

## Original article

# Prevalence and intensity of dumping symptoms and their association with health-related quality of life following surgery for oesophageal cancer



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## SUMMARY

**Background & aims:** This study aimed to investigate the prevalence and intensity of symptoms of dumping syndrome (early and late) experienced by oesophageal cancer survivors one year after surgery and their association with health related quality of life (HRQL).

**Methods:** A prospective cohort study of patients who underwent surgery for oesophageal cancer in Sweden from January 2013 to April 2018, included at one year after surgery with follow-up at 1.5 years. Common symptoms of dumping syndrome were the exposure, classified as early and late onset, further divided into 'moderate' or 'severe' based on symptom intensity, and no dumping symptoms (reference group). The primary outcome was mean summary score of HRQL, and secondary outcomes were global quality of life, physical, role, emotional, cognitive and social function measured using the EORTC QLQ-C30 1.5 years after surgery. An ANCOVA model, adjusted for potential confounders was used to study the association between dumping symptoms and HRQL, presented as mean score differences (MD) with 95% confidence intervals (CI).

**Results:** Among 188 patients, moderate early dumping symptoms was experienced by 45% and severe early dumping by 9%. Moderate late dumping symptoms was reported by 13%, whereas 5% reported severe late dumping symptoms. Severe early dumping symptoms was associated with worse HRQL in 4 out of 7 aspects with worse global quality of life (MD -16, 95% CI: -27 to -4) and social function (MD -17, 95% CI: -32 to -3), which showed clinically large differences compared to having no such symptoms. Patients with moderate late dumping symptoms reported poorer HRQL in 6 out of 7 aspects compared to those with no dumping symptoms. Cognitive function (MD -27, 95% CI: -47 to -7) and emotional function (MD -24, 95% CI: -47 to -2) were significantly declined (clinically large relevance) in those with severe late dumping symptoms.

**Conclusions:** Patients who have undergone curative treatment for oesophageal cancer experience reduced HRQL from early and late dumping symptoms at one year after surgery that indicate clear implications for clinical routine. Medical support and additional dietary counselling are required as potential ways to alleviate dumping symptoms on clinical repercussions.

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**Abbreviations:** BMI, Body mass index; CI, Confidence intervals; EORTC, European Organization for Research and Treatment of Cancer; HRQL, Health related quality of life; MD, Mean score differences; OSCAR, Oesophageal Surgery in Cancer patients: Adaptation and Recovery study.

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## 1. Introduction

The common curatively intended treatment for oesophageal cancer is extensive surgery often combined with neo-adjuvant therapy [1,2]. After the tumour is resected a large part of the oesophagus is substituted with the stomach [3]. There is substantial risk for post-operative complications and the overall long term survival is still poor despite improving trends [4]. In those who survive, there is considerable deterioration in nutritional status and health related quality of life (HRQL) [5,6]. Dumping syndrome describes symptoms that are experienced following ingestion of a meal as a consequence of rapid gastric emptying of food to the small intestine [7]. The symptoms of dumping syndrome manifest as early and late dumping and with distinct pathophysiology and onset of symptoms in relation to the time passed after ingestion of a meal [8]. Early dumping symptoms occur within an hour of ingestion of a meal and are attributed to the rapid passage of osmotically active particles into the small intestine which causes a combination of gastrointestinal and vasomotor symptoms [9]. Late dumping symptoms, on the other hand, occur 1–3 h after a meal and are attributed to reactive hypoglycemia [9].

Dumping syndrome is a known complication following upper gastrointestinal surgery, however it is inconsistently reported in the case of oesophagectomy. A recent systematic review established that 20.2% of a pooled sample of 2044 patients exhibited symptoms of dumping syndrome following oesophagectomy, and the rates of reported dumping ranged from 0% to 78% [10]. This study also inferred that the intensity of dumping and its impact on patients' quality of life were inconsistent. To the best of our knowledge no previous studies have explored the association between dumping symptoms after oesophagectomy and HRQL in survivors. Therefore, this study aimed to investigate the prevalence of symptoms of dumping syndrome (early and late) experienced by oesophageal cancer survivors at one year after surgery, and their association with HRQL in a nationwide and population-based setting.

## 2. Methods

### 2.1. Data source and study design

The main source of data is derived from the cohort, Oesophageal Surgery in Cancer patients: Adaptation and Recovery (OSCAR) study explained in detailed elsewhere [11]. Briefly, the OSCAR study is a nationwide and prospective cohort study of patients who underwent surgery for oesophageal cancer in Sweden from 2013 onwards. Patients were included into the cohort one year after surgery (i.e., from 2014) with regular follow-up until five years postoperatively. The OSCAR study was approved by the Regional Ethical Review Board in Stockholm, Sweden (diary number 2013/844-31/1) and all participants provided written informed consent. For the present prospective cohort study, data on patients operated on between January 2013 and 31 April 2018 from the OSCAR cohort were included.

### 2.2. Data collection

A home visit was made by a research nurse one year after surgery. The research nurse used a combination of interview questions and validated written and self-reported questionnaires to collect patient-reported outcomes. For the purpose of the current study, data concerning risk factors (BMI and other diseases), HRQL (cancer specific) and symptoms of dumping syndrome collected during the home visit were used. Following the home visit, regular follow-ups

were carried out and data from the one and half year follow up were used for the current study. Clinical data were collected from medical records reviewed by a group of researchers and clinicians according to a predefined protocol to ensure uniformity of the data collection. The clinical information collected included sex, age at operation, pre-operative BMI, co-morbidities, tumour location, tumour histology, neo-adjuvant therapy, type of operation, post-operative tumour stage, post-operative complications and eating difficulties.

### 2.3. Exposure

Information on the frequency and intensity of dumping symptoms at one year after surgery was obtained using a study specific questionnaire. The OSCAR dumping questionnaire is based on Sigstad's score [12] and the Arts dumping questionnaire [13] which are the most commonly used dumping symptom-based questionnaires. The questionnaire contains 10 common symptoms of dumping (Fig. 1). Response alternatives are "present" (yes) or "absent" (no). The symptom intensity is rated with a question how troublesome each symptom is based on a 4-point Likert scale: (1) not at all, (2) a little, (3) quite a bit, or (4) very much. Further, patients report if they had experienced the symptoms before surgery. Current symptoms of dumping that also were present before surgery, but not related to eating a meal, are not regarded as dumping symptoms. In addition, two open-ended questions assess the occurrence of symptoms throughout the day and their relation to a meal. Early or late dumping is inferred from the responses to the two open-ended questions, as early dumping – symptoms within 60 min after a meal, late dumping – symptoms more than 2 h after a meal (Fig. 1).

Following the categorisation of early or late dumping, symptoms were further divided according to intensity:

- 1) Severe – at least two symptoms with an intensity of "quite a bit" or "very much".
- 2) Moderate – at least one symptom with an intensity of "not at all", "a little", "quite a bit" or "very much".
- 3) None – no dumping symptoms. The third group consisted of those with no early or late dumping symptoms and was used as the reference group (Fig. 1).

### 2.4. Outcome

The primary outcome of the study was the mean summary score of HRQL measured with the European Organization for Research and Treatment of Cancer (EORTC) Questionnaire QLQ-C30 [14] one and half years after surgery. Secondary outcomes included the global quality of life (QOL) scale and the functional scales (physical, role, emotional, cognitive and social) from the same questionnaire. The summary score is calculated as the mean of 13 of the 15 QLQ-C30 scales combined (excluding financial difficulties and global QOL) and suggested as a robust single factor model for the QLQ-C30 [15].

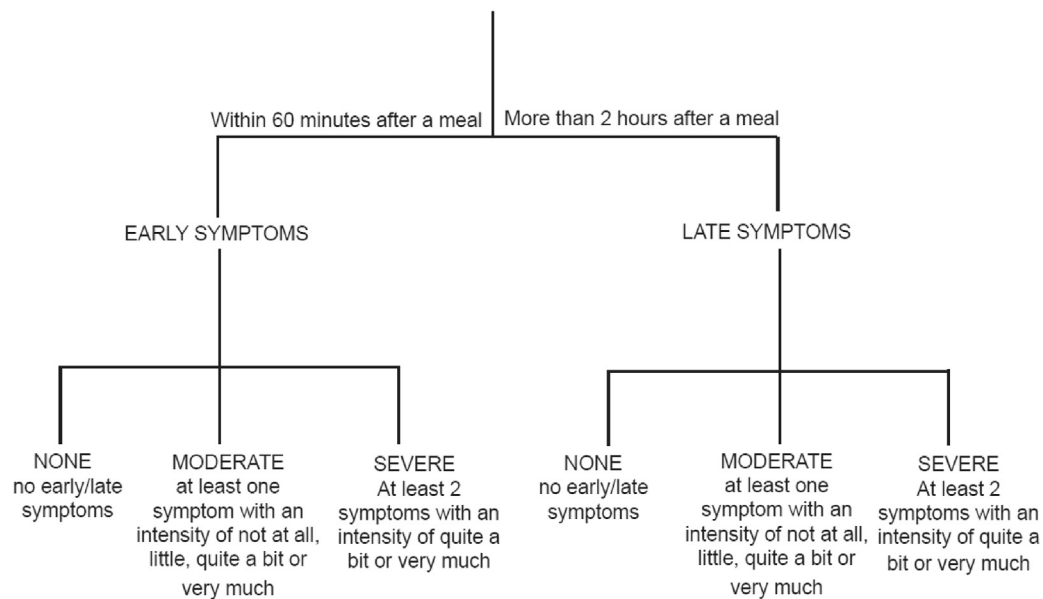
### 2.5. Statistical analysis

Mean scores for the selected scales were obtained by transforming the responses from the QLQ-C30 to linear scale scores of 0–100, in accordance with the EORTC scoring manual [16].

An ANCOVA model was used to assess the association between exposure and outcome adjusted for potential confounders and

OSCAR DUMPING QUESTIONNAIRE

I have had these symptoms today		If you have any of the symptoms, how troublesome are they for you?				I have had these symptoms before operation
		Not at all	A Little	Quite a bit	Very much	
1. Sweating	Yes/No	1	2	3	4	Yes/No
2. Dizziness	Yes/No	1	2	3	4	Yes/No
3. Palpitation	Yes/No	1	2	3	4	Yes/No
4. Fainting	Yes/No	1	2	3	4	Yes/No
5. Nausea	Yes/No	1	2	3	4	Yes/No
6. Stomach cramps	Yes/No	1	2	3	4	Yes/No
7. Diarrhoea	Yes/No	1	2	3	4	Yes/No
8. Handshakes	Yes/No	1	2	3	4	Yes/No
9. Difficulty concentrating	Yes/No	1	2	3	4	Yes/No
10. Sleepiness	Yes/No	1	2	3	4	Yes/No
11. Describe how the symptom/symptoms occur during the day						
12. How do you relate these symptoms to a meal?						



**Fig. 1.** Categorisation of early/late dumping symptoms with moderate/severe intensity based on OSCAR dumping questionnaire. OSCAR – Oesophageal Surgery in Cancer patients: Adaptation and Recovery Cohort.

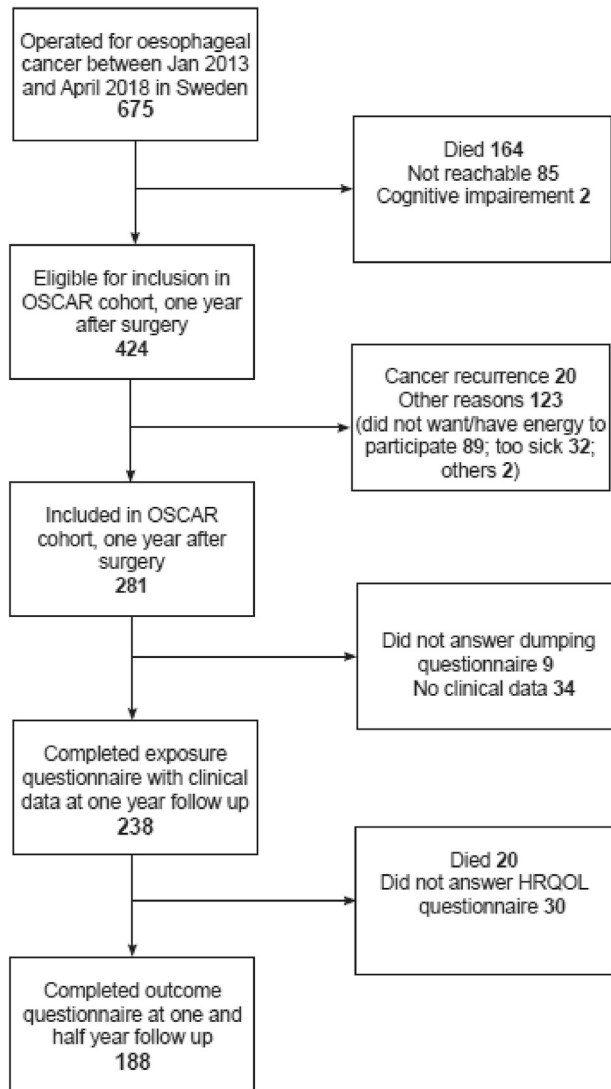
presented as mean score differences (MD) with 95% confidence intervals (CI). Complete-case analysis was used to address missing values due to a very low number of missing in confounders and missing in the questionnaire data was dealt in line with the EORTC guidelines [16]. All statistical analyses were conducted by an experienced biostatistician (AJ) using SAS® version 9.4 (SAS Institute, Cary, North Carolina, USA).

Adjusted MDs for the summary score and functional HRQL were calculated from ANCOVA regression models as: adjusted mean score of the exposure group—adjusted mean score of reference group. For example, the MD for global QOL for the group with severe early dumping was obtained by deducting their adjusted mean score from that of those with no dumping i.e., 45–61 giving a MD of –16. The cross-sectional guidelines were used to interpret mean changes between exposure groups for determining medium and large clinical relevance in MDs [17]. For the sub-scales where no such cut-offs were defined by the guidelines, an MD score  $\geq 10$  was used as medium clinical significance and  $\geq 20$  as large clinical relevance [18].

### 3. Results

#### 3.1. Response rate and patient characteristics

The flow chart of the number of patients who were included in the OSCAR cohort and subsequently participated in the present study are presented in Fig. 2. Between January 2013 and April 2018, 675 patients were operated for oesophageal cancer in Sweden. Of these, 164 died before the one-year follow up, 85 were not reachable and two were excluded owing to cognitive impairment, leaving 424 patients eligible for inclusion in the OSCAR study. Of these 142 (33% of eligible) declined to participate either owing to cancer recurrence (n = 20) or other reasons [because they did not want/had the energy to participate (n = 89), were too sick (n = 32), others (n = 2)]. Between the follow-up time points, 20 patients died. In total, 188 who answered both questionnaires concerning exposure (1 year postoperatively) and outcome (1.5 years postoperatively) and those who had complete clinical data from medical records were included in the analysis (Fig. 2).



**Fig. 2.** Patient inclusion and participation flow chart. OSCAR – Oesophageal Surgery in Cancer patients: Adaptation and Recovery; HRQL – Health related quality of life.

Patient characteristics are presented in Table 1. Patients were predominantly males (86.7%) with a mean age of 66 at surgery. More co-morbidities (greater than 2) according to Charlson comorbidity score were observed in 19.2%, and 28.2% had tumour stage III/IV. Majority underwent neo-adjuvant therapy (80.8%) and low-grade complications (Clavien Dindo Score 0-II) were more common (61.2%) post-operatively. Nearly 48% reported eating difficulties at one year after surgery.

### 3.2. Dumping symptoms

Moderate early dumping symptoms were reported by 45% and severe early dumping symptoms by 9%, whereas 13% experienced moderate late dumping symptoms and 5% experienced severe late dumping symptoms. Patients undergoing open oesophagectomy had more severe early dumping symptoms (56%) than patients undergoing minimally invasive (20%) or hybrid (thorascopic/laparoscopic) surgery (24%). Similarly, both moderate (56%) and severe late dumping (75%) were more common for open

oesophagectomies (Table 1). Figure 3 shows HRQL raw scores and MDs between the three symptom intensity groups (none, moderate and severe dumping) presented in Fig. 3a, b (early dumping) and Fig. 3c, d (late dumping).

### 3.3. Early dumping symptoms and health-related quality of life

Patients who reported moderate early dumping symptoms had poorer emotional function than those with no such symptoms (Fig. 3a, b). The differences were statistically significant with a medium clinical relevance (MD –12, 95% CI: –18 to –6) (Fig. 3b). No other HRQL aspects worsened significantly.

Severe early dumping had a significant impact on the total summary score with clinically medium relevance (MD –12, 95% CI: –21 to –4) but after adjustment for confounders the effect disappeared (MD –8, 95% CI: –16 to 1). Among those who experienced severe early dumping symptoms after adjustment for confounders, cognitive function (MD –12, 95% CI: –22 to –2) and emotional function (MD –13, 95% CI: –24 to –2) declined significantly with medium clinical relevance compared to those with no symptoms of dumping. Severe early dumping symptoms were also related to worsened global QOL (MD –16, 95% CI: –27 to –4) and social function (MD –17, 95% CI: –32 to –3) following adjustments for confounders (Fig. 3b). The differences in scores were of large clinical relevance compared with those with no such symptoms.

Between those who reported moderate and severe early dumping symptoms, global QOL and social function varied with scores that were clinically medium (MD –13, 95% CI: –24 to –2) and large clinical (MD –16, 95% CI: –29 to –2) relevance, respectively (Fig. 3b).

### 3.4. Late dumping symptoms and HRQL

Moderate late dumping symptoms were associated with worsening in 6 out of 7 HRQL aspects after adjustment for confounders. Summary HRQL score, cognitive, social and emotional function worsened with clinically large relevance in scores while global QOL (MD –14, 95% CI: –23 to –4) and role function (MD –19, 95% CI: –33 to –5) was poorer indicating medium clinical relevance (Figure 3c, d).

Severe late dumping had a significant effect on total summary score with clinically large relevance (MD –23, 95% CI: –39 to –7) that disappeared after adjustment for confounders (MD –13, 95% CI: –30 to 4). After adjustments for confounders, severe late dumping had worse cognitive function (MD –27, 95% CI: –47 to –7) and emotional function (MD –24, 95% CI: –47 to –2) compared to those with no symptoms (Fig. 3d).

## 4. Discussion

In this population-based prospective cohort study, self-reported symptoms of both early and late dumping experienced after surgery for oesophageal cancer were associated with poorer HRQL. Notably, worsened HRQL in terms of number of aspects was more common among patients reporting severe early dumping and moderate late dumping symptoms.

Several methodological aspects should be considered in the interpretation of the findings. The principle strength of this study lies in its design with a prospective longitudinal data collection based on a nationwide population of patients who underwent surgery for oesophageal cancer which counteract selection bias.

**Table 1**  
Comparison of patient characteristics between moderate and severe intensity early and late dumping and no dumping.

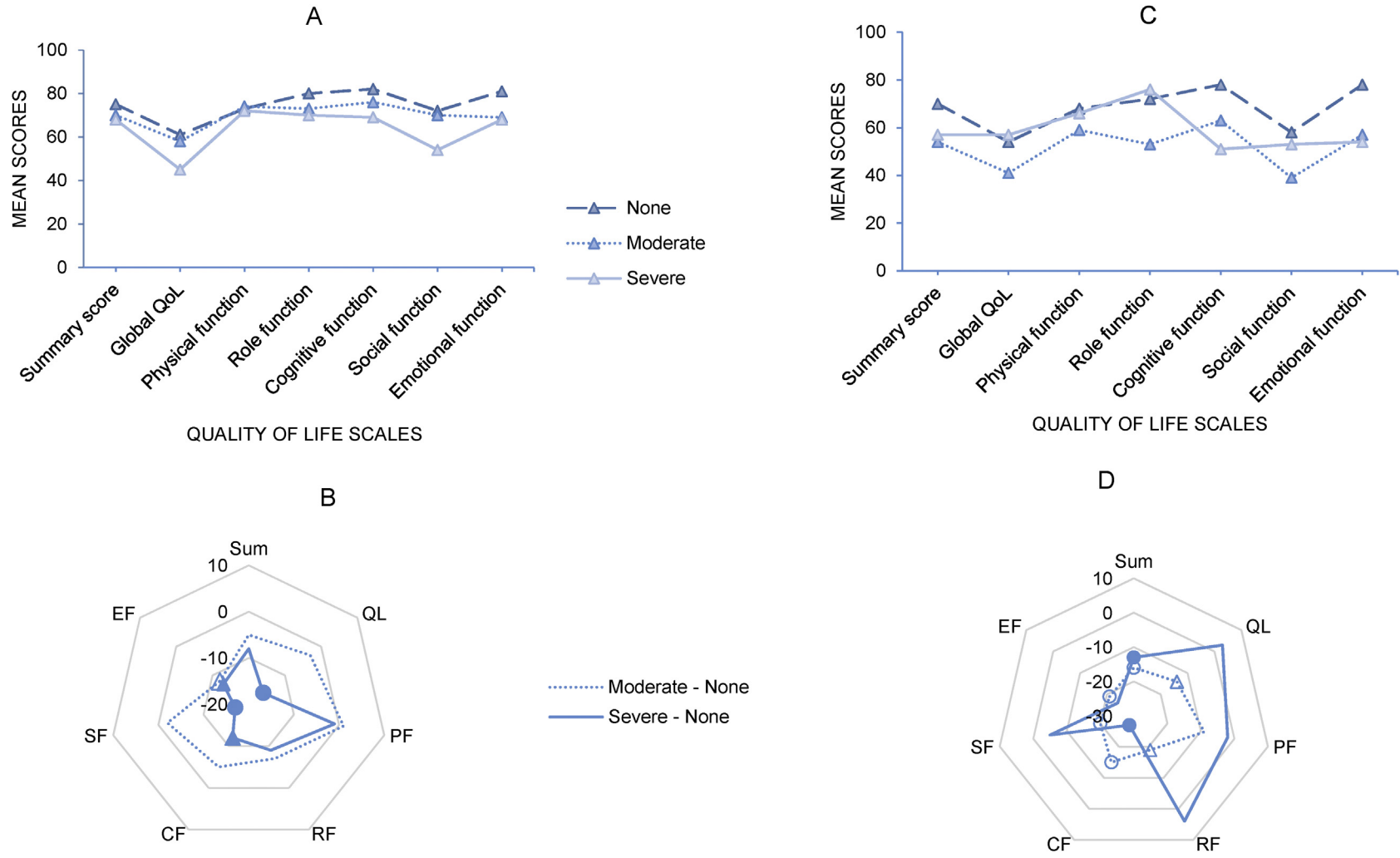
Characteristics	Overall (n = 188)	Early dumping n = 100 <sup>†</sup>		Late dumping n = 29 <sup>†</sup>		No dumping n = 79 <sup>†</sup>
		Moderate (n = 84)	Severe (n = 16)	Moderate (n = 25)	Severe (n = 4)	
Sex						
Male	163 (86.7)	75 (89.3)	11 (68.8)	24 (96.0)	2 (50.0)	69 (87.3)
Female	25 (13.3)	9 (10.7)	5 (31.3)	1 (4.0)	2 (50.0)	10 (12.7)
*Average age at operation	66.5 (8.6)	65.7 (9.5)	64.6 (12.7)	63.9 (9.7)	53.4 (16.3)	67.7 (6.5)
Preoperative BMI						
≤25	26 (14.1)	13 (15.7)	4 (25.0)	2 (8.3)	0 (0)	8 (10.4)
>25	159 (86.0)	70 (84.3)	12 (75.0)	22 (91.7)	4 (100.0)	69 (89.6)
Co-morbidities (Charlson score)						
0	93 (49.5)	44 (52.4)	7 (43.8)	13 (52.0)	2 (50.0)	37 (46.8)
1	59 (31.4)	26 (31.0)	6 (37.5)	7 (28.0)	1 (25.0)	25 (31.7)
>2	36 (19.2)	14 (16.7)	3 (18.8)	5 (20.0)	1 (25.0)	17 (21.5)
Tumour location						
Upper and Middle	20 (10.8)	10 (12.2)	2 (12.5)	3 (12.0)	1 (25.0)	7 (8.9)
Lower and Cardia (Siewert II/III)	166 (89.3)	72 (87.8)	14 (87.5)	22 (88.0)	3 (75.0)	72 (91.1)
Tumour histology						
Adenocarcinoma and Dysplasia	158 (84.0)	70 (83.3)	11 (68.8)	21 (84.0)	3 (75.0)	69 (87.3)
Squamous cell carcinoma	30 (16.0)	14 (16.7)	5 (31.3)	4 (16.0)	1 (25.0)	10 (12.7)
Post-operative tumour stage						
I	70 (37.2)	30 (35.7)	6 (37.5)	11 (44.0)	1 (25.0)	32 (40.5)
II	65 (34.6)	27 (32.1)	5 (31.3)	8 (32.0)	2 (50.0)	29 (36.7)
III-IV	53 (28.2)	27 (32.1)	5 (31.3)	6 (24.0)	1 (25.0)	18 (22.8)
Neo-adjuvant therapy						
Yes	152 (80.8)	67 (79.8)	10 (62.5)	18 (72.0)	3 (75.0)	67 (84.8)
No	36 (19.2)	17 (20.2)	6 (37.5)	7 (28.0)	1 (25.0)	12 (15.2)
Type of operation						
Minimally invasive	57 (30.3)	25 (29.8)	3 (18.8)	5 (20.0)	1 (25.0)	26 (32.9)
Hybrid thoracoscopic/laparoscopic	56 (29.8)	27 (32.1)	4 (25.0)	6 (24.0)	0 (0)	25 (31.7)
Open oesophagectomy	75 (39.9)	32 (38.1)	9 (56.3)	14 (56.0)	3 (75.0)	28 (35.4)
Post-operative complications						
Low-grade (CDS 0-II)	115 (61.2)	51 (60.7)	12 (75.0)	14 (56.0)	1 (25.0)	47 (59.5)
High-grade (CDS III-IV)	73 (38.8)	33 (39.3)	4 (25.0)	11 (44.0)	3 (75.0)	32 (40.5)
Eating difficulties						
No	98 (52.1)	40 (47.6)	6 (37.5)	15 (60.0)	2 (50.0)	44 (55.7)
Yes	90 (47.9)	44 (52.4)	10 (62.5)	10 (40.0)	2 (50.0)	35 (44.3)

Values are number of patients and percentages within brackets unless specified; \*Average age (SD); <sup>†</sup>Groups are not mutually exclusive; CDS – Clavien-Dindo Score.

As the collection of exposure data was carried out by a research nurse in the patients' homes, missing data was minimal. On the other hand, selection bias could still have been introduced from those who were not reachable and those who declined participation into OSCAR. Another limitation could have resulted from misclassification of the exposure mainly owing to the use of a non-validated questionnaire for measurement of dumping symptoms. However, the OSCAR dumping questionnaire was piloted in a group of test patients and the face validity of the questions was considered good (data not shown). Moreover, in the absence of a well-validated questionnaire for measuring dumping symptoms, our tool has incorporated the segregation of early and late symptoms and a measure of intensity of the most common symptoms of dumping that is lacking in most existing questionnaires. Since the pathophysiology and clinical management of early and late dumping differ [8] they have been considered separately in this study for meaningful conclusions to be drawn regarding their association with HRQL. Another limitation of this study is the small number of patients in the exposure categories based on early or late dumping and its intensity, as well as missing variables from the clinical data. Our results should thereby be verified in larger studies when the sample size is bigger, and the statistical power enhanced. Another limitation is the lack of data regarding the extent of nutrition or dietitian support informing the patients how often to eat and what to eat after surgery to conservatively manage dumping symptoms and if this was associated with different results. Although it can be assumed that

majority of patients received dietitian support after surgery as part of the routine clinical process or as part of the enhanced recovery program for patient's follow-up after operation of which nutrition plays a major role.

There is increasing evidence for the prevalence of dumping syndrome following oesophagectomy [10]. A recent meta-analysis showed that a large proportion of patients reported dumping syndrome after oesophagectomy (60%), however results showed high heterogeneity in terms of sample size and only 4 studies were included in the meta-regression analysis [19]. In line with this, a recent systematic review showed a large variation in the incidence of dumping syndrome reported across studies (0–78%) [10]. Reasons for the large variation could be that the surgical techniques differed, as well as that different time-points of reporting dumping symptoms were used in the studies. Another reason for heterogeneity was the varied methods used to measure dumping. Few studies have categorised dumping according to intensity, based on the level of management they required [10]. In the present study, symptoms were categorised according to early or late onset and graded according to self-reported intensity. Thereby, the prevalence of dumping symptoms and their intensity in our study population are not comparable to earlier studies owing to the high heterogeneity that exists in literature in terms of the above-mentioned factors. To the best of our knowledge none of the previous studies have linked the influence of dumping symptoms after oesophagectomy to HRQL, making this study the first to explore this association.



**Fig. 3.** Panel figure of association between dumping symptoms and HRQL assessed at one and half years after surgery for oesophageal cancer. (a) Line graph of adjusted mean scores (x axis) of functional scales, global QOL scale and summary score of HRQL (y axis) between moderate early dumping, severe early dumping and no dumping; (b) Spider graph of MDs in functional scales, global QOL scale and summary score of HRQL between moderate early dumping – no dumping and severe early dumping – no dumping; (c) Line graph of adjusted mean scores (x axis) of functional scales, global QOL scale and summary score of HRQL (y axis) between moderate late dumping, severe late dumping and no dumping; (d) Spider graph of MDs between moderate late dumping – no dumping and severe late dumping – no dumping, ANCOVA model was used to compare the HRQL scores of the reference group (no dumping) with the two exposure groups (moderate/severe early and late dumping) adjusted for sex (Male/Female), average age at operation, pre-operative BMI ( $\leq 25 / > 25$ ), co-morbidities (Charlson score 0/1/>2), tumour location (Upper and Middle/Lower and Cardia-Siewert II/III), tumour histology (Adenocarcinoma and Dysplasia/Squamous cell carcinoma), neo-adjuvant therapy (Yes/No), type of operation (Minimally invasive/Hybrid thoracoscopic/laposcopic/Open oesophagectomy), post-operative tumour stage (I/II/III-IV), post-operative complications (Low grade – Clavien Dindo Score 0-II/High grade – Clavien Dindo Score III-IV) and eating difficulties (No/Yes). HRQL – Health related quality of life; QOL – Quality of life; MDs – Mean score differences; ▲ Statistically significant at  $p < 0.05$ ; Medium clinical relevance as per evidence based guidelines compared to reference exposure group; ● Statistically significant at  $p < 0.05$ ; Large clinical relevance as per evidence based guidelines compared to reference exposure group.

The mechanisms underlying dumping as a syndrome following oesophagectomy remain poorly understood. Amongst patient related factors, one other study found higher prevalence of dumping in younger patients [20]. Similarly, in our study patients with late dumping with severe intensity were significantly younger than those with moderate intensity of late dumping or no dumping. The reasons behind the higher prevalence of late dumping in younger patients need further investigation. Some surgical factors are believed to increase the risk of post-oesophagectomy dumping, including pyloric drainage [21,22] and vagotomy [23,24].

In early dumping rapid fluid shifts occur from the plasma compartment into the intestinal lumen owing to the hyper osmolality of the food, resulting in hypotension and a sympathetic nervous-system response. On the other hand, late dumping usually occurs 1–3 h after a meal and is a result of an incretin-driven hyper insulinemic response after carbohydrate ingestion. Gastrointestinal hormones are also believed to have a role in dumping by mediating responses to surgical resection [8]. The association of severe intensity of early dumping with a reduced global QOL, social, cognitive and emotional function in the present study may be explained with the above-mentioned factors. For late dumping symptoms, both moderate and severe intensities were related to poorer cognitive and emotional function. Additionally, for moderate late dumping summary HRQL score, global QOL, role function and social function were as well worse. Eating may become a burden and an unpleasant experience because of the dumping-related symptoms. The symptoms can be emotionally distressing, leading to anxiety and apprehension. Neuroglycopenic symptoms such as difficulty concentrating and confusion induced by the reactive hypoglycemia are likely to restrict cognitive function [9]. The distressing symptoms are thus likely to interfere with everyday role function. The neuroglycopenic symptoms such as fatigue, weakness, confusion, tachycardia distinct to late dumping symptoms may have a worse impact on patients' HRQL even if present in moderate intensity as indicated by the results of the present study.

Management of dumping syndrome based on early or late onset and its intensity in patients who undergo oesophageal surgery has been suggested [9]. The first line of management consists of advocating dietary behavior modifications such as dividing the total energy intake into smaller portions (6 meals per day) or delay liquid intake until up to 30 min after a meal. Dietary measures to prevent late dumping symptoms such as avoiding rapidly absorbable carbohydrates specially and conservatively manage symptoms of hypovolemia by lying down for 30 min after a meal to prolong gastric emptying are also encouraged. The secondary stage is pharmaceuticals such as acarbose as a measure for patients with hypoglycemia or dietary supplements such as guar gum or pectin to slow gastric emptying by increasing viscosity of food, somatostatin analogs are the most effective medical therapy for dumping syndrome, and a slow-release preparation is the treatment of choice. The third line of management is surgical interventions for patients with treatment-refractory dumping syndrome, or continuous enteral feeding can be considered, but the outcomes of such approaches are variable [8,9].

There is an underlying need to consider dumping syndrome as a clinical complication following oesophagectomy for cancer that is objectively diagnosed and managed as suggested. Although certain surgical approaches are related to fewer dumping symptoms, they are reported in only a small number of studies with both methodological heterogeneity and often contradictory findings. This limits the conclusions that can be drawn. Therefore, there is a need for sufficiently powered studies on surgical risk factors for dumping syndrome to be able to identify surgical methods associated with lower risk for dumping in the future. Moreover, future studies should also focus on exploring the severity of dumping symptoms

as a risk factor for weight development since weight loss is a central problem for some patients after surgery for oesophageal cancer [25–27].

In conclusion, this study is the first to our knowledge that focuses on how dumping symptoms influence HRQL after surgery for oesophageal cancer. The results are of great clinical importance as they identify dumping symptoms as one of the contributing factors for the reduced HRQL. Furthermore, the results highlight the importance of additional dietary counselling to those patients who have dumping symptoms and the need for medical support to help them manage the symptoms.

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## Conflict of interest

None declared.

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Not applicable.

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