Original Article

Comparative evaluation of lignocaine nebulization with and without dexmedetomidine for flexible videoendoscopic guided awake nasal intubation for general anaesthesia

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Abstract

Background and Aims: Awake fibreoptic intubation is considered a safe approach in airway management of a patient with difficult airway. Awake fibreoptic endoscopy needs appropriate anaesthesia of airway to suppress airway reflexes and prevent discomfort. We planned this study to evaluate effect of adding dexmedetomidine to lignocaine nebulization on conditions for awake videoendoscopic intubation.

Material and Methods: In this prospective randomized double blind controlled study, ninety six ASA grade I, II patients of either gender, aged 18-65 years, scheduled for elective surgeries under general anaesthesia, were randomly allocated into two groups, Group D and L to receive nebulization with 4% Lignocaine 5 ml + Dexmedetomidine 2 mcg/kg and 4% Lignocaine alone respectively, 20 min before procedure. Time taken to intubate the patient, ease of intubation assessed by cough severity score, patient comfort score, post-intubation patient satisfaction and hemodynamic changes were recorded and compared.

Results: Group D and L had comparable intubation time (196.8 ± 61.2 s) and (205.8 ± 52.2 s) ($p = 0.437$). Cough severity, patient comfort and quality of procedure with post intubation patient satisfaction score were significantly better in Group D. Haemodynamics parameters were better post nebulization in group D as compared to group L.

Conclusion: Addition of Dexmedetomidine 2 mcg/kg with 4% Lignocaine during nebulization improves intubating conditions during awake flexible videoendoscopy in terms of ease of intubation, cough severity, patients comfort and satisfaction along with providing stable Haemodynamics profile.

Keywords: Awake videoendoscopic intubation, dexmedetomidine, lignocaine, nebulization

Introduction

Awake fibreoptic intubation is considered a safe approach in the airway management of a patient with difficult intubation, difficult mask ventilation as well as difficult laryngoscopy. Prerequisite for awake fibreoptic endoscopy need appropriate anaesthesia of nose, oropharynx, larynx and trachea to suppress airway reflexes and prevent discomfort during bronchoscopy and intubation.[1]

This can be achieved in broadly two ways- topical administration of local anesthetic and blockade of neural supply to oropharynx and larynx. Topical administration of local anesthetic in the form of spray or gargle causes less discomfort and trauma

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to patients as compared to airway nerve blocks. Topical application of local anaesthesia by nebulization technique is one of the promising techniques used to anaesthetize the airway. Various pharmacological methods have been reported to achieve conscious sedation for awake fibreoptic intubation including fentanyl, midazolam, ketamine, propofol, remifentanil and dexmedetomidine.[2,3]

Lignocaine nebulization for awake fibreoptic intubation has been studied previously.[4,5] But to the best of our knowledge, nebulization with dexemedetomidine a highly selective and specific α2 adrenoreceptor agonist for awake video endoscopic intubation is not studied till now. Considering the unique properties of dexmedetomidine as an anxiolytic, hypnotic, analgesic, amnesic and antisialogogue for an awake sedation,[6] we had made hypothesis that dexmedetomidine can be helpful in awake video endoscopic intubation. So we planned this study to evaluate the effect of adding dexmedetomidine to lignocaine nebulization on conditions for awake videoendoscopic intubation.

Material and Methods

This prospective randomized double blind controlled study was conducted after taking approval from institutional ethical committee (RNT/STAT/IEC/2018/1837) along with Clinical Trials Registry India registration (CTRI/2018/05/020146).

Ninety six patients of either gender, aged 18-65 years with ASA I and II grade, scheduled for elective surgeries under general anaesthesia were randomly allocated into two groups using computer-generated tables of random numbers in opaque sealed envelopes as depicted in Figure 1, Group D received nebulization with 4% Lignocaine 5 ml + Dexmedetomidine 2 mcg/kg diluted with normal saline up to total 7 ml and Group L received nebulization with 4% Lignocaine 5 ml diluted with 2 ml normal saline, 20 mins before flexible videoendoscopic guided nasal intubation.

Patients who had hypersensitivity to lignocaine, baseline heart rate less than 50 bpm, blood pressure <100/50 mmHg, history of hypertension, cardiac diseases, coagulopathy, refusal for study and who required 2 or more attempts for intubation were excluded from the study.

Prior to conducting the present study, a pilot study was conducted, constituting 2 groups - group D (nebulisation with Lignocaine + Dexmedetomidine) and Group L (nebulisation with Lignocaine + Normal Saline). Mean Intubation time was compared between both the groups containing 10 patients in each group.

Mean intubation time was 190 ± 61 sec in group L compared to 103 ± 58 sec in group D which was about 50% of

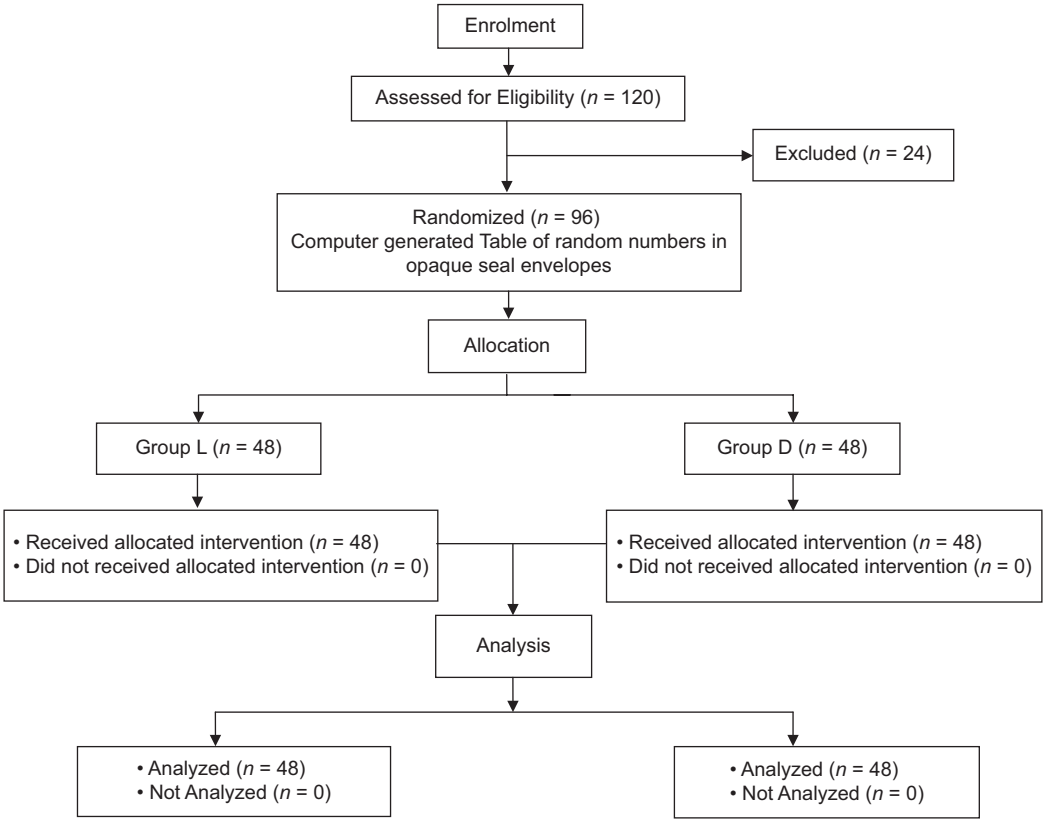

Figure 1: Consort Diagram

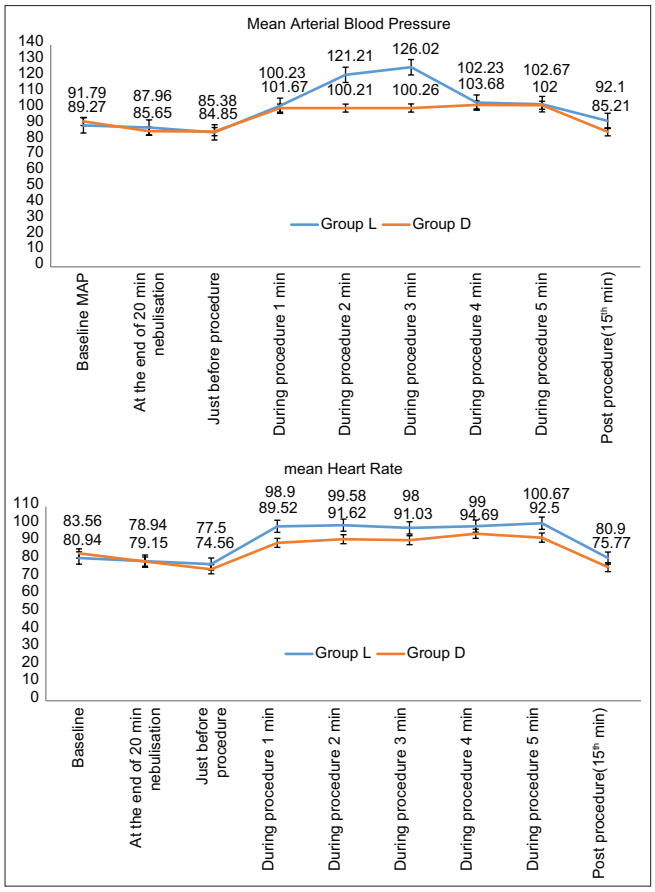

Figure 2: Comparison of haemodynamic variables (mean HR and MAP) between the two groups at different

intubation time of group L, so we assumed that Group D is 50% more effective than Group L. We calculated our sample size with the help of formula from Jerold H Zar. Sample size = $[(Z\alpha)^2 P(P\text{-}1)]/E^2$. To calculate the sample size we have presumed the confidence interval as ± 10 (c = 0.1) and confidence level as 95% (Z = 1.96). *P* value <0.05 was considered statistically significant. Sample size was calculated as 48 patients for each group.

All patients underwent a pre-anesthetic evaluation with thorough airway examination including modified mallampatti grading, thyromental distance and upper lip bite test. The procedure of awake videoendoscopic intubation was explained to all patients and informed consent was obtained. On arrival of patient in preoperative room, an intravenous line was secured with 18 G IV cannula and baseline parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) and oxygen saturation (SpO_2) were measured. Glycopyrrolate 0.2 mg IM was given 30 minutes before surgery and two drops of Xylometazoline 0.1% instilled in both nostrils. Patients were nebulized for 20 mins before nasal intubation along with oxygenation with nasal prong @ 4 L/min flow. All patients received Midazolam 1 mg intravenously at 15th minute of nebulization.

To ensure double blindness, patients were nebulized by an anesthesiologist who was not involved in further study. Another anesthesiologist performed the procedure and recorded the data. Continuous monitoring of vitals was done at baseline, at 5, 10, 15, 20 min during nebulization, just before procedure, at 1, 2, 3, 4, 5 min during procedure and post procedure at 1, 3, 5, 10 and 15 mins. Sedation level was assessed at baseline, 5, 10, 15, 20 min during nebulization and just before procedure with Ramsay Sedation score[7] Adequate local anaesthesia was confirmed by heaviness of the tongue and dryness of posterior pharynx of patients.

Awake videoendoscopy was performed using flexible videoendoscope iView 100 A, 5.0 mm outer diameter preloaded with 7.0 mm ID ET tube for female patient and 7.5 mm ID ET tube for male patient respectively. During videoendoscopy, 2 ml lignocaine 4% was administered by spray-as-you-go technique. ET tube position was confirmed by auscultation and capnography. The amount of total lignocaine required in each patient was also noted.

Intubation time was defined as the time from passing the videoendoscope tip through the nostril to the first reading obtained by the capnograph after endotracheal intubation. A Grading system[1] was used for assessing intubating conditions, vocal cord positions and patient comfort during and after intubation. General anaesthesia was then administered with Fentanyl 2 mcg/kg, Propofol 2 mg/kg and Vecuronium 0.1 mg/kg IV. Anaesthesia was maintained with Oxygen and Nitrous Oxide (50:50), Sevoflurane up to 2% v/v and intermittent dose of Vecuronium 0.02 mg/kg IV for muscle relaxation. Reversal was given with Neostigmine 2.5 mg and Glycopyrrolate 0.5 mg IV at the end of the surgery. Postoperatively, patient satisfaction was assessed using the grading system [Table 1].

Data were entered into MS-EXCEL (Microsoft) and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 20 (IBM). The qualitative/categorical variables like gender and ASA grade were summarized as frequency and percentage and were analyzed using Chi square test. Quantitative variables like weight, blood pressure and heart rate were summarized as mean and standard deviation and were analyzed using unpaired Student's t test. *P* value <0.05 was regarded as statistically significant.

The primary outcome measured was the time required for videoendoscopic guided nasal intubation. The secondary outcomes measured were intubating condition, vocal cord

Table 1: Grading System Used to Assess Intubating Conditions, Vocal Cord Position, Patient Comfort and Satisfaction

	Intubating conditions	Vocal cord positions	Patient comfort indices			Post-operative patient satisfaction
			cough severity	Comfort during intubation	Post intubation assessment	
Grade 1	Optimal (no hold-up or collision of tracheal tube with vocal cords)	Relaxed/glottis open	No cough	No reaction	Cooperative	Excellent
Grade 2	Suboptimal (hold-up relieved by one rotation of the tube)	Moving/glottis partially open	Slight (<2 coughs)	Grimacing	Restless/minimal resistance	Good
Grade 3	Difficult (hold-up requiring more than one rotation of the tube)	Adducted/glottis closed	Moderated 3-5 coughs)	Verbal objection	Severe resistance/ requirement for immediate general anaesthesia	Fair
Grade 4	Failure (failed attempt at awake intubation)		Severe (>5 coughs)	Defensive movements		Poor

position, cough severity, patient comfort, postintubation patient cooperativeness, hemodynamic changes and level of sedation during the procedure.

Results

Demographic data regarding age, gender and weight were comparable in both groups. The patients were equally distributed in groups according to Modified mallampatti grading, Upper lip bite test and thyromental distance [Table 2]. Although we found significant difference regarding ASA grading between the groups ($p = 0.006$), but this could not confound our results as we had taken only ASA I and II patients for our study which we considered as normal and ASA III and above patients who were not optimized were excluded from the study. In present study, the mean intubation time in Group D (196.8 ± 61.2 s) and group L (205.8 ± 52.2 s) was statistically comparable ($p = 0.437$).

We found more favorable intubating conditions as grade 1 (optimal) in Group D as compared to Group L ($p = 0.015$) [Table 3]. The vocal cords were found more relaxed resulting in better glottic opening in group D as compared to group L ($p = 0.045$).

On 4 point scale of cough reflex we found that group D patients had less cough as compared to Group L ($p = 0.011$). Patient comfort during intubation was grade 1 (no reaction to the procedure) in 20 patients of group D as compared to 9 patients of group L. There was one patient with vocalization in Group D as compared to 6 patients of group L and there were no defensive movement with group D as compared to one patient of group L. All these findings were statistically comparable. In post intubation assessment, we found that in Group D, 27 patients were cooperative (grade 1) as compared to 12 patients of Group L ($p = 0.006$).

Regarding postoperative patient satisfaction, we didn't find grade 1 (excellent) in either group but 32 patients in group D had grade 2 (good) as compared to 22 patients of group L. There weren't any poor grade in Group D as compared to 5 patients in Group L felt poor. Nevertheless, patients were significantly satisfied with the procedure in Group D ($p = 0.023$).

Table 2: Demographic Data, Airway Assessment and Intubation Time

	Group L	Group D	*P*
Age (yr)	43.54±10.59	41.04±12.46	0.29
Sex (M/F)	28/20	27/21	0.873
Weight (Kg)	65.81±10.330	65.1±13.738	0.776
ASA grade (1/2)	37/11	24/24	0.006
Modified Mallampatti grade (1/2/3/4)	6/32/4/6	5/30/4/9	0.86
Thyromental distance (cm)	5.95±0.168	5.89±0.612	0.482
Upper lip bite test (1/2/3)	27/11/10	20/15/13	0.359
Intubation time (Sec)	205.8±52.2	196.8±52.2	0.437

Among hemodynamic variables, baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and SpO_2 were comparable in both groups [Figure 2]. All the hemodynamic variables were comparable during the nebulization procedure between the two groups. During the process of videoendoscopy, the heart rate was statistically significantly lower in group D at 1, 2 and 3 mins ($p < 0.05$). SBP, DBP and MAP were comparable between the two groups at all measured time intervals during nebulization except at 1 min where SBP was statistically significantly reduced in group D as compared to group L ($p = 0.031$). Systolic blood pressure and MAP post procedure at 5, 10 and 15 mins were statistically reduced in group D.

In our study, patients in group D were better sedated as compared to group L but none of the patients had any respiratory compromise. We couldn't find any significant side effects in both the groups.

Discussion

During general anaesthesia difficult airway is always a risk to patient and a challenge to anesthesiologist. Flexible

Table 3: Comparison of Intubating Conditions, Vocal Cord Position, Post intubation Patient Comfort and Satisfaction

	Intubating conditions		
	Group L	**Group D**	***P***
Grade			
I	26 (54.2%)	39 (81.2%)	0.015
II	21 (43.8%)	8 (16.7%)	
III	1 (2.1%)	1 (2.1%)	
IV	0 (0%)	0 (0%)	
Total	48 (100%)	48 (100%)	
Vocal cord position			
I	10 (20.8%)	19 (39.6%)	0.045
II	38 (79.2%)	29 (60.4%)	
III	0 (0%)	0 (0%)	
Total	48	48	
Cough severity			
I	11 (22.9%)	24 (50.0%)	0.011
II	25 (52.1%)	21 (43.8%)	
III	9 (18.8%)	3 (6.2%)	
IV	3 (6.2%)	0 (0%)	
Total	48	48	
Patient Comfort During Intubation			
I	9 (18.8%)	20 (41.7%)	0.27
II	32 (66.7%)	27 (56.2%)	
III	6 (12.5%)	1 (2.1%)	
IV	1 (2.1%)	0. (0%)	
Total	48	48	
Post Intubation Assessment			
I	12 (25.0%)	27 (56.2%)	0.006
II	32 (66.7%)	20 (41.7%)	
III	4 (8.3%)	1 (2.1%)	
Total	48	48	
Post Operative Patient Satisfaction			
I	0	0	0.023
II	22 (45.8%)	32 (66.7%)	
III	21 (43.8%)	16 (33.3%)	
IV	5 (10.4%)	0 (.0%)	
Total	48	48	

videoendoscopic intubation is one of the innovations which have resulted in remarkable improvement in various aspects of airway management. Awake fibreoptic intubation offers several advantages over conventional laryngoscopic intubation in patients with no to limited mouth opening, anticipated difficult intubation and cervical spine instability.[5] But it is a painful and agonizing procedure for the patient to feel so there are various techniques and modalities to combat these feelings.

Many studies have been done to compare the different techniques of anaesthetizing an airway for awake fiberoptic intubation.[1,3,5] Airway blocks provide good airway anaesthesia to facilitate the performance of an awake fibreoptic intubation[5] but it is more or less invasive technique which requires multiple pricks for performing block and there is no surety for desired effect even after giving block.

Topical application of local anaesthesia by topical sprays and nebulization is an alternate technique to anaesthetize the airway.[8] Nebulized drug administration may be preferred over intranasal administration as the primary disadvantage of the intranasal route is transient nasal irritation, with some patients also experiencing cough, vocal cord irritation or laryngospasm.[9] Converting the drug to an atomized spray results in maximizing surface area coverage with a thin layer of drug, less drug loss to the oropharynx, better patient acceptability and improved clinical effectiveness.[10]

Airway blocks for awake fibreoptic intubation has been compared to nebulization by various authors as Khandelwal *et al.*[4] Mathur *et al.*[1] Gupta *et al.*[5] but they have delivered conflicting results.

Until now no previous studies has compared dexmedetomidine as an adjunct with lignocaine nebulization for awake flexible videoendoscopic intubation.

Nebulized dexmedetomidine administration may allow rapid drug absorption through nasal, respiratory and buccal mucosa, which allow bioavailability of 65% through nasal mucosa and 82% through buccal mucosa.[11] We had planned this study to compare whether nebulization of dexmedetomidine along with lignocaine provide effective conditions for awake flexible video endoscopic guided nasal intubation or not.

Maximum requirement of Lignocaine dosages were 280 mg (nebulisation and spray) in both groups but in group D the requirement of spray technique was lesser than Group L for executing the procedure. The British Thoracic Society in 2001 recommended that the total dose of lignocaine during bronchoscopy should be limited to 8.2 mg/kg.[12] Thus we were in the safe dose frame of lignocaine. We did not observe any local anesthetic related complication in any of our patients.

Niyogi *et al.*[13] and Wang SS, *et al.*[14] studied the topical use of dexmedetomidine 1 mcg/kg in the form of intranasal route in comparison of intravenous use for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation. Due to scarcity of studies regarding dexmedetomidine nebulization dosages for video-endoscopic guided awake intubation, considering the previous studies of topical use, we performed the pilot study starting with the dose of 0.5 mcg/kg, 1 mcg/kg, 1.5 mcg/kg, 2 mcg/kg, 2.5 mcg/kg; but we found profound bradycardia with 2.5 mcg/kg for which we had to keep patient in ICU under close observation. So on the basis of above observations, we performed our study only with dexmedetomidine 2 mcg/kg with 4% lignocaine to achieve the desired effects.

In present study, there was no statistically significant difference in the time required to perform videoendoscopic guided awake nasal intubation between the two groups. Patients were more comfortable in Lignocaine- Dexmedetomidine nebulized group as compared to Lignocaine- Normal saline group in terms of less coughing, low secretion as well as better tolerability with procedure. Since group D gave better visibility and relaxed vocal cord, ease of performing the procedure was significantly better than group L, even the patient's postoperative satisfaction was better in group D as compared to group L.

Coughing is invariably associated with awake intubation so we needed to blunt or block this reflex to achieve the desired effects. Although, lignocaine suppresses the cough reflexes but we found better results when combined with dexmedetomidine. This difference might be due to sedative, anxiolytic and antisialogogue action of nebulized dexmedetomidine.

In our study we found stable hemodynamic status on performing our procedure with group D as compared to group L. Although there were comparable results at all intervals during nebulization but there were significantly lower results in group D compared to group L on performing the procedure and after procedure.

Similar impression were observed in Bajwa *et al.*[15] study that the mean HR and MAP were significantly lower in the Group D (dexmedetomidine) 20 min after the infusion of study drug as compared with similar parameters in Group F. Just after the induction of anaesthesia, mean HR and MAP decreased further in both the groups and on analyzing the magnitude of decrease in hemodynamics, it was found to be highly significant on statistical comparison ($P < 0.001$) Although this study was conducted for conventional laryngoscopic intubation but found the stable hemodynamics with the use of dexmedetomidine.

In post intubation assessment, blinded investigator who were performing the procedure were questioned and we concluded that patients in Group D were more cooperative as compared to Group L, thus achieving better conditions for achieving the goal of successful intubation.

Postoperative patient satisfaction in which we followed up for 24 hours in terms of sore throat, pain, hoarseness of voice, recall of the procedure, bleeding after extubation and any discomfort of the procedure, patients were significantly satisfied with the procedure in Group D as compare to Group L ($p = 0.023$).

The SpO_2 parameters in our study during nebulization, performing the procedure and post procedure were comparable as patients were constantly oxygenated via nasal prongs so we didn't come across desaturation state.

On a 5 point sedation score,[7] the maximum score we achieved in our study was grade 2 in Group D after 10, 15, 20 minutes of nebulization ($p < 0.01$) whereby the patients were drowsy but arousable. Ghaffar *et al.*[16] inferred that after dexmedetomidine 2 mcg/kg nebulization for 30 minutes, the sedation score on arrival in the operating room were in the median range of 2.0 (2-3) on a 5 point sedation score which was similar to our study.

We did not observe any significant side effects like hypotension, bradycardia, excessive sedation, and signs of lignocaine toxicities.

Limitations of our study are that we included patients with all grades of airway, so the results cannot be directly extrapolated to cases with difficult airways. We did not measure the plasma lignocaine levels due to feasibility issues. Further studies are required to overcome these limitations.

Conclusion

Addition of Dexmedetomidine 2 mcg/kg with 4% Lignocaine through nebulization improves intubating conditions during awake flexible videoendoscopy in terms of ease of intubation, cough severity, patients comfort and satisfaction along with providing stable hemodynamic profile.

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Conflicts of interest
There are no conflicts of interest.

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