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A Comparative Study of Dexmedetomidine and Propofol in Achieving Controlled Hypotension and Optimizing Surgical Field Visibility During Functional Endoscopic Sinus Surgery

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ABSTRACT

Controlled hypotension is a widely utilized anesthetic technique aimed at reducing intraoperative bleeding, improving surgical field conditions, and minimizing the risk of complications. In Functional Endoscopic Sinus Surgery (FESS), the quality of the surgical field plays a critical role in determining procedural success and is closely influenced by intraoperative bleeding. Dexmedetomidine and propofol are commonly used intravenous anesthetic agents known for their hypotensive effects. This study aims to compare the effectiveness of dexmedetomidine and propofol in achieving controlled hypotension and enhancing surgical field visibility during FESS. A quasi-experimental analytic study was conducted at Dr. Soetomo General Hospital, Surabaya, Indonesia. Patients aged 18-65 years undergoing elective FESS were recruited. Hemodynamic parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate were recorded at 5-minute intervals. Surgical field visibility was assessed using the Boezaart scaling score by the primary surgeon. Data were analyzed using Wilcoxon signed-rank test and Mann-Whitney U test, with a significance level of $p < 0.05$. Among 24 patients, the median time to reach target hypotension was 20 minutes in the dexmedetomidine group and 30 minutes in the propofol group; however, the difference was not statistically significant ($p > 0.05$). The mean Boezaart scaling score was 1.83 in the dexmedetomidine group and 2.0 in the propofol group, also showing no significant difference ($p > 0.05$) in surgical field visibility. There was no statistically significant difference between dexmedetomidine and propofol in terms of the onset of achieving controlled hypotension or in improving surgical field visibility during FESS. Both agents appear to be equally effective and may be chosen based on clinical preference or individual patient factors.

KEYWORDS: Controlled hypotension, Functional Endoscopic Sinus Surgery, Dexmedetomidine, Propofol, Surgical field visibility, Boezaart scaling score.

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INTRODUCTION

Monitoring stable blood pressure within normal limits during surgery is a key indicator of anaesthesia success. Controlled blood pressure reduction can be beneficial in various situations, including reducing bleeding and facilitating the surgical process [1]. Maintaining the correct blood pressure level is crucial for maintaining organ perfusion during surgery [2,3]. Controlled hypotension is a technique used to reduce intraoperative bleeding, facilitate the surgical process, and reduce the risk of complications [4,5].

In certain surgical procedures such as Functional Endoscopic Sinus Surgery (FESS) for the nose, Cannal Wall up surgery for the ear, and Cochlear Implant surgery, controlled hypotension techniques are essential for maintaining a clear surgical field and achieving surgical success [5]. Controlled hypotension techniques have been proven effective in reducing intraoperative bleeding and creating optimal bloodless surgical conditions [6].

The risk of complications associated with FESS mainly depends on the endoscopic visibility of the paranasal sinus anatomical structures, the extent of the sino-nasal disease, and the operator's experience [7]. According to Lourijsen [8], the difficulty of this procedure is often caused by bleeding. Bleeding from capillaries is the most serious issue that can affect the success of the FESS procedure. Failure of this procedure is closely related to the occurrence of bleeding. Therefore, it is important to keep the surgical area as free from bleeding as possible [8].

Several pharmacological agents such as magnesium sulphate, vasodilators, nitroglycerine and beta-adrenergic antagonists have been used to achieve controlled hypotension. However, prolonged recovery times, resistance to vasodilators, tachyphylaxis and toxicity have been reported [9]. The choice of medication to achieve optimal hypotension should be a well-known drug that is easy to use,

has a rapid onset, a short recovery time, and minimal side effects. Propofol and dexmedetomidine, as anaesthetic drugs, play an important role in achieving controlled hypotension [10].

Dexmedetomidine is an adrenergic receptor agonist that has sedative, analgesic and sympatholytic effects. The sympatholytic properties of Dexmedetomidine are mediated by adrenergic receptors and result in a decrease in cardiac output, blood pressure and heart rate. The use of dexmedetomidine at a dose of 0.4 mcg/kg/hour has also been reported to be effective in controlling post-operative pain and reducing the risk of vomiting and nausea compared to the use of Esmolol [11].

Propofol produces a sedative-hypnotic effect through interaction with GABA receptors (gamma-aminobutyric acid receptor agonists). The use of propofol also causes a decrease in blood pressure and MAP (mean arterial pressure) [12]. This beneficial effect is used for sedation and anaesthesia in almost all types of surgery, especially in controlled hypotension techniques [13].

Dexmedetomidine itself is still rarely used in Indonesia, especially in FESS surgery. Although Propofol is widely used for many head tumor surgeries, its application in FESS surgery remains uncommon in Indonesia. Hence, comparing the success and effectiveness of these two drugs in achieving controlled hypotension is relevant to help choose the optimal anaesthetic approach during surgery. Based on the above background, this study aims to analyse the differences between dexmedetomidine and propofol in achieving controlled hypotension during FESS surgery.

RESEARCH METHOD

2.1. Research Design

This study is quasi-experimental with cross-sectional data collection and analytical study.

2.2. Place and Time of Research

This study was conducted at the Integrated Surgical Centre (GBPT) of Dr. Soetomo General Hospital in Surabaya. The study commenced in January 2025 and continued until the required sample size was reached.

2.3. Research Population and Sample

The study population consisted of all patients who underwent FESS surgery at the Integrated Surgical Centre (GBPT) of Dr. Soetomo General Hospital in Surabaya. The sample size in this study was all patients who underwent FESS surgery at the Integrated Surgical Centre (GBPT) of Dr. Soetomo General Hospital in Surabaya who met the study criteria. The sampling technique used was random, whereby patients who met the inclusion criteria were selected consecutively according to the time of the study.

The sample size was determined using the sample size formula for comparing the means of two independent populations [14]. The random sampling technique in a previous study examining the use of Dexmedetomidine in achieving controlled hypotension found a standard deviation of 5.4 [15]. The total sample size for each group was at least 11 people. Considering the possibility of dropouts, 10% was added to each group, resulting in a total sample size of 24 people, with 12 people in each group.

2.4. Inclusion and Exclusion Criteria

Inclusion criteria

1. Patients aged between 18 and 65 years.
2. Patients with American Society of Anaesthesiologists (ASA) physical status class I or II.
3. Patients who have provided written consent to participate in the study.

Exclusion criteria

1. Patients with a history of allergy to dexmedetomidine or propofol.
2. Obese patients with a BMI greater than 30.
3. Patients with uncontrolled hypertension, who do not receive regular treatment, with blood pressure exceeding 160/90 mmHg.
4. Patients with a history of heart disease.
5. Patients with a history of stroke.
6. Pregnant or breastfeeding women.

Dropout criteria

1. Patients who experience propofol infusion syndrome during surgery.
2. Patients who experience decreased consciousness after surgery.
3. Patients who experience a drop in blood pressure to the point of shock requiring vasopressor medication until the end of surgery.
4. Patients who choose to withdraw from the study or are unable to continue their participation.

2.5. Research Data Collection Methods

The data collection methods in this study will involve several observation and recording techniques, as well as the use of medical data available at the hospital. The following are some of the methods that will be used:

1. Direct Observation: The research team will conduct direct observation during surgery to record data on blood pressure monitoring, heart rate, evaluation of the surgeon's field of view, and intraoperative blood loss.

2. Medical Records: Data on patient age, gender, physical status according to ASA, and duration of surgery will be obtained from patient medical records available at the hospital.

2.6. Data Processing and Analysis Techniques

The collected data will be processed and analysed using appropriate statistical techniques, including descriptive and inferential analysis. The following are several steps in data processing and analysis techniques:

The collected data will be recorded and tabulated. Data processing in this study uses an application. All demographic characteristic data (age, gender, etc.) will be summarised using descriptive statistics. All measurement data are presented in the form of mean ± standard deviation. The statistical tests used in this study are:

1. Paired difference test
   The aim is to distinguish changes in blood pressure, pulse, and MAP before induction and after extubation in the dexmedetomidine group compared to the propofol group. If the data is normally distributed, it will be tested using a Paired T Test; if not normally distributed, it will be tested using a Wilcoxon Signed Rank Test.
2. Independent group difference test
   The aim was to compare total bleeding and visibility of the surgical field between the dexmedetomidine group and the propofol group. If the data were normally distributed, an independent t-test was used; if not, a Mann-Whitney test was used.

2.7. Confidentiality

All data contained in this study is confidential and will be used solely for scientific research purposes.

2.8. Informed Consent

Patients and their families will be given an explanation of the purpose of this study. If they agree to participate in the study, patients or their families will be asked to sign a written consent form. This study will be submitted for ethical clearance to the Ethics Committee of the Faculty of Medicine, Airlangga University / Dr. Soetomo General Hospital.

RESEARCH RESULTS

3.1. Description of Patient Characteristics

Patient characteristics are displayed according to the type of data available. For categorical (nominal) and ordinal data, they are presented as frequencies and percentages. Numerical data, i.e. ratio and internal scale data, are presented as mean + standard deviation if the normality test shows normal results, and if not normal, as median (range). Range is the display of minimum – maximum data.

Table 1. Description of Data Characteristics

No.	Characteristics	Number (n=24 people)	Percentage (%)
	Gender		
1	Male	8	33.33%
2	Female	16	66.67%
	Age		
1	18-25	7	29,2
2	26-33	7	29,2
3	34-41	2	8,3
4	42-49	2	8,3
5	50-57	2	8,3
6	58-65	1	4,1
	PS		
1	PS ASA 1	4	16.67%
2	PS ASA 2	20	83.33%
	Diagnosis		
1	Barosinusitis	2	8.3%
2	RSA	3	12.5%
3	RSK without polyps	5	20.8%
4	RSK with polyps	5	20.8%
5	Isolated RSK	9	37.5%

Desc: PS: Physical Status; RSA: Acute Rhinosinusitis; RSK: Chronic Rhinosinusitis

Looking at the Table 1, the results of the demographic description of patients based on gender showed that there were 8 male patients (33.3%) and 16 female patients (66.7%). The demographic description of patients based on age showed that 16 (66.67%) were young adults (18-40 years old), 2 (8.3%) were aged 41-50 years, and 3 (12.5%) were aged >50 years. Based on ASA PS, 4 patients (16.7%) were ASA PS 1 and 20 patients (83.3%) were ASA PS 2. Based on diagnosis, 2 patients (8.3%) were diagnosed with Barosinusitis, 3 patients or 12.5% were diagnosed with RSA, 5 patients or 20.8% were diagnosed with RSK without polyps, 5 patients or 20.8% were diagnosed with RSK with polyps, and 9 patients or 37.5% were diagnosed with isolated RSK.

3.2. Blood Pressure Differences

3.2.1. Normality test

Normality testing is a test to determine the distribution of research data, namely whether it is normally distributed or not. The test is carried out using the Shapiro-Wilk test on samples of less than 50. The test results in table 2 below show that some research data have a significance of less than 0.05 ($p < 0.05$), indicating that the data are not normally distributed, while other research data have a significance of more than 0.05 ($p > 0.05$), indicating that the data are normally distributed. Thus, further testing is carried out using nonparametric tests.

Table 2. P-values in Data Normality Tests

Time (Minutes)	TDS		TDD		MAP		Pulse	
	DEX	PRO	DEX	PRO	DEX	PRO	DEX	PRO
Pre Op	0,989*	0,139*	0,076*	0,446*	0,150*	0,479*	0,605*	0,390*
0	0,157*	0,174*	0,605*	0,764*	0,813*	0,648*	0,064*	0,069*
5	0,596*	0,079*	0,998*	0,978*	0,594*	0,965*	0,096*	0,111*
10	0,193*	0,372*	0,433*	0,135*	0,201*	0,648*	0,031	0,190*
15	0,202*	0,410*	0,099*	0,501*	0,162*	0,864*	0,089*	0,236*
20	0,190*	0,306*	0,042	0,135*	0,220*	0,285*	0,070*	0,642*
25	0,385*	0,269*	0,020	0,078*	0,116*	0,284*	0,058*	0,165*
30	0,071*	0,394*	0,084*	0,126*	0,350*	0,375*	0,432*	0,434*
35	0,002	0,682*	0,153*	0,045	0,547*	0,713*	0,964*	0,250*
40	0,000	0,022	0,595*	0,083*	0,483*	0,342*	0,955*	0,509*
45	0,001	0,207*	0,180*	0,138*	0,974*	0,243*	0,501*	0,486*
50	0,043	0,137*	0,044	0,191*	0,059*	0,156*	0,768*	0,735*
55	0,002	0,060*	0,354*	0,086*	0,098*	0,067*	0,913*	0,677*
60	0,006	0,335*	0,015	0,333*	0,281*	0,195*	0,998*	0,333*
65	0,285*	0,096*	0,153*	0,362*	0,433*	0,674*	0,345*	0,696*
70	0,057*	0,028	0,092*	0,041	0,021	0,173*	0,824*	0,786*
75	0,018	0,007	0,030	0,131*	0,455*	0,294*	0,940*	0,624*
80	0,245*	0,050*	0,495*	0,011	0,589*	0,553*	0,632*	0,819*

Note: Testing was conducted using the Shapiro-Wilk test, *p >0.05 Data is normally distributed

3.2.2. Results of systolic blood pressure comparison tests

A comparison test between patients with DEX and patients with PRO was performed using the Mann-Whitney test. TDS observations conducted on patients with an observation period of 5 minutes showed significant results between groups ($p < 0.05$) at observation times of 25, 30, 40, 45, 50, 65, 70, 75, and 80 minutes.

Table 3. TDS Observation Results

Time (Minutes)	Groups		All Samples Median (min-max)	p
	DEX (n=12) Median (min-max)	PRO (n=12) Median (min-max)		
0	130 (102 - 140)	130 (105-140)	130 (102-140)	0,755
5	120 (97 - 135)	122.5 (95-130)	120 (95-135)	0,977
10	112.5 (96 - 130)	115 (92-128)	115 (92-130)	0,630
15	108.5 (93 - 128)	110 (90-125)	110 (90-128)	0.478
20	104 (92 - 114)	107.5 (92-118)	105 (92-118)	0.078
25	102 (94 - 108)	106.5 (95-115)	103.5 (94-115)	0.020*
30	100 (92 - 106)	101.5 (93-110)	100 (92-110)	0.039*
35	98 (90 - 100)	100 (92-108)	98.5 (90-108)	0.060
40	98 (90 - 98)	99 (90-104)	98 (90-104)	0.012*
45	96 (88 - 98)	98 (90-102)	96 (88-102)	0.020*
50	95 (90 - 97)	98 (90-102)	96 (90-102)	0.004*
55	95.5 (89 - 97)	98 (91-100)	96 (89-100)	0.068
60	95.5 (88 - 98)	98 (92-100)	96 (88-100)	0.052
65	94.5 (90 - 98)	98.5 (91-101)	96.5 (90-101)	0.012*
70	96 (90 - 98)	98.5 (90-102)	98 (90-102)	0.006*
75	96.5 (92 - 98)	100 (91-104)	98 (91-104)	0.001*
80	97 (94 - 100)	101 (90-105)	98 (90-105)	0.007*

The TDS description results in the DEX group showed a decrease from the 5th minute to the 70th minute, then a slight increase at the 75th minute and a decrease again at the 80th minute. Furthermore, in PRO patients, there was a decrease from the 5th minute to the 35th minute, followed by a slight increase at the 40th minute and a decline again at the 45th minute, then an increase again until the 60th minute and a constant decrease until the 80th minute. Further observation showed that the median TDS in DEX patients was higher before surgery, at minutes 0, 10, 20, and 30, while the median in PRO patients was higher at other observation times.

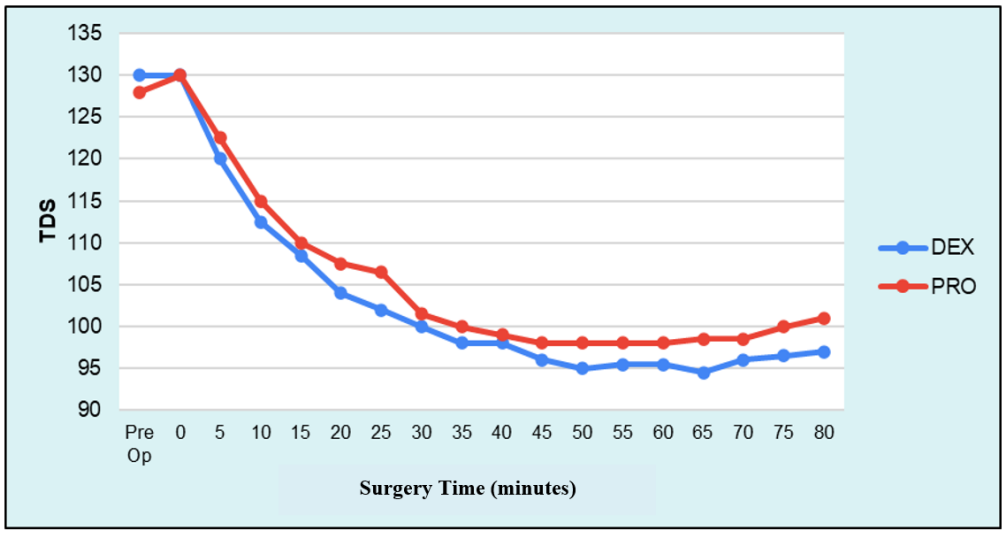

Figure 1. Average TDS based on time

3.2.3. Results of diastolic blood pressure comparison tests

A comparison test between patients with DEX and patients with PRO was performed using the Mann-Whitney test. TDD observations conducted on patients with an observation period of 5 minutes showed significant differences between groups ($p < 0.05$) at the 60th, 70th, 75th, and 80th minutes of observation.

Table 4. TDD Observation Results

Time	Groups		Total Median (min-max)	p
	DEX (n=12) Median (min-max)	PRO (n=12) Median (min-max)		
0	79 (65 - 95)	79 (65-95)	79 (65-95)	0.713
5	74.5 (61 - 90)	72.5 (60-90)	73.5 (60-90)	0.799
10	69 (59 - 85)	67.5 (58-85)	69 (58-85)	0.887
15	65.5 (59 - 85)	69 (58-80)	67 (58-85)	0.443
20	63 (58 - 80)	65 (60-80)	64.5 (58-80)	0.266
25	62 (57 - 78)	66 (60-86)	63.5 (57-86)	0.060
30	60 (56 - 70)	61.5 (58-68)	60 (56-70)	0.266
35	59 (55 - 67)	60.5 (58-65)	60 (55-67)	0.160
40	58 (54 - 62)	60 (57-62)	58 (54-62)	0.089
45	57 (54 - 60)	58 (55-61)	58 (54-61)	0.291
50	57 (54 - 58)	58 (55-60)	57 (54-60)	0.178
55	56 (54 - 58)	57.5 (55-60)	56 (54-60)	0.178
60	56 (55 - 58)	57.5 (55-60)	56 (55-60)	0.024*
65	56 (54 - 58)	58 (55-62)	56.5 (54-62)	0.060
70	56 (55 - 60)	58 (55-65)	58 (55-65)	0.012*
75	57 (56 - 61)	61.5 (58-66)	59 (56-66)	0.000*
80	59.5 (55 - 62)	61 (60-68)	60 (55-68)	0.006*

Note: Using the Mann-Whitney test * Significant ($p < 0.05$)

The TDD results in DEX patients showed a decrease from pre-surgery to 35 minutes into surgery, followed by fluctuations until the 80th minute. Similarly, PRO patients showed a decrease from pre-surgery to 35 minutes into surgery, followed by fluctuations until the 80th minute.

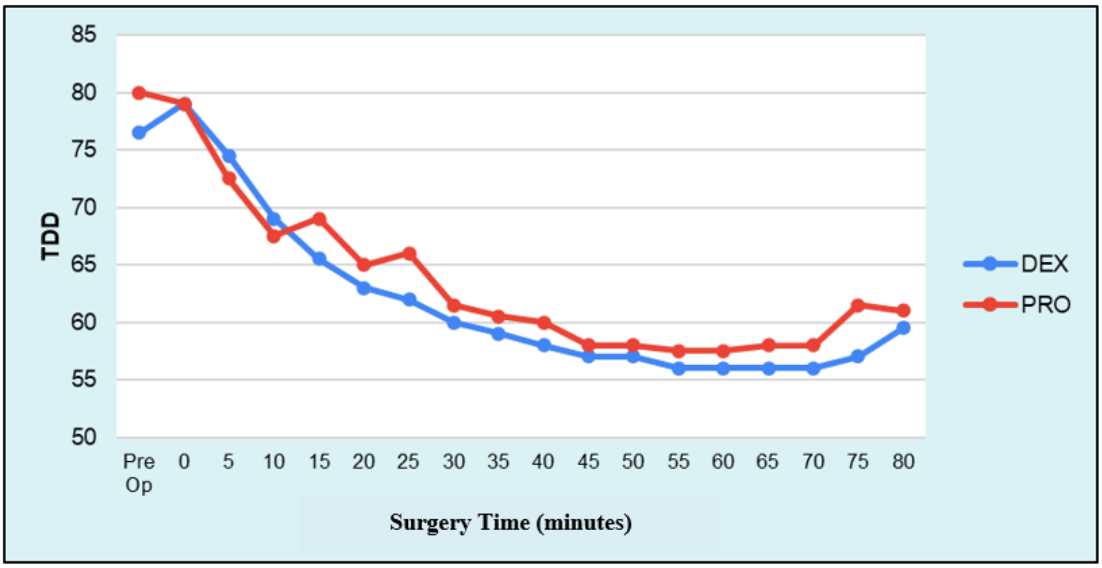

Figure 2. Average TDD based on time

Further observation showed that the median TDD in DEX patients was higher before surgery, at 0, 5, and 10 minutes, while the median in PRO patients was higher at other observation times.

3.2.4. Results of Mean Arterial Pressure (MAP) Comparison Test

A comparison test between patients with DEX and patients with PRO was performed using the Mann-Whitney test. MAP observations conducted on patients with an observation period of 5 minutes showed significant differences between groups ($p < 0.05$) at the 50th, 60th, 65th, 70th, 75th, and 80th minutes of observation.

Table 5. MAP Observation Results

Time (Minutes)	Groups		Total Median (min-max)	p
	DEX (n=12) Median (min-max)	PRO (n=12) Median (min-max)		
0	97 (78 - 110)	97.5 (78-110)	97 (78-110)	0.755
5	87 (73 - 105)	89 (72-103)	87.5 (72-105)	0.887
10	83.5 (71 - 98)	82 (69-99)	82.5 (69-99)	0.713
15	79 (70 - 99)	82.5 (69-95)	81.5 (69-99)	0.319
20	76.5 (69 - 91)	78 (71-92)	77.5 (69-92)	0.128
25	75.5 (69 - 88)	80 (73-96)	76.5 (69-96)	0.052
30	73 (68 - 82)	74.5 (70-82)	73 (68-82)	0.178
35	72 (67 - 78)	74 (69-79)	73 (67-79)	0.198
40	71 (67 - 74)	73 (68-76)	72 (67-76)	0.068
45	69.5 (66 - 73)	71.5 (67-74)	71 (66-74)	0.089
50	69.5 (66 - 71)	71 (67-73)	70 (66-73)	0.045*
55	69 (66 - 71)	70 (68-73)	69 (66-73)	0.178
60	69 (66 - 71)	70 (68-73)	69 (66-73)	0.039*
65	69 (67 - 71)	70.5 (68-75)	70 (67-75)	0.020*
70	69 (68 - 71)	72 (69-77)	71 (68-77)	0.002*
75	70.5 (68 - 73)	74.5 (70-78)	72.5 (68-78)	0.000*
80	72 (68 - 74)	75 (70-80)	73 (68-80)	0.003*

Note: Using the Mann-Whitney test * Significant ($p < 0.05$)

The MAP description results in DEX patients showed a decrease from pre-surgery to 35 minutes into surgery, then fluctuated until the 80th minute. Similarly, in PRO patients, there was a decrease from pre-operatively until 35 minutes into the surgery, followed by fluctuations until the 80th minute. Further observation showed that the median MAP in DEX patients was higher before the surgery, at 0, 5, and 10 minutes, while the median in PRO patients was higher at other observation times.

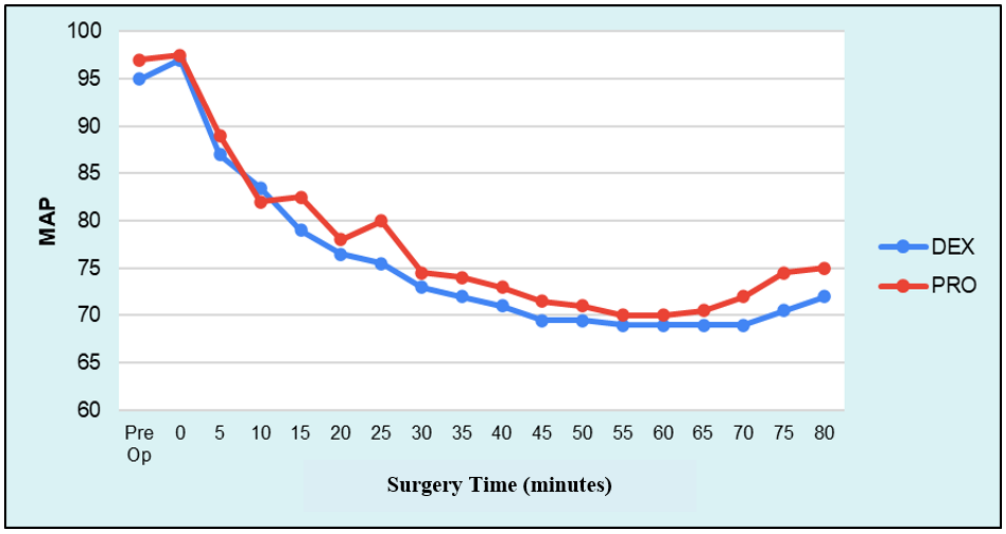

Figure 3. Average MAP based on time

3.2.5. Results of pulse rate comparison tests

A comparison test between patients with DEX and patients with PRO was performed using the Mann-Whitney test. Pulse observations conducted on patients over a 5-minute observation period showed a significant comparison between groups ($p < 0.05$) at the 30th to 80th minute observation periods.

Table 6. Results of Pulse Rate Observations

Time (Minutes)	Groups		Total Median (min-max)	p
	DEX (n=12) Median (min-max)	PRO (n=12) Median (min-max)		
0	95 (63 - 120)	98 (76-110)	95 (63-120)	0.143
5	90 (58 - 110)	97 (75-108)	93.5 (58-110)	0.101
10	88 (56 - 105)	95 (70-105)	89.5 (56-105)	0.128
15	85 (57 - 100)	93.5 (71-103)	85.5 (57-103)	0.128
20	82.5 (58 - 98)	91 (74-110)	85 (58-110)	0.143
25	80 (58 - 95)	89 (74-98)	82 (58-98)	0.068
30	78 (60 - 95)	89 (68-100)	80 (60-100)	0.010*
35	76 (58 - 90)	84.5 (66-99)	77.5 (58-99)	0.024*
40	73.5 (58 - 87)	83 (70-96)	78 (58-96)	0.045*
45	75 (57 - 84)	80 (68-97)	77.5 (57-97)	0.045*
50	73 (56 - 82)	81.5 (68-98)	76 (56-98)	0.017*
55	71 (55 - 84)	81 (65-95)	76.5 (55-95)	0.020*
60	72 (55 - 88)	79 (66-98)	78 (55-98)	0.039*
65	72.5 (56 - 80)	79 (65-100)	77 (56-100)	0.020*
70	71 (56 - 82)	80 (66-98)	74.5 (56-98)	0.010*
75	69 (58 - 82)	81 (65-97)	74 (58-97)	0.006*
80	72 (58 - 84)	81.5 (64-98)	73.5 (58-98)	0.010*

Note: Using the Mann-Whitney test * Significant ($p < 0.05$)

The pulse rate description results in DEX patients showed a gradual decrease from minute 0 to 80 minutes into the surgery. Furthermore, PRO patients showed the same condition, namely a gradual decrease from minute 0 to 80 minutes into the surgery. Further observation showed that the median pulse rate in DEX patients was low throughout the observation period compared to PRO patients.

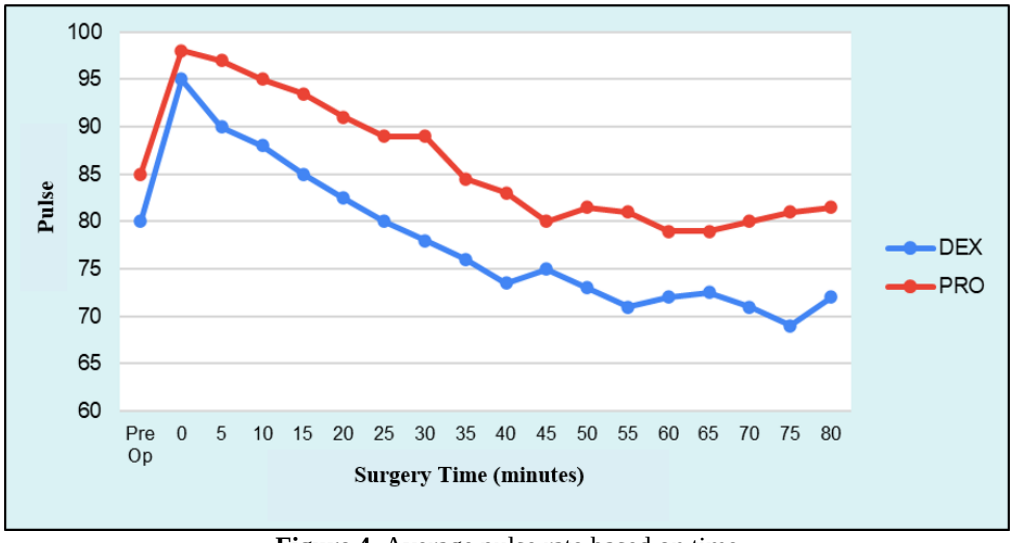

Figure 4. Average pulse rate based on time

3.2.6. Difference in Onset of Achieved Controlled Hypotension

Controlled hypotension can be achieved if either the patient's blood pressure or MAP is reduced by 20-30% from the initial value. The results of the examination of 24 samples based on the time taken to reach the hypotension target were obtained in the dexmedetomidine group with a median of 20 minutes and in the propofol group with a median of 30 minutes. The significance test yielded a significance value of 0.671 ($p > 0.05$), indicating no significant difference in the time to reach the target between the DEX and PRO groups.

Table 7. Observation of the Onset of Hypotension and Duration of Surgery

Variables	Group		Total	p
	DEX (n-12) Median (min-max)	PRO (n=12) Median (min-max)		
Onset of Controlled Hypotension	20 (5-40)	30 (5-45)	22.5 (5-45)	0.671
Duration of Surgery	105 (80-120)	102.5 (85-120)	105 (80-120)	0.478
Notes: min: minimum, max: maximum; Significance $p<0.05$				

3.2.7. Differences in Surgery Field of View Visibility

Another objective of this study was to analyse the differences in the visibility of the surgical field between the propofol group and the dexmedetomidine group. The assessment used the Boezaart scaling score, with a minimum value of 0 and a max value of 5.

Table 8. Average Visibility of the Field of View during Surgery

Variable	Group		p
	DEX Mean ± SD	PRO Mean ± SD	
Field of View Visibility	1.83 ± 0.58	2.00 ± 0.74	0.544
Notes: SD: standard deviation; Significance $p < 0.05$			

The results of the description of field of vision visibility in the dexmedetomidine group obtained an average of 1.83 and in the propofol group obtained an average of 2.00. The test results showed a significance value of 0.544 ($p > 0.05$), indicating that there was no significant difference in the field of vision of patients between the dexmedetomidine group and the propofol group.

DISCUSSIONS

4.1. Demographics

FESS is the definitive treatment for acute and chronic rhinosinusitis, tumours and fungal sinusitis. In this study, various cases undergoing FESS surgery were found. The finding of only two cases of barosinusitis (8.3%) out of 24 FESS samples observed is consistent with global literature evidence regarding the epidemiological characteristics of barosinusitis as a rare case. A systematic review conducted by Chen et al. [16], which analysed 27 studies with 232 cases of barosinusitis from 1967 to 2020, confirmed that although the prevalence of barosinusitis is quite high in at-risk populations (19.5-25% in pilots and up to 34% in divers), only a small proportion ultimately require surgical intervention, namely less than 5% of all cases [16].

Acute rhinosinusitis (ARS) was found in 12.5% of 24 FESS samples, consistent with global literature that records recurrent acute rhinosinusitis as an indication for surgery with a range of 10–15% in international referral centres. These findings confirm that ARS accounts for approximately 10–15% of all indications for FESS at the global level [17]. In this study, cases of RSK with and without polyps were found to have the same distribution, namely 5 people each (20.8%). This data was found to be lower than the findings in the United States, China, Italy, and other countries in the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) 2020, which stated that chronic rhinosinusitis (CRS) with nasal polyps reached around 60–70% [18,19], whereas in RSK without nasal polyps, it was found to reach 25–40% in patients undergoing FESS according to Asian and European surveys [20]. Meanwhile, the isolated RSK ratio (sphenoid isolated) in this investigation was found to be the most common case with a total of 9 cases (37.5%), far exceeding the data found in large cohorts, which was 1–3% [21], possibly due to Dr Soetomo General Hospital is a referral centre [22].

This study found that the distribution of patients based on gender was higher in women at 66.67% (16 patients) than in men, and that the age group undergoing FESS surgery was predominantly young adults aged 18-40 years. A prospective study in India involving 75 FESS patients showed a predominance of females at 64% and a peak incidence in the 20-30 age group (64%) [23]. A cohort analysis of FESS revisions in the United States from 2015 to 2021 with a total of 682 cases found that 56.9% were women with an average age of 48.6 ± 16.7 years [24]. Meanwhile, in Indonesia, research conducted by Irfandy [25] recorded that 52.2% of men with the highest number of patients were aged 41-60 years [25], a retrospective study conducted by Khabiburrokhman and Sutikno at Dr. Soetomo General Hospital from 2017 to 2020 found that the ratio of males to females was equal at 50%, with adults

dominating (93.48%). [22].

Estrogen and reproductive hormones are known to modulate inflammatory responses, increasing the susceptibility of sinus mucosa to chronic inflammation. Women have a more responsive immune system, putting them at greater risk of experiencing severe RSK symptoms that necessitate surgical intervention [26]. Sociologically, women are more likely to report symptoms and seek medical treatment than men. This affects diagnosis rates and referrals to FESS, resulting in a higher proportion of women [27]. Incidence of RSK without polyps and RSK with polyps has increased since the third decade, with peak diagnosis often occurring between the ages of 20 and 40 due to the accumulation of inflammatory risk factors and lifestyle factors [28]. In addition, young adults are more frequently exposed to air pollutants, work stress, and lifestyle factors such as smoking or air conditioner (AC) use, which exacerbate RSK to the point of requiring FESS [29].

4.2. Achievement of Controlled Hypotension

Controlled hypotension can be achieved if either the patient's blood pressure or MAP is reduced by 20-30% from the initial value. As a result, TDS reaches around 90-100 mmHg or TDD reaches 55-60 or MAP decreases to 60–70 mmHg [1]. In this study, both the dexmedetomidine and propofol groups were found to be equally effective in reducing TDS, TDD and MAP to achieve controlled hypotension targets. However, dexmedetomidine was found to have a lower median value and was more stable in reducing blood pressure than propofol. There were meaningful differences in the median values for SBP measurements from 25 minutes until the end of surgery, and in the median values for DBP and MAP measurements from 20 minutes until the end of surgery.

To date, there have been no studies in Indonesia comparing dexmedetomidine versus propofol for the purpose of controlled hypotension, especially in FESS surgery. However, there are studies conducted in other countries that are consistent with the current study. Divakar et al. [30] also comparing dexmedetomidine with propofol in 100 elective surgery patients, dexmedetomidine was found to provide superior haemodynamic stability. This study found that dexmedetomidine significantly reduced haemodynamic variability compared to propofol, with significant reductions in pulse rate ($p<0.001$), TDS ($p=0.075$), TDD ($p<0.001$), and MAP ($p<0.001$). Further, Divakar explained that dexmedetomidine showed a more consistent and stable decline pattern throughout the 12-hour observation period without the sharp fluctuations observed in the propofol group [30].

This prospective randomised controlled trial involving 70 patients undergoing laparoscopic cholecystectomy showed significant differences in haemodynamic patterns between dexmedetomidine (0.5 µg/kg/hour) and propofol (75 µg/kg/minute). Dexmedetomidine was shown to provide superior TDS stability with a consistent reduction in haemodynamic variability throughout the entire surgical phase ($p < 0.001$), while propofol exhibited greater fluctuations, particularly between minutes 25 and 35. This 25-35 minute period is a critical phase where intensive surgical manipulation occurs simultaneously with the effects of pneumoperitoneum, so propofol, with its different mechanism of action, produces a less stable haemodynamic response compared to dexmedetomidine, which acts through central α2-adrenergic receptors and provides a sustained sympatholytic effect [31].

Joe et al. [32], conducted research on patients undergoing spinal anaesthesia. Administration of dexmedetomidine at a loading dose of 0.6 µg/kg for 10 minutes followed by an infusion of 0.3 µg/kg/hour resulted in a biphasic TDS decrease pattern, namely a significant decrease in TDS during the first 10–20 minutes due to the sympatholytic effect. then at 30 minutes, TDS returned to near baseline values before falling again at 40 minutes; this pattern reflects the ability of dexmedetomidine to counteract spinal sympathetic blockade with central α2-agonist effects that delay the peak of hypotension and increase parasympathetic activity, thereby reducing pressure variability and maintaining cardiovascular stability throughout the procedure. In contrast, propofol caused an earlier and more consistent decrease in TDS without an initial recovery phase, but sharper fluctuations occurred when intense surgical stimuli were applied, showing significant differences ($p < 0.001$) compared to dexmedetomidine at 20 and 40 minutes [32].

In a double-blind, controlled randomised trial in the emergency department involving 114 patients, administration of dexmedetomidine 0.4 µg/kg prior to intubation was shown to significantly reduce haemodynamic fluctuations compared with propofol 1–1.5 mg/kg/hour. The propofol group showed a spike in TDS, TDD and MAP immediately after intubation and a greater increase in heart rate in the first 5–15 minutes, whereas dexmedetomidine, through central α2 receptor agonism, suppressed the release of noradrenaline, thereby dampening the sympathetic response and resulting in more homogeneous and stable haemodynamic control. these findings confirm the clinical advantage of dexmedetomidine in preventing acute blood pressure fluctuations during emergency intubation and reducing the risk of post-intubation cardiovascular complications [33].

In a randomised clinical trial involving 60 patients who had undergone major surgery and were receiving treatment in the ICU, patients were divided into two groups: the dexmedetomidine group (loading dose of 1 µg/kg over 10 minutes followed by an infusion of 0.2–0.7 µg/kg/hour) and the propofol group (titrated infusion of 25–75 µg/kg/minute). The results showed that TDS and MAP were consistently lower in the dexmedetomidine group than in the propofol group, with a significance level of $p < 0.05$. Propofol caused a more rapid decrease in TDS in the first 30 minutes after infusion, whereas in the dexmedetomidine group, TDS initially approached baseline values at 30 minutes before gradually decreasing again, illustrating a more controlled and stable haemodynamic effect through central α2-adrenergic receptor agonism [34].

In a prospective randomised study by Gupta et al. [35] involving 80 patients undergoing FESS surgery, the dexmedetomidine group (loading dose of 1 µg/kg over 10 minutes followed by an infusion of 0.4–0.8 µg/kg/hour) showed consistently lower MAP and pulse rate throughout the procedure compared to the propofol group (100–200 µg/kg/minute) ($p < 0.05$), reflecting better haemodynamic control and suppression of the sympathetic response without an increase in the incidence of serious side effects [35].

4.3. Onset of Achieved Controlled Hypotension

The results of the examination of the 24 samples in this study based on the time taken to achieve the target hypotension showed a difference, namely a median of 20 minutes in the dexmedetomidine group and a median of 30 minutes in the propofol group. However, statistical testing did not reveal any significant differences ($p>0.05$). Although there are no studies that explicitly compare dexmedetomidine with propofol in terms of controlled hypotension, especially in FESS procedures, there are several studies that compare these two drugs in terms of the onset of controlled hypotension.

In the study by Saleh et al. [36], a comparison was made between dexmedetomidine, propofol, and nitroglycerin. It was found that in the dexmedetomidine group, a loading dose of 1 µg/kg over 10 minutes immediately after induction, followed by maintenance of 0.5 µg/kg/hour, resulted in achieving target hypotension between the 10th and 15th minutes post-loading dose. In contrast, the propofol group (with an infusion of 8 mg/kg/hour) achieved target hypotension more slowly as dose titration required 15-20 minutes longer than the dexmedetomidine group [36].

Gupta et al. [35] also observed a variance in the onset of achieving hypotension with dexmedetomidine following a loading dose of 1 µg/kg over 10 minutes, reaching the target MAP of 60-70 mmHg within 15 minutes of the initial loading dose administration, while the propofol group (infusion 100-200 µg/kg/minute) required continuous infusion rate adjustment for approximately 20 minutes to lower MAP to the same range. This difference indicates a faster and more stable onset of controlled hypotension with dexmedetomidine due to its central α_2-agonist effects, compared to the mechanism of action of propofol which necessitates a longer dose titration period to achieve the hypotension target [35].

4.4. Field of View Visibility

Operative field visibility was assessed using the Boezaart scaling score. In this study, the mean score in the dexmedetomidine group was lower (1.83) than in the propofol group (2.0). However, there was no statistically significant difference ($p > 0.05$).

In a prospective randomised study of 80 FESS patients [35], the quality of the surgical field was assessed using the Boezaart scaling score. The results showed that the distribution of scores 1, 2, and 3, reflecting a surgical field with minimal to moderate bleeding, occurred in balanced proportions in both groups (dexmedetomidine vs. propofol), with the majority of patients receiving scores of 2–3 in each study group. Statistical comparison revealed no significant difference between dexmedetomidine and propofol in terms of surgical field quality ($p > 0.05$), indicating that both agents are equally effective in creating optimal visualisation conditions during FESS [35].

In a prospective study by Bharathwaj and Kamath [37] on 80 ASA I–II patients undergoing FESS, surgical field visibility was assessed using the Boezaart scaling score, with scores of 2 and 3 dominating (87.5%) in the dexmedetomidine group, while 72.5% in the propofol group received a score of 2 and the remainder received a score of 3. Statistical analysis showed no significant difference in the quality of the surgical field between the two agents ($p > 0.05$), thus proving that dexmedetomidine and propofol are equally effective in ensuring optimal visibility during FESS [37].

CONCLUSION

The conclusion of this study shows that there is no significant difference between dexmedetomidine and propofol in terms of the onset of controlled hypotension and visibility of the surgical field during FESS surgery. Based on these findings, dexmedetomidine can be considered as one of the drug options in controlled hypotension methods. In addition, further research is recommended to assess the economic impact of using dexmedetomidine and propofol as controlled hypotension agents in FESS surgery, as well as research with more specific diagnoses to obtain more in-depth and relevant data.

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