Original Research Article

# Impact of resident training on anaesthesia induction times

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## Abstract

**Background:** The increasing role of ambulatory surgery has emphasized the need for an anaesthetic technique with smooth induction and rapid recovery and minimal side effects. It may have an impact of training. The effect of resident training in anaesthesiology economics is an issue of debate. **Aim:** To study the impact of resident training on anaesthesia induction times. **Material and Methods:** Anaesthesia induction time was studied in 150 patients who were randomly selected. 30 patients each are induced by one of the techniques and equally divided between the two resident groups. Half of them were induced by resident group J (Anaesthesia residents who have training experience of one and half years or less, minimum 6 months training was completed) and the other half by resident group S (Anaesthesia residents who have training experience of more than one and half years). **Results:** The mean anaesthesia induction time for all five techniques under study was less in resident Group S than resident Group J. The difference was found to be statistically significant with independent t-test. Although the difference was found to be significant, in terms of mean absolute time taken, the difference was not found significant in terms of operating theatre efficiency. **Conclusion:** There is definite difference for anaesthesia induction time between residents with more work experience than residents with less work experience. Training improved the anaesthesia induction time and quality of anaesthesia in senior trainees of anaesthesia.
**Key Word:** Resident training, induction time, anaesthetic techniques, education

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## INTRODUCTION

The effect of resident training in anaesthesiology on operating theatre economics is an issue of debate. Operating room efficiency is an important concern in many hospitals in today's date due to increase in number of patients for surgery within fixed and valuable operating theatre time. The drive for operating room efficiency has led to increased interest in the time taken by resident training in the operating room. Several studies have been published regarding the impact of surgical resident training on surgical times[1-3] however, the results are conflicting and seem to be dependent on the specific type of operation performed.[4] Little work has been reported to evaluate the contribution of anaesthesia residents to changes in anaesthesia-controlled time-related efficiencies in operating theatre. Regarding anaesthesia resident training, the main focus has been on the anaesthesia induction times and the pre-incisional time period. The assumption is that, training of anaesthesia residents might increase the anaesthesia process time thereby negatively influencing operation theatre efficiency and increase waiting time for surgeons. Anaesthetic technique had the major effect on the anaesthesia induction time and operating theatre efficiency. The major challenge in comparing anaesthesia induction times between residents with difference in training experience is the complex interactions of technique, provider and the patient. The present study was conducted to observe any difference in terms of time duration between anaesthesia residents with less than one

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and half years training experience (minimum six months' residency completed) and residents with more than one and half years' experience.

## MATERIAL AND METHODS

This prospective randomized double blind study was conducted on 150 patients scheduled for different surgeries. The study was approved from Institutional Ethical Committee. Written, valid, informed consent was obtained from all included patients. The patients were randomly allocated into two groups to get induced by one of the following group.

1. **Group J:** Anaesthesia residents who have training experience of one and half years or less (minimum 6 months training was completed).
2. **Group S:** Anaesthesia residents who have training experience of more than one and half years.

**INCLUSION CRITERIA**

- Patients between the age group of 12-70 years.
- Gender – either male or female.
- Patients with ASA physical status I and II.
- Patients undergoing elective general surgeries, cardiovascular thoracic surgeries, urosurgeries, orthopaedic surgeries, gynaecological surgeries and surgeries on ear, nose and throat.

**EXCLUSION CRITERIA**

- Patients operated under local anaesthesia with monitored anaesthesia care.
- Patients coming to operation theatre from ICU already intubated.
- Patients for Emergency surgeries.
- Morbidly obese patients.
- Patients with difficult airway.
- Pregnant patients.
- Patients allergic to egg lecithin or soya oil.
- Patients refusal to participate

**Definitions**

**Anaesthesia preparation time:** was defined as the time from the beginning of presence of the anaesthetist to the beginning of anaesthetic induction. In this time, the anaesthetist prepares the case and places the i.v. cannula. For regional techniques, the patient is positioned during this time and the site for any planned regional technique is inspected and prepared.

**Anaesthetic induction time:** was defined as the time from the injection of anaesthetic drug to the end of induction, after placement of all catheters, when the patient was ready to be positioned by the surgeon. Time was noted by an independent observer who was not involved directly or indirectly in administration of anaesthesia. Time was measured by a stopwatch. In the case of regional anaesthesia, the penetration of the skin with the needle was used for the anaesthetic start time and the end of induction was when the anaesthetist released the patient for surgical positioning. In cases where an arterial line was placed by the anaesthetist in the awake patient immediately before induction, the induction time started with the start of placement of the arterial line. Every case was induced in the presence of assistant professor or professor. In case the resident had difficulty or unable the case was taken over by respective senior assistant professor or professor. After preoperative assessment, premedications were given before shifting to operation theatre. On arrival in the operation theatre, standard monitors were attached. An intravenous cannula was placed for administration of fluids and all patients were given Inj. Midazolam 0.03 µgm/kg i.v. 5 min before induction. Induction was carried out according to the type of technique used.

**Group T: General Anaesthesia and Endotracheal Tube Placement**

Induction time was measured from injection of intravenous drug into patient up to ETT was properly fixed and patient was handed over to surgeons for positioning and surgical preparation.

**Group TC:General Anaesthesia and Endotracheal Tube Placement and Central Venous Catheter**

Total induction time for this group included time starting from injection of intravenous drug into patient up to ETT was properly fixed plus time taken for putting central line (starting from preparation of site to fixation of central line with adhesive tape). Patient was ready for surgical positioning and preparation.

**Group TCA: General Anaesthesia and Endotracheal Tube Placement and Central Venous Catheter and Arterial Cannulation**

Total induction time for this group included time from injection of intravenous drug into patient up to ETT is properly fixed plus time taken for putting central line (starting from preparation of site to fixation of central line with adhesive tape) plus time taken for arterial cannulation (including preparation of site with fixation of arterial cannula with adhesive tape and arterial transducer showing arterial waveforms). Patient was ready for surgical positioning and preparation.

**Group LMA: General Anaesthesia with LMA Insertion**

Induction time for this group is measured from intravenous drug injection to fixation of LMA on face with adhesive tape. Patient is ready for surgical positioning and preparation.

**Group SP: Spinal Anaesthesia**
Induction time for this group was measured from penetration of the skin with the needle to achievement of sensory block up to T6. All the data was analyzed using SPSS (social package for statistical studies) software version 16.

## RESULTS

The mean age of patients was 35.5 years in resident group J and 36.7 years in resident group S, which was comparable and the difference was not statistically significant. The maximum numbers of patients were in the age group of 20-30 years in both the groups. The mean weight of patients in resident group J was 52.6 kgs. And in resident group S was 53.2 kgs. The numbers were comparable and the difference was not significant. Maximum number of patients was in the weight group of 51-60 kgs in both the groups. The number of males were 44 in resident group J and 48 in resident group S. The number of females were 31 in the resident group J and 27 in resident group S. The number were comparable and the difference was not significant.

**Table 1:** Comparison of Induction Time in Resident Group J Vs S in Group T (General Anaesthesia with Endotracheal Intubation)

| Group | Sample size | Mean±SD | SEM |
|---|---|---|---|
| J | 15 | 8.3±0.52 | 0.13 |
| S | 15 | 7.16±0.36 | 0.09 |

T Value 6.85, Df = 28, P Value < 0.05

The mean time taken for induction with general anaesthesia and endotracheal intubation by resident group J and S were 8.3 minutes and 7.16 minutes respectively. The difference was found to be significant (p value < 0.05, independent t – test).

**Table 2:** Comparison of Induction Time in Resident Group J Vs S in Group TC (General Anaesthesia with Endotracheal Intubation and Central Line Placement)

| Group | Sample size | Mean±SD | SEM |
|---|---|---|---|
| J | 15 | 21.6±0.68 | 0.17 |
| S | 15 | 17.8±1.08 | 0.27 |

T Value -11.48, Df = 28, p >0.05

The mean time taken for induction with general anaesthesia and endotracheal intubation with central line placement by resident group J and S were 21.6 minutes and 17.8 minutes respectively. The difference was found to be significant (p value < 0.05, independent t – test).

**Table 3:** Comparison of Induction Time in Resident Group J Vs S in Group TCA (General Anaesthesia with Endotracheal Intubation, Central Line Placement and Arterial Cannulation)

| Group | Sample size | Mean±SD | SEM |
|---|---|---|---|
| J | 15 | 31.43±2.59 | 0.67 |
| S | 15 | 28.03±1.77 | 0.45 |

T Value -4.18, Df = 28

The mean time taken for induction with general anaesthesia and endotracheal intubation with central line placement and arterial cannulation by resident group J and S were 31.43 minutes and 28.03 minutes respectively. The difference was found to be significant (p value < 0.05, independent t – test).

**Table 4:** Comparison of Induction Time in Resident Group J Vs S inGroup LMA (General Anaesthesia with LMA Insertion)

| Group | Sample size | Mean±SD | SEM |
|---|---|---|---|
| J | 15 | 7.1±0.28 | 0.07 |
| S | 15 | 6.4±0.33 | 0.08 |

T Value -61.73, Df = 28, P Value < 0.05

The mean time taken for induction with general anaesthesia and Laryngeal mask insertion by resident group J and S were 7.1 minutes and 6.4 minutes respectively. The difference was found to be significant (p value < 0.05, independent t – test).

**Table 5:** Comparison of Induction Time in Resident Group J Vs S inGroup SP(Spinal Anaesthesia)

| Group | Sample size | Mean±SD | SD | SEM |
|---|---|---|---|---|
| J | 15 | 8.86 | 0.44 | 0.11 |
| R | 15 | 7.9 | 0.57 | 0.14 |

T Value -5.17, Df = 28, p >0.05

The mean time taken for induction with spinal anaesthesia by resident group J and S were 8.86 minutes and 7.9 minutes respectively. The difference was found to be significant (p value < 0.05, independent t – test).

## DISCUSSION

The increasing role of ambulatory surgery has emphasized the need for an anaesthetic technique with smooth induction, good intraoperative monitoring and maintenance of anaesthesia, rapid recovery and minimal side effects. In the country like India, where there is burden of surgical cases due to large number of patients, lack of enough operating theatres, inadequate efficient staff and OT time available. Anaesthesia induction time is said to be responsible for the delay in handover the patient to surgeons. It may have impact of training. If anaesthetic induction is completed too early, it may result in complications occurring under stress. If the induction is completed too late, there is delay in handover of patient to surgeons. Therefore, several studies have been undertaken to examine the impact of anaesthesia resident training on operating theatre economics. In our study, 30 patients each of comparable age, sex and ASA physical status scheduled for surgeries were randomly allocated and induced with one of the technique mentioned. Half of them were induced by resident group J and the other half by resident group S. The mean age of patients was 35.5 years in group J and 36.7 years in group S, which were

comparable. Eappen *et al* found a small, but statistically significant increase of about 3 mins when comparing cases of new anaesthetic residents with cases performed by consultants alone.[5] Davis *et al* found an overall increase of approximately 5 mins for teaching cases, but no increase in process times for placement of CVCs or arterial lines in a prospective study of 1558 cases. They conclude that teaching occurs in the majority of cases in the operating room and although it contributes to increased time to incision, this increase is insignificant compared with the time required to complete the surgical procedure.[6] A study by Posner and Freund using data from a quality management database showed that residents in the second year might have a higher incidence of adverse outcomes compared with first or third year residents.[7] Costs for residents are lower than for consultants. On the other hand, consultants are needed in order to ensure proper training and for crisis management. Schuster *et al* examined a range of anaesthetic techniques and found increased induction times and anaesthesia preparation time for resident cases compared to consultants. The effect of resident training was significant but small, explaining only approximately 1% of anaesthetic time variability.[8] In this study it was found that, mean time taken for general anaesthesia with endotracheal intubation by both consultants and residents was 11 minutes, and no significant difference was found between the two groups. The mean time taken for general anaesthesia with endotracheal intubation and central venous catheter placement by resident group was 38 minutes and by consultants 22 minutes. Significant difference found between consultants and residents was for endotracheal intubation and central venous catheter placement. The mean time taken for general anaesthesia with endotracheal intubation with central venous catheter placement and radial artery cannulation was 37 minutes by resident group whereas 35 minutes by consultants. Here the difference was found not to be significant. The mean time taken for general anaesthesia with LMA insertion was found to be 11 minutes in resident group whereas 8 minutes in consultant group. The difference was found to be significant between two groups. In the last category for spinal anaesthesia induction, the mean time taken by the resident group was 10 minutes whereas 8 minutes by consultants. This study suggests that the main predictor for anaesthetic induction time is the anaesthetic technique, and for some techniques also young patient age and resident training. In our study, the mean time taken for administering general anaesthesia with endotracheal intubation by resident group J is 8.3 minutes and by resident group S is 7.16 minutes. The difference was found to be significant (p value < 0.05, independent t-test). The mean time taken for administering general anaesthesia with endotracheal intubation and central venous catheter placement by resident group J was 21.6 minutes and by resident group S was 17.8 minutes. The difference is found to be significant (p value < 0.05, independent t-test). In the present study, the mean time taken for administering general anaesthesia with endotracheal intubation with central venous catheter placement and radial artery cannulation was found to be 31.43 minutes in resident group J and by resident group S was 28.03 minutes. The difference is found to be significant (p value < 0.05, independent t-test). The mean time taken for general anaesthesia with LMA insertion was found to be 7.1 minutes by resident group J and 6.4 minutes by resident group S. The difference is found to be significant (p value < 0.05, independent t-test). It was found that, the mean time taken for administering spinal anaesthesia by resident group J was 8.86 minutes and by resident group S was 7.16 minutes. The difference is found to be significant (p value < 0.05, independent t-test). Although there is significant difference has been found between two resident groups for all five anaesthetic techniques under study, the absolute time difference between both the groups for anaesthesia induction is found to be minimal. The mean time difference was found to be 0.7 minutes for administering general anaesthesia with LMA insertion which was minimum whereas mean time difference of 3.8 minutes was found for administering general anaesthesia with endotracheal intubation and central venous catheter placement which was maximum between two resident groups. During our study no significant difference was found in terms of complications in both the resident groups. In our study, the significant difference found between the two resident groups with less induction time by resident group S may be due to large number of patients being operated in our hospital, increased work experience in terms of duration of working, teaching and working going simultaneously and good back up for guiding and assisting i.e., nothing but the consultants.

## CONCLUSION

There is definite difference for anaesthesia induction time between residents with more work experience than residents with less work experience. Training improved the anaesthesia induction time and quality of anaesthesia in senior trainees of anaesthesia. The difference found between two resident groups does not lead to decrease in operating theatre efficiency and OT turnover. Anaesthesia training has significant effect on anaesthesia induction time.

**Limitations of the study**

In our study, the partition of cases according to the different anaesthesia techniques led to rather small groups. This reduces the statistical power to detect differences. Exclusion of several complex techniques like fibreoptic intubation or pulmonary artery catheters placement, since these are usually not performed by residents. Anxiety of being observed among residents during study. However, as far as possible, the anaesthetists were blinded regarding the real reason for data collection and any bias should have applied to both resident groups.

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