Surgery in Practice and Science 18 (2024) 100250

Contents lists available at ScienceDirect

Surgery in Practice and Science

journal homepage: www.sciencedirect.com/journal/surgery-in-practice-and-science

Research Article

Marital status shows no protective effect on perioperative outcomes after robotic-assisted pulmonary lobectomy

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ARTICLE INFO

Presented in part as a QuickShot presentation at: Academic Surgical Congress, Houston, TX, USA, February 7–9, 2023,

Keywords:
Marital status
Perioperative outcomes
Robotic surgery
Pulmonary lobectomy

ABSTRACT

Background: Marital status has been shown to have protective effects for married patients with various cancers. We sought to determine effects of marital status on perioperative outcomes after robotic-assisted pulmonary lobectomy (RAPL).

Methods: We retrospectively analyzed 709 consecutive patients who underwent RAPL between 2010 and 2022 by one surgeon. Patients were stratified by marital status at time of surgery. The Married group included married, domestically partnered, and co-habitating patients ($N = 473$). The Unmarried group included never married, divorced, and widowed individuals ($N = 236$). Demographics, preoperative comorbidities, intraoperative and postoperative complications, estimated blood loss (EBL), chest tube duration, hospital length of stay (LOS), tumor characteristics, and survival data were analyzed utilizing Student's *t*-test, Wilcoxon rank-sum test, Chi-square, or Fisher's exact test as appropriate, with significance at $p \leq 0.05$.

Results: Unmarried patients were more likely to be female, while married patients were more likely to experience robotic-associated intraoperative complications and greater intraoperative estimated blood loss. Kaplan-Meier survival analysis revealed no difference in 5-year overall survival based on marital status. Other perioperative outcomes, intraoperative complications (except robotic-associated), postoperative complications, demographic history (except gender), and preoperative comorbidities did not significantly differ between the two groups.

Conclusion: This study challenges the existing reports in the literature that marriage confers cancer treatment outcomes advantage and prolonged survival among cancer patients. Social support, in terms of a spouse or domestic partner, may be less protective in early-stage lung cancer and after minimally invasive pulmonary lobectomy compared to other cancer populations.

Introduction

According to the 2019 American Community Survey (Integrated Public Use Microdata Series, https://www.ipums.org), roughly 53 % of Americans are married.[1] Existing literature assessing the impact of marital status on malignancy-specific survival has repeatedly shown to be protective in prior investigations, a theory which originated in 1897 from Durkheim's study of suicide.[2] Despite ample evidence for the benefit of marriage on survival outcomes in patients with cancers of the prostate, breast, esophagus, head/neck, colon, kidney, cervix, liver, stomach, rectum, and lung, causality has been difficult to determine and remains unsubstantiated in many cases. Additionally, studies of marital status as the primary independent variable have heavily focused on survival analysis and excluded the potential impact of social support on other perioperative outcomes.[3-11] Since 1990, societal trends have demonstrated significant growth in the never-married and unpartnered population of the United States, necessitating further investigation of the influence of marital status on health outcomes.[1]

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https://doi.org/10.1016/j.sipas.2024.100250
Received 8 January 2024; Received in revised form 22 April 2024; Accepted 25 April 2024
Available online 26 April 2024

Although late-stage presentation and mortality rates of lung cancer continue to steadily decline, it remains the leading cause of cancer death, claiming approximately 350 lives per day in the United States.[12] Non-small cell lung cancer (NSCLC) represents the majority of lung cancer patients, approximately 80 %. Although 50 % of NSCLC diagnoses are stage IV with distant metastases at presentation, for the other half of NSCLC patients, pulmonary lobectomy is the gold standard for treatment, significantly extending 5-year overall survival (OS). For patients with advanced disease, other treatment options include chemotherapy, immunotherapy, genetically-targeted therapies, and radiotherapy; however, these therapies are often palliative.[13]

The prognostic significance of marital status among NSCLC patients remains unclear despite similar studies among other malignancies. Kumi et al. found no impact of marital status on duration of survival or quality of life across three studies of Japanese NSCLC patients between 2006 and 2008.[14-16] This study stands in contrast to more recent investigations identifying marital status as an independent predictor of survival in a variety of cancer types.[3-11] In a similar study of NSCLC patients in the United States from 2004 to 2012, Wu et al. reported a considerable risk of poorer prognosis among those patients divorced/-separated, widowed, or never married as compared to married patients. Among the categorized statuses, widowed patients had the worst OS following surgery, independent of stage at diagnosis, and non-surgical advanced disease unmarried patients had poorer outcomes when compared to married patients at the same stage.[10]

Many theories exist as to the benefits of marriage in cancer patients. Proposed benefits of social support in chronic disease states and malignancy include decreases in depressive affect as well as improvements in patient compliance with therapy, patient perception of quality of life, better access to health care, and positive physiologic immune response.[17] Psychological health may be bolstered by marriage or significant others, alleviating anxiety and depression often present in cancer patients. Consequently, adherence to post-operative treatment regimens is typically superior in married patients, as evidenced by the negative correlation between depression and adherence and three-times increased risk of noncompliance in depressed patients.[18] Furthermore, physiologic advantages in cardiovascular, endocrine, and immunological health, as well as lower cortisol levels, have been well-studied among married individuals.[19,20] In total, both psychological and physiologic factors may contribute to a proposed improvement in treatment outcomes for lung cancer patients and overall protective effect.

At our institution, pulmonary lobectomy for early-stage NSCLC is generally performed in a minimally invasive procedure with the assistance of a robotic surgical system, highlighting a divergence from past studies in which pulmonary lobectomy via traditional thoracotomy was customary, and, moreover, naturally raising the question of whether prior analysis of demographic factors translates to new surgical techniques. With the exception of publications from Kumi et al. and Wu et al., few studies exist assessing the correlation between marital status and NSCLC survival, and to the best of our knowledge, no current studies in literature have reported outcome data following robotic-assisted pulmonary lobectomy (RAPL).[10,14-16] Considering the significant contribution of NSCLC to morbidity and mortality in the United States and globally, and the current knowledge gap regarding the impact of social supports in this specific patient population, we sought to determine effects of marital status on perioperative outcomes after robotic-assisted pulmonary lobectomy.

Materials and methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethical approval to report this study was obtained from our institution's Scientific Review Committee and by our university's Institutional Review Boards. Informed consent for patient information to be published in this article was waived by our Institutional Review Boards for this retrospective study, which is considered a review of existing data. However, through our institutional surgical informed consent, patients gave permission to use surgery-related and tissue-related data for education and research purposes.

We performed a retrospective cohort study of 709 consecutive patients that underwent RAPL between September 2010 and March 2022 for suspected or known non-small cell lung cancer (NSCLC). All surgeries were completed by one surgeon at a single institution with robotic assistance from the da Vinci® S™, Si™, or Xi™ robotic surgical systems (Intuitive Surgical Corp., Sunnyvale, CA, USA) dependent on date of surgery. Patients were then grouped into two cohorts based upon the current marital status at the time of surgery regardless of any prior marital status. The Married group included patients currently married, in a domestic partnership, or co-habitating with a significant other at the time of surgery regardless of any prior marital status ($N = 473$). The Unmarried group included individuals who were currently divorced, widowed, or never-married at the time of surgery regardless of any prior marital status ($N = 236$). A previously divorced or widowed patient, for example, currently living in a domestic partnership or co-habitating with a significant other at time of surgery would be included in the Married group. All data was obtained via chart review of the electronic medical records at our institution.

Demographic information, including age, sex, body mass index (BMI), and smoking history and status, was compared between the Married and Unmarried cohorts. Smoking history was determined by calculating pack-years (number of packs smoked per day multiplied by number of years patient has smoked). Regarding smoking status, patients were classified as either current smokers or former/never smokers. Patients who had ceased smoking at least three months prior to their date of surgery were classified as former smokers. Additionally, preoperative comorbidities, including the Charlson-Deyo Comorbidity Index (CCI) score, intraoperative and postoperative complications, and tumor characteristics, were evaluated between the two groups.

Perioperative outcomes were assessed by comparing skin-to-skin operative duration, estimated blood loss (EBL), chest tube duration, hospital length of stay (LOS), in-hospital mortality, and disposition at discharge (favorable vs. unfavorable), between the cohorts. Skin-to-skin operative time was defined as the time, in minutes, from first incision to closure of the last incision during surgery. Estimated blood loss was determined solely by the anesthesiologists measuring the amount of evacuated fluid in the suction canister at the end of the procedure. Surgical sponges were not used during robotic-assisted pulmonary lobectomy procedures and, thus, were not available to be weighed during estimation of blood loss.

Favorable disposition at discharge was assigned to patients discharged to home with self-care or with home health, while unfavorable disposition at discharge was assigned to patients who were transferred to long-term acute care or rehabilitation facility, patients who were discharged to assisted-living facility or to hospice, or patients who died. Survival analysis, using Kaplan-Meier curves, was also performed to compare 5-year OS among cohorts. The vital status of each patient was obtained from existing electronic medical records using the documented date of last follow-up or last contact or else the documented date of death. No contact with patients or their families to determine their vital status was ever attempted.

Descriptive analysis for continuous variables was conducted, and means with standard error of the mean or medians 1st and 3rd quartiles were reported as appropriate. Frequencies, both number and percentage, were given for categorical variables. Comparative analysis between Married and Unmarried cohorts was performed using the student's *t*-test and Wilcoxon rank-sum test to identify differences in continuous variables. Pearson Chi-square test, or Fisher's exact test where appropriate (denoted in Table 2), was used to highlight relationships among categorical variables. All variables were analyzed using univariate models with significance at $p \leq 0.05$. Survival analysis comparing 5-year OS between groups was performed using Kaplan-Meier curves, as seen in Fig. 1.

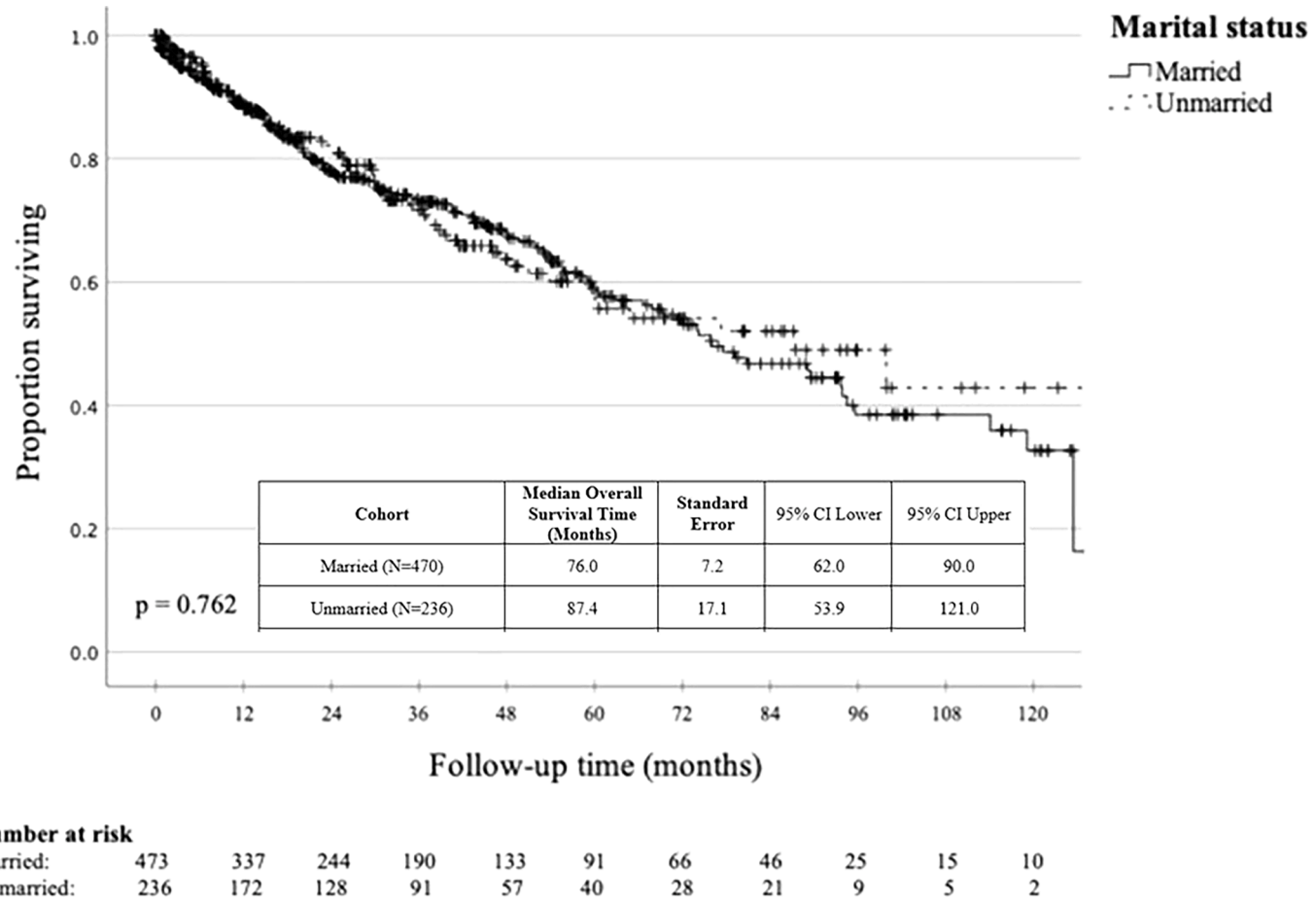

Fig. 1. Kaplan Meier Curves of 5-Year Overall Survival (OS) by Marital Status. Median OS time for the entire study cohort was 77.6 months ± standard error of the mean (SEM) of 7.5 months (95 % confidence interval [CI] = 63.0–92.2). Median OS time in Married patients was 76.0 ± 7.2 months (95 % CI = 62.0–90.0) compared to 87.4 ± 17.1 months (95 % CI = 53.9–121.0) in Unmarried patients. The 5-year OS estimate is 72.5 % in the Married group and 72.5 % in the Unmarried group. The numbers at risk noted below the x-axis denote the number of patients still alive who had follow-up (i.e., not yet censored) at each respective time point in the follow-up period. Our findings show no statistically significant difference in OS between Married and Unmarried patients (log-rank $p = 0.762$).

Results

Our retrospective analysis of 709 consecutive patients included those who underwent robotic-assisted pulmonary lobectomies (RAPL) performed by a single surgeon at our institution during the study period from 2010 to 2022. Patients were grouped according to marital status at the time of surgery. Of the 709 study patients, 473 patients formed the "Married" cohort, including currently married patients and those who were currently in domestic partnerships or co-habitating with a significant other, and 236 patients formed the "Unmarried" cohort, including patients who were never married or who were currently divorced or widowed.

Patient demographics and preoperative comorbidities

Unmarried patients were more likely to be female (70.3 % vs. 48.7 %; $p < 0.0002$). No statistically significant differences were found between the two cohorts with respect to age, BMI, forced expiratory volume in 1 second as percent of predicted (FEV1 %), diffusion capacity of the lung for carbon monoxide as percent of predicted (DLCO %), smoking status, smoking history, or tumor characteristics (Tables 1 and 3). Additionally, no statistically significant differences were found between groups in our examination of pre-existing comorbidities (Table 2).

Table 1
Demographics.

Variables	Married ($N = 473$)	Unmarried ($N = 236$)	*p*-value
Age*, years	68.3 ± 0.9* [29–88]	68.2 ± 1.4 [24–93]	0.9099
Sex	51.3 %	29.7 %	<0.0002
Male	48.7 %	70.3 %	
Female			
Body Mass Index*, kg/m2	28.1 ± 0.5* [14.0–59.0]	27.6 ± 0.8 [16.3–60.1]	0.2918
FEV1 %*	88.0 ± 1.8* [34–147]	89.4 ± 2.5 [32–140]	0.3437
DLCO %*	77.9 ± 1.8* [37–130]	74.9 ± 2.6 [18–131]	0.0622
Smoking Status	82.0 %	80.9 %	0.7220
Never/Former	18.0 %	19.1 %	
Current			
Smoking History*, pack-years	34.8 ± 1.5	33.4 ± 2.0	0.1504

* Mean ± standard error of the mean (SEM) [range]; FEV1 % = forced expiratory volume in 1 second as percent of predicted; DLCO % = diffusion capacity of the lungs for carbon monoxide as percent of predicted.

Intraoperative and postoperative factors and complications

Married patients were more likely to experience robotic-associated intraoperative complications (5.7 % vs. 2.1 %, $p = 0.034$). However,

Table 2
Preoperative Comorbidities.

Variables	Married (*N* = 473)	Unmarried (*N* = 236)	*p*-value
Cerebrovascular accident	13 (2.7 %)	11 (4.7 %)	0.1845
Carotid Stenosis	16 (3.4 %)	9 (3.8 %)	0.7694
Coronary Artery Disease or Myocardial Infarction	53 (11.2 %)	38 (16.1 %)	0.0662
Valve Disease or Cardiomyopathy	23 (4.9 %)	13 (5.5 %)	0.7120
Atrial Fibrillation	35 (7.4 %)	11 (4.7 %)	0.1630
Other Arrhythmias	70 (14.8 %)	31 (13.1 %)	0.5504
Congestive Heart Failure	8 (1.7 %)	2 (0.8 %)	0.3692
Hypertension	204 (43.1 %)	96 (40.7 %)	0.5336
Hyperlipidemia	146 (30.1 %)	89 (37.7 %)	0.0681
Peripheral Vascular Disease	13 (2.7 %)	10 (4.2 %)	0.2916
Chronic Obstructive Pulmonary Disease	62 (13.1 %)	36 (15.3 %)	0.4352
Obstructive Sleep Apnea	26 (5.5 %)	8 (3.4 %)	0.2160
Asthma	32 (6.8 %)	9 (3.8 %)	0.1126
Pneumonia	27 (5.7 %)	15 (6.4 %)	0.7307
Pulmonary Fibrosis	5 (1.1 %)	2 (0.8 %)	0.7902
Pulmonary Embolus or Deep Venous Thrombosis	14 (3.0 %)	6 (2.5 %)	0.7517
Gastroesophageal Reflux Disease	74 (15.6 %)	35 (14.8 %)	0.7770
Cirrhosis or Liver Failure	3 (0.6 %)	1 (0.4 %)	0.7243
Pancreatitis	8 (1.7 %)	2 (0.8 %)	0.3692
Kidney Disease	6 (1.3 %)	8 (3.4 %)	0.0557
Chronic Anemia	9 (1.9 %)	3 (1.3 %)	0.5390
Coagulation, Hemophilia, Thrombocytopenia	6 (1.3 %)	4 (1.7 %)	0.6500
Diabetes Mellitus	6 (14.0 %)	26 9 (11.0 %)	0.2729
Previous Cancer	154 (32.6 %)	74 (31.4 %)	0.7467
Charlson Comorbidity Index Score	0.80 ± 0.10 [0–3]	0.82 ± 0.15 [0–3]	0.7529

Table 3
Tumor Characteristics.

Variables	Married (*N* = 473)	Unmarried (*N* = 236)	*p*-value
Pathology	461 (97.4 %)	232 (98.3 %)	0.6547
Malignant	12 (2.5 %)	4 (1.7 %)	
Benign			
Malignant Pathology			0.9512
Primary Lung Cancer	432/461 (93.7 %)	216/232 (93.1 %)	
Pulmonary Metastasis	27/461 (5.9 %)	15/232 (6.5 %)	
Other (e.g., Lymphoma)	2/461 (0.4 %)	1/232 (0.4 %)	
Primary Lung Cancer Nodal Status	294/432 (68.1 %)	151/216 (69.9 %)	0.8825
pN0	58/432 (13.4 %)	28/216 (13.0 %)	
pN1	80/432 (18.5 %)	37/216 (17.1 %)	
pN2			
Primary Lung Cancer Metastatic Status	425/432 (98.4 %)	210/216 (97.2 %)	0.4884
pM0	7/432 (1.6 %)	6/216 (2.8 %)	
pM1			

pN = pathologic nodal status; pM = pathologic metastasis status.

there were no statistically significant differences between Married and Unmarried cohorts in overall rate of intraoperative complications nor in any other intraoperative complication, as reported in Table 4.

Our study assessed perioperative outcomes chiefly in terms of skin-to-skin operative time, EBL, hospital LOS, chest tube duration, and disposition at discharge (Table 5). The Married cohort experienced greater median EBL than the Unmarried cohort (200 mL vs. 128 mL; $p < 0.001$). All other measures of perioperative outcomes were not statistically insignificant between groups.

Table 4
Intraoperative Complications.

Variables	Married (*N* = 473)	Unmarried (*N* = 236)	*p*-value
Presence of Any Intraoperative Complications	32 (6.8 %)	8 (3.4 %)	0.066
Bleeding (Pulmonary Artery)	15 (3.2 %)	3 (1.3 %)	0.130
Bleeding (Pulmonary Vein)	7 (1.5 %)	1 (0.4 %)	0.210
Bleeding (Other)	6 (1.3 %)	2 (0.8 %)	0.617
Tracheal/Bronchial Injury	7 (1.5 %)	0 (0.0 %)	0.060
Diaphragm Injury	0 (0.0 %)	1 (0.4 %)	0.157
Phrenic Nerve Injury	1 (0.2 %)	0 (0.0 %)	0.480
Recurrent Laryngeal Nerve Injury	0 (0.0 %)	0 (0.0 %)	N/A
Robotic-Associated Intraoperative Complications	27 (5.7 %)	5 (2.1 %)	0.030*

Rates of postoperative complication in both the Married and Unmarried group were nearly identical, 52.6 % vs 52.5 % ($p = 0.996$), respectively. In our analysis of the specific postoperative complications listed in Table 6, none were statistically significant.

Perioperative mortality and overall survival

In-hospital mortality remained low in both cohorts. As seen in Table 4, there were 6 in-hospital deaths in the Married cohort (1.3 %) as compared to 4 in-hospital deaths in the Unmarried cohort (1.7 %) ($p = 0.994$).

Kaplan-Meier curves were generated to assess 5-year OS between groups. Median OS time for the entire study cohort was 77.6 months ± standard error of 7.5 months (95 % confidence interval [CI] = 63.0–92.2). Median OS time in Married patients was 76.0 ± 7.2 months (95 % CI = 62.0–90.0) compared to 87.4 ± 17.1 months (95 % CI = 53.9–121.0) in Unmarried patients. Mean follow-up time achieved for the entire study population was 33.0 months. Our findings, illustrated in Fig. 1, showed no statistically significant difference in OS between Married and Unmarried patients (log-rank $p = 0.762$) and, thus, did not warrant further multivariable analysis of survival.

Discussion

Although marital status and social support are a common discussion point in medical research, few studies exist examining the impact of marital status on NSCLC, and none have been published with data obtained in the last decade. The best study for comparison was conducted by Wu et al. in 70,006 NSCLC patients from 2004 to 2012 and found that marriage has a strong protective effect and survival benefit in NSCLC patients. This was the only other publication found by our study team assessing the relationship between NSCLC and marital status in the United States. That study was also the most recent investigation

Table 5
Perioperative Outcomes.

Variables	Married (*N* = 473)	Unmarried (*N* = 236)	*p*-value
Estimated Blood Loss*, mL	200 [100, 300]	128 [75, 250]	<0.001
Skin-to-skin duration*, min	176 [143, 230]	178 [148, 217]	0.358
Overall Conversion to Thoracotomy	25 (5.3 %)	14 (5.9 %)	0.722
Urgent Conversion to Thoracotomy	8 (1.7 %)	7 (3.0 %)	0.266
Hospital Length of Stay*, days	4 [3, 7]	4 [3, 6]	0.242
Chest Tube Duration*, days	4 [2, 6]	5 [3, 6]	0.110
In-Hospital Mortality	6 (1.3 %)	4 (1.7 %)	0.650
Favorable Disposition**	458 (96.8 %)	227 (96.2 %)	0.657
Unfavorable Disposition***	15 (3.2 %)	9 (3.8 %)	0.656

* Median [1st Quartile, 3rd Quartile].
** Home with self-care or with home health.
*** Transferred to long-term acute care or rehabilitation facility, discharged to assisted-living facility or hospice, or died.

Table 6
Postoperative Complications.

Variables	Married ($N = 473$)	Unmarried ($N = 236$)	*p*-value
Presence of Any Postoperative Complications	246 (52.0 %)	124 (52.5 %)	0.893
Cerebrovascular Accident	1 (0.2 %)	1 (0.4 %)	0.615
True Postop Atrial Fibrillation	52 (11.0 %)	28 (11.9 %)	0.730
Other Arrhythmia	88 (18.6 %)	52 (22.0 %)	0.280
Hypotension	13 (2.7 %)	10 (4.2 %)	0.292
Myocardial Infarction	3 (0.6 %)	1 (0.4 %)	0.724
Shock/Multi-Organ System Failure	2 (0.4 %)	3 (1.3 %)	0.203
Cardiopulmonary Arrest	2 (0.4 %)	1 (0.4 %)	0.999
Pulmonary Embolism	3 (0.6 %)	2 (0.8 %)	0.749
Respiratory Failure	9 (1.9 %)	8 (3.4 %)	0.223
Hemothorax	5 (1.1 %)	2 (0.9 %)	0.790
Chyle Leak	19 (4.0 %)	12 (5.1 %)	0.512
Effusion or Emphysema	19 (4.0 %)	13 (5.5 %)	0.367
Pneumothorax after Chest Tube Removal	7 (1.5 %)	7 (3.0 %)	0.180
Air Leak >5 days	113 (23.9 %)	48 (20.6 %)	0.288
Air Leak ≥7 days w/wo Subcutaneous Emphysema	89 (18.8 %)	36 (15.5 %)	0.241
Hypoxia	11 (2.3 %)	5 (2.1 %)	0.861
Mucous Plug Requiring Bronchoscopy	24 (5.1 %)	9 (3.8 %)	0.453
Aspiration	11 (2.3 %)	2 (0.8 %)	0.167
Pneumonia	24 (5.1 %)	19 (8.1 %)	0.118

conducted on this topic; however, the data is now over ten years old. Their study included demographics, tumor characteristics, and survival data but did not report correlation between marital status and preoperative comorbidities, intraoperative and postoperative complications, or other perioperative outcomes. Furthermore, their Unmarried cohort was subdivided into Divorced/Separated, Widowed, and Never Married.[10]

Contrary to Wu et al., our data revealed that Married patients and Unmarried patients showed no difference in post-operative complications or 5-year OS, and, in fact, the Unmarried group fared better during surgery in our study in terms of robotic-associated complications and EBL. Our patient database included patients from 2010 to 2022, and, thus, our results may reflect the recent impact of surgical advancement and minimally invasive techniques on patient outcomes after lobectomy for NSCLC. Our findings suggest that social support may be less essential to recovery and long-term health outcomes following minimally invasive surgery, such as RAPL, as compared to prior open lobectomies. Moreover, only 26.2 % of patients in the study by Wu et al. underwent surgery for NSCLC, and specifics of surgical procedure type (minimally invasive vs. open via thoracotomy) were not reported in their data. Our cohort of 709 patients was comprised of only individuals who had surgery for NSCLC. Additionally, Wu et al. observed almost 46 % of patients with stage-IV NSCLC, while our patients, as candidates for minimally invasive surgery were largely stage I or II, with some stage-III patients, but only two (0.3 %) stage-IV patients. Of the 648 patients in our database with primary lung cancers, 503 (77.6 %) of patients undergoing RAPL were stage I or stage II, and 145 (22.4 %) were stage III. This indicates that post-operative support, like that provided by a partner or spouse, may have been more influential in patients with terminal or advanced disease and those who underwent more invasive procedures, i.e. open lobectomy via traditional thoracotomy.[10]

The subclassification of the Unmarried cohort is another important divergence between Wu et al. and our own study. In our interpretation of study results, we report marital status as a reflection of close social support in the perioperative period rather than abiding by the strict definition of marriage with legal certification. Hence, patients living in a domestic partnership and co-habitating with a significant other were also considered "married", even if they were previously widowed, divorced, or separated. As a result, different definitions of "marital status" may have further contributed to our findings contrasting to those by Wu et al.[10]

The benefits of marriage have been repeatedly presented in studies of a wide variety of malignancies, including but not limited to cancers of the prostate, breast, esophagus, head/neck, colon, kidney, cervix, liver, stomach, rectum, and lung.[3-11] However, we hypothesize that these findings may be confounded by (a) invasiveness of the surgical procedure and (b) early versus advanced disease status at time of diagnosis. Although outdated with surgial procedures occurring from June 1996 to April 1999, Kumi et al. supports our findings and mirrors our study by including only patients whose treatment included curative resection. Those authors reported no association between marital status and social support and survival after resection for NSCLC, albeit with a sample size much smaller than our own ($N = 238$).[15]

Limitations of our study include its retrospective nature, permitting loss of patients to follow-up, or missing data for specific variables in some patients. In addition, while the elimination of confounders partially achieved by having all operations completed by one surgeon at a single hospital, this fact may limit the generalizability of our findings to all pulmonary lobectomies for NSCLC. Furthermore, as an observational study, natural limitations exist, such as the presence of confounding variables, which were isolated to the best of our ability.

Conclusions

The existing literature analyzing the relationship between marital status and survival outcomes of lung cancer, specifically NSCLC, patients is scarce and outdated. Broader impacts of marriage and social support on preoperative comorbidities, intraoperative complications, and perioperative outcomes has not previously been reported in NSCLC patients. We identified Unmarried patients as more likely to be female and Married patients as more likely to experience intraoperative robotic-associated complications and greater EBL. However, no statistically significant differences in in-hospital mortality or 5-year OS were evident between our two cohorts. In conclusion, our data do not support the hypothesis that marital status and social support provide better outcomes and/or a survival benefit after robotic-associated pulmonary lobectomy in NSCLC patients in the United States. Our findings propose that social support may be less protective in minimally invasive surgery and early-stage malignancy, such as following RAPL for NSCLC, and that marriage, as opposed to being single, may not provide the universal health benefits we once thought.

CRediT authorship contribution statement

Jenna C. Marek: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Allison O. Dumitriu Carcoana:** Writing – review & editing, Data curation. **William J. West:** Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation. **Emily E. Weeden:** Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ajay Varadhan:** Writing – review & editing, Funding acquisition, Data curation. **Jessica Cobb:** Writing – review & editing, Data curation. **Sarah Cool:** Writing – review & editing, Funding acquisition, Data curation. **Gregory Fishberger:** Writing – review & editing, Funding acquisition, Data curation. **Collin B. Chase:** Writing – review & editing, Funding acquisition, Data curation. **Maykel Dolorit:** Writing – review & editing, Data curation. **Harrison E. Strang:** Writing – review & editing, Funding acquisition, Data curation. **Carla C. Moodie:** Writing – review & editing, Data curation. **Joseph R. Garrett:** Writing – review & editing, Data curation. **Jenna R. Tew:** Writing – review & editing, Data curation. **Jobelle Joyce-Anne R. Baldonado:** Writing – review & editing, Resources, Methodology, Data curation. **Jacques P. Fontaine:** Writing – review & editing, Resources, Methodology, Data curation. **Eric M. Toloza:** Writing – review & editing, Writing – original draft, Visualization,

Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

Funding: This research was supported in part by a 2022 Summer Scholarly Award presented to W.J.W.III and individual 2021 Summer Scholarly Awards presented to J.C., S.C. G.F., C.B.C., and H.E.S. from the Scholarly Concentrations Program of the Office of Research, Innovation & Scholarly Endeavors (RISE) at the University of South Florida (USF) Health Morsani College of Medicine in Tampa, FL, USA, and by a Summer Immersion Award to A.V. from the Scholarly Excellence, Leadership Experiences, Collaborative Training (SELECT) Program of the USF Health Morsani College of Medicine and the Lehigh Valley Health Network, Allentown, PA, USA. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict-of-Interest (COI) Disclosure: JPF and EMT have had financial relationships with Intuitive Surgical, Inc., in the form of honoraria received as robotic thoracic surgery observation sites and proctors. The other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Two-sentence article summary

This retrospective study assessed the impact of marital status on perioperative outcomes after robotic-assisted pulmonary lobectomy. This study is significant by challenging existing reports in the literature that social support, such as marriage, confers an advantage in cancer treatment outcomes and survival and suggesting that social factors may play a less substantial role in minimally invasive surgery and early-stage malignancy.

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