Peer Review File

Article information: https://dx.doi.org/10.21037/jtd-2025-1586

Reviewer A

This is a retrospective study where you have compared outcomes in managing air-leaks identified intra-operatively in 12 versus 24 patients (with 14 versus 26 air-leaks). The 12 patients are the conventional group where a double -armed 4.0 polysiloxane suture was used, using free pericardial fat pledges (FPFP) to repair the air-leak. In the second group (the "modified technique" group) a shorter 4.0 PDS suture. (10-15cm length) was used for the repair with FPFP. This was a single arm suture with a knot in the distal end of the suture to prevent the distal end from migrating through the fat pledged, as the suture is placed. You assessed a number of surgical outcomes such as total suturing time, needle handling time etc. and also post-operative outcomes. The main differences were a difference in median suturing time and fewer suture entanglements in the modified group. There were no differences in clinical outcome such as air-leak, complication and chest-tube reinsertion

Although the paper is enhanced by the videos that you have attached, I do not favor acceptance of the manuscript for the following reasons

Comment 1: there were robotic proctors present in the conventional group. This implies that this was earlier in your robotic experience and that the differences in suture times could be explained by that.

Reply 1: We thank the reviewer for highlighting this important issue. We regret that our initial wording (“surgeon with RATS proctor”) was misleading. We have revised it to “surgeons certified as RATS proctors,” which correctly describes these surgeons who had obtained an official proctor certification and were qualified to supervise robotic procedures.

Our RATS program began on April 9, 2018. Two surgeons obtained official proctor certification during the study period (A: March 1, 2019; B: March 6, 2020), while all other surgeons did not hold RATS certifications during the study period. As a result, the conventional group included a significantly higher proportion of sites performed by proctor-certified surgeons (78.6% vs. 41.7%). This imbalance would bias against shorter suturing times in the modified group.

To address this potential confounding factor, we performed stratified sensitivity analyses. **For proctor-certified surgeons, the** median suturing time was 408 sec (IQR 264–474) in the modified group versus 419 sec (IQR 382–456) in the conventional group (P=0.793). **For non-certified surgeons, the** suturing time was 296 sec (IQR 272–375) in the modified group versus 488 sec (IQR 428–537) in the conventional group (P=0.076).

Although statistical significance was limited by the small sample size, both strata consistently favored the modified technique. These findings suggest that the observed advantages of the modified method cannot be explained solely by surgeon experience or proctor status.

Changes in the text:
In the main text, “with/without RATS proctor” has been changed to “certified/not certified as a RATS proctor.”
2. Methods: In *2.1 Study Design*, “To evaluate potential confounding by surgeon experience, we recorded whether the operating surgeon was certified as an official RATS proctor at the time of surgery.” (Page 5, lines 58–60)
In *2.7 Statistical Analysis*, “To address surgeon experience, we recorded whether the operating surgeon was certified as a RATS proctor and carried out sensitivity analyses stratified by certification status.” (Page 9, lines 143–145)
3. Results: “Stratified analyses by proctor certification revealed consistent trends between the two groups (Table 4). Among procedures by certified surgeons, median total suturing time was 408 [264–474] sec in the modified group vs. 419 [382–456] sec in the conventional group (P=0.793). Among non-certified surgeons, time was 296 [272–375] sec vs. 488 [428–537] sec (P=0.076). Entanglements were observed only in conventional cases carried out by certified surgeons (5 sites, 45.5%; P=0.035).” (Page 12, lines 210–214)
4. Discussion: “Similarly, stratification by proctor certification status proved that surgeon experience or certification could not fully explain the benefit associated with the modified technique.” (Page 13, lines 241–243)
Table 4: Sensitivity analyses stratified by robot-assisted thoracic surgery proctor certification
Supplementary Figure 1. Institutional timeline of the RATS program and introduction of the modified FPFP technique.

Comment 2: Although it is useful to consider the option of FPFP suture repair of parenchyma in the thoracic surgeon’s armamentarium, this is not a technique that is commonly used. It is unclear when this should be considered, and what advantage this has over other techniques of air-leak control. A discussion of patient selection, and perhaps comparison of clinical outcomes to cases where other techniques were used would be helpful
Reply 2: We appreciate this helpful suggestion. We have expanded the **Discussion** to clarify our institutional indications and to compare FPFP with other air-leak control strategies.
As predefined in the **Methods**, FPFP was considered when (i) leaks persisted after soft coagulation, (ii) the intraoperative Macchiarini Scale Score (MSS) was **2–3**, or (iii) the fistula was extensive. This aligns with contemporary use of MSS for visual grading of leaks during the saline submersion test (Macchiarini P, et al. JTCVS 1999).
Published studies suggest that **fibrin sealants** can reduce air-leak incidence and duration after pulmonary resection, and that **combination strategies with bioabsorbable sheets (e.g., PGA)** may be more effective than fibrin alone in selected settings (Fabian T, et al. ATS 2003). Recent reviews and trials support these points, although product performance may vary by material and indication (Itano H. JTD 2023).
We acknowledge that **quantitative intraoperative testing (VMT)** and **postoperative digital drainage** provide objective flow thresholds (e.g., **<100, 100–400, or >400**

mL/min intraoperatively and **<50 mL/min for 8 h** postoperatively) that can guide treatment escalation (Alayche M, JTCVS open 2024) (Zaraca F, et al. JVS 2017).
Our study period predated routine use of such measurements at our institution; therefore, we relied on MSS grading and water-seal testing. We have added this as a limitation and outlined plans to integrate VMT or digital systems in future studies.
Regarding comparative data, during the study window, our center did **not** treat cases with **fibrin products alone** or **PGA sheets alone**, precluding in-house head-to-head comparisons. We now state this explicitly as a limitation and instead, provide a balanced synopsis of published outcomes for these alternatives and explain how FPFP fits into a step-up algorithm (soft coagulation → sealant/sheet for minor leaks → **FPFP** for MSS 2–3 or persistent/extensive leaks).

Changes in the text:
2. Methods: In *2.2 Surgical Technique*, "At our institution, intraoperative leak assessment was routinely performed with a water-seal visual scale." (Page 6, lines 7-8)
4. Discussion: In *4.3 Strengths and Limitations*, "Finally, regarding alternatives, fibrin sealants have been shown to reduce air leak incidence and duration after lung resection in randomized and prospective studies. Several reports have indicated a potential additive benefit when fibrin sealants are combined with bioabsorbable sheets in selected scenarios; however, material-specific performance differs across products (20, 21). In our cohort, no cases received fibrin-only or PGA sheet-only management during the study period, which precluded direct in-house comparisons. Therefore, we summarized the published evidence and position FPFP as a step-up option when MSS 2 or 3 leaks persist after soft coagulation or when fistulae are extensive. We believe that further prospective studies directly comparing FPFP with other sealants are needed." (Page 16, lines 301–309)
In *4.4 Implications and Actions Needed*, "While visual leak grading by MSS is widely used during the saline test, the quantitative intraoperative measurement using ventilation mechanical test, which classifies leaks as mild <100 mL/min, moderate 100–400 mL/min, or severe >400 mL/min, and maybe preferred to standardize treatment thresholds. Likewise, digital chest drainage provides objective postoperative classification criteria (e.g., <50 mL/min for 8 h to declare resolution) (22, 23). We did not routinely implement intraoperative ventilation mechanical test or postoperative digital drainage; thus, severity grading and treatment decisions were based on visual MSS. Although this reflected real-world practice at the time, future protocols will incorporate quantitative thresholds to improve comparability and external validity.**"** (Pages 16–17, lines 312–320)

Comment 3: would be helpful to see similar videos for the conventional technique. Also clarify the length of suture used in the conventional technique.
Reply 3: We thank the reviewer for this constructive suggestion. In the **Methods** section, we have clarified that a **70-cm length of 4-0 PDS (SH, double-armed needle)** was used in the conventional technique. In addition, we have added a **Supplementary video** demonstrating the conventional technique, as well as a **comparative figure** contrasting

the conventional double-armed 4-0 PDS with the modified loop-end 4-0 PDS. These additions are intended to enhance transparency and facilitate direct comparison between the two approaches.

Changes in the text:
2. Methods: In *2.4* *Conventional FPFP Technique*, "As previously reported, a 70-cm length of 4-0 polydioxanone suture (PDS) (**SH, double-armed needle**) was used (Figure 1) (9)." (Page 6, lines 94–95)
We added Figure 1 and a conventional FPFP video, and updated the video number.

Reviewer B

Your study addresses a high-impact pragmatic problem—streamlining intraoperative air-leak repair under RATS with reduced assistant dependence. Demonstrating a clinically meaningful reduction in total suturing time without adverse postoperative signals is valuable; however, strengthening internal validity (confounding control, correct tests, clustering) is essential before advocating broad adoption. My comments are as follows:

Comment 1: The modified technique appears to be an institutional evolution toward "solo RATS," likely introduced later in the 2020–2024 interval. Please report the exact implementation date and present a timeline or era-adjusted analysis; otherwise, secular trends and learning curves may confound results.

Reply 1: We thank the reviewer for this important suggestion. Our RATS program began on April 9, 2018, and the modified FPFP suture technique was introduced in 2021. Accordingly, in the early period (2018–2020), only conventional FPFP sutures were performed. To address possible secular trends, we performed a period-adjusted sensitivity analysis (Supplementary Table X). In the late period (2021–2024), when both techniques were available, suturing time remained significantly shorter with the modified technique (335 sec [IQR 270–428]) compared with the conventional technique (445 sec [404–472]; P=0.021). Entanglement occurred only in the conventional group (4/11 vs. 0/26; P=0.005). These results indicate that the observed benefit of the modified technique is not explained solely by secular trends or learning-curve effects.

Changes in the text:

2. Method: In *2.2 Surgical Technique*, "Our RATS program was initiated on April 9, 2018, and the modified FPFP suture technique was introduced in 2021. Accordingly, only conventional FPFP technique was performed in the early period (2018–2020) and both techniques were available in the late period (2021–2024). Supplementary Figure 1 presents the timeline of the RATS program and introduction of the modified FPFP technique at our institution." (Page 5, lines 64–68)

2. Method: In *2.7 Statistical Analysis*, "Finally, to examine potential secular trends or learning-curve effects, we defined an "early period" (2018–2020, when only the conventional technique was used) and a "late period" (2021–2024, when both techniques were available) and performed period-adjusted sensitivity analyses." (Page 9, lines 145–147)

3. Results: "Period-adjusted analyses also confirmed robustness of the data (Table 5). In the late period (2021–2024), when both techniques were in use, the modified technique achieved significantly shorter median total suturing time than the conventional technique (335 sec [270–428] vs. 445 sec [404–472]; P=0.021). Entanglements occurred in 4 of 11 conventional cases vs. none of 26 modified cases (P=0.005)." (Page 12, lines 215–218)

4. Discussion: “Finally, period-adjusted analyses demonstrated that the beneficial effect of the modified technique persists in the late period, reducing the likelihood that secular trends or learning-curve effects were responsible for our findings.” (Page 13, lines 243–245)
Table 5: Period-adjusted analysis of total suturing time and suture entanglement
Supplementary Figure 1. Institutional timeline of the RATS program and introduction of the modified FPFP technique.

Comment 2: Procedures by a RATS-proctored surgeon were significantly more frequent in the conventional group (78.6% vs 41.7%, p=0.043). Surgeon experience should be treated as a confounder; consider multivariable adjustment and/or stratified/sensitivity analyses (e.g., limiting to non-proctored surgeons).
Reply 2: We thank the reviewer for highlighting this important issue. We regret that our initial wording (“surgeon with RATS proctor”) was misleading. We have revised it to “surgeons certified as RATS proctors,” which correctly describes these surgeons who had obtained an official proctor certification and were qualified to supervise robotic procedures.
Our RATS program began on April 9, 2018. Two surgeons obtained official proctor certification during the study period (A: March 1, 2019; B: March 6, 2020), while all other surgeons did not hold RATS certifications during the study period. As a result, the conventional group included a significantly higher proportion of sites performed by proctor-certified surgeons (78.6% vs. 41.7%). This imbalance would bias against shorter suturing times in the modified group.
To address this potential confounding factor, we performed stratified sensitivity analyses. **For proctor-certified surgeons, the** median suturing time was 408 sec (IQR 264–474) in the modified group versus 419 sec (IQR 382–456) in the conventional group (P=0.793). **For non-certified surgeons, the** suturing time was 296 sec (IQR 272–375) in the modified group versus 488 sec (IQR 428–537) in the conventional group (P=0.076).
Although statistical significance was limited by the small sample size, both strata consistently favored the modified technique. These findings suggest that the observed advantages of the modified method cannot be explained solely by surgeon experience or proctor status. We revised the Methods, Results, and Discussion accordingly and added Table 4 and Supplementary Figure 1.
Changes in the text:
In the main text, “with/without RATS proctor” has been changed to “certified/not certified as a RATS proctor.”
2. Methods: In *2.1 Study Design*, “To evaluate potential confounding by surgeon experience, we recorded whether the operating surgeon was certified as an official RATS proctor at the time of surgery.” (Page 5, lines 58–60)
In *2.7 Statistical Analysis*, “To address surgeon experience, we recorded whether the operating surgeon was certified as a RATS proctor and carried out sensitivity analyses stratified by certification status.” (Page 9, lines 143–145)

3. Results: “Stratified analyses by proctor certification revealed consistent trends between the two groups (Table 4). Among procedures by certified surgeons, median total suturing time was 408 [264–474] sec in the modified group vs. 419 [382–456] sec in the conventional group (P=0.793). Among non-certified surgeons, time was 296 [272–375] sec vs. 488 [428–537] sec (P=0.076). Entanglements were observed only in conventional cases carried out by certified surgeons (5 sites, 45.5%; P=0.035).” (Page 12, lines 210–214)

4. Discussion: “Similarly, stratification by proctor certification status proved that surgeon experience or certification could not fully explain the benefit associated with the modified technique.” (Page 13, lines 241–243)

Table 4: Sensitivity analyses stratified by robot-assisted thoracic surgery proctor certification

Supplementary Figure 1. Institutional timeline of the RATS program and introduction of the modified FPFP technique.

Comment 3: Outcomes such as time and entanglement are analyzed per leak site, but two patients per group had multiple sites. Ignoring within-patient (and within-surgeon) correlation can underestimate variance. You could re-analyze per-site endpoints using cluster-robust methods (mixed-effects models or GEE with patient and surgeon random effects) and provide a patient-level summary analysis as sensitivity.

Reply 3: We appreciate this important comment. We agree that outcomes per leak site may not be fully independent, as some patients contributed multiple sites and cases were clustered by surgeon. We explored logistic mixed-effects modeling for entanglement to account for within-patient and within-surgeon correlation. However, because the modified group experienced **no entanglement events at both the site and patient levels**, the model was numerically unstable and failed to converge, a known limitation in small-sample binary data with complete separation. Similarly, GEE and cluster-robust approaches were unstable under these conditions.

Therefore, to address the reviewer’s concern in a robust and interpretable manner, we conducted a **patient-level sensitivity analysis**. Outcomes were summarized at the patient-level (median suturing time per patient; presence of any entanglement) and compared between groups. The modified group showed shorter suturing times (median 353 sec [IQR 280–415]) compared with the conventional group (427 sec [IQR 382–456]; P=0.027, Mann–Whitney U test). Entanglement was observed in 6 of 12 patients (50%) in the conventional group and in none of the 24 patients in the modified group (P<0.001, Fisher’s exact test). These findings corroborate the site-level analysis and indicate that our conclusions are robust even when accounting for within-patient correlation.

Changes in the text:

2. Methods: In 2.7 Statistical Analysis, “To account for possible correlations within patients and within surgeons, we also summarized outcomes at the individual patient level by calculating each patient’s median total suturing time and determined whether suture entanglement occurred at least once.” (Page 8, lines 136-138)

3. Results: In 3.3 Sensitivity and Robustness Analyses, “The patient-level sensitivity analysis is summarized in Supplementary Table 1. The modified group’s median total suturing time remained significantly shorter (353 [280–415] sec) than in the conventional group (427 [382–456] sec; P=0.027). Entanglement was observed in 6 of 12 patients (50%) in the conventional group but in none of 24 patients in the modified group (P<0.001).” (Page 11, lines 195-198)
4. Discussion: “Because some patients had multiple leak sites, analyses based on individual sites may underestimate variance due to within-patient clustering. Our patient-level sensitivity analyses confirmed that the modified technique was associated with significantly shorter total suturing time and no entanglement events compared with the conventional technique, indicating that our main conclusions are robust despite the limitations presented by the small sample size and complete separation in binary outcome data.” (Page 13, lines 232-237)
Supplementary Table 1: The patient-level sensitivity analysis

Comment 4: The inclusion criterion “anatomical resection requiring repair” is inherently post-operative and at the surgeon's discretion, risking selection bias—especially given variable use of soft coagulation. Specify whether all consecutive eligible cases were included and clarify any exclusion criteria (e.g., wedge resections, benign disease).

Reply 4: Thank you for your important comments. We have modified our text as advised.

Change in the text:
2. Methods: In *2.1 Study Design*, “This study included consecutive patients who underwent anatomical lung resection for primary or metastatic lung cancers requiring intraoperative air leak repair, using either the conventional or modified FPFP technique. Wedge resections and benign diseases were excluded.” (Page 4–5, lines 52–55)

Comment 5: The text reports several procedure-time components; however, only the total suturing time shows statistical significance. Please pre-specify the primary endpoint (e.g., total suturing time per site) and label all others as secondary to avoid multiplicity concerns. If the primary endpoint was designated post hoc, acknowledge this and temper claims.

Reply 5: We appreciate the reviewer’s insightful comment. We have clarified that the primary endpoint of this study was the **total suturing time per leak site**, which was designated a priori as the most relevant measure of overall procedural efficiency. Other components such as needle-passing time, knot-tying time, and entanglement were analyzed as **secondary exploratory endpoints** to provide mechanistic insights. We have revised the Methods, Results, and Discussion accordingly. In addition, we acknowledge in the Discussion that the study was not prospectively powered for

multiple secondary endpoints, and thus these analyses should be interpreted as exploratory.

Changes in the text:

2. Methods: In *2.6 Surgical Outcome Measures*, "The primary endpoint of this study was total suturing time per leak site, as this represents the overall efficiency of FPFP repair. Secondary exploratory endpoints included needle handling time, suture ligating time, and other time." (Page 7–8, lines 119–121)

4. Discussion: In *4.3 Strengths and Limitations*, "Third, this study was not powered for multiple secondary outcomes. Therefore, analyses of procedure-time subcomponents should be considered exploratory, and the conclusions primarily relied on the total suturing time as the predefined primary endpoint." (Page 15, lines 293–295)

Comment 6: The manuscript mentions postoperative air leaks and "prolonged" cases but does not clearly define PAL (commonly ≥5 or 7 days). Provide an a priori PAL definition and apply it consistently in Table 3 and text.

Reply 6: We thank the reviewer for pointing out this omission. At our institution, prolonged air leak (PAL) was defined a priori as air leakage persisting for **≥5 postoperative days**, consistent with common practice in thoracic surgery. We have revised the Methods to clarify this definition and applied it consistently in the Results, Table 3, and Discussion.

Changes in the text:

2. Methods: In *2.6 Surgical Outcome Measures*, "PAL was defined as postoperative air leakage lasting ≥5 days." (Page 8, lines 129–130)

Table 3: "A prolonged air leak was defined as postoperative air leakage lasting ≥5 days."

Comment 7: Water-seal leak test settings (15–20 cmH_2O) are given, but indicate whether pressure and ventilation strategy were fixed across cases and eras. Please specify it.

Reply 7: We thank the reviewer for your comment. The water-seal leak test was performed in a standardized manner across all cases and time periods. Specifically, airway pressure was gradually increased from 15 cmH_2O to 20 cmH_2O while observing for air leakage from the lung parenchyma and bronchi. We have revised the Methods section to state this more explicitly to avoid any misunderstanding.

Changes in the text:

2. Methods: In *2.2 Surgical Technique*, "Airway pressure was gradually increased from 15 to 20 cm H_2O while observing for air leaks in the lung parenchyma and bronchi." (Page 6, lines 76–77)

Comment 8: You state the use of the Wilcoxon signed-rank test, which is for paired data. These are independent groups; the correct nonparametric test is the Wilcoxon rank-sum (Mann–Whitney U). Please re-run all continuous-variable comparisons accordingly.

Reply 8: We thank the reviewer for pointing out this error. We apologize for the incorrect terminology in the original manuscript. All comparisons of continuous variables between independent groups have been reanalyzed using the Wilcoxon rank-sum test (Mann–Whitney U test). The results and P-values remain unchanged, as the same test was effectively applied in our statistical software, but we have corrected the descriptions throughout the manuscript to avoid confusion.

Changes in the text:

2. Methods: In 2.7 Statistical Analysis, "These variables were compared between the conventional and modified FPFP groups using the Mann–Whitney U test and the Fisher exact test or chi-square test." (Page8, lines 134-135)

Comment 9: Report median differences with 95% CIs (e.g., via bootstrap) alongside p-values for key endpoints (time components, entanglement rate). This will improve interpretability beyond significance testing alone.

Reply 9: We thank the reviewer for this important suggestion. In the revision, we re-analyzed the main outcomes using bootstrap resampling (10,000 replicates) to estimate median differences with 95% confidence intervals (CIs), in addition to reporting P-values.

Key results were as follows:

Total suturing time: median 335 sec [IQR 270–428] in the modified group vs. 426 sec [382–453] in the conventional group (P= 0.025). The bootstrap-estimated median difference was -82 sec (95% CI: -164 to -9).

Other time components (harvesting, needle handling, ligating, "other" time): no statistically significant differences; bootstrap 95% CIs for median differences all crossed zero.

Entanglement: 6/14 cases (42.9%) in the conventional group vs. 0/26 in the modified group (P= <0.001, Fisher's exact test). The bootstrap-estimated risk difference was -0.38 (95% CI: -0.69 to -0.17).

We believe this presentation enhances interpretability by quantifying the magnitude and precision of observed differences beyond P-values alone.

Changes in the text:

2. Methods: In *2.7 Statistical Analysis*, "For key endpoints, we further estimated median differences and absolute risk differences with 95% confidence intervals (CIs) via bootstrap resampling (10,000 replicates)." (Page 8, lines 139-141)

3. Results: "Bootstrap analyses are summarized in Supplementary Table 2. The median total suturing time was 335 [270–428] sec in the modified group versus 426 [382–453] sec in the conventional group (P=0.025), with a bootstrap-estimated median difference of -82 sec (95% CI -164 to -9). Time components for harvesting, needle handling, ligating, and "other" did not differ significantly; their bootstrap 95% CIs all included zero. Entanglements occurred in 42.9% (6/14) of conventional cases vs. 0% (0/26) of modified cases (P<0.001), with a bootstrap-estimated risk difference of -0.38 (95% CI -0.69 to -0.17)." (Page 11, lines 199-204)

4. Discussion: “By reporting bootstrap-estimated median and risk differences along with 95% CIs, we provide estimates of effect size and precision beyond P-values alone, thereby improving interpretability.” (Page 13, lines 237-239)
Supplementary Table 2: The Bootstrap analyses

Comment 10: Please justify the choice of the visual Macchiarini grading instead of the quantitative Ventilation Mechanical Test (VMT) described by Zaraca et al., which reports intraoperative air-leak severity in mL/min and provides actionable thresholds (<100, 100–400, >400 mL/min). Was VMT not feasible in your setting (e.g., lack of flowmeter/standardized ventilatory settings or constraints of the RATS workflow)? If possible, consider adding a sensitivity analysis correlating Macchiarini's grades with an objective measure (intraoperative VMT or postoperative digital drain flow), or at a minimum, discuss the implications of relying on a subjective visual scale for severity assessment.

Reply 10: Thank you for your insightful comment. At our institution, intraoperative leaks were assessed visually using the Macchiarini scale (MSS) during water-seal testing, whereas quantitative methods such as the Ventilation Mechanical Test (VMT) were not implemented as part of routine practice, due to lack of a flowmeter system and workflow constraints. Thus, retrospective VMT-based analysis was not feasible. We acknowledge that reliance on a subjective visual scale is a limitation of this study, and future prospective investigations should correlate MSS grading with objective airflow measurements such as intraoperative VMT or digital postoperative drain data.

Changes in the text:
4. Discussion: In *4.4 Implications and Actions Needed*, “While visual leak grading by MSS is widely used during the saline test, the quantitative intraoperative measurement using ventilation mechanical test, which classifies leaks as mild <100 mL/min, moderate 100–400 mL/min, or severe >400 mL/min, and maybe preferred to standardize treatment thresholds. Likewise, digital chest drainage provides objective postoperative classification criteria (e.g., <50 mL/min for 8 h to declare resolution) (22, 23). We did not routinely implement intraoperative ventilation mechanical test or postoperative digital drainage; thus, severity grading and treatment decisions were based on visual MSS. Although this reflected real-world practice at the time, future protocols will incorporate quantitative thresholds to improve comparability and external validity.” (Pages 16–17, lines 312–320)

Comment 11: Segmentectomy was more frequent in the modified group (33.3% vs 8.3%). Even if not statistically significant, it is clinically relevant and should be adjusted for.

Reply 11: We thank the reviewer for pointing out this potential imbalance. To address it, we performed a sensitivity analysis restricted to lobectomy cases only. In this subset, the modified technique remained associated with shorter total suturing time (median

343 sec [IQR 276–435] vs 434 sec [IQR 379–456]; median difference -91 s, 95% CI -169 to -3; P=0.042) and with a lower entanglement rate (0/17 vs 6/13; risk difference =0.46, 95% CI -0.74 to -0.18; P=0.0029). These consistent results indicate that the observed advantage of the modified technique is not explained by the higher frequency of segmentectomy in that group.

Changes in the text:

2. Methods: In *2.7 Statistical Analysis*, "Because segmentectomy was more frequent in the modified group, we also performed a sensitivity analysis restricted to lobectomy cases only, applying the same bootstrap procedures." (Page 8-9, lines 141-143)

3. Results: "When restricted to lobectomy cases, the modified technique remained associated with shorter median total suturing time (343 [276–435] sec vs. 434 [379–456] sec; P=0.042), with a median difference of -91 sec (95% CI -169 to -3; Supplementary Table 3). Entanglements occurred in 6 of 13 lobectomy cases (46.2%) in the conventional group and in none of 17 cases in the modified group (P=0.002), yielding a bootstrap-estimated risk difference of -0.46 (95% CI -0.74 to -0.18)." (Page 11-12, lines 205-209)

4. Discussion: "Although the modified group had a higher frequency of segmentectomy, lobectomy-only analyses yielded consistent results, suggesting that the imbalance in procedure type did not account for the observed differences." (Page 13, lines 239-241)

Supplementary Table 3: The sensitivity analysis restricted to lobectomy cases

Comment 12: The statement that the modified method "eliminated suture entanglement" should be softened to "no entanglements were observed in this series," given the small sample and nonrandomized design. Similarly, claims of suitability for surgeons with limited RATS experience should be framed as hypothesis-generating.

Reply 12: We thank the reviewer for pointing this out. We agree that our original wording was too strong given the limited, nonrandomized sample. We have revised the statement to: "no suture entanglements were observed in this series."

Similarly, the description of potential suitability for surgeons with limited RATS experience has been reframed as a hypothesis-generating observation rather than a definitive conclusion.

In the main text, "with/without RATS proctor" has been changed to "certified/not certified as a RATS proctor."

Changes in the text:

Abstract: "eliminated suture entanglement." has been changed to "no suture entanglements were observed" or "did not cause suture entanglement."

5. Conclusion: "The modified FPFP technique significantly reduced the total suturing time and prevented suture entanglement compared to the conventional FPFP technique. This novel and straightforward procedure may be suitable for surgeons with limited RATS experience and for use during solo RATS as it allows surgeons to complete the intrathoracic procedure independently. These findings from this study were hypothesis-generating observations and warrant further validation in larger and more diverse cohorts." (Page 17, lines 323-327)

Reviewer C

This is a well-written and clinically relevant manuscript addressing intraoperative air leak management during robotic-assisted thoracic surgery.

The authors propose a modified free pericardial fat pledged (FPFP) technique designed to reduce suturing time and eliminate suture entanglement, thereby facilitating solo RATS. The topic is timely and important, as prolonged air leak (PAL) remains a frequent complication after pulmonary resection, and minimally invasive robotic approaches are increasingly performed worldwide.

The manuscript is clearly structured, adheres to the STROBE checklist, and provides both methodological and outcome detail. The technique is innovative and has practical value.

However, some issues require clarification or expansion to strengthen the paper before publication.

Minors Comments

1: The retrospective and single-institutional design should be emphasized more strongly in the discussion. While the modified technique shows promising results, the inherent biases and small cohort size (n=36) limit generalizability.
Reply 1: We thank the reviewer for this important suggestion. We agree that the retrospective and single-institutional design imposes limitations, particularly in terms of selection bias, confounding, and generalizability. We have revised the Discussion to emphasize these limitations more strongly. Although our findings suggest promising advantages of the modified technique, they should be interpreted cautiously, and validation in larger, prospective, and multi-institutional cohorts is required.

Changes in the text:
4. Discussion: In *4.3 Strengths and Limitations*, “Its retrospective nature and single-institutional design introduced risks of selection bias and confounding, and the small cohort size (n=36) further limited its statistical power and generalizability. Therefore, the results should be regarded as exploratory and hypothesis-generating, warranting confirmation in larger, prospective, multi-institutional investigations.” (Page 15, lines 282-286)

Comment 2: The study compares two variations of FPFP but does not provide direct outcome comparisons with other commonly used intraoperative sealants (fibrin glue). Although the discussion touches on this, expanding the comparison would better

contextualize the advantages and limitations of FPFP techniques in the broader field of air leak management.
Reply 2: We appreciate this helpful comment. We agree that direct comparison with other intraoperative sealants such as fibrin glue would provide valuable context. However, at our institution during the study period, cases treated solely with fibrin glue or PGA sheets were extremely rare, precluding meaningful statistical comparison. We have therefore expanded the Discussion to include a more detailed summary of published evidence on fibrin- and PGA-based sealants and contextualized the relative advantages and limitations of FPFP techniques. We also emphasize that further prospective studies directly comparing FPFP with other sealants are needed.
Changes in the text:
4. Discussion: In *4.3 Strengths and Limitations*, "Finally, regarding alternatives, fibrin sealants have been shown to reduce air leak incidence and duration after lung resection in randomized and prospective studies. Several reports have indicated a potential additive benefit when fibrin sealants are combined with bioabsorbable sheets in selected scenarios; however, material-specific performance differs across products (20, 21). In our cohort, no cases received fibrin-only or PGA sheet-only management during the study period, which precluded direct in-house comparisons. Therefore, we summarized the published evidence and position FPFP as a step-up option when MSS 2 or 3 leaks persist after soft coagulation or when fistulae are extensive. We believe that further prospective studies directly comparing FPFP with other sealants are needed." (Page 16, lines 301–309)

Statistical Considerations

Comment 3: Given the small sample size, the power to detect differences in postoperative complications is limited. The authors should acknowledge the risk of type II error more explicitly.

I would like to congratulate the authors on conducting this practical study. The modified FPFP technique represents a creative yet simple solution to a common intraoperative problem, and the clear presentation (including the supplementary videos) enhances both the scientific and educational value of the work.

Reply 3: We thank the reviewer for this important observation. We agree that our relatively small cohort size limited the statistical power to detect differences in postoperative complications. As such, there is a risk of type II error, whereby clinically meaningful differences might not have reached statistical significance. We have revised the Discussion to explicitly acknowledge this limitation, consistent with our prior recognition of the retrospective, single-institutional design and limited generalizability.

Changes in the text:
4. Discussion: In *4.3 Strengths and Limitations*, "Moreover, the limited number of patients reduced the statistical power to detect differences in postoperative

complications, raising the possibility of type II error whereby clinically meaningful differences may not have reached statistical significance.” (Page 15, lines 286–288)