The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 6, 2025

COMPARISON OF RECOVERY AT EXTUBATION IN SUPINE VERSUS SEMI-FOWLER'S POSITION IN PATIENTS UNDERGOING OPEN CHOLECYSTECTOMY UNDER GENERAL ANESTHESIA

Dr. Umme Laila*[1], Prof. Dr. Muzamil Hussain[2]

*[1] *Post Graduate Trainee (FCPS Anesthesiology), Sir Ganga Ram Hospital, Lahore.*
[2] *Professor / HOD Anesthesia (Study Supervisor), Sir Ganga Ram Hospital, Lahore.*

*[1]ummelaila1993@gmail.com

DOI: https://doi.org/10.5281/zenodo.15781958

Keywords
Recovery at Extubation, Supine Position, Semi-Fowler's Position, Bruggemann Comfort score

Article History
Received on 24 May 2025
Accepted on 24 June 2025
Published on 30 June 2025

Corresponding Author: *
Dr. Umme Laila

Abstract
Background: *Recovery at extubation is crucial for patients undergoing open cholecystectomy under general anesthesia. While traditional supine positioning may cause discomfort, the semi-Fowler's position offers potential benefits. However, data on this comparison—particularly regarding the Bruggemann Comfort Score—are scarce. This study aimed to evaluate these positions in a local population.*
Objective: *To compare the recovery of patients emerging from anesthesia by evaluating the mean comfort scores when extubated in the supine position versus the semi-Fowler's position.*
Duration: *4th February 2025 to 3rd May 2025.*
Methodology: *A total of 152 patients undergoing open cholecystectomy were enrolled after ethical approval and informed consent. They were randomly assigned to Group A (supine) or Group B (semi-Fowler's) using a lottery method. Standard anesthesia was administered, and the Bruggemann Comfort Score was assessed immediately after extubation.*
Results: *152 patients (mean age 39.62 ± 13.87 years) participated in the study. Group A had significantly higher heart rate, systolic blood pressure, and respiratory rate at extubation, indicating a more stressful recovery. Group B demonstrated better oxygen saturation and significantly higher Bruggemann Comfort Scores (2.49 ± 0.81 vs. 1.93 ± 0.91, p = 0.000), suggesting improved comfort and a smoother recovery process.*
Conclusion: *Patients extubated in the semi-Fowler's position showed better recovery, with more stable vital signs and higher Bruggemann Comfort Scores. Although superiority was consistent across subgroups, statistical significance was lacking in some, likely due to small sample sizes. The semi-Fowler's position appears to enhance extubation outcomes after open cholecystectomy.*

INTRODUCTION

Data indicates that nearly 15 million intubations occur annually in operating rooms worldwide, making intubation and extubation routine yet crucial procedures for anesthesiologists, where patient comfort is a significant consideration.[1] Intubation typically involves using a laryngoscope to maneuver the tongue to the left, allowing visualization of the vocal cords, after which the airway is secured with an endotracheal tube.[2,3] After surgery, the patient is extubated once deemed capable of clearing their airway and breathing independently.[4,5]

Reintubation or extubation failure can result from several factors, with the most common being respiratory airway spasms, hypoxia, or obstruction at any level.[6] Typically, extubation is performed with the patient lying in the supine position, which may increase intra-abdominal pressure, leading to greater discomfort and more intense coughing episodes.[7,8] In contrast, the semi-Fowler's position, where the head and torso are elevated to an angle of 30 degrees, helps reduce intra-abdominal pressure.[9]

A study comparing these two positions found that recovery was smoother in the semi-Fowler's position. Specifically, severe coughing occurred in 11.43% of patients in the semi-Fowler's group compared to 21.6% in the supine group, bucking was observed in 4.2% versus 25.3%, and comfort scores post-extubation were higher in the semi-Fowler's group (6.11 ± 2.30 vs. 5.17 ± 1.78).[9]

Data on optimal extubation positioning—particularly concerning the Bruggemann Comfort Score—remain limited, and no prior studies have been conducted in the local population. This gap highlights the need for evidence tailored to regional clinical practices. Intubation and extubation are routine procedures performed daily in operating rooms worldwide, where patient safety and comfort during recovery are critical concerns. The semi-Fowler's position, by reducing intra-abdominal pressure, may promote smoother recovery and fewer complications compared to the traditional supine approach. This study was planned to explore these outcomes locally.

METHODOLOGY

A randomized controlled trial was conducted at the General Operation Theatre, Sir Ganga Ram Hospital, Lahore, with a calculated sample size of 152 patients (76 in each group), based on an anticipated mean Bruggemann Comfort Score of 6.11 ± 2.3 versus 5.17 ± 1.78, using a 95% confidence interval and 80% power of the test.[9] Patients aged 18 to 65 years of any sex, undergoing elective surgery under general anesthesia with planned endotracheal intubation, ASA grade I–III, and any Mallampati score were included. Exclusion criteria were BMI >45, history of chronic lung disease, refusal to consent, maxillofacial or thoracic surgeries, and patients with dentures or poor dentition. Recovery from extubation was assessed using the Bruggemann Comfort Score, ranging from 0 to 4 at the time of extubation. After obtaining ethical approval from the IRB and informed consent from participants, patients were randomly allocated to either Group A or Group B in a 1:1 ratio using the lottery method. All patients underwent anesthesia induction according to institutional protocol with midazolam, isoflurane, propofol, and atracurium. Group A was extubated in the supine position, while Group B was extubated in the semi-Fowler's position. Data regarding demographics and clinical characteristics, including smoking status, Mallampati score, NYHA class, and ASA grade, were recorded on a structured proforma. The researcher evaluated the Bruggemann Comfort Score immediately after extubation. Data analysis was performed using SPSS version 24.0. Qualitative variables such as gender, smoker, NYHA, ASA class, diabetes, and hypertension were expressed as frequencies and percentages and analyzed using the chi-square test, with a p-value <0.05 considered statistically significant. Quantitative variables, including age and Bruggemann Comfort Score, were presented as means with standard deviations and compared between groups using the t-test. Stratification was performed for variables such as age, gender, BMI, NYHA class, ASA status, smoking status, Mallampati score, diabetes (BSR >200 mg/dL), and hypertension (BP >160/90 mmHg). Post-stratification t-tests were applied, and a p-value of <0.05 was considered statistically significant.

RESULTS

A total of 152 patients were included in the study, with a mean age of 39.62 ± 13.87 years. Among them, 83 patients (54.6%) were between 18 and 40 years of age, while 69 patients (45.4%) were in the 41 to 65-year range. The cohort consisted of 89 males (58.6%) and 63 females (41.4%). The mean body mass index (BMI) was 24.82 ± 2.92 kg/m², with 80 patients (52.6%) classified as having normal weight and 72 patients (47.4%) as overweight or obese. Based on the New York Heart Association (NYHA) classification, 115 patients (75.7%) were categorized as NYHA-I, 25

(16.4%) as NYHA-II, and 12 (7.9%) as NYHA-III. Regarding smoking status, 48 patients (31.6%) were smokers, while 104 (68.4%) were non-smokers. According to the American Society of Anesthesiologists (ASA) classification, 26 patients (17.1%) were ASA-I, 102 (67.1%) were ASA-II, and 24 (15.8%) were ASA-III. The distribution of the Mallampati score showed 59 patients (38.8%) as MPS-I, 46 (30.3%) as MPS-II, and 47 (30.9%) as MPS-III. Additionally, 69 patients (45.4%) had diabetes, and 64 (42.1%) had hypertension. Data is given in Table 1.0. Moreover, both groups were statistically comparable at baseline for all variables as given in Tables 1.0 & 2.0.

At extubation, Group A had a significantly higher mean heart rate (92.51 ± 5.95) than Group B (86.84 ± 6.03; $p = 0.000$), and this difference remained at 15 minutes (83.30 ± 6.22 vs. 81.37 ± 5.68; $p = 0.047$). Systolic blood pressure was also higher in Group A both at extubation (101.22 ± 4.38 vs. 98.24 ± 4.81; $p = 0.000$) and 15 minutes later (94.09 ± 3.93 vs. 91.66 ± 4.02; $p = 0.000$). Group A showed lower SpO_2 at extubation (94.42 ± 1.81%) compared to Group B (96.00 ± 1.38%; $p = 0.000$), with this difference persisting at 15 minutes (96.03 ± 1.48% vs. 98.13 ± 1.41%; $p = 0.000$). Respiratory rate was also higher in Group A at extubation (20.29 ± 2.46 vs. 19.24 ± 2.20; $p = 0.006$) and after 15 minutes (17.42 ± 1.78 vs. 16.59 ± 1.93; $p = 0.007$). Data is given in Table 2.0.

At the time of extubation, Group B demonstrated a significantly higher Bruggemann Comfort Score (2.49 ± 0.81) compared to Group A (1.93 ± 0.91), with a p-value of 0.000, indicating better postoperative comfort in the semi-Fowler's position. Data is given in Table 3.0. Stratification of the Bruggemann Comfort Score after extubation by age, gender, NYHA class, BMI, smoking status, ASA status, Mallampati score, diabetes, and hypertension revealed consistently higher scores in Group B across all subgroups. However, statistical significance was not achieved in certain subgroups, specifically NYHA Class II and III, overweight or obese individuals, ASA-I and III, and Mallampati Score I, possibly due to limited sample sizes within these categories.

Table 1.0: Demographic Characteristics of Patients Undergoing Open Cholecystectomy

Characteristics	Total (n=152)	Group A (n=76)	Group B (n=76)	p-value
Age (years)	39.62±13.87	39.11±13.29	40.14±14.50	0.646
• 18-40 years	83 (54.6%)	44 (57.9%)	39 (51.3%)	0.415
• 41-65 years	69 (45.4%)	32 (42.1%)	37 (48.7%)	
Gender				
• Male	89 (58.6%)	42 (55.3%)	47 (61.8%)	0.410
• Female	63 (41.4%)	34 (44.7%)	29 (38.2%)	
BMI (kg/m^2)	24.82±2.92	25.02±2.88	24.62±2.97	0.401
• Normal Weight	80 (52.6%)	37 (48.7%)	43 (56.6%)	0.330
• Overweight/Obese	72 (47.4%)	39 (51.3%)	33 (43.4%)	
NYHA Class				
• NYHA-I	115 (75.7%)	56 (73.7%)	59 (77.6%)	0.484
• NYHA-II	25 (16.4%)	12 (15.8%)	13 (17.1%)	
• NYHA-III	12 (7.9%)	8 (10.5%)	4 (5.3%)	
Smoker				
• Yes	48 (31.6%)	23 (30.3%)	25 (32.9%)	0.727
• No	104 (68.4%)	53 (69.7%)	51 (67.1%)	
ASA-Status				
• ASA-I	26 (17.1%)	10 (13.2%)	16 (21.1%)	0.419
• ASA-II	102 (67.1%)	54 (71.1%)	48 (63.2%)	

• ASA-III	24 (15.8%)	12 (15.8%)	12 (15.8%)	
Mallampatti Score				
• MPS-I	59 (38.8%)	27 (35.5%)	32 (42.1%)	0.673
• MPS-II	46 (30.3%)	25 (32.9%)	21 (27.6%)	
• MPS-III	47 (30.9%)	24 (31.6%)	23 (30.3%)	
Diabetes				
• Yes	69 (45.4%)	33 (43.4%)	36 (47.4%)	0.625
• No	83 (54.6%)	43 (56.6%)	40 (52.6%)	
Hypertension				
• Yes	64 (42.1%)	34 (44.7%)	30 (39.5%)	0.511
• No	88 (57.9%)	42 (55.3%)	46 (60.5%)	

Chi Square test/ Independent sample t test, taking p-value>0.05 as insignificant.

Table 2.0: Comparison of Mean Heart Rate, Blood Pressure, SpO2, and Respiratory Rate at Various Time Intervals

Study Variable	Group A (n=76)	Group B (n=76)	p-value
Heart Rate (beats/min)			
• Baseline	79.97±5.82	79.53±5.60	0.630
• At Extubation	92.51±5.95	86.84±6.03	0.000
• At 15 minutes after Extubation	83.30±6.22	81.37±5.68	0.047
Blood Pressure (mmHg)			
• Baseline	89.46±3.76	89.75±3.79	0.637
• At Extubation	101.22±4.38	98.24±4.81	0.000
• At 15 minutes after Extubation	94.09±3.93	91.66±4.02	0.000
SPO2 (%)			
• Baseline	98.01±1.34	97.76±1.44	0.270
• At Extubation	94.42±1.81	96.00±1.38	0.000
• At 15 minutes after Extubation	96.03±1.48	98.13±1.41	0.000
Respiratory Rate (breaths/min)			
• Baseline	16.21±1.33	16.11±1.28	0.620
• At Extubation	20.29±2.46	19.24±2.20	0.006
• At 15 minutes after Extubation	17.42±1.78	16.59±1.93	0.007

Independent Sample t test, taking p-value≤0.05 as significant

Table 3.0: Comparison of Bruggemann Comfort Score between the Groups

Time Interval	Group A (n=70)	Group B (n=70)	p-value
• At Extubation	1.93±0.91	2.49±0.81	0.000

Independent Sample t test, taking p-value≤0.05 as significant

DISCUSSION

The recovery process at extubation plays a crucial role in patient outcomes following surgery, especially for those undergoing open cholecystectomy under general anesthesia.[10,11] Traditionally, patients have been extubated in the supine position, a technique that may lead to post-operative discomfort and delayed recovery due to compromised airway and respiratory dynamics. In contrast, the semi-Fowler's position has been proposed as a more beneficial alternative, potentially improving hemodynamics and comfort.[12,13] However, data comparing recovery outcomes in these two positions, particularly concerning the Bruggemann Comfort Score, remains limited. This study was designed to evaluate the effectiveness of both positions in a local population, offering valuable insights into optimal extubation practices.

This study included 152 patients with a mean age of 39.62 ± 13.87 years, consisting of 89 males (58.6%) and 63 females (41.4%). The mean BMI was 24.82 ± 2.92 kg/m², with 80 patients (52.6%) classified as normal weight and 72 (47.4%) as overweight or obese. Hemodynamic data at two intervals showed that, at extubation, Group A had significantly higher heart rate, systolic blood pressure, and respiratory rate, and lower SpO_2 compared to Group B. Specifically, Group A had a heart rate of 92.51 ± 5.95, systolic blood pressure of 101.22 ± 4.38, and SpO_2 of 94.42 ± 1.81%, while Group B had heart rate 86.84 ± 6.03, systolic blood pressure 98.24 ± 4.81, and SpO_2 96.00 ± 1.38%. At 15 minutes, these differences persisted. Furthermore, Group B had a significantly higher Bruggemann Comfort Score (2.49 ± 0.81 vs. 1.93 ± 0.91; p = 0.000), indicating better postoperative comfort.

The comparison of findings from this study with existing literature reveals several consistent trends regarding the benefits of the semi-Fowler's position post-extubation. Zhu et al. observed that the semi-Fowler's position significantly reduced wound pain scores at all intervals after extubation compared to the supine position (P = 0.009, 0.005, and 0.005, respectively). They also noted a decrease in severe coughing (P = 0.008) and bucking (P < 0.001) after extubation, alongside improved comfort scores at 5 minutes (P = 0.007) and discharge from the post-anesthesia care unit (P = 0.034). These findings align with our study's results, which demonstrated the superior comfort and reduced discomfort for patients in the semi-Fowler's position, contributing to a smoother recovery process.[9]

Kumar et al. similarly reported that patients in the semi-Fowler's position experienced fewer postoperative complications, including respiratory distress, hypoxemia, and aspiration, compared to those in the supine position (P < 0.05). The semi-Fowler's group also showed better hemodynamic stability, lower pain scores, and a faster recovery, as evidenced by shorter extubation times. However, there was no significant difference in the length of stay in the PACU between the two groups. Their study concluded that adopting the semi-Fowler's position during extubation and post-abdominal surgery recovery promotes faster recovery and enhances patient outcomes, a finding consistent with the positive effects observed in our study.[13]

Singh et al. also found no significant changes in respiratory rate, oxygen saturation, or blood pressure between the two positions. However, they did observe a significant increase in heart rate in the semi-Fowler's group before and after extubation (P = 0.011, 0.016, 0.023, and 0.006 at various intervals). In addition, they reported less coughing and bucking in the semi-Fowler's position, which corresponds with our findings that suggest this position leads to a more comfortable recovery experience.[14]

Sidar et al. highlighted differences in pain levels between the two groups, noting that patients in the supine position exhibited higher visual analogue scale (VAS) scores at 5, 15, and 30 minutes post-extubation compared to those in the semi-Fowler's position. This aligns with our study, where patients in the semi-Fowler's position reported reduced pain and discomfort.[15]

Finally, Ahmed et al. reported significant improvements in respiratory parameters, such as respiratory rate, PaO_2, $PaCO_2$, and SpO_2, among patients in the semi-Fowler's position after coronary artery bypass graft surgery (P < 0.05). This suggests that the semi-Fowler's position not only improves comfort but also positively affects physiological outcomes, particularly respiratory function, which mirrors the findings of improved respiratory stability in our study.[16]

CONCLUSION

Patients extubated in the semi-Fowler's position showed better recovery, with more stable vital signs and higher Bruggemann Comfort Scores. Although superiority was consistent across subgroups, statistical significance was lacking in some, likely due to small sample sizes. Semi-Fowler's position appears to enhance extubation outcomes after open cholecystectomy.

LIMITATIONS & RECOMMENDATIONS

This study's strengths include a well-defined patient cohort and objective comparison of two extubation positions using standardized hemodynamic parameters and the Bruggemann Comfort Score. It provides relevant clinical evidence supporting the semi-Fowler's position for improved recovery and patient comfort following open cholecystectomy. However, limitations include a single-center design and a lack of long-term follow-up. Future studies with larger, multicenter populations and diverse surgical procedures are warranted to validate these findings and support wider clinical implementation.

Conflict of Interest: None

Source of Funding: None

Authors' Contributions

Author 1

- Substantial contributions to study design, acquisition of data, analysis, and interpretation of data, and manuscript writing.
- Has given final approval of the version to be published.
- Agrees to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Author 2

- Substantial contributions to concept and study design.
- Data analysis, manuscript writing, and critical review.
- Has given final approval of the version to be published.
- Agrees to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

Turner JS, Bucca AW, Propst SL, Ellender TJ, Sarmiento EJ, Menard LM, et al. Association of checklist use in endotracheal intubation with clinically important outcomes: a systematic review and meta-analysis. JAMA Network Open. 2020;3(7):e209278.

Elamoudy H, Mohammad S, Abdellatif G, Dessowky S. Effect of positioning on oxygenation and hemodynamics among patients on mechanical ventilation. Evid Based Nurs Res. 2022;4(1):61-7.

Parotto M, Cooper RM, Behringer EC. Extubation of the challenging airway. Curr Anesthesiol Rep. 2020;10(4):334-40.

Shimada K, Inokuchi R, Iwagami M, Tanaka M, Tamiya N. Comparison of postextubation complications between positive-pressure and suctioning techniques: a systematic review. Respir Care. 2023;68(3):429-36.

Jarraya A, Kammoun M, Bouchaira H, Ketata H, Safi F, Ben Hamad A. Lateral versus supine position for tracheal extubation among infants after intraabdominal surgery: a randomised controlled trial. J Periop Pract. 2024;12:17504589241261184.

Kifle N, Zewdu D, Abebe B, Tantu T, Wondwosen M, Hailu Y, et al. Incidence of extubation failure and its predictors among adult patients in intensive care unit of low-resource setting: a prospective observational study. Plos One. 2022;17(11):e0277915.

Langeron O, Bourgain JL, Francon D, Amour J, Baillard C, Bouroche G, et al. Difficult intubation and extubation in adult anaesthesia. Anaesth Crit Care Pain Med. 2018;37(6):639-51.

Al-Ali AH, Alraeyes KA, Julkarnain PR, Lakshmanan AP, Alobaid A, Aljoni AY, et al. Independent risk factors of failed extubation among adult critically ill patients: a prospective observational study from Saudi Arabia. Saudi J Med Med Sci. 2024;12(3):216-22.

Zhu Q, Huang Z, Ma Q, Wu Z, Kang Y, Zhang M, et al. Supine versus semi-Fowler's positions for tracheal extubation in abdominal surgery randomized clinical trial. BMC Anesthesiol. 2020;20:1-9.

Weatherall AD, Burton RD, Cooper MG, Humphreys SR. Developing an extubation strategy for the difficult pediatric airway—who, when, why, where, and how?. Pediatr Anesth. 2022;32(5):592-9.

Benham-Hermetz J, Mitchell V. Safe tracheal extubation after general anaesthesia. BJA Edu. 2021;21(12):446-54.

Wong TH, Weber G, Abramowicz AE. Smooth extubation and smooth emergence techniques: a narrative review. Anesthesiol Res Pract. 2021;2021(1):8883257.

Kumar S, Kampil M, Dhamija A. A comparative study between supine and Semi-Fowler's position during extubation and post anesthesia care unit following abdominal surgeries: a one-year hospital-based randomized controlled trial. Int J Pharm Clin Res. 2023; 15(7); 1335-9.

Singh SK, Sarma R, Borkataki SS, Das KK. A comparative study of supine versus semi-fowler's position for tracheal extubation in lower abdominal surgery. Int J Sci Res. 2023;12(3):2277-9.

Sidar I, Vishwanath A, Latheef L, Rashmi NR. Comparison of effect of tracheal extubation in supine versus semi-Fowler's position in abdominal onco-surgeries. Int J Pharm Clin Res. 2024;16(12):1067-73.

E Ahmed R, A Abd El-Hay S, A Al-Metyazidy H, A Allam Z. Effectiveness of Supine versus semi-fowler positioning on physiological indices among patients post coronary artery bypass graft surgery. Int Egypt J Nurs Sci Res. 2023;3(2):623-40.