Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Comparison between King Vision Channeled versus C-MAC D-Blade Video Laryngoscope for Ease of Intubation – A Prospective Randomized Study

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Abstract

Introduction: The approach to airway management has completely changed since the introduction of video laryngoscopes. Video laryngoscopes have quickly gained interest as an intubation device in a variety of clinical scenarios and settings, as well as in the hands of experts and novices. Their indirect view with the help of camera improves glottic visualization, including in anticipated and unanticipated difficult airways.

Purpose: The purpose of conducting this study is to compare C-MAC D Blade video laryngoscope with King Vision channeled video laryngoscope to form a protocol in our department for anticipated and unanticipated difficult airway for orotracheal intubations in general elective surgeries.

Methods: Eighty patients between the age of 18 and 60 years, ASA Grade I and II posted for general surgeries under general anesthesia were randomly selected. Both groups were assigned 40 patients each, Group KC patients were intubated using King Vision channeled and Group CM patients were intubated using C-MAC D-Blade video laryngoscope. Time for visualization of glottis, duration of intubation, number of attempts, success rate, and hemodynamic parameters up to 120 min was observed. Quality of visualization of glottis, airway injuries, and assisted maneuvers were also noted.

Results: The mean time taken for visualization of glottis in group KC was 12.67 ± 1.39 s and in group CM was 10.74 ± 1.01 s. The mean time taken for intubation in group KC was 25.74 ± 3.874 s and in group CM was 28.06 ± 2.23 s. There was no significant difference in the number of attempts and quality of visualization of the glottis achieved by each device in both groups. Devices were also comparable with respect to airway injuries and assisted maneuvers required for successful intubation.

Conclusion: Although KVVL and C-MAC video laryngoscopes have been efficient video laryngoscope in this study, we conclude that KVVL is a faster alternative to C-MAC for endotracheal intubation in patients with normal airways.

Key words: C-MAC D-blade video laryngoscope, Duration of intubation, Ease of intubation, General elective surgeries, King Vision channeled laryngoscope

INTRODUCTION

Laryngoscopy is a medical procedure performed by anesthesiologists for the purpose of placing an endotracheal tube (ETT) into the airway of patients to secure the airway and to administer inhalational agents for maintenance of anesthesia. The ultimate aim is to safely intubate the trachea and secure the airway.[1]

In routine practice, direct laryngoscopy (DL) using a Macintosh laryngoscope remains the gold standard technique as an effective means for securing the airway. In the presence of certain anatomical variants or airway pathology, visualization of the glottis by DL can be difficult or impossible.[2]

Access this article online

www.ijss-sn.com

Month of Submission : 04-2023
Month of Peer Review : 05-2023
Month of Acceptance : 06-2023
Month of Publishing : 06-2023

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Table 1

Parameters	Mean±SD		*P*
	Group KC	Group CM	
Time to visualization (s)	12.67±1.39	10.74±1.01	0.001
Duration of intubation (s)	25.74±3.74	28.06±2.23	0.001

SD: Standard deviation

Table 2

Number of attempts	Age	
	Group KC, *n* (%)	Group CM, *n* (%)
1	40 (100.00)	37 (92.50)
2	0	3 (10.00)
Total	40 (100.00)	40 (100.00)
P	0.070	

Table 3

Quality of visualization (Cormack-Lehane grade)	Age	
	Group KC, *n* (%)	Group CM, *n* (%)
1	37 (92.50)	38 (95.00)
2a	3 (7.50)	2 (5.00)
2b	0	0
3	0	0
Total	40 (100.00)	40 (100.00)

Table 4

Ease of intubation	Age	
	Group KC, *n* (%)	Group CM, *n* (%)
0 - easy	26 (65.00)	22 (55.00)
1 - difficult	12 (30.00)	15 (37.50)
2 - very difficult	2 (5.00)	3 (7.50)
Total	40 (100.00)	40 (100.00)
P	0.436	

DL has a variable learning curve requiring training, experience, and regular practice to acquire and maintain. It requires a direct line of sight to align airway axes (oral pharyngeal-laryngeal) for optimal glottic visualization. DL and passage of ETT through larynx can lead to sympathetic stimulation and adverse effects in the cardiovascular, respiratory, and nervous systems.[3,4] The hemodynamic responses caused due to this are mostly short-lived and well-tolerated by healthy individuals.[5] However, they can be detrimental in susceptible patients resulting in a myriad of complications such as myocardial ischemia, cardiac failure, arrhythmia, intracranial bleed, and increased bleeding from wounds.[6]

All the above complications of DL can be reduced using video laryngoscope, Hence, it can be safely called the potential replacement of DL in such scenarios.[7]

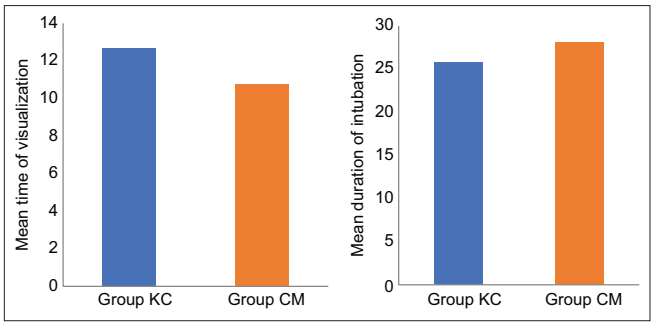

Figure 1: Mean time for visualisation of glottis and mean time for intubation

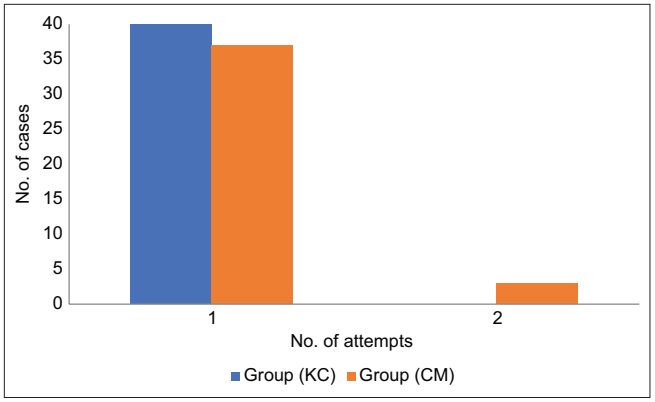

Figure 2: Number of attempts

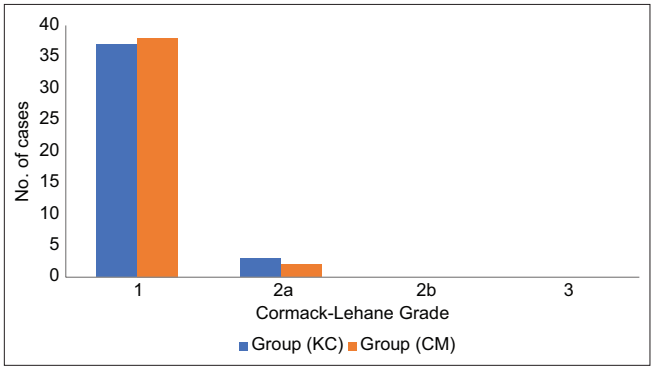

Figure 3: Quality of visualization of glottis assessed by Cormack-Lehane grades

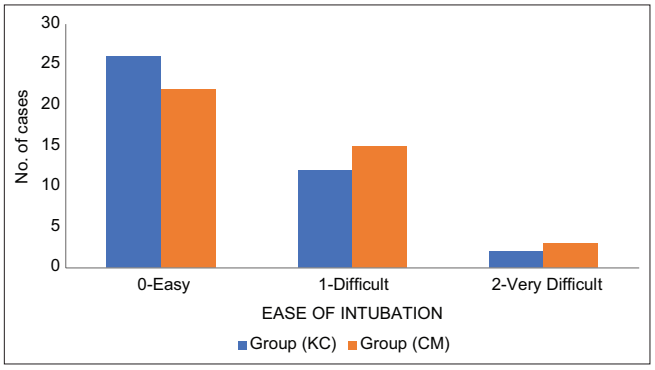

Figure 4: Ease of intubation

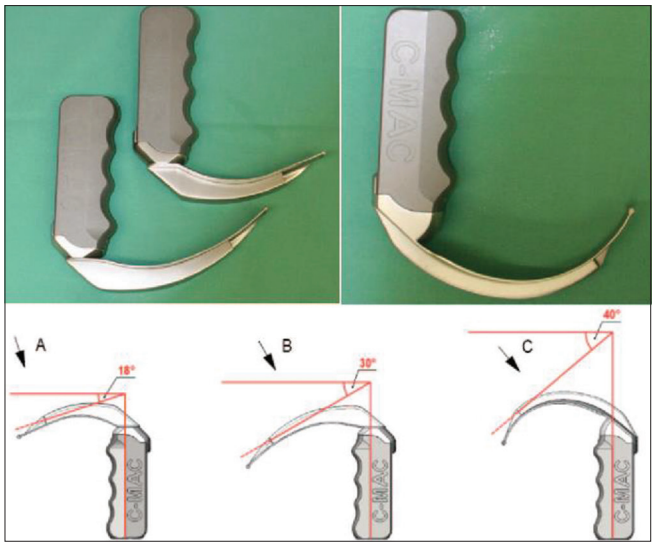

Figure 5: Diagrammatic representation of angulation of C-MAC video laryngoscope - Macintosh blade and D-blade

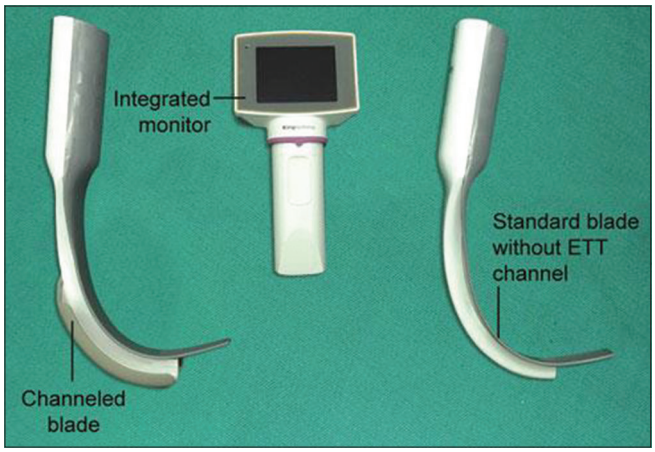

Figure 6: Kings vision laryngoscope and the channeled and non-channeled disposable blades

Video laryngoscopes have surely made their way as a routinely used laryngoscope, we conducted this study to compare C-MAC D-Blade video laryngoscope with King Vision channeled video laryngoscope to form a protocol in our department for anticipated and unanticipated difficult airway for orotracheal intubations in general elective surgeries.

MATERIALS AND METHODS

This study was conducted on 80 patients, aged 18–60 years, ASA grade I and II, MPG Grade I and II scheduled to undergo elective surgery under general anesthesia. Written informed consent was obtained from each subject after explaining the technique and procedure before the addition of the subject in the study in their own vernacular language. Patients giving refusal, MPG Grade III and IV, history of hypertension, heart failure, or with any predictors of difficult airway were excluded from the study.

A detailed pre-anesthetic and airway examination was done 1 day before surgery and pre-operative routine investigations. Each patient was kept fasting for 8 h pre-operatively. Tablet alprazolam 0.25 mg orally was given at night before surgery.

In the preparation room, an intravenous (I.V) cannula 20 gauge was inserted and Ringer lactate was started. Injection of midazolam 0.02–0.03 mg/kg and injection of glycopyrrolate 0.2 mg were given I.V to all patients. In the operating room, an injection of butorphanol 0.015–0.02 mg/kg was given, and standard monitors were applied. Patients were pre-oxygenated through face mask for 3 min. General anesthesia was induced using propofol 1.5–2.5 mg/kg. Ventilation was assessed using face mask and manual ventilation and if proved satisfactory, an injection of succinylcholine 1–1.5 mg/kg I.V was given. Then, intubation was performed using C-MAC D-Blade video laryngoscope in the group (CM) and King Vision laryngoscope with channeled blade in the group (KC) with 40 patients in each group. Then, the cuff was inflated and ETT was connected to the breathing circuit and checked by EtCO2, five-point auscultation of chest, observation of B/L chest movement, and misting of the tube.

The parameters measured and observed were as follows -Time taken for visualization of glottis and intubation time was measured using a stopwatch. Ease of intubation was assessed using a subjective scale – It was graded as easy, difficult, or very difficult. The success rate was calculated for each group. Failure to intubate was considered if the time taken was more than 120 s or more than 2 attempts were required. The number of attempts was calculated, an intubation attempt will be defined insertion of laryngoscope blade into the oropharynx, regardless of whether an attempt was made to pass the ETT. The quality of visualization was assessed using Modified Cormack and Lehane grading. If any assisted maneuvers were required for successful intubation which included external laryngeal manipulation, aided by bougie, changing blade size was recorded and noted.

Hemodynamic variables were measured during baseline just before induction of anesthesia, at time of laryngoscopy, at time of ETT insertion then after every 15 min till 120 min, or end of surgery. Any airway injury was recorded, it was assessed by the presence of any blood in the oropharyngeal airway or blood on the ETT when the patient was extubated.

Statistical Analysis

Duration of intubation was taken as the outcome measure of interest for the purpose of sample size calculation. Sample size was calculated keeping in view at most 5% risk, with minimum 80% power, and 5% significance level (significant at 95% confidence interval). Data were recorded in a Microsoft Excel spreadsheet and analyzed using Statistical Package for the IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp., Chicago. Continuous data were presented as mean with standard deviation. Categorical data were expressed as numbers and percentages. Power analysis was done to calculate the power of the study which was 95% by taking α error of 0.05. The *P*-value was then determined to evaluate the level of significance. The results were analyzed and compared to previous studies to draw relevant conclusions.

RESULTS

The results of our study were as follows:

- The two groups were comparable in view of demographic data and patient characteristics
- The mean time is taken for visualization of the glottis in both groups. The mean time taken for visualization of glottis in group KC is 12.67 ± 1.39 s which is longer than the mean time taken in group CM which is 10.74 ± 1.01 s. The groups showed a highly statistically significant difference ($P = 0.001$)
- The mean time taken for intubation in group KC was 25.74 ± 3.874 s and in group CM was 28.06 ± 2.23 s. The difference in the groups was found to be statistically highly significant ($P = 0.001$)
- The number of attempts were - All 40 patients in group KC were intubated in the first attempt although 3 patients in group CM required second attempt. The difference between both groups was found to be statistically non-significant ($P > 0.05$)
- First attempt's success rate was 100% in group KC and 92.5% in group CM. Rest 7.5% of group CM patients were intubated in the second attempt. All the patients were successfully intubated and no intubation failure was recorded ($P > 0.05$)
- The ease of insertion of the laryngoscope blade was compared. In group KC, in 28 patients were labeled as easy, 10 were slightly difficult, and 2 were labeled as difficult. In group CM, 33 patients were labeled as easy and 7 were labeled slightly difficult ($P > 0.05$)
- Quality of visualization was compared with Cormack-Lehane Grading. Cormack-Lehane Grade I was achieved in both the groups in all the patients ($P > 0.05$)
- The two groups were found to be comparable with respect to the hemodynamic and ventilatory parameters such as BP, SpO_2, and $EtCO_2$ with the difference being statistically non-significant at all time points ($P > 0.05$)
- In group KC, 3 patients out of 40 (7.50%) recorded airway injury indicated by blood on laryngoscope blade or on the ETT seen after extubation, whereas in group CM, only 1 patient out of 40 (2.50%) was recorded to have an airway injury ($P > 0.05$)
- In group KC, 2 patients (5.00%) required any additional maneuver and in group CM, 4 patients (10.00%) required the same ($P > 0.05$) (Figures 1-6).

DISCUSSION

Video laryngoscopes are rapidly gaining popularity in airway management and several devices with different design features are now available. Their use is not only being advocated for difficult airways[8] but is also now being suggested by many airway experts as the first-line technique device for tracheal intubation in all patients.[9-11] The C-MAC video laryngoscope and King Vision laryngoscope are two revolutionary devices in this field which have made the skill of laryngoscopy much easier to learn.

C-MAC VL has two types of blades – conventional Macintosh and D-Blade, which are hyper-angulated. The screen is located on a separate stand for C-MAC but in the case of King Vision, the screen is located on the top of laryngoscope itself. King Vision has two types of blades – channeled and non-channeled. The one used in this study has a channel into which an ETT is pre-loaded before laryngoscope is inserted into the patient's oral cavity.

Both groups did not differ with respect to any of the patient characteristics such as age, sex, BMI, Wilson scoring, and ASA grading.

The time for visualization of the glottis was recorded from the time of laryngoscope insertion into the patient's mouth until the glottis was visible on the camera screen. The mean time taken for visualization of glottis in group KC is 12.67 ± 1.39 s which is longer than the mean time taken in group CM which is 10.74 ± 1.01 s. The reason for a slightly longer time in group KC, the patients intubated with KVVL is the bulkier nature of the channeled blade than the C-MAC D-Blade which makes it slightly more difficult than the C-MAC Blade to enter the mouth of the patient. Similarly, in a study conducted by Sahajanandan *et al.*, they compared KVVL with C-MAC D-Blade laryngoscope in patients with anticipated difficult airways. The mean time for visualization of glottis with King Vision was 12.93 s and with C-MAC D-Blade was 10.32 s. Our results also coincide with the study conducted by Chandy *et al.*, as the results of the study conducted by them also showed a significantly

shorter time for visualization of the glottis with C-MAC D-Blade as compared to KVVL. They also concluded in their study that KVVL was difficult to introduce into the mouth of the patient during laryngoscopy.[12]

The duration of intubation was recorded from the time of KVVL or the C-MAC D-Blade laryngoscope insertion into the patient's mouth until the passage of ETT into the trachea in a fully anesthetized patient. The mean time taken for intubation in both groups was calculated. The mean time taken in group KC was 25.74 ± 3.874 s and in group CM was 28.06 ± 2.23 s. The longer duration of intubation with C-MAC D-Blade video laryngoscope even after the shorter time for visualization of glottis might be due to the hyperangulated shape of the D-Blade which is more than the curvature of the normal ETT. Hence, it was slightly difficult to aim the tube directly into the trachea on the first attempt. This was overcome by adjusting the laryngoscope blade or use of a stylet to match the curvature of the blade. Other problem with the C-MAC D-Blade VL was a blind phase when the ETT is entered into the patient's mouth till it reaches the front of the camera which makes it slightly difficult to angle the tube directly toward the vocal cords. With the KVVL, the ETT was pre-loaded into the channel of the blade. Hence, it took comparatively a shorter time to push the ETT into the trachea as compared to the C-MAC. Even with King Vision, the most common cause of failure was the tube impinging on the right arytenoid. The use of a smaller ET tube facilitated 90° counter-clockwise rotation within the channel which rectified impingement on the right arytenoid and facilitated intubation. Shravanalakshmi *et al.* compared ease of intubation and glottic visualization with C-MAC Conventional and D-Blade and King Vision channeled blades. Time for intubation in seconds was significantly faster with conventional C-MAC video laryngoscope (23.3 ± 4.7) compared to D blade C-MAC video laryngoscope (26.7 ± 7.1), whereas conventional C-MAC and King Vision were comparable (24.9 ± 7.2).[13]

The number of attempts required in each patient to successfully intubate the trachea was noted. All 40 patients in group KC were intubated in the first attempt, although 3 patients in group CM required the second attempt. The groups showed that this difference is non-significant ($P = 0.07$). First attempt success rate in group KC was 100% that is all the patients were intubated in the first attempt whereas in group CM, the first attempt success rate was 92.5%. Rest 7.5% of patients in group CM were successfully intubated in the second attempt. Although the result was found to be statistically insignificant.

The systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) showed no significant statistical difference among the two groups. Baseline mean SBP in group KC was (119.93 ± 5.56) mmHg which was comparable to baseline mean SBP in group CM (117.88 ± 6.72) mmHg ($P = 0.07$). The SBP at 5 min, just around 1 min after intubation, in group KC was (136.83 ± 6.84) mmHg and in group CM was (134.80 ± 5.32) mmHg. The mean diastolic pressure in group KC was 82.88 ± 6.31 mmHg and in the group at baseline was 83.20 ± 3.73 mmHg. The MAP in group KC was (95.18 ± 4.28) mmHg and in group CM at baseline was (94.83 ± 3.29) mmHg. The SBP, DBP, MAP, HR, and SpO2 were noted at 1 min, 3 min, 5 min, 10 min, and every 10 min for the rest of the duration of surgery and no statistically significant differences were found in both the groups ($P > 0.05$)

Quality of visualization was assessed using modified Cormack-Lehane grading. In group KC, 37 out of the 40 (92.5%) patients and in group CM, 38 of the 40 (95%) patients achieved CL grade I, and CL grade 2a was observed in 3 (7.5%) and 2 (5%) patients out of the 40 patients in group KC and CM, respectively($P > 0.05$). Similar to our study, Shetty *et al.* recorded Cormack-Lehane grade 1 in 90% of the patients in the KVL group and 93.3% of patients had grade 1 view in the C-MAC group.[14] Variations are recorded over different studies conducted comparing the quality of visualization of glottis as laryngoscopy is a skillful procedure and one's experience adds a great depth to it.

In group KC, 2 patients (5.00%) required any additional maneuver and in group CM, 4 patients (10.00%) required the same ($P > 0.05$). In the case of C-MAC, it was noted that the mistake was in the correct placement of the laryngoscope blade with respect to the glottis or the vocal cords and with King Vision channeled laryngoscope the most encountered problem was impingement of the tube on the right arytenoid. The ETT had to be turned in the clockwise direction in the case of C-MAC VL in contrast to the channeled blade of King Vision in which an anti-clockwise turn to the pre-loaded ETT was found to be beneficial, which was recognized and corrected over time of the study.

Limitations

Limitations of our study are as follows -

- Single-blinded study, as it is not possible to blind the anesthesiologist to the device used for the intubation
- Second, study findings might not be applicable to a larger population, bigger sample size might be required to document its advantages
- Our study was conducted on patients with normal airways without the predictors of difficult airways. Hence, the results might not extrapolate to a difficult airway

- The hemodynamic responses were recorded in ASA I and II patients. The hemodynamic parameters might vary in a hypertensive or ASA III or ASA IV patient
- Out of several that are currently available in the market, we can only comment on what we found better out of the two devices included in our study.

CONCLUSION

- C-MAC D-Blade video laryngoscope was found to be faster than the King Vision laryngoscope channeled blade in the aspect of time taken to visualize the glottis
- In spite of that, King Vision channeled blade was found to take a shorter duration for successful intubation when compared to the total duration taken by the C-MAC D-Blade video laryngoscope
- There was no significant difference in the number of attempts and quality of visualization of the glottis achieved by each device in both the groups
- There was no statistically significant difference in hemodynamic changes in both the groups
- In aspect to airway injuries and assisted maneuvers, no statistically significant difference was found between both the groups.

ACKNOWLEDGMENT

I bow with reverence, all humility and gratitude to thank The Almighty for giving me the opportunity and strength to undertake this work and the ability to successfully complete it.

Mere words are insufficient to express adequately my profound indebtedness and deep gratitude to my most revered teacher, encouraging mentor Dr. Veena Chatrath, MD, Professor and Head, Department of Anesthesia and Intensive Care Unit, Govt. Medical College, Amritsar. Her unconditional help, affectionate guidance from the very inception of the study has contributed more to the accomplishment of my task than my over diligence and devotion. It has been a matter of great pride and privilege for me to have worked under the able guidance of teacher of such great caliber. I owe her, a lifelong gratitude. I would like to express my gratitude toward Dr. Rajan Kumar, MD, Professor, Department of Anesthesia and Intensive Care Unit, Govt. Medical College, Amritsar, for his meticulous advice, sustained encouragement, generous help, and invaluable guidance throughout the course of the study. I wish to express my sincere appreciation to Dr. Harpreet Kaur, Assistant Professor, Department of Anesthesia and Intensive care Unit, Government Medical College, Amritsar, for her invaluable guidance and encouragement.

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How to cite this article: Kaur H, Kumar R, Khurana R, Kaur H, Chatrath V. Comparison between King Vision Channeled versus C-MAC D-Blade Video Laryngoscope for Ease of Intubation – A Prospective Randomized Study. Int J Sci Stud 2023;11(3):30-35.

Source of Support: Nil, **Conflicts of Interest:** None declared.