

High-intensity theatre for robotic thoracic surgery

10 patients in 1 day · 39-min mean console · zero ICU · zero mortality

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1. AIM · MATERIALS AND METHODS

Lung-cancer surgical capacity is constrained by theatre availability rather than surgical skill. Each week of delay carries measurable upstaging risk for early-stage NSCLC. The **High-Intensity Theatre (HIT)** model, proven in robotic urology, concentrates consultant time on the console while parallel induction and recovery sustain throughput. We piloted the first thoracic HIT day to test whether **safety and oncological completeness can be preserved at high throughput**.

The HIT day at a glance

10	1	2	39 min
PATIENTS	WORKING DAY	PARALLEL OR	MEAN CONSOLE
Patient demographics			
Variable	Value		
n	10		
Age range (yr)	39–79		
Female	5 (50%)		
ASA II / III	6 / 4		
FEV ₁ % predicted (median)	84		
cTNM I–II	9 (90%)		
Indication: primary NSCLC	8 (80%)		
Indication: metastasectomy	2 (20%)		

Selection criteria

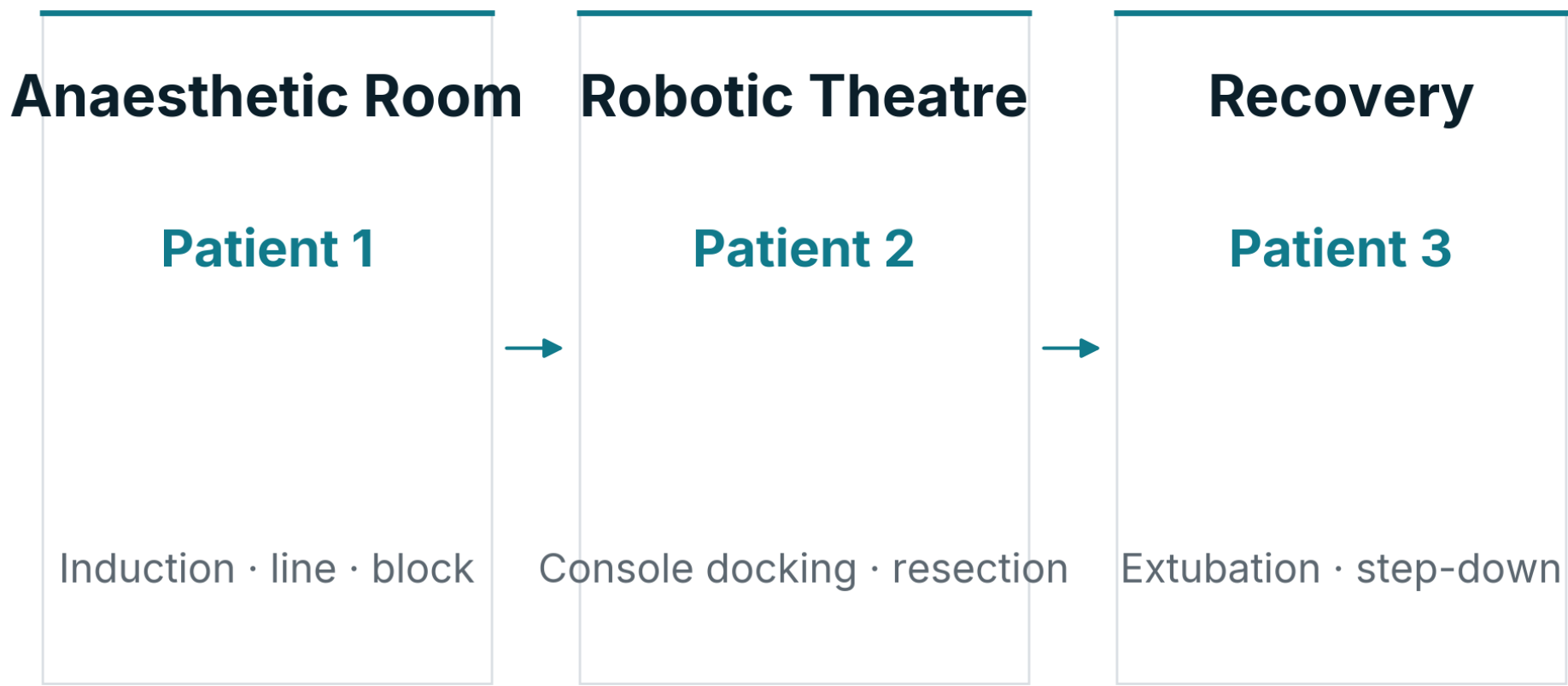
- Included:** robot-amenable lobectomy/segmentectomy/wedge; cTNM I–II; ASA II–III; pre-optimised; same-day discharge to ward.
- Excluded:** planned ICU; complex chest-wall or vascular reconstruction; neoadjuvant chemo/RT within 12 weeks; redo thoracotomy.
- Pathway:** two adjacent theatres, single consultant surgeon at console; dedicated anaesthetic, scrub, recovery teams.

Methods · workflow & endpoints

- Prospective single-centre pilot, dedicated HIT theatre day, Guy's & St Thomas'.
- Three-station flow: induction · robotic console · recovery, all running in parallel between two theatres.
- Endpoints: console time, list completion time, peri-operative complications (Clavien–Dindo), R0 rate, ICU admissions, mortality, 30-day readmission.
- Comparator: consultant's standard 4-list weekly throughput in the preceding 6 months.

Workflow, three-station parallel flow

Three-station parallel flow · two Da Vinci Xi systems, two theatres



Patient 1 is prepared while Patient 2 operates and Patient 3 recovers, continuous parallel throughput

Governance and pre-optimisation

- Pre-list MDT:** every case discussed with anaesthetics, physiotherapy and ward team the working day before the list.
- Enhanced recovery:** pre-operative carbohydrate loading, regional analgesia, early mobilisation, avoidance of long-acting opioids.
- Escalation triggers:** pre-defined thresholds for delay, complication or unplanned admission that terminate the list early.
- Governance:** single consultant surgeon, dedicated senior anaesthetist and scrub team for the whole day; no trainee-led operating.

2. RESULTS · TIMELINE AND CONSOLE EFFICIENCY

Findings



Console time held steady from case 1 to case 10 with no drift across the list. The rate-limiting step was patient turnover, not the surgical console itself, which is why the three-station parallel flow (concurrent induction, console and recovery) is the operational mechanism that makes the day fit.

Case-level console times

Case	Procedure	Console (min)	LOS (d)
1	RUL lobectomy	42	4
2	Wedge LLL	28	3
3	RLL segment	36	4
4	LUL lobectomy	45	5
5	Wedge RUL	31	3
6	RLL lobectomy	39	4
7	LUL segment	34	4
8	Wedge LLL	30	3
9	RUL lobectomy	47	8
10	RLL wedge	58	5

Throughput vs standard practice

- Standard:** ~2.5 robotic cases per consultant theatre day.
- HIT day:** 10 cases in one day, ~4x per-day throughput.
- Weekly throughput equivalent achievable in one HIT day plus one standard list.

Where the theatre time goes

Phase	Median (min)	Range
Anaesthetic room	22	15–32
Docking and set-up	11	8–16
Robotic console	39	28–58
Undock and closure	14	9–22
Turnover to next case	18	11–28

Console time is the smallest lever; turnover and docking, run in parallel, drive the extra throughput.

Team composition on the HIT day

- Surgical:** 1 consultant thoracic surgeon (console), 1 bedside assistant, 1 scrub practitioner per theatre.
- Anaesthetic:** 2 senior anaesthetists, 1 ODP per theatre, dedicated regional-block operator in the anaesthetic room.
- Recovery and ward:** 2 recovery nurses ring-fenced, ward matron with pre-agreed bed-flow plan for 10 admissions.

3. RESULTS · PERIOPERATIVE OUTCOMES

Findings



Peri-operative outcomes were at least equivalent to a standard consultant list from the same period. The one prolonged stay was for managed post-operative atrial fibrillation, not a surgical complication. Patient selection (ASA II–III, robot-amenable anatomy, no planned ICU) was as important as the operative workflow.

Peri-operative outcomes summary

Outcome	HIT (n=10)	Standard*
R0 resection	100%	97%
Median LOS (d)	4 (2–8)	5
ICU admission	0%	4%
Clavien–Dindo III	0%	6%
30-d readmission	0%	7%
30-d mortality	0%	<1%

* Consultant's preceding 6-month standard-list cohort.

Case-level complications and disposition

Case	Complication	Discharge
1	None	Home d4
2	None	Home d3
3	None	Home d4
4	Air leak (CD I)	Home d5
5	None	Home d3
6	None	Home d4
7	None	Home d4
8	None	Home d3
9	AF, rate-controlled (CD II)	Home d8
10	Prolonged air leak (CD I)	Home d5

No returns to theatre, no ICU escalation, no 30-day readmissions across the list.

Capacity implication

On the consultant's standard schedule, delivering the same 10 anatomical resections would occupy the equivalent of four theatre days. HIT compresses this into a single dedicated day, releasing three days of consultant, theatre and anaesthetic capacity per cycle, without requiring additional surgical FTE.

How this compares · literature

- Furrer 2023** (Nat Rev Urol): HIT model first scaled in robotic urology; safety preserved at increased throughput.
- Serna-Gallegos 2019** (JTCVS): each week of delay for Stage I NSCLC carries measurable upstaging risk.
- Maruthappu 2015** (Ann Surg 261:642–7): consultant-led, dedicated-team theatre composition materially affects throughput.
- NHS LCSP 2024:** UK lung-cancer pathway pressure; 62-day target; surgical capacity is a key bottleneck.

CONCLUSIONS · CLINICAL IMPLICATIONS

1. HIT delivers ~4× throughput with preserved safety. 2. Three-station parallel flow is the critical enabler.

Ten robotic thoracic resections completed in one working day with zero ICU, zero mortality, zero readmissions, and 100% R0. Console times remained stable across the list, with no fatigue-related drift.

Concurrent induction, console and recovery, supported by a dedicated team, is the operational mechanism that compresses the list without compromising standards. Patient selection mattered: ASA II–III, robot-amenable resections, no planned ICU.

3. HIT could materially expand UK lung-cancer surgical capacity.

If reproducible, even one HIT day per consultant per month would substantially augment national surgical throughput against rising lung-cancer pathway pressure. Multicentre validation is the next step.

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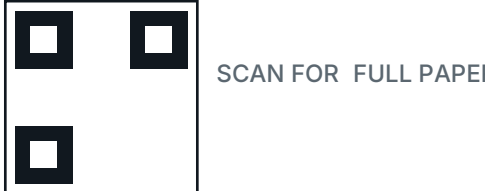
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