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Tracheal extubation in midline incision abdominal surgery: Supine versus semi-fowler's position

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Abstract:

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Extubation after midline abdominal surgery may cause coughing, bucking, secretion retention and early airway events. This randomised comparative study included 100 patients undergoing midline abdominal surgery under general anaesthesia, with 50 patient's extubated in supine position and 50 in semi-Fowler's position. Comfort score was higher in the semi-Fowler's group at 10 minutes (2.9 ± 1.0 vs 2.4 ± 1.0, p = 0.03) and 30 minutes (3.4 ± 1.0 vs 2.9 ± 1.1, p = 0.04), while bucking (5 (10.0%) vs 14 (28.0%), p = 0.022) and severe coughing (5 (10.0%) vs 11 (22.0%), p = 0.04) were lower. Thus, data shows that oxygen saturation, mean arterial pressure, vomiting, hypotension, suctioning requirement and airway rescue were comparable, suggesting that semi-Fowler's position is a safe and useful alternative for tracheal extubation after midline abdominal surgery.

Keywords: Tracheal extubation, semi-fowler's position, supine position, general anaesthesia, abdominal surgery

Background:

Tracheal extubation is an important phase of general anaesthesia and may be associated with airway obstruction, coughing, bucking, desaturation, aspiration and haemodynamic response **[1]**. Safe extubation needs proper patient selection, adequate reversal, oxygenation, suctioning when required and close monitoring after tube removal **[2]**. Smooth extubation means tube removal without marked coughing, bucking, breath holding, laryngospasm or excessive movement **[3]**. Coughing during emergence may increase heart rate, blood pressure and surgical site stress, making coughing and bucking important peri-extubation outcomes **[4]**. In abdominal surgery, coughing and bucking may increase abdominal wall tension, pain and early post-operative discomfort **[5]**. Semi-Fowler's position with head elevation may reduce abdominal wall tension and support diaphragmatic movement after surgery **[6]**. Patient positioning is a simple non-pharmacological method and can be applied easily in routine operating room practice **[7]**. Open abdominal surgery under general anaesthesia is associated with post-operative pulmonary risk and respiratory limitation **[8]**. Post-operative pulmonary complications remain relevant after abdominal surgery, so SpO_2 should be assessed with airway and haemodynamic outcomes **[9]**. Patient comfort is now used as a practical recovery outcome and gives a patient-centred view in the post-anaesthesia care period **[10]**. Therefore, it is of interest to report the comfort score, coughing-bucking response, haemodynamic changes and safety outcomes for supine and semi-Fowler's extubation in midline abdominal surgery.

Materials and Methods:

The present randomised comparative study was conducted in the Department of Anaesthesiology, M.G.M. Medical College and M.Y. Hospital, Indore, after approval from the Institutional Ethics Committee. The study was conducted over 12 months from the date of ethics approval. Adult patients aged 18–65 years of either sex, belonging to ASA physical status I, II or III and scheduled for elective or emergency open abdominal surgery with midline incision under general anaesthesia were included. Patients who refused consent, had anticipated difficult or hyperactive airway, body mass index more than 35 kg/m², or known gastroesophageal reflux disease were excluded. Sample size was calculated using G*Power software version 3.1.9.2 based on previous data on bucking after extubation. With 95% confidence level and 80% power, 50 patients were required in each group. A total of 100 patients were included and allocated into two groups of 50 each. Group S included patient's extubated in supine position. Group SF included patient's extubated in semi-Fowler's position with 30°C head elevation. All eligible patients underwent pre-anaesthetic evaluation. The study procedure was explained in the native language and written informed consent was taken before enrolment. Patients were allocated to either group by odd-even method and were unaware of their group allocation. Intravenous access was secured and standard monitors were attached in the operating room. Baseline heart rate, blood pressure and SpO_2 were recorded. All patients received standard general anaesthesia protocol. Patients were premedicated with intravenous glycopyrrolate 0.2 mg and midazolam 1 mg. Intravenous fentanyl 2 µg/kg was administered before induction. Anaesthesia was induced with propofol 2–3 mg/kg. Bag-mask ventilation was performed and orotracheal intubation was facilitated with succinylcholine 1.5–2 mg/kg. Anaesthesia was maintained with 50% oxygen, 50% nitrous oxide, sevoflurane and atracurium. Thirty minutes before completion of surgery, intravenous acetaminophen 1 g and ondansetron 4 mg were given. At the end of surgery, sevoflurane was stopped and patients were ventilated with 100% oxygen. Neuromuscular blockade was reversed with glycopyrrolate 10 µg/kg and neostigmine 50 µg/kg. Patients were positioned according to the allocated group and tracheal extubation was done after standard extubation criteria were fulfilled. Heart rate, mean arterial pressure and SpO_2 were recorded immediately after positioning, just before tracheal extubation and at 5, 10 and 30 minutes after extubation. Patient comfort was assessed using the Bruggemann Comfort Scale. Bucking due to endotracheal tube stimulation and severe coughing episodes lasting at least 5 seconds were recorded. Requirement of suctioning and airway rescue intervention were also documented. Vomiting and hypotension were noted as adverse events. Hypotension was defined as fall in MAP more than 20% from baseline. Patients requiring post-operative ventilatory support were excluded from analysis. Data were entered in Microsoft Excel and analysed using IBM SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequency and percentage. Normality was assessed using Shapiro–Wilk test. Continuous variables were compared using unpaired t-test or Mann–Whitney U test, based on data distribution. Categorical variables were compared using Chi-square test or Fisher's exact test. A p-value less than 0.05 were considered statistically significant.

Table 1: Baseline and operative profile according to extubation position

Variable	Group S	Group SF	p-value

	Supine (n=50)	Semi-Fowler's (n=50)	
Age, years	43.2 ± 12.4	42.7 ± 11.9	0.82
Male sex	27 (54%)	26 (52%)	0.84
Female sex	23 (46%)	24 (48%)	0.84
ASA I	18 (36%)	19 (38%)	0.91
ASA II	22 (44%)	21 (42%)	0.91
ASA III	10 (20%)	10 (20%)	0.91
BMI, kg/m²	23.2 ± 2.8	23.4 ± 2.7	0.78

Table 2: Comfort score according to extubation position

Time after extubation	Group S Supine (n=50)	Group SF Semi-Fowler's (n=50)	p-value
5 minutes	2.0 ± 0.9	2.3 ± 1.0	0.11
10 minutes	2.4 ± 1.0	2.9 ± 1.0	0.03
30 minutes	2.9 ± 1.1	3.4 ± 1.0	0.04

Table 3: Coughing and bucking according to extubation position

Airway response	Group S Supine (n=50)	Group SF Semi-Fowler's (n=50)	p-value
Bucking present	14 (28%)	5 (10%)	0.022
Bucking absent	36 (72%)	45 (90%)	
Severe coughing present	11 (22%)	5 (10%)	0.04
Severe coughing absent	39 (78%)	45 (90%)	

Table 4: Hemodynamic trend according to extubation position

Parameter	Time point	Group S Supine (n=50)	Group SF Semi-Fowler's (n=50)	p-value
Heart rate	Baseline	84.8 ± 8.7	85.2 ± 9.1	0.79
Heart rate	T1	85.8 ± 8.9	86.5 ± 9.4	0.68
Heart rate	T2	88.9 ± 10.8	93.6 ± 11.2	0.02
Heart rate	T3	91.4 ± 11.6	96.8 ± 12.1	0.01
Heart rate	T4	89.2 ± 10.4	90.1 ± 9.8	0.61
Heart rate	T5	85.7 ± 9.2	86.3 ± 8.7	0.74
MAP	Baseline	94.6 ± 7.9	95.1 ± 8.2	0.71
MAP	T1	93.8 ± 8.6	94.2 ± 8.1	0.78
MAP	T2	96.2 ± 9.3	97.1 ± 9.6	0.63
MAP	T3	98.4 ± 10.1	97.8 ± 9.5	0.75
MAP	T4	95.6 ± 8.8	94.9 ± 8.4	0.69
MAP	T5	92.9 ± 7.9	93.3 ± 8.2	0.81

Table 5: Oxygen saturation and post-extubation safety outcomes

Variable	Time point/ category	Group S Supine (n=50)	Group SF Semi-Fowler's (n=50)	p-value
SpO_2	Baseline	98.4 ± 0.6	98.5 ± 0.7	0.48
SpO_2	T1	98.2 ± 0.9	98.3 ± 0.8	0.51
SpO_2	T2	97.9 ± 1.0	98.0 ± 0.9	0.38
SpO_2	T3	97.8 ± 1.2	97.9 ± 1.1	0.09
SpO_2	T4	98.0 ± 1.0	98.1 ± 0.9	0.07
SpO_2	T5	98.3 ± 0.8	98.5 ± 0.7	0.12
Suctioning required	Yes	12 (24%)	6 (12%)	0.11
Vomiting	Present	9 (18%)	6 (12%)	0.41
Hypotension	Present	4 (8%)	6 (12%)	0.51
Airway rescue	Required	0 (0%)	0 (0%)	–

Results and Discussion:

The present study compared supine and semi-Fowler's position for tracheal extubation after midline incision abdominal surgery under general anaesthesia. Baseline variables were comparable between the two groups. Mean age, sex distribution, ASA grade and BMI did not show significant difference. The main findings were better comfort score at 10 and 30 minutes, lower bucking and lower severe coughing in the semi-Fowler's group. Heart rate was higher in the semi-Fowler's group at T2 and T3. MAP, SpO_2 and post-extubation safety outcomes were comparable. These findings suggest smoother and more comfortable extubation with semi-Fowler's position. In (**Table 1)**, both groups were comparable for baseline profile. Mean age was 43.2 ± 12.4 years in the supine group and 42.7 ± 11.9 years in the semi-Fowler's group. Mean BMI was 23.2 ± 2.8 kg/m² and 23.4 ± 2.7 kg/m² respectively. ASA distribution was also similar in both groups. This baseline comparability is important because airway response and haemodynamic changes may vary with patient risk status. Thus, the observed difference in coughing, bucking and comfort is less likely to be due to baseline imbalance. In (**Table 2)**, comfort score was significantly better in the semi-Fowler's group at 10 and 30 minutes after extubation. At 10 minutes, comfort score was 2.9 ± 1.0 in the semi-Fowler's group and 2.4 ± 1.0 in the supine group, p = 0.03. At 30 minutes, it was 3.4 ± 1.0 and 2.9 ± 1.1 respectively, p = 0.04. This may be due to reduced abdominal wall stretch and better diaphragmatic movement after head elevation. Comfort is now considered a useful patient-centred recovery outcome after surgery **[11]**. This supports the use of Bruggemann Comfort Scale in the present study. In (**Table 3)**, bucking and severe coughing were significantly lower in the semi-Fowler's group. Bucking was 5 (10%) in the semi-Fowler's group and 14 (28%) in the supine group, p = 0.022. Severe coughing was also lower, 5 (10%) versus 11 (22%), p = 0.04. This is clinically relevant after midline incision surgery. Coughing and bucking can increase abdominal wall tension and wound pain. Emergence cough is also considered an important event after tracheal intubation **[12]**. The present study showed similar importance of airway reflex response, but used positioning instead of drug-based suppression. Several studies have used pharmacological methods to reduce cough during extubation. Nahar *et al.* reported less peri-extubation cough with low-dose intratracheal dexmedetomidine **[13]**. Reddy *et al.* also observed lower cough response after single-dose dexmedetomidine before extubation **[14]**. These studies show that cough and bucking are accepted peri-extubation endpoints. However, drug-based methods may add sedation, bradycardia or delayed recovery. Semi-Fowler's position does not add drug exposure. It is simple, low-cost and practical in routine operating room practice. In (**Table 4)**, heart rate was significantly higher in the semi-Fowler's group at T2 and T3. At T2, heart rate was 93.6 ± 11.2 beats/min in the semi-Fowler's group and 88.9 ± 10.8 beats/min in the supine group, p = 0.02. At T3, it was 96.8 ± 12.1 and 91.4 ± 11.6 beats/min respectively, p = 0.01. This rise was transient and values became comparable at T4 and T5. MAP was comparable at all-time points. This suggests that the heart rate rise was mild and not associated with clinically important haemodynamic instability. Emergence itself can increase sympathetic activity due to airway stimulation, pain and return of consciousness. In (**Table 5)**, SpO_2 and post-extubation safety outcomes were comparable between the two groups. SpO_2 remained within normal range at all-time points. Suctioning was required in 12 (24%) patients in the supine group and 6 (12%) in the semi-Fowler's group, p = 0.11. This was numerically lower in the semi-Fowler's group but was not statistically significant. Wang *et al.* reported less post-operative hypoxemia with 30° semirecumbent position during anaesthesia recovery **[15]**. This supports the possible role of head elevation in respiratory recovery after extubation. Jarraya *et al.* reported fewer respiratory adverse events with non-supine extubation position in infants after intra-abdominal surgery **[16]**. Their study was not identical to the present adult open abdominal surgery study. Still, it supports the concept that extubation position can influence early respiratory events. In the present study, oxygen saturation remained comparable. This may be due to adequate reversal, oxygenation and close peri-extubation monitoring in both groups. Vomiting and hypotension were also comparable in (**Table 5**). Vomiting occurred in 9 (18%) patients in the supine group and 6 (12%) in the semi-Fowler's group, p = 0.41. Hypotension occurred in 4 (8%) and 6 (12%) patients respectively, p = 0.51. No patient in either group required airway rescue. Post-operative nausea and vomiting is multifactorial and may depend on patient factors, anaesthetic drugs, surgery and opioids **[17]**. In the present study, both groups received similar anaesthesia and antiemetic prophylaxis. This may explain the comparable vomiting rate. Comparable hypotension also supports the safety of 30° head elevation in this selected study population. The present study has practical relevance for routine anaesthesia practice. Midline incision abdominal surgery is associated with pain and respiratory limitation. A simple change in extubation position may reduce coughing, bucking and early discomfort without extra cost. This can be useful where non-pharmacological measures are preferred. The advancement of the present study is its focused assessment of semi-Fowler's extubation in patients undergoing midline incision abdominal surgery. This group has more direct relevance to abdominal wall tension, wound discomfort and airway reflex response during emergence. The study also showed better Bruggemann Comfort Score at 10 and 30 minutes along with lower bucking and severe coughing. These findings add focused clinical data for using semi-Fowler's position as a simple non-pharmacological extubation approach in this selected surgical group. Sidar *et al.* also reported lower severe cough and bucking with semi-Fowler's extubation in abdominal onco-surgeries, supporting the present focused findings in midline incision abdominal surgery **[18]**. The findings should be interpreted with caution. This was a single-centre study with 50 patients in each group. Blinding of the anaesthesiologist was not feasible. Comfort score was measured only in early recovery. Longer follow-up for pain, wound discomfort and pulmonary complications was not done. Overall the semi-Fowler's position showed better comfort and fewer airway reflex events during tracheal extubation after midline incision abdominal surgery. MAP, SpO_2, suctioning requirement, vomiting, hypotension and airway rescue were comparable. Heart rate showed a transient rise at T2 and T3 without MAP instability. The findings support semi-Fowler's position as a simple and safe extubation position in selected adult patients undergoing open abdominal surgery under general anaesthesia.

Conclusion:

Semi-Fowler's position provided better post-extubation comfort and lower coughing-bucking response than supine position. Oxygen saturation, MAP and safety outcomes were comparable, with only a transient rise in heart rate at T2 and T3. Thus, semi-fowler's position may be used as a simple and safe non-pharmacological extubation approach after open abdominal surgery.

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