

# Comparative study of indications, complications and outcome of elective and emergency intubation

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## Abstract

**Objectives:** Acute respiratory failure frequently necessitates the introduction of endotracheal tube to maintain airway patency and for mechanical ventilation. Intubation is a procedure in day today practice in EMS, medical wards, operation theatres. This is study done retrospectively of 200 patients to correlate the factors which affect outcome of intubation age, sex, nature of underlying disease. The purpose of this study is also to determine whether intubation alone or subsequent tracheostomy in previously intubated patients can prognosticate outcome and the complications of endotracheal intubation and tracheostomy as acquired either during the procedure, with tube in situ or on extubation. **Methods:** A retrospective study of 200 adult patients was conducted, who satisfied inclusion and exclusion criteria for intubation on elective or emergency grounds over a period of 18 months. Patient's demographic data along with lab tests of Sr. Creatinine, Sr. K<sup>+</sup>, ABG analysis, chest X-ray, Mallampatti grade was noted. The indication for intubation as elective or emergency was based on ABG or severity of respiratory failure or for tracheal toileting. SOFA score, GCS score at Admission and 48 hrs was noted. **Results:** In this study, 200 patients were intubated. Out of which 137 were elective and 63 emergency and 146 were Males and 54 were Females. Major age group was 21- 40 years. Organ involvement in form of respiratory (168 patients), hepatic(19 patients), renal failure(44 patients) or MODS (18 patients) didn't affect outcome in these patients. The overall mortality rate of the study was 37%. The disease specific mortality for sepsis patients was 100%, Coma was 56.2% and pneumonia was 52.4%. The elective intubated patients had lower mortality (32.1%) compared to that of emergency intubated patients (47.6%). **Conclusion:** Patients have to be intubated electively and early tracheostomy at 72- 96 hrs has improved survival.

**Key Words:** Endotracheal, mechanical ventilation, tracheostomy, extubation.

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## INTRODUCTION

“When you can't breathe, nothing else matters” In critical care units, intubation is procedure which is lifesaving to maintain airway patency in patients with respiratory failure. Though the procedure is lifesaving, it is associated with few complications some lifethreatening

like pneumothorax or pneumomediastinum while other non-lifethreatening. The underlying disease for which intubation was done also affects outcome of intubation. Respiratory diseases in general have a bad outcome in elderly patients because of the premorbid conditions like chronic obstructive lung disease, diabetes mellitus, hypertension, occupational hazards and habits like smoking<sup>1</sup> In critical care units, multisystem organ failure patients have highest mortality<sup>2,3</sup> Endotracheal intubation being common and important procedure, it is essential to determine whether factors like age, sex and nature of primary illness in intubated patients have any role in determining their clinical course and outcome. Many studies have been done till date in neuroparalytic patients especially in Guillian Barre syndrome patients which studied factors affecting respiratory failure and requirement for endotracheal intubation and factors affecting outcome<sup>4,5,6,7</sup> The aim of this study is to

compare which patient should be intubated electively or emergency basis and to compare the outcome and complication of each group. This study is also intended to correlate the factors which affect outcome of intubation age, sex, nature of underlying disease. This study was also done to determine whether intubation alone or subsequent tracheostomy in previously intubated patients can prognosticate outcome. The timing of doing the intubation procedure has also been evaluated as a prognostic parameter. In this series we have determined the complications of endotracheal intubation and tracheostomy as acquired either during the procedure, with tube in situ or on extubation.

### MATERIAL AND METHODS

The study was approved by the Ethical and Research Committee of our hospital. This retrospective study of 200 adult patients was carried out in a 1500 bedded Lokmanya Tilak Municipal Medical college and General hospital, Sion, Mumbai from January 2012 to December 2013. All patients admitted in intensive care unit or emergency medical services for acute medical condition requiring immediate emergency intubation or later requiring elective intubation were included in the study. Patients less than 12 years of age who were intubated after CPR or died within 2 hrs of admission were excluded from the study. Also patients with tetanus and corrosive acid poisoning, intubated before admission in intensive care unit or emergency medical services and post-operative patients were excluded from the study. Patient's demographic data along with lab tests of Sr. Creatinine, Sr. K+, ABG analysis, chest X-ray, Mallampatti grade was noted. The indication for intubation as elective or emergency was based on ABG or severity of respiratory failure or for tracheal toileting. SOFA score, GCS score at Admission and 48 hrs was noted. Patients were monitored for the development of renal failure, hepatic failure, self (unplanned) extubation, hypotension, barotrauma, ventilator associated pneumonia, multi organ dysfunction. Patient's outcome (survived/death) and duration of hospital stay was noted. The indications for intubation were ARDS due to malaria or leptospirosis (80 patients), Sepsis (3 patients), Pneumonia (20 patients), OPC poisoning (45 patients), GBS (9 patients), Myasthenia gravis (4 patients), Coma (16 patients), snake bite (10 patients) and miscellaneous (13 patients).

### RESULTS

**Table 1:** Indication for intubation and outcome and their association

| Indication |                | Outcome      |              | Total         |
|------------|----------------|--------------|--------------|---------------|
|            |                | Survival     | Death        |               |
| ARDS       |                | 57           | 43           | 100           |
|            |                | 57.0%        | 43.0%        | 100.0%        |
|            | Neuroparalytic | 63           | 27           | 90            |
|            |                | 70.0%        | 30.0%        | 100.0%        |
| Others     |                | 6            | 4            | 10            |
|            |                | 60.0%        | 40.0%        | 100.0%        |
|            | <b>Total</b>   | <b>126</b>   | <b>74</b>    | <b>200</b>    |
|            |                | <b>63.0%</b> | <b>37.0%</b> | <b>100.0%</b> |

$\chi^2=3.475$ , df=2 P=0.176 (Not significant), Chi square test

**Table 2:** Correlation of Elective vs Emergency Intubation and outcome

| Intubation |              | Outcome      |              | Total         |
|------------|--------------|--------------|--------------|---------------|
|            |              | Survival     | Death        |               |
| Elective   |              | 93           | 44           | 137           |
|            |              | 67.9%        | 32.1%        | 100.0%        |
| Emergency  |              | 33           | 30           | 63            |
|            |              | 52.4%        | 47.6%        | 100.0%        |
|            | <b>Total</b> | <b>126</b>   | <b>74</b>    | <b>200</b>    |
|            |              | <b>63.0%</b> | <b>37.0%</b> | <b>100.0%</b> |

$\chi^2=4.449$ , df=1 P=0.035 (Significant), Chi square test

**Table 3:** Correlation between SOFA score of Elective vs Emergency Intubation and outcome

#### a) Elective intubation

| SOFA Score |              | Outcome      |              | Total         |
|------------|--------------|--------------|--------------|---------------|
|            |              | Survival     | Death        |               |
| Mild       |              | 46           | 12           | 58            |
|            |              | 79.3%        | 20.7%        | 100.0%        |
| Moderate   |              | 37           | 21           | 58            |
|            |              | 63.8%        | 36.2%        | 100.0%        |
| Severe     |              | 10           | 11           | 21            |
|            |              | 47.6%        | 52.4%        | 100.0%        |
|            | <b>Total</b> | <b>93</b>    | <b>44</b>    | <b>137</b>    |
|            |              | <b>67.9%</b> | <b>31.1%</b> | <b>100.0%</b> |

$\chi^2=7.038$ , df=2 P=0.030 (Significant), Chi square test

#### Table 3: b) Emergency intubation

| SOFA Score |              | Outcome      |              | Total         |
|------------|--------------|--------------|--------------|---------------|
|            |              | Survival     | Death        |               |
| Mild       |              | 19           | 14           | 33            |
|            |              | 57.6%        | 42.4%        | 100.0%        |
| Moderate   |              | 14           | 14           | 28            |
|            |              | 50.0%        | 50.0%        | 100.0%        |
| Severe     |              | 0            | 2            | 2             |
|            |              | 0.0%         | 100.0%       | 100.0%        |
|            | <b>Total</b> | <b>33</b>    | <b>30</b>    | <b>63</b>     |
|            |              | <b>52.4%</b> | <b>47.6%</b> | <b>100.0%</b> |

$\chi^2=2.126$ , df=2 P=0.270 (Significant), Chi square test

**Table 4:** Correlation between Complication and outcome in Elective vs Emergency Intubation A)

| Complication   |              | Outcome      |              | Total         |
|----------------|--------------|--------------|--------------|---------------|
|                |              | Survival     | Death        |               |
| Yes Intubation | Elective     | 12           | 7            | 19            |
|                |              | 63.2%        | 36.8%        | 100.0%        |
|                | Emergency    | 6            | 1            | 7             |
|                |              | 85.7%        | 14.3%        | 100.0%        |
| No Intubation  | Total        | 18           | 8            | 26            |
|                |              | 69.2%        | 30.8%        | 100.0%        |
|                | Elective     | 81           | 37           | 118           |
|                |              | 68.6%        | 31.4%        | 100.0%        |
| Yes Intubation | Emergency    | 27           | 29           | 56            |
|                |              | 48.2%        | 51.8%        | 100.0%        |
|                | <b>Total</b> | <b>108</b>   | <b>66</b>    | <b>174</b>    |
|                |              | <b>62.1%</b> | <b>37.9%</b> | <b>100.0%</b> |

$\chi^2=3.633$ , df=1 P=0.375 (Not Significant), Chi square test

**Table 4 B:**

| Complication             |     |           | Outcome  |        |       |        |
|--------------------------|-----|-----------|----------|--------|-------|--------|
|                          |     |           | Survival |        | Death |        |
|                          |     |           | Count    | Per    | Count | Per    |
| Tube Blockage            | No  | Elective  | 90       | 67.2%  | 44    | 32.8%  |
|                          | Yes | Emergency | 33       | 52.4%  | 30    | 47.6%  |
| False Intubation         | No  | Elective  | 3        | 100.0% | 0     | .0%    |
|                          | Yes | Emergency | 33       | 52.4%  | 30    | 47.6%  |
| Oral Trauma              | No  | Elective  | 90       | 67.2%  | 44    | 32.8%  |
|                          | Yes | Emergency | 33       | 52.4%  | 30    | 47.6%  |
| Hoarseness of Voice      | No  | Elective  | 3        | 100.0% | 0     | .0%    |
|                          | Yes | Emergency | 87       | 66.4%  | 44    | 33.6%  |
| Tracheomalacia           | No  | Elective  | 27       | 48.2%  | 29    | 51.8%  |
|                          | Yes | Emergency | 6        | 100.0% | 0     | .0%    |
| Spontaneous pneumothorax | No  | Elective  | 6        | 85.6%  | 1     | 14.3%  |
|                          | Yes | Emergency | 93       | 67.9%  | 44    | 32.1%  |
| Pneumo Mediastinum       | No  | Elective  | 33       | 52.4%  | 30    | 47.6%  |
|                          | Yes | Emergency | 93       | 68.9%  | 42    | 31.1%  |
| Subcutaneous Emphysema   | No  | Elective  | 33       | 52.4%  | 30    | 47.6%  |
|                          | Yes | Emergency | 0        | .0%    | 2     | 100.0% |
|                          | No  | Elective  | 93       | 68.4%  | 43    | 31.6%  |
|                          | Yes | Emergency | 33       | 52.4%  | 30    | 47.6%  |
|                          | No  | Elective  | 0        | .0%    | 1     | 100.0% |
|                          | Yes | Emergency | 92       | 70.8%  | 38    | 29.2%  |
|                          | No  | Elective  | 33       | 52.4%  | 30    | 47.6%  |
|                          | Yes | Emergency | 1        | 14.3%  | 6     | 85.7%  |

**Table 5:** Complications and Duration of hospital stay and their association

|                     | Duration Days |              |              |            | P Value | Significance    |
|---------------------|---------------|--------------|--------------|------------|---------|-----------------|
|                     | <10 (N=147)   | 11-20 (N=36) | 21-30 (N=12) | >30 (N=5)  |         |                 |
| Renal Failure       | 35 (23.8%)    | 07 (19.4%)   | 2 (16.7%)    | 0          | 0.567   | Not Significant |
| Respiratory Failure | 123 (83.7%)   | 29 (80.6%)   | 11(91.7%)    | 5 (100.0%) | 0.613   | Not Significant |
| Hepatic Failure     | 14 (9.5%)     | 3 (8.3%)     | 2 (16.7%)    | 0          | 0.729   | Not Significant |
| MODS                | 13 (8.8%)     | 3 (8.3%)     | 2 (16.7%)    | 0          | 0.710   | Not Significant |
| VAP                 | 4 (2.7%)      | 5 (13.9%)    | 5 (41.7%)    | 1 (20.0%)  | <0.001  | Significant     |

In this study, 200 patients were intubated. Out of which 137 were elective and 63 emergency and 146 were Males and 54 were Females. Major age group was 21- 40 years. The data was analysed SPSS-16 software and the following results were observed in this study: Table 1 reveals that, ARDS was the most common indication for intubation accounting for 50.0% of total patients. The overall mortality was 37.0%. Maximum disease specific mortality of 43.0% was estimated in patients who had ARDS as indication for intubation and ventilatory support. Mortality was 30.0% in Neuro-paralytic patients. Table 2 reveals that in our study, most of the intubations were elective intubations (68.5%) than emergency intubations (31.5%) and that emergency vs elective intubation was determined as independent predictor of outcome in intubated patients. Table 3 a reveals that, in electively intubated patients, 42.3% of cases had mild SOFA score and 42.3% of cases had moderate SOFA score and 15.2% of cases had severe SOFA score and SOFA score on admission can predict mortality in electively intubated patients significantly. Table 3 b reveals that, in emergency intubated patients, 52.3% of cases had mild SOFA score and 44.4% of cases had moderate SOFA score and 3.1% of cases had severe SOFA score and SOFA score on admission cannot predict mortality in emergency intubated patients significantly. Above data reveals that, in emergency intubated patients, 52.3% of cases had mild SOFA score of elective and emergency intubation at admission and after 48 hours showed significant improvement of SOFA score in elective more than emergency group.

Organ involvement in form of respiratory (168 patients), hepatic (19 patients), renal failure (44 patients) or MODS (18 patients) didn't affect outcome in these patients. Correlation between time taken for intubation and outcome. This analysis reveals that, 45.0% of cases had time taken for intubation was 10-20 seconds followed by 51.0% of cases had time taken for intubation was 20-30 seconds and 3.0% of cases time taken for intubation was >30 seconds and that the time taken for intubation was not a predictor of mortality in intubated patients. Patients with difficult intubation (11 patients) were not associated with greater mortality. No. of attempts of intubation as well as time taken for intubation was not associated with greater mortality. Table 4 a reveals that, 13% of cases had complications, of which 73.1% were elective and 26.9% were emergency, 87.0% of cases did not had any complications. Table 4 b reveals that the complication rate was greater in elective intubation patients than in emergency intubation patients. Status at 72-96 hours and outcome and their association in Elective vs Emergency Intubation. Data reveals that, out of the 200 intubated patients, 36.5% of cases were extubated at 72-96 hrs, of

which 70.4% were elective and 29.6% were emergency intubations. 21.5% were still intubated at 72-96 hrs, of which 46.5% were elective and 53.5% were emergency intubations and 43.0% were tracheostomised at 72-96 hrs, of which 77.9% were elective and 22.1% were emergency intubations. Table 5 reveals that, VAP was associated with significantly prolonged duration of hospital stay. The overall mortality rate of the study was 37%. The disease specific mortality for sepsis patients was 100%, Coma was 56.2% and pneumonia was 52.4%. The elective intubated patients had lower mortality (32.1%) compared to that of emergency intubated patients (47.6%).

## DISCUSSION

This retrospective study of characteristics and outcomes of patients who received elective intubation or emergency intubation in EMS (Emergency medical services), Medical intensive care unit of a tertiary care hospital. Total 200 patients requiring intubation and mechanical ventilation and satisfying the inclusion criteria were studied over a period of 18 months. In our study, mortality was higher above 60 years of age. Higher mortality in elderly can be due to pre-morbid conditions like diabetes, hypertension, chronic obstructive airway disease. In this study, ARDS was most common indication for intubation accounting for 50% of total patients. Among ARDS patients, ARDS-related to malaria and leptospirosis was most common indication for intubation (39%) followed by Pneumonia (10.5%). In neuromuscular group, OPC poisoning was most common indication for intubation (22.5%) followed by Coma (8%). Other indications were Neuromuscular snakebite (5%), GBS (4.5%), Hanging (2%), COPD (2%), Sepsis (1.5%) and Miscellaneous (3.5%).

In a study by Alia *et al*<sup>8</sup>, acute respiratory failure was the most frequent reason for reason for intubation and mechanical ventilation, accounting for two-thirds of patients. The most common cause for acute respiratory failure was Pneumonia comprising 16% of the patients, followed by Sepsis and ARDS, accounting for 15% of patients each. COPD was indication for intubation and mechanical ventilation in 13% of patients while neuromuscular weakness demanded intubation and mechanical ventilation in 5% of patients.

### Correlation between Mortality and Patient / Disease characteristics

**Age and Mortality:** Though there was an apparently better outcome in the younger age group and poorer outcome in elderly age group, it was not found to be statistically significant. Only a minimal difference was found in relation to male and female survival

**Indication for Intubation and Mortality:** (Table 1) In this study, the overall mortality was 37%. Maximum disease specific mortality of 43% was estimated in patients who had ARDS as indication for intubation and ventilatory support. Mortality was 27% in Neuro-paralytic patients. Among the ARDS patients, maximum disease specific mortality of 52.4% was estimated in patients who had Pneumonia as indication for intubation while that of 50% in CCF patients, in ARDS (related to malaria and leptospirosis) was 42.3%, 25% in COPD patients. There was 100% mortality in patients with Sepsis while Hanging and ILD patients had 100% survival. Esteben *et al*<sup>9</sup> estimated that the overall mortality of 30.7% in intubated patients on mechanical ventilation. Disease specific mortality was as follows: ARDS- 52%, Sepsis- 55%, cardiac arrest- 44%, Pneumonia- 38%, Coma- 36%, CCF- 28%, COPD- 22% and Neuro-paralytic - 15%. In a study by Udawadia *et al*<sup>10</sup>, which comprised of 1569 patients, patients with sepsis had a marked high mortality of 81%. Patients suffering from CCF had a mortality of 56% while those of ARDS had a mortality of 47%. COPD patients had a mortality of 37%. Better outcome was seen in patients of Neuro-muscular weakness (9%) and OPC poisoning (4%).

**Elective vs Emergency Intubation and Mortality:** (Table 2) In our study, most of the intubations were elective intubations (68.5%) than emergency intubations (31.5%). The electively intubated patients had lower mortality (32.1%) compared to those intubated on emergency basis (47.6%) and it was statistically significant.

**SOFA Score and Mortality:** In this study, SOFA Score at time of intubation was significantly lower (SOFA Score<11) in survivors than in non-survivors (SOFA Score<11). Patients with Mild SOFA Score (SOFA Score<7) and Moderate. SOFA Score (SOFA Score7-11) were associated with marked low mortality of 28.6% and 40.7% respectively while that of 56.1% in those with Severe SOFA Score (SOFA Score>11) and was statistically significant and in concordance with below studies. In a study by Price K J *et al*(11), death rate was higher in patients with SOFA scores >11 (68%) than those with lower SOFA score (34%) in leukaemia patients on mechanical ventilation.

**SOFA Score of Elective vs Emergency Intubation and Mortality:** (Table 3a and b) In this study, Mild SOFA Score of elective intubated patients had an overall mortality of 20.7% while that of emergency intubated patients was 42.4%. Patients with Moderate and Severe SOFA Score in electively intubated patients had an overall mortality of 36.2% and 52.4% respectively while that of emergency intubated patients was 50% and 100% respectively. Thus in this study at any SOFA Score,

patients with emergency Intubation had higher mortality than in electively intubated patients. It was statistically significant in electively intubated patients and insignificant in emergency intubated patients. However this requires a large population based trial to confirm this observation. There is no study which has compared SOFA Score in electively vs emergency intubated patients to our knowledge till date.

**Organ failure and Mortality:** In this study, out of the 200 intubated patients, 22.0% of cases had Renalfailure, 84.0% of cases had Respiratory failure, 9.5% cases had Hepatic failure and 9.0% cases had MODS. The death rate in patients with renal failure was 43.2%, in patients with hepatic failure was 36.3%, in patients with respiratory failure was 40.0% and that in patients with MODS was 44.4%. Renal failure, Hepatic failure, Respiratory failure and MODS (Multi organ dysfunction syndrome) were determined not to predict mortality in intubated patients.

**Ventilator associated pneumonia with Elective / Emergency Intubation and Mortality:** In this study, 7.5% of the intubated patients developed ventilator associated pneumonia. The death rate in patients with ventilator associated pneumonia, who were electively intubated was 50.0% while in those patients with ventilator associated pneumonia, who were emergency intubated was 100.0%. The death rate in patients without ventilator associated pneumonia, who were electively intubated was 30.1% while in those patients with ventilator associated pneumonia, who were emergency intubated was 46.8%.

**Complication with Elective / Emergency Intubation and Mortality:** (Table 4a and b) In this study, 13.0% of the intubated patients developed complications related to intubation. The death rate in patients with complications, who were electively intubated was 36.8% while in those patients with complications, who were emergency intubated was 14.3%. The death rate in patients without complications, who were electively intubated was 31.4% while in those patients with complications, who were electively intubated was 51.8%. After statistical analysis, it was found to be insignificant. In this study, the complications were, pneumothorax, pneumomediastinum, subcutaneous emphysema, associated with increased mortality. These complications were prevalent in elective intubation patients than emergency intubation patients. In a study by Jaber *et al*<sup>12</sup> and by Donald E. G. Griesdale *et al*<sup>13</sup> the death rate due to complications in emergency intubation patients (29.4%) was greater than that in elective intubation patients (15.4%). In this study, increased ventilator associated complications developed in patients requiring prolonged duration of ventilation and hospital stay. VAP developed in 1 out of 5 patients

requiring prolonged duration of ventilation and hospital stay and Respiratory failure (excludes VAP) developed in remaining 4 out of 5 patients requiring prolonged duration of ventilation and hospital stay. On statistical analysis, incidence of VAP was significant. Underlying disease related complications like renal failure, respiratory failure, hepatic failure and MODS were not significant. A study by Koch *et al*<sup>14</sup> observed and concluded that increasing duration of a patient on ventilator support increased the incidence the incidence of ventilator associated complications.

## CONCLUSIONS

The mean age of patient intubated was 35.42 years and majority (45.0%) of patients were between the age group 21-40 years. The mortality rate was greater in female patients (42.6%) than that of male patients (34.9%). The most common indication for intubation was ARDS accounting for half of intubated patients with ARDS related to malaria and leptospirosis, pneumonia accounting for majority of cases. Early tracheostomy (at 72-96 hours) was associated with significantly improved survival. The overall mortality was 37.0%. Sepsis had the maximum disease specific mortality of 100% while that of Coma was 56.2% and pneumonia was 52.4%. The elective intubated patients had lower mortality (32.1%) compared to that of emergency intubated patients (47.6%). The independent prognostic indicators of mortality in intubated patients were

- a) Emergency intubation
- b) High SOFA score on admission
- c) Abnormal chest X-ray on admission
- d) Abnormal platelet count on admission in ARDS patients.

The most frequent complications were hoarseness of voice (6.5%) and subcutaneous emphysema (3.5%). The mean duration of stay in elective intubated patients who survived was 10.51 days that in emergency intubated who survived was 9.45 days. Ventilator associated pneumonia was associated with prolonged duration of stay

## LIMITATIONS OF STUDY

In this study at any SOFA Score, patients with emergency Intubation had higher mortality than in electively intubated patients. It was statistically significant in electively intubated patients and insignificant in emergency intubated patients. However this requires a large population based trial to confirm this observation. Also the complications and duration of study was greater in elective intubation patients than in emergency intubation patients, however this requires a large population based trial to confirm this observation and the

mortality rate in emergency intubation patients was greater significantly, so their duration of stay was lesser and complications related to procedure and post-procedure was lesser.

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