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# Intended and completed treatment pathways in non-metastatic oesophageal cancer treated with chemoradiotherapy: real-world survival and swallowing outcomes

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## Abstract

In oesophageal cancer, the treatment pathway intended at the start of chemoradiotherapy is not always the pathway ultimately completed, particularly when surgery depends on post-treatment reassessment. We retrospectively reviewed consecutive patients with non-metastatic oesophageal or gastro-oesophageal junction cancer planned for curative-intent concurrent chemoradiotherapy at AIIMS Bathinda between August 2023 and August 2025. Patients were classified by initial treatment strategy as definitive chemoradiotherapy or planned trimodality treatment with subsequent surgical evaluation. Overall survival, treatment delivery, completed pathway, reasons for non-surgery, pathological response and swallowing outcomes were assessed, with follow-up updated to March 2026.

Of 105 patients identified, 91 completed the planned radiotherapy course and were analysed. Seventeen (18.7%) were planned for definitive chemoradiotherapy and 74 (81.3%) for trimodality treatment. None of the definitive-chemoradiotherapy group underwent surgery. Among the 74 patients initially planned for trimodality treatment, 21 (28.4%) underwent surgery, and 53 (71.6%) did not; the most common reasons were failure to return after chemoradiotherapy (39.6%), disease progression or unresectability (22.6%), and declining surgery (18.9%). All 91 patients completed 50.4 Gy in 28 fractions, and 90 (98.9%) received concurrent chemotherapy, predominantly weekly paclitaxel–carboplatin. Pathological complete response (ypT0N0) was observed in 15 of 21 operated patients (71.4%). At data cut-off, 31 deaths had occurred; median follow-up among survivors was 12.6 months (IQR, 10.5–20.4), median overall survival was 23.5 months and 1- and 2-year overall survival were 72.5% and 48.0%, respectively. Among 60 surviving patients with evaluable swallowing outcomes, median dysphagia grade improved from 3 to 1, with 55 (91.7%) improving by at least one grade. Intended and completed treatment pathways frequently diverged in routine practice; reporting both provides a more meaningful context for interpreting real-world outcomes, without implying equivalence between surgical and non-surgical strategies.

**Keywords:** *oesophageal cancer*, *chemoradiotherapy*, *treatment pathways*, *real-world outcomes*, *overall survival*, *dysphagia*

Research

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## Background

Oesophageal cancer remains a major global health problem because its mortality is disproportionately high in relation to its incidence. According to GLOBOCAN 2022 estimates, oesophageal cancer was the 11th most commonly diagnosed cancer worldwide and the 7th leading cause of cancer-related death, with approximately 510,716 new cases and 445,129 deaths in 2022 [1]. This high mortality reflects aggressive disease biology, late presentation, nutritional compromise and challenges in delivering multimodality treatment in routine practice.

Current guideline-based management of oesophageal cancer is stage-adapted and individualised according to histology, tumour location, resectability, patient fitness and institutional expertise [2]. For locally advanced non-metastatic disease, multimodality treatment is generally required. In resectable locally advanced oesophageal and gastro-oesophageal junction (GEJ) cancers, neoadjuvant chemoradiotherapy followed by surgery is an established standard for appropriately selected patients. In contrast, definitive concurrent chemoradiotherapy remains an accepted curative-intent option for patients with unresectable disease, medical inoperability, high surgical risk, or those who are unable or unwilling to proceed to surgery [2].

The evidence base for chemoradiotherapy has evolved over several decades. The RTOG 85-01 trial first established the superiority of concurrent chemoradiotherapy over radiotherapy alone in locally advanced oesophageal cancer, and its long-term follow-up confirmed durable survival benefit with combined-modality treatment [3,4]. Subsequently, the INT 0123 trial showed no survival advantage from escalating the radiotherapy dose beyond 50.4 Gy in definitive chemoradiotherapy [5]. More recently, the ARTDECO trial also failed to demonstrate improved local control or survival with dose escalation to 61.6 Gy [6]. Together, these data support approximately 50.4 Gy with concurrent chemotherapy as an evidence-based definitive chemoradiotherapy platform.

For patients suitable for surgery, the CROSS trial established neoadjuvant chemoradiotherapy with weekly paclitaxel and carboplatin followed by surgery as an effective treatment approach for resectable oesophageal or GEJ cancer [7]. Long-term follow-up confirmed durable survival benefit, supporting broad adoption of weekly paclitaxel–carboplatin-based chemoradiotherapy because of its efficacy, outpatient feasibility and acceptable tolerability [8].

However, the treatment pathway planned at diagnosis is not always the pathway ultimately completed. In routine practice, patients receiving curative-intent chemoradiotherapy comprise at least two clinically distinct groups: those treated with definitive chemoradiotherapy from the outset and those receiving chemoradiotherapy as part of an intended trimodality pathway followed by surgical reassessment. Among the latter, surgery may not ultimately occur because of disease progression or unresectability, medical unfitness, patient preference, failure to return for surgical follow-up, or logistical and access-related barriers. Consequently, analyses based only on eventual surgical status may obscure important differences in the treatment strategy initially intended.

This issue is particularly relevant in oesophageal squamous cell carcinoma. Randomised trials such as FFCD 9102 and the German study by Stahl et al. [10] showed that surgery after chemoradiotherapy improved local control but did not consistently translate into an overall survival advantage over chemoradiotherapy alone [9,10]. These trials demonstrate that selected patients can achieve durable outcomes with a non-operative chemoradiotherapy strategy, although their findings should not be extrapolated directly to patients initially planned for trimodality treatment who do not subsequently undergo surgery.

Interest in non-operative management has further increased with contemporary organ-preserving strategies. The SANO trial showed that active surveillance after clinical complete response to neoadjuvant chemoradiotherapy may be feasible in carefully selected and closely monitored patients [11]. Although this protocol-driven approach differs fundamentally from the situation of patients who do not proceed to surgery in routine practice, it illustrates the increasing interest in response-adapted organ-preserving strategies after chemoradiotherapy. The relevant real-world gap therefore extends beyond a simple surgery-versus-no-surgery comparison. Patients receiving curative-intent chemoradiotherapy may have been assigned to definitive treatment from the outset or may have entered treatment with an intended trimodality strategy but subsequently not undergone surgery. Distinguishing these initial treatment strategies is important when interpreting outcomes, particularly in settings where surgical completion may be influenced by disease evolution, medical fitness, patient choice, follow-up and access-related factors. During the study period, our institutional radiotherapy prescription was 50.4 Gy in 28 fractions for curative-intent chemoradiotherapy, including patients initially planned for subsequent surgical evaluation.

This treatment approach provided an opportunity to examine how initial treatment strategy related to the pathway ultimately completed in routine clinical practice. The present study therefore evaluated consecutive patients with non-metastatic oesophageal or gastro-oesophageal junction cancer treated with curative-intent concurrent chemoradiotherapy at a tertiary-care centre in India. We examined initial treatment strategy, completion of planned surgery and documented reasons for non-surgery, together with overall survival, treatment delivery, pathological response among operated patients and swallowing outcomes. Particular emphasis was placed on distinguishing patients treated with definitive chemoradiotherapy from those initially planned for trimodality treatment and on interpreting outcomes according to both the intended and completed treatment pathways.

## Methods

### *Study design and patients*

This retrospective cohort study was conducted in the Department of Radiation Oncology, All India Institute of Medical Sciences, Bathinda, India. Departmental radiotherapy records, treatment charts and hospital case files were reviewed to identify consecutive patients with non-metastatic carcinoma of the oesophagus, including gastro-oesophageal junction tumours, who were planned for curative-intent concurrent chemoradiotherapy between August 2023 and August 2025. At treatment initiation, patients were classified according to the documented initial treatment strategy as either definitive chemoradiotherapy or chemoradiotherapy delivered as part of a planned trimodality pathway with subsequent surgical evaluation. Patients were included in the final analysis if they had non-metastatic oesophageal or gastro-oesophageal junction carcinoma and completed the planned curative-intent radiotherapy course, with concurrent chemotherapy delivered wherever clinically feasible. Patients with metastatic disease on baseline staging, those treated with purely palliative radiotherapy schedules and those who did not initiate or complete the planned curative-intent radiotherapy course were excluded. Survival and functional follow-up were updated during final data collection in late February to early March 2026, with March 2026 used as the final data cut-off.

### *Baseline assessment*

Baseline clinical and disease-related variables were extracted from hospital records, endoscopy reports, imaging records and departmental radiotherapy documentation. All patients had histologically confirmed oesophageal or gastro-oesophageal junction carcinoma. Recorded variables included age, sex, anatomical tumour site, histology, tumour length, clinical T category, nodal status, AJCC stage group, baseline dysphagia grade and initial treatment strategy. Initial treatment strategy was classified from the documented pretreatment clinical plan as either definitive chemoradiotherapy or chemoradiotherapy within a planned trimodality pathway with subsequent surgical evaluation. Clinical staging was assigned according to the AJCC 8th edition of the staging system using available clinical, endoscopic and radiological information. Contrast-enhanced computed tomography of the thorax and abdomen was the most commonly used staging investigation, while positron emission tomography-computed tomography was performed in selected patients according to clinical indication, availability and feasibility.

### *Chemoradiotherapy*

All patients in the final cohort received curative-intent radiotherapy. During the study period, the standard institutional radiotherapy prescription was 50.4 Gy in 28 fractions for patients treated with definitive chemoradiotherapy as well as for those receiving chemoradiotherapy within a planned trimodality pathway. Concurrent chemotherapy was administered wherever clinically feasible. The preferred regimen was weekly paclitaxel 50 mg/m$^2$ with carboplatin dosed at an area under the curve of 2. In selected patients considered unsuitable for paclitaxel–carboplatin, concurrent capecitabine was used at the treating clinician's discretion.

The radiotherapy technique was selected according to departmental practice, target-volume geometry and organ-at-risk considerations. Three-dimensional conformal radiotherapy was used in most patients, while intensity-modulated radiotherapy or volumetric-modulated arc

therapy was used when clinically or dosimetrically indicated to improve target coverage or reduce dose to organs at risk. Image verification was performed using cone-beam computed tomography according to departmental protocol.

Treatment delivery and post-chemoradiotherapy pathway: Treatment feasibility and compliance were assessed from delivered treatment parameters, including radiotherapy dose, number of fractions completed, treatment technique, receipt and regimen of concurrent chemotherapy, number of chemotherapy cycles delivered, overall treatment time and completion of radiotherapy within 45 days. Overall treatment time was calculated from the first to the last day of radiotherapy.

After chemoradiotherapy, the completed treatment pathway was determined from institutional records. Patients were classified according to whether surgery was ultimately performed. Among patients initially planned for trimodality treatment who did not undergo surgery, the principal documented reason was categorised as disease progression or unresectability, medical unfitness or high surgical risk, patient refusal, failure to return or default after chemoradiotherapy or logistical/access-related factors.

Among operated patients, the interval from radiotherapy completion to surgery, baseline clinical stage and postoperative pathological findings were recorded from surgical and histopathology records. Pathological complete response was defined as the absence of viable residual tumour in both the resected primary specimen and sampled lymph nodes (ypT0N0). Receipt of adjuvant immunotherapy after surgery was also reviewed. For patients with documented disease progression during follow-up, available records were reviewed to identify subsequent systemic therapy, radiotherapy, combined treatment, supportive care or absence of further treatment.

## *Nutritional support and major treatment-related events*

Available treatment records were reviewed for documented nutritional interventions during chemoradiotherapy, including nasogastric/Ryle's tube placement, feeding jejunostomy and oesophageal stenting. Major treatment-related events requiring hospital admission or significant supportive management were also recorded where documented. Because systematic physician-graded toxicity data were not consistently available across the retrospective cohort, formal CTCAE-based toxicity grading was not performed; instead, only clearly documented major treatment-related events and hospitalisations were summarised descriptively.

## *Follow-up and dysphagia assessment*

Follow-up information was obtained from outpatient records, admission notes, treatment files and departmental documentation. Where institutional records were incomplete, structured telephonic follow-up with patients or primary caregivers was used to update survival and swallowing status. Survival status was classified as alive or deceased, and patients alive at last contact were censored at the date of last documented follow-up.

Swallowing function was assessed using a pragmatic 0–4 dysphagia grading system: grade 0, normal swallowing or no dysphagia; grade 1, difficulty swallowing solids; grade 2, semisolid intake only; grade 3, liquid intake only; and grade 4, complete dysphagia, including inability to swallow saliva. Dysphagia outcome was evaluated among surviving patients with available swallowing data by comparing the baseline grade with the grade recorded at the final dysphagia assessment. Improvement was defined as a reduction of at least one dysphagia grade. The interval from completion of chemoradiotherapy to the final dysphagia assessment was also calculated to characterise the duration of functional follow-up.

## *Study endpoints*

The primary endpoint was overall survival, defined as the time from initiation of radiotherapy to death from any cause or last known follow-up. One-year and 2-year overall survival estimates were derived using the Kaplan–Meier method. Secondary endpoints included treatment feasibility and compliance, initial treatment strategy and completed treatment pathway, receipt of surgery after chemoradiotherapy, documented reasons for non-surgery among patients initially planned for trimodality treatment, pathological response and adjuvant immunotherapy among operated patients, nutritional support during chemoradiotherapy, major treatment-related events or hospitalisations, subsequent treatment after documented disease progression and functional swallowing outcomes among surviving evaluable patients.

### *Statistical analysis*

Descriptive statistics were used to summarise baseline characteristics, treatment delivery, treatment pathways, surgical and pathological outcomes, nutritional support, major treatment-related events, subsequent treatment, dysphagia outcomes and survival data. Continuous variables were reported as median with interquartile range or mean with standard deviation, as appropriate, and categorical variables as frequencies and percentages. Between-group comparisons were performed using the chi-square test or Fisher's exact test for categorical variables and the independent-samples *t* test or Mann–Whitney U test for continuous variables, as appropriate.

Overall survival was estimated using the Kaplan–Meier method, and survival distributions were compared using the log-rank test. Change in dysphagia grade from baseline to the final dysphagia assessment was assessed using the Wilcoxon signed-rank test. Because of the limited number of deaths, an exploratory parsimonious multivariable Cox proportional hazards model was fitted to evaluate the association of selected baseline factors with overall survival. The model included age, expressed per 10-year increase, clinical AJCC stage group and initial treatment strategy. Stage II and definitive chemoradiotherapy were used as the reference categories. Adjusted hazard ratios with 95% confidence intervals were reported.

All analyses were two-sided, and $p$ values <0.05 were considered statistically significant. Missing data were handled using available-case analysis. No formal sample-size calculation was performed because this was a retrospective analysis of consecutive eligible patients treated during the study period. Statistical analyses were performed using IBM SPSS Statistics, version 25.



## Results

### *Study cohort and baseline characteristics*

A total of 105 patients with non-metastatic oesophageal or gastro-oesophageal junction cancer were identified as having been planned for curative-intent concurrent chemoradiotherapy during the study period. Fourteen patients were excluded because the planned curative-intent radiotherapy course was either not initiated or not completed, leaving 91 patients in the final analysis (Figure 1). Pretreatment clinicopathological characteristics are summarised in Table 1.

The median age was 60 years (IQR, 52–71), and 50 patients (54.9%) were female. Squamous cell carcinoma was the predominant histology, present in 86 patients (94.5%). Tumour location was upper thoracic/cervical in 17 patients (18.7%), middle thoracic in 35 (38.5%) and lower thoracic/gastro-oesophageal junction in 39 (42.9%). Clinical T category was T2 in 8 patients (8.8%), T3 in 54 (59.3%), T4a in 18 (19.8%) and T4b in 11 (12.1%). Nodal involvement was present in 63 patients (69.2%), and all patients had non-metastatic disease at baseline. Fifteen patients (16.5%) had stage II disease, 47 (51.6%) stage III and 29 (31.9%) stage IVA. The median tumour length was 5.5 cm (IQR, 4.0–7.6), with tumour length ≥8 cm in 21 patients (23.1%). Baseline dysphagia was present in all patients: grade 2 in 27 (29.7%), grade 3 in 56 (61.5%) and grade 4 in 8 (8.8%); overall, 64 patients (70.3%) had grade 3–4 dysphagia.

### *Initial treatment strategy and completed pathway*

At the start of treatment, 17 of 91 patients (18.7%) were planned for definitive chemoradiotherapy, whereas 74 patients (81.3%) were treated within an intended trimodality pathway with subsequent surgical evaluation. None of the 17 patients initially planned for definitive chemoradiotherapy subsequently underwent surgery. Among the 74 patients initially planned for trimodality treatment, 21 (28.4%) ultimately underwent surgery after chemoradiotherapy, while 53 (71.6%) did not proceed to surgery. Baseline characteristics according to initial treatment strategy are presented in Supplementary Table S1.

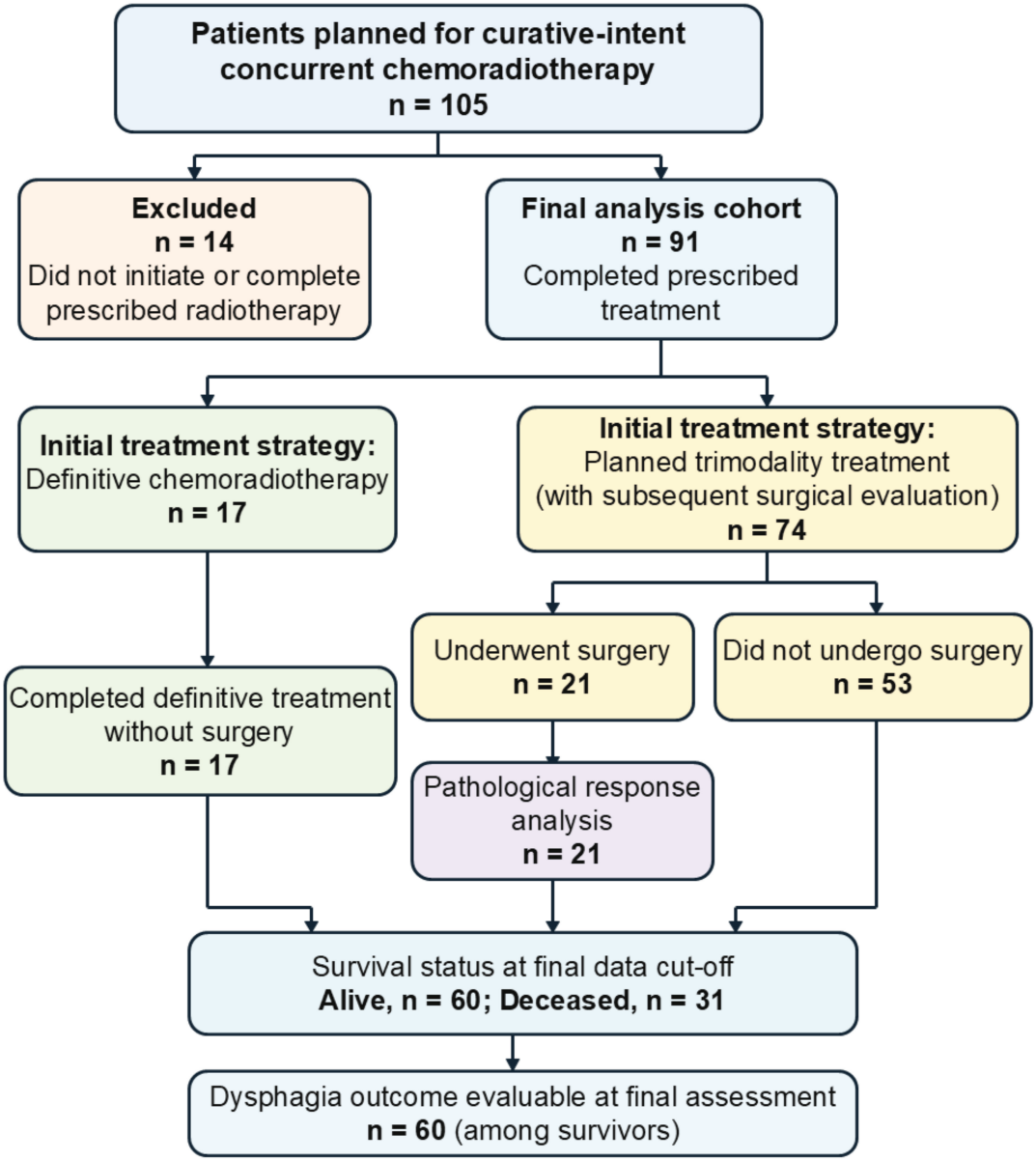



**Figure 1. Study flow diagram of the analysed cohort. Flow diagram showing patient screening, inclusion in the final analysis, initial treatment strategy and the treatment pathway ultimately completed. Of 105 patients planned for curative-intent concurrent chemoradiotherapy, 14 did not initiate or complete prescribed radiotherapy and were excluded. The final cohort comprised 91 patients who completed prescribed radiotherapy; 90 received concurrent chemotherapy, while one received radiotherapy alone. At treatment initiation, 17 patients were planned for definitive chemoradiotherapy and 74 for trimodality treatment with subsequent surgical evaluation. All 17 patients initially planned for definitive chemoradiotherapy completed definitive treatment without surgery. Among the 74 patients initially planned for trimodality treatment, 21 underwent surgery and 53 did not. Pathological response was evaluable in all 21 operated patients. At the final data cut-off, 60 patients were alive and 31 were deceased. Dysphagia outcomes were evaluable in all 60 surviving patients at the final assessment.**

**Table 1. Baseline clinicopathological characteristics of the overall cohort.**

| Variable | Overall cohort (*n* = 91) |
|---|---|
| Age, years, median (IQR) | 60 (52–71) |
| Sex, n (%) | |
| Male | 41 (45.1) |
| Female | 50 (54.9) |
| Histology, n (%) | |
| Squamous cell carcinoma | 86 (94.5) |
| Non-squamous/other histology | 5 (5.5) |
| Tumour site, n (%) | |
| Upper thoracic/cervical | 17 (18.7) |
| Middle thoracic | 35 (38.5) |
| Lower thoracic/gastro-oesophageal junction | 39 (42.9) |
| Clinical T stage, n (%) | |
| T2 | 8 (8.8) |
| T3 | 54 (59.3) |
| T4a | 18 (19.8) |
| T4b | 11 (12.1) |
| Node-positive disease, n (%) | 63 (69.2) |
| Overall clinical stage, AJCC 8th edition, n (%) | |
| Stage II | 15 (16.5) |
| Stage III | 47 (51.6) |
| Stage IVA | 29 (31.9) |
| Tumour length, cm, median (IQR) | 5.5 (4.0–7.6) |
| Tumour length ≥8 cm, n (%) | 21 (23.1) |
| Baseline dysphagia grade, n (%) | |
| Grade 2 | 27 (29.7) |
| Grade 3 | 56 (61.5) |
| Grade 4 | 8 (8.8) |
| Grade 3–4 dysphagia, n (%) | 64 (70.3) |

**Abbreviations:** GEJ, gastro-oesophageal junction; IQR, interquartile range.
All patients had baseline dysphagia grade ≥2
**Table legend:**
Baseline demographic and clinicopathological characteristics of the 91 patients with non-metastatic oesophageal or gastro-oesophageal junction cancer included in the analysis. Continuous variables are presented as median (IQR), and categorical variables as n (%)

## *Reasons for not undergoing surgery*

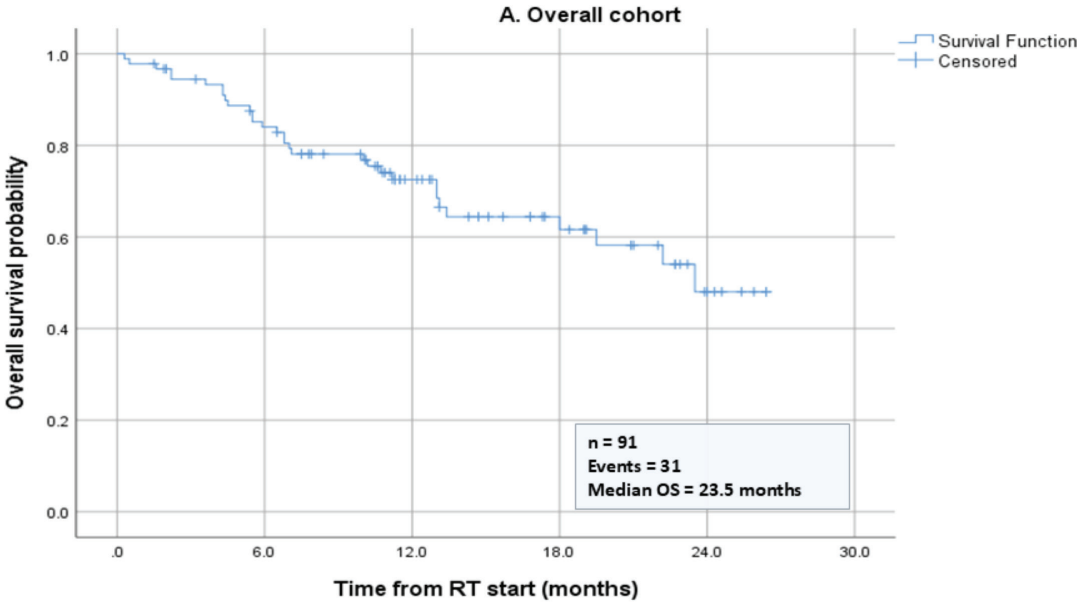
Among the 53 patients initially planned for trimodality treatment who did not proceed to surgery, the most common reason was failure to return or default after chemoradiotherapy, documented in 21 patients (39.6%). Disease progression or persistent unresectability accounted for 12 cases (22.6%), while 10 patients (18.9%) declined surgery. Six patients (11.3%) were considered medically unfit or at high surgical risk, and 4 patients (7.5%) did not proceed because of documented logistical or access-related factors.

## Overall survival

At the final data cut-off in March 2026, 31 deaths had occurred, and 60 patients were alive. Among surviving patients, the median follow-up duration from initiation of radiotherapy was 12.6 months (IQR, 10.5–20.4). The median overall survival for the entire cohort was 23.5 months. The estimated 1-year and 2-year overall survival rates were 72.5% (95% CI, 62.9%–82.2%) and 48.0% (95% CI, 31.0%–65.1%), respectively (Figure 2A ; Table 2).

## Exploratory survival according to ultimate surgical status

In an unadjusted exploratory analysis, the median overall survival was not reached among the 21 patients who underwent surgery; estimated 1-year and 2-year overall survival rates were 90.2% and 55.0%, respectively. Among the 70 patients who did not undergo surgery, median overall survival was 22.2 months, with estimated 1-year and 2-year overall survival rates of 66.9% and 47.1%, respectively. The difference between the two groups was not statistically significant on log-rank testing ($p$ = 0.110; Figure 2B). Because surgical status was determined after completion of chemoradiotherapy, this comparison is descriptive and is susceptible to selection and immortal-time bias.




| | | | | | |
|---|---|---|---|---|---|
| **Number at risk** | 0 | 6 | 12 | 18 | 24 |
| **Overall cohort** | 91 | 72 | 40 | 23 | 7 |

**Figure 2A. Overall survival in the entire cohort.**

**Kaplan–Meier curve showing overall survival from initiation of radiotherapy in the 91 patients included in the final analysis. Median overall survival was 23.5 months. Numbers below the curve indicate patients at risk at 0, 6, 12, 18 and 24 months**

**Table 2. Overall survival, treatment delivery, treatment pathways and key secondary outcomes following chemoradiotherapy.**

| Outcome | Result |
|---|---|
| Primary outcome: overall survival | |
| Median follow-up among survivors, months (IQR) | 12.6 (10.5–20.4) |
| Deaths, n/N (%) | 31/91 (34.1) |
| Median overall survival, months | 23.5 |
| 1-year overall survival, % | 72.5 (95% CI, 62.9–82.2) |
| 2-year overall survival, % | 48.0 (95% CI, 31.0–65.1) |
| Exploratory overall survival according to ultimate surgical status | |
| Median OS, surgery group | Not reached |
| 1-year OS, surgery group, % | 90.2 |
| 2-year OS, surgery group, % | 55.0 |
| Median OS, no-surgery group, months | 22.2 |
| 1-year OS, no-surgery group, % | 66.9 |
| 2-year OS, no-surgery group, % | 47.1 |
| Surgery versus no-surgery OS comparison | Log-rank $p = 0.110$ |
| Treatment feasibility and compliance | |
| Completed 50.4 Gy radiotherapy, n/N (%) | 91/91 (100) |
| 3D-CRT, n/N (%) | 59/91 (64.8) |
| IMRT/VMAT, n/N (%) | 32/91 (35.2) |
| Received concurrent chemotherapy, n/N (%) | 90/91 (98.9) |
| Weekly paclitaxel–carboplatin used, n/N (%) | 88/91 (96.7) |
| Concurrent capecitabine used, n/N (%) | 2/91 (2.2) |
| No concurrent chemotherapy, n/N (%) | 1/91 (1.1) |
| Concurrent chemotherapy cycles completed, median (IQR) | 4 (4–4) |
| Received ≥4 concurrent chemotherapy cycles, n/N (%) | 70/91 (76.9) |
| Overall radiotherapy treatment time, days, median (IQR) | 39 (37–43) |
| Completed radiotherapy within 45 days, n/N (%) | 82/91 (90.1) |
| Initial treatment strategy and completed treatment pathway | |
| Definitive chemoradiotherapy planned at treatment initiation, n/N (%) | 17/91 (18.7) |
| Planned trimodality treatment with subsequent surgical evaluation, n/N (%) | 74/91 (81.3) |
| Underwent surgery among planned trimodality patients, n/N (%) | 21/74 (28.4) |
| Did not undergo surgery among planned trimodality patients, n/N (%) | 53/74 (71.6) |
| Underwent surgery after initially planned definitive chemoradiotherapy, n/N (%) | 0/17 (0) |
| Reasons for non-surgery among patients initially planned for trimodality treatment ($n = 53$) | |
| Did not return/defaulted after chemoradiotherapy, n/N (%) | 21/53 (39.6) |
| Disease progression or unresectability, n/N (%) | 12/53 (22.6) |
| Patient declined surgery, n/N (%) | 10/53 (18.9) |
| Medically unfit/high surgical risk, n/N (%) | 6/53 (11.3) |
| Logistical/access-related factors, n/N (%) | 4/53 (7.5) |

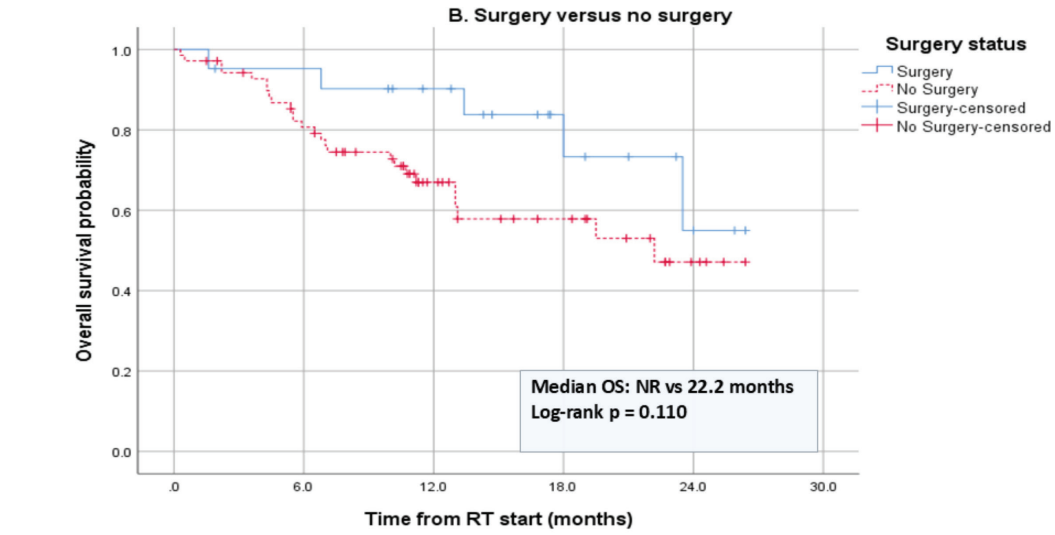
*Continued*

**Table 2. Overall survival, treatment delivery, treatment pathways and key secondary outcomes following chemoradiotherapy.** *Continued*

| Outcome | Result |
|---|---|
| Surgical and pathological outcomes among operated patients (*n* = 21) | |
| Interval from radiotherapy completion to surgery, days, median (IQR) | 84 (69–104) |
| Clinical stage II, n/N (%) | 4/21 (19.0) |
| Clinical stage III, n/N (%) | 10/21 (47.6) |
| Clinical stage IVA, n/N (%) | 7/21 (33.3) |
| Pathological complete response (ypT0N0), n/N (%) | 15/21 (71.4) |
| Residual pathological disease, n/N (%) | 6/21 (28.6) |
| Received adjuvant immunotherapy among patients with residual pathological disease, n/N (%) | 0/6 (0) |
| Supportive nutritional interventions during treatment | |
| No documented enteral or mechanical nutritional intervention, n/N (%) | 73/91 (80.2) |
| Nasogastric/Ryle's tube, n/N (%) | 9/91 (9.9) |
| Feeding jejunostomy, n/N (%) | 8/91 (8.8) |
| Oesophageal stent, n/N (%) | 1/91 (1.1) |
| Major treatment-related events | |
| Major event requiring hospitalisation or substantial supportive management, n/N (%) | 6/91 (6.6) |
| Severe dysphagia/dehydration, n/N (%) | 4/91 (4.4) |
| Febrile neutropenia, n/N (%) | 2/91 (2.2) |
| Functional swallowing outcomes | |
| Patients evaluable for final dysphagia outcome, n | 60 |
| Interval from chemoradiotherapy completion to final dysphagia assessment, months, median (IQR) | 11.2 (9.2–18.3) |
| Median dysphagia grade, baseline to final assessment | 3 to 1 |
| Improvement by ≥1 dysphagia grade, n/N (%) | 55/60 (91.7) |
| Grade 0–1 dysphagia at final assessment, n/N (%) | 47/60 (78.3) |
| Grade 0 dysphagia at final assessment, n/N (%) | 10/60 (16.7) |
| Grade 1 dysphagia at final assessment, n/N (%) | 37/60 (61.7) |
| Grade 2 dysphagia at final assessment, n/N (%) | 13/60 (21.7) |
| Grade 3–4 dysphagia at final assessment, n/N (%) | 0/60 (0) |

**Abbreviations:** 3D-CRT, three-dimensional conformal radiotherapy; CI, confidence interval; CRT, chemoradiotherapy; IQR, interquartile range; IMRT, intensity-modulated radiotherapy; OS, overall survival; RT, radiotherapy; VMAT, volumetric-modulated arc therapy.
The comparison of overall survival according to ultimate surgical status was exploratory and is susceptible to selection and immortal-time bias. Major treatment-related events are reported descriptively because systematic longitudinal CTCAE-based toxicity grading was not available in this retrospective cohort

**Table legend:** Summary of overall survival, treatment delivery, intended and completed treatment pathways, reasons for non-surgery, surgical and pathological outcomes, supportive nutritional interventions, major treatment-related events and functional swallowing outcomes following chemoradiotherapy. Overall survival was estimated using the Kaplan–Meier method. Dysphagia outcomes were assessed among surviving patients with an available final dysphagia assessment




| Number at risk | 0 | 6 | 12 | 18 | 24 |
|---|---|---|---|---|---|
| Surgery | 21 | 19 | 15 | 8 | 3 |
| No surgery | 70 | 53 | 25 | 15 | 4 |

**Figure 2B. Exploratory overall survival according to ultimate surgical status.**

**Kaplan–Meier curve comparing patients who ultimately underwent surgery after chemoradiotherapy with those who did not undergo surgery. Median overall survival was not reached in the surgery group and was 22.2 months in the no-surgery group; the difference was not statistically significant on log-rank testing ($p$ = 0.110). Numbers below the curve indicate patients at risk at 0, 6, 12, 18 and 24 months. This unadjusted comparison is exploratory and should be interpreted descriptively because ultimate surgical status was determined after initiation of chemoradiotherapy and is therefore susceptible to selection and immortal-time bias**



## *Exploratory multivariable Cox regression*

In a parsimonious multivariable Cox proportional hazards model including age, clinical stage and initial treatment strategy, none of the included baseline variables showed a statistically significant independent association with overall survival (Table 3). The adjusted hazard ratio was 1.08 per 10-year increase in age (95% CI, 0.82–1.44; $p$ = 0.578), 0.95 for stage III versus stage II (95% CI, 0.34–2.63; $p$ = 0.922), 0.97 for stage IVA versus stage II (95% CI, 0.33–2.88; $p$ = 0.952) and 2.16 for planned trimodality treatment versus definitive chemoradiotherapy (95% CI, 0.65–7.17; $p$ = 0.207). These estimates should be interpreted cautiously given the limited number of deaths and the small definitive-chemoradiotherapy subgroup.

## *Secondary outcomes*

- **Treatment delivery and compliance**

Treatment delivery data were available for all 91 patients. All patients completed the prescribed radiotherapy dose of 50.4 Gy in 28 fractions. Radiotherapy was delivered using three-dimensional conformal radiotherapy in 59 patients (64.8%), while 32 patients (35.2%) received IMRT/VMAT. Concurrent chemotherapy was administered to 90 patients (98.9%), most commonly weekly paclitaxel-carboplatin in 88 patients (96.7%); two patients received concurrent capecitabine and one patient received no concurrent chemotherapy. The median number

of concurrent chemotherapy cycles completed was 4 (IQR, 4–4), and 70 patients (76.9%) received at least four cycles. The median overall radiotherapy treatment time was 39 days (IQR, 37–43), with 82 patients (90.1%) completing radiotherapy within 45 days.

- **Surgery and pathological response**

Twenty-one patients ultimately underwent surgery after chemoradiotherapy, all of whom had been initially planned for trimodality treatment. At baseline, 4 of these patients had stage II disease, 10 had stage III disease and 7 had stage IVA disease. The median interval from completion of radiotherapy to surgery was 84 days (IQR, 69–104). Pathological complete response, defined as ypT0N0, was documented in 15 of 21 operated patients (71.4%), while residual pathological disease was present in 6 patients (28.6%). None of the six patients with residual pathological disease received adjuvant immunotherapy.

- **Nutritional support and major treatment-related events**

During chemoradiotherapy, no formal enteral intervention was documented in 73 patients (80.2%). Nutritional support included nasogastric/Ryle's tube placement in 9 patients (9.9%), feeding jejunostomy in 8 patients (8.8%) and oesophageal stenting in 1 patient (1.1%). Major treatment-related events or hospitalisations were documented in 6 patients (6.6%): 4 required admission or significant supportive management for severe dysphagia/dehydration, and 2 for febrile neutropenia. Because formal longitudinal CTCAE-based toxicity grading was not consistently available, these events are reported descriptively rather than as graded toxicity outcomes.

- **Treatment after disease progression**

Disease progression during follow-up was documented in 20 patients. Subsequent treatment information was available for 16 of these patients. Among patients with available treatment data, 10 (62.5%) received systemic therapy, 2 (12.5%) received radiotherapy alone and 4 (25.0%) received both systemic therapy and radiotherapy. Details of post-progression treatment were unavailable for the remaining 4 patients.

## *Functional swallowing outcomes*

Swallowing outcomes at the final dysphagia assessment were available for all 60 surviving patients. The median interval from completion of chemoradiotherapy to the final dysphagia assessment was 11.2 months (IQR, 9.2–18.3 months). Median dysphagia grade improved from grade 3 at baseline to grade 1 at the final assessment (Figure 3). Overall, 55 patients (91.7%) improved by at least one dysphagia grade, while 5 (8.3%) remained unchanged. At the final assessment, 10 patients (16.7%) had grade 0 dysphagia, 37 (61.7%) had grade 1 and 13 (21.7%) had grade 2; no surviving patient had grade 3 or 4 dysphagia. The improvement from baseline to the final assessment was statistically significant on Wilcoxon signed-rank testing ($Z=-6.615$, $p < 0.001$).

**Table 3. Exploratory multivariable Cox regression analysis for overall survival.**

| Variable | Adjusted HR | 95% CI | *p* value |
|---|---|---|---|
| Age, per 10-year increase | 1.08 | 0.82–1.44 | 0.578 |
| Clinical stage | | | |
| Stage II | Reference | — | — |
| Stage III | 0.95 | 0.34–2.63 | 0.922 |
| Stage IVA | 0.97 | 0.33–2.88 | 0.952 |
| Initial treatment strategy | | | |
| Definitive chemoradiotherapy | Reference | — | — |
| Planned trimodality treatment | 2.16 | 0.65–7.17 | 0.207 |

**Abbreviations:** CI, confidence interval; HR, hazard ratio.

The exploratory multivariable Cox proportional hazards model included age, clinical AJCC stage group and initial treatment strategy. Age was modelled per 10-year increase. Stage II and definitive chemoradiotherapy were used as the reference categories. The analysis included 91 patients and 31 deaths. Ultimate surgical status was not included in the model because surgery occurred after treatment initiation and conventional modelling according to eventual surgical status would be susceptible to immortal-time and selection bias. Estimates should be interpreted cautiously given the limited number of events and the small definitive-chemoradiotherapy subgroup

**Table legend:**

Adjusted associations of selected baseline clinical factors with overall survival in the study cohort. Overall survival was calculated from initiation of radiotherapy to death from any cause or last known follow-up. No variable included in the exploratory model showed a statistically significant independent association with overall survival

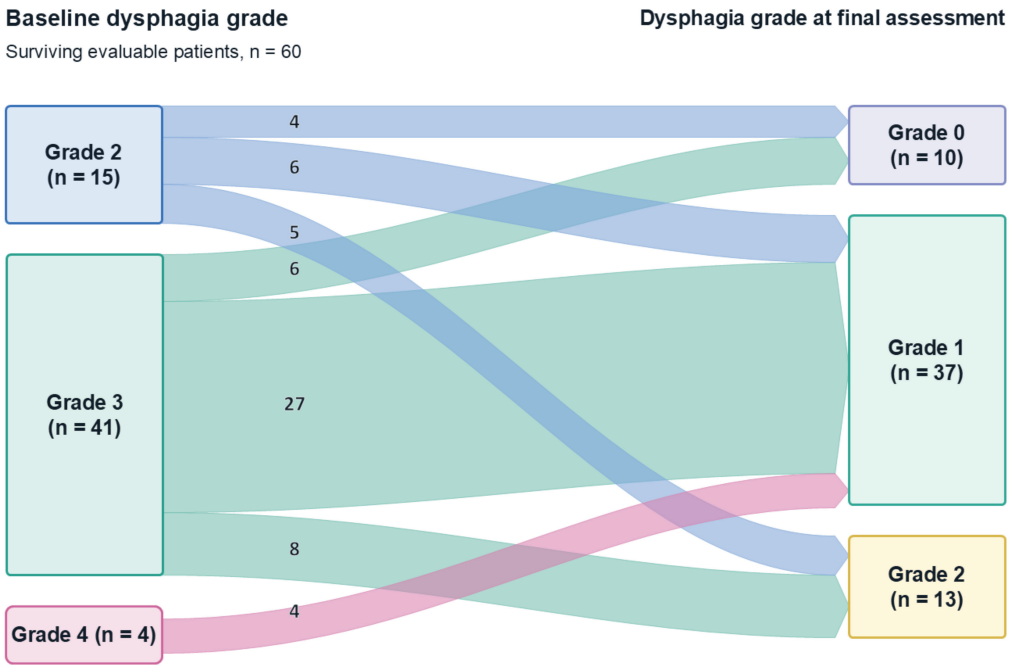



**Figure 3. Change in dysphagia grade from baseline to final assessment among evaluable survivors.**

**grade from baseline to the final assessment among 60 surviving evaluable patients. The median interval from completion of chemoradiotherapy to the final dysphagia assessment was 11.2 months (IQR, 9.2–18.3). Overall, 55 of 60 patients (91.7%) improved by at least one dysphagia grade, five (8.3%) remained unchanged and none worsened. At the final assessment, 10 patients had grade 0, 37 had grade 1 and 13 had grade 2 dysphagia; no patient had grade 3 or 4 dysphagia. The overall change was statistically significant on Wilcoxon signed-rank testing (Z=−6.615, $p < 0.001$)**

## Discussion

In this real-world cohort, the treatment pathway ultimately completed was frequently different from that intended at the start of chemoradiotherapy. Most patients were initially treated within a planned trimodality pathway, yet fewer than one-third of this group subsequently underwent surgery. Failure to proceed to surgery reflected a combination of failure to return for surgical follow-up, disease progression or unresectability, patient preference, medical inoperability and access-related factors. A smaller group was treated with definitive chemoradiotherapy from the outset, and none subsequently underwent surgery. Despite these heterogeneous pathways, curative-intent chemoradiotherapy was deliverable in most patients, overall survival remained clinically meaningful and substantial improvement in swallowing was observed among evaluable survivors. The exploratory adjusted analysis did not identify a significant independent association between overall survival and age, clinical stage or initial treatment strategy. These findings primarily describe how intended and completed treatment pathways diverge in routine practice and should not be interpreted as establishing equivalence between surgical and non-surgical treatment strategies.

A central strength of this analysis is the distinction between the treatment strategy intended at baseline and the pathway ultimately completed. Classifying patients only according to whether surgery was eventually performed can combine clinically different situations: patients selected for definitive chemoradiotherapy from the outset and patients initially considered for trimodality treatment who subsequently do

not reach surgery. In the present cohort, the latter group was substantial, and the reasons extended beyond disease progression to include medical unfitness, patient choice, failure to return for surgical follow-up and access-related factors. This distinction is particularly relevant in routine practice, where treatment pathways may evolve after chemoradiotherapy and where eventual surgical status alone may not adequately represent the clinical intent at treatment initiation. Reporting both the intended and completed pathways therefore provides a more clinically interpretable description of real-world care.

The distinction between intended and completed treatment pathways also has implications for how radiotherapy dose is interpreted in this cohort. All patients received 50.4 Gy in 28 fractions, including those initially planned for subsequent surgical evaluation. This dose is consistent with an established definitive chemoradiotherapy platform, supported by the historical RTOG experience and by trials showing no clear benefit from escalation beyond conventional definitive doses [3–6]. In the present study, however, the use of 50.4 Gy across both treatment strategies should be viewed as an institutional treatment approach rather than evidence that a definitive-dose schedule should routinely replace standard neoadjuvant regimens. Its relevance in this cohort is that patients who ultimately did not proceed to surgery had nevertheless completed a curative-intent chemoradiotherapy course of definitive-dose intensity. The feasibility of weekly paclitaxel–carboplatin in the present cohort is also consistent with previous definitive chemoradiotherapy series using this regimen [12–16].

The surgical outcomes require particularly cautious interpretation. All 21 patients who underwent resection had been initially treated within a planned trimodality pathway, consistent with the established role of neoadjuvant chemoradiotherapy followed by surgery in appropriately selected patients [7,8]. However, patients who ultimately reached surgery represented a selected subgroup: they had to survive the interval after chemoradiotherapy, remain medically fit, retain technically resectable disease and continue to be willing and able to undergo surgery. The observed comparison between operated and non-operated patients is therefore vulnerable to both selection bias and immortal-time bias and cannot be interpreted as demonstrating a causal survival advantage from surgery. The pathological complete response rate of 71.4% should be viewed in the same context. Its denominator comprises only the 21 patients selected for resection after chemoradiotherapy, in a cohort predominantly composed of squamous-cell carcinoma, rather than all patients receiving chemoradiotherapy. Accordingly, this high pathological response rate is likely influenced by post-treatment selection and should not be interpreted as the expected response rate for the entire study population. Randomised studies in oesophageal squamous-cell carcinoma have similarly shown improved local control with surgery after chemoradiotherapy without a consistent overall survival advantage [9,10], underscoring the need to avoid drawing causal conclusions from the present non-randomised comparison.

The presence of residual pathological disease after neoadjuvant chemoradiotherapy and surgery also has implications for contemporary postoperative management. The CheckMate 577 trial established adjuvant nivolumab as a standard option for patients with residual pathological disease after neoadjuvant chemoradiotherapy and R0 resection, demonstrating a substantial improvement in disease-free survival compared with placebo [17]. In the present cohort, six operated patients had residual pathological disease, and none received adjuvant immunotherapy. This should be considered when interpreting their subsequent outcomes, particularly because contemporary postoperative immunotherapy may modify recurrence risk and disease-free survival in this subgroup.

The improvement in swallowing provides an important functional complement to the survival findings. Dysphagia is a major determinant of nutritional status, treatment tolerance and quality of life in oesophageal cancer, particularly for patients who remain on a non-operative pathway. In the present cohort, most evaluable survivors experienced meaningful improvement in swallowing, and this benefit was sustained at a median of approximately 11 months after completion of chemoradiotherapy. Although these data were obtained from surviving patients with available follow-up and therefore remain subject to survivorship and ascertainment bias, the magnitude and persistence of improvement suggest that chemoradiotherapy provided clinically relevant symptomatic benefit in addition to disease control. Functional outcomes such as swallowing should therefore be considered alongside survival when evaluating real-world treatment pathways in oesophageal cancer.

The need for supportive care during chemoradiotherapy was relatively limited despite the high burden of baseline dysphagia. Enteral or mechanical nutritional support was required in a minority of patients, most commonly through nasogastric feeding or feeding jejunostomy, while oesophageal stenting was uncommon. Major treatment-related events requiring hospitalisation or substantial supportive management were documented in six patients, predominantly for severe dysphagia/dehydration or febrile neutropenia. These observations provide useful clinical context regarding treatment feasibility, although they should not be interpreted as formal toxicity rates because systematic longitudinal CTCAE grading was not available in this retrospective cohort. The findings nevertheless highlight the importance of nutritional assessment and early supportive intervention when delivering curative-intent chemoradiotherapy to patients presenting with significant swallowing impairment.

Subsequent treatment after disease progression may also have influenced overall survival in this retrospective cohort. Among patients with documented progression, most with available treatment information received systemic therapy, radiotherapy or both. Because post-progression management was not protocolised and progression-free survival endpoints were not systematically collected, the contribution of later lines of treatment to overall survival cannot be quantified reliably. Overall survival should therefore be interpreted as reflecting the entire subsequent clinical course rather than the effect of the initial chemoradiotherapy pathway alone.

The findings also have practical implications for centres managing oesophageal cancer in routine clinical settings. Patients initially planned for trimodality treatment may not ultimately reach surgery, and this possibility should be recognised early in the treatment pathway. Post-chemoradiotherapy reassessment should document response, operability, medical fitness, nutritional status, patient preference and, where surgery is not undertaken, the reason for deviation from the planned pathway. In addition, institutional audits should distinguish initial treatment intent from the treatment ultimately completed and should incorporate patient-centred outcomes such as swallowing function alongside conventional oncological endpoints. Such documentation may improve interpretation of real-world outcomes and help identify potentially modifiable barriers to completion of planned multimodality care.

### *Strengths and limitations*

This study provides a detailed real-world description of both intended and completed treatment pathways after chemoradiotherapy, with additional information on reasons for non-surgery, treatment delivery, pathological response, nutritional support and swallowing outcomes. The distinction between patients treated with definitive chemoradiotherapy from the outset and those initially planned for trimodality treatment is an important strength and improves interpretation of the observed outcomes. Several limitations, however, warrant emphasis. The retrospective, single-centre design introduces potential selection and information bias, and treatment decisions were not protocolised. In particular, patients who ultimately underwent surgery constituted a selected subgroup who had to survive to surgery, remain medically fit and retain resectable disease; consequently, comparisons according to ultimate surgical status are susceptible to both selection and immortal-time bias and should be considered descriptive rather than causal. The relatively small cohort and limited number of deaths constrained the precision of multivariable estimates, particularly within the definitive-chemoradiotherapy subgroup. Although reasons for non-surgery could be reconstructed from available records, their retrospective classification remains dependent on the completeness and accuracy of clinical documentation. Formal longitudinal CTCAE-based toxicity assessment was not feasible, and subsequent treatment after disease progression was not uniformly documented or protocolised. Swallowing outcomes were available among surviving patients at the final dysphagia assessment and are therefore subject to survivorship and ascertainment bias. Finally, the predominance of squamous-cell carcinoma and the single-institution setting may limit generalisability to populations with a higher proportion of adenocarcinoma or different treatment pathways.

### *Future directions*

Prospective studies should distinguish initial treatment intent from the pathway ultimately completed and should systematically capture reasons for deviation from planned surgery, post-chemoradiotherapy response, nutritional status, toxicity, subsequent treatment and patient-reported functional outcomes. Larger multicentre cohorts with longer follow-up would help define which patients are most likely to complete trimodality treatment and which factors predict transition to a non-operative pathway. Such data may also allow more robust time-dependent analyses of surgery and better assessment of the relationship between treatment pathway, disease control, swallowing function and survival.

## Conclusion

In this real-world cohort, the treatment pathway ultimately completed often differed from that intended at the start of chemoradiotherapy. A substantial proportion of patients initially planned for trimodality treatment did not proceed to surgery for a range of disease-, patient- and access-related reasons, while a separate group had been treated with definitive chemoradiotherapy from the outset. Despite this heterogeneity, curative-intent chemoradiotherapy was deliverable in most patients and was associated with meaningful survival and sustained improvement in swallowing among evaluable survivors. These findings should be regarded as hypothesis-generating and do not establish equivalence between surgical and non-surgical strategies. Prospective studies with structured pathway documentation and longer follow-up are needed to better define outcomes according to both intended and completed treatment pathways.

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## Conflicts of interest

The authors declare that they have no conflicts of interest.

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Nil.

## Prior presentation

The abstract of this study was presented as a poster at the European Society for Medical Oncology Gastrointestinal Cancers Congress (ESMO GI), Munich, Germany, July 2026.



## Author contributions

Nikhil Bathija, Jyoti Sharma, Rohit Mahajan and Anil Kumar Goel conceptualised the study and designed the methodology. Jyoti Sharma, Nikhil Bathija, Siva Ranjani, Mounika Sirimalla and Deep Shikha contributed to patient data collection, clinical data verification and database preparation. Gourav Kaushal contributed surgical data and interpretation of operative and pathological outcomes. Korukonda Vinod Kumar contributed to surgical data collection and verification and to the interpretation of surgical and pathological outcomes. Shilpa Jain contributed laboratory-related data support and verification where applicable. Sapna Marcus and Madhur Verma contributed to data interpretation, methodological guidance and critical review of the manuscript. Nikhil Bathija and Jyoti Sharma performed the primary analysis and drafted the initial manuscript. Rohit Mahajan, Anil Kumar Goel, Gourav Kaushal, Shilpa Jain, Madhur Verma and Deep Shikha critically revised the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript and agree to be accountable for the accuracy and integrity of the work.

## AI-assisted writing disclosure

AI-assisted tools were used only for language editing and formatting support. They were not used for data collection, statistical analysis, result generation or scientific interpretation. All content was reviewed and verified by the authors, who take full responsibility for the manuscript.

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## Supplementary methods

This supplementary appendix provides additional descriptive and exploratory analyses supporting the main manuscript. Baseline clinicopathological characteristics were compared according to the initial treatment strategy documented at the start of chemoradiotherapy: definitive chemoradiotherapy or planned trimodality treatment with subsequent surgical evaluation. Exploratory unadjusted overall survival estimates were generated for selected clinically relevant subgroups, including ultimate surgical status, tumour length, AJCC stage group, nodal status and overall radiotherapy treatment time. Survival estimates were generated using the Kaplan–Meier method and compared using log-rank tests. Continuous variables were compared using the Mann–Whitney U test, and categorical variables using the chi-square test or Fisher's exact test, as appropriate. Dysphagia transitions among surviving evaluable patients and detailed surgical and pathological findings among operated patients were also summarised. All subgroup analyses and associated P values were exploratory and were not adjusted for multiple comparisons.

## Supplementary results

Baseline clinicopathological characteristics according to initial treatment strategy are presented in Supplementary Table S1. Exploratory unadjusted subgroup overall survival estimates are summarised in Supplementary Table S2. Transitions in dysphagia grade from baseline to the final dysphagia assessment among evaluable survivors are presented in Supplementary Table S3. Baseline clinical stage, surgical timing, pathological response and postoperative pathological findings among operated patients, together with receipt of adjuvant immunotherapy among patients with residual disease, are presented in Supplementary Table S4.



**Supplementary Table S1. Baseline clinicopathological characteristics according to initial treatment strategy.**

| Variable | Definitive chemoradiotherapy (*n* = 17) | Planned trimodality treatment (*n* = 74) | *p* value |
|---|---|---|---|
| Age, years, median (IQR) | 60 (46–71) | 60 (52–70.8) | 0.756 |
| Sex, n (%) | | | 0.722 |
| Female | 10 (58.8) | 40 (54.1) | |
| Male | 7 (41.2) | 34 (45.9) | |
| Tumour site, n (%) | | | **<0.001** |
| Upper thoracic/cervical | 15 (88.2) | 2 (2.7) | |
| Middle thoracic | 2 (11.8) | 33 (44.6) | |
| Lower thoracic/GEJ | 0 (0) | 39 (52.7) | |
| Histology, n (%) | | | 0.579 |
| Squamous cell carcinoma | 17 (100) | 69 (93.2) | |
| Non-squamous histology | 0 (0) | 5 (6.8) | |
| Clinical T stage, n (%) | | | 0.729 |
| T2 | 2 (11.8) | 6 (8.1) | |
| T3 | 9 (52.9) | 45 (60.8) | |
| T4a | 3 (17.6) | 15 (20.3) | |
| T4b | 3 (17.6) | 8 (10.8) | |

*Continued*

**Supplementary Table S1. Baseline clinicopathological characteristics according to initial treatment strategy.** *Continued*

| Variable | Definitive chemoradiotherapy (*n* = 17) | Planned trimodality treatment (*n* = 74) | *p* value |
|---|---|---|---|
| Clinical N stage, n (%) | | | 0.425 |
| N0 | 3 (17.6) | 25 (33.8) | |
| N1 | 8 (47.1) | 27 (36.5) | |
| N2 | 6 (35.3) | 22 (29.7) | |
| AJCC stage group, n (%) | | | 0.473 |
| Stage II | 1 (5.9) | 14 (18.9) | |
| Stage III | 10 (58.8) | 37 (50.0) | |
| Stage IVA | 6 (35.3) | 23 (31.1) | |
| Tumour length, cm, median (IQR) | 5.7 (5.0–8.0) | 5.2 (4.0–7.2) | 0.206 |
| Tumour length category, n (%) | | | 0.209 |
| <8 cm | 11 (64.7) | 59 (79.7) | |
| ≥8 cm | 6 (35.3) | 15 (20.3) | |
| Baseline dysphagia grade, n (%) | | | 0.773 |
| Grade 2 | 4 (23.5) | 23 (31.1) | |
| Grade 3 | 12 (70.6) | 44 (59.5) | |
| Grade 4 | 1 (5.9) | 7 (9.5) | |

**Abbreviations:** AJCC, American Joint Committee on Cancer; GEJ, gastro-oesophageal junction; IQR, interquartile range.
Data are presented as median (interquartile range) or n (%), with percentages calculated within each initial treatment-strategy group. Initial treatment strategy was classified from the documented pretreatment plan as either definitive chemoradiotherapy or chemoradiotherapy delivered within a planned trimodality pathway with subsequent surgical evaluation. *P* values are exploratory and compare the two initial treatment-strategy groups. Continuous variables were compared using the Mann–Whitney U test; categorical variables were compared using the Pearson chi-square test or Fisher's exact test, as appropriate. *P* values were not adjusted for multiple comparisons

**Table legend:**
Baseline demographic and clinicopathological characteristics according to the treatment strategy documented at initiation of chemoradiotherapy. The table distinguishes patients planned for definitive chemoradiotherapy from those treated within an intended trimodality pathway with subsequent surgical evaluation. Bold *p* values indicate statistical significance at $p < 0.05$.

**Supplementary Table S2. Exploratory unadjusted subgroup overall survival estimates.**

| Comparison | Group | *n* | Deaths | Median OS, months (95% CI) | 1-year OS, % (95% CI) | 2-year OS, % (95% CI) | Log-rank *p*-value |
|---|---|---|---|---|---|---|---|
| Ultimate surgical status | Surgery | 21 | 5 | NR | 90.2 (77.3–100.0) | 55.0 (18.9–91.0) | 0.110 |
| | No surgery | 70 | 26 | 22.2 (NE) | 66.9 (55.2–78.7) | 47.1 (29.4–64.8) | |
| Tumour length | <8 cm | 70 | 24 | 23.5 (17.1–29.9) | 75.4 (64.9–86.0) | 44.0 (24.1–63.9) | 0.809 |
| | ≥8 cm | 21 | 7 | NR | 62.7 (40.6–84.9) | 62.7 (40.6–84.9) | |
| AJCC stage group | II–III | 62 | 21 | 22.2 (18.0–26.4) | 75.5 (64.3–86.7) | 36.8 (11.0–62.5) | 0.973 |
| | IVA | 29 | 10 | NR | 66.5 (48.3–84.6) | 59.8 (39.4–80.3) | |
| Nodal status | N0 | 28 | 10 | NR | 64.9 (46.1–83.7) | 55.6 (32.3–78.9) | 0.955 |
| | N-positive | 63 | 21 | 23.5 (15.9–31.1) | 75.8 (64.6–86.9) | 41.9 (18.3–65.6) | |
| Radiotherapy overall treatment time | ≤45 days | 82 | 28 | 23.5 (NE) | 72.0 (61.7–82.3) | 46.5 (28.1–64.9) | 0.864 |
| | >45 days | 9 | 3 | NR | 77.8 (50.6–100.0) | 62.2 (27.4–97.1) | |

**Abbreviations:** AJCC, American Joint Committee on Cancer; CI, confidence interval; NE, not estimable; NR, not reached; OS, overall survival.

Survival estimates were generated using the Kaplan–Meier method. *P* values were derived from log-rank tests. All subgroup analyses were exploratory and unadjusted. The comparison according to ultimate surgical status should be interpreted descriptively because it is susceptible to selection and immortal-time bias

**Supplementary Table S3. Transition in dysphagia grade from baseline to final dysphagia assessment among evaluable survivors.**

| Baseline dysphagia grade | Final grade 0 | Final grade 1 | Final grade 2 | Final grade 3 | Final grade 4 | Total |
|---|---|---|---|---|---|---|
| Grade 2 | 4 | 6 | 5 | 0 | 0 | 15 |
| Grade 3 | 6 | 27 | 8 | 0 | 0 | 41 |
| Grade 4 | 0 | 4 | 0 | 0 | 0 | 4 |
| Total | 10 | 37 | 13 | 0 | 0 | 60 |

**Abbreviation:** IQR, interquartile range.

Dysphagia outcomes were evaluable in all 60 surviving patients at the final assessment. The median interval from completion of chemoradiotherapy to the final dysphagia assessment was 11.2 months (IQR, 9.2–18.3). Overall, 55/60 patients (91.7%) improved by at least one dysphagia grade, and 5/60 (8.3%) remained unchanged; no patient experienced worsening of dysphagia. No patient had grade 3–4 dysphagia at the final assessment. The change in dysphagia grade from baseline to final assessment was statistically significant on Wilcoxon signed-rank testing ($Z=-6.615$, $p < 0.001$)

**Supplementary Table S4. Surgical and pathological findings among operated patients.**

| Variable | Operated patients (*n* = 21) |
|---|---|
| Baseline clinical stage | |
| Stage II | 4 (19.0%) |
| Stage III | 10 (47.6%) |
| Stage IVA | 7 (33.3%) |
| Surgery timing | |
| Interval from RT completion to surgery, days, median (IQR) | 84 (69–104) |
| Interval from RT start to surgery, days, median (IQR) | 127 (109–142) |
| Pathological response | |
| Pathological complete response (pCR; ypT0N0) | 15 (71.4%) |
| Residual pathological disease | 6 (28.6%) |
| Postoperative pathological T category | |
| ypT0 | 16 (76.2%) |
| ypT1 | 2 (9.5%) |
| ypT2 | 3 (14.3%) |
| Postoperative pathological N category | |
| ypN0 | 20 (95.2%) |
| ypN2 | 1 (4.8%) |
| Combined postoperative pathological category | |
| ypT0N0 | 15 (71.4%) |
| ypT1N0 | 2 (9.5%) |
| ypT2N0 | 3 (14.3%) |
| ypT0N2 | 1 (4.8%) |
| Postoperative systemic treatment | |
| Received adjuvant immunotherapy among patients with residual pathological disease | 0/6 (0%) |

**Abbreviations:** AJCC, American Joint Committee on Cancer; IQR, interquartile range; pCR, pathological complete response; RT, radiotherapy.

Data are presented as median (interquartile range) or n (%). Baseline clinical stage refers to pretreatment AJCC 8th edition stage. Pathological complete response was defined as ypT0N0. Separate ypT and ypN categories were derived from the recorded postoperative combined pathological categories. Percentages are calculated using the 21 operated patients as the denominator unless otherwise specified; receipt of adjuvant immunotherapy is reported among the six patients with residual pathological disease

**Table legend:**

Surgical timing, baseline clinical stage, postoperative pathological response, detailed ypT/ypN categories, and use of adjuvant immunotherapy among the 21 patients who underwent surgery after chemoradiotherapy