evaluating differences in outcome among subgroups. Finally, missing data on weight outcomes increase with time, allowing only up to 2 years of follow-up time for weight outcomes, thus not allowing analyses of long-term weight effects and weight regain.

Conclusion

Individuals with ADHD who are prescribed medication for this disorder demonstrate similar postoperative risks and positive outcomes in term of weight loss and remission of co-morbid diseases after MBS as matched patients without ADHD. In contrast, individuals with ADHD report a lower HRQoL before and after surgery and have an increased risk of substance abuse and self-harm, particularly if they do not attend follow-up visits. This further emphasizes the need for close follow-up of this group of patients.

Disclosures

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Supplementary materials

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