Case series
Effective and safe reduction in visceral fat using a formula diet in a short period before highly invasive endoscopic surgery – Case series

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A R T I C L E   I N F O

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A B S T R A C T

Introduction: We retrospectively assessed the efficacy and safety of use of short-term formula diet therapy to achieve preoperative reduction in visceral fat immediately prior to highly invasive endoscopic surgery. Presentation of case: We reviewed 5 cancer patients who underwent thoracoscopic and/or laparoscopic-assisted esophagectomy or gastrectomy. The cases were those with a BMI ≥30 kg/m² or waist circumference ≥100 cm. Patients replaced one meal out of the three main meals with one or two sachets of formula diet (170–340 kcal). The other two meals were set to 600 kcal. The dietary therapy was implemented approximately 1 month before the operation. Weight loss achieved after dietary therapy ranged from 6.4% to 14.1% (p < 0.01). With the exception of one case, the decrease in visceral fat area ranged from 17.0%–40.7% (p = 0.03). Postoperative complications were anastomotic insufficiency in two cases.

Discussion: Although the decreases of the visceral fat were effectively implemented, the adverse effects on postoperative complications must be examined in the farther study.

Conclusion: It was suggested that use of formula diet to achieve preoperative visceral fat reduction in a short period of time immediately prior to highly invasive endoscopic cancer surgery would be an effective and safe strategy.

1. Introduction

Several studies have demonstrated that visceral fat area (VFA) is a better parameter for evaluation of the difficulty of laparoscopic gastrectomy, the dissected number of lymph nodes, and the risk of postoperative complications [1–3]. In other studies, elevated VFA was associated with increased surgical complexity and postoperative morbidity [4,5]. In this setting, preoperative VFA loss may confer several benefits including reduction in surgical complexity and the risk of postoperative complications. Many studies have reported the efficacy of a low-energy formula diet (FD) in achieving preoperative weight loss before bariatric surgery and laparoscopic gastrectomy [6–11].

In this study, we retrospectively reviewed the use of FD to achieve safely acceptable reduction in VFA as quantified by CT (Computed tomography), in a short period immediately prior to highly invasive surgery. This work has been reported in accordance with the Surgical Case Report (SCARE) guidelines [12].

2. Presentation of cases

Tables 1 and 2 show the characteristics and the diet schedules of patients. We investigated 5 cancer patients who underwent thoracoscopic and/or laparoscopic-assisted esophagectomy or gastrectomy between 2014 and 2020 in Suwa Red Cross Hospital. The surgeon was a gastrointestinal surgeon certified by the Japanese Society of Gastroenterological Surgery. The subjects were those with a BMI ≥30 kg/m² or waist circumference ≥100 cm and no nutritional problems. All patients underwent multislice spiral CT (Aquilion™ One, Canon Medical Systems Corporation, Tochigi, Japan) before the start of diet and immediately prior to surgery. A single cross-sectional scan at the level of the umbilicus was selected for quantification of VFA. VFA was calculated by the software (Slim Vision®, KGT Corporation, Tokyo, Japan).

We opted for use of FD (Obe Cure®, USCure, Tokyo, Japan) to achieve weight loss. Patients replaced one meal out of the three main meals with one or two sachets of FD (170–340 kcal). The other two meals were set to usual diet in 600 kcal and no other intake of calories was allowed.

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The results of nutritional data.

Table 3

| Case | Total protein (g/dL) | Albumin (g/dL) | Transferrin (mg/dL) | Prealbumin (mg/dL) | Retinol binding protein (mg/dL) |
|------|---------------------|---------------|---------------------|-------------------|--------------------------------|
|      | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| 1    | 6.8 | 7.7  | 4.1 | 4.9  | 250 | 272  | 32.8 | 32.4 | 4.0  | 3.5  |
| 2    | 7.4 | 7.7  | 4.1 | 3.9  | 283 | 239  | 23.9 | 24.2 | 3.0  | 4.3  |
| 3    | 7.3 | 7.2  | 4.1 | 4.5  | 220 | 236  | 38.6 | 28.4 | 5.8  | 3.6  |
| 4    | 7.0 | 7.6  | 4.4 | 6.8  | 239 | 256  | 27.3 | 29.8 | 3.5  | 3.7  |
| 5    | 7.3 | 7.2  | 4.6 | 4.6  | 330 | 319  | 20.4 | 20.9 | 2.2  | 2.5  |
| p    | 0.18| 0.18 | 0.99 | 0.33 | 0.54 |  |

Pre, just before the diet therapy; post, just after the diet therapy; p, p value (t-test).

The purpose and safety of this study, possible disadvantages, patient anonymity and the fact that it can be rejected at any time during the study and will not be adversely affected, are fully explained for all the cases before participating in this study. And we got consent from them.

This study is a non-consecutive, retrospective study conducted in a single center.

All patients experienced no complications with no dissatisfaction with the dietary restrictions. Nutritional data measured just before and after the diet therapy are shown in Table 3. Data for all cases except case 5 were within the normal reference range. In case 5, prealbumin and retinol binding protein after dieting showed low values. There was no statistically significant difference between the data.

Table 4 shows the values quantified by CT. Weight loss resulting from diet therapy ranged from −6.4% to −14.1% (p < 0.01). The subcutaneous fat area decreased in all patients and the rate of decrease ranged from −13.1% to −23.8% (p < 0.01). With the exception of case 4, the decrease in VFA ranged from −17.0% to −40.7% (p < 0.05), which represented a much greater reduction compared to the decrease in subcutaneous fat.

Table 5 shows the details of the postoperative course. The operation time seems to be standard. Blood loss was somewhat higher (range, 100–450 g); however, massive bleeding of ≥500 mL was not observed. In case 4 and 5, these cases were extended in the hospital stay due to anastomotic insufficiency (Clavien-Dindo Classification IIIa). Other cases were discharged within the planned number of days.

3. Discussion

In a study, laparoscopic-assisted distal gastrectomy in obese patients was associated with more technical difficulties, longer operative time, and delayed recovery of bowel activity [12]. Other studies have reported a significant association between visceral obesity and increased postoperative serum levels of C-reactive protein [14,15]. As seen in case 1, patients with excessive body fat tend to have reduced muscle mass; this has a considerable influence on the postoperative cardiopulmonary function and physical activity.

The FD is rich in protein, vitamins, and minerals and deficient in energy-dense carbohydrates and fats. One sachet of Obe Cure® provides a total energy content of 170 kcal and contains 15 g carbohydrates, 22 g protein and 2 g fat. Our approach of FD replacement is based on the recommendations for diets in type 2 diabetes, as well as on the previously published reviews and meta-analysis [16,17]. In the setting of cancer surgery, extended time spent for achieving weight loss is typically not desirable; the efficacy and safety of short-term nutritional therapy to achieve weight loss in this setting has not been established.

It has been reported that diet therapy using FD could be effectively performed before laparoscopic gastrectomy [11]. The authors administered a diet with FD 20 days before surgery to patients with BMI ≥ 25 kg/m² or waist circumference ≥ 85 cm in men and ≥ 90 cm in women. In our study, we mainly targeted esophagectomy, which is more invasive than gastrectomy, and targeted BMI ≥ 30 kg/m². The above report only includes a few cases with BMI ≥ 30. Severe cardiopulmonary complications after esophagectomy, which can have fatal consequences especially in sarcopenic obese patients with reduced muscle mass, should be avoided at all costs. Focusing on the highly invasive esophagectomy and BMI ≥ 30, we examined whether a safe and effective diet can be achieved. In our study, a short-term diet resulted in a decrease in VF, and there was no preoperative malnutrition or postoperative...
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References

[1] Y. Liu, D. Guo, Z. Niu, Y. Wang, G. Fu, Y. Zhou, et al., Prediction of the risk of laparoscopy-assisted gastrectomy by comparing visceral fat area and body mass index, Gastroenterol. Res. Pract. (2018), https://doi.org/10.1155/2018/1359626.

[2] K. Yoshikawa, M. Shimada, N. Kurita, T. Iwata, M. Nishioka, S. Morimoto, et al., Visceral fat area is superior to body mass index as a predictive factor for risk with laparoscopy-assisted gastrectomy for gastric cancer, Surg. Endosc. 25 (2011) 3825–3830, https://doi.org/10.1007/s00464-011-1798-7.

[3] Y. Seki, M. Ohue, M. Sekimoto, S. Takiguchi, I. Takemasa, M. Ikeda, et al., Evaluation of the technical difficulty performing laparoscopic resection of a rectosigmoid carcinoma: visceral fat reflects technical difficulty more accurately than body mass index, Surg. Endosc. Other Interv. Tech. 21 (2007) 929–934, https://doi.org/10.1007/s00464-006-9884-9.

[4] Z. Qu, B. Zhang, Z. Qin, C. Chen, Elevated visceral obesity quantified by CT is associated with adverse postoperative outcome of laparoscopic radical nephrectomy for renal clear cell carcinoma patients, Int. Urol. Nephrol. 50 (2018) 845–850, https://doi.org/10.1007/s11255-018-1858-1.

[5] M. Takeuchi, K. Ishii, H. Seki, N. Yasui, M. Sakata, A. Shimada, et al., Excessive visceral fat area as a risk factor for early postoperative complications of total gastrectomy for gastric cancer: a retrospective cohort study, BMC Surg. 16 (2016) 1–7, https://doi.org/10.1186/s12893-016-0160-8.

[6] L.V. Nielsen, M.S. Nielsen, J.B. Schmidt, S.D. Pedersen, A. Sjödin, Efficacy of a liquid low-energy formula diet in achieving preoperative target weight loss before bariatric surgery, J. Nutr. Sci. 5 (2016) 1–7, https://doi.org/10.1017/jns.2016.13.

[7] D. Edholm, J. Kubilberg, A. Hämmi, F.A. Karlsson, A. Ahlström, J. Hedberg, et al., Preoperative 4-week low-calorie diet reduces liver volume and intrahepatic fat, and facilitates laparoscopic gastric bypass in morbidly obese, Obes. Surg. 21 (2011) 345–350, https://doi.org/10.1007/s11695-010-0337-2.

[8] S.L. Colles, J.B. Dixon, P. Marks, B.J. Strauss, P.F. O’Brien, Preoperative weight loss with a very-low-energy diet: quantification of changes in liver and abdominal fat by serial imaging, Am. J. Clin. Nutr. 84 (2006) 304–311, https://doi.org/10.1093/ajcn/84.2.304.

[9] S. Huerta, S. Dredar, E. Hayden, A.A. Siddiqui, T. Anthony, M. Asolati, et al., Preoperative weight loss decreases the operative time of gastric bypass at a veterans administration hospital, Obes. Surg. 18 (2008) 508–512, https://doi.org/10.1007/s11695-008-9334-5.

[10] R.S. Alami, J.M. Morton, R. Schuster, J. Lie, B.R. Sanchez, A. Peters at al, Is there a benefit to preoperative weight loss in gastric bypass patients? A prospective randomized trial, Surg. Obes. Relat. Dis. 3 (2007) 141–145, https://doi.org/10.1016/j.soard.2006.11.006.

[11] K. Inoue, S. Yoshiuchi, M. Yoshida, N. Nakamura, S. Nakajima, A. Kitamura, et al., Preoperative weight loss program involving a 20-day very low-calorie diet for obesity before laparoscopic gastrectomy for gastric cancer, Asian J. Endoscopic Surg. 12 (2019) 43–50, https://doi.org/10.1111/aes.12479.

[12] R.A. Agha, C. Sahrabi, G. Mathew, T. Franchi, A. Kerwan, N. O’Neill, PROCESS Group, The PROCESS 2020 guideline: updating consensus Preferred Reporting Of CaSe Series in Surgery (PROCESS) guidelines, Int. J. Surg. 84 (2020) 231–235, https://doi.org/10.1016/j.ijsu.2020.11.005.

[13] H. Noshibo, S. Shimizu, E. Nagai, K. Ouchida, M. Tanaka, Laparoscopy-assisted distal gastrectomy for early gastric cancer: is it beneficial for patients of heavier weight? Ann. Surg. 238 (2003) 680–685, https://doi.org/10.1097/01.sla.0000094302.51616.2a.

[14] A. Okamura, M. Watanabe, I. Fukudome, K. Yamaishi, M. Yuda, M. Hayami, et al., Relationship between visceral obesity and postoperative inflammatory response following minimally invasive esophagectomy, World J. Surg. 42 (2018) 3651–3657, https://doi.org/10.1007/s00268-018-4675-x.

[15] S.L. Doyle, A.M. Mongan, C.L. Donohoe, G.P. Pidgeon, M. Sherlock, J.V. Reynolds, et al., Impact of visceral obesity and metabolic syndrome on the postoperative immune, inflammatory, and endocrine response following surgery for esophageal adenocarcinoma, Dis. Esophagus 30 (2017) 6–7, https://doi.org/10.1007/dote.008.

[16] F. Qian, A.A. Korat, V. Malik, F.B. Hu, Metabolic effects of monounsaturated fatty acid-enriched diets compared with carbohydrate or polyunsaturated fatty acid-enriched diets in patients with type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials, Diabetes Care 39 (2016) 1448–1457, https://doi.org/10.2337/dc16-0513.

[17] O. Snongaard, M.G. Poulsen, H.K. Andersen, A. Astrup, Systematic review and meta-analysis of dietary carbohydrate restriction in patients with type 2 diabetes, BMJ Open Diabetes Res. Care 5 (2017), https://doi.org/10.1136/bmjdr-2016-000354.

[18] V. Mengardo, F. Pucetti, O. McCormack, A. Chaudry, W.H. Allum, The impact of obesity on esophagectomy: a meta-analysis, Dis. Esophagus 31 (2017) 1–9.

[19] P. Wang, Y. Li, H. Sun, S. Liu, R. Zhang, X. Liu, et al., Predictive value of body mass index for short-term outcomes of patients with esophageal cancer after esophagectomy: a meta-analysis, Ann. Surg. Oncol. 26 (2019) 2090–2103.