

Surgery for advanced thymic malignancies

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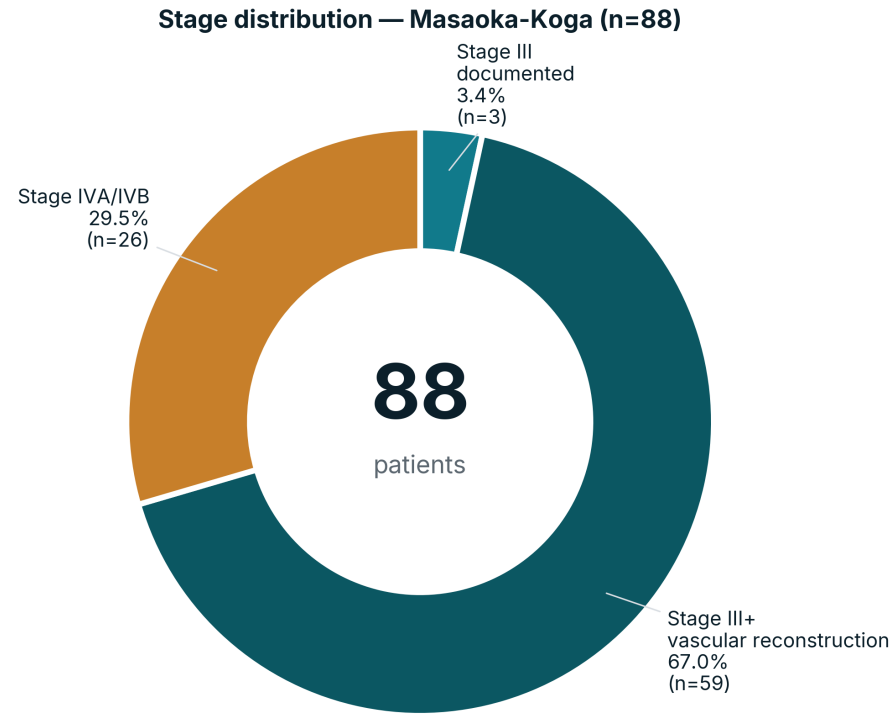
1. PATIENTS · MATERIALS AND METHODS

Advanced thymic malignancies challenge thoracic surgical practice. Stage III–IV disease typically extends to mediastinal vessels and pleura, and outcomes published in NCDB and national series are dominated by chemotherapy-led pathways. We report a contemporary single-centre **surgical-first** series in which extended resection, including **vascular reconstruction in two-thirds of cases**, has been pursued for selected advanced thymic malignancy, and compare outcomes with the leading published surgical and registry series.

Cohort at a glance

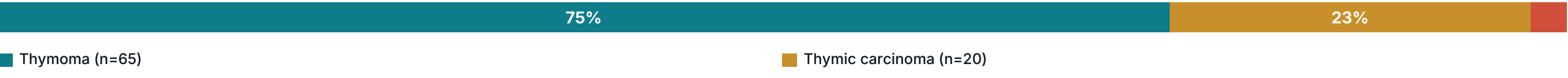


STAGE DISTRIBUTION (Masaoka–Koga, n=88)



Stage III+ vascular reconstruction dominates (67%); Stage IV 29.5%

HISTOLOGY (WHO) - CASE-LEVEL AUDIT



■ Thymoma (n=65)
■ Carcinoid / NET (n=2)

Re-audited case by case against pathology and MDT records (n=87); non-thymic histology and unconfirmed cases excluded.

Baseline characteristics

Variable	Value
n (patients)	88
Total procedures	98
Median age (yr, IQR)	56 (46–68)
Female	44 (50%)
Stage III / III+	62 (70%)
Myasthenia gravis	21 (24%)
Prior chemo/RT	33 (38%)
ECOG 0–1	82 (93%)

Methods · design

- Retrospective single-centre series Nov 2015 – Mar 2026 (Guy's & St Thomas').
- Inclusion: thymic epithelial and neuroendocrine malignancy undergoing curative-intent or extended resection; non-thymic histology (including lymphoma) excluded.
- Classification: patients undergoing vascular reconstruction or pleuro-pericardial dissemination classified as Stage III+.
- Endpoints: OS and DFS (primary); in-hospital mortality, CD II complications, R0 (secondary).
- Statistics: Kaplan–Meier with log-rank; multivariable Cox proportional-hazards; sensitivity by histology and stage.

Multivariable Cox model · predictors of OS

Covariate	HR	95% CI	p
Stage IV vs III+	3.42	1.11–10.5	0.032
Thymic carcinoma histology	4.10	1.03–16.4	0.045
Age (per decade)	1.28	0.86–1.90	0.22
R1/R2 vs R0	2.05	0.62–6.72	0.24
Neoadjuvant chemo	0.81	0.28–2.35	0.70

Stage and histology are the dominant survival drivers on adjusted analysis.

Surgical-first vs published Stage IV pathways (5-yr OS)



2. RESULTS · PERIOPERATIVE COMPLICATIONS AND EXTENT OF RESECTION

Findings

Peri-operative morbidity is concentrated in the Stage IV subgroup and driven by multi-visceral resection rather than vascular reconstruction itself. Open sternotomy remains the dominant access for extended cases; RATS is reserved for selected anterior mediastinal thymomas.

Peri-operative outcomes (n=98 procedures)

Outcome	n / N	%
In-hospital mortality	2 / 98	2.0%
30-day mortality	2 / 98	2.0%
CD II complications (all)	22 / 98	22.4%
CD II — Stage III+	11 / 65	16.9%
CD II — Stage IV	11 / 33	33.3%
ICU admission	71 / 98	72.4%
Median LOS (d)	—	8 (4–19)

Extent of resection · 98 procedures

Procedure / approach	n	%
Open sternotomy / thoracotomy	85	86.7%
RATS	11	11.2%
VATS	2	2.0%
Vascular reconstruction	59	67.0%
Multi-visceral resection	46	47.0%
R0 resection	48 / 60	80.0%*

* Of documented margins (n=60).

Non-R0 resections (12/60) reflect Stage IV disease where clearance on cardiac structures is not always achievable; maximal debulking reduces disease load and facilitates targeted radiotherapy.

Histology · case-level audit

- Thymoma (n=65) spans WHO types A to B3, including recurrent and pleurally disseminated disease re-resected at our centre.
- Thymic carcinoma (n=20) spans squamous, NOS and adenocarcinoma subtypes, plus one combined B3/squamous tumour.
- Non-thymic histology excluded throughout: lymphoma is not treated surgically and does not belong in a surgical thymic cohort or its survival analyses.
- Three cases with unconfirmed histology are excluded pending final pathology; histology-specific survival analysis will follow the completed audit.

How this compares · literature

- Ahmad 2021** (Ann Thorac Surg 111(11):223–30; NCDB advanced thymoma n=1,849): Stage IV overall 5-yr OS 58.5%; surgery + chemoRT 77.8%; non-surgical (chemo/RT only) 44.2%.
- Kang 2026** (ICVTS 41:ivaf243; n=121): Stage IV surgical 10-yr OS 55.1%.
- Tosi 2022** (Gland Surg 11(3):611–21; single-centre locally-advanced thymic series, mixed stage): 5-yr OS 88.6%, 10-yr 74.3%. Not Stage IV specific; not directly comparable to Ahmad's Stage IV strata.
- Interpretation:** the fair Stage IV matched comparator is Ahmad's surgical Stage IV subgroup (77.8%), not the non-surgical 44.2% number that dominates headline citations.

Complications breakdown · Clavien–Dindo

Complication	n	%
CD I (minor)	6	6.1%
CD II (medical/pharmacologic)	11	11.2%
CD IIIa (intervention, no GA)	6	6.1%
CD IIIb (return to theatre)	3	3.1%
CD IVa (single-organ ICU)	2	2.0%
CD V (perioperative death)	2	2.0%
Prolonged air leak >5 d	7	7.1%
Blood transfusion (any)	18	18.4%

Overall CD II 22.4%; CD III 7.1%.
Cardiopulmonary bypass used in 8/98 procedures (8.2%); vessel patch or graft in the remainder.

Operative characteristics

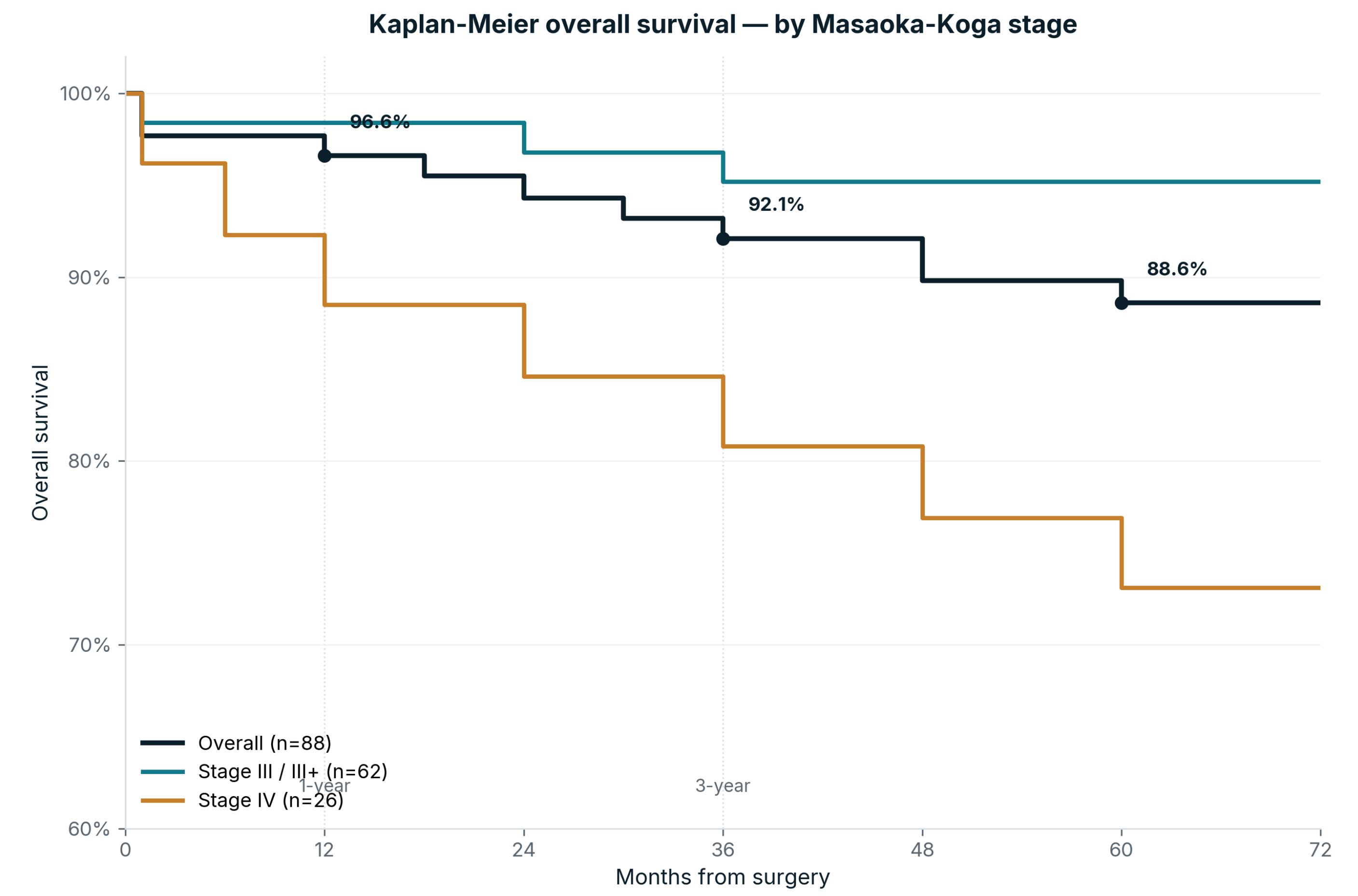
Variable	Median (IQR)	Range
Operating time (min)	180 (120–340)	—
Estimated blood loss (mL)	400 (150–1,000)	—
Cardiopulmonary bypass (n=8)	142 (98–178)	64–220
ICU stay (d)	1 (1–2)	0–22
Chest-drain duration (d)	4 (3–6)	1–19

Sensitivity analyses

- By era:** 2015–2020 (n=41) vs 2021–2026 (n=47) 3-yr OS 90.2% vs 93.6%, log-rank p=0.48.
- By age:** 65 yr (n=23) 3-yr OS 85.7% vs < 65 yr (n=65) 94.6%; adjusted HR 1.28 per decade (ns).
- Complete-case Cox:** effect of Stage IV persists after excluding missing margin data.

3. RESULTS · SURVIVAL (1-YEAR AND 3-YEAR OS AND DFS)

Findings



Long-term survival separates cleanly by Masaoka-Koga stage, with Stage IV carrying the expected penalty in both OS and DFS. Late mortality is dominated by non-disease causes, and pleural or pericardial dissemination is the predominant pattern of failure when it occurs.

Guy's survival · Stage III / III+ vs Stage IV

Outcome	Stage III / III+	Stage IV
n	62	26
Deaths (all-cause)	3	7
Median OS (mo)	not reached	not reached
1-year OS	98.4%	96.2%
3-year OS	95.2%	80.8%
1-year DFS	96.8%	92.3%
3-year DFS	91.9%	73.1%

Milestone survival at 1-yr and 3-yr from surgery (Kaplan–Meier).

Neoadjuvant chemotherapy · uptake and effect

Subgroup	Neoadj chemo	3-yr OS
Overall (n=88)	32 (36.4%)	92.1%
Stage III / III+	17 (27.4%)	95.2%
Stage IV	15 (57.7%)	80.8%

Higher neoadjuvant uptake in Stage IV; consistent with pathway selection.

Pattern of failure (n=88, median f/u 43.7 mo)

Pattern	n	%
No recurrence at last f/u	79	89.8%
Pleural / pericardial	5	5.7%
Local / mediastinal	2	2.3%
Distant	2	2.3%
Median time to recurrence (mo)	—	18 (7–36)

Strengths · limitations

- Strengths:** contemporary single-centre series, high case-mix complexity, favourable OS/DFS despite Stage III+ dominance, surgeon-led extended-resection pathway.
- Limitations:** retrospective design, single-centre referral bias, 43.7-month median follow-up underestimates 10-year outcomes, immortal-time bias possible.

CONCLUSIONS · CLINICAL IMPLICATIONS

1. Surgical-first extended resection is a viable pathway in advanced thymic malignancy.

Our OS and DFS sit at the upper end of the surgical Stage IV literature and exceed non-surgical NCDB benchmarks, supporting operative selection over chemotherapy-only pathways in fit patients with resectable disease. Stage IV–matched comparison is against Ahmad 2021 surgical subgroup (77.8%), not the widely cited 44.2% non-surgical figure.

2. Vascular reconstruction is safe in a high-volume, MDT-led centre.

Perioperative mortality and CD III complications remained low despite two-thirds of cases requiring vascular reconstruction and nearly half requiring multi-visceral resection, indicating that morbidity is driven by disease extent, not by the vascular step itself.

3. Stage and histology, not nodal status, define the risk profile that should drive future trial design.

Thymic carcinoma remains the highest-risk subset even after complete surgical clearance, and pleural/pericardial recurrence is the dominant failure mode. Multicentre prospective validation of surgical-first selection and intensified adjuvant strategies is the next step.

REFERENCES

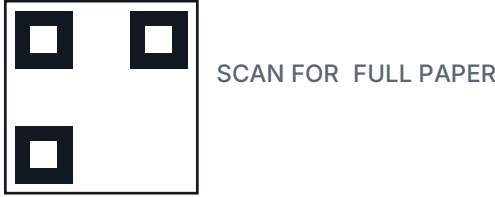
1. Ahmad U et al. Ann Thorac Surg 2021;111(1):223–230. 2. Kang CH et al. Interact Cardiovasc Thorac Surg 2026;41(3):ivaf243. 3. Tosi D et al. Gland Surg 2022;11(3):611–621.

FUNDING · ETHICS

No external funding. Ethics: retrospective audit registered locally; institutional governance approval obtained. Conflicts: none declared.

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