Original Paper

Video-Assisted Thoracoscopic Surgery versus Open Sternotomy for Cardiac Procedures: A Cohort Study of Comparative Outcomes

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ABSTRACT: Background: Median sternotomy is the conventional method of cardiac surgery, yet has postsurgical complications and long recuperation periods. Video-assisted thoracoscopic surgery (VATS) is a new minimally invasive option that may give patients a better recovery without compromising safety. Methods: A retrospective cohort study was conducted using medical records from tertiary cardiac surgery hospitals. A total of 400 adult patients were included, comprising 187 patients who underwent VATS and 213 who underwent open sternotomy. Demographic and clinical characteristics, ICU stay, hospital stay, ventilation time, postoperative complications, and mortality were assessed. Comparisons were made using Mann-Whitney U and chi-square tests, and multivariable regression analyses were performed to account for confounding factors. Results: Patients in the VATS group had significantly shorter ICU stays (2.0 vs. 3.0 days, p<0.001), hospital stays (6.0 vs. 8.0 days, p<0.001), and ventilation times (16.0 vs. 30.0 hours, p<0.001). Postoperative infection (8% vs. 15%, p=0.028) and bleeding (5% vs. 11%, p=0.041) were less frequent following VATS. There was no significant difference in mortality rates between the groups (2% vs. 3%, p=0.512). The relationship between VATS and better recovery and fewer complications was confirmed by the adjusted analyses. Conclusions: VATS was associated with better postoperative recovery and fewer complications than open sternotomy, despite similar short-term mortality rates. VATS proves to be a safe and effective minimally invasive option for particular cardiac surgery patients, according to these results.

KEYWORDS: *Video-assisted thoracoscopic surgery, open sternotomy, cardiac surgery, minimally invasive surgery, postoperative outcomes.*

Introduction

The median sternotomy has been the gold-standard technique in cardiac surgery for decades because of its reproducibility [1,2].

However, median sternotomy remains an invasive surgery and can be associated with pain after surgery, a risk of sternal wound infection, and prolonged recovery [3,4].

Surgical techniques that offer the same clinical outcomes but with minimal trauma to the patient and improved recovery are being adopted due to evolving expectations of surgical care [5].

In this context, video-assisted thoracoscopic surgery (VATS) has become a minimally invasive choice for some cardiac procedures [6].

VATS attempts to cause less damage to surrounding tissues by creating smaller incisions and introducing an endoscope [7].

Although technical difficulties and limited availability have restricted its use, its use has been increasing due to advances in surgical technique and technology [8].

Over the last few years, some positive findings have emerged, such as reductions in hospital stay and quicker recovery after surgery.

Still, significant problems have been noted, including the difficulty of the procedure and the technical expertise required [9,10].

In this context, the current cohort study aims to compare video-assisted thoracoscopic surgery versus open sternotomy in cardiac surgery.

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The primary objective is to compare perioperative and postoperative outcomes, including recovery and complications.

This research seeks to compare the effectiveness of minimally invasive procedures with the current standard of care using common data in a consistent framework, thereby providing insight into the future of cardiac surgery practice.

Methodology

Study Design and Setting

This was a retrospective cohort study based on hospital medical records from tertiary cardiac surgery hospitals.

All cardiac surgeries were reviewed, and cases were identified for the last 2-5 years.

A retrospective study design enabled analysis of the actual outcomes of various surgical approaches without impacting patient care.

Study Population and Sampling Technique

Study subjects included adults undergoing cardiac surgery during the study period.

The sampling method used was non-probability, consecutive sampling, in which patients who met the inclusion criteria and had complete medical records were sampled.

Medical records were obtained from the hospital's Medical Records Department, and patients were identified by medical record number in the hospital database for review.

Patients were then sorted into two groups based on the documented surgery type: video-assisted thoracoscopic surgery (VATS) and open sternotomy. To provide a clear comparative framework, each patient was assigned to only one group.

Sample Size

In this study, 400 patients were included, of which 187 were in the video-assisted thoracoscopic surgery (VATS) group, and 213 were in the open sternotomy group.

The sample size was calculated based on the availability of complete and eligible medical records at the time of the study.

All cases with the inclusion criteria were included to maximize statistical power and for a detailed comparison of the two surgical techniques.

Inclusion and Exclusion Criteria

Patients aged 18 years and older, with operative data for both the peri- and the post-operative periods, and who had undergone cardiac surgery through either VATS or open sternotomy were included.

Those with missing data were excluded for data integrity.

In addition, to minimize confounding and internal validity, cases that required conversion from VATS to sternotomy or a second operation within the same admission were excluded, as were cases with other factors that might influence the outcome of recovery.

Data Collection Procedure

Data was extracted from medical records using a predesigned data proforma.

A coding system was created for the pro forma to facilitate data extraction and reduce variation.

This comprised age, sex, BMI, smoking status, and other medical conditions, including hypertension and diabetes.

The underlying cardiac diagnosis and surgical procedure were documented to confirm the group assignment.

The variables analyzed were time in the intensive care unit, hospital stay, ventilator time, post-operative complications (infection, bleeding, arrhythmia), and in-hospital mortality.

For ease of data extraction, a group allocation was used, but values were also recorded for continuous variables, such as ICU and hospital stay, to facilitate statistical analysis.

Study Variables

The main independent variables in this study were surgical approach (VATS vs open sternotomy).

The dependent variables (outcomes) were ICU stay, hospital stay, complications, and mortality, and the secondary outcome was time to ventilation.

Other factors, including age, sex, BMI, smoking, hypertension, and diabetes, were also considered as covariates to adjust for confounding effects and allow for comparisons between groups.

Ethical Considerations

Before the study began, the institutional review board of Faisalabad Medical University (FMU/IRB/2025/468) approved the protocol.

Since it was a records review, informed consent was not necessary.

All information obtained from patients was anonymized and confidential before analysis.

The data collected was used solely for research purposes and in compliance with guidelines.

10.12865/CHSJ.52.03.04

Statistical Analysis

The Statistical Package of the Social Sciences (SPSS) was used to enter and analyze data.

Because these data were not normally distributed, the median and interquartile range (IQR) were used to summarize the ICU stay, hospital stay, and ventilation time.

The categorical variables, such as postoperative complications and mortality, were presented as frequencies and percentages.

Due to the non-normal distribution of continuous variables, the Mann-Whitney U test was used to compare groups with VATS vs. open sternotomy, and the chi-square test was used to compare categorical variables.

The effect of surgical methods on patients' postoperative outcomes, assessed as continuous variables after adjusting for demographic and clinical parameters, was analyzed using multivariable linear regression.

A multivariable logistic regression was used to evaluate the likelihood of infection and bleeding after surgery.

A p-value of <0.05 was considered statistically significant.

Results

Participant Characteristics

Table 1 shows the demographic and clinical features of the participants (N=400).

The majority of participants were aged 46-60 years (n=132, 33.0%), followed by 31-45 years (n=124, 31.0%), >60 years (n=80, 20.0%), and 18-30 years (n=64, 16.0%).

Females constituted a slightly higher proportion (n=213, 53.2%) compared to males (n=187, 46.8%).

In terms of body mass index, most participants had normal weight (n=155, 38.8%), followed by overweight (n=126, 31.5%) and obese (n=100, 25.0%), while a smaller proportion were underweight (n=19, 4.8%).

In terms of smoking status, 48.3% of the participants had never smoked (n=193), and 32.3% and 19.5% were current and former smokers, respectively (n=129 and n=78).

A high percentage of the participants had hypertension (n=236, 59.0) and diabetes mellitus (n=299, 74.7).

In terms of the primary diagnosis, the most frequent one was coronary artery disease (n=152, 38.0%), then came valvular heart disease (n=123, 30.8%), congenital heart disease (n=80, 20.0%), and others (n=45, 11.3%).

Table 1. Demographic characteristics of participants (N=400).

Variable	f	%
Age	-	-
18-30 years	64	16.0
31-45 years	124	31.0
46-60 years	132	33.0
>60 years	80	20.0
Gender	-	-
male	187	46.8
female	213	53.2
Body mass index (BMI)	-	-
Underweight (<18.5)	19	4.8
Normal weight (18.5–24.9)	155	38.8
Overweight (25–29.9)	126	31.5
Obese (≥30)	100	25.0
Smoking status	-	-
current smoker	129	32.3
former smoker	78	19.5
never smoked	193	48.3
Hypertension	-	-
yes	236	59.0
no	164	41.0
Diabetes Mellitus	-	-
yes	299	74.7
no	101	25.3
Primary Diagnosis	-	-
Coronary artery disease (CAD)	152	38.0
Valvular heart disease	123	30.8
Congenital heart disease	80	20.0
other	45	11.3

Note. N=number of participants; f=frequency, %=percentage

Comparison of Postoperative Outcomes Between VATS and Open Sternotomy

Table 2 demonstrates that patients who underwent video-assisted thoracoscopic surgery (VATS) experienced significantly better postoperative outcomes compared to those who underwent open sternotomy.

The VATS group had a median ICU stay of 2.0 days (interquartile range 1.5 to 3.0), compared to the sternotomy group, which had a median stay of 3.0 days (interquartile range 2.0 to 5.0), with a p-value of less than 0.001.

The VATS patients spent less time hospitalized, with a median hospital duration of 6.0 days compared to 8.0 days, and their ventilation time decreased to 16.0 hours, which was less than their 30.0-hour ventilation time.

The VATS group experienced fewer postoperative complications, including lower infection rates (8.0% vs 15.0%) and lower bleeding rates (5.0% vs 11.0%).

Table 2. Comparison of Postoperative Outcomes Between Video-Assisted Thoracoscopic Surgery (VATS) and Open Sternotomy (N=400.)

Variable	Surgery	N	Median (IQR)	p value	Mean difference
ICU stay (days)	VATS	187	2.0 (1.5, 3.0) days		
	Sternotomy	213	3.0 (2.0, 5.0) days	<0.001***	-1.2 days
Hospital stay (days)	VATS	187	6.0 (4.5, 7.5) days		
	Sternotomy	213	8.0 (6.0, 10.0) days	<0.001***	-2.0 days
Ventilation time (hours)	VATS	187	16.0 (12.0, 24.0) hours		
	Sternotomy	213	30.0 (24.0, 42.0) hours	<0.001***	-14.0 hours
Infection	VATS	187	8%		
	Sternotomy	213	15%	0.028*	7% difference
Bleeding	VATS	187	5%		
	Sternotomy	213	11%	0.041*	6% difference
Mortality	VATS	187	2%		
	Sternotomy	213	3%	0.512	1% difference

Note. ***=p <0.001, *=p <0.05 considered significant; N=400.

The two surgical methods showed no impact on patient mortality rates, with rates of 2.0 percent and 3.0 percent, respectively, and a p-value of 0.512.

The research results demonstrate that VATS provides better recovery and reduces surgical complications compared to open sternotomy.

Multivariable Linear Regression Analysis of Recovery Outcomes

Table 3 shows a multivariable linear regression analysis for ICU stay, hospital stay, and ventilation time, with demographic and clinical factors controlled.

Table 3. Multivariable Linear Regression Analysis Predicting ICU Stay, Hospital Stay, and Ventilation Time Adjusted for Demographic and Clinical Covariates (N=400).

Model	Variable	B	β	t	p	95% CI LL	95% CI UL
ICU Stay	(Constant)	2.112	—	6.319	<0.001***	1.455	2.769
	Surgery Type	0.35	0.22	4.118	<0.001***	0.182	0.518
	Age	-0.03	-0.03	-0.698	0.486	-0.115	0.055
	Gender	0.125	0.065	1.452	0.147	-0.043	0.293
	BMI	-0.02	-0.025	-0.417	0.677	-0.116	0.076
	Smoking Status	-0.07	-0.075	-1.469	0.142	-0.166	0.024
	Hypertension	-0.005	-0.004	-0.06	0.952	-0.178	0.168
	Diabetes Mellitus	-0.13	-0.066	-1.327	0.191	-0.321	0.064
Hospital Stay	(Constant)	2.111	—	7.42	<0.001***	1.552	2.671
	Surgery Type	-0.18	-0.11	-2.463	0.014*	-0.322	-0.038
	Age	-0.039	-0.052	-1.048	0.295	-0.111	0.034
	Gender	-0.25	-0.17	-3.4	0.001**	-0.317	-0.030
	BMI	0.024	0.03	0.574	0.566	-0.057	0.104
	Smoking Status	0.015	0.018	0.368	0.713	-0.066	0.096
	Hypertension	-0.048	-0.033	-0.655	0.513	-0.192	0.096
	Diabetes Mellitus	0.002	0.001	0.022	0.983	-0.162	0.166
Ventilation Time	(Constant)	1.395	—	5.007	<0.001***	0.847	1.943
	Surgery Type	0.22	0.14	3.098	0.002**	0.080	0.360
	Age	-0.007	-0.01	-0.199	0.843	-0.078	0.064
	Gender	-0.086	-0.061	-1.209	0.227	-0.227	0.054
	BMI	0.048	0.059	1.188	0.236	-0.031	0.127
	Smoking Status	0.125	0.15	3.125	0.002**	0.013	0.171
	Hypertension	0.045	0.031	0.62	0.535	-0.097	0.186
	Diabetes Mellitus	-0.04	-0.024	-0.486	0.627	-0.200	0.121

Note. Multiple linear regression was conducted; β represents adjusted mean difference after controlling for confounders; Values include unstandardized coefficients (B), 95% confidence intervals (CI), standardized beta coefficients (β), and p-values; *=p <0.05, **=p <0.01, ***=p 0.001 was considered statistically significant, N=400.

The type of surgery had significant predictive power, influencing all three postoperative outcomes.

Patients who underwent different surgical procedures showed different ICU stay durations because ICU stay length for sternotomy patients exceeded that of VATS patients, according to the

10.12865/CHSJ.52.03.04

results, which controlled for confounding variables.

The surgery type had a substantial impact on both hospital stay duration (β=−0.11, p=0.014) and ventilation time (β=0.14, p=0.002), resulting in better recovery outcomes for patients who underwent VATS surgery.

Gender was the other covariate significantly associated with hospital stay (β=−0.17, p=0.001), and smoking status was independently predictive of longer ventilation time (β=0.15, p=0.002).

The study found that age, body mass index, hypertension, and diabetes mellitus were not associated with intensive care unit stay, hospital duration, or ventilator use time.

The study results showed that surgical method selection influenced patients' postoperative recovery, despite accounting for both patient demographics and medical history.

Factors Associated with Postoperative Infection and Bleeding

Table 4 shows the results of a multivariable logistic regression analysis identifying factors associated with postoperative infection and bleeding after adjustment for demographic and clinical characteristics.

The surgery type proved to be a critical factor for predicting postoperative infection because patients who underwent sternotomy faced more than double the risk of developing this condition.

The study found that gender played a critical role in determining infection risk (OR=0.595, p=0.038).

The research showed that age, BMI, smoking status, hypertension, and diabetes mellitus did not have any impact on postoperative infection risk because all p-values exceeded 0.05.

The research showed that the type of surgery performed was a separate factor in determining postoperative bleeding.

The study found that patients who underwent VATS had lower odds of bleeding complications than those who underwent sternotomy.

The research found a strong connection between gender and bleeding risk, with an odds ratio of 1.585 and a statistical significance level of 0.022.

The research established surgical method as a vital factor in determining both infection rates and bleeding outcomes after surgery for patients with various medical issues.

Table 4. Multivariable Logistic Regression Analysis of Factors Associated with Postoperative Infection and Bleeding (N=400).

Variables	B	SE	Wald	p	Exp(B)	95% C.I. for Exp(B)
Constant (infection)	-1.216	1.288	0.892	0.345	0.296	-
Surgery Type	0.850	0.330	6.693	0.010*	2.341	1.212-4.505
Age	0.284	0.170	2.786	0.095	1.328	0.952-1.854
Gender	-0.520	0.250	4.315	0.038*	0.595	0.358-0.997
BMI	-0.342	0.193	3.137	0.077	0.710	0.486-1.037
Smoking Status	-0.174	0.184	0.902	0.342	0.840	0.586-1.204
Hypertension	0.221	0.329	0.451	0.502	1.247	0.655-2.374
Diabetes Mellitus	-0.034	0.378	0.008	0.929	0.967	0.461-2.028
Constant (bleeding)	-3.518	1.819	3.739	0.053	0.030	-
Surgery Type	-1.250	0.400	9.938	0.002**	0.286	0.137-0.601
Age	-0.086	0.230	0.141	0.708	0.917	0.584-1.440
Gender	0.460	0.200	5.211	0.022*	1.585	1.073-2.344
BMI	0.143	0.254	0.319	0.572	1.154	0.702-1.899
Smoking Status	0.219	0.269	0.667	0.414	1.245	0.736-2.108
Hypertension	-0.571	0.497	1.319	0.251	0.565	0.214-1.496
Diabetes Mellitus	-0.379	0.572	0.438	0.508	0.685	0.223-2.103

Note. Values include unstandardized coefficients (B), 95% confidence intervals (CI), standard error (SE), and p-values; *=p <0.05, **=p <0.01 was considered statistically significant, N=400.

Adjusted Effect of Surgical Approach on Postoperative Outcomes

Table 5 displays the adjusted relationship between surgical procedures and surgical outcomes after controlling for age, gender, BMI, smoking habits, hypertension, and diabetes mellitus.

All primary surgical results showed a strong relationship with the type of surgical procedure.

Patients who underwent sternotomy experienced longer ICU hospitalizations (β=0.35, 95% CI: 0.18-0.52, p <0.001) and required more time on ventilation (β=0.22, 95% CI: 0.08-0.36, p=0.002) than patients who underwent VATS.

Patients who underwent VATS surgery experienced shorter hospital stays, with results showing a statistical value of β=−0.18 and a

confidence interval from −0.32 to −0.04, with a p value of 0.014.

Patients who underwent sternotomy had a more than twofold increased risk of postoperative infection (OR=2.34, 95% CI: 1.21-4.51, p=0.010), while VATS was associated with a reduced risk of postoperative bleeding (OR=0.29, 95% CI: 0.14-0.60, p=0.002).

Given these findings, VATS appears to be independently associated with better postoperative recovery outcomes and fewer complications compared with open sternotomy.

Table 5. Adjusted Association of Surgery Type with Postoperative Outcomes (N=400).

Outcome	Adjusted Effect	95% CI	p-value
ICU stay (days)	β=0.35	0.18-0.52	<0.001**
Hospital stay (days)	β=−0.18	−0.32-−0.04	0.014*
Ventilation time	β=0.22	0.08-0.36	0.002**
Infection	OR=2.34	1.21-4.51	0.010*
Bleeding	OR=0.29	0.14-0.60	0.002**

Note. β represents adjusted mean difference after controlling for confounders; OR=Odds Ratio; CI=Confidence Interval; All estimates adjusted for age, gender, BMI, smoking status, hypertension, and diabetes mellitus.

Association of Gender and Smoking Status with Surgical Approach

Table 6 shows the cross-tabulation of gender and smoking status according to the type of surgery (VATS vs open sternotomy) (N=400).

In males (n=187), more patients underwent open sternotomy (n=127) than VATS (n=60), whereas in females (n=213), more patients underwent VATS (n=127) than open sternotomy (n=86).

Gender and type of surgery were significantly associated (χ^2 (1)=16.56, p <0.001), indicating that females were more likely to undergo VATS than males.

In terms of smoking status, current smokers (n=129) underwent VATS (n=75) more than open sternotomy (n=54).

Conversely, more former smokers received open sternotomy (n=49) than VATS (n=29).

Likewise, in individuals who never smoked (n=193), the proportion of patients who had undergone open sternotomy (n=110) was higher than the proportion of patients who had undergone VATS (n=83).

The difference in smoking status and type of surgery was also statistically significant (χ^2 (2)=9.43, p=0.009), as smoking statuses were not distributed equally across the two types of surgery.

Table 6. Cross-tabulation of Gender and Smoking Status by Surgery Type (VATS vs Open Sternotomy) with Chi-Square Results (N=400).

Gender	VATS	Open Sternotomy	Total	x^2(df=1)	p value
Male	60	127	187	-	-
Female	127	86	213	-	-
Total	187	213	400	16.56	<0.001***
Smoking Status	VATS	Open Sternotomy	Total	x^2(df=2)	p value
Current Smoker	75	54	129	-	-
Former Smoker	29	49	78	-	-
Never Smoked	83	110	193	-	-
Total	187	213	400	9.43	0.009**

Note. The chi-square statistic (χ^2) and associated p-values are reported for both gender and smoking status. For gender, there is a significant association with surgery type (χ^2(1)=16.56, p <0.001), indicating a higher proportion of females undergoing VATS surgery. For smoking status, the chi-square test reveals a significant difference between smoking status and surgery type (χ^2(2)=9.43, p=0.009), with more "never smoked" patients undergoing Open Sternotomy.

Distribution of Hypertension and Diabetes Mellitus According to Surgical Approach

Figure 1 shows how common hypertension and diabetes mellitus occur in patients who received video-assisted thoracoscopic surgery (VATS) and open sternotomy procedures (N=400).

A higher number of patients with hypertension underwent open sternotomy (n=146) compared with VATS (n=90).

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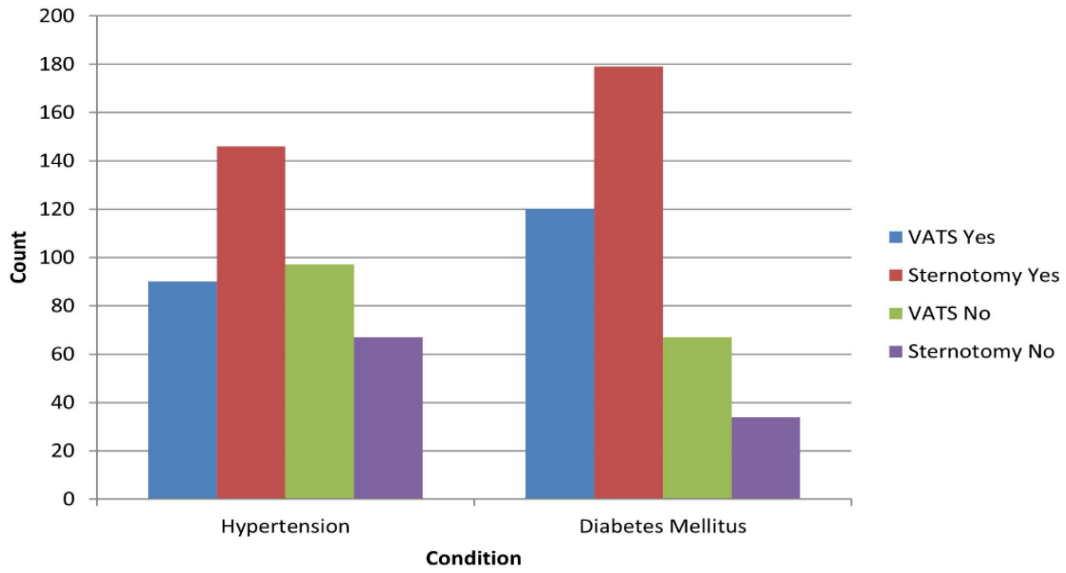


Figure 1. Comparison of the Prevalence of Hypertension and Diabetes Mellitus Between VATS and Sternotomy Groups (N=400).

The sternotomy group had more cases of diabetes mellitus than the VATS group, which included 120 patients.

The VATS group showed higher rates of patients who did not have hypertension or diabetes mellitus compared to other groups.

The research results show that open sternotomy patients had more additional medical conditions than patients who underwent VATS.

Discussion

This study aimed to compare the results of video-assisted thoracoscopic surgery (VATS) and open sternotomy in cardiac operations, and the differences between the two methods were very evident.

Patients with VATS generally had an easier postoperative course, with shorter ICU stays, reduced total hospital stays, and shorter mechanical ventilation times.

The results of these studies are consistent with prior literature indicating that VATS is associated with improved postoperative outcomes.

Decreased hospital stay has been reported in some studies, whereas reductions in ICU use and in complication rates have been noted in others. Also, there is evidence of reduced need for mechanical ventilation, indicating an overall less difficult postoperative course [11-14].

The difference in recovery time was one of the most obvious findings. The reduced ICU and hospital stay in the VATS group is consistent with the literature, particularly studies assessing early VATS.

This could be attributed to the procedure's minimality, which allows reduced surgical trauma and rapid stabilization and recovery [13].

Similar results were obtained for ventilation time, with VATS patients requiring far less respiratory support, demonstrating better preservation of early postoperative lung function.

This observation is corroborated by previous studies, which have shown that VATS is associated with much shorter ventilation times and a lower incidence of ventilator-associated complications than open thoracotomy.

These results reflect the enhanced recovery of respiration and, indirectly, the enhanced maintenance of pulmonary function during the early postoperative period [15].

Complication rates also followed the same trend.

The incidence of infections and postoperative bleeding was lower in the VATS group.

This is not unexpected as smaller incisions and less tissue disturbance help to reduce exposure and surgical trauma.

This has been confirmed by a meta-analysis, which shows that the total complication rate is significantly lower with VATS than with open thoracotomy.

The low level of invasiveness (small incisions and minimal tissue disturbance) has helped reduce the morbidity [12].

In contrast, sternotomy is more complex and may lead to a higher risk of wound complications and bleeding.

These clinically significant differences also support the practical benefit of minimally invasive practices in standard surgical practice.

This has been supported by the studies, which indicate that there are greater bleeding outcomes with sternotomy, such as the need to have more transfusions and higher rates of re-operation.

Also, sternotomy is known to pose a risk of sternal wound infection, which supports the benefit of minimally invasive techniques of decreasing surgical trauma and postoperative morbidity [16,3].

Interestingly, there was no significant difference in mortality between the two groups.

This indicates that VATS is better in recovery and lessens complications; both surgical methods are similar in short-term survival.

That is, VATS does not compromise safety but provides additional benefits during recovery [17,18].

The associations between surgery type and postoperative outcomes remained statistically significant after researchers controlled for both demographic and clinical variables.

The multivariable regression analyses demonstrated that VATS was independently associated with shorter ICU stay, reduced hospital stay, shorter ventilation time, and lower odds of postoperative complications.

The results of this study are consistent with those of a propensity-matched analysis, which showed that VATS lobectomy was associated with lower postoperative complications, fewer respiratory issues, and shorter hospital stays compared to open thoracotomy after controlling for preoperative patient characteristics [19].

The research results demonstrate that VATS delivered medical advantages that extended beyond simple age, BMI, smoking, and hypertension and diabetes mellitus level medical baseline patient characteristics.

The adjusted regression analyses showed that the surgical approach remained independently associated with ICU stay, hospital stay, and ventilation time; this relationship persisted after controlling for patient demographic and clinical factors.

Patients who underwent VATS showed better postoperative recovery results, which persisted even after researchers adjusted for their initial characteristics of age and gender, BMI, smoking status, hypertension, and diabetes mellitus.

The research findings are consistent with previous studies that found that patients who had minimally invasive surgery had shorter hospital stays, fewer surgical complications, and better recovery outcomes than those who had traditional sternotomy or thoracotomy surgery [20-22].

Another point to highlight is the differential distribution of co-morbidity across groups.

Patients with hypertension and diabetes were more likely to have an open sternotomy.

This may reflect the actual surgical decision-making process, where higher-risk patients are treated more conservatively.

Previous studies suggest that minimally invasive procedures are typically used for low-risk patients.

However, the standard sternotomy approach is used more often in complicated or high-risk cases.

This explains why the distribution of the comorbidity is not uniform and represents the actual surgical decision-making process, not a random assignment [23,24].

However, it also suggests that the observed differences in outcomes may be due to baseline risk rather than the surgical technique itself.

On the whole, the results are trending in the same direction: VATS has a distinct benefit in the recovery and complication profile, but the safety outcomes are similar.

Limitations

There are a few limitations to this study.

A retrospective design suggests that only available data were used in the analysis, and that there may be missing data and an inability to control for confounding factors.

Selection bias is also present because consecutive sampling is used rather than randomization.

There was an imbalance in the number of comorbidities, such as hypertension and diabetes, between the two groups, which may have influenced the outcomes.

Furthermore, the study was conducted in tertiary care hospitals and may not be fully generalizable to smaller hospitals or those with different levels of expertise.

The absence of long-term follow-up is another limitation.

The research is limited in its coverage of long-term recovery, quality of life, and late complications that may occur after surgery.

Finally, other factors, such as surgeon experience and the complexity of the procedure, were not assessed and could significantly affect surgical outcomes.

Despite many adjustments for confounding factors, residual bias may remain.

10.12865/CHSJ.52.03.04

Future Directions

Further studies should be prospective and preferably randomized to reduce bias and allow for a more meaningful comparison of surgical techniques.

The generalizability of findings would also be improved with multiple centers.

It's also important to see past short-term outcomes.

Long-term recovery, patient satisfaction, and functional outcomes should be evaluated to understand the overall impact of VATS better.

In addition, it would be advantageous to identify patients who would benefit from minimally invasive approaches to assist in surgical decision-making.

Other factors, such as surgeon experience, operating time, and cost-effectiveness, could be included in future studies.

Conclusion

In general, the results of VATS are better than those of open sternotomy, with fewer days in the ICU and hospital, fewer days on ventilation, and fewer complications.

In the meantime, the mortality outcomes are comparable with both methods.

Overall, these findings suggest that VATS can be considered a safe and effective alternative to sternotomy, particularly when patient selection and surgical skills allow for its performance.

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Conflicts of Interest

The authors declare no competing interests.

Institutional Review Board

The study was conducted in accordance with the principles of the Declaration of Helsinki.

Ethical approval was obtained from the Institutional Review Board/Ethics Committee of the Faisalabad Medical University (FMU/IRB/2025/468) prior to commencement of the study.

Consent Statement

The requirement for informed consent was waived by the Institutional Review Board because of the retrospective nature of the study and the use of anonymized medical record data.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Data are not publicly available due to institutional and patient confidentiality requirements.

References

1. Matache R, Dumitrescu M, Bobocea A, Cordoș I. Median sternotomy-gold standard incision for cardiac surgeons. J Clin Investig Surg, 2016, 1(1):33-40.
2. Vignaroli W, Pala B, Nasso G, Sechi S, Campolongo G, Speziale G, Navarra EM. Mini- and micro-invasive approaches in cardiac surgery: current techniques, outcomes, and future perspectives. Medicina (Kaunas), 2026, 62(1):102.
3. Ma X, Chen D, Liu J, Wang W, Feng Z, Cheng N, Li S, Wang S, Liu L, Chen Y. Risk factors for sternal wound infection after median sternotomy: a nested case-control study and time-to-event analysis. Int Wound J, 2024, 21(7):e14965.
4. Bui R, Macnojia A, Li T, Hasoon J, Aftab M, Estrera AL, Preventza O, LeMaire SA, Coselli JS. A review of chronic post-sternotomy pain syndrome. Curr Pain Headache Rep, 2026, 30(1):41.
5. Amin A, Kumar R, Mokhtassi SS, Alassiri AK, Odaman A, Khan MAR, Lakshmana S, Din ZU, Acharya P, Cheema HA, Nashwan AJ, Khan AA, Hussain A, Bhudia S, Vincent RP. Minimally invasive vs. conventional mitral valve surgery: a meta-analysis of randomised controlled trials. Front Cardiovasc Med, 2024, 11:1437524.
6. Drosos V, Durak K, Autschbach R, Spillner J, Nubbemeyer K, Zayat R, Kalverkamp S. Video-assisted thoracoscopic surgery management of subacute retained blood syndrome after cardiac surgery. Ann Thorac Cardiovasc Surg, 2021, 28(2):146-153.

7. Ocheli EO, Amadi CE, Okonta KE. Video-assisted thoracoscopic surgery. In: Ray-Offor E, Rosenthal RJ (Eds): Principles and Practice of Laparoscopic Surgery, Springer, 2025, Cham, 235-250.
8. Gonzalez-Rivas D. Uniportal thoracoscopic surgery: from medical thoracoscopy to non-intubated uniportal video-assisted major pulmonary resections. Ann Cardiothorac Surg, 2016, 5(2):85-91.
9. Poddi S, Rungatscher A. Minimally invasive cardiac surgery: a state-of-the-art review. J Clin Med, 2026, 15(1):371.
10. Servito M, Ramsay H, Mann S, Ramelli L, Fernandez AL, El Diasty M. Surgical outcomes after minimally invasive versus full sternotomy aortic valve replacement: meta-analysis of 75 comparative studies. Innovations (Phila), 2025, 20(3):257-264.
11. Niskakangas A, Mustonen O, Puro I, Karjula T, Helminen O, Yannopoulos F. Results of video-assisted thoracoscopic surgery versus thoracotomy for lung cancer in a mixed practice medium-volume hospital: a propensity-matched study. Interdiscip Cardiovasc Thorac Surg, 2023, 37(6):ivad189.
12. Sudarma IW, Yasa KP, Harta IKAP, Pertiwi PFK. Video-assisted thoracoscopic surgery vs open thoracotomy in the management of empyema: a meta-analytical perspective. J Indones Vasc Access, 2024, 4(2):32-37.
13. Maneval AC, Brahmbhatt TS. Early video-assisted thoracoscopic surgery (VATS) in blunt chest trauma: a narrative review of indications, outcomes, and evolving practice patterns. Video Assist Thorac Surg, 2025, 10:35.
14. Sabra MJ, Alwatari Y, Bierema C, Wolfe LG, Cassano AD, Shah RD. Five-year experience with VATS versus thoracotomy segmentectomy for lung tumor resection. Innovations (Phila), 2020, 15(4):346-354.
15. Qi Y. Clinical study on VATS combined mechanical ventilation treatment of ARDS secondary to severe chest trauma. Exp Ther Med, 2016, 12(2):1034-1038.
16. Pojar M, Karalko M, Dergel M, Vojacek J. Minimally invasive or sternotomy approach in mitral valve surgery: a propensity-matched comparison. J Cardiothorac Surg, 2021, 16(1):228.
17. Cao C, Manganas C, Ang SC, Peeceeyen S, Yan TD. Video-assisted thoracic surgery versus open thoracotomy for non-small cell lung cancer: a meta-analysis of propensity score-matched patients. Interact Cardiovasc Thorac Surg, 2013, 16(3):244-249.
18. da Nobrega Oliveira REN, de Andrade Pontual Peres C, Oliveira AC, Onyeji P, Kemczenski F. Comparative outcomes of video-assisted thoracic surgery versus open thoracic surgery in pediatric pulmonary metastasectomy: a systematic review and meta-analysis. Pediatr Surg Int, 2024, 41(1):34.
19. Paul S, Altorki NK, Sheng S, Lee PC, Harpole DH, Onaitis MW, Stiles BM, Port JL, D'Amico TA. Thoracoscopic lobectomy is associated with lower morbidity than open lobectomy: a propensity-matched analysis from the STS database. J Thorac Cardiovasc Surg, 2010, 139(2):366-378.
20. Gutman S, Kanani F, Messer N, Goldstein AL, Shimonov M, Kamar A, Salhab A, Akar FA.The role of video-assisted thoracic surgery (VATS) in the management of thoracic stab wounds: a narrative review. Video Assist Thorac Surg, 2025, 10:23.
21. Suwanarawat T, Deesang R, Tawanseree S, Watcharasoonthonkit S, Saeteng S, Siwachat S, Tantraworasin A. Comparative analysis of surgical outcomes: video-assisted thoracoscopic surgery versus open thoracotomy in organizing thoracic empyema management. PLoS One, 2025, 20(10):e0332618.
22. Li Y, Liu Y, Lu Y, Lin D. Video-assisted thoracoscopic surgery versus thoracotomy for locally advanced lung cancers: a systematic review and meta-analysis. Medicine (Baltimore), 2026, 105(4):e47359.
23. Liang L, Ma X, Kong Q, Xiao W, Chi L, Zhu J. Comparing patient outcomes following minimally invasive coronary artery bypass grafting surgery vs coronary artery bypass grafting: a single-center retrospective cohort study. Cardiovasc Diagn Ther, 2022, 12(3):378-388.
24. Cisneros Clavijo PE, Moreno Barragan AS, López Hernández M, Dorado Ramírez JM, Sanchez Prada LC, Bonilla Rojas ND, Zabaleta Orozco SD. Minimally invasive coronary artery revascularization surgery versus conventional techniques in patients with complex coronary artery disease: a systematic review of cardiac function. Cureus, 2026, 18(1):e102275.

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