*Original Research Article*

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# Comparison of Efficacy of Dexmedetomidine with Ketamine for Anaesthesia in Dilatation and Curettage

**Meghana Nain[1], Shubhada R.Deshmukh[2], Sunil Godara[3], Rahul Jibkate[4], Deepak Bharat Kawade[5]**

[1,4,5]Resident [2]Professor, Department of Anaesthesia, NKP Salve Medical College and Research Center and LataMangeshkar Hospital, Digdoh Hills, Higna, Nagpur, Maharashtra 440019, India. [3]Senior Resident, Department of Orthopedics, Adesh Institute of Medical Sciences & Research Centre, Bathinda, Punjab 151109, India.

**Abstract**

*Background:* Anaesthesia in dilatation and curettage (D & C) is administered with the dual goals of rapidly and safety establishing satisfactory procedural condition for the performance of therapeutic or diagnostic procedures while ensuring rapid predictable recovery with minimal post operative sequel.Therefore, we decided to use Dexmedetomidine in 2 doses (1µg/kg and 0.6µg/kg) with Ketamine (1 mg/kg) to provide procedural sedation in D&C and compare the efficacy and safety of dexmedetomidine 1µg/kg + 1mg/kg ketamine versus dexmedetomidine 0.6µg/kg + 1mg/kg ketamine for the procedure. *Material & Methods:* This prospective randomized double blind study was conducted in department of Anaesthesiology of a Tertiary care hospital. In this study 80 patients scheduled for elective Dilatation and Curettage were included and divided equally in two groups.Group A- In this group 1µg/kg lnj. Dexmedetomidine was given, along with 1mg/kg lnj. ketamine IV and group B- Inthis group 0.6µg/kg lnj. Dexmedetomidine was given, along with 1mg/kg lnj. Ketamine IV. *Results:* In our studythe mean age of patients in group A (41.5007 years) and group B (4 1.1008 years) differed insignificantly with p-value of 0.8254. The comparison of mean between two groups after giving dexmedetomedine was statistically significant in heart rate, DBP and SBP but respiratory rate & $SpO_2$ was statistically not significant. *Conclusion:* We have concluded that the comparison of baseline, intraoperative (after Ketamine) and post operative values of heart rate, systolic BP and diastolic BP showed that the values were better maintained in group A as compared to group B. Hence both the combination were comparable in safety but since the vital parameters were better maintained in group A, 1 µg/kg Dexmedetomidine + 1 mg/kg Ketamine is better than 0.6 µ/kg.

**Keywords:** Dexmedetomidine; DBP; SBP; Respiratory Rate; $SpO_2$; Anaesthesia.

## Introduction

Procedural sedation is a seamless continuum of an altered state of consciousness, varying from mild anxiolysis to anaesthesia. The greatest threat to the safety of sedated patients is airway compromise and/or respiratory arrest. To decrease the risk of airway and respiratory complications, careful attention must be directed towards the appropriate selection of medications, adherence to dosing recommendations, and the identification of the high-risk patient [1].

Anaesthesia in dilatation and curettage (D & C) is administered with the dual goals of rapidly and safety establishing satisfactory procedural condition for the performance of therapeutic or diagnostic procedures while ensuring rapid predictable recovery with minimal post operative sequel.

Ketamine is in clinical use since 1970. Unique features of ketamine which make it particularly attractive for procedural sedation, include the provision of amnesia, sedation, immobilization and profound analgesia along with limited deleterious effects on hemodynamic and respirator function.

**Corresponding Author: Shubhada R. Deshmukh,** Professor, Department of Anaesthesia, NKP Salve Medical College, Digdoh Hills, Higna, Nagpur, Maharashtra 440019, India.
E-mail: rohingarg99@gmail.com

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These characteristics allow for the completion of short, painful procedures such as fracture reduction, abscess incision and drainage, but debridement under optimal conditions [2].

Ketamine is an N-methyi-Daspartate (NMDA) receptor antagonist, causing dissociative anaesthesia, currently making a comeback in Office Based Anaesthesia owing to excellent analgesic properties with a low incidence of respiratory depression [1].

Ketamine in low doses in combination with other drugs provides effective and safe sedo-analgesia in short surgical procedures like patients undergoing colonoscopy and short gynecological procedures. As co-induction agent in low doses and in combination with other drugs like propofol/ midazolam/fentanyl and dexmedetomidine, ketamine has gained increasing popularity [3].

Anecdotal experience and a few large series from the literature demonstrate the utility of a combination of dexmedetomidine with ketamine for procedural sedation. When used together, dexmedetomidine may limit the tachycardia, hypertension, salivation, and emergence phenomena from ketamine, whereas ketamine may prevent the bradycardia and hypotension that has been reported with dexmedetomidine. When compared with other agents used for procedural sedation, these two agents have limited effects on ventilatory function than other more commonly used agents. Dexmedetomidine-ketamine combination effectively achieves the desired level of sedation while minimizing the potential for adverse effects [4].

Though Dexmedetomidine has been used in different doses, the most commonly used dose has been 1µg/kg [5-15] Dexmedetomidine as premedication in minor gynaecological surgeries was studied in doses of 0.167, 0.33, 0.67, and 1µg/ kg. The dose found to be most effective was 0.67µg/ kg. Therefore, we decided to use Dexmedetomidine in 2 doses (1µg/kg and 0.6µg/kg) with Ketamine (1 mg/kg) to provide procedural sedation in D&C and compare the efficacy and safety of dexmedetomidine 1µg/kg + 1mg/kg ketamine versus dexmedetomidine 0.6µg/kg + 1mg/kg ketamine for the procedure.

## Material & Methods

This prospective randomized double blind study was conducted in department of Anaesthesiology of a Tertiary care hospital. In this study 80 patients scheduled for elective Dilatation and Curettage were included anddivided equally in two groups.

The patients were randomized to following two groups by systematic random sampling.

- Group A- In this group 1µg/kg lnj. Dexmedetomidine was given, along with 1mg/ kg lnj. ketamine IV.
- Group B- Inthis group 0.6µg/kg lnj. Dexmedetomidine was given, along with 1mg/ kg lnj. Ketamine IV.

*Inclusion Criteria*

1. ASA grade I or II patients
2. Age 18-50 years.
3. BMI < 25 kg/$m^2$
4. patient willing to give informed con sent

*Exclusion Criteria*

1. Renal and Hepatic insufficiency
2. Uncontrolled Diabetes Mellitus & Hypertension
3. Ongoing Beta blocker therapy.
4. Ischemic heart disease, Valvular heart disease & heart blocks
5. Known allergy to either Dexmedetomidine or Ketamine

## Methods

In the morning of surgery on entering the OT, standard monitoring modules including NIBP, Pulse oximetry and EGG were attached to the patient. After establishing intravenous access using an 20G cannula, lnj. Ringer Lactate was started at the rate of 100ml/hour. Pre-operative vitals were recorded.

In group A, total dose of 1 µg/kg of Dexmedetomidine and in group B total dose of 0.6 µg/kg was given. The calculated dose of Dexmedetomidine was rnixed with 100ml normal saline and given over 10m ins. 10 mins after infusion of dexmedetomidine was completed Ketamine 1 mg/kg was given IV.

- After 2 mins of Ketamine administration patient was allowed to be put in lithotomy position and external cleaning and draping, cleaning of vagina was allowed. If patient did not move in response to this stimulus, D & C was allowed to proceed.

- If patient moved in response to stimulus of internal cleaning or at any time during procedure, if haemodynamic parameters like heart rate (> 160/min) and BP (180/120mmHg) was found raised, Propofol in 10mgincrements was administered I.V.

The anaesthesiologist preparing the infusion of the study drug wasdifferent from the one who conducted the proceedings.

*Observation*

1. Following were recorded every 2 mins till completion of procedure-

- Pulse rate
- Heart rate
- NIBP
- Respiratory rate Ventilation was assisted with Bain's circuit in case of respiratory rate less than 8/min.
- Maintenance of airway
- Any desaturation ($SpO_2$ less than 94% on room air). If it occurred, it was treated with 4Umin Oxygen on mask With Hudson mask.

2. Total dose of Propofol required during surgery.
3. Total duration of surgery.

After surgery the patient was shifted to the Post Anaesthesia care Unit (PACU) and observed there for 2 hours. The observer in the PACU was unaware of the group that the patient belonged to. Bradycardia (heart rate <50/min) was treated with lnj. Atropine 0.6mg IV.

Hypotension (Systolic BP less than 30% of the baseline value or absolute value less than 80 mm of Hg)with lnj. Mephentermine 3mg/IV in incremental doses.ventilation was assisted with Bain's circuit incase of respiratory rate lessthan 10/min.

Hypertension (180/120 mm Hg) was defined as BP hmore t an 30% ofbaseline, tachycardia (heart rate > 160) both were treated with I.V. Propofol in10mg increments.

Analgesic in the form of lnj.Diclofenac was given on demand or at the VAS score of 4. Nausea and vomiting was treated with lnj. Ondansetron 4 mg IV.Emergence delirium was treated with lnj. Midazolam in 1 mg IV increments.

Patients were shifted to the ward after 2 hours observation or afterAldrete score was 9, whichever was later. Patient was visited after 4 hoursand before discharge know the occurrence of nausea, vomiting.

## Results

In our studythe mean age of patients in group A (41.5007 years) and group B (4 1.1008 years) differed insignificantly with p-value of 0.8254, as obtained using t-test for independent samples. Thus, the baseline age profile of patients in two groups was statistically similar (Table 1).

At the pre-operative stage the comparison of mean value of time of surgery, heart rate, diastolic blood pressure, systolic blood pressure, respiratory rate and $SpO_2$ was statistically insignificant (Table 2).

The comparison of mean between two groups after giving dexmedetomedine was statistically significant in heart rate, DBP and SBP but respiratory rate & $SpO_2$ was statistically not significant (Table 3).

The study showed that the heart rate for group (A) there is highly significant difference between pre-operative stage and after giving Dexmedetomedine case with p-values< 0.0001. However, there is insignificant difference for rest of cases. For group (B), there is a significant difference between pre-operative stage with rest of cases with p-value

**Table 1:** Distribution of patients according to age in two treatment groups

| Age (in year) | Group [No. (%)] | |
|---|---|---|
| | A (N=40) | B (N=40) |
| 22-32 | 3 (7.50) | 5 (12.50) |
| 33-42 | 21 (52.50) | 20 (50.00) |
| 43-52 | 13 (32.50) | 11 (27.50) |
| ≥53 | 3 (7.50) | 4 (10.00) |
| Mean | 41.500 | 41.000 |
| Median | 40.500 | 40.000 |
| SD | 7.136 | 8.924 |
| Range (Min, Max) | (23, 55) | (24, 65) |

< 0.05. Thus, we can conclude that mean heart rate of patients are significantly different between pre-operative stage and case of after giving Dexmedetomedine for both groups of treatment (Table 4).

The descriptive statistics of mean diastolic blood (DBP) at pre-operative stage and their comparison with after giving dexmedetomedine, intra-operative and post-operative stage for two groups and highly significant difference between pre-operative stage and after giving dexmedetomedine case with p-values < 0.0001 and insignificant difference *for* rest of cases. For group B, there is a significant difference between preoperative stage with rest of cases with p-value < 0.05 (Table 5). The mean SBP of patients are significantly different between pre-operative stage and case after giving dexmedetomedine for both groups (Table 6).

In present study showed that the mean of respiratory rate of patients are insignificant different at each stage of operation (Table 7) and the mean of $SpO_2$ were significant different at each stage of operation for group A patients (Table 8).

## Discussion

An ideal intravenous anaesthetic regime used in minor surgeries like dilatation and curettage (D & C) should provide rapid recovery and early discharge from the post anaesthesia care unit with

**Table 2:** Descriptive statistics for different vital parameters in two groups at pre-operative stage

| Parameters | Group [(mean ± SD)] | | |
|---|---|---|---|
| | A (N=40) | B (N=40) | P-value |
| Time of Surgery (Min.) | 8.205 ± 2.05 | 8.351 ± 2.07 | 0.7521 (NS) |
| Heart Rate (/min.) | 78.00± 11 .28 | 74.90± 10.62 | 0.2268 (NS) |
| DBP (mmHg) | 75.35± 9.08 | 73.45± 8.67 | 0.3418 (NS) |
| SBP (mmHg) | 129.00±1 0.05 | 126.20± 9.57 | 0.2058 (NS) |
| RR (/min.) | 23.85 ± 3.82 | 23.40± 3.93 | 0.6055 (NS) |
| SPO2 (%) | 99.32± 0.85 | 99.00± 1.03 | 0.1312 (NS) |

**Table 3:** Descriptive statistics for different vital parameters and comparison between two groups after administering Dexmedetomedine

| Parameters | Group [(mean±SD)] | | |
|---|---|---|---|
| | A (N=40) | B (N=40) | P-value |
| Heart Rate (/min.) | 62.02 ± 10.79 | 68.88 ± 11.18 | 0.0066(S) |
| DBP (mmHg) | 62.90± 11 .37 | 68.78± 08.93 | 0.0122 (S) |
| SBP (mmHg) | 109.15±16.68 | 119.20± 12.73 | 0.0034 (S) |
| RR (/min.) | 22.73 ±03.61 | 22.35± 03.68 | 0.6468 (NS) |
| SPO2 (%) | 98.12± 01.90 | 98.60± 01.03 | 0.1694 (NS) |

**Table 4:** Descriptive statistics for heart rate and its comparison between pre, after Dexmedetomedine, intra and post operation times in two groups

| Group | Hear rate (Mean±SD) | | P-value |
|---|---|---|---|
| A | Pre-Operative 78.00±11.28 | After Dexmedetomedine 62.02±10.79 | <0.0001(HS) |
| | | Intra-operative 77.375±12.313 | 0.8135 (NS) |
| | | Post-operative 77.175±9.636 | 0.7261 (NS) |
| B | Pre-Operative 74.90±10.62 | After Dexmedetomedine 68.88±11.18 | 0.0157 (S) |
| | | Intra-operative 82.875±11.122 | 0.0016(S) |
| | | Post-operative 82.15±11.026 | 0.0037 (S) |

**Table 5:** Descriptive statistics for diastolic blood pressure and its comparison between pre, after Dexmedetomedine, intra and post operation times in two groups

| Group | DBP (Mean±SD) (mmHg) | | P-value |
|---|---|---|---|
| A | Pre-Operative 75.35±9.08 | After Dexmedetomedine 62.9±11.37 | <0.0001(HS) |
| | | Intra-operative 74.95±9.737 | 0.8499 (NS) |
| | | Post-operative 74.95±7.884 | 0.8341 (NS) |
| B | Pre-Operative 73.45±8.67 | After Dexmedetomedine 68.78±8.93 | 0.0200 (S) |
| | | Intra-operative 77.325±8.144 | 0.0428(S) |
| | | Post-operative 77.025±7.011 | 0.0462 (S) |

**Table 6:** Descriptive statistics for systolic blood pressure and its comparison between pre, after Dexmedetomedine, intra and post operation times in two groups

| Group | SBP (Mean±SD) (mmHg) | | P-value |
|---|---|---|---|
| A | Pre-Operative 129.00±10.05 | After Dexmedetomedine 109.15±16.68 | <0.0001(HS) |
| | | Intra-operative 129.1±13.865 | 0.9706 (NS) |
| | | Post-operative 130.425±10.170 | 0.5303 (NS) |
| B | Pre-Operative 126.20±9.57 | After Dexmedetomedine 119.2±12.73 | 0.0069 (S) |
| | | Intra-operative 133.25±9.535 | 0.0015(S) |
| | | Post-operative 133.375±10.312 | 0.0018 (S) |

**Table 7:** Descriptive statistics for respiratory rate and its comparison between pre, after Dexmedetomedine, intra and post operation times in two groups

| Group | RR (Mean±SD) | | P-value |
|---|---|---|---|
| A | Pre-Operative 23.85±3.82 | After Dexmedetomedine 22.73±3.61 | 0.1801 (NS) |
| | | Intra-operative 24.10±3.365 | 0.7572 (NS) |
| | | Post-operative 24.175±3.234 | 0.6828 (NS) |
| B | Pre-Operative 23.40±3.93 | After Dexmedetomedine 22.35±3.68 | 0.2216 (NS) |
| | | Intra-operative 24.10±3.747 | 0.4176 (NS) |
| | | Post-operative 24.75±3.342 | 0.1022 (NS) |

**Table 8:** Descriptive statistics for SPO2 (%) and its comparison between pre, after Dexmedetomedine, intra and post operation times in two groups

| Group | SPO2 (Mean±SD) (%) | | P-value |
|---|---|---|---|
| A | Pre-Operative 99.32±0.85 | After Dexmedetomedine 98.12±1.9 | 0.0006 (S) |
| | | Intra-operative 98.775±1.025 | 0.0112 (S) |
| | | Post-operative 98.975±0.733 | 0.0536 (S) |
| B | Pre-Operative 99.00±1.03 | After Dexmedetomedine 98.6±1.03 | 0.0880 (NS) |
| | | Intra-operative 99.025±1.097 | 0.9169 (NS) |
| | | Post-operative 99.175±0.813 | 0.4039 (NS) |

minimal side effects. A very commonly used anaesthetic technique for dilatation and curettage is Total Intravenous Anaesthesia (TIVA). Comfort of the patient and avoidance of movement is of great significance during D & C for the procedure to be effectively completed. Propofol is a frequently chosen agent because it can be easily titrated, is generally effective, and allows for rapid awakening once the procedure is completed. However, in patients with co-morbid respiratory or cardiovascular diseases, there may be a relatively high incidence of adverse effects including hypotension, hypoventilation, upper airway obstruction and apnoea. Although these effects are generally dose dependent and more likely with higher doses as deeper levels of sedation/anaesthesia are achieved, there is significant interpatient variability regarding the potential for adverse effects [4].

Ketamine is an agent that provides sedation, analgesia and amnesia and it might be an appropriate option for short–lasting procedures. Its value has been established because of its lack of cardiovascular and respiratory depressant effects and preservation of airway reflexes. Cardiostimulatory effects, drug induced delirium and secretion increment are the main drawbacks of ketamine. Hence Ketamine has been used in combination with different drugs like benzodizepines, opioids and propofol to mitigate these side effects.

With the addition of midazolam to ketamine for procedural sedation, there was a statistically significant increase in recovery times as well as an increased risk for adverse respiratory events. The only positive attribute was a reduction in the incidence of emesis during the recovery period. Recent studies suggest that routine use of adjunctive midazolam with ketamine does not effectively reduce the incidence of emergence phenomena [2].

Ketamine-fentanyl combinations have accepted anesthetic period, but there was prolonged recovery with respiratory and central nervous depression. Other adverse effect of fentanyl is emesis (nausea and vomiting) which are the most common side effects of opioids [5].

Ketamine-propofol combinations in TIVA showed less intra- and post-procedural hemodynamic stability, more PONV more postoperative cognitive dysfunctions and longer recovery time [6].

Combination of dexmedetomidine-kitamine makes a pharmacologic sense as each of the two medications has the potential to balance the hemodynamic and adverse effects of the other. Dexmedetomidine may prevent tachycardia, hypertention, salivation, and emergence phenomena from ketamine, whereas ketamine may prevent bradycardia and hypotension that have been reported with dexmedetomidine [7].

In this double blind, randomized study we compared 2 doses (1 µg/kgand 0.6µg/kg) of dexmedetomidine with Ketamine (1 mg/kg) to provide procedural sedation in D & C and compared the efficacy and safety of the two combinations for the procedure. Dexmedetomidine has been widely used indose of 1 µg/kg (5-15). Riku E. Aantaa et al. compared four diferent doses (0.167, 0.33, 0.67, and 1.0µg/kg) of dexmedetomidine in minor Gynecologic surgery and found that optimal dose of dexmedetomidine for single-dose intravenous premedication in minor surgery appears to be in the range of 0.334-0.67 µg/kg [8]. Hence, we chose 1µg/kg as the dose of dexmedetomidine in group A and 0.6 µg/kg in group B.

This study was conducted on 80 patients coming to the operation theatre for elective D & C after Institute's Ethics Committee approval for the conduct of study. In our study no statistically significant difference was found in age and in both groups ($p>0.05$).

In our study, the mean heart rate in the two groups A and 8 were 62±10.79 and 68.88±11.18 respectively after the administration of the calculated dose of dexmedetomidine over 10 minutes. This difference is statistically significant with p value < 0.0066, after the administration of 1 mg/kg lnj. Ketamine IV, the procedure was started. The intraoperative comparison of the mean heart rate of both groups showed an increase from baseline starting from the first observation point at 2 minutes which continued till the patient was shifted from the OT table after 12 minutes and in the Post Anaesthesia Care Unit (PACU). Comparison of mean heart rates of the patients in group A preoperatively, intra-operatively and in PACU showed that the values do not have statistically significant difference. On the other hand, in group B, there was a statistically significant difference between the mean heart rate intra-operatively (after Ketamine) and postoperatively from the base line mean heart rate. The mean heart rate in group B and group A showed a statistically significant difference at 6, 8, 10 and 12 minutes intra-operative. This could be because the patients in group B had lighter sedoanalgesia than patients in group A though they were sedated enough to prevent any purposeful movementintra-

operatively. Also the effect of Ketamine on heart rate could have been more effectively countered by 1 µg/kg dexmedetomidine than 0.6µg/kg. We had planned to give additional dose of anaesthetic (propofol) if the patient showed any movement. This was in accordance to the study of Heard C, Burrows F,Johnson K et al. [9] where they used prevention of movement to optimize the anaesthetic. The mean heart rate in group A was never more than preoperative (baseline) value.

In the PACU also patients of group A had a statistically significant less mean heart rate than the patients of group B. The decrease in heart rate found In our study is in accordance with studies of Sethi P, Sindhi S, Verma A et al. [10], Antaa RE et al. [8], Verma R, Gupta R, Bhatia VK et al. [11], Rasheed MA et al. [12], Koroglu A. et al. [13], Sinha SK et al. [14], and Sayeda AA et al. [5]. The study results of Gunduz M et al. [15], Gupta K et al. [16], Celik M. et al. [17] are in partial concurrence with our results.

Thus the systolicas well as the diastolic blood pressure showed a fall from the baseline values in both groups with group A showing lower values as compared to group B.comparison of mean systolic and diastolic values between the groups is alsostatistically significant (p value 0.0034) and (p value 0.0122) respectively.

Intraoperatively, after the administration of Inj· Ketamine 1 mg/kg, the meansystolic as well as diastolic BP increased in both group. This Increase was never more than the preoperative value in group A. If the baseline, meansystolic BP in group A is compared with intraoperative and posto-perative values, it can be seen that the difference is not significant with p value of 0.9706 and 0.5303 respectively. This comparison in group B shows the intraoperative and post-operative difference to have p value of 0.0015 and 0.0018 respectively and both values are significant. This means that the meansystolic and diastolic blood pressures after administration of Ketamine were better maintained as compared to baseline values in group A than in group B. On comparison of mean systolic and diastolic values of group A and group B, it was seen that the difference was statistically insignificant at all time points intraoperatively. Our results are comparable to the studies of Gundu MA [15].

In the PACU the mean systolic and diastolic blood pressures in the two groups were comparable and there was no statistical significance in the difference of the values of the two groups (all p values >0.05). These results in our study are comparable with Shaaban A. M. et al [7].

The mean respiratory rates in our study groups were 23.85±03.82 in group A and 23.40±03.93 in group B at baseline. The difference between the groups was not significant. After dexmedetomidine, group A patients had a mean respiratory rate of 22.73±03.61 and group B had a mean respiratory rate of 22.35±03.68 breaths/min. which did not show any statistically significant difference. Intraoperatively as well as postoperatively the mean respiratory rates in the two groups remained comparable with p value>0.05 at all time points.

Our results are comparable with Gunduz M et al. [15], Gupta K et al. [16], verrna R, Gupta R, Bhatia VK et al. [11], Raseed MA et al. [12], Sinha S. K et al. [14], Koroglu A. et al. [13] found a decrease in respiratory rate in their patients after dexmedetomidine which is contrary to our study.

## Conclusion

We have concluded that the comparison of baseline, intraoperative (after Ketamine) and post operative values of heart rate, systolic BP and diastolic BP showed that the values were better maintained in group A as compared to group B. Hence both the combination were comparable in safety but since the vital parameters were better maintained in group A, 1 µg/kg Dexmedetomidine + 1 mg/kg Ketamine is better than 0.6 µ/kg.

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