

Effect of Omega-3 Supplementation on Liver Size-related access to the Gastroesophageal Junction during Bariatric Surgery

Ng C.Y.D.¹, Tan B.C.¹, Lim K.T.¹, Babu S.², Tan C.H.¹, Cheng K.S.A.¹

¹ Department of General Surgery (Bariatric & Upper GI Surgery), Khoo Teck Puat Hospital

² Department of Diagnostic Radiology, Khoo Teck Puat Hospital

Background

Bariatric Surgery is the most effective way to drop substantial weight and maintain weight loss long term. These operations require access to the gastroesophageal junction (GEJ) under the left lobe of the liver.

Morbidly obese individuals have large livers that often impede this access. Different ways have been utilized to decrease the liver size pre-op so as to make the operation easier and hence safer. A common way is the use of Very Low Calorie Diet (VLCD), often 800 Kcal or less, in the form of meal replacement.

VLCD is costly and difficult to follow, resulting in poor compliance. Omega-3 supplementation is cheap and has been found to reduce hepatic steatosis by reducing lipogenic gene expression and can reduce liver size^{1,2,3}.

We aimed to conduct a safety and efficacy study to investigate the effect of 4 weeks of pre-operative Omega-3 supplement on liver size, its impact on facilitating access to the GEJ during surgery.

Method

The National Healthcare Group (NHG) Domain Specific Review Board approval was obtained (DSRB 2018/00525) and the study was performed in accordance with the Ethical Principles of the World Medical Association Declaration of Helsinki.

Patients with BMI < 45, without excessive central obesity, who were planned for Bariatric & Metabolic Surgery were recruited.

A dietician provided standard pre-bariatric surgery dietary counseling. The patient was given 2 g/day of Omega-3 for 4 weeks after informed consent.

Liver size measurement using ultrasound scan, as well as liver function and full blood count tests were performed pre and post omega-3 supplementation.

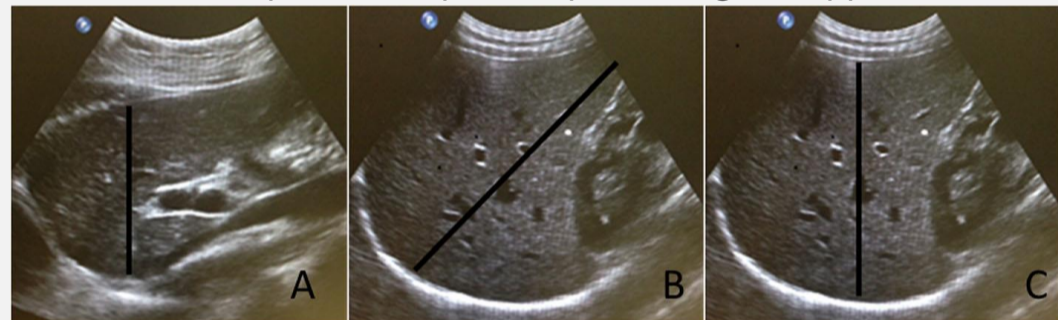


Figure 1. Liver Size Ultrasound measurement using Liver volume⁴ (cm³) = 343.71 + [0.84 × ABC], where A- Anterior to Posterior measurement of Left lobe of liver (probe placed longitudinally at where xiphisternum); B- Dome of liver to tip of Right liver (probe placed longitudinally at right midclavicular line); C- Anterior to posterior measurement of Right lobe of liver (probe placed longitudinally at right midclavicular line).

Intraoperatively, the operating surgeon subjectively scored the ease of access to the GEJ using Likert scale of 1 to 5 (easiest to most difficult).

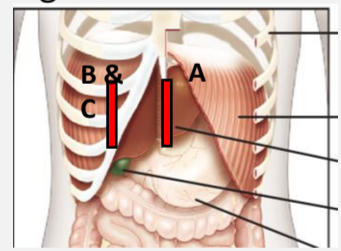


Figure 2. Ultrasound Probe Placements



Figure 3. "Most Easy" access to the GEJ (Score 1/5) on the Likert Scale.

Results

A total of 23 patients were recruited. 16 had completed the study whereas 5 are still awaiting surgery in view of the current COVID-19 pandemic. 2 had dropped-out. 63% (10/16) were females with mean average age of 43 years old. Compliance was 94% (15/16).

Average pre- and post-intervention liver volumes were 1866cm³ and 1721cm³ respectively. Despite 62.5% (10/16) of patients gaining weight post intervention (mean +0.44kg, p=0.393), it is significant to note that all patients (100%) experienced a reduction in liver volume (mean liver volume reduction 7.6±5%, -145 ±103 cm³, p<0.0001*).

Of significance, even when stratified amongst those with weight gain post intervention (+1.58kg, p=0.006), reduction in liver volume (6.6±4.6%, -129± 97 cm³, p=0.002) was significant as well.

Majority of patients had a Likert Score of 2 (62.5%) for Ease of Access to liver, followed by Score 1 "Most Easy" (25%) and then Score 3 "Average" (12.5%). There was however no demonstrable relationship between Change in Liver Volume, Change in Weight and Ease of Access (Figure 5a & 5b). Possible reasons for this include subjective assessments and different surgeons & experience.

No patients had Scores 4- 5 "Most Difficult". This could be due to lower BMI of recruited subjects (BMI < 45, as this is a safety & efficacy study) as well as due to ethnicity.

Mean operative time was 111 mins and Length of Stay (LOS) 2.4 days.

Results

	All Patients (n= 16)	Lost Weight (n=6)	Gained Weight (n=10)
Average Age (years)	43 ± 10	46 ± 10	41 ± 10
Gender			
Female	10 (63%)	3 (50%)	7 (70%)
Male	6 (37%)	3 (50%)	3 (30%)
Race			
Malay	10 (63%)	2 (33%)	8 (80%)
Indian	3 (18.8%)	2 (33%)	1 (10%)
Chinese	3 (18.8%)	2 (33%)	1 (10%)
Pre- Omega 3 Intervention			
Average Weight (kg)	101.6 ± 11	99.7 ± 13	102.8 ± 10
Average BMI (kg/m ²)	37.3 ± 3	35.7 ± 3	38.2 ± 3
Liver volume (cm ³)	1866 ± 394	1838 ± 383	1882 ± 420
Post- Omega 3 Intervention			
Average Weight (kg)	102.0 ± 12	98.2 ± 13	104.3 ± 11
Average BMI (kg/m ²)	37.5 ± 3	35.4 ± 2	38.8 ± 3
Liver Volume (cm ³)	1721 ± 359	1665 ± 350	1754 ± 379
Reduction in Liver Volume Post Intervention	16 (100%)	6 (100%)	10 (100%)
Average Δ in Weight (kg)	+0.44 ± 2 (p = 0.393)	-1.47 ± 1 (p=0.031)*	+ 1.58 ± 1 (p=0.006)*
Average Δ in Liver Volume (cm ³)	- 145 ± 103 (p< 0.0001)*	- 173 ± 118 (p=0.015)*	-129 ± 97 (p=0.002)*
Average Decrease in Liver Volume (%)	7.6 ± 5 % (p< 0.0001)*	9.2 ± 6 % (p=0.015)	6.6 ± 4.6% (p= 0.002)
Ease of Access to Liver			
1- Most Easy	4 (25%)	2 (33%)	2 (20%)
2	10 (62.5%)	3 (50%)	7 (70%)
3- Average	2 (12.5%)	1 (17%)	1 (10%)
4	0	0	
5- Most Difficult	0	0	
Operation Type			
Laparoscopic Sleeve Gastrectomy (LSG)	12 (75%)	5 (83%)	7 (70%)
LSG + Hiatal Hernia Repair	3 (18.8%)	0	3 (30%)
Laparoscopic Roux-en-Y Gastric Bypass (RYGB)	1 (6.2%)	1 (17%)	0
Operative time (mins)	111 ± 18	111 ± 23	111 ± 15
Length of Stay (days)	2.4 ± 2	3 ± 3 [^]	2 ± 0.5
Complications ^{^^}			
No Complications	14 (87.5%)	5 (83%)	9 (90%)
Small Bowel Injury	1 (6.3%)	0	1 (10%)
GJ hematoma	1 (6.3%)	1 (17%)	0

* p<0.05

[^]RYGB's LOS was 9 days in view GJ hematoma

^{^^} Small bowel injury and GJ hematoma were unrelated to liver size/ease of access to GEJ

Figure 4. Results Pre- & Post- Omega 3 Intervention on Liver Size.

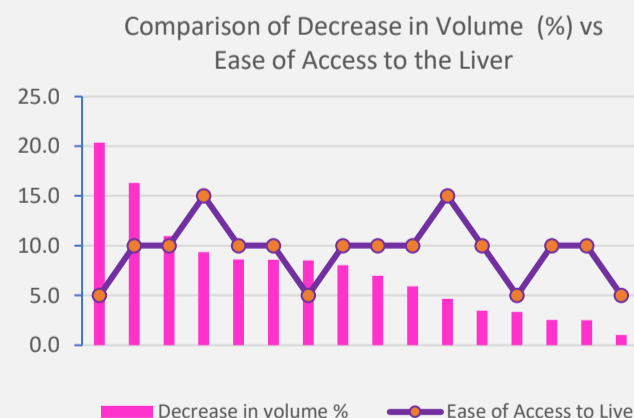


Figure 5a. Graph comparing decrease in Liver Volume vs Ease of Access to the Liver. Average Decrease in Liver Volume was 7.6±5%, p<0.0001. No demonstrable relationship was noted. Possible reasons for this include subjective assessments and differing surgeon experience.

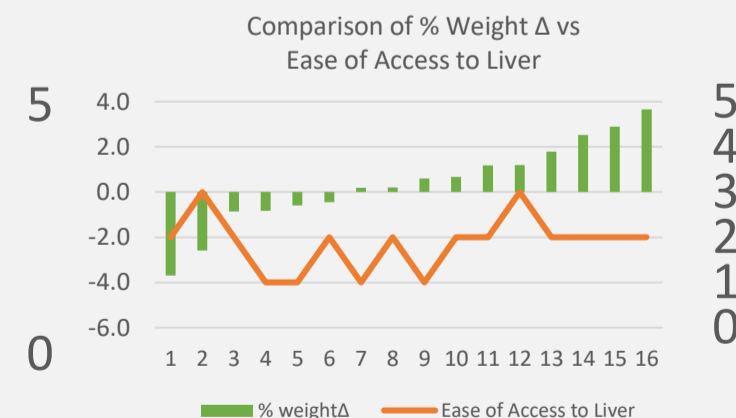


Figure 5b. Graph comparing change in Body Weight vs Ease of Access to the Liver. Average change in weight was +0.44 ± 2, p = 0.393. No demonstrable relationship noted.

Conclusion

Four weeks of Omega-3 supplementation is safe and may be a cheaper alternative to VLCD for liver size reduction pre-bariatric surgery in this interim report.

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