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# Dexmedetomidine combined with narcotic anesthesia induction in coronary artery bypass graft surgery

## *Koroner arter baypas greft cerrahisinde deksmedetomidin ile kombine edilen narkotik anestezi indüksiyonu*

**Funda Gümüş,[1] Sıtkı Nadir Şinikoğlu,[1] Abdülkadir Yektaş,[1] Adil Polat,[2] Nihan Kayalar,[2] Kerem Erkalp,[1] Ayşin Alagöl[1]**

[1]Department of Anaesthesiology and Reanimation, Bağcılar Training and Research Hospital, İstanbul, Turkey
[2]Department of Cardiovascular Surgery, Bağcılar Training and Research Hospital, İstanbul, Turkey

***Background:*** This study aims to investigate the possible effects of dexmedetomidine in combination with narcotics on anesthesia induction.

***Methods:*** Between March 2011 and June 2011, 63 consecutive patients who underwent coronary artery bypass graft (CABG) surgery and received fentanyl (group F) or fentanyl + dexmedetomidine (group D) in our clinic were retrospectively analyzed. The level of anesthesia was monitored with bispectral index. The additional fentanyl doses and use of additional drugs were recorded at the end of induction, after endotracheal intubation, before and after skin incision, and after sternotomy. The hemodynamic parameters were recorded at the end of anesthesia induction, after intubation (1st, 3rd, 5th and 10th min), before and after skin incision and after sternotomy. Variation coefficients were calculated to compare the hemodynamic variables and bispectral index variables.

***Results:*** The comparison of demographic parameters showed no significant difference between the groups. The fentanyl dose was lower in induction, additional administered doses and total administered doses in group D. The occurrence of hypertension was significantly higher in group F. Bispectral index levels were found to be lower and more stable in group D. The variability of systolic arterial pressure was lower in group D. Postoperative time to extubation was shorter in group D.

***Conclusion:*** Concomitant use of dexmedetomidine and narcotics may lower opioid doses in anesthesia induction and lead to more stable hemodynamic parameters, particularly systolic arterial pressure in patients undergoing CABG. Therefore, occurrence of hypertension and fluctuations in the arterial pressure may be reduced and patients can be weaned from the ventilator more rapidly.

*Key words:* Coronary artery bypass graft surgery; dexmedetomidine; opioid anesthesia.

***Amaç:*** Bu çalışmada narkotik ile kombine edilen deksmedetomidinin anestezi indüksiyonu üzerindeki muhtemel etkileri incelendi.

***Çalışma planı:*** Mart 2011 - Haziran 2011 tarihleri arasında kliniğimizde ardışık olarak koroner arter baypas greft (KABG) ameliyatı yapılan ve fentanil (grup F) veya fentanil + deksmedetomidin (grup D) verilen ardışık 63 hasta retrospektif olarak incelendi. Anestezi seviyesi bispektral indeks ile takip edildi. İndüksiyon sonu, endotrakeal entübasyon sonrası, cilt insizyonu öncesi ve sonrası ve sternotomi sonrası kullanılan ek fentanil ve ek ilaç dozları kaydedildi. Hemodinamik parametreler indüksiyon sonu, entübasyon sonrası (1, 3, 5. ve 10. dk.), cilt insizyonu öncesi ve sonrası ve sternotomi sonrasında kaydedildi. Hemodinamik değişkenler ve bispektral indeks değişkenliklerinin karşılaştırılması için varyasyon katsayıları hesaplandı.

***Bulgular:*** Gruplar arası demografik değişkenlerin karşılaştırılmasında anlamlı bir fark saptanmadı. Grup D'de fentanil dozları indüksiyon, ek doz ve uygulanan toplam dozlarda daha düşük bulundu. Hipertansiyon oluşumu grup F'de anlamlı olarak daha yüksek idi. Grup D'de bispektral indeks seviyeleri daha düşük ve daha stabil bulundu. Sistolik arter basıncı değişkenliği grup D'de daha düşüktü. Ameliyat sonrası ekstübasyon süreleri grup D'de daha kısaydı.

***Sonuç:*** Koroner arter baypas greft ameliyatı yapılan hastalarda anestezi indüksiyonunda deksmedetomidinin narkotikler ile birlikte kullanılması, opioid dozlarını azaltılabilir ve sistolik arteriyel basınç başta olmak üzere hemodinamik parametrelerin daha stabil olmasını sağlayabilir. Bu sayede hipertansiyon gelişimi ve arteriyel basınçtaki dalgalanmalar azaltılabilir ve hastalar ventilatörden daha çabuk ayrılabilir.

*Anahtar sözcükler:* Koroner arter baypas greft cerrahisi; deksmedetomidin; opioid anestezisi.

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Correspondence: Funda Gümüş, M.D. Bağcılar Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, 34200 Bağcılar, İstanbul, Turkey.
Tel: +90 212 - 440 40 00 e-mail: fgumus@hotmail.com

Endotracheal intubation may cause hypertension, arrhythmias, and myocardial ischemia as a consequence of the reflex increases of sympathetic activity.[1] This can be attenuated by the use of local anesthetics, opioids, adrenergic blockers, and vasodilators.[2] In cardiac surgery, high-dose narcotic agents are utilized,[3] but adjuncts may also be used to prevent the excessive use of fentanyl. Alpha-2 adrenergic agonists, such as the popular dexmedetomidine (DEX), have been shown to decrease the sympathetic tone to noxious stimuli and provide hemodynamic stability.[4]

In this retrospective study, we evaluated the effects of DEX as an adjunct to narcotics in anesthesia induction and analyzed the hemodynamic responses and variability in response to intubation, anesthesia induction, skin incision, and sternotomy.

## PATIENTS AND METHODS

Our study was composed of 63 consecutive coronary artery bypass graft CABG patients who met the criteria after the use of DEX was instituted at our facility. Patients were excluded for the following reasons: hypersensitivity to DEX, a left ventricular ejection fraction (LVEF) less than 40%, a body mass index (BMI) ≥30 kg/m$^2$, preoperative left branch bundle block, renal failure, valvular dysfunction, concomitant procedures during coronary artery bypass grafting (CABG), preoperative use of any alpha-2 agonists, long-term beta-blocker therapy, insulin-dependent diabetes mellitus (DM), respiratory failure, emergency surgery for CABG, and endotracheal intubation of more than 20 seconds.

Preoperatively, all patients were given metoprolol 50 mg/day and were receiving beta-blocker, statin and angiotensin-converting enzyme (ACE) inhibitor therapies. Thirty-three patients received fentanyl (Johnson & Johnson, New Brunswick, NJ, USA) anesthesia only (group F), and 30 others received a combination of fentanyl and DEX (Precedex™; Hospira Inc, Lake Forest, IL, USA) anesthesia (group D). All patients received 10 mg diazepam the night before the operation, and premedication was done with midazolam 0.07 mg/kg intramuscularly 30 minutes before surgery. Additionally, a 16-gauge peripheral venous cannula was inserted into the right antecubital vein, and all patients were hydrated with 500 mL lactated Ringer's solution. In the operating room, a 12-lead electrocardiogram and a lead from the A-2000™ Bispectral Index™ (BIS™) monitoring system (Aspect Medical Systems, Inc., Needham, MA, USA) that was placed on the forehead were used to follow the patients' progress. In addition, the invasive arterial pressure was obtained via a right radial artery catheter. The patients were also checked for urinary output and pulse oximetry, and capnography [end-tidal carbon dioxide ($CO_2$)] was conducted with the Leoni Plus model BSM-6701 neonatal monitor (Heinen and Löwenstein GmbH & Co. KG, Koblenz, Germany). The proximal end of the BIS™ Quattro probe (Aspect Medical System, Inc. Needham, MA, USA) was placed on the forehead at the midline of the eyebrows, and the distal end was placed on the temple at eye level. All cannulations were performed with local anesthesia. The baseline heart rate (HR), systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), oxygen saturation ($SpO_2$), and BIS™ values were obtained three minutes after the insertion of another radial artery catheter. The DEX infusion was then commenced. Group D received 1 $\mu$g/kg of the drug in 100 cc of 0.9% sodium choloride (NaCl) solution via an Abbott Lifecare 5000 infusion pump (Abbott Laboratores, North Chicago, IL, USA). The level of anesthesia was monitored by BIS™, and the fentanyl doses were arranged in order to obtain a BIS™ level of 40. Then the number of these doses that were needed to reach the desired BIS™ level were recorded. The additional fentanyl doses and use of additional drugs (nitroglycerine) were recorded at the end of induction, after endotracheal intubation, before and after the skin incision, and before and after the sternotomy. The hemodynamic parameters were also recorded at the end of anesthesia induction, after intubation (first, third, fifth, and 10th minutes), before and after the skin incision, and before and after the sternotomy.

Anesthesia induction was achieved with midazolam 0.1 mg/kg and vecuronium bromide 0.1 mg/kg. The fentanyl doses were adjusted in order to obtain BIS™ levels of 40. Endotracheal intubation was performed after muscular relaxation was achieved. Depending on the hemodynamic measurements and BIS™ levels, additional doses of fentanyl (200 $\mu$g) were administered to stabilize the BIS™ levels between 40 and 50, and nitroglycerin (2 mg) was given in cases where there was a 20% increase in systolic or diastolic blood pressures. Central venous cannulation (CVC) was performed via the right internal jugular vein with a 7F central cannula. Controlled mechanical ventilation was instituted to achieve an end-tidal $CO_2$ between 35-45 mmHg. The patients then underwent on-pump CABG, and the temperatures during CPB were maintained between 30-32 °C. Anesthesia maintenance was achieved with 1.5% sevoflurane, 50% oxygen, and 50% medical air. Bolus doses of midazolam (0.1 mg/kg) and vecuronium bromide (0.1 mg/kg) were repeated before the onset of CPB and during the

rewarming period. If the BIS™ levels were not sufficient, bolus doses of fentanyl were also given.

Statistical analyses were made by the SPSS version 11.5 for Windows statistical software package (SPSS Inc., Chicago, IL, USA). All data was presented terms of frequencies and percentages or mean ± standard deviation, accordingly. In addition, the coefficients of variation (standard deviation/mean of the parameter) for the HR, SAP, DAP, MAP, and BIS™ were calculated to compare the variability. The comparisons of discrete data were made by either a chi-square analysis or Fisher's exact test, and comparisons of continuous data were using an independent samples t-test. A *p* value of <0.05 was accepted as being significantly different.

## RESULTS

Comparisons of the demographic parameters showed no significant differences between the groups (Table 1), and both groups had similar preoperative demographic properties. The main operative parameters and durations were also similar in the two groups, and these are shown in Table 2. The number of patients that required for additional fentanyl doses and the total of additional fentanyl doses were significantly higher in Group F. Hypertension also occurred in eight patients (24.2%) in group D, but only one (3.3%) in group F (p=0.028).

Twenty-four patients (38.1%) required inotropic support during weaning from CPB, but the difference between the groups was not statistically significant (Table 2). Furthermore, we did not encounter any tachycardia, bradycardia, or hypotension during the anesthesia induction.

The hemodynamic parameters and BIS™ levels of both groups were compared, and the BIS™ levels were lower and more stable in group D (Table 3). Additionally, no significant differences were observed in the HR measurements. There were several differences in the SAP, DAP, and MAP, but one of the most significant was the variability of SAP, which was lower in group D (0.238 vs. 0.183; p=0.016).

Postoperatively, four patients (6.3%) had in-hospital mortality (two patients from each group), but the difference was not statistically significant (p=1.000). Eleven patients had postoperative morbidities. In group F, seven patients (21.2%) suffered from postoperative complications and two had pulmonary complications. There were also two cases of paroxysmal atrial fibrillation, one of tamponade, one of myocardial infarction (MI). In addition, there was one patient who had mediastinitis that required revision surgery. In group D, four patients (13.3%) had postoperative complications. Bleeding that required revision surgery, a cerebrovascular event, paroxysmal atrial fibrillation, and MI each occurred in one of the study participants.

The average time to extubation in the intensive care unit (ICU) was significantly higher in group F than group D (9.2±3.8 vs. 6.4±1.6, respectively; p=0.014). Although the raw average values were lower in group D, the average durations of ICU (group F=5.7±13.4 vs. group D=3.4±1.0; p=0.107) and hospital stays (group F=6.0±9.8 vs. group D=4.0±1.8; p=0.224) did not differ significantly.

**Table 1. Demographic parameters**

| | Group F | | | | Group D | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | Mean±SD | Range | n | % | Mean±SD | Range | *p* |
| Gender | | | | | | | | | |
| Male | 24 | 72.7 | | | 24 | 80.0 | | | 0.497 |
| Female | 9 | 22.3 | | | 6 | 20.0 | | | |
| Age (years) | | | 61.0±10.2 | 33-79 | | | 58.6±7.7 | 43-70 | 0.356 |
| Body mass index (kg/m$^2$) | | | 27.2±2.8 | 20.6-30.4 | | | 26.2±3.8 | 18.0-30.0 | 0.118 |
| ASA class | | | | | | | | | 0.631 |
| Class I | 1 | 3.0 | | | 1 | 3.3 | | | |
| Class II | 29 | 87.9 | | | 28 | 93.3 | | | |
| Class III | 3 | 9.1 | | | 1 | 3.3 | | | |
| Ejection fraction | | | 52.6±7.8 | 40-70 | | | 55.3±6.8 | 45-60 | 0.394 |
| NYHA class | | | | | | | | | 0.254 |
| Class I | 5 | 15.2 | | | 4 | 14.3 | | | |
| Class II | 26 | 78.8 | | | 26 | 86.7 | | | |
| Class III | 2 | 6.1 | | | 0 | 0 | | | |

SD: Standard deviation; ASA: American Society of Anesthesiologists; NYHA: New York Heart Association.

**Table 2. Operative parameters**

| | Group F | | | | Group D | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | Mean±SD | Range | n | % | Mean±SD | Range | *p* |
| CPB duration (min) | | | 110.9±45.0 | 35-200 | | | 95.4±35.1 | 45-170 | 0.317 |
| Aortic cross-clamp time (min) | | | 74.9±37.2 | 20-160 | | | 58.9±27.8 | 20-110 | 0.118 |
| Number of revascularized vessels | | | 2.8±0.9 | 1-4 | | | 2.7±0.8 | 1-4 | 0.901 |
| $T_1$ (min) | | | 23.9±5.2 | 16-40 | | | 25.0±6.0 | 10-37 | 0.874 |
| $T_2$ (min) | | | 25.3±5.2 | 17-42 | | | 26.6±4.1 | 20-40 | 0.154 |
| $T_3$ (min) | | | 28.7±5.6 | 19-43 | | | 30.0±4.4 | 23-41 | 0.296 |
| $T_4$ (min) | | | 31.6±5.5 | 23-45 | | | 32.5±3.9 | 26-44 | 0.135 |
| Duration of operation (min) | | | 236.4±34.8 | 180-300 | | | 234.7±29.3 | 180-300 | 0.521 |
| Fentanyl dose | | | | | | | | | |
| D1 ($\mu$g/kg) | | | 13.8±4.4 | 6.3-25.0 | | | 7.6±2.0 | 3.5-10.0 | 0.002 |
| D2 ($\mu$g) | | | 1042.4±354.9 | 500-2000 | | | 535.0±140.3 | 250-8000 | 0.0001 |
| D3 ($\mu$g) | | | 1119.7±404.6 | 500-2250 | | | 535.0±140.3 | 250-800 | 0.0001 |
| D4 ($\mu$g) | | | 86.4±143.2 | 0-400 | | | – | – | 0.0001 |
| D5 ($\mu$g) | | | 1869.7±472.5 | 1250-3000 | | | 1248.3±294.3 | 700-1750 | 0.004 |
| Need for NTG for HT | 8 | 24.2 | | | 1 | 3.3 | | | 0.028 |
| Use of NTG for HT (mg) | | | 0.5±0.9 | 0-2 | | | 0.1±0.4 | 0-2 | 0.0001 |
| Duration of ETI (sec) | | | 7.9±1.3 | 5-10 | | | 9.2±1.6 | 8-13 | 0.278 |
| Need for inotropic support | 13 | 39.4 | | | 11 | 36.7 | | | 0.824 |

SD: Standard deviation; CPB: Cardiopulmonary bypass; $T_1$: Duration from anesthesia induction to the beginning of the skin incision; $T_2$: Duration from anesthesia induction to the end of the skin incision; $T_3$: Duration from anesthesia induction to the beginning of the sternotomy; $T_4$: Duration from anesthesia induction to the end of the sternotomy; $D_1$: Required fentanyl dose for induction of anesthesia (BIS™=40); $D_2$: Total fentanyl dose until the end of anesthesia induction; $D_3$: Total fentanyl dose until sternotomy; $D_4$: Additional fentanyl dose after anesthesia induction; $D_5$: Total fentanyl dose; NTG: Nitroglycerine; HT: Hypertension; ETI: Endotracheal intubation;

## DISCUSSION

The main finding of this study concerned the affect that the adjunct use of DEX had on the stabilization of hemodynamic parameters, especially SAP. We determined that DEX limits the occurrence of hypertension and fluctuations in the arterial pressure during the CABG procedure.

The BIS™ is a processed electroencephalography (EEG) parameter which is statistically derived from an empirical formula that calculates the indices of the EEG power spectrum, burst synchronization, and phase coupling.[5] It is commonly used to monitor sedation levels during anesthesia and intensive care[6] and has been shown to be correlated with dose-dependent levels of anesthesia for agents like midazolam and propofol.[7,8] The BIS™ index is a clinically accepted system for monitoring the depth of anesthesia since it offers an objective, continuous, reproducible, non-invasive, high-resolution variable.[9,10] Bispectral Index™ monitoring was used in this study to compare the groups regarding the ability to reach the desired anesthesia levels and to monitor any fluctuations in these levels. Although both groups reached the desired levels of anesthesia, group D showed less variation throughout the operation in the target range with lower doses of fentanyl. This indicates that anesthesia levels can be maintained with adjunct doses of DEX. Ramsay and Luterman[11] also reported on the use of DEX as a total intravenous anesthetic agent in different groups of patients and found that opioid doses may be lowered by the use of DEX similar to our findings.

The most critical events in general anesthesia have been accepted as laryngoscopies and endotracheal intubation.[12] The consequences of reflex increases of sympathetic activity may be hazardous for patienst with coronary artery disease (CAD). In this study, we used DEX, an alpha-2 adrenergic agonist, for the attenuation of this reflex increase in order to prevent ischemic complications. The unique pharmacological profile of the drug provides sedation and analgesia along with the attenuation of sympathetic activity.

The attenuation of hypertension during surgery was an important yet expected result of the use of DEX. Furthermore, the adjunct drug also produced a decrease in noradrenaline levels.[3] Dexmedetomidine is also known to decrease plasma catecholamine levels via a decrease in central sympathetic activity. Additionally, several other probable mechanisms (like effects on glutamate mediated excitatoxicity, apoptotic neuronal death, imidazoline receptors and so forth) have also been proposed which may contribute to the neuronal protection and attenuation of cerebral ischemia.[13] The incidence of perioperative myocardial ischemia, which is difficult to detect without laboratory parameters, may

**Table 3. Hemodynamic parameters**

| | BIS™ | | | Heart rate (bpm) | | | SAP (mm Hg) | | | DAP (mm Hg) | | | MAP (mm Hg) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Group F | Group D | | Group F | Group D | | Group F | Group D | | Group F | Group D | | Group F | Group D | |
| | Mean±SD | Mean±SD | *p* | Mean±SD | Mean±SD | *p* | Mean±SD | Mean±SD | *p* | Mean±SD | Mean±SD | *p* | Mean±SD | Mean±SD | *p* |
| Before anesthesia induction | 93.9±5.1 | 95.9±2.6 | 0.0001 | 100.8±110.9 | 74.3±11.9 | 0.116 | 152.5±26.0 | 150.4±20.3 | 0.062 | 71.4±13.1 | 66.8±8.7 | 0.023 | 99.6±14.6 | 97.0±12.0 | 0.057 |
| End of adjunct drug infusion | 92.2±5.9 | 74.1±11.8 | 0.001 | 79.2±13.7 | 66.0±10.0 | 0.083 | 146.7±26.7 | 127.4±23.0 | 0.151 | 69.6±12.3 | 60.7±10.3 | 0.726 | 96.8±14.1 | 83.1±14.8 | 0.812 |
| End of anesthesia induction | 40 | 40 | | 65.2±10.4 | 61.0±9.4 | 0.785 | 92.4±17.5 | 110.8±29.2 | 0.001 | 49.9±9.0 | 56.0±10.3 | 0.354 | 63.7±12.5 | 75.0±18.5 | 0.017 |
| End of ETI | 42.5±4.7 | 40.6±1.9 | 0.009 | 67.2±10.7 | 62.8±9.5 | 0.784 | 94.1±19.4 | 109.6±25.0 | 0.040 | 50.9±11.8 | 54.1±11.2 | 0.616 | 64.3±11.8 | 72.9±17.4 | 0.045 |
| 1st minute after ETI | 43.5±5.5 | 41.8±3.2 | 0.031 | 65.6±10.6 | 61.9±8.4 | 0.650 | 100.0±24.4 | 111.8±23.4 | 0.930 | 53.3±10.3 | 56.7±10.1 | 0.785 | 68.5±13.5 | 74.4±14.6 | 0.584 |
| 3rd minute after ETI | 42.5±6.4 | 41.0±3.8 | 0.041 | 63.6±10.5 | 60.9±8.6 | 0.300 | 1010.3±22.6 | 106.1±23.3 | 0.835 | 55.7±11.2 | 53.4±11.3 | 0.788 | 68.3±14.0 | 70.9±15.9 | 0.679 |
| 5th minute after ETI | 42.9±6.9 | 40.1±3.2 | 0.0001 | 61.4±9.1 | 60.4±8.2 | 0.630 | 95.8±19.6 | 102.5±21.5 | 0.635 | 52.9±9.4 | 51.3±9.6 | 0.875 | 66.8±12.2 | 68.4±13.6 | 0.748 |
| 10th minute after ETI | 42.7±6.3 | 40.9±4.2 | 0.076 | 61.4±9.7 | 60.0±8.1 | 0.371 | 91.3±16.1 | 99.3±17.5 | 0.919 | 51.7±10.0 | 50.9±8.4 | 0.464 | 64.1±10.7 | 66.8±12.2 | 0.624 |
| Before skin incision | 44.2±8.1 | 40.9±4.2 | 0.033 | 59.9±12.4 | 58.3±8.5 | 0.344 | 89.2±15.3 | 95.2±15.5 | 0.935 | 48.9±9.5 | 48.5±7.6 | 0.416 | 62.9±10.5 | 64.2±11.1 | 0.800 |
| After skin incision | 44.6±8.2 | 40.2±4.4 | 0.010 | 62.3±13.8 | 58.5±9.2 | 0.154 | 96.3±22.9 | 94.8±14.6 | 0.133 | 52.7±13.2 | 50.8±8.8 | 0.438 | 66.2±14.0 | 64.5±9.8 | 0.471 |
| Before sternotomy | 45.7±7.8 | 42.3±5.0 | 0.050 | 63.9±12.8 | 61.3±8.5 | 0.134 | 111.7±25.7 | 98.7±13.2 | 0.0001 | 62.1±13.1 | 52.4±8.4 | 0.010 | 77.8±15.6 | 68.0±10.4 | 0.036 |
| After sternotomy | 45.4±6.2 | 43.2±5.1 | 0.418 | 68.3±14.7 | 63.0±9.2 | 0.096 | 111.4±21.5 | 97.8±12.3 | 0.012 | 63.8±13.4 | 55.0±8.9 | 0.041 | 79.7±15.0 | 70.0±9.8 | 0.030 |
| Coefficient of variance | 0.389 | 0.376 | 0.004 | 0.186 | 0.098 | 0.130 | 0.238 | 0.183 | 0.016 | 0.193 | 0.150 | 0.051 | 0.218 | 0.173 | 0.038 |

SD: Standard deviation; BIS™: Bispectral index™; ETI: Endotracheal intubation; SAP: Systolic arterial pressure; DAP: Diastolic arterial pressure; MAP: Mean arterial pressure.

also be decreased by alpha-2-agonists.[14] Although no significant preventive association has been detected, in randomized studies, a significant decrease has been reported at the two-year follow-up.[15] Pathological and angiographic evidence has indicated that the etiology of perioperative MI resembles what is found in non-surgical settings.[16,17] In particular, stress-induced myocardial ischemia is a primary suspect.[18] These issues may lead to DEX becoming a drug of choice for CABG patients with unstable angina or MI who may be more vulnerable to hemodynamic instabilities during endotracheal intubation.

Another important finding in this study was the superiority of the adjunct use of DEX in order to achieve more stable levels of anesthesia and systolic blood pressure. All subjects were monitored with the BIS™ index for anesthesia depth, and the use of DEX in conjunction with significantly lower doses of fentanyl produced the required lower BIS™ levels. Evidence of the lower amounts of fentanyl were seen in the lower postoperative time to extubation of the patients in the ICU, and earlier extubation has been shown to be beneficial in other studies.[19,20] No significant differences were observed between the lengths of hospital and ICU stays in our study, however, significant differences may be found in patients with additional morbidities like chronic obstructive pulmonary disease (COPD). Probable complications may be prevented by use of DEX in such patients. Barletta et al.[21] compared the use of DEX with propofol as an adjunct to intravenous anesthesia and reported that use of opioids was lower with DEX when compared with propofol; however, they did not find significant differences in the mechanical ventilation durations between the groups. Since lowering the opioid dose is critical for early extubation, patients for whom an early extubation is planned may benefit from DEX as an adjunct during anesthesia induction.

The attenuation of blood pressure variability was another important finding in our study. Perioperative blood pressure variability has been shown to be associated with 30-day mortality after cardiac surgery.[22] Furthermore, a decrease in blood pressure variability has been reported with volatile induced and maintenance anesthesia that has not been reported with total intravenous anesthesia.[23] Although the postoperative inotropic needs and morbidity rates were similar in our study, the use of DEX effectively attenuated the systolic blood pressure variability and also achieved more stable hemodynamics throughout the operation. In addition, while postoperative mortality and morbidity were similar in both groups, more stable hemodynamics may provide lower cardiac and systemic complications in patients with limited cardiac reserve. Furthermore, establishing better control of a patient's blood pressure can help provide a more successful postoperative course.

In our retrospective study, the patients' BIS™ measurements demonstrated that the adjunct use of DEX provided more stable anesthesia depth with lower fentanyl doses. In turn, this allowed for lower postoperative ventilation durations. Blood pressure control was superior with DEX, and the increase in sympathetic reflexes was significantly attenuated. In addition, hemodynamic control was superior throughout the CABG procedure, and systolic blood pressure variability was significantly reduced. Hence, while further studies are needed to verify our findings, we recommend the adjunct use of DEX in conjunction with other anesthetic drugs.

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