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Original Article

Fit-for-Discharge Criteria after Esophagectomy: An International Expert Delphi Consensus

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SUMMARY. **There are no internationally recognized criteria available to determine preparedness for hospital discharge after esophagectomy. This study aims to achieve international consensus using Delphi methodology. The expert panel consisted of 40 esophageal surgeons spanning 16 countries and 4 continents. During a 3-round, web-based Delphi process, experts voted for discharge criteria using 5-point Likert scales. Data were analyzed using descriptive statistics. Consensus was reached if agreement was ≥75% in round 3. Consensus was achieved for the following basic criteria: nutritional requirements are met by oral intake of at least liquids with optional supplementary nutrition via jejunal feeding tube. The patient should have passed flatus and does not require oxygen during mobilization or at rest. Central venous catheters should be removed. Adequate analgesia at rest and during mobilization is achieved using both oral opioid and non-opioid analgesics. All vital signs should be normal unless abnormal preoperatively. Inflammatory parameters should be trending down and close to normal (leucocyte count ≤12G/l and C-reactive protein ≤80 mg/dl). This multinational Delphi survey represents the first expert-led process for consensus criteria to determine 'fit-for-discharge' status after esophagectomy. Results of this Delphi survey may be applied to clinical outcomes research as an objective measure of short-term recovery. Furthermore, standardized endpoints identified through this process may be used in clinical practice to guide decisions regarding patient discharge and may help to reduce the risk of premature discharge or prolonged admission.**

KEY WORDS: **esophagectomy, hospital stay, discharge criteria, Delphi consensus.**

INTRODUCTION

Esophagectomy for cancer is a complex surgical procedure that involves significant surgical trauma and causes substantial physiological alterations. Recovery is often prolonged depending on perioperative complications, mobilization and food intake, the individual patient's physical fitness and psychological well-being.

Consequently, many recent innovations in esophageal surgery—such as minimally invasive approaches[1,2], pre-habilitation[3,4], and enhanced recovery (ERAS) programs[5,6]—were introduced to reduce surgical morbidity and improve postoperative recovery. However, there is a paucity of literature pertaining to validated parameters that can be used to help define the multifaceted process of short-term recovery. Instead, surgical outcomes research often relies on the length of postoperative hospital stay (LOS) as surrogate endpoint, because it reflects both postoperative morbidity and cost and is readily available even in retrospective study designs.[7,8] Conversely, LOS rarely reflects the true time frame of short-term recovery and is an unreliable measure owing to the varying discharge policies. Furthermore, hospital discharge must be interpreted in light of available support, namely family, ambulatory nursing, and rehabilitation. Consequently, comparison of postoperative recovery between different institutions remains challenging and has a relevant impact on outcomes research pertaining to multi-center, and particularly multi-national studies.[1,9]

To overcome this problem, standardized criteria indicating readiness for hospital discharge have recently been devised and validated for colorectal surgery.[10] As similar measures are not currently available for esophagectomy, this study aims to bridge this gap by developing appropriate discharge criteria using an expert Delphi consensus process. The discharge criteria may serve as an objective measure of short-term recovery and may help to render postoperative hospital stay comparable between different institutions in future outcomes research. In addition, the criteria may be used to guide decisions regarding patient discharge, potentially helping to reduce the risk of premature discharge or prolonged hospitalization.

MATERIALS AND METHODS

Expert panel

Inclusion criteria for invited experts were 1) ≥10 years of esophagectomy experience, 2) an institutional caseload of ≥30 esophagectomies per year, and 3) a specialty interest in upper-gastrointestinal surgery as evidenced by recent publications in the field. To ensure the study was as representative as possible, members of three international medical societies focusing on esophageal disease were invited to contribute: The International Society for Diseases of the Esophagus, the European Society for Diseases of the Esophagus, and the World Organization for Specialized Studies on Diseases of the Esophagus.

In addition, experts from a collaborative group of European surgeons with a specific focus on minimally invasive esophagectomy (MIO Think Tank) were also invited. Experts were contacted via email containing the study protocol, the expected number of Delphi rounds, and the anticipated time commitment.

Preselection of criteria

As a first step, the lead authors (P.C.M, J.R.K, and C.A.G) screened all available literature in May 2019 via PubMed using the following search terms: hospital discharge, discharge criteria, esophagectomy, surgery, and hospital stay. From this search[7–10] (7-10), general domains of criteria potentially influencing recovery from surgery (nutrition, respiratory function, etc.) were adapted to address the specific clinical scenario following esophagectomy (Fig. 1). During the ensuing Delphi process, participants established endpoints for the above-mentioned domains, representing the completed 'ready-for-discharge' criteria.

Delphi survey

The lead authors selected a modified Delphi process using an online tool (SurveyMonkey, Palo Alto, CA, USA).[11–13] Throughout the Delphi survey, voting and commenting was conducted anonymously. After agreeing to participate, experts were provided with access to each Delphi round via secure, institute-to-institute email. In Delphi round 1, basic information on personal and institutional experience of participants was gathered (Supplementary File 2). In addition, experts were asked to comment on general domains indicating recovery and to vote on 5-point Likert scales (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree). Experts were also invited to define own criteria and to suggest changes to the wording for each domain. Three Delphi rounds were planned to build consensus.

After completion of each Delphi round, the lead authors adapted the results according to the expert's suggestions in order to create the next questionnaire. In Delphi rounds 2 and 3, the percentage of concordance (agree or strongly agree) and the median scores of the preceding rounds were visible, enabling experts to re-vote in consideration of previous results (Supplementary File 2). General domains of criteria not reaching consensus following round 2 (agreement <75%) were not included in round 3. For remaining domains in round 3, only the two highest voted endpoints from round 2 were included.

In Delphi rounds 2 and 3, experts were asked to define the leucocyte count and C-reactive protein level they considered 'close to normal' in the context of discharge after esophagectomy.

Experts were given 2 weeks to complete each round. Two reminders were sent, the first 1 week after opening and the second 2 days before closing of each round. Data collection took place from May 2019 to August 2019.

Data analysis

Consensus was defined if general domains and related criteria were agreed upon (strongly agree or agree) by ≥75% of experts in Delphi round 3.[14] Data were analyzed using descriptive statistics and expressed as percentage of agreement and median (IQR) for each domain and endpoint. In addition, median values (IQR) for inflammatory markers (leucocyte and C-reactive protein) were calculated, and cut-offs were defined as the 75th percentile of the median using SPSS version 26.0 (IBM Inc., Chicago, Ill, USA).

RESULTS

Expert panel

Fifty-seven experts were invited, of which 40 agreed to participate. Thirty-eight experts spanning 16 countries across 4 continents (Europe (74%), America (18%), Oceania (5%), Asia (3%)) completed all rounds of the survey (response rate 95%). All participants were specialist surgeons with a median (IQR) personal experience performing esophagectomy of 15 (11–22) years and an annual caseload of 35 (28–50) esophagectomies. Minimally invasive transthoracic esophagectomy with gastric pull-up and intrathoracic esophago-gastrostomy was the favored approach. ERAS programs were established in 71%, and 79% of experts discharged the majority (≥60%) of patients home. A detailed analysis is presented in Table 1.

Delphi survey

Ten general domains of criteria ('oral/enteral nutrition, lower-GI function, respiratory function, wound status,' 'wound drains, venous, and urinary catheters,' 'pain control, mobilization, and self-care,' 'vital signs, inflammatory markers, and upper-GI symptoms') were evaluated over the first two Delphi rounds. Apart from 'wound status' and 'upper-GI symptoms,' all domains reached agreement ≥75% after round 2 (Table 2). According to the participants' suggestions, two additional criteria ('adequate support after discharge and no clinical deterioration after reaching fit-for-discharge criteria') were introduced after Delphi round 1 (Supplementary Table 1).

For each general domain, experts suggested specific endpoints that were subsequently evaluated in Delphi rounds 2 and 3 (Supplementary Table 1). The wording of the criteria related to 'wound drains and catheters' was changed after round 2 according to the expert's suggestions. Although the domain 'mobilization and self-care' reached agreement ≥75%

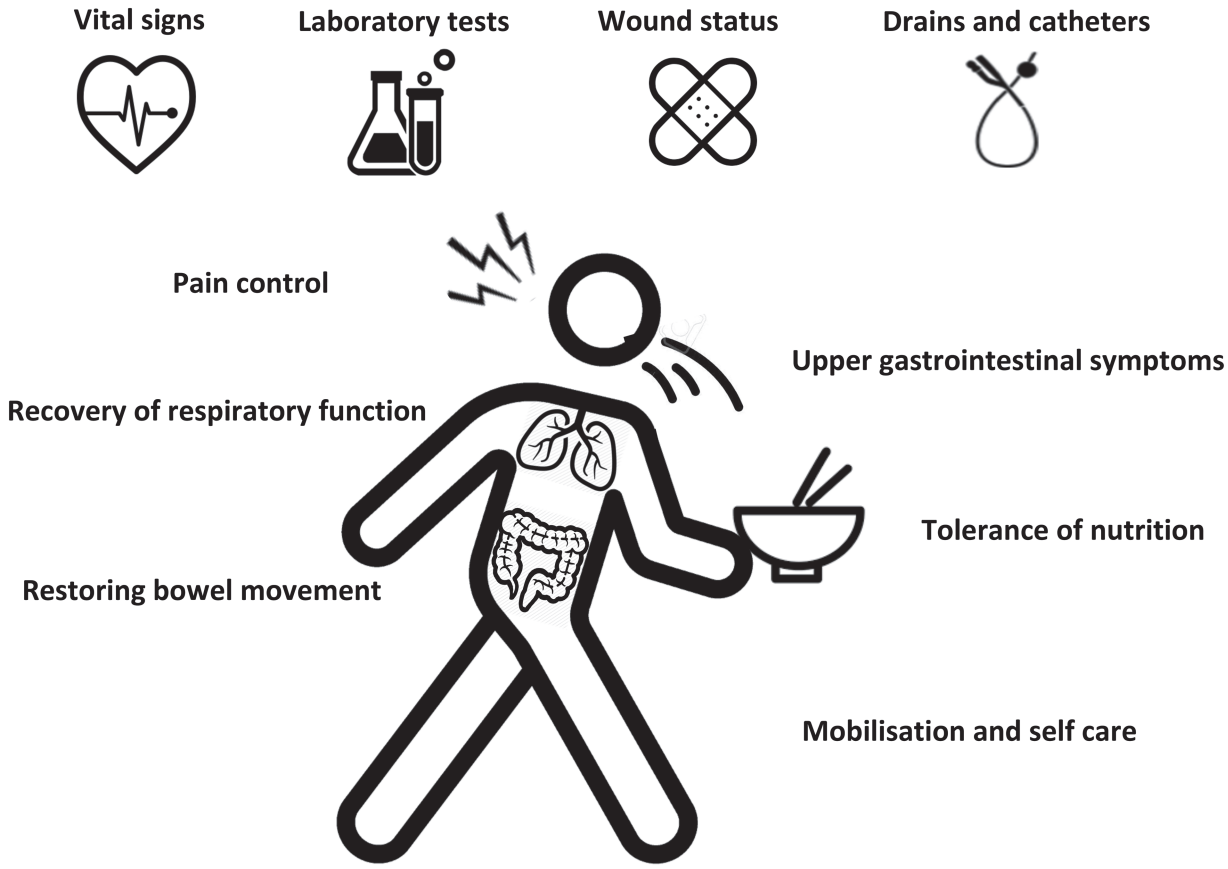

Fig. 1 General domains of criteria with the potential to influence hospital discharge decision-making following esophagectomy.

in rounds 1 and 2, no consensus was achieved for related endpoints in rounds 2 and 3. After Delphi round 3, nine criteria with ≥75% agreement constituted the final set of 'ready-for-discharge' criteria after esophagectomy (Table 3): 1) The patients' oral/enteral nutritional requirements are met by oral intake of at least liquids with optional supplementary nutrition via jejunal feeding tube. 2) The patient should have passed flatus. 3) The patient does not require oxygen during mobilization (short walk or climbing stairs) or at rest. 4) Central venous catheters should be removed before discharge. 5) Adequate analgesia at rest and during mobilization using both oral opioid and non-opioid analgesics. 6) All vital signs should be normal unless abnormal preoperatively. 7) Inflammatory parameters should be trending down and close to normal (leucocyte count ≤12G/l and C-reactive protein ≤80 mg/dl; assuming a stable and appropriate clinical context). 8) There should be adequate support after discharge (assistance by family, ambulatory nursing, or rehabilitation facility). 9) The patient does not experience clinical deterioration precluding discharge having already achieved 'fit-for-discharge' status.

The recommended upper thresholds for inflammatory markers at discharge ('close to normal' in the context of esophagectomy) were ≤ 12G/l for leucocyte count and ≤ 80 mg/dl for C-reactive protein, respectively (assuming a stable and appropriate clinical context).

DISCUSSION

Recovery from surgery is a complex process depending on type and invasiveness of the surgical procedure and the patient's physical and psychological resilience. The timeline of recovery involves an early phase during which return of normal organ function is attained and hospital discharge may be considered, and a later phase, defined by resolution of residual symptoms.[15] Complete recovery from major surgery may require several months[16] but even in the long term, postoperative changes in body physiology and anatomy may still impact on quality of life.[17]

In the context of increasing awareness regarding cost-efficiency in healthcare, the timing of discharge after surgery has become a key measurable outcome. After esophagectomy, previous research has demonstrated a readmission rate between 12 and 19%, with 60% of readmissions occurring during the first week after discharge. It is conceivable that some of these early readmissions are due to premature discharge and could be prevented by applying objective fit-for-discharge criteria.[18–21] From an economic perspective, the ideal discharge policy balances the

Table 1 Characteristics of the experts and their institutions

	Overall ($n=38$)		Europe ($n=29$)		America ($n=6$)		Australia ($n=2$)		Asia ($n=1$)	
Expert experience										
Experience after board exams, y	17	(13–22)	18	(12–22)	17	(14–41)	22	(16–27)	35	-
Experience in performing esophagectomy, y	15	(11–22)	14	(10–20)	22	(14–45)	22	(16–27)	30	-
Personal annual volume of esophagectomy	35	(28–50)	35	(29–50)	40	(33–58)	8	(6–10)	26	-
Institutional experience										
Annual volume of esophagectomy	60	(37–77)	60	(40–84)	68	(49–100)	20	(23–26)	45	-
Surgeons performing esophagectomy	3	(2–4)	3	(2–4)	3	(3–7)	5	(4–5)	3	-
Standardized 'fit-for-discharge' criteria	23	(62)	17	(59)	3	(50)	2	(100)	1	(100)
Established ERAS program	27	(71)	20	(69)	4	(67)	2	(100)	1	(100)
Patient discharge policy										
Home										
1–20%	3	(8)	3	(10)	0	(0)	0	(0)	0	(0)
21–40%	4	(11)	4	(14)	0	(0)	0	(0)	0	(0)
41–60%	1	(3)	1	(3)	0	(0)	0	(0)	0	(0)
61–80%	6	(16)	6	(20)	0	(0)	0	(0)	0	(0)
81–100%	24	(63)	15	(52)	6	(100)	2	(100)	1	(100)
Rehabilitation facility										
1–20%	25	(74)	18	(62)	6	(100)	1	(50)	0	(0)
21–40%	2	(6)	2	(7)	0	(0)	0	(0)	0	(0)
41–60%	3	(9)	3	(10)	0	(0)	0	(0)	0	(0)
61–80%	4	(12)	4	(14)	0	(0)	0	(0)	0	(0)
81–100%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Other hospital										
1–20%	19	(90)	15	(52)	3	(50)	1	(50)	0	(0)
21–40%	2	(10)	2	(7)	0	(0)	0	(0)	0	(0)
41–60%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
61–80%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
81–100%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Other institutions										
1–20%	17	(100)	14	(48)	2	(33)	1	(50)	0	(0)
21–40%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
41–60%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
61–80%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
81–100%	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Preferred surgical approach										
Thoracoscopic	25	(66)	18	(62)	4	(66)	2	(100)	1	(100)
Laparoscopic	27	(71)	21	(72)	4	(66)	1	(50)	1	(100)
Intrathoracic anastomosis	31	(82)	24	(83)	4	(66)	2	(100)	1	(100)
Gastric tube reconstruction	32	(84)	25	(86)	5	(83)	2	(100)	0	(0)
Two-field or two-1/2-field lymphadenectomy	34	(90)	26	(90)	5	(83)	2	(100)	1	(100)

Note: Data are presented as n (%) and median (IQR). Y: years.

Table 2 General domains of discharge

Category	Round 1		Round 2	
	Strongly agree and agree (%)	Median Likert score	Strongly agree and agree (%)	Median Likert score
Oral/enteral nutrition	97	5 (4–5)	9*	5 (5–5)
Lower-GI function	68	4 (3–5)	76*	4 (4–4)
Respiratory function	92	5 (4–5)	97*	5 (5–5)
Wound status	54	4 (2–4)	45	3 (3–4)
Drains and catheters	67	4 (3–5)	79*	4 (4–4)
Pain control	100	5 (4–5)	100*	5 (5–5)
Mobilization and self-care	89	4 (4–5)	95*	5 (4–5)
Vital signs	95	5 (4–5)	100*	5 (5–5)
Inflammatory markers	78	4 (4–5)	92*	4 (4–4)
Upper-GI symptoms	59	4 (3–4)	50	4 (3–4)
Support after discharge			89*	5 (4–5)
No clinical deterioration after achieving «fit-for-discharge'> > status.			91*	5 (4–5)

*Consensus achieved (≥75% of the experts agree/strongly agree). Values expressed as % or median (IQR).

risk of premature discharge, particularly in light of the high costs of readmission, against the costs of an unnecessarily prolonged hospitalization. In addition, patient discharge within a certain time frame is often considered an important marker of quality of care and can be used to rank performance amongst health care providers with the goal of transparency and competitiveness.

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Table 3 Final 'fit-for-discharge' criteria following esophagectomy

Domain	Endpoint
Oral/enteral nutrition	The patients' oral/enteral nutritional requirements are met by oral intake of at least liquids with optional supplementary nutrition via jejunal feeding tube.
Lower-GI function	The patient should have passed flatus.
Respiratory function	The patient does not require oxygen during mobilization (short walk or climbing stairs) or at rest.
Drains and catheters	Central venous catheters should be removed before discharge (unless present preoperatively).
Pain control	Adequate analgesia at rest and during mobilization (pain score < 4 on a scale from 0 to 10) is achieved using both oral opioid and non-opioid analgesics.
Vital signs	All vital signs should be normal unless abnormal preoperatively.
Inflammatory markers	Inflammatory parameters should be trending down and close to normal (leucocyte count ≤12G/l and C-reactive protein ≤80 mg/dl).
Additional discharge criteria	There should be adequate support after discharge (assistance by family, ambulatory nursing, or rehabilitation facility). The patient does not experience clinical deterioration precluding discharge having already achieved 'fit-for-discharge' status.

In this context, one of the major challenges remains how to reliably measure short-term recovery from surgery. Many studies on ERAS programs have used the LOS—defined as the number of days from surgery until discharge—as an endpoint[22] for various reasons[23,24]: First, LOS can easily be gathered from electronic hospital records or insurance datasets, even in retrospective study designs. Second, LOS correlates closely with resource utilization and can be quantified in economic terms. Third, LOS not only impacts on patients, but also on their families, whose quality of life is perturbed by longer hospitalization.[23,25] In addition, continuous measures such as LOS generate greater statistical power than dichotomous or categorical outcomes.[26,27] On the other hand, LOS depends on many non-clinical factors such as local amenities, availability of rehabilitation, insurance status, post-discharge support, or even surgical traditions. In this context, it has been shown that even within studies focusing on ERAS pathways, most patients are not discharged immediately after clinical recovery.[9,22,28,29]

The present Delphi study has the potential to resolve this dilemma and to provide much-needed international consensus on useable and reliable criteria, which more objectively help determine preparedness for hospital discharge after esophagectomy, irrespective of local and national particularities. The 'fit-for-discharge' criteria are independent from specific local habits and protocols and should be easy to implement into clinical practice. However, while meeting these criteria may be sufficient for a safe discharge in the majority of patients, not meeting them is not necessarily a contradiction to discharge as the individual situation of the patient has to be considered. For instance, a preoperatively deconditioned patient may be ready for discharge before meeting the proposed criteria. A strength of this study is that only internationally renowned, high-volume surgeons from 16 countries and 4 continents were involved. Our participants were highly engaged in the survey as demonstrated by the excellent response rate and numerous comments throughout the process. In this regard, it appears that the opportunity to interact promoted engagement by giving some idea of group ownership to this project.[10,30]

Undeniably, our study also has some limitations. First, our experts were from high-volume institutions in developed countries, which may limit the external validity of our criteria to healthcare systems with similar resources. In addition, the study design exclusively reflects the surgeon's view and does not consider other stakeholder's perspectives. Indeed, we did not involve nursing staff, patients, or other medical specialties, because the early recovery of basic organ function after esophagectomy is typically overseen by the attending surgeon. Patient-reported outcomes such as quality of life are more important in long-term rehabilitation, and therefore beyond the scope of this study.

Other limitations that must be mentioned are inherent to the Delphi process itself. First, there is no published evidence regarding the threshold of agreement required to reach consensus.[10,30,31] Consistent with previous studies, we concluded that concordance of ≥75% would represent a reasonable cut-off for a given criterion to be accepted.[10,30,31] Second, statements with poor concordance were removed between rounds two and three, and we agree that this approach may have caused bias by preventing potential agreement for those items in the following rounds. Third, there are no generally accepted rules relating to the expert nomination process and the minimum number of participants required. Our strategy was to maximize representativeness, and therefore, we chose potential candidates among members of international societies with a focus on esophageal disease. Although we invited experts from Asia to participate to this study, they were underrepresented in the final cohort of experts. We are aware that this approach may be criticized because

it lacks formal transparency and reproducibility. To overcome this problem, others have recommended performing a systematic review of the literature to identify potential experts.[10,30] However, such a systematic approach carries the risk of underrepresenting potential candidates with less academic output or fail to identify experts whose scientific contributions have not been captured by the literature search.

In conclusion, this international Delphi survey among experts for esophageal surgery has identified a set of nine clinical criteria that delineate preparedness and serve as an objective measure of readiness for discharge after esophagectomy. We are confident that our criteria may be applicable in different ways: first, they may serve as an objective measure of short-term recovery after esophagectomy and may help to render LOS comparable between different institutions in future outcome research. Second, our endpoints may increase the efficiency of care after esophagectomy by rationalizing patient discharge. To evaluate whether our discharge criteria may improve discharge quality after esophagectomy and thus reduce the readmission rate, this expert group intends to follow-up with a multinational prospective study.

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