**Supplementary files**

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Item No** | **Recommendation** | **Page No** |
| **Title and abstract** | | 1 | (*a*) Indicate the study’s design with a commonly used term in the title or the abstract | 1,3 |
| (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 3-4 |
| **Introduction** | | | | |
| Background/rationale | | 2 | Explain the scientific background and rationale for the investigation being reported | 5 |
| Objectives | | 3 | State specific objectives, including any prespecified hypotheses | 6 |
| **Methods** | | | | |
| Study design | | 4 | Present key elements of study design early in the paper | 6 |
| Setting | | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 6-7 |
| Participants | | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up | 6-7 |
| (*b*)For matched studies, give matching criteria and number of exposed and unexposed | 6-7, Fig.1, Table 1 |
| Variables | | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 7-8, Supp. Table 1 |
| Data sources/ measurement | | 8\* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 7, Supp. Table 1 |
| Bias | | 9 | Describe any efforts to address potential sources of bias | 9-10 |
| Study size | | 10 | Explain how the study size was arrived at | 6-7, Fig 1 |
| Quantitative variables | | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 8-9 |
| Statistical methods | | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 8-10 |
| (*b*) Describe any methods used to examine subgroups and interactions | 9 |
| (*c*) Explain how missing data were addressed | 9 |
| (*d*) If applicable, explain how loss to follow-up was addressed | 9 |
| (*e*) Describe any sensitivity analyses | 9 |
| **Results** | | | |  |
| Participants | | 13\* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | Fig. 1 |
| (b) Give reasons for non-participation at each stage | 6-7, Fig 1 |
| (c) Consider use of a flow diagram | Fig. 1 |
| Descriptive data | | 14\* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 10, Table 1 |
| (b) Indicate number of participants with missing data for each variable of interest | Tables |
| (c) Summarise follow-up time (eg, average and total amount) | 10-11 |
| Outcome data | | 15\* | Report numbers of outcome events or summary measures over time | Tables |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | | Tables |
| (*b*) Report category boundaries when continuous variables were categorized | | NA |
| (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | | 11-14,  Table 3, Fig. 2, Supp. Tables 4, 7, and 9 |
| **Discussion** | | | | |
| Key results | 18 | Summarise key results with reference to study objectives | | 14-15 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | | 17 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | | 14-17 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | | 17-18 |
| **Other information** | | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | | 2 |

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

**Supplementary Table 1.** Codes.

|  |  |
| --- | --- |
| **Codes (SNOMED, CPT, ICD-10-PCS, ICD-10-CM, TNX, VA …)** | **Inclusion and exclusion criteria** |
| 43644 | Laparoscopy, surgical, gastric restrictive procedure; with gastric bypass and Roux-en-Y gastroenterostomy (roux limb 150 cm or less) (at least 18 years old at event) |
| 43645 | Laparoscopy, surgical, gastric restrictive procedure; with gastric bypass and small intestine reconstruction to limit absorption (at least 18 years old at event) |
| 43846 | Gastric restrictive procedure, with gastric bypass for morbid obesity; with short limb (150 cm or less) Roux-en-Y gastroenterostomy (at least 18 years old at event) |
| 43775 | Laparoscopy, surgical, gastric restrictive procedure; longitudinal gastrectomy (ie, sleeve gastrectomy) (at least 18 years old at event) |
| E03.8 | Other specified hypothyroidism |
| E03.9 | Hypothyroidism, unspecified |
| Z94 | Transplanted organ and tissue status |
| 8794 | propylthiouracil |
| 6835 | methimazole |
| E01 | Iodine-deficiency related thyroid disorders and allied conditions |
| C00-C26, C30-C58, C60-C96, C7A, C7B, D37-D49, D3A | Neoplasms |
| E05 | Thyrotoxicosis [hyperthyroidism] |
| N18.6 | End stage renal disease |
| ICD-10 | Baseline diagnosis |
| E78 | Disorders of lipoprotein metabolism and other lipidemia |
| E11 | Type 2 diabetes mellitus |
| I10 | Essential (primary) hypertension |
| I25 | Chronic ischemic heart disease |
| K76.0 | Fatty (change of) liver, not elsewhere classified |
| K74.0 | Hepatic fibrosis |
| N18 | Chronic kidney disease (CKD) |
|  | **Outcomes** |
| Deceased, R99 | Mortality |
| 1013659, 99232, 99233, HL7V3.0 | Readmission |
| 1013729, 305351004, 99291, 99292 | ICU visit/Critical Care Services |
| I74, I26, I82.4, I82.6 | All embolism and thrombosis |
| K80, K81, K82, K83.0 | Biliary diseases |
| 302497006, 90935, 90937, Z99.2, N17, N19, 90945 | Acute Kidney Injury |
| R65.20, R65.21, A40.0, A40.1, A40.3, A40.8, A40.9, A41.1, A41.2, A41.3, A41.4, A41.9, A42.7, A41.01, A41.02, A41.50, A41.51, A41.52, A41.53, A41.59, A41.81, A41.89, T81.44XA, T81.44XD, T81.44XS, T81.12XD, T81.12XS | Postoperative Sepsis |
| K56 | Bowel and/or ileus Obstruction |
| 36430, 30233H0, 30233H1, 30233N0, 30233N1, 30233P1, 30243H0, 30243H1, 30243N0, 30243N1, 30243P1, 30253H0, 30253H1, 30253N0, 30253N1, 30253P1, 30263H0, 30263H1, 30263N0, 30263N1, 30263P1 | Blood transfusion |
| K43.0, K43.1, K43.2 | Incisional hernia |
| E16.1, E16.2 | Hypoglycemia |
| K65.1, K63.2, K91.81, K91.89, T81.43XA, T81.43XD, T81.43XS | Leak |
| D62, D64.9, D78.02, D78.22, D78.32, E36.02, E89.821, K91.840, K91.841, K91.870, K91.871, L76.02, L76.22, L76.32, M96.811, M96.831, M96.841, N99.61, N99.62, N99.820, N99.821, N99.840, N99.841 | Bleeding / anemia |
| K25, K26, K26, K27, K28 | Gastrointestinal Ulcer |
| R12, R13.1 | Dysphagia / reflux |
| T81.41, T81.42, T81.43 | Surgical site infection |
| T81.3, T81.4, K65.0, K65.1, K65.2, K65.4, K65.3, K65.8, K65.9, K67, K68, K66.0, K66.1, K66.8, K66.9, T81.89 | Wound disruption |
| N39.0, R82.79, N10 | Urinary infection |
| I80, I81, I82, T81.72XA, T81.72XD, T81.72XS, T81.718A, T81.718D, T81.718S, I26.01, I26.02, I26.09, I26.90, I26.92, I26.93, I26.94, I26.99 | Pulmonary embolic |
| G45.0, G45.1, G45.2, G45.3, G45.4, G45.8, G45.9, G46, H34.0, H34.1, H34.2, I20.0, I20.1, I20.8, I20.9, I22, I21.0, I21.1, I21.2, I21.3, I21.4, I21.9, I21.A, I24.0, I24.1, I24.8, I24.9, I46, I60, I61, I62, I63, I65, I66, I50.1, I50.2, I50.3, I50.4, I50.8, I50.9 | Cardiovascular complications |
| I50, I21, I47.2, R57.0, I23, I46, I24, I22, I20.0, I20.1, I20.8, I20.9, I48 | Cardiovascular events |
| I63, G45, I65, I66, I60, I61 | Cerebrovascular events |
| N18.4, N18.6, N18.5 | CKD |
| E11, 19037 | Diabetes |
| I10 | Hypertension |
| E78.2, E78.4, E78.5, E78.9, 272, E78.89 | Dyslipidemia |
| HS501, HS502 | Diabetes (medication) |
| CV100, CV200, CV400, CV490 | Hypertension (medication) |
| CV350 | Dyslipidemia (medication) |
| W19, W18.3 | Falls |
| M81.0, M81.8 | Osteoporosis |
| S32, S72 | Fracture of femur or lumbar and pelvis |
| D50 | Iron deficiency |
| E51, E52, E53 | Vitamin B deficiency |
| G62.9 | Polyneuropathy |

**Supplementary Table 2.** Multiple comparison correction using Benjamini-Hochberg False Discovery Rate (FDR).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Primary analysis** | | **Sensitivity analysis for TSH normal patients** | |
|  | Original | FDR | Original | FDR |
|  | p-value | p-value | p-value | p-value |
| **SHORT-TERM** |  |  |  |  |
| Mortality | 0.999 | 0.999 | 0.994 | 0.994 |
| Readmission | **0.0000008** | **<0.001** | **0.0006** | **0.015** |
| Critical care services/ ICU | 0.928 | 0.975 | 0.269 | 0.562 |
| Common Surgical Complications | 0.113 | 0.371 | 0.244 | 0.561 |
| Leak | 0.436 | 0.810 | 0.128 | 0.515 |
| Incisional hernia | **0.008** | 0.092 | **0.037** | 0.426 |
| Bowel or ileus Obstruction | 0.879 | 0.975 | 0.356 | 0.596 |
| Gastrointestinal Ulcer | 0.549 | 0.842 | 0.731 | 0.801 |
| Dysphagia / reflux | 0.360 | 0.753 | 0.145 | 0.515 |
| Surgical site infection | 0.104 | 0.371 | 0.068 | 0.515 |
| Wound disruption | 0.931 | 0.975 | 0.132 | 0.515 |
| Blood transfusion | 0.821 | 0.975 | 0.363 | 0.596 |
| Bleeding/anemia | 0.493 | 0.810 | 0.542 | 0.686 |
| Serious Systemic Complications | 0.199 | 0.572 | 0.918 | 0.960 |
| Embolism and thrombosis | 0.341 | 0.753 | 0.523 | 0.686 |
| Biliary diseases | **0.022** | 0.169 | 0.237 | 0.561 |
| Acute Kidney Injury | 0.108 | 0.371 | 0.464 | 0.686 |
| Postoperative Sepsis | 0.933 | 0.975 | 0.656 | 0.754 |
| Pneumonia | 0.921 | 0.975 | 0.567 | 0.686 |
| Hypoglycemia | 0.459 | 0.810 | 0.537 | 0.686 |
| Urinary infection | 0.081 | 0.371 | 0.179 | 0.515 |
| Pulmonary embolic | 0.236 | 0.603 | 0.171 | 0.515 |
| Cardiovascular complications | 0.759 | 0.975 | 0.340 | 0.596 |
| **LONG-TERM** |  |  |  |  |
| Mortality | 0.625 | 0.703 | 0.704 | 0.792 |
| Cardiovascular events | 0.106 | 0.147 | 0.550 | 0.707 |
| Cerebrovascular events | **0.046** | 0.075 | **0.012** | **0.031** |
| Chronic kidney disease | 0.820 | 0.820 | 0.634 | 0.761 |
| Diabetes | **0.003** | **0.014** | **0.015** | **0.034** |
| Hypoglycemic agents | **0.028** | 0.056 | **0.008** | **0.029** |
| Hypertension | 0.071 | 0.107 | 0.148 | 0.266 |
| Antihypertensive agents | 0.194 | 0.235 | 0.487 | 0.674 |
| Dyslipidemia | **0.030** | 0.056 | 0.248 | 0.372 |
| Antilipemic agents | 0.671 | 0.710 | 0.902 | 0.902 |
| Hypoglycemia | **0.0001** | **0.001** | **0.006** | **0.027** |
| Bone Composite | **0.001** | **0.006** | **0.025** | 0.050 |
| Falls | **0.031** | 0.056 | 0.210 | 0.344 |
| Osteoporosis | **0.008** | **0.023** | **0.001** | **0.009** |
| Fracture | 0.196 | 0.235 | 0.851 | 0.901 |
| Iron deficiency | **0.007** | **0.023** | **0.004** | **0.024** |
| Vitamin B deficiency | **0.00000008** | **<0.001** | **0.0004** | **0.007** |
| Polyneuropathy | **0.009** | **0.023** | **0.011** | **0.031** |

**Note:** p-values for short-term outcomes are based on risk difference analyses; p-values for long-term adverse events are based on log-rank tests.

**Supplementary Table 3.** Baseline characteristics of the sample in the sensitivity analysis 2.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Before propensity score matching** | | **Std diff.** | **After propensity score matching** | | **Std diff.** |
|  | Hypothyroidism-BS (n= 5,702) | Control-BS  (n= 77,048) | Hypothyroidism-BS (n= 5,624) | Controls-BS  (n= 5,624) |
| **Demographics** |  |  |  |  |  |  |
| Age at index, mean (SD) | 46.7 (11.7) | 42.1 (11.5) | **0.40** | 46.6 (11.6) | 46.5 (11.4) | 0.02 |
| Female | 5,024 (88.1%) | 62,431 (75.7%) | **0.32** | 4,947 (88.0%) | 4,976 (88.5%) | 0.02 |
| White | 4,424 (77.6%) | 47,933 (58.1%) | **0.41** | 4,335 (77.1%) | 4,351 (77.4%) | 0.01 |
| Black | 453 (7.9%) | 19,378 (23.5%) | **0.40** | 507 (9.0%) | 489 (8.7%) | 0.01 |
| Not Hispanic | 4,139 (72.6%) | 55,446 (67.2%) | **0.16** | 4,184 (74.4%) | 4,209 (74.8%) | 0.01 |
| Married | 1,734 (30.4%) | 19,125 (23.2%) | **0.17** | 1,733 (30.8%) | 1,608 (28.6%) | 0.05 |
| **Diagnosis** |  |  |  |  |  |  |
| Dyslipidemia | 2,932 (51.4%) | 27,815 (33.7%) | **0.38** | 2,925 (52.0%) | 2,942 (52.3%) | 0.01 |
| Type 2 diabetes mellitus | 1,915 (33.6%) | 19,580 (23.7%) | **0.16** | 1,735 (30.9%) | 1,711 (30.4%) | 0.01 |
| Hypertension | 3,324 (58.3%) | 39,667 (48.1%) | **0.20** | 3,275 (58.2%) | 3,288 (58.5%) | 0.00 |
| CKD | 279 (4.9%) | 1,520 (1.8%) | **0.16** | 262 (4.7%) | 196 (3.5%) | 0.06 |
| Chronic ischemic heart disease | 365 (6.4%) | 3,161 (3.8%) | **0.12** | 358 (6.4%) | 342 (6.1%) | 0.01 |
| NAFLD | 873 (15.3%) | 9,449 (11.5%) | **0.14** | 918 (16.3%) | 795 (14.1%) | 0.06 |
| Hepatic fibrosis | 36 (0.6%) | 240 (0.3%) | 0.05 | 34 (0.6%) | 19 (0.3%) | 0.04 |
| **Medication** |  |  |  |  |  |  |
| Antilipemic agents | 1,565 (27.5%) | 11,183 (13.6%) | **0.34** | 1,507 (26.8%) | 1,488 (26.5%) | 0.01 |
| Atorvastatin | 749 (13.1%) | 6,029 (7.3%) | **0.19** | 721 (12.8%) | 761 (13.5%) | 0.02 |
| Simvastatin | 265 (4.6%) | 1,987 (2.4%) | **0.12** | 261 (4.6%) | 267 (4.7%) | 0.01 |
| Insulin | 675 (11.8%) | 5,061 (6.1%) | **0.18** | 635 (11.3%) | 541 (9.6%) | 0.05 |
| Oral hypoglycemic agents | 1,468 (25.8%) | 13,003 (15.8%) | **0.23** | 1,409 (25.1%) | 1,397 (24.8%) | 0.00 |
| Metformin | 1,300 (22.8%) | 11,468 (13.9%) | **0.21** | 1,239 (22.0%) | 1,229 (21.9%) | 0.00 |
| Beta blockers/related | 1,155 (20.3%) | 10,515 (12.8%) | **0.19** | 1,106 (19.7%) | 1,048 (18.6%) | 0.03 |
| Calcium channel blockers | 642 (11.3%) | 7,713 (9.4%) | 0.06 | 625 (11.1%) | 605 (10.8%) | 0.01 |
| Antiarrhythmics | 1,989 (34.9%) | 23,421 (28.4%) | **0.15** | 1,985 (35.3%) | 1,983 (35.3%) | 0.00 |
| Antihypertensives, other | 325 (5.7%) | 3,755 (4.6%) | 0.05 | 316 (5.6%) | 312 (5.5%) | 0.00 |
| **Laboratory** |  |  |  |  |  |  |
| Serum calcium (mg/dL) | 9.44 (0.47) | 9.41 (0.44) | 0.07 | 9.44 (0.47) | 9.45 (0.46) | 0.01 |
| Cholesterol in HDL (mg/dL) | 45.8 (15.2) | 44.3 (15.0) | **0.12** | 46.0 (15.0) | 45.4 (15.4) | 0.04 |
| Cholesterol in LDL (mg/dL) | 105 (34) | 106 (33) | 0.02 | 105 (34) | 105 (36) | 0.00 |
| Triglyceride (mg/dL) | 160 (101) | 141 (95) | **0.17** | 158 (101) | 155 (96) | 0.03 |
| Ferritin (ng/mL) | 89.2 (97.6) | 104 (118) | **0.13** | 90.2 (98.5) | 102 (118) | 0.09 |
| Vitamin B12 (pg/mL) | 544 (289) | 536 (299) | 0.02 | 542 (290) | 543 (312) | 0.00 |
| BMI (kg/m2) | 45.6 (7.4) | 45.8 (7.2) | 0.02 | 45.7 (7.4) | 45.1 (6.9) | 0.08 |
| Hemoglobin A1c (%) | 6.09 (1.19) | 5.97 (1.25) | **0.10** | 6.09 (1.16) | 6.06 (1.32) | 0.02 |
| TSH levels (mIU/L) | 3.37 (11.7) | 2.27 (16.9) | 0.07 | 3.30 (10.2) | 2.26 (15.4) | 0.08 |
| FT4 levels (ng/dL) | 1.16 (0.35) | 1.04 (0.23) | **0.38** | 1.16 (0.34) | 1.04 (0.23) | **0.40** |

**Note**. Standard differences (Std diff.) ≥ 0.1 were considered statistically significant. CKD: chronic kidney disease. NAFLD: nonalcoholic fatty liver disease. Age and laboratory measures are presented as mean (SD). Demographics, diagnosis, and medication are presented as No. (%). Propensity-score matching for age, sex, race, type 2 diabetes, hypertension, dyslipidemia, CKD, ethnicity, use of antilipemic, oral hypoglycemic, and antiarrhythmic agents.

**Supplementary Table 4.** Adverse outcomes associated with previous hypothyroidism diagnosis, after bariatric surgery, controlling PSM for ethnicity and medication use (sensitivity analysis 2).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Hypothyroidism-BS** | | **Control-BS** | | **RR (95% CI)** |
| **SHORT-TERM** | Events/total | % risk | Events/total | % risk |  |
| Mortality | ≤10/5,379 | 0.2% | ≤10/5,388 | 0.2% | 1.00 (0.42, 2.41) |
| Readmission | 861/5,621 | **15.3%** | 749/5,621 | **13.3%** | **1.15 (1.05, 1.26)** |
| Critical care services/ICU | 58/5,225 | 1.1% | 72/5,298 | 1.4% | 0.82 (0.58, 1.15) |
| Common Surgical Complications | 358/3,205 | 11.2% | 397/3,811 | 10.4% | 1.07 (0.94, 1.23) |
| Leak | 105/5,313 | 2.0% | 108/5,375 | 2.0% | 0.98 (0.75, 1.28) |
| Incisional hernia | 82/5,281 | **1.6%** | 55/5,327 | **1.0%** | **1.50 (1.07, 2.11)** |
| Bowel or ileus Obstruction | 78/5,319 | 1.5% | 88/5,359 | 1.6% | 0.89 (0.66, 1.21) |
| Gastrointestinal Ulcer | 61/5,157 | 1.2% | 57/5,198 | 1.1% | 1.08 (0.75, 1.55) |
| Dysphagia / reflux | 145/4,316 | **3.4%** | 115/4,537 | **2.5%** | **1.33 (1.04, 1.69)** |
| Surgical site infection | 20/5,404 | 0.4% | 18/5,401 | 0.3% | 1.11 (0.59, 2.10) |
| Wound disruption | 496/5,097 | **9.7%** | 448/5,211 | **8.6%** | **1.13 (1.00, 1.28)** |
| Blood transfusion | 52/5,347 | 1.0% | 38/5,363 | 0.7% | 1.37 (0.91, 2.08) |
| Bleeding / anemia | 175/4,377 | 4.0% | 186/4,774 | 3.9% | 1.03 (0.84, 1.26) |
| Serious Systemic Complications | 222/2,796 | 7.9% | 244/3,513 | 6.9% | 1.14 (0.96, 1.36) |
| Embolism and thrombosis | 34/5,144 | 0.7% | 35/5,207 | 0.7% | 0.98 (0.61, 1.57) |
| Biliary diseases | 105/4,665 | 2.3% | 84/4,901 | 1.7% | 1.31 (0.99, 1.75) |
| Acute Kidney Injury | 78/5,187 | **1.5%** | 55/5,284 | **1.0%** | **1.45 (1.03, 2.04)** |
| Postoperative Sepsis | 34/5,285 | 0.6% | 30/5,341 | 0.6% | 1.15 (0.70, 1.87) |
| Pneumonia | 144/4,171 | 3.5% | 179/4,580 | 3.9% | 0.88 (0.71, 1.10) |
| Hypoglycemia | 16/5,269 | 0.3% | 21/5,349 | 0.4% | 0.77 (0.40, 1.48) |
| Urinary infection | 73/4,450 | **1.6%** | 52/4,770 | **1.1%** | **1.51 (1.06, 2.14)** |
| Pulmonary embolic | 46/5,069 | 0.9% | 45/5,170 | 0.9% | 1.04 (0.69, 1.57) |
| Cardiovascular complications | 43/4,801 | 0.9% | 41/4,949 | 0.8% | 1.08 (0.71, 1.66) |
| **LONG-TERM** |  |  |  |  | **HR (95% CI)** |
| Mortality | 95/5,583 | 1.7% | 86/5,592 | 1.5% | 1.13 (0.84, 1.51) |
| Cardiovascular events | 233/4,924 | **4.7%** | 185/5,031 | **3.7%** | **1.29 (1.06, 1.56)** |
| Cerebrovascular events | 170/5,412 | **3.1%** | 121/5,454 | **2.2%** | **1.40 (1.11, 1.77)** |
| Chronic kidney disease | 41/5,571 | 0.7% | 36/5,590 | 0.6% | 1.15 (0.74, 1.80) |
| Diabetes | 160/3,339 | 4.8% | 127/3,443 | 3.7% | 1.22 (0.97, 1.54) |
| Hypoglycemic agents | 214/2,881 | 7.4% | 208/3,139 | 6.6% | 1.07 (0.88, 1.29) |
| Hypertension | 157/1,902 | 8.3% | 139/1,940 | 7.2% | 1.13 (0.90, 1.42) |
| Antihypertensive agents | 282/1,821 | 15.5% | 271/2,007 | 13.5% | 1.13 (0.95, 1.33) |
| Dyslipidemia | 301/2,393 | 12.6% | 271/2,533 | 10.7% | 1.15 (0.97, 1.35) |
| Antilipemic agents | 292/3,364 | 8.7% | 269/3,624 | 7.4% | 1.12 (0.95, 1.32) |
| Hypoglycemia | 211/5,457 | **3.9%** | 152/5,534 | **2.7%** | **1.38 (1.12, 1.70)** |
| Bone Composite | 472/5,011 | **9.4%** | 389/5,227 | **7.4%** | **1.27 (1.11, 1.45)** |
| Falls | 315/5,220 | **6.0%** | 265/5,369 | **4.9%** | **1.21 (1.03, 1.43)** |
| Osteoporosis | 218/5,462 | **4.0%** | 165/5,518 | **3.0%** | **1.35 (1.10, 1.65)** |
| Fracture | 90/5,519 | 1.6% | 74/5,552 | 1.3% | 1.22 (0.90, 1.67) |
| Iron deficiency | 646/4,882 | **13.2%** | 596/5,128 | **11.6%** | **1.14 (1.02, 1.27)** |
| Vitamin B deficiency | 722/4,944 | **14.6%** | 607/5,212 | **11.6%** | **1.25 (1.13, 1.40)** |
| Polyneuropathy | 176/5,348 | 3.3% | 164/5,431 | 3.0% | 1.08 (0.88, 1.34) |

Notes. BS: Bariatric Surgery. RR: risk ratio. HR: hazard ratio. 95%CI: 95% confidence interval.

**Supplementary Table 5.** Baseline characteristics of the samples that underwent gastric bypass.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Before propensity score matching** | | **Std diff.** | **After propensity score matching** | | **Std diff.** |
|  | HT-bypass  (n= 2,261) | Control-bypass  (n= 29,524) | HT-bypass  (n= 2,261) | Control-bypass  (n= 2,261) |
| **Demographics** |  |  |  |  |  |  |
| Age at index, mean (SD) | 47.3 (11.4) | 42.9 (11.2) | **0.38** | 47.3 (11.4) | 47.1 (11.3) | 0.01 |
| Female | 1987 (87.9%) | 22493 (76.2%) | **0.31** | 1987 (87.9%) | 1996 (88.3%) | 0.01 |
| White | 1801 (79.7%) | 19470 (65.9%) | **0.31** | 1801 (79.7%) | 1804 (79.8%) | 0.00 |
| Black | 150 (6.6%) | 4750 (16.1%) | **0.30** | 150 (6.6%) | 144 (6.4%) | 0.01 |
| Not Hispanic | 1619 (71.6%) | 17700 (60.0%) | **0.25** | 1619 (71.6%) | 1431 (63.3%) | **0.18** |
| Married | 614 (27.2%) | 6872 (23.3%) | **0.09** | 614 (27.2%) | 579 (25.6%) | 0.04 |
| **Diagnosis** |  |  |  |  |  |  |
| Dyslipidemia | 1214 (53.7%) | 11170 (37.8%) | **0.32** | 1214 (53.7%) | 1222 (54.0%) | 0.01 |
| Type 2 diabetes mellitus | 740 (32.7%) | 8160 (27.6%) | **0.11** | 740 (32.7%) | 746 (33.0%) | 0.01 |
| Hypertension | 1320 (58.4%) | 15002 (50.8%) | **0.15** | 1320 (58.4%) | 1332 (58.9%) | 0.01 |
| CKD | 127 (5.6%) | 584 (2.0%) | **0.19** | 127 (5.6%) | 115 (5.1%) | 0.02 |
| Chronic ischemic heart disease | 142 (6.3%) | 1206 (4.1%) | **0.10** | 142 (6.3%) | 125 (5.5%) | 0.03 |
| NAFLD | 406 (18.0%) | 3834 (13.0%) | **0.14** | 406 (18.0%) | 354 (15.7%) | 0.06 |
| Hepatic fibrosis | 15 (0.7%) | 101 (0.3%) | 0.05 | 15 (0.7%) | 11 (0.5%) | 0.02 |
| **Medication** |  |  |  |  |  |  |
| Antilipemic agents | 687 (30.4%) | 4593 (15.6%) | **0.36** | 687 (30.4%) | 482 (21.3%) | **0.21** |
| Atorvastatin | 310 (13.7%) | 2229 (7.6%) | **0.20** | 310 (13.7%) | 249 (11.0%) | 0.08 |
| Simvastatin | 132 (5.8%) | 1014 (3.4%) | **0.11** | 132 (5.8%) | 92 (4.1%) | 0.08 |
| Insulin | 324 (14.3%) | 2372 (8.0%) | **0.20** | 324 (14.3%) | 221 (9.8%) | **0.14** |
| Oral hypoglycemic agents | 667 (29.5%) | 5280 (17.9%) | **0.28** | 667 (29.5%) | 460 (20.3%) | **0.21** |
| Metformin | 574 (25.4%) | 4361 (14.8%) | **0.27** | 574 (25.4%) | 372 (16.5%) | **0.22** |
| Beta blockers/related | 472 (20.9%) | 3912 (13.3%) | **0.20** | 472 (20.9%) | 378 (16.7%) | **0.11** |
| Calcium channel blockers | 264 (11.7%) | 2590 (8.8%) | **0.10** | 264 (11.7%) | 221 (9.8%) | 0.06 |
| Antiarrhythmics | 851 (37.6%) | 7961 (27.0%) | **0.23** | 851 (37.6%) | 643 (28.4%) | **0.20** |
| Antihypertensives, other | 135 (6.0%) | 1362 (4.6%) | 0.06 | 135 (6.0%) | 106 (4.7%) | 0.06 |
| **Laboratory** |  |  |  |  |  |  |
| Serum calcium (mg/dL) | 9.43 (0.48) | 9.41 (0.45) | 0.03 | 9.43 (0.48) | 9.46 (0.45) | 0.07 |
| Cholesterol in HDL (mg/dL) | 46.0 (14.8) | 44.0 (15.0) | **0.13** | 46.0 (14.8) | 45.3 (15.7) | 0.05 |
| Cholesterol in LDL (mg/dL) | 105 (35) | 105 (34) | 0.02 | 105 (35) | 106 (35) | 0.02 |
| Triglyceride (mg/dL) | 161 (108) | 149 (100) | **0.12** | 161 (108) | 161 (102) | 0.00 |
| Ferritin (ng/mL) | 87.7 (97.5) | 106 (119) | **0.16** | 87.7 (97.5) | 93.9 (94.2) | 0.06 |
| Vitamin B12 (pg/mL) | 547 (284) | 546 (290) | 0.00 | 547 (284) | 552 (285) | 0.02 |
| BMI (kg/m2) | 45.7 (7.5) | 45.7 (7.2) | 0.01 | 45.7 (7.5) | 45.2 (7.2) | 0.07 |
| Hemoglobin A1c (%) | 6.18 (1.27) | 6.05 (1.37) | **0.10** | 6.18 (1.27) | 6.15 (1.35) | 0.02 |
| TSH levels (mIU/L) | 3.66 (17.1) | 2.60 (23.75) | 0.05 | 3.66 (17.1) | 2.02 (1.00) | **0.14** |
| FT4 levels (ng/dL) | 1.18 (0.33) | 1.06 (0.22) | **0.44** | 1.18 (0.33) | 1.05 (0.24) | **0.44** |

**Note**. Standard differences (Std diff.) ≥ 0.1 were considered statistically significant. HT: Hypothyroidism. CKD: chronic kidney disease. NAFLD: nonalcoholic fatty liver disease. Age and laboratory are presented as mean (SD). Demographics, diagnosis, and medication are presented as No. (%). Propensity-score matching for age, sex, race, type 2 diabetes, hypertension, dyslipidemia, and CKD.

**Supplementary Table 6.** Baseline characteristics of the samples that underwent sleeve gastrectomy.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Before propensity score matching** | | **Std diff.** | **After propensity score matching** | | **Std diff.** |
|  | HT-sleeve  (n= 3,395) | Control-sleeve  (n= 47,068) | HT-sleeve  (n= 3,394) | Control-sleeve  (n= 3,394) |
| **Demographics** |  |  |  |  |  |  |
| Age at index, mean (SD) | 46.3 (11.8) | 41.7 (11.7) | **0.39** | 46.3 (11.8) | 46.3 (11.8) | 0.00 |
| Female | 2998 (88.3%) | 35192 (74.8%) | **0.35** | 2997 (88.3%) | 3006 (88.6%) | 0.01 |
| White | 2589 (76.3%) | 26156 (55.6%) | **0.45** | 2588 (76.3%) | 2593 (76.4%) | 0.00 |
| Black | 300 (8.8%) | 11746 (25.0%) | **0.44** | 300 (8.8%) | 299 (8.8%) | 0.00 |
| Not Hispanic | 2486 (73.2%) | 31086 (66.0%) | **0.16** | 2485 (73.2%) | 2372 (69.9%) | 0.07 |
| Married | 1111 (32.7%) | 12176 (25.9%) | **0.15** | 1111 (32.7%) | 983 (29.0%) | 0.08 |
| **Diagnosis** |  |  |  |  |  |  |
| Dyslipidemia | 1699 (50.0%) | 15583 (33.1%) | **0.35** | 1698 (50.0%) | 1700 (50.1%) | 0.00 |
| Type 2 diabetes mellitus | 983 (29.0%) | 9654 (20.5%) | **0.20** | 982 (28.9%) | 977 (28.8%) | 0.00 |
| Hypertension | 1977 (58.2%) | 22055 (46.9%) | **0.23** | 1976 (58.2%) | 1983 (58.4%) | 0.00 |
| CKD | 150 (4.4%) | 906 (1.9%) | **0.14** | 149 (4.4%) | 123 (3.6%) | 0.04 |
| Chronic ischemic heart disease | 221 (6.5%) | 1779 (3.8%) | **0.12** | 221 (6.5%) | 196 (5.8%) | 0.03 |
| NAFLD | 461 (13.6%) | 4486 (9.5%) | **0.13** | 461 (13.6%) | 365 (10.8%) | 0.09 |
| Hepatic fibrosis | 21 (0.6%) | 132 (0.3%) | 0.05 | 21 (0.6%) | 13 (0.4%) | 0.03 |
| **Medication** |  |  |  |  |  |  |
| Antilipemic agents | 871 (25.7%) | 6193 (13.2%) | **0.32** | 870 (25.6%) | 647 (19.1%) | **0.16** |
| Atorvastatin | 435 (12.8%) | 3250 (6.9%) | **0.20** | 434 (12.8%) | 338 (10.0%) | 0.09 |
| Simvastatin | 130 (3.8%) | 856 (1.8%) | **0.12** | 130 (3.8%) | 94 (2.8%) | 0.06 |
| Insulin | 348 (10.3%) | 2334 (5.0%) | **0.20** | 348 (10.3%) | 237 (7.0%) | **0.12** |
| Oral hypoglycemic agents | 793 (23.4%) | 6715 (14.3%) | **0.23** | 792 (23.3%) | 557 (16.4%) | **0.17** |
| Metformin | 664 (19.6%) | 5284 (11.2%) | **0.23** | 663 (19.5%) | 450 (13.3%) | **0.17** |
| Beta blockers/related | 674 (19.9%) | 5849 (12.4%) | **0.20** | 674 (19.9%) | 515 (15.2%) | **0.12** |
| Calcium channel blockers | 373 (11.0%) | 4272 (9.1%) | 0.06 | 373 (11.0%) | 315 (9.3%) | 0.06 |
| Antiarrhythmics | 1125 (33.1%) | 13884 (29.5%) | 0.08 | 1124 (33.1%) | 1077 (31.7%) | 0.03 |
| Antihypertensives, other | 186 (5.5%) | 2206 (4.7%) | 0.04 | 186 (5.5%) | 153 (4.5%) | 0.04 |
| **Laboratory** |  |  |  |  |  |  |
| Serum calcium (mg/dL) | 9.45 (0.47) | 9.42 (0.44) | 0.07 | 9.45 (0.47) | 9.46 (0.44) | 0.02 |
| Cholesterol in HDL (mg/dL) | 45.2 (15.6) | 43.3 (15.9) | **0.12** | 45.2 (15.6) | 44.8 (15.3) | 0.02 |
| Cholesterol in LDL (mg/dL) | 105 (33) | 107 (33) | 0.04 | 105 (33) | 108 (34) | 0.07 |
| Triglyceride (mg/dL) | 159 (94) | 139 (94) | **0.21** | 159 (94) | 157 (94) | 0.03 |
| Ferritin (ng/mL) | 90.9 (98.5) | 103 (115) | **0.11** | 90.9 (98.5) | 96.6 (112.1) | 0.05 |
| Vitamin B12 (pg/mL) | 541 (290) | 535 (308) | 0.02 | 541 (290) | 538 (295) | 0.01 |
| BMI (kg/m2) | 45.7 (7.4) | 45.9 (7.1) | 0.03 | 45.7 (7.4) | 44.9 (7.0) | **0.11** |
| Hemoglobin A1c (%) | 6.03 (1.13) | 5.92 (1.21) | **0.10** | 6.03 (1.13) | 6.04 (1.24) | 0.01 |
| TSH levels (mIU/L) | 3.18 (4.74) | 2.10 (12.0) | **0.12** | 3.18 (4.74) | 2.02 (0.98) | **0.34** |
| FT4 levels (ng/dL) | 1.15 (0.35) | 1.04 (0.24) | **0.37** | 1.15 (0.35) | 1.03 (0.25) | **0.37** |

**Note**. Standard differences (Std diff.) ≥ 0.1 were considered statistically significant. HT: Hypothyroidism. CKD: chronic kidney disease. NAFLD: nonalcoholic fatty liver disease. Age and laboratory are presented as mean (SD). Demographics, diagnosis, and medication are presented as No. (%). Propensity-score matching for age, sex, race, type 2 diabetes, hypertension, dyslipidemia, and CKD.

**Supplementary Table 7.** Adverse outcomes associated with previous hypothyroidism diagnosis after gastric bypass surgery.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **HT-bypass** | | **Control-bypass** | | | **RR (95% CI)** |
|  | Events/total | % risk | | Events/total | % risk |
| **SHORT-TERM** |  |  |  | |  |  |
| Mortality | ≤10/2,246 | 0.4% | ≤10/2,248 | | 0.4% | 1.00 (0.42, 2.40) |
| Readmission | 471/2,261 | 20.8% | 342/2,261 | | 15.1% | **1.38 (1.21, 1.56)** |
| Critical care services/ICU | 35/2,178 | 1.6% | 34/2,215 | | 1.5% | 1.05 (0.66, 1.67) |
| Common Surgical Complications | 207/1,247 | 16.6% | 225/1,560 | | 14.4% | 1.15 (0.97, 1.37) |
| Leak | 81/2,200 | 3.7% | 73/2,238 | | 3.3% | 1.13 (0.83, 1.54) |
| Incisional hernia | 55/2,211 | 2.5% | 35/2,227 | | 1.6% | **1.58 (1.04, 2.41)** |
| Bowel or ileus Obstruction | 81/2,221 | 3.6% | 67/2,244 | | 3.0% | 1.22 (0.89, 1.68) |
| Gastrointestinal Ulcer | 55/2,121 | 2.6% | 41/2,172 | | 1.9% | 1.37 (0.92, 2.05) |
| Dysphagia / reflux | 77/1,731 | 4.4% | 81/1,836 | | 4.4% | 1.01 (0.74, 1.37) |
| Surgical site infection | 11/2,256 | 0.5% | 10/2,255 | | 0.4% | 1.10 (0.47, 2.58) |
| Wound disruption | 293/2,102 | 13.9% | 263/2,172 | | 12.1% | 1.15 (0.99, 1.35) |
| Blood transfusion | 27/2,231 | 1.2% | 28/2,243 | | 1.2% | 0.97 (0.57, 1.64) |
| Bleeding / anemia | 98/1,794 | 5.5% | 95/2,010 | | 4.7% | 1.16 (0.88, 1.52) |
| Serious Systemic Complications | 106/1,048 | 10.1% | 136/1,419 | | 9.6% | 1.06 (0.83, 1.34) |
| Embolism and thrombosis | ≤10/2,125 | 0.5% | 14/2,182 | | 0.6% | 0.73 (0.33, 1.65) |
| Biliary diseases | 52/1,876 | 2.8% | 40/2,003 | | 2.0% | 1.39 (0.92, 2.09) |
| Acute Kidney Injury | 32/2,144 | 1.5% | 32/2,197 | | 1.5% | 1.03 (0.63, 1.67) |
| Postoperative Sepsis | 17/2,200 | 0.8% | 22/2,225 | | 1.0% | 0.78 (0.42, 1.47) |
| Pneumonia | 70/1,657 | 4.2% | 99/1,917 | | 5.2% | 0.82 (0.61, 1.10) |
| Hypoglycemia | ≤10/2,194 | 0.5% | ≤10/2,230 | | 0.4% | 1.02 (0.42, 2.44) |
| Urinary infection | 45/1,808 | 2.5% | 40/2,000 | | 2.0% | 1.24 (0.82, 1.90) |
| Pulmonary embolic | 19/2,084 | 0.9% | 21/2,157 | | 1.0% | 0.94 (0.51, 1.74) |
| Cardiovascular complications | 22/1,977 | 1.1% | 17/2,042 | | 0.8% | 1.34 (0.71, 2.51) |
| **LONG-TERM** |  |  |  | |  | **HR (95% CI)** |
| Mortality | 52/2,245 | 2.3% | 48/2,246 | | 2.1% | 1.08 (0.73, 1.60) |
| Cardiovascular events | 111/1,944 | 5.7% | 96/2,035 | | 4.7% | 1.21 (0.92, 1.59) |
| Cerebrovascular events | 99/2,167 | 4.6% | 75/2,181 | | 3.4% | 1.32 (0.98, 1.79) |
| Chronic kidney disease | 26/2,240 | 1.2% | 24/2,240 | | 1.1% | 1.09 (0.63, 1.90) |
| Diabetes | 75/1,271 | 5.9% | 65/1,320 | | 4.9% | 1.16 (0.83, 1.61) |
| Hypoglycemic agents | 84/991 | **8.5%** | 63/1,208 | | **5.2%** | **1.55 (1.12, 2.15)** |
| Hypertension | 75/736 | 10.2% | 60/773 | | 7.8% | 1.37 (0.98, 1.93) |
| Antihypertensive agents | 141/710 | **19.9%** | 115/836 | | **13.8%** | **1.35 (1.05, 1.72)** |
| Dyslipidemia | 99/900 | 11.0% | 110/1,049 | | 10.5% | 1.07 (0.82, 1.40) |
| Antilipemic agents | 87/1,263 | 6.9% | 115/1,509 | | 7.6% | 0.87 (0.66, 1.15) |
| Hypoglycemia | 151/2,185 | **6.9%** | 107/2,220 | | **4.8%** | **1.43 (1.11, 1.83)** |
| Bone Composite | 243/1,998 | **12.2%** | 188/2,097 | | **9.0%** | **1.37 (1.14, 1.66)** |
| Falls | 147/2,090 | **7.0%** | 114/2,172 | | **5.2%** | **1.34 (1.05, 1.72)** |
| Osteoporosis | 134/2,191 | **6.1%** | 95/2,203 | | **4.3%** | **1.43 (1.10, 1.87)** |
| Fracture | 54/2,206 | 2.4% | 36/2,228 | | 1.6% | 1.51 (0.99, 2.30) |
| Iron deficiency | 397/1,951 | **20.3%** | 336/2,052 | | **16.4%** | **1.29 (1.12, 1.49)** |
| Vitamin B deficiency | 367/1,960 | **18.7%** | 277/2,097 | | **13.2%** | **1.45 (1.24, 1.70)** |
| Polyneuropathy | 99/2,129 | 4.7% | 89/2,188 | | 4.1% | 1.12 (0.84, 1.49) |

Notes. HT: Hypothyroidism. RR: risk ratio. HR: hazard ratio. 95%CI: 95% confidence interval.

**Supplementary Table 8.** Adverse outcomes associated with previous hypothyroidism diagnosis after sleeve gastrectomy.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **HT-sleeve** | | **Control-sleeve** | | **RR (95% CI)** |
|  | Events/total | % risk | Events/total | % risk |
| **Short-term** |  |  |  |  |  |
| Mortality | ≤10/3,373 | 0.3% | ≤10/3,383 | 0.3% | 1.00 (0.42, 2.41) |
| Readmission | 451/3,394 | 13.3% | 401/3,394 | 11.8% | 1.13 (0.99, 1.28) |
| Critical care services/ICU | 29/3,274 | 0.9% | 31/3,332 | 0.9% | 0.95 (0.58, 1.58) |
| Common Surgical Complications | 167/2,051 | 8.1% | 169/2,459 | 6.9% | 1.19 (0.96, 1.46) |
| Leak | 31/3,344 | 0.9% | 23/3,368 | 0.7% | 1.36 (0.79, 2.32) |
| Incisional hernia | 32/3,306 | 1.0% | 23/3,334 | 0.7% | 1.40 (0.82, 2.39) |
| Bowel or ileus Obstruction | ≤10/3,336 | 0.3% | 20/3,368 | 0.6% | 0.51 (0.24, 1.08) |
| Gastrointestinal Ulcer | ≤10/3,260 | 0.3% | ≤10/3,279 | 0.3% | 1.01 (0.42, 2.41) |
| Dysphagia / reflux | 74/2,755 | 2.7% | 68/2,931 | 2.3% | 1.16 (0.84, 1.60) |
| Surgical site infection | 13/3,388 | 0.4% | 10/3,390 | 0.3% | 1.30 (0.57, 2.96) |
| Wound disruption | 233/3,206 | **7.3%** | 198/3,273 | **6.0%** | **1.20 (1.00, 1.44)** |
| Blood transfusion | 23/3,355 | 0.7% | 28/3,368 | 0.8% | 0.83 (0.48, 1.43) |
| Bleeding / anemia | 83/2,751 | 3.0% | 90/3,011 | 3.0% | 1.01 (0.75, 1.35) |
| Serious Systemic Complications | 116/1,799 | 6.4% | 138/2,305 | 6.0% | 1.08 (0.85, 1.37) |
| Embolism and thrombosis | 26/3,233 | 0.8% | 21/3,300 | 0.6% | 1.26 (0.71, 2.24) |
| Biliary diseases | 54/2,976 | 1.8% | 40/3,123 | 1.3% | 1.42 (0.94, 2.13) |
| Acute Kidney Injury | 51/3,253 | **1.6%** | 29/3,312 | **0.9%** | **1.79 (1.14, 2.82)** |
| Postoperative Sepsis | 17/3,305 | 0.5% | 17/3,354 | 0.5% | 1.02 (0.51, 1.98) |
| Pneumonia | 67/2,685 | 2.5% | 71/2,919 | 2.4% | 1.03 (0.74, 1.43) |
| Hypoglycemia | ≤10/3,308 | 0.3% | ≤10/3,356 | 0.3% | 1.02 (0.42, 2.43) |
| Urinary infection | 39/2,804 | 1.4% | 37/3,055 | 1.2% | 1.15 (0.74, 1.80) |
| Pulmonary embolic | 32/3,193 | 1.0% | 34/3,275 | 1.0% | 0.97 (0.60, 1.56) |
| Cardiovascular complications | 26/3,014 | 0.9% | 26/3,112 | 0.8% | 1.03 (0.60, 1.77) |
| **LONG-TERM** |  |  |  |  | **HR (95% CI)** |
| Mortality | 43/3,368 | 1.3% | 32/3,379 | 0.9% | 1.34 (0.85, 2.12) |
| Cardiovascular events | 117/2,988 | 3.9% | 95/3,087 | 3.1% | 1.23 (0.94, 1.61) |
| Cerebrovascular events | 79/3,279 | 2.4% | 73/3,300 | 2.2% | 1.06 (0.77, 1.45) |
| Chronic kidney disease | 17/3,362 | 0.5% | 20/3,372 | 0.6% | 0.84 (0.44, 1.61) |
| Diabetes | 97/2,052 | 4.7% | 82/2,174 | 3.8% | 1.22 (0.91, 1.63) |
| Hypoglycemic agents | 140/1,734 | **8.1%** | 117/2,105 | **5.6%** | **1.41 (1.10, 1.80)** |
| Hypertension | 82/1,138 | 7.2% | 84/1,215 | 6.9% | 0.95 (0.70, 1.29) |
| Antihypertensive agents | 133/1,021 | 13.0% | 124/1,195 | 10.4% | 1.19 (0.93, 1.52) |
| Dyslipidemia | 191/1,499 | 12.7% | 185/1,642 | 11.3% | 1.08 (0.88, 1.32) |
| Antilipemic agents | 193/2,084 | 9.3% | 180/2,383 | 7.6% | 1.18 (0.96, 1.44) |
| Hypoglycemia | 62/3,299 | 1.9% | 48/3,349 | 1.4% | 1.28 (0.87, 1.86) |
| Bone Composite | 234/3,034 | **7.7%** | 200/3,178 | **6.3%** | **1.23 (1.01, 1.48)** |
| Falls | 164/3,163 | 5.2% | 141/3,256 | 4.3% | 1.18 (0.94, 1.48) |
| Osteoporosis | 91/3,298 | 2.8% | 69/3,337 | 2.1% | 1.32 (0.97, 1.81) |
| Fracture | 38/3,334 | 1.1% | 37/3,354 | 1.1% | 1.02 (0.65, 1.60) |
| Iron deficiency | 228/2,964 | 7.7% | 212/3,120 | 6.8% | 1.11 (0.92, 1.33) |
| Vitamin B deficiency | 381/2,990 | **12.7%** | 268/3,139 | **8.5%** | **1.49 (1.27, 1.74)** |
| Polyneuropathy | 87/3,235 | 2.7% | 65/3,275 | 2.0% | 1.34 (0.97, 1.84) |

Notes. HT: Hypothyroidism. RR: risk ratio. HR: hazard ratio. 95%CI: 95% confidence interval.

**Supplementary Table 9.** Baseline characteristics of the samples with hypothyroidism (secondary analysis).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Before propensity score matching** | | **Std diff.** | **After propensity score matching** | | **Std diff.** |
|  | HT-BS (n= 5,702) | HT- Nonsurgical care (n= 77,048) | HT-BS (n= 5,624) | HT-Nonsurgical care (n= 5,624) |
| **Demographics** |  |  |  |  |  |  |
| Age at index, mean (SD) | 46.7 (11.7) | 55.6 (15.3) | **0.65** | 46.7 (11.7) | 46.7 (11.7) | 0.00 |
| Female | 5,024 (88.1%) | 351182 (77.0%) | **0.29** | 4951 (88.0%) | 4955 (88.1%) | 0.00 |
| White | 4,424 (77.6%) | 346267 (76.0%) | 0.03 | 4337 (77.1%) | 4337 (77.1%) | 0.00 |
| Black | 453 (7.9%) | 40728 (8.9%) | 0.00 | 509 (9.0%) | 507 (9.0%) | 0.00 |
| Not Hispanic | 4,139 (72.6%) | 332997 (73.0%) | 0.03 | 4188 (74.4%) | 4159 (73.9%) | 0.01 |
| Married | 1,734 (30.4%) | 142502 (31.3%) | 0.01 | 1732 (30.8%) | 1834 (32.6%) | 0.04 |
| **Diagnosis** |  |  |  |  |  |  |
| Dyslipidemia | 2,932 (51.4%) | 184477 (40.5%) | **0.23** | 2927 (52.0%) | 2924 (52.0%) | 0.00 |
| Type 2 diabetes mellitus | 1,915 (33.6%) | 111295 (24.4%) | **0.14** | 1737 (30.9%) | 1736 (30.9%) | 0.00 |
| Hypertension | 3,324 (58.3%) | 205135 (45.0%) | **0.27** | 3278 (58.3%) | 3279 (58.3%) | 0.00 |
| CKD | 279 (4.9%) | 37004 (8.1%) | **0.14** | 266 (4.7%) | 262 (4.7%) | 0.00 |
| Chronic ischemic heart disease | 365 (6.4%) | 44487 (9.8%) | **0.12** | 359 (6.4%) | 362 (6.4%) | 0.00 |
| NAFLD | 873 (15.3%) | 15618 (3.4%) | **0.44** | 918 (16.3%) | 291 (5.2%) | **0.37** |
| Hepatic fibrosis | 36 (0.6%) | 1947 (0.4%) | 0.02 | 34 (0.6%) | 22 (0.4%) | 0.03 |
| **Medication** |  |  |  |  |  |  |
| Antilipemic agents | 1,565 (27.5%) | 145329 (31.9%) | **0.11** | 1511 (26.9%) | 1830 (32.5%) | **0.12** |
| Atorvastatin | 749 (13.1%) | 72241 (15.8%) | 0.08 | 725 (12.9%) | 894 (15.9%) | 0.09 |
| Simvastatin | 265 (4.6%) | 29259 (6.4%) | 0.08 | 261 (4.6%) | 374 (6.6%) | 0.09 |
| Insulin | 675 (11.8%) | 62047 (13.6%) | 0.07 | 635 (11.3%) | 887 (15.8%) | **0.13** |
| Oral hypoglycemic agents | 1,468 (25.8%) | 78538 (17.2%) | **0.19** | 1413 (25.1%) | 1288 (22.9%) | 0.05 |
| Metformin | 1,300 (22.8%) | 61849 (13.6%) | **0.22** | 1242 (22.1%) | 1086 (19.3%) | 0.07 |
| Beta blockers/related | 1,155 (20.3%) | 112479 (24.7%) | **0.12** | 1106 (19.7%) | 1410 (25.1%) | **0.13** |
| Calcium channel blockers | 642 (11.3%) | 69219 (15.2%) | **0.12** | 626 (11.1%) | 818 (14.5%) | **0.10** |
| Antiarrhythmics | 1,989 (34.9%) | 98864 (21.7%) | **0.30** | 1986 (35.3%) | 1282 (22.8%) | **0.28** |
| Antihypertensives, other | 325 (5.7%) | 38069 (8.4%) | **0.11** | 317 (5.6%) | 481 (8.5%) | **0.11** |
| **Laboratory** |  |  |  |  |  |  |
| Serum calcium (mg/dL) | 9.44 (0.47) | 9.27 (0.58) | **0.32** | 9.45 (0.47) | 9.26 (0.57) | **0.35** |
| Cholesterol in HDL (mg/dL) | 45.8 (15.2) | 46.7 (17.4) | 0.04 | 46.0 (15.0) | 45.8 (16.8) | 0.02 |
| Cholesterol in LDL (mg/dL) | 105 (34) | 102 (38) | 0.08 | 105 (34) | 108 (38) | 0.07 |
| Triglyceride (mg/dL) | 160 (101) | 156 (107) | 0.02 | 158 (101) | 171 (125) | **0.11** |
| Ferritin (ng/mL) | 89.2 (97.6) | 174 (499) | **0.23** | 90.2 (98.4) | 124 (217) | **0.20** |
| Vitamin B12 (pg/mL) | 544 (289) | 614 (638) | 0.14 | 542 (290) | 570 (340) | 0.09 |
| BMI (kg/m2) | 45.6 (7.4) | 38.3 (6.7) | **1.04** | 45.7 (7.4) | 39.6 (7.3) | **0.82** |
| Hemoglobin A1c (%) | 6.09 (1.19) | 6.54 (1.58) | **0.32** | 6.09 (1.16) | 6.64 (1.73) | **0.37** |
| TSH levels (mIU/L) | 3.37 (11.7) | 5.41 (31.6) | 0.09 | 3.30 (10.2) | 4.60 (15.8) | **0.10** |
| FT4 levels (ng/dL) | 1.16 (0.35) | 1.16 (0.40) | 0.02 | 1.16 (0.34) | 1.12 (0.37) | 0.09 |

**Note**. Standard differences (Std diff.) ≥ 0.1 were considered statistically significant. HT: Hypothyroidism. CKD: chronic kidney disease. NAFLD: nonalcoholic fatty liver disease. Age and laboratory are presented as mean (SD). Demographics, diagnosis, and medication are presented as No. (%). Propensity-score matching for age, sex, race, type 2 diabetes, hypertension, dyslipidemia, and CKD.

**Supplementary Table 10.** Secondary analysis of the long-term adverse outcomes associated with bariatric surgery in patients with previous hypothyroidism diagnosis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Hypothyroidism-BS** | | **Hypothyroidism- Nonsurgical care** | | **HR (95% CI)** |
|  | Events/total | % risk | Events/total | % risk |
| Mortality | 95/5,586 | **1.7%** | 267/5,584 | **4.8%** | **0.46 (0.36, 0.58)a** |
| Cardiovascular events | 235/4,927 | **4.8%** | 435/4,860 | **9.0%** | **0.68 (0.58, 0.80)** |
| Cerebrovascular events | 171/5,415 | 3.2% | 235/5,323 | 4.4% | 0.90 (0.74, 1.09) |
| Chronic kidney disease | 42/5,573 | **0.8%** | 113/5,534 | **2.0%** | **0.48 (0.34, 0.69)** |
| Diabetes | 160/3,339 | **4.8%** | 474/3,446 | **13.8%** | **0.40 (0.33, 0.48)** |
| Hypoglycemic agents | 214/2,882 | **7.4%** | 617/3,353 | **18.4%** | **0.45 (0.39, 0.53)a** |
| Hypertension | 156/1,902 | **8.2%** | 408/1,858 | **22.0%** | **0.41 (0.34, 0.49)** |
| Antihypertensive agents | 283/1,822 | **15.5%** | 777/2,914 | **26.7%** | **0.60 (0.52, 0.68)a** |
| Dyslipidemia | 301/2,394 | **12.6%** | 677/2,486 | **27.2%** | **0.47 (0.41, 0.54)** |
| Antilipemic agents | 291/3,363 | **8.7%** | 676/3,163 | **21.4%** | **0.43 (0.38, 0.50)a** |
| Hypoglycemia | 210/5,460 | **3.8%** | 140/5,495 | **2.5%** | **1.83 (1.48, 2.27)** |
| Bone Composite | 472/5,012 | 9.4% | 557/5,096 | 10.9% | 1.09 (0.96, 1.23) |
| Falls | 315/5,222 | 6.0% | 422/5,288 | 8.0% | 0.93 (0.81, 1.08) |
| Osteoporosis | 220/5,465 | **4.0%** | 208/5,467 | **3.8%** | **1.40 (1.15, 1.69)a** |
| Fracture | 89/5,521 | 1.6% | 98/5,525 | 1.8% | 1.18 (0.88, 1.57) |
| Iron deficiency | 648/4,883 | **13.3%** | 493/4,989 | **9.9%** | **1.76 (1.57, 1.99)** |
| Vitamin B deficiency | 723/4,945 | **14.6%** | 355/5,259 | **6.8%** | **2.83 (2.49, 3.21)a** |
| Polyneuropathy | 176/5,351 | **3.3%** | 318/5,389 | **5.9%** | **0.69 (0.57, 0.83)** |

Notes. HR: hazard ratio. 95%CI: 95% confidence interval. a Proportionality p<0.05.

**Supplementary Table 11.** Comparison of levothyroxine (LT4) dose change in patients with hypothyroidism within 2 years after gastric bypass and sleeve gastrectomy.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Gastric Bypass** | | **Sleeve Gastrectomy** | | **Risk ratio** |
|  | Events/total | % | Events/total | % |
| **Decreased dose after surgery** |  | | | |  |
| LT4 >150 µg/day before BS | 168/250 | 67.2% | 209/308 | 67.9% | 0.99 (0.88,1.11) |
| LT4 101–150 µg/day before BS | 120/386 | 31.1% | 129/485 | 26.6% | 1.17 (0.95,1.44) |
| LT4 76–100 µg/day before BS | 43/240 | 17.9% | 44/336 | 13.1% | 1.37 (0.93,2.01) |
| LT4 51-75 µg/day before BS | 28/168 | 16.7% | 37/247 | 15.0% | 1.11 (0.71,1.75) |
| LT4 ≤50 µg/day before BS | - /328 | - | - /424 | - | - |
| Overall | 359/1,372 | 26.2% | 419/1,800 | 23.3% | 1.12 (0.99,1.27) |
| **Increased dose after surgery** |  | | | |  |
| LT4 ≤50 µg/day before BS | 122/328 | 37.2% | 147/424 | 34.7% | 1.07 (0.89,1.30) |
| LT4 51-75 µg/day before BS | 51/168 | 30.4% | 68/247 | 27.5% | 1.10 (0.81,1.50) |
| LT4 76–100 µg/day before BS | 70/240 | 29.2% | 69/336 | 20.5% | **1.42 (1.07,1.90)** |
| LT4 101–150 µg/day before BS | 68/386 | 17.6% | 55/485 | 11.3% | **1.55 (1.12,2.16)** |
| LT4 >150 µg/day before BS | - /250 | - | - /308 | - | - |
| Overall | 311/1,372 | 22.7% | 339/1,800 | 18.8% | **1.20 (1.05,1.38)** |

Note: LT4: levothyroxine. BS: bariatric surgery. \*p-value for risk difference.