

Effects of Bariatric Surgery on Seasonal Influenza and Influenza Like Illness: a two-center cross-sectional

study



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INTRODUCTION

Obese has been included in the high-risk population, together with children, elderly, and immunocompromised

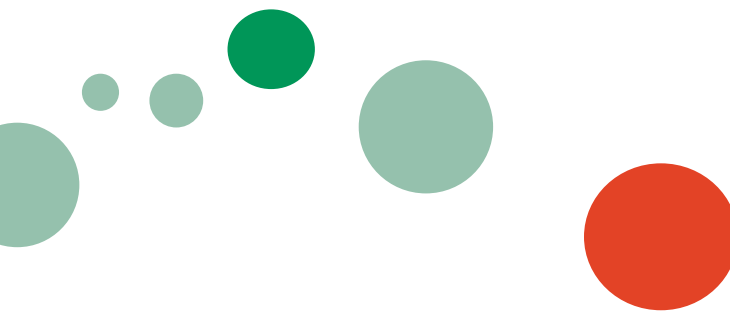


The association between excess adiposity, metabolic syndrome, and pulmonary comorbidities is widely acknowledged.

More recently, a role of obesity as a risk factor for infectious diseases has been highlighted



Adults suffering from obesity have a higher risk of hospitalization during seasonal influenza, and a prolonged hospital stay

A decorative graphic consisting of several circles of varying sizes and colors (green, teal, red) arranged in a horizontal line from left to right.

Obesity is characterized by an altered metabolic milieu, resulting in derailment of immune response, and creation of a pro-inflammatory environment, which could promote infections



Bariatric Surgery, by means of its favorable effects on weight loss, obesity-related comorbidities, and on overall pulmonary function, can influence the incidence and clinical course of influenza in patients suffering from obesity

OBJECTIVE

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To assess whether BS may influence the clinical expression of influenza virus infection

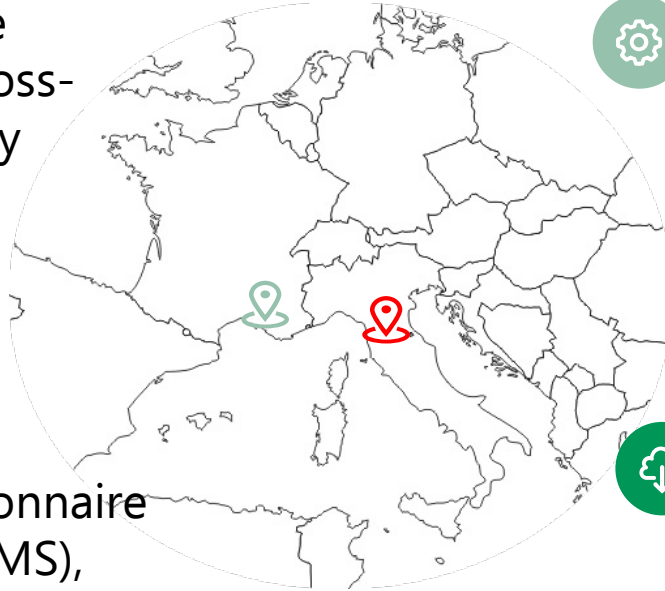


To investigate the impact of BS on influenza, by comparing the clinical course of seasonal influenza among patients who had undergone BS and obese subjects, candidates for a bariatric procedure

MATERIALS AND METHODS



Retrospective
observational cross-
sectional study



2 major centres of BS in
Italy (Parma) and France
(Nice)



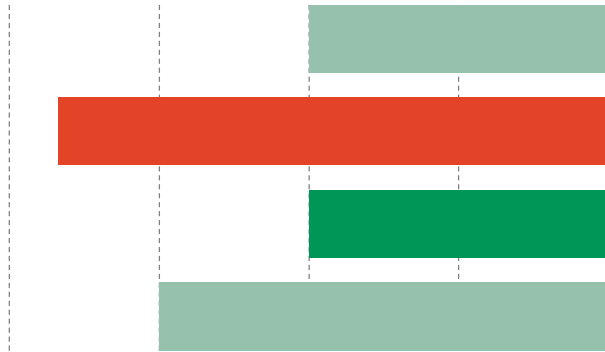
Web-based questionnaire
(Google ® FORMS),
consisted of 37 closed-
ended questions



Data regarding
anthropometric characteristics,
vaccination history, BS history,
comorbidities, influenza
related symptoms, clinical
evaluation and paid sick days

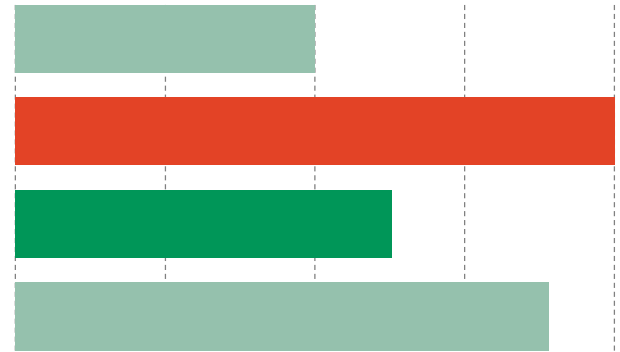
Inclusion criteria were:

- age above 18 years
- ability to give a valid informed consent
- 2020 EAES Clinical Practice Guidelines on bariatric surgery



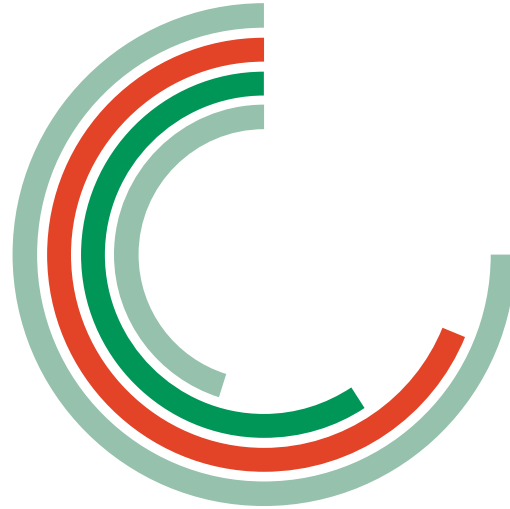
We excluded from the analysis

- subjects that underwent a bariatric procedure other than AGB, SG, and RYGB
- BS less than 12 months before the beginning of the 2018-2019 seasonal influenza epidemic





The enrolment period lasted 14 days starting from the end of the 2018-2019 seasonal influenza epidemic in each country



ILI: acute respiratory illness with a measured temperature of ≥ 38 °C and cough



SARI: acute respiratory illness with a history of fever or measured fever of ≥ 38 °C and cough, with onset within the past 10 days, requiring hospitalization

RESULTS

	TOTAL (N=184)		Op (N=103)		C (N=81)		P value
Gender (N, %)							0.458
Male	44	23.9	22	21.4	22	27.2	
Female	140	76.1	81	78.6	65	72.8	
Age (years; average ± SD)	48.0 ± 10.8		48.6 ± 10.4		47.2 ± 11.2		0.380
Center (N, %)							0.014
Italy	110	59.8	53	51.5	57	70.4	
France	74	40.2	50	48.5	24	29.6	
Surgical procedure (N, %)							
RYGB	72	39.1	72	69.9	-		
SG	27	14.7	27	26.2	-		
AGB	4	2.2	4	3.9	-		
BMI (kg/m ² ; average ± SD)	35.6 ± 9.6		29.4 ± 5.6		43.4 ± 7.6		< 0.001
Status by BMI (N, %)							< 0.001
Normal weight (< 25 kg/m ²)	23	12.5	23	22.3	0	-	
Overweight (25-29.9 kg/m ²)	36	19.6	36	35.0	0	-	
Obesity 1 st class (30-34.9 kg/m ²)	33	17.9	26	25.2	7	8.5	
Obesity 2 nd class (35-39.9 kg/m ²)	38	20.7	13	12.6	25	30.9	
Obesity 3 rd class (≥ 40 kg/m ²)	54	29.3	5	4.9	49	60.5	
Vaccination history (N, %)							
SIV during previous winter season	44	23.9	24	23.3	20	24.7	0.964
Any uptake of SIV, previous years	54	29.3	32	31.1	22	27.2	0.678
Pneumococcal vaccination, any	5	2.7	2	1.9	3	3.7	0.785
Comorbidities (N, %)							
Any respiratory disorder	29	15.8	17	16.5	12	14.8	0.914
Any cardiovascular disorder	49	26.9	27	26.5	22	27.5	1.000
Diabetes	34	18.5	10	9.7	24	29.6	0.001
Smoking history (N, %)	112	60.9	62	60.2	50	61.7	0.953

Op and C groups were similar for age and sex proportion

As predictable effect for BS, Op patients presented a significant lower BMI, and lower incidence of metabolic comorbidities, such as diabetes

	TOTAL (N=184)		Op (N=103)		C (N=81)		P value
Symptoms (N, %)							
Fever (body temperature > 38° C)	60	32.6	21	20.4	39	48.1	< 0.001
Fever, sudden onset	51	27.7	15	14.6	36	44.4	< 0.001
Sore throat	100	54.3	48	46.6	52	64.2	0.026
Running nose	116	63.0	63	61.2	53	65.4	0.659
Cough	93	50.5	45	43.7	48	59.3	0.051
Shivering	86	46.7	48	46.6	38	46.9	1.000
Muscle pain	90	48.9	47	45.6	43	54.1	0.392
Nausea	53	29.0	26	25.2	27	33.8	0.274
Diarrhea	74	40.2	40	38.8	34	42.0	0.780
Asthenia	91	49.5	50	48.5	41	50.6	0.896
ILI (fever + cough)	42	22.8	14	13.6	28	34.6	0.001
SARI (ILI + hospital admission)	12	6.5	4	3.9	8	9.9	0.182
Any symptom	161	87.5	88	85.4	73	90.1	0.466
More than 3 symptoms	115	62.5	57	55.3	58	71.6	0.035
Drugs uptake (N, %)							
Paracetamol	126	69.6	71	68.9	55	70.5	0.948
Painkillers	94	51.1	49	47.6	45	55.6	0.354
NSAIDs	55	29.9	21	20.4	34	42.0	0.003
Antibiotics	60	32.8	28	27.2	32	40.0	0.094
Antiviral drugs	7	3.8	2	1.9	5	6.2	0.271
Antitussive drugs	56	30.4	27	26.2	29	35.8	0.214
Nasal sprays	62	33.7	29	28.2	33	40.7	0.102
Medical evaluation (N, %)							
Assessment by GP for any malaise	60	32.8	24	23.3	36	45.0	0.003
Home assessment by GP	19	10.3	3	2.9	16	19.8	< 0.001
Evaluation by a medical specialist	14	7.6	6	5.8	8	9.9	0.454
Admission to Emergency Department	15	8.2	4	3.9	11	13.6	0.034
Sick leave (N, %)							
Length of sick leave (days; mean ± SD)	4.6 ± 4.9		3.1 ± 1.9		5.7 ± 6.0		0.028
Sick leave > 3 days (N, %)	27, 14.7		9, 8.7		18, 22.2		0.018

Lower incidence of fever and of fever with rapid onset among Op patients, resulting in a lower incidence of ILI

Lower uptake of NSAIDs among Op patients, as well as a higher rate of evaluation by a General Practitioner (GP) in C patients, both as general or home assessment

A higher percentage of sick leave found among C patients, who had also a higher rate of prolonged (>3 days) leaves

	ILI			Sick Leave			Sick Leave > 3 days		
	Pos. (N=42)	Neg. (N=142)	P value	Pos. (N=57)	Neg. (N=127)	P value	Pos. (N=27)	Neg. (N=157)	P value
Male gender (N, %)	9 21.4	35 24.6	0.823	13 22.8	31 24.4	0.961	5 18.5	39 24.8	0.640
Age (ys, average ± S.D.)	48.7±10.6	45.7 ±10.9	0.109	46.6±10.3	48.7±10.9	0.275	48.7±10.9	43.9 ± 9.2	0.030
BMI (average ± S.D.)	38.0 ± 8.6	34.9 ± 9.8	0.046	38.3 ± 8.3	34.4 ± 9.9	0.007	40.1 ± 7.6	34.8 ± 9.7	0.003
Obesity (N, %)	35 83.3	88 62.0	0.017	48 84.2	75 59.1	0.001	25 92.6	98 62.4	0.004
SIV during previous winter season (N, %)	8 19.0	36 25.4	0.525	11 19.3	34 26.9	0.426	5 18.5	39 24.8	0.640
Any previous uptake of SIV (N, %)	11 26.2	43 30.3	0.750	12 21.1	42 33.1	0.139	5 18.5	49 31.2	0.267
Pneumococcal vaccine (N, %)	2 4.8	3 2.1	0.698	0 -	5 3.9	0.304	0 -	5 3.2	0.765
Respiratory disease (N, %)	10 23.8	19 13.4	0.165	12 21.1	17 13.4	0.271	4 14.8	25 15.9	1.000
Diabetes (N, %)	11 26.2	23 16.2	0.215	19 33	15 11.8	0.001	11 40.7	23 14.6	0.003
Cardiovascular disease (N, %)	8 19.5	41 29.1	0.310	16 28.6	33 26.2	0.878	8 29.6	41 26.5	0.914
Smoking history (N, %)	26 61.9	86 60.6	1.000	37 64.9	75 59.1	0.556	19 70.4	93 59.2	0.378

Univariate analysis indicated BMI and obesity as related to ILI, to sick leave, and to prolonged leaves

Diabetes showed a significant correlation only with sick leave and prolonged leaves

	BS			ILI			Sick leave			Sick Leave >3 days		
	OR	95%CI		OR	95%CI		OR	95%CI		OR	95%CI	
Obesity	-	-		1.116	0.412	3.027	3.151	1.352	7.342	9.097	1.859	44.519
Respiratory disease	-	-		2.783	1.100	7.044	-	-		-	-	
Diabetes	0.359	0.092	1.404	-	-		3.569	1.534	8.300	4.231	1.533	11.678
Previous SIV	-	-					0.538	0.247	1.174	0.658	0.217	1.992
Fever	0.097	0.010	0.967	-	-		-	-		-	-	
Fever – sudden onset	0.306	0.083	1.129	-	-		-	-		-	-	
Sore throat	0.102	0.021	0.489	-	-		-	-		-	-	
Cough	1.355	0.493	3.726									
More than 3 symptoms	0.090	0.018	0.442									
ILI	0.172	0.019	1.567									
SARI	0.857	0.068	10.857									
Uptake of NSAIDs	0.575	0.221	1.492									
Uptake of antibiotics	1.785	0.661	4.891									
Nasal sprays	0.560	0.232	1.354									
Assessment by GP	0.771	0.252	2.361	-	-		-	-		-	-	
Home assessment by GP	0.240	0.042	0.963	-	-		-	-		-	-	
Admission to Emergency Department	0.439	0.044	4.332	-	-		-	-		-	-	
Any Sick Leave	0.543	0.144	2.051									
Sick Leave > 3 days	0.198	0.038	0.930	-	-		-	-		-	-	

Fever, sore throat, home assessment by Gp and prolonged sick leaves showed to be associated with BS at multivariate analysis

Both obesity and diabetes confirmed to be associated with sick leave and to prolonged leaves, while the presence of underlying respiratory disease showed a correlation with ILI

CONCLUSIONS

- **Patients submitted to BS seem to develop less influenza-related symptoms and ILI than obese subjects**
- **The protective role of BS is probably due to the improvement in obesity related comorbidities, as well as to weight loss and its effects on respiratory mechanics**
- **Further studies could confirm the role of BS on larger scale and on outcome parameter, such as hospitalization and mortality**