Bariatric surgery affects plasma levels of alanine aminotransferase independent of weight-loss: a registry-based study

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Supplementary Information

	SG (n=1073)	RYGB (n=168)	OAGB (n=94)
ALT pre-surgery [IU/L]	26 [19-39]	24 [18-36]	25.5 [20-33.75]
ALT post-surgery [IU/L]*	17 [13-22]	21 [16-28]	21.5 [17-28]
Patients with abnormal ALT levels pre-surgery	459 (43%)	65 (39%)	36 (38%)
Patients with abnormal ALT levels post-surgery*	110 (10%)	43 (26%)	23 (24%)
AST pre-surgery [IU/L]	23 [18-30]	23 [18.75-30.25]	23 [19-28]
AST post-surgery [IU/L]*	18 [15-22]	23 [18.75-29]	23 [18-28]
A1C pre-surgery [%]*	6.5 [5.8-7.6]	7.2 [6.1-8.7]	6.3 [6-7.68]
A1C post-surgery [%]*	5.6 [5.3-6]	5.7 [5.4-6.4]	5.4 [5-5.7]
BMI pre-surgery [kg/m^2]	41.34 [38.57-44.6]	40.15 [37.58-43.96]	41.2 [38.06-43.86]
BMI post-surgery [kg/m^2]*	30.07 [26.77-33.24]	28.33 [25.67-31.27]	27.2 [24.92-30.12]
EWL [%]*	69.81[53.2-88.04]	77.62 [60.74-95.13]	83.95 [69.84-100.53]
TG pre-surgery [mg/dL]	157 [115-215.8]	156.5 [114.25-221.75]	152.75 [101.93-212]
Age [years]*	51.29 [41.08-58.41]	55.37 [46.44-60.72]	52.67 [43.94-59.77]
Female sex	672 (63%)	101 (60%)	57 (61%)
Jewish ethnicity	909 (85%)	144 (86%)	85 (90%)
Smoking	178 (17%)	25 (15%)	14 (15%)
Hypertension*	539 (50%)	108 (64%)	52 (55%)
Alcohol Consumption*	16 (1%)	9 (0.5%)	0 (0%)

Table S1: pre- and two-year post-surgery outcomes for the three surgery types in the study population. BMI: body mass index; A1C: glycated hemoglobin; TG: triglycerides. SG: sleeve gastrectomy; RYGB: Roux en Y Gastric Bypass; OAGB: one anastomosis gastric bypass. p-values derived using Kruskal-Wallis H-tests for continuous variables and using $\chi 2$ test for categorical variables. Bonferroni correction was used to correct for multiple hypothesis testing. *p-value<0.05 in all three surgery types.

	All cohort (n=19403)	**population characteristics (n=1335)**
ALT pre-surgery [IU/L]	26 [18-38]	26 [19-38]
AST pre-surgery [IU/L]	22 [18-29]	23 [18-30]
A1C pre-surgery [%]*	5.8 [5.4-6.3]	6.5 [5.9-7.7]
BMI pre-surgery [kg/m^2]	41.23 [38.83-44.52]	41.21 [38.39-44.55]
TG pre-surgery [mg/dL]*	144 [106-200]	156 [114-216]
Patients with abnormal ALT levels pre-surgery	8327 (43%)	560 (42%)
Hypertension*	6057 (31%)	699 (52%)
smokers	4146 (21%)	217 (16%)
Alcohol consumption	499 (3%)	25 (2%)
Age [years]*	42.2 [32.2-51.8]	51.7 [41.9-58.9]
Sex – female*	12903 (67%)	830 (62%)
Ethnicity – Jewish*	15850 (82%)	1138 (85%)
Surgery type*	SG: 14880 (77%)	1073 (80%)
	RYGB: 1661 (8%)	RYGB: 168 (13%)
	OAGB: 2862 (15)	OAGB: 94 (7%)

Table S2: Pre-surgery parameters of patients from the registry and from study population. ALT: alanine aminotransferase; AST: aspartate aminotransferase; BMI: body mass index; A1C: glycated hemoglobin; TG: triglycerides; SG: sleeve gastrectomy; RYGB: Roux en Y gastric bypass; OAGB: one anastomosis gastric bypass.

p-values derived using Mann-Whitney U-test for continuous variables and using χ^2 test for categorical variables. * p value<0.05

	β	SE β	p value	CI
Constant	-11.83	2.17	<1e-5	[-16.07 -7.58]
AST [IU/L]	0.89	0.04	<1e-5	[0.82 0.95]
Age [years]	-0.1	0.04	<0.001	[-0.18 -0.03]
RYGB vs SG	-5.45	1.42	<1e-5	[-8.23 -2.67]
OAGB vs SG	-5.72	1.83	<0.001	[-9.31 -2.13]

Table S3: Backwards elimination multivariate linear regression, predicting change in AST. β: Coefficient, SE: Standard Error, OR: Odds Ratio, CI: Confidence Interval, NA: not applicable, SG: sleeve gastrectomy. RYGB: Roux en Y gastric bypass. OAGB: one anastomosis gastric bypass. ALT: alanine aminotransferase. N=1355. R^2=0.34.

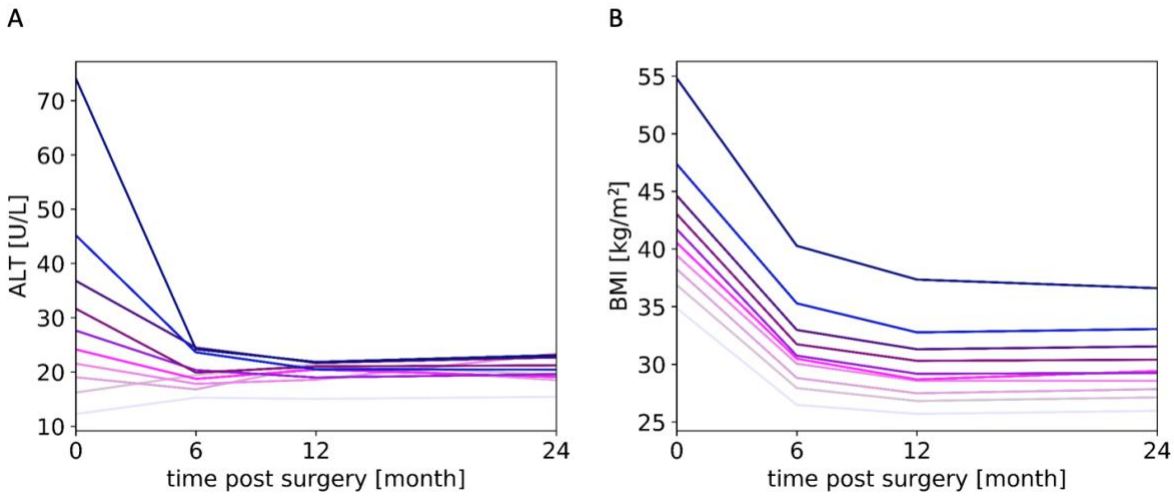

Figure S1: The mean ALT (A) and BMI (B) values of each decile in the study population where this data was available, according to the patients' pre-operative values. Highest decile in dark purple, middle decile in shades of pink and bottom decile in light purple. n=887. BMI: body mass index; ALT alanine aminotransferase.