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ORIGINAL RESEARCH

Deliberate Hypotension in Maxillofacial Surgeries. A Comparative Study Using Dexmedetomidine Versus Propofol Infusion

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ABSTRACT

Background: Deliberate hypotension (DH) is described as controlled reduction and maintenance of blood pressure (BP) in range of mean arterial pressure (MAP) between 50 and 65 mmHg or intraoperative reduction of baseline MAP from 20 to 30%. Surgical procedures of the maxillofacial region have a propensity to bleed profoundly because the region's blood supply is rich and this reduces the visibility of surgical site. **Objectives:** To assess intraoperative bleeding and visibility of surgical field during deliberate hypotension produced by intravenous propofol and dexmedetomidine when performing maxillofacial surgery under General Anaesthesia.

Material and Methods: A prospective comparative study was done in 100 patients after obtaining Institutional ethical committee approval during January 2022 to September 2022 in adult patients who were posted for maxillofacial surgery at tertiary care hospital. Patients belonging to group D received Dexmedetomidine 0.4-0.8 μg/kg/hr in 500ml 0.9% normal saline. Patients belonging to group P received Propofol 75 – 100 μg/kg/min in 500ml 0.9% normal saline after induction of GA. Outcomes assessed were heart rate, MAP, Quality of surgical field, blood loss and sedation score. Statistical tests used were Chi-square test and student "t" Test with p value of < 0.05 as statistically significant.

Results: Mean of pulse rate($p=0.012$) and MAP ($p=0.0144$)in group D is slightly less than Group P which was significant statistically. Quality of surgical field as assessed by the surgeon was, grade 2 in 88% and 90% of patients respectively in group D and group P and grade 3 in 12% and 10% of patients in group D and group P respectively as per average category scale.

Conclusion: Dexmedetomidine and propofol both are comparable with quality of surgical field. Dexmedetomidine induction produced significantly less mean PR and MAP compared to propofol.

Keywords: Deliberate hypotension, Dexmedetomidine, Propofol, Maxillofacial surgery.

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INTRODUCTION

Surgical procedures of the maxillofacial region have a propensity to bleed profoundly because the region's blood supply is rich and this reduces the visibility of surgical site.[1]The circulation of blood in the operating field depends on three factors: central BP and its regulation, measured in a large artery, sympathetic nervous system regulation on the local arteriolar vasomotor tone and microcirculatory autoregulation of the organ.[2] Therefore, drug selection is the key determinant of the anticipated outcome.

Reduced visibility of the surgical field results in increased risk of dangerous vascular, orbital and intracranial complications. Hence the role of an anaesthesiologist is extremely important in reducing bleeding.[3]

Deliberate hypotension (DH) is described as controlled reduction and maintenance of blood pressure (BP) in range of mean arterial pressure (MAP) between 50 and 65 mmHg or intraoperative reduction of baseline MAP from 20 to 30%.[4] Also, it can be classified as the safe minimal BP limit, during which the autoregulation of the cerebral blood flow (CBF) force is still in function.[5]

Indications for applying DH depends on the type of surgery, for instance, Le Fort I osteotomy, genioplasty, bi-maxillary surgery, sagittal split of the mandible and the mandibular symphysis osteotomy are more frequently associated with DH application compared to other procedures.[6]

For achieving deliberate hypotension, several agents such as nitroglycerine,[7] higher dose of inhaled anaesthetics,[8] and vasodilator such as sodium nitroprusside,[9] β-blocker,[10] have been used either alone or in combination with each other. Propofol and dexmedetomidine can be pharmacological methods to induce deliberate hypotension.

Propofol is one of a group of alkylphenols. It is presumed to exert its sedative hypnotic effects through interaction with GABA. It reduces arterial blood pressure by drop in systemic vascular resistance, preload and cardiac contractility.[11,12]

Dexmedetomidine is a α2-adrenoceptor agonist with sedative, anxiolytic, sympatholytic, analgesic-sparing effects, and minimal depression of respiratory function. It is potent and highly selective α2-receptors.[13] The α2-receptors are involved in regulating the autonomic and cardiovascular system. In blood vessels, these receptors cause vasoconstriction, and in the sympathetic terminals they inhibit the release of norepinephrine.[14]

Our study was done to compare intraoperative bleeding and visibility of surgical field during deliberate hypotension produced by intravenous propofol and dexmedetomidine when performing maxillofacial surgery under General Anaesthesia.

MATERIAL &METHODS

A prospective comparative study was done in 100 patients after obtaining Institutional ethical committee approval during January 2022 to September 2022 in adult patients who were posted for maxillofacial surgery at tertiary care hospital. Patients with ASA Physical Status I and II was also the inclusion criteria. Patients who are known to be hypersensitive to Dexmedetomidine or Propofol, haemodynamically unstable and not willing for participation were excluded.

Patients were selected by consecutive sampling method. The patients were randomly allocated into two groups comprising of 50 patients each in Group D and Group P. Preanesthetic check-up and appropriate investigations were done, written informed consent was taken and patients were kept nill by oral for 8 hrs.

After shifting to operation theatre, preoperative vitals were monitored and recorded. Patients were secured with 18-G intravenous catheter. Premedication with IV midazolam 0.05 mg/kg was given. General anaesthesia was induced. Patients belonging to group D received Dexmedetomidine 0.4-0.8 μg/kg/hr in 500ml 0.9% normal saline. Patients belonging to group

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P received Propofol 75 – 100 µg/kg/min in 500ml 0.9% normal saline after induction of GA. Target MAP for controlled hypotension was 60–70 mmHg, which was maintained in all the patients.

Outcomes assessed were heart rate, MAP, Quality of surgical field, blood loss and sedation score. Dexmedetomidine/Propofol infusion was stopped approximately 5 min before the expected end of surgery and monitoring of vitals continued. Residual paralysis was reversed with neostigmine 0.05mg/kg and glycopyrrolate 0.08mg/kg iv and after complete recovery patients were extubated. The highest infusion dose for each patient was recorded.

AVERAGE CATEGORY SCALE was used to assess quality of surgical field. 0 score given for Absence or no bleeding, 1 score given for slight bleeding not requiring suction of blood, 2 score given for slight bleeding, sometimes blood has to be suctioned out, 3 score given for slight bleeding, sometimes blood has to be evacuated, visible operative field for some seconds after evacuation, 4 score given for average bleeding, blood has to be often evacuated, operative field is visible only right after evacuation, 5 score given for high bleeding, constant blood evacuation is needed, sometimes bleeding exceeds evacuation as per Fromme et al.[15]

SEDATION SCORE ASSESED BY USING RAMSAY SEDATION SCORE: Score 1 - Patient is anxious, agitated or restless or both, Score 2 - Patient is cooperative, oriented and tranquil, Score 3 - Patient responds to commands only, Score 4 - Patient exhibits brisk response to light, glabellar tap or loud auditory stimulus, Score 5 - Patient exhibits sluggish response to light, glabellar tap or loud auditory stimulus, Score 6 - Patient exhibits no response.[16]

Severe hypotension below the targeted level when occurred, was managing by discontinuing hypotensive drugs and mephenteramine 6mg was given if needed, and the patient was excluded from the study. Bradycardia (decrease in heart rate< 20% from baseline or <50 min) was treated with Inj. atropine 0.01mg/kg or 0.6 mg IV and the patient was excluded from the study. Postoperative complications, duration of surgical intervention (from beginning to end of surgical procedure) and surgeon satisfaction were recorded. Blood loss volume, measured in suction bottle and by the visual estimation of the soaked swabs was recorded.

Data analysis: Data entered into MS excel 2019 and analysed using SPSS, version 20. Data represented as frequency, percentage, Mean and standard deviation. Statistical tests used were Chi-square test and student "t" Test with p value of < 0.05 as statistically significant.

RESULTS

Out of 100 patients in this study, mean age of patients belonging to Group D was more compared to Group P but was not significant statistically. Mean weight of patients belonging to Group D was less compared to Group P but was not significant statistically. Patients in Group D and Group P were similar with respect to ASA status and duration of surgery. (table 1).

Table 1: Distribution by Patients Characteristics

Variables	Sub- group	Group D (N=50)	Group P (N=50)	P value
Age (in years) Mean± SD		42.76± 9.41	39.79±11.56	0.162
Weight (in Kg) Mean±SD		67.02±9.68	70.32±10.96	0.114
Sex	Female	17	23	
	Male	33	27	

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ASA (n/%)	Grade 1	31(62%)	35(70%)	0.713
	Grade 2	19(38%)	15(30%)	
Duration of surgery (in mins)		179±23	183±15	0.3055

Surgeries performed included Unilateral cervical lymph node dissection (21%), Intracapsular temporomandibular joint arthroplasty (20%), Le Fort I osteotomy (19%), Subtotal resection of maxilla (17%) and Total resection and partial resection of mandible (3%). table 2

Table 2: Type of Surgeries Performed

Surgeries Performed	Group D	Group P	Total
Unilateral cervical lymph node dissection	10 (20%)	11 (22%)	21 (21%)
Intracapsular temporomandibular joint arthroplasty	12 (24%)	8 (16%)	20(20%)
Le Fort I osteotomy	9 (18%)	10 (20%)	19(19%)
Subtotal resection of maxilla	7 (14%)	10 (20%)	17(17%)
Total resection and partial resection of mandible	2 (4%)	1 (2%)	3(3%)

Mean of pulse rate in group D is slightly less than Group P and was significant statistically(p=0.012). Mean of SBP in group D is slightly less than Group P which was significant statistically (p=0.028). Mean of MAP in group D is slightly less than Group P this was significant statistically (p=0.0144). Mean of SPO2 (%) in group D and Group P were similar (p=0.7066). (Table 3)

Table 3: Distribution by Baseline Vital Parameters

Outcomes Measured	Group D	Group P	P Value
	Mean± S.D		
PR	75.38±7.319	79.56±8.97	P=0.012
SBP	107.54±10.03	111.56±7.89	P=0.028
MAP	74.97±6.78	77.99±5.24	P=0.0144
SPO2 (%)	98.96±2.52	99.14±2.24	P=0.7066

Mean pulse rate compared between two groups after inducing deliberate hypotension, during intraoperative period is shown in figure 1. Mean of pulse rate was higher in group P patients compared to group D and this was statistically significant at 30, 45, 60 & 120 min where p value was <0.05. (figure 1).

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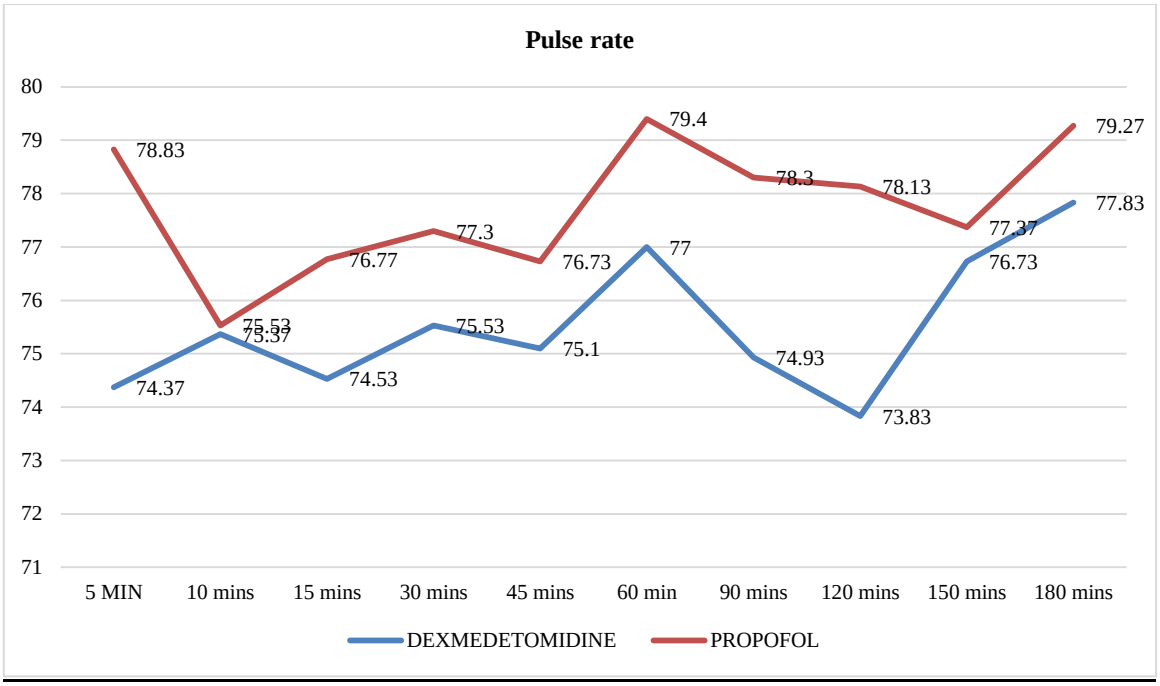

Figure 1: Comparison of Pulse rate between the groups intraoperatively

Mean arterial pressure was almost similar in both the groups up to 150 mins. MAP was higher in group P patients compare to group D and this association was statistically significantat150 mins and180min. (figure 2).

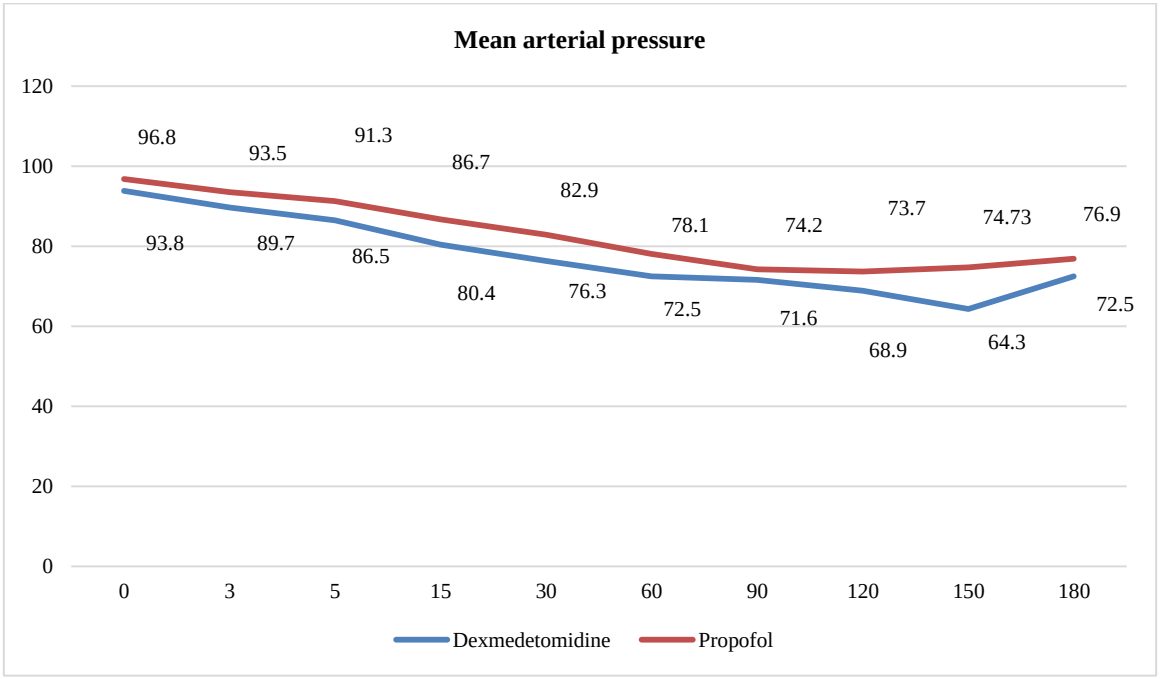

Figure 2: Comparison of mean arterial pressure between the two groups intraoperatively

Quality of surgical field as assessed by the surgeon was, grade 2in88% and 90% ofpatients respectively in group D and group Pandgrade3in 12% and 10% of patients in group D and

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group P respectively as per average category scale. This shows that both drugs have similar effects on quality of surgical fields. (Table 4)

Table 4: Quality of surgical field- average category scale

Average category scale grade	Group D	Group P	TOTAL
Grade 2	44(88%)	45(90%)	89
Grade 3	6(12%)	5(10%)	11
Total	50	50	100

Mean blood loss in Group D (356.52±23.71) was significantly less compared to Group P (391.12±11.53). Comparison between two groups showed that there were statistically significant differences in sedation score at 30 mins and 60 min (P-value=0.02) after induction. Ramsay sedation scores were statistically higher in Propofol group than Dexmedetomidine group. More proportion of patients in group P (38%) have adverse events compared to group D (20%). (Table 5)

Table: 5 Mean blood loss, sedation score and complication rates in Group D versus Group P

Variables	subcategory	Group D (N=50)	Group P (N=50)	PValue
Mean blood loss		356.52±23.71	391.12±11.53	0.0001
Ramsay sedation score	15 min	2.64±0.637	2.73±0.546	0.450
	30 min	2.44±0.535	2.69±0.532	0.0212
	60 min	2.22±0.44	2.42±0.52	0.023
	150 min	1.8±0.19	2±0.22	1
	180 mins	1.9±0.18	1.85±0.17	0.1565
Adverse events	Yes	10(20%)	19(38%)	0.047
	No	40(80%)	31(62%)	

DISCUSSION

Maxillofacial surgeries are major surgeries with risk of postoperative complications due to excessive blood loss as it has profound blood supply. As per many previous studies deliberate hypotension greatly reduced blood loss and improved visibility and quality of surgical field.[1] Vital organ perfusion and tissue perfusion, as is decided by mean Arterial Pressure (MAP); MAP is our primary outcome measured to assess the efficacy and safety of Dexmedetomidine and Propofol as an agent to induce deliberate hypotension in this study.

Out of 100 patients in this study, mean age of patients belonging to Group D was more compared to Group P but was not significant statistically. Mean weight of patients belonging to Group D was less compared to Group P but was not significant statistically. Patients in Group D and Group P were similar with respect to ASA status and duration of surgery. In this study patients were comparable in both groups with regards to mean age, sex distribution, mean weight and ASA status distribution. Similar to study by Sujatha D et al where study patients were comparable with mean age and mean weight.[17]

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In current study, mean PR and mean MAP decreased following induction of hypotensive anaesthesia. The decrease of mean PR and mean MAP in patients received dexmedetomidine was more compare to propofol group patients. This association was statistically significant at some time intervals. In study by Sujatha D et al mean PR and mean MAP were significantly low in Group D compared to Group P.[17]

In present study mean blood loss in propofol group was more (391.12±11.53) compared to group D (356.52±23.71) which was statically significant. Unlike in study by Chen J et al, blood loss was significantly more in group D (374± 36) compared to group P (302 ±28).[18]

In our study, the quality of surgical field as scored by surgeon, we found that both propofol and dexmedetomidine were effective in producing a surgical field with improved visibility (average category scale=2). Study by Mandal D et al, shows that perioperative surgical site bleeding score was significantly ($P < 0.05$) higher in group PL than group DL. Again due to less bleeding and excellent operative condition, surgeon's satisfaction score was significantly better in dexmedetomidine group than placebo infiltrated group.[19] Basar et al. opined Dexmedetomidine impact on establishing better surgical conditions and less bleeding during controlled hypotension in tympanoplasty, septoplasty, and maxillofacial surgeries has been reported.[14]

In present study majority of propofol group patients having high sedation score when compared to dexmedetomidine group at 15 min and 30 min after surgery. In study by Chen J et al Ramsay score was higher in group D in the first 3 hours of sedation than in group P ($P < .05$).[18] Thus, a lower score in dexmedetomidine group suggests that patients were not under deep sedation compared to propofol which helps in early postoperative recovery.

In the present study mean blood loss in Group D (356.52±23.71) was significantly less compared to Group P (391.12±11.53). Mean Blood loss (mL) in study by Chen J et al et al was 374 ±36 and 302 ±28 in Group D and Group P respectively.[18]

In this study more proportion of patients in group P (38%) have adverse events compared to group D (20%). Similarly, the adverse events reported in study by Chen J et al are 36% and 48% in Group D and Group P respectively.[18]

CONCLUSION

The decrease of mean PR and mean MAP in patients received dexmedetomidine was more compare to propofol group patients. This association was statistically significant at some time intervals. Dexmedetomidine and propofol both are comparable with quality of surgical field. Dexmedetomidine induction produced significantly less mean PR and MAP compared to propofol

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