ASSESSMENT OF CARDIOVASCULAR SYSTEM CHANGES FOLLOWING OBESITY INTERVENTIONAL PROCEDURES

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ABSTRACT

Obesity is highly prevalent in Egypt where the estimated prevalence of overweight and obesity (BMI ≥ 25 kg/m²) is 61-70% of the whole population aged 20 and above. This translates to 65% for males and 76%for females aged 15 and above. With high rate of using surgical intervention for obesity treatment either through sleeve surgery or liposuction, the study assessed cardiovascular changes that might follow obesity interventional procedures including 50 obese patients. The study was carried out in Cairo and South Sinai in Egypt between September 2019 and August 2020. The cardiovascular system changes measured after reduction of body fat mass included arterial blood pressure, pulse rate, and ECG changes (S-T segment represents conductivity and P wave represent arrhythmicity). All study parameters were assessed immediately before intervention then one, three and six months afterwards. A total of 50 patients were included in the study (50% gastric sleeve -50% liposuction). The mean age was 34.820 with female predominance (56.00%). The results showed that sleeve gastrectomy was significantly improving cardiovascular functions in obese patients while liposuction has minimal or no effect.

Keywords: Sleeve gastrectomy, morbid obesity, liposuction, cardiovascular disease.

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INTRODUCTION

Obesity refers to the accumulation of excess body fat such that it has an adverse effect on health; it is the sixth most important risk factor contributing to the overall burden of disease worldwide (Lavie et al, 2018). The prevalence of obesity in adults is very high in Egypt, particularly among women. The prevalence of diabetes mellitus and of hypertension parallel that of obesity and both are very high. Public awareness of the increasing prevalence of obesity and of diet-related chronic disease is increasing, and attention has turned to documenting the problem and recent guidelines for management (Ibrahim *et al*, 2010). Consistent with this, there are several studies using load-dependent measures demonstrating the detrimental effects of excess body weight on diastolic function as measured using traditional echocardiographic Doppler imaging (Kosmala *et al*, 2017).

Metabolic and bariatric surgery (MBS) is currently the most successful therapeutic option for combating obesity and obesity-related comorbidities and has experienced increase in procedures from about 16,000 in the early 1990s (Weiner, 2010). Globally, the number of operative procedures has also increased from 146,301 MBS procedures carried out in 2003 to almost 600,000 in 2013 (Phillips & Shikora, 2018). Interventional procedures for obesity include gastric procedure for generalized obesity like sleeve gastrectomy (Xu *et al*, 2022) and body shaping procedures for localized obesity like liposuction (Stein and Matarasso, 2022). The overall aim of this

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study was to assess cardiovascular changes that might follow obesity interventional procedures.

SUBJECTS AND METHODS

Fifty obese patients who were seeking interventional obesity procedure either through sleeve surgery or liposuction were selected for the study which was carried out in Cairo at Al-Hussein hospital in Al-Azhar University and in South Sinai at Sinai-hospital in Sharm El-Sheikh in Egypt during the period from September 2019 to August 2020. Consent was taken from all patients before being enrolled tin the study. The following cardiovascular effects changes were assessed before and the after the procedures: arterial blood pressure (mean systolic and diastolic blood pressure), pulse rate, and ECG changes (S-T segment for conductivity and P wave for arrhythmicity). All study parameters had been assessed immediately before intervention then one, three and six months after, where every patient was subjected to the following:

1) **Preoperative investigations:** Complete blood picture -liver and kidney functions – pulse rate-blood pressure – respiratory rate- electrocardiogram (ECG) using ECG machine. (Meditech EKG6012,7inch TFT touch screen 3,6 channel ECG machine with interpretation, Digital isolation)
2) **Operative procedures:** Patients had been divided in two groups 25 persons each:

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- Group (A) had undergone sleeve gastrectomy.
- Group (B) had undergone liposuction surgery.

Surgical procedures were done and cardiovascular assessment data had been collected 1st, 3rd, 6th months after the procedures per each person.

Selection Criteria:

- Patients age between 22 – 65 years old.
- Gender, both sexes are equally included in the study.

Exclusion criteria:

- Upper major abdominal surgery either laparoscopic or open surgery.
- Patients with disturbed endocrine functions e.g., hypo and hyperthyroidism
- Patients who are subjected to invasive non-surgical weight loss procedure e.g., gastric balloon insertion. (Upper GI endoscopy could be done prior to surgery to ensure normal gastric mucosa and to exclude gastric balloon insertion complications).
- Bed ridden patients
- Long standing history of hyperacidity or reflux symptoms.
- Abnormal laboratory investigation e.g., impaired liver functions.

Sleeve gastrectomy: Patients were subjected to laparoscopic sleeve gastrectomy through 5 ports:

- 10 mm visual port supra umbilical for the scope using 30-degree scope and full HD camera visualization.

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- Two 5-12mm ports for staplers and vessel sealing devices placed lateral to the visual port on both sides.
- Two 5 mm ports places lateral to previous 12 mm ports on both sides for instrumentation and retraction (Amirbeigi *et al.*, 2022).

Liposuction

- An abdominal subcutaneous liposuction procedure was done through three incisions. Two incisions are suprapubic at the lower abdominal fold and another incision is placed over the umbilicus.
- The cannula was inserted with the opening away from the skin, and the adipose tissue was broken from the fibrous stroma with multiple crisscross movements. These movements create tunnels in subcutaneous area. The deep or intermediate fat layer had been suctioned 2-4 mm cannulas with lengths from 15 to 45 cm had used.
- Suction cannula collected to vacuum pump, and then the multiple tunnels were created by cannula forming “honeycomb” inside the suctioned area that allowed the skin to adhere to its new profile following surgery. Pressure bandages occlude the tunnels by collapsing the remaining fat into the spaces of the honeycomb (Bellini *et al*., 2017).

RESULTS and DISCUSSION

Data were analysed using SPSS computer programme version 20. Descriptive statistics were expressed as mean and standard deviation,

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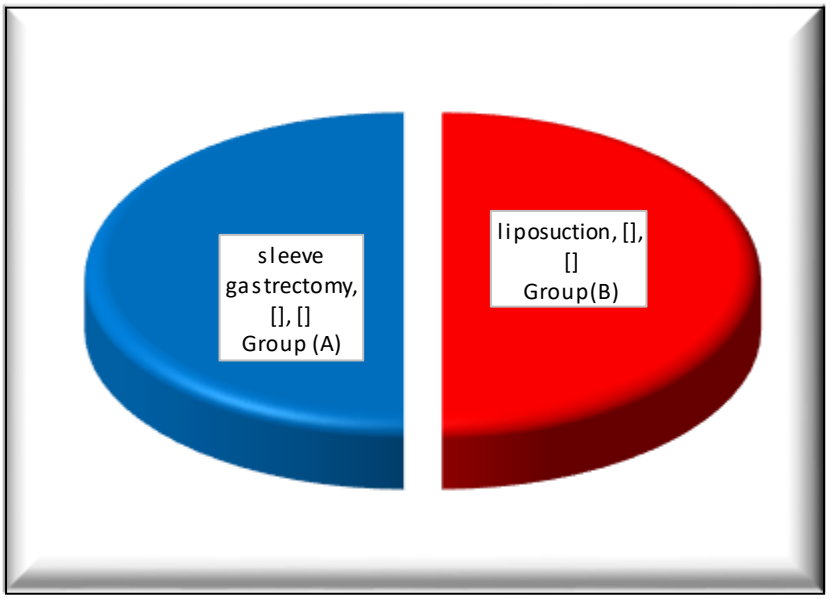
independent sample t-test was used to compare means of two groups, P-value was considered significant if less than 0.05 P-value was considered highly significant if less than 0.01.

All readings were statistically analysed and illustrated in the following tables and figures.



Figure(1): Two groups of patient's numbers and percentage mentioned by procedure type

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Table(1): Age, weight and height range for patients

Variables	Range			Mean	±	SD
Age	21	-	53	34.820	±	9.801
Weight	76	-	172	117.260	±	24.688
Height	132	-	188	166.360	±	10.984

Table (2): Gender percentage in all patients

Gender	N	%
Male	22	44.00
Female	28	56.00
Total	50	100.00

Table (3): Body Mass Index of patients before procedures and one, three and six months after in both groups (A) and (B)

BMI		Operation						t-Test	
		Group (B)			group (A)			T	P-value
Preoperative	Range	30.1	-	41.8	38.3	-	58.5	-9.494	<0.001*
	Mean ±SD	36.144	±	3.296	47.240	±	4.825		
Postoperative one Month	Range	29	-	40	36	-	55	-9.796	<0.001*
	Mean ±SD	34.332	±	3.114	44.968	±	4.447		
Postoperative three Months	Range	29	-	39.7	34	-	53	-8.113	<0.001*
	Mean ±SD	34.192	±	3.081	42.632	±	4.191		
Postoperative six Months	Range	29	-	39.5	31	-	50	-5.770	<0.001*
	Mean ±SD	34.076	±	3.060	40.036	±	4.160		
Before-After1Month	Differences	1.812	±	0.563	2.272	±	0.637		
	Paired Test	<0.001*			<0.001*				
Before-After3Months	Differences	1.952	±	0.532	4.608	±	1.187		
	Paired Test	<0.001*			<0.001*				

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Table (4): Mean arterial blood pressure in group (A) before procedures and one, three and six months after

Treatment	Mean arterial pressure						COMP.	Differences		Paired Test	
	Range			Mean	±	SD		Mean	SD	t	P-value
Preoperative	95.67	-	130	113.227	±	9.123					
Postoperative one Month	94	-	122.67	110.453	±	7.925	Before-After1Month	2.774	2.396	5.790	<0.001*
Postoperative three months	91.33	-	118.67	107.788	±	7.203	Before-After3Months	5.440	3.035	8.962	<0.001*
Postoperative six Months	88.33	-	114	104.746	±	6.175	Before-After6Months	8.481	4.625	9.169	<0.001*

Table (5): Pulse in group (A) before procedures and one, three and six months after

Treatment	Pulse						COMP.	Differences		Paired Test	
	Range			Mean	±	SD		Mean	SD	t	P-value
Preoperative	69	-	107	93.680	±	9.281					
Postoperative one Month	65	-	105	91.960	±	9.555	Before-After 1 Month	1.720	1.400	6.143	<0.001*
Postoperative three Month	65	-	100	89.880	±	8.643	Before-After 3 Months	3.800	2.121	8.957	<0.001*
Postoperative six Months	66	-	98	88.320	±	7.301	Before-After 6 Months	5.360	3.226	8.308	<0.001*

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Table (6): P wave in group (A) before procedures and one, three and six months after

P Wave	Preoperative		Postoperative one Month		Postoperative three Months		Postoperative six Months	
	N	%	N	%	N	%	N	%
Abnormal	8	32.00	8	32.00	7	28.00	7	28.00
Normal	17	68.00	17	68.00	18	72.00	18	72.00
Total	25	100.00	25	100.00	25	100.00	25	100.00
Chi-Square	-		Before-After1Month		Before-After 3 Months		Before-After 6 Months	
X^2	-		0.000		0.000		0.000	
P-value	-		1.000		1.000		1.000	

Table (7): ST segment in group (A) before procedures with one, three and six months after

ST segment	Preoperative		Postoperative 1 Month		Postoperative 3 Months		Postoperative 6 Months	
	N	%	N	%	N	%	N	%
Abnormal	10	40.00	10	40.00	7	28.00	4	16.00
Normal	15	60.00	15	60.00	18	72.00	21	84.00
Total	25	100.00	25	100.00	25	100.00	25	100.00
Chi-Square	-		Before-After1Month		Before-After 3 months		Before-After 6 Months	
X2	-		0.000		0.357		2.480	
P-value	-		1.000		0.551		0.115	

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Table (8): Pulse in group group(B) before procedures and one, three and six months after

Treatment	Pulse						COMP.	Differences		Paired Test	
	Range			Mean	±	SD		Mean	SD	t	P-value
Preoperative	65	-	96	78.160	±	7.717					
Postoperative one Month	65	-	96	77.760	±	7.801	Before-After 1 Month	0.400	1.118	1.789	0.086
Postoperative three Months	64	-	95	77.560	±	7.422	Before-After 3 Months	0.600	2.041	1.470	0.155
Postoperative six Months	65	-	95	77.560	±	6.983	Before-After6 Months	0.600	2.141	1.401	0.174

Table(9): Mean arterial blood pressure in group (B) before procedures and one, three and six months after

Treatment	Mean arterial pressure						COMP.	Differences		Paired Test	
	Range			Mean	±	SD		Mean	SD	T	P-value
Preoperative	83	-	108	94.974	±	6.532					
Postoperative 1 Month	84	-	106.67	94.466	±	5.667	Before-After 1 Month	0.508	2.302	1.103	0.281
Postoperative 3 Months	83.33	-	106.67	95.106	±	5.656	Before-After 3 Months	-0.133	1.991	-0.334	0.742
Postoperative 6 Months	86	-	104.67	94.826	±	5.192	Before-After 6 Months	0.147	2.557	0.288	0.776

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Table(10): P wave in group (B) before procedures and one, three and six months after

P wave	Preoperative		Postoperative 1 Month		Postoperative 3 Months		Postoperative 6 Months	
	N	%	N	%	N	%	N	%
Abnormal	8	16.00	8	16.00	7	14.00	7	14.00
Normal	42	84.00	42	84.00	43	86.00	43	86.00
Total	50	100.00	50	100.00	50	100.00	50	100.00
Chi-Square	-		Before-After 1 Month		Before-After3 Months		Before-After 6 Months	
X2	-		0.000		0.000		0.000	
P-value	-		1.000		1.000		1.000	

Table(11): ST segment in group(B) before procedures with one, three and six months after

ST seg.	Preoperative		Postoperative 1 Month		Postoperative 3 Months		Postoperative 6 Months	
	N	%	N	%	N	%	N	%
Abnormal	10	20.00	10	20.00	7	14.00	4	8.00
Normal	40	80.00	40	80.00	43	86.00	46	92.00
Total	50	100.00	50	100.00	50	100.00	50	100.00
Chi-Square	-		Before-After 1 Month		Before-After 3 Months		Before-After 6 M	
X2	-		0.000		0.283		2.076	
P-value	-		1.000		0.594		0.150	

B-A6M	Differences	2.068	±	0.598	7.204	±	1.640
	Paired Test	<0.001*			<0.001*		

The study aimed to assess cardiovascular changes that might follow obesity interventional procedures namely sleeve gastrectomy and liposuction.

1) Group (A) sleeve gastrectomy: The group had significant changes in BMI occurred in range (38.3-58.5) to (31-50). The group also showed significant changes in pulse mean which was 93.68 before and became 88.32 after 6 months, mean arterial blood pressure from 113.227 to

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104.746 with no changes in S-T segment nor in P wave as shown in table (3), (4), (5), (6) and (7). Results were in agreement with those reported by Kheirvari and co-authors who mentioned that sleeve surgery for weight loss has proven to remarkably increase life expectancy and reduce cardiovascular risk in morbidly obese patients (Kheirvari *et al*, 2020).

2) **Group (B) liposuction:** Significant changes in BMI occurred in range (30.1-58.5) to (29-50) at group (B). On the other hand, patients did not show significant changes in pulse, mean arterial blood pressure wave or ST segment as shown in table (3), (8), (9), (10) and (11). Also, the results went in agreement with a meta-analysis about liposuction procedure which failed to show improvements in cardiovascular metabolic markers. Furthermore, there is no evidence to support the hypothesis that fat removal from the abdominal wall, by either suction or direct excision, decreases cardiovascular risk or the inflammatory markers associated with metabolic syndrome (Danilla *et al*, 2013).

The current study didn't find any significant changes in the P wave and S-T Segment length both after sleeve gastrectomy and liposuction.

CONCLUSION AND RECOMMENDATIONS

- Obese patients undergo sleeve gastrectomy have a benefit to decrease their possibility to worthen their cardiovascular complications.

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- Liposuction has no role in decreasing risk of cardiovascular diseases in obese persons.
- The main improvement in cardiovascular functions after sleeve gastrectomy will be in mean arterial pressure, pulse rate rather than S-T segment length or P wave length.
- Further studies should be done to discuss the accurate effects of other weight loss procedures on cardiovascular functions other than those studied in our work.
- Our study needs to be repeated on a bigger sample number and on multicenter bases to cover more variables.

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تقييم تغيرات الجهاز الدوري التالية للإجراءات التداخلية لعلاج السمنة

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المستخلص

السمنة منتشرة بشكل كبير فى مصر، ويقدر معدل انتشار الوزن الزائد والسمنة قياسا على ازدياد مؤشر كتلة الجسم عن ٢٥ كجم / م^2 بنسبة ٦١–٧٠ ٪ من مجموع السكان بداية من عمر عشرين عاما بنسب ٦٥٪ للذكور و٧٦٪ للإناث. ومع ارتفاع معدل استخدام التدخل الجراحى لعلاج السمنة سواء من خلال جراحة تكميم المعدة أو شفط الدهون، فقد قيمت الدراسة التغيرات فى الجهاز الدوري التى قد تتبع تلك الجراحات وشملت ٥٠ مريضا يعانون من السمنة، وأجريت الدراسة فى القاهرة وجنوب سيناء فى مصر خلال الفترة التى بدأت من سبتمبر ٢٠١٩ حتى أغسطس ٢٠٢٠. تم قياس التغيرات فى الجهاز الدوري بعد انخفاض كتلة الدهون فى الجسم فيما يتعلق بضغط الدم الشريانى (متوسط ضغط الدم الانقباضى والانبساطى)، والنبض (المعدل)، وتغيرات تخطيط القلب وتم القياس مباشرة قبل اجراء الجراحة ثم بعد ذلك بشهر واحد وثلاثة أشهر وستة أشهر. تضمنت الدراسة ٥٠ مريضاً (٥٠٪ تكميم معدة –٥٠٪ شفط دهون). كان متوسط الاعمار ٣٤,٨٢٠ مع غالبية للإناث (٥٦,٠٠٪). أظهرت النتائج أن تكميم المعدة أدى إلى تحسن كبير فى وظائف القلب والأوعية الدموية لدى المرضى الذين يعانون من السمنة المفرطة بينما شفط الدهون له تأثير ضئيل أو معدوم على وظائف القلب والأوعية الدموية.

الكلمات المفتاحية: السمنة–امراض الجهاز الدوري–شفط الدهون – تكميم المعدة

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