Can Dexmedetomidine Influence Recovery Profiles from General Anesthesia in Nasal Surgery?

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Abstract

Objectives. Dexmedetomidine has sympatholytic, sedative, anesthetic, and analgesic effects, as well as vasoconstrictive effects, which may help prevent hypotension under general anesthesia. This meta-analysis aimed to perform a systematic review of the literature and investigate the effect of dexmedetomidine on perioperative morbidity following nasal surgery and its adverse effects.

Data Sources. MEDLINE, SCOPUS, and the Cochrane database.

Review Methods. Two authors independently searched the databases from their inception to March 2017. Studies were selected that compared perioperative dexmedetomidine administration (dexmedetomidine groups) with a placebo or remifentanil (control groups) with regard to intraoperative morbidity, including surgical time, bleeding amount, hypotension, and bradycardia during operation, and postoperative morbidity, such as emergence agitation, nausea and vomiting, and sedation after operation.

Results. Surgical time, intraoperative blood loss, dose of inhaled anesthetic gas, dose of fentanyl, postoperative pain, and incidence of emergence agitation were significantly lower in the dexmedetomidine group versus the placebo group. In contrast, there were no significant differences in intraoperative hemodynamic stability and postoperative residual sedation and nausea and vomiting between groups. Additionally, compared with remifentanil (a currently widely used agent), dexmedetomidine was superior in view of postoperative pain and intraoperative blood pressure control.

Conclusion. This meta-analysis shows that the systemic administration of dexmedetomidine can decrease surgical time, intraoperative blood loss, and doses of intraoperative inhaled anesthetic gas and fentanyl as compared with placebo. It can also decrease postoperative pain and incidence of the emergence agitation. Due to the small number of studies, further clinical trials are needed to confirm these results.

Keywords
dexmedetomidine, nasal surgery, morbidities, controlled hypotension, systematic review, meta-analysis
that perioperative morbidities are the most common complication of nasal surgery, it is important that clinicians follow effective practices for decreasing this discomfort. This review aims to assess the evidence on the efficacy of dexmedetomidine for improving the nasal surgery experience of patients.

**Materials and Methods**

**Search Strategy and Selection of Studies**

An electronic database search (MEDLINE, Scopus, Cochrane Register of Controlled Trials) with the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-analyses) was conducted with the goal of identifying all available studies prior to February 2017 related to administration of dexmedetomidine during nasal surgery. Two authors (H.S.L., S.H.H.) independently conducted the literature search using the search terms “septoplasty,” “rhinoplasty,” “endoscopic sinus surgery,” “nasal surgery,” “dexametomidine,” “general anesthesia,” “operative bleeding,” “surgical field,” “sedation,” and “pain.” Only studies written in English were selected. We complemented the keyword-based searches by the combinations of all possible keywords with hand screening of references listed in the retrieved articles. Two authors independently reviewed the articles to determine whether they met the requirements. In cases of disagreement, consensus was achieved by discussion. Institutional review board approval was not required due to the nature of this study.

Two independent literature reviewers screened all abstracts and titles for candidate studies and discarded studies that were not related to the intraoperative administration of dexmedetomidine. Full-text studies that were potentially relevant to the topic were obtained if a decision for inclusion could not be made from the abstract alone. Randomized controlled trials that met the following inclusion criteria were eligible for review: participants underwent nasal surgery (septoplasty, rhinoplasty, or endoscopic sinus surgery) and intraoperative administration of dexmedetomidine via a systemic route. Outcomes analyzed were surgical time, mean operative blood loss, surgical field score, dose of inhaled anesthetic gas, postoperative pain, the occurrence of postoperative nausea and vomiting (PONV; incidence or percentage of patients), intraoperative hypotension, intraoperative bradycardia, residual sedation in recovery room, and EA. These outcomes were compared preoperatively between the dexmedetomidine group, in which there was intravenous administration, and the control group. Remifentanil has been combined with an inhaled anesthetic for good surgical conditions, and this method is suggested to achieve controlled hypotension with the best benefit-to-risk ratio. Therefore, dexmedetomidine was compared with a placebo or remifentanil separately (Table 1). Studies were excluded if, in addition to nasal surgery, patients underwent procedures such as pharyngeal and otologic surgery or if multiple reports were based on the same trial data. In cases where there were missing or incomplete data, attempts were made to obtain further details directly from the authors. Studies were excluded from the analysis if outcomes of interest were not clearly reported with quantifiable data or if it was not possible to extract and calculate the appropriate data from the published results (Figure 1).

**Data Extraction and Risk of Bias Assessment**

Data from eligible studies were extracted with standardized forms and were independently checked by 2 reviewers. Among outcomes measured, EA is defined as a negative postoperative behavior during the recovery period from general anesthesia that presents as combative movements, excitement, thrashing, and disorientation. Level of agitation was measured with the Riker Sedation-Agitation Scale, with ranges from 1 to 7 and with higher scores meaning more excitation. EA was defined as any score >5. Extracted data for measurement of outcomes included the patient number, continuous measurements, incidence or percentage of adverse effects, and the P value recorded for the comparison between the intraoperative dexmedetomidine group and the control group. Although no one rating system supersedes the others and there can be variability even among rating systems, the Cochrane Risk of Bias Tool has been adopted as the recommended method throughout the Cochrane Collaboration since it was published in February 2008. The risk of bias for each study was evaluated with this tool (Table 2).

**Statistical Analysis**

A meta-analysis was performed with R statistical software (R Foundation for Statistical Computing, Vienna, Austria). When original data were expressed as continuous variables, meta-analysis was performed with the standardized mean difference (SMD). This method was used to calculate effect sizes because there was not a standardized scale across all studies for surgical time, mean operative blood loss, surgical field score, dose of fentanyl, dose of inhaled anesthetic gas, and postoperative pain. In all other cases, incidence analysis was performed with the relative risk. A funnel plot and Egger’s test were used simultaneously to detect publication bias and conducted if the number of studies analyzed was ≥3. Additionally, the Duval and Tweedie trim-and-fill method was used to adjust for missing data and to correct the overall effect size according to publication bias. Sensitivity analyses were performed to estimate the influence of each study on the overall meta-analysis results.

**Results**

Thirteen studies comprising 795 participants were reviewed in this study. The results of bias assessment and study characteristics are described in Table 1. Funnel plot and Egger’s test may have limited power to detect publication bias due to the small number of enrolled studies for individual outcomes.
Administration of Dexmedetomidine versus Control (Saline)

Surgical time (SMD = −0.32; 95% CI, −0.55 to −0.09; I² = 0%, test for funnel plot asymmetry [P = .35]), intraoperative blood loss (SMD = −1.02; 95% CI, −1.39 to −0.65; I² = 0%, test for funnel plot asymmetry [P = .80]), dose of inhaled anesthetic gas (SMD = −0.61; 95% CI, −1.03 to −0.19; I² = 0%, test for funnel plot asymmetry not applied), dose of fentanyl

Table 1. Studies Included in the Meta-analysis.a

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Sample Size, n</th>
<th>Comparison with Dexmedetomidine</th>
<th>Outcome Measures Analyzed</th>
<th>Risk of Bias of Randomized Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee (2013)16</td>
<td>66</td>
<td>Remifentanil</td>
<td>Surgical time, operative bleeding, surgical field, adverse effects (bradycardia, hypotension)</td>
<td>Low risk</td>
</tr>
<tr>
<td>Polat (2015)17</td>
<td>90</td>
<td>Saline, remifentanil</td>
<td>Postoperative pain score, adverse effects (EA, bradycardia, hypotension, sedation)</td>
<td>Low risk</td>
</tr>
<tr>
<td>Kavalci (2012)13</td>
<td>60</td>
<td>Remifentanil</td>
<td>Surgical time</td>
<td>Low risk</td>
</tr>
<tr>
<td>Gupta (2016)8</td>
<td>40</td>
<td>Saline</td>
<td>Operative bleeding, dose of inhalation gas, dose of fentanyl, postoperative pain score, adverse effects (bradycardia, hypotension, PONV)</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Kumari (2016)14</td>
<td>48</td>
<td>Saline</td>
<td>Operative bleeding</td>
<td>Low risk</td>
</tr>
<tr>
<td>Kaur (2016)9</td>
<td>52</td>
<td>Saline</td>
<td>Surgical time, dose of inhalation gas, dose of fentanyl</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Khurshid (2015)19</td>
<td>100</td>
<td>Saline</td>
<td>Adverse effects (EA, bradycardia, PONV, sedation)</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Ayoglu (2008)7</td>
<td>40</td>
<td>Saline</td>
<td>Surgical time, operative bleeding, dose of fentanyl</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Xu (2016)10</td>
<td>60</td>
<td>Saline</td>
<td>Surgical time, adverse effects (EA, bradycardia)</td>
<td>Low risk</td>
</tr>
<tr>
<td>Gupta (2016)11</td>
<td>50</td>
<td>Saline</td>
<td>Surgical time, dose of fentanyl</td>
<td>Unclear risk</td>
</tr>
<tr>
<td>Kim (2013)12</td>
<td>100</td>
<td>Saline</td>
<td>Surgical time</td>
<td>Low risk</td>
</tr>
<tr>
<td>Kim (2015)3</td>
<td>39</td>
<td>Remifentanil</td>
<td>Surgical time, operative bleeding, surgical field, postoperative pain score, adverse effects (PONV)</td>
<td>Low risk</td>
</tr>
<tr>
<td>Karabayirli (2017)15</td>
<td>50</td>
<td>Remifentanil</td>
<td>Surgical time, operative bleeding, surgical field, adverse effects (PONV, sedation)</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

Abbreviations: EA, emergence agitation; PONV, postoperative nausea and vomiting.

aAll studies were randomized controlled studies.

Figure 1. Diagram of study selection.
Table 2. Individual Randomized Controlled Trial Methodological Quality.a

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Random Sequence Generation</th>
<th>Allocation Concealment</th>
<th>Blinding of Participants and Personnel</th>
<th>Blinding of Outcome Assessment</th>
<th>Incomplete Outcome Data Addressed</th>
<th>Free of Selective Reporting</th>
<th>Free of Other Bias: Risk of Bias</th>
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<tr>
<td>Lee (2013)16</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Low risk</td>
</tr>
<tr>
<td>Gupta (2016)8</td>
<td>?</td>
<td>Yes</td>
<td>?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Unclear risk</td>
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<td>Kumari (2016)14</td>
<td>Yes</td>
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<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

*Yes indicates low risk of bias; no indicates high risk of bias; and the question mark indicates unclear risk of bias.

(SMD = −2.89; 95% CI, −4.44 to −1.33; I² = 99%, test for funnel plot asymmetry [P = .02]), and postoperative pain (SMD = −0.72; 95% CI, −1.12 to −0.31; I² = 0%, test for funnel plot asymmetry not applied) were significantly lower in the dexmedetomidine group than the control group (Figure 2).

The incidence of intraoperative hypotension (relative risk = 1.68; 95% CI, 0.52-5.44; I² = 0%, test for funnel plot asymmetry [P = .69]) and bradycardia (relative risk = 1.64; 95% CI, 0.31-8.65; I² = 0%, test for funnel plot asymmetry [P = .36]) showed no significant difference between groups. In the recovery room, EA (relative risk = 0.51; 95% CI, 0.38-0.70; I² = 0%, test for funnel plot asymmetry [P = .79]) occurred less frequently in the dexmedetomidine group than in the control group, but the residual sedation (relative risk = 1.52; 95% CI, 0.38-6.03; I² = 4.1%, test for funnel plot asymmetry [P = .15]) and PONV (relative risk = 0.87; 95% CI, 0.33-2.26; I² = 24.2%, test for funnel plot asymmetry [P = .20]) were similar in both groups (Figure 3). With the exception of the dose of fentanyl, there was no significant interstudy heterogeneity (I² < 50%) and publication bias (P > .05) in the overall outcomes that were evaluated from the comparison of the dexmedetomidine group with the saline group.

Administration of Dexmedetomidine versus Remifentanil

There were no significant differences in surgical time (SMD = −0.20; 95% CI, −0.47 to 0.07; I² = 0%, test for funnel plot asymmetry [P = .80]), intraoperative blood loss (SMD = −0.23; 95% CI, −1.05 to 0.58; I² = 78.3%, test for funnel plot asymmetry not applied), or surgical field score (SMD = 0.26; 95% CI, −0.06 to 0.58; I² = 0%, test for funnel plot asymmetry [P = .85]) between the dexmedetomidine and remifentanil groups. In contrast, postoperative pain (SMD = −1.84; 95% CI, −2.31 to −1.36; I² = 0%, test for funnel plot asymmetry not applied) was significantly lower in the dexmedetomidine group than the remifentanil group (Figure 4).

Intraoperatively, there was no significant difference in the incidence of bradycardia (relative risk = 0.50; 95% CI, 0.18-1.38; I² = 0%, test for funnel plot asymmetry not applied) between groups, but hypotension (relative risk = 0.56; 95% CI, 0.32-0.96; I² = 0%, test for funnel plot asymmetry not applied) occurred less frequently in the dexmedetomidine group than in the remifentanil group. The incidence of EA (relative risk = 6.00; 95% CI, 0.77-46.87; I² = 0%, test for funnel plot asymmetry not applied), residual sedation in the recovery room (relative risk = 1; 95% CI, 0.15-6.64; I² = 0%, test for funnel plot asymmetry not applied), and PONV in the recovery room (relative risk = 0.77; 95% CI, 0.32-1.83; I² = 0%, test for funnel plot asymmetry [P = .13]) was not significantly different between groups. Significant interstudy heterogeneity (I² > 50%) was found on intraoperative blood loss (Figure 5). No publication bias was found on surgical time, surgical field score, and incidence of PONV. However, the results about all outcomes except surgical time were based on the analysis of <3 studies and therefore should be interpreted with caution.

Sensitivity Analyses

Sensitivity analyses evaluated the differences in the pooled estimates by repeating the meta-analysis with a different study omitted each time. All results were consistent with the aforementioned outcomes.

Discussion

To date, there have been some investigations into the efficacy of dexmedetomidine with nasal surgery. A systematic...
review was conducted to pool data from these studies, and it concluded that dexmedetomidine decreased intraoperative blood loss and improved the quality of the operative field for endoscopic sinus surgery. However, there were significant methodologic problems in this systematic review. Snidvongs et al included 5 studies to maximize the numbers of studies without language restriction. Although 2 studies written in non-English were included to performed meta-analysis, they could not be adequately assessed in view of the outcomes and quality of studies due to language difficulties. Additionally, among the 3 studies published in English, 1 study evaluated efficacy under monitored anesthesia care (local anesthesia plus sedation without intubation), and 2 studies measured the effect under general anesthesia. The different types of anesthesia can affect the results of key outcomes and therefore interfere with accurate comparisons between the dexmedetomidine and control groups. Furthermore, dexmedetomidine has additional advantages in the clinical setting, such as

![Figure 2. Perioperative dexmedetomidine versus saline. Standardized mean difference (SMD) of surgery time, intraoperative bleeding, anesthetic gas, fentanyl, and postoperative pain score. seTE, standard error of treatment effect; TE, treatment effect by conducting one treatment versus another treatment. Horizontal line, 95% CI of the effect size; gray box (vertical mark), effect of each study; diamond, overall treatment effect; dotted line, combined treatment effect.](image)
a postoperative analgesic effect and an intraoperative sedative effect. However, some disadvantages of dexmedetomidine are its adverse hemodynamic effect, including bradycardia and hypotension, and a postoperative sedative effect, such as delayed awakening, although these are not common with low doses. In addition, the previous systematic review assessed the efficacy of dexmedetomidine only with regard to intraoperative bleeding.  

Figure 3. Perioperative dexmedetomidine versus saline. Relative risk of the incidence of hypotension, bradycardia, emergence agitation, postoperative nausea and vomiting (PONV), and residual sedation. seTE, standard error of treatment effect; TE, treatment effect by conducting one treatment versus another treatment. Horizontal line, 95% CI of the effect size; gray box (vertical mark), effect of each study; diamond, overall treatment effect; dotted line, combined treatment effect.
In this study, we included studies with narrow inclusion criteria (intraoperative systemic administration methods and dose). It has been recommended that a slow loading dose of dexmedetomidine—1 μg/kg during 10 minutes and continuous infusion at 0.3 to 0.7 μg/kg/h—would be safe for nasal surgery under general anesthesia. The studies adopting the recommended regimen were enrolled in this meta-analysis. We assessed the various effects for a comparison between the dexmedetomidine and control groups. Additionally, remifentanil, a short-acting μ-opioid receptor agonist, has been demonstrated to provide a bloodless operative field with the ability to lower heart rate, cardiac output, and blood pressure without additional potent hypotensive agents. Given this point, we performed 2 analyses—1 comparing dexmedetomidine with a placebo and 1 comparing it with remifentanil. Additionally, in the meta-analysis, measures of effect magnitude for indirect comparisons are essential to make judicious evaluations. Because different studies typically use different outcome measures despite concentrating on the same concept, the simple approach to computing an absolute measure, the weighted mean difference, cannot address this problem. However, the formula for SMD adjusts the intervention-versus-placebo differences for the scale and precision of measurement and the size of the population sample used. This is why SMD was applied for continuous variables in this study.

Our results showed that intraoperative blood loss was significantly lower in the dexmedetomidine group as compared with the placebo group. Intraoperative hemorrhage control is one of the most important factors in improving the surgical field for successful operation. Previous studies demonstrated that peripheral vasoconstrictive effect as well as hemodynamic control with dexmedetomidine decreases intraoperative bleeding and enables better visibility of the surgical field, and our results are consistent with these findings. Additionally, surgical time was significantly decreased in the dexmedetomidine group. Intraoperative bleeding increases

![Figure 4. Perioperative dexmedetomidine versus remifentanil. Standardized mean difference (SMD) of surgery time, intraoperative bleeding, surgical field score, and postoperative pain score. seTE, standard error of treatment effect; TE, treatment effect by conducting one treatment versus another treatment. Horizontal line, 95% CI of the effect size; gray box (vertical mark), effect of each study; diamond, overall treatment effect; dotted line, combined treatment effect.]

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operative time due to the need for multiple pauses during the surgery for suctioning and packing.\textsuperscript{10,11} These facts could explain our results regarding surgical time and the relationship between operative bleeding and surgical time.

Nasal operative procedures are stressful and involve severe sympathetic stimulation.\textsuperscript{31} For preventing sympathetic discharge and achieving perioperative hemodynamic stability, opioid analgesics have been used with variable success.\textsuperscript{32} Although previous studies have shown that different opioids can achieve a clear surgical field, they also reported various side effects, such as nausea, vomiting, respiratory depression, pruritus, sinus bradycardia, and hypotension.\textsuperscript{11} An increased

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Figure 5. Perioperative dexmedetomidine versus remifentanil. Relative risk of the incidence of hypotension, bradycardia, emergence agitation, postoperative nausea and vomiting (PONV), and residual sedation. seTE, standard error of treatment effect; TE, treatment effect by conducting one treatment versus another treatment. Horizontal line, 95% CI of the effect size; gray box (vertical mark), effect of each study; diamond, overall treatment effect; dotted line, combined treatment effect.
amount of inhaled anesthetics can also be administrated to
decrease blood pressure. Nevertheless, using a high dose of
inhaled anesthetics is associated with hepatic or renal injury
and a prolonged recovery from anesthesia leading to delayed
patient discharge.9 Recently, dexmedetomidine was identified
to attenuate stress-induced hemodynamic responses and pro-
duce relatively stable hemodynamics throughout the surgery.

Bhagat et al and Gupta et al reported that the intraoperative
consumption of fentanyl and isoflurane was significantly less
in the dexmedetomidine group.11,31 In our study, similarly,
the amount of inhaled anesthetic gas and fentanyl was signifi-
cantly lower in the dexmedetomidine group as compared
with the placebo group. These results corroborate the effec-
tive sympatholytic and analgesic properties of dexmedeto-
midine during nasal surgery.32,33

Because postoperative pain of nasal surgery has become
one of the most important factors in patients’ postoperative
recovery, it needs to be managed more aggressively for
better results.34 Previous studies have suggested that post-
operative pain is mainly due to nociceptive stimulation
related to surgical trauma itself. However, surgical trauma
also leads to peripheral sensitization by the release of
inflammatory mediators from immune cells and nonneuro-
nal cells. The partial peripheral nociceptive stimulus can
directly cause a central sensitization.34 In a previous study,
dexmedetomidine administration prevented an increase in
inflammatory cytokine levels when compared with the con-
trol group. Dexmedetomidine also produces analgesic
effects by acting at the alpha-2 adrenoceptors within the
locus coeruleus and the spinal cord.8 Therefore, these
effects can prevent peripheral and central sensitization,
thereby attenuating the postoperative amplification of pain
sensation. In our study, postoperative pain was signifi-
cantly decreased in the dexmedetomidine group when compared
with the control group. This may explain why dexmedeto-
midine was effective in controlling postoperative pain.

EA is a phenomenon that occurs during recovery from
general anesthesia20 and is especially common after ear,
nose, and throat surgery where, in 1 study, 55.4% of
patients experienced EA. Agitation may be related to vari-
ous risks, including self-extubation or removal of catheters,
which can cause serious complications, such as hypoxia,
aspiration pneumonia, bleeding, and reoperation.15 Although
pain is not the only factor creating agitation, it is one of the
major factors that increases the severity and frequency of
agitation.36,37 In addition, it has been speculated that a
“sense of suffocation,” caused by procedures such as nasal
packing during anesthetic recovery, may provoke EA in
patients undergoing nasal surgery.12 In our study, we found
that intravenous administration of dexmedetomidine signifi-
cantly reduced EA when compared with placebo. These
effects may be due to the sedative and analgesic properties
of dexmedetomidine,10 which are consistent with the effects
on the postoperative pain.

Remifentanil is a highly selective μ-opioid agonist. It
has rapid onset and offset of action as well as controllable
cardiovascular effects and titratability. Intraoperative
remifentanil infusion decreases the incidence of EA in
patients after the operation. There have been some recent
studies comparing the effects of dexmedetomidine and remi-
fentanil for reduction of intra- and postoperative morbidity
regarding general anesthesia in adult patients.17 From a
meta-analysis based on these studies, both adjunctive agents
were effective at reducing the perioperative morbidity,
including intraoperative bleeding and surgical field, and
were safely administered without any serious complications
during or after the operation. There were also no differences
in the occurrence of bradycardia, EA, nausea, vomiting, or
residual sedation. However, in terms of postoperative pain
and incidence of hypotension, dexmedetomidine was signifi-
cantly superior to remifentanil. This result regarding the
pain would be related to the fact that remifentanil is associ-
ated with hyperalgesia.11 As can be seen from these results,
dexmedetomidine could be administered efficiently as an
adjuvant agent to patients under general anesthesia.

Nausea, vomiting, sedation, hypotension, and bradycardia
are commonly reported adverse effects of dexmedetomidine.
In this study, the incidence of perioperative adverse effects
was not significantly different between the dexmedetomi-
dine group and the placebo group. All studies enrolled in
our study adopted safe administration protocols. These facts
could explain our positive results regarding the adverse
effects.

This meta-analysis had 2 limitations. First, the results
were based a small sample size (13 trials with a total of 795
participants), weakening the evidence for the use of dexme-
detomidine on intra- and postoperative morbidities. In par-
cular, several of the outcomes analyzed were only able to
include <3 studies, which could make them interpreted with
caution. Second, although there would be significant risk of
publication bias for these studies regarding new application,
all the methods for possible detection of publication bias are
underpowered due to a small number of enrolled studies.
For this problem, we searched the relevant studies with the
combinations of all possible keywords and complemented
keyword-based searches with hand screening of references
in the retrieved articles to maximize the number of searched
studies.38,39 Another important mechanism for reducing the
impact of publication bias is to keep systematic reviews reg-
ularly updated. An analysis of unpublished studies within
Cochrane reviews found that 38% were eventually pub-
lished, but their earlier inclusion would have reduced time-
lag bias.40 In this study, this bias was minimized to conduct
the trial to update the list of the enrolled studies during this
analysis.

Based on our results, intraoperative administration of
dexmedetomidine could provide various positive effects
without significant side effects in patients undergoing nasal
surgery. In particular, compared with remifentanil, dexme-
detomidine performs equally or better in view of postopera-
tive pain and intraoperative blood pressure control.
However, considering the small number of studies to date,
 further clinical trials are needed to confirm the results of
this study.
Conclusion

This meta-analysis showed that the systemic administration of dexmedetomidine can decrease intraoperative bleeding and postoperative pain efficiently without adverse effects, such as nausea, vomiting, and respiratory depression. It can also decrease analgesic consumption. However, clinicians and patients should be aware that intraoperative bradycardia and hypotension are potential side effects of dexmedetomidine use. Caution is needed when applying these results to practice due to the small number of studies on dexmedetomidine to date.

Author Contributions

Ho Seok Lee, study conception and design, acquisition of data, analysis and interpretation of data, drafting the article and revisions, final approval of article; Ho Young Yoon, study conception and design, analysis and interpretation of data, drafting the article and revisions, final approval of article; Ho Jun Jin, acquisition of data, analysis and interpretation of data, drafting the article and revisions, final approval of article; Se Iwan Hwang, study conception and design, acquisition of data, analysis and interpretation of data, drafting the article and revisions, final approval of article.

Disclosures

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