Bleeding control in nasal surgery part II

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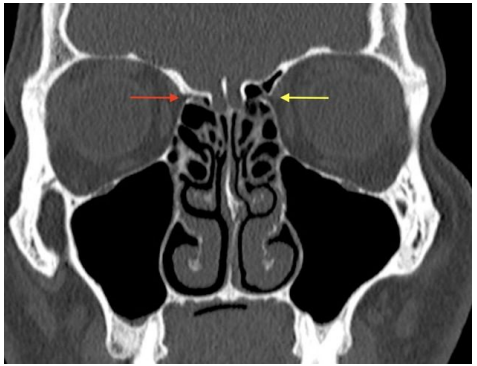
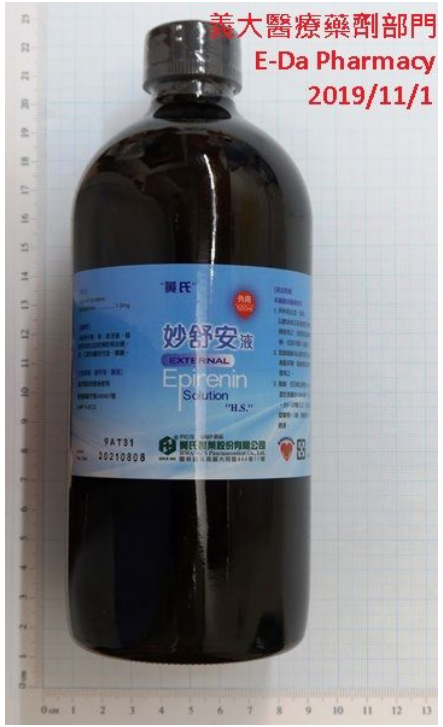


Outline

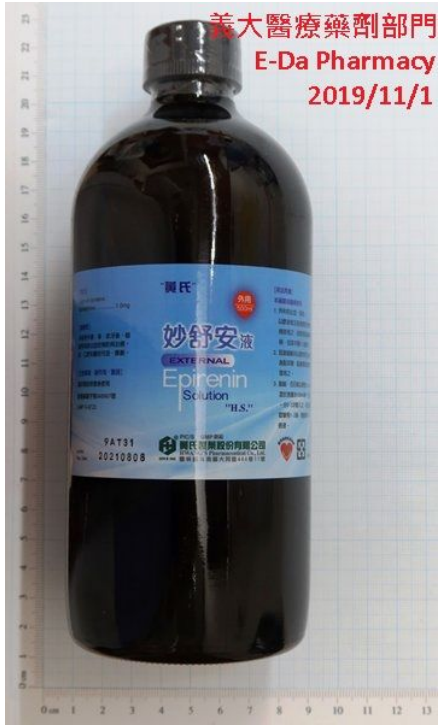
- 多少的Epinephrine濃度才是最適合鼻部手術(注射、浸潤)
- 到底要不要加麻醉藥物(注射、浸潤)
- 術中使用會不會增加手術風險(高血壓、心跳)



- 0.1%/ml(500ml/bot)1mg/ml/amp
- 每 1,000 單位的溶液中包含 1 單位的藥物。

→ 0.001g:1ml→ 1g:1000ml→ 1:1000

→1g epinephrine:1000ml 溶液



- 100ml solution + 400ml saline

→1:5000

- LIDOCAINE / EPINEPHRINE
- EPINEPHRINE-0.02mg/ml
- LIDOCAINE HCL -20mg/ml

- LIDOCAINE / EPINEPHRINE
- EPINEPHRINE-0.02mg/ml
- LIDOCAINE HCL -20mg/ml

→ 0.0002g:1ml → 1:50000(E)

→ 0.2g:1ml → 1:50(L)(2%)

藥理分類： **Local Anesthetic.**

用法用量： Lidocaine HCl 2% with adrenaline should NOT be given IV.

Recommended Dosages for Lidocaine HCl with Adrenaline 1:5000 (0.02 mg/mL) Solution for Various Anesthetic Procedures in The Average, Healthy, 70 kg Adult.

Procedure	Lidocaine HCl with Adrenaline 1:50,000		
	Conc.(%)	Vol.(mL)	Total Dose(mg)
Local infiltration	0.5	100	500
	1.0	50	500
	2.0	25	500
Brachial plexus block	1.0	20-40	200-400
	1.5	15-30	225-450
Other nerve blocks			
Intercostal	1.0	3-5/segment	30-50
Paravertebral	1.0	3-5/segment	30-50
Pudenda	1.0	10-20	100-200
stellate ganglion block			
Cervical	1.0	5-10	50-100
Lumbar	1.0	5-20	50-200
Epidural anesthesia*			
Thoracic	1.0	15-30	150-300
Lumbar	1.5	15-30	225-450
	2.0	10-25	200-500
Caudal	1.5	15-30	225-450
Epidural analgesia			
Lumbar	1.0	15-30	150-300
Caudal	1.0	15-30	150-300

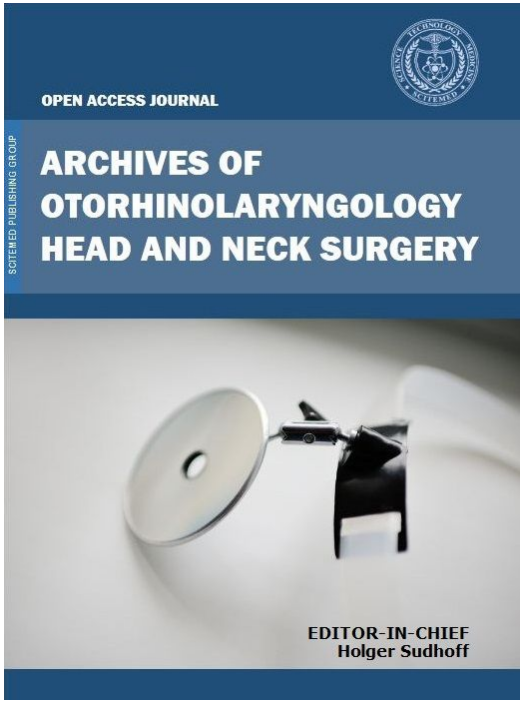
*Dosage determined by number of segments to be anesthetized (2-3 mL/segment).

The above suggested concentrations and volumes serve only as a guide. Other volumes and concentrations may be used provided the total maximum recommended dose is not exceeded.

For normal healthy adults, the individual maximum recommended dose of lidocaine HCl with epinephrine should not exceed 7 mg/kg (up to 500 mg).

- 多少的濃度才是最適合鼻部手術(注射、浸潤)
- 到底要不要加麻醉藥物(注射、浸潤)
- 術中使用會不會增加手術風險(高血壓、心跳)

Local Injection(2009)



The hemostatic and hemodynamic effects of epinephrine during endoscopic sinus surgery: a randomized clinical trial

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Affiliations + expand

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Local Injection(2009)

- **Objective:**

  To assess the hemodynamic and hemostatic effects of two different concentrations of epinephrine(1:100,000 and 1:200,000) in local anesthetic used during functional endoscopic sinus surgery (FESS).

Local Injection(2009)

- **Design:**
  Double-blind, randomized clinical trial.
- **Setting:**
  Tertiary referral center.
- **Patients:**
  - 140 patients undergoing FESS were randomly divided into two groups.

  - Group 1 received 2% lidocaine + 1:100,000 epinephrine

  - Group 2 received 2% lidocaine + 1:200,000 epinephrine.

Local Injection(2009)

- **Main Outcome Measures:**
  - Baseline and post-injection hemodynamic parameters were recorded at 1~5 mins

  - Patient demographics, extent of surgery, and the presence of polyps were recorded in both groups.

  - Hemodynamic and hemostatic parameters and intraoperative blood loss were compared.

Table 2. Patient Demographics and Baseline Data

Characteristic	Group (Dosage)[a] 1 (Lidocaine Hydrochloride, 2%, With 1:100 000 Epinephrine)	2 (Lidocaine Hydrochloride, 2%, With 1:200 000 Epinephrine)
Patients, No.	70	70
Age, mean ± SD, y	39.1 ± 11.1	41.1 ± 12.3
Male sex, No. (%)	35 (50)	34 (49)
Polyps, No. (%)	38 (54)	36 (51)
Bilateral surgery, No. (%)	49 (70)	49 (70)
Baseline parameter, mean ± SD		
HR, bpm	75.4 ± 18.7	77.4 ± 14.7
SBP, mm Hg	107.3 ± 17.5	102.2 ± 15.4
DBP, mm Hg	61.1 ± 11.2	59 ± 12.8
MAP, mm Hg	76.5.1 ± 11.8	73.4 ± 12.1

Abbreviations: bpm, beats per minute; DBP, diastolic blood pressure; HR, heart rate; MAP, mean arterial pressure; SBP, systolic blood pressure.
[a] $P > .05$.

Table 3. Mean (SD) Hemodynamic Parameters at Baseline and Postinjection of Study Drugs at 1-Minute Intervals

Group (Dosage)	Time, min: 0	1	2	3	4	5
1 (Lidocaine hydrochloride, 2%, with 1:100 000 epinephrine)						
HR, bpm	75.4 (18.7)	86.8 (18.2)[a]	82.3 (18.2)[b]	78.6 (18.0)	76.7 (18.9)	75.0 (17.1)
SBP, mm Hg	107.3 (17.5)	127.5 (27.0)[a]	128.0 (28.7)[a]	118.2 (26.5)[b]	110.2 (20.3)	104.8 (19.8)
DBP, mm Hg	61.1 (11.2)	72.7 (15.0)[a]	70.6 (14.5)[a]	65.5 (15.0)[b]	61.3 (14.1)	57.2 (13.1)
MAP, mm Hg	76.5 (11.8)	91.0 (17.6)[a]	89.7 (17.1)[a]	83 (17.1)[b]	77.6 (14.5)	73.1 (13.7)
2 (Lidocaine hydrochloride, 2%, with 1:200 000 epinephrine)						
HR, bpm	77.4 (14.7)	77.9 (14.5)	76.0 (14.0)	76.0 (13.9)	75.3 (13.4)	75.1 (13.5)
SBP, mm Hg	102.2 (15.4)	107.1 (15.8)	106.6 (15.6)	104.1 (15.8)	102.5 (16.9)	102.6 (17.3)
DBP, mm Hg	59.0 (12.8)	58.8 (10.7)	59.9 (10.0)	58.4 (10.7)	57.7 (9.8)	56.6 (10.7)
MAP, mm Hg	73.4 (12.1)	74.9 (11.3)	75.4 (11.1)	73.6 (11.5)	72.6 (11.1)	71.3 (11.9)

Abbreviations: bpm, beats per minute; DBP, diastolic blood pressure; HR, heart rate; MAP, mean arterial pressure; SBP, systolic blood pressure.
[a] $P < .001$ compared with baseline measurement.
[b] $P < .01$.

Table 4. Difference in the Mean Change Hemodynamic Parameters at 1, 2, and 5 Minutes Between the 2 Groups

	Mean Difference (95% CI)					
Variable	At 1 Minute	*P* Value	At 2 Minutes	*P* Value	At 5 Minutes	*P* Value
HR, bpm	10.18 (6.22 to 14.13)	<.001	7.40 (2.96 to 11.86)	<.001	1.06 (−2.85 to 4.97)	.59
SBP, mm Hg	17.46 (10.67 to 24.24)	<.001	18.77 (11.54 to 26.00)	<.001	−0.42 (−6.00 to 5.16)	.88
DBP, mm Hg	12.64 (9.01 to 16.27)	<.001	9.52 (6.06 to 12.98)	<.001	0.66 (−2.90 to 4.22)	.71
MAP, mm Hg	14.02 (9.80 to 18.23)	<.001	12.36 (8.23 to 16.49)	<.001	0.15 (−3.59 to 3.88)	.94

Abbreviations: bpm, beats per minute; CI, confidence interval; DBP, diastolic blood pressure; HR, heart rate; MAP, mean arterial pressure; SBP, systolic blood pressure.

Table 1. Quality of Surgical Field

Grade	Assessment
0	No bleeding, cadaveric conditions
1	Slight bleeding, no suctioning required
2	Slight bleeding, occasional suctioning required
3	Slight bleeding, frequent suctioning required. Bleeding threatens surgical field a few seconds after the suction is removed.
4	Moderate bleeding, frequent suctioning required, and bleeding that threatens surgical field directly after suction is removed
5	Severe bleeding, constant suctioning required. Bleeding appears faster than can be removed by the suction; surgical field severely threatened, and surgery usually not possible.

Local Injection(2009)

- **Results:**
- The increase was found to be significant ($P < 0.001$) in the first and second minutes after injection, and it decreased to baseline levels by the fifth minute.
- This fluctuation was not noted in Group 2 patients, who received 2% lidocaine with 1:200,000 epinephrine.
- Using a standardized scale to assess surgical bleeding, no statistical difference between the two groups was observed ($P > 0.05$).

Local Injection(2009)

- **Results:**
- Significant hemodynamic fluctuations were noted following injection of 2% lidocaine with 1:100,000 epinephrine (Group 1).
- Increases in heart rate, systolic, diastolic, and mean arterial blood pressure were observed in Group 1 patients.
- However, tese fluctuations normalize within five minutes.

Conclusion

- Submucosal injection of lidocaine, 2%, with 1:200 000 epinephrine during FESS does not lead to hemodynamic fluctuations or increased intraoperative bleeding compared with lidocaine, 2%, with 1:100 000 epinephrine.

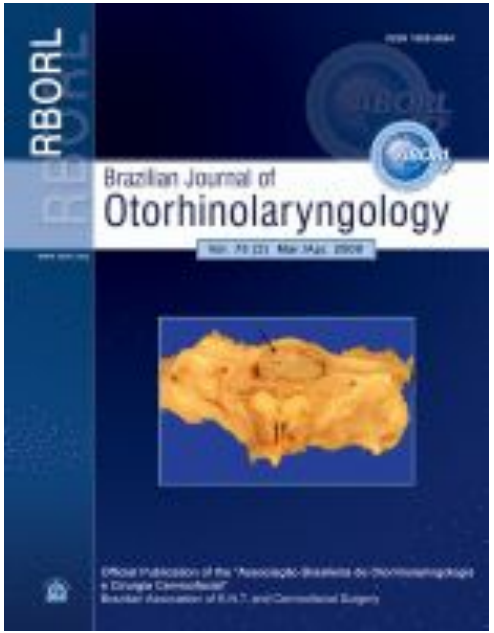
結論

- 在鼻竇手術中(FESS)，使用含 1:200,000 腎上腺素的 2% 利多卡因進行黏膜下注射，與使用含 1:100,000 腎上腺素的 2% 利多卡因相比，不會導致嚴重的血流動力學波動或增加術中出血量。

臨床應用

- 依照現行鼻竇手術 **局部注射麻醉 (injection)**施行方法，稀釋到 4倍是有研究證實安全且風險低的麻醉方式；稀釋2倍則會造成短暫的心血數值波動，五分鐘之 內會回到正常 。

Topical Infiltration(2009)

- 

Randomized Controlled Trial > Braz J Otorhinolaryngol. 2009 Mar-Apr;75(2):280-9.
doi: 10.1016/s1808-8694(15)30791-6.

Topical use of adrenaline in different concentrations for endoscopic sinus surgery

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Topical Infiltration(2009)

Aim:

To compare the efficacy of topical adrenaline solutions at different concentrations.

Study Design:

Prospective, double-blind, randomized trial.

Topical Infiltration(2009)

Patients and Methods:

- 49 patients undergoing endoscopic sinus surgery.
- Patients were divided into 3 groups, each receiving a different concentration of topical adrenaline (1:2,000, 1:10,000, and 1:50,000).
- Parameters compared: surgery duration, intraoperative bleeding, plasma catecholamine levels, hemodynamic changes, and heart rhythm changes.

Table 3. Statistical analysis of perioperative bleeding variables (in milliliters) for each group.

Group	N	Mean	D.P.	Median	Minimum	Maximum	p value[a]	Significant differences[b]
Adrenalin 1:2000	17	140,3	56,7	135	40	270	0,0001	
Adrenalin 1:10.000	16	336,9	20,40	315	85	750		1:2000 ≠ 1:10.000 1:2000 ≠ 1:50.000 1:10.000 ≠ 1:50.000
Adrenalin 1:50.000	16	425,8	25,58	334	100	1100		

SD: Standard deviation p value[a]: Kruskal-Wallis ANOVA for the three study groups.
Sig. dif.[b]: Tukey's multiple comparisons test at 5%.

Table 4. Distribution of the measured hemodynamic parameters as normal and abnormal values for each group.

Parameter	Values	Adrenalin 1:2000	Adrenalin 1:10.000	Adrenalin 1:50.000	Group Control	p value[a]	Significant differences[b]
HR	< 100 bpm	912 (99,2%)	915 (99,9%)	1013 (99,6%)	236 (99,6%)	0,45	None
		7 (0,8%)	1 (0,1%)	4 (0,4%)	1 (0,4%)		
		0	0	0	0		
SAP	< 140 mmHg	866 (94,2%)	857 (93,6%)	1012 (99,5%)	229 (96,6%)	< 0,0001	140~159 mmHg at 1:2 000 and 1:10 000 ≠ 1:50 000 and Control
		40 (4,3%)	48 (5,2%)	5 (0,5%)	8 (3,4%)		
		11 (1,3%)	10 (1,1%)	0	0		160~179 mmHg at 1:2 000 and 1:10 000 ≠ 1:50 000
		2 (0,2%)	1 (0,1%)	0	0		
DAP	< 90 mmHg	857 (93,3%)	868 (94,8%)	997 (98%)	235 (99,2%)	< 0,0001	90~99 mmHg at 1:2 000 and 1:10 000 ≠ 1:50 000 and Control
	90 ~ 99 mmHg	52 (5,7%)	45 (4,9%)	18 (1,8%)	1 (0,4%)		
	100 ~ 109 mmHg	8 (0,9%)	3 (0,3%)	2 (0,2%)	1 (0,4%)		
	> or equal to 110 mmHg	2 (0,1%)	0	0	0		

HR = Heart rate SAP = Systolic arterial pressure DAP = Diastolic arterial pressure
MAP = Mean Arterial Pressure p valuea: repeated measures ANOVA
Sig. dif.b: Bonferroni multiple comparisons

Table 5. Distribution of the measured hemodynamic parameters above normal values in each group in relation to operative time.

Parameter	Occurrences	Adrenalin concentration	First half of operative time	Second half of operative time	p value[a]	Significant differences[b]
HR (≥ 100 bpm)	4	1:2000	5	2	0,71	None
	7	1:10.000	1	-		
	1	1:50.000	1	3		
	1	Controle	1	-		
SAP (≥ 140 mmHg)	5	1:2000	12	41	0,042	Groups B and C had more occurrences in the second half compared to group A and the Control.
	53	1:10.000	18	41		
	59	1:50.000	2	3		
	8	Control	3	5		
DAP (≥ 90 mmHg)	20	Group B (1:2000)	21	41	< 0,05	Groups B and C had more occurrences in the second half compared to group A and the Control.
	62	Group C (1:10.000)	14	34		
	48	Group A (1:50.000)	12	8		
	2	Control	2	-		

HR = Heart rate SAP = Systolic arterial pressure DAP = Diastolic arterial pressure
MAP = Mean Arterial Pressure p valuea: repeated measures ANOVA
Sig. dif.b: Bonferroni multiple comparisons

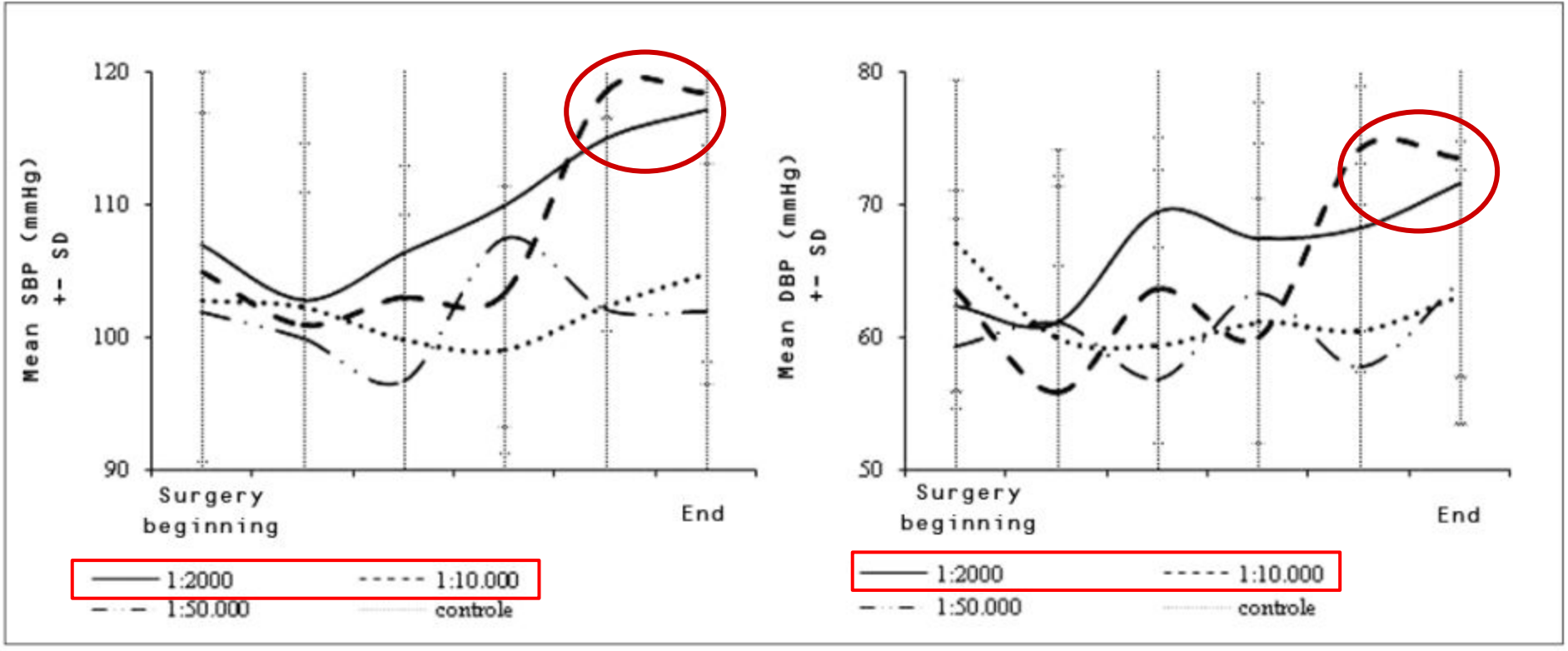


Chart 3. Variations in systolic blood pressure (SBP) and diastolic blood pressure (DBP) throughout the operation for each group. DP=Standard Deviation.

Topical Infiltration(2009)

Conclusion:

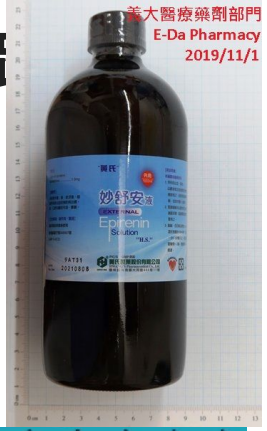
- Favor the use of topical adrenaline at 1:2,000 for superior hemostasis.
- Topical epinephrine at concentrations of 1:2,000 and 1:10,000 causes greater blood pressure fluctuations compared to 1:50,000.

結論

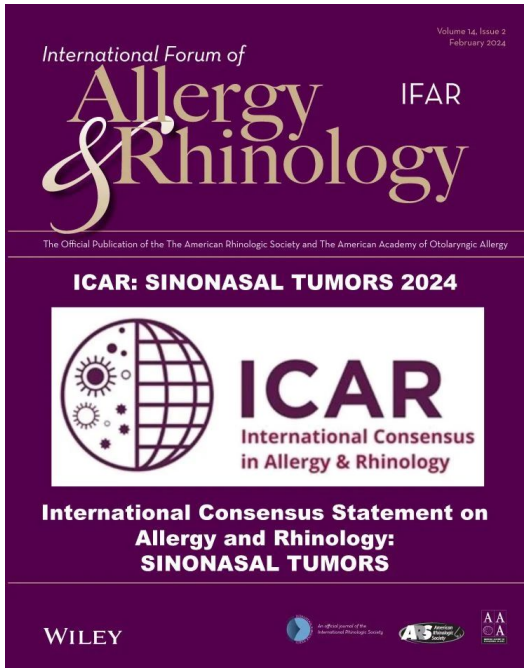
- 在2009年巴西耳鼻喉科醫學雜誌(2023 IF:1.7, Q2), 建議可以在鼻竇內視鏡手術中使用局部浸潤 1:2,000 腎上腺素，其在止血效果上具有明顯的優越性。
- 使用局部浸潤的腎上腺素，不管哪個濃度都會導致血壓上升，但心跳不會。

臨床應用

- 依照現行鼻竇手術 **局部浸潤麻醉 (infiltration)**施行方法，若是認為該手術出血量較大甚至需要更好的手術視野時，稀釋 2倍的狀況是被證實比 10倍跟50倍有效的，但要注意患者術中血壓上變化。



Topical Infiltration(2017)



Evaluating real-time effects of topical 1:1000 epinephrine in endoscopic sinus and skull-base surgery on hemodynamic parameters through intraoperative arterial line monitoring

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Potential conflict of interest: M.T.: MEDA Pharmaceuticals (speakers bureau), Entellus Medical, Intersect ENT (advisory board).
Presented orally at the ARS Meeting at the annual Combined Otolaryngology Spring Meetings (COSM) on April 26-29, 2017, in San Diego, CA.

Topical Infiltration(2017)

- **Background:**
- Topical 1:1000 epinephrine is commonly used in endoscopic sinus surgery and skull-base surgery for vasoconstriction.
- However, the real-time effects on cardiovascular changes due to systemic absorption have not been well studied.

Topical Infiltration(2017)

Methods:

- **26 patients** undergoing endoscopic transsphenoidal resection of a pituitary lesion were included in the study.
- After arterial line placement by anesthesiology, **6 coronoid pledgets** soaked in **1:1000 epinephrine** were placed into the bilateral nasal passages.

Topical Infiltration(2017)

Methods:

- Hemodynamic parameters, including **heart rate**, **blood pressure**, and **mean arterial pressure**, were measured at baseline, 30 seconds, and at minute increments up to 10 minutes.

TABLE 1. The mean HR, SBP, DBP and MAP at baseline, 3 minutes, and 5 minutes*

	Baseline	3 minutes	*p*	5 minutes	*p*
HR (bpm)	77 ± 11	78 ± 12	0.73	77 ± 10	0.94
SBP (mmHg)	109 ± 22	135 ± 44	0.006	124 ± 37	0.012
DBP (mmHg)	63 ± 16	69 ± 23	0.05	61 ± 16	0.65
MAP (mmHg)	78 ± 16	88 ± 28	0.013	82 ± 22	0.19

*Values are mean ± standard deviation. Paired sample 2-tail *t* test comparison was utilized to determine *p* value (<0.05 considered significant).
DBP = diastolic blood pressure; HR = heart rate; MAP = mean arterial pressure; SBP = systolic blood pressure.

TABLE 2. The mean changes over time compared to baseline of HR, SBP, DBP, and MAP at 30-second and 1-minute to 5-minute intervals*

	30 seconds	1 minute	2 minutes	3 minutes	4 minutes	5 minutes
ΔHR (bpm)	0 ± 1	2 ± 2	1 ± 2	1 ± 2	−1 ± 2	0 ± 2
ΔSBP (mmHg)	3 ± 2	12 ± 5	17 ± 6	25 ± 8	22 ± 7	15 ± 6
ΔDBP (mmHg)	1 ± 2	3 ± 3	6 ± 3	6 ± 3	5 ± 3	−1 ± 2
ΔMAP (mmHg)	2 ± 2	6 ± 3	10 ± 4	13 ± 5	11 ± 4	4 ± 3

*Values are mean ± standard deviation.
DBP = diastolic blood pressure; HR = heart rate; MAP = mean arterial pressure; SBP = systolic blood pressure.

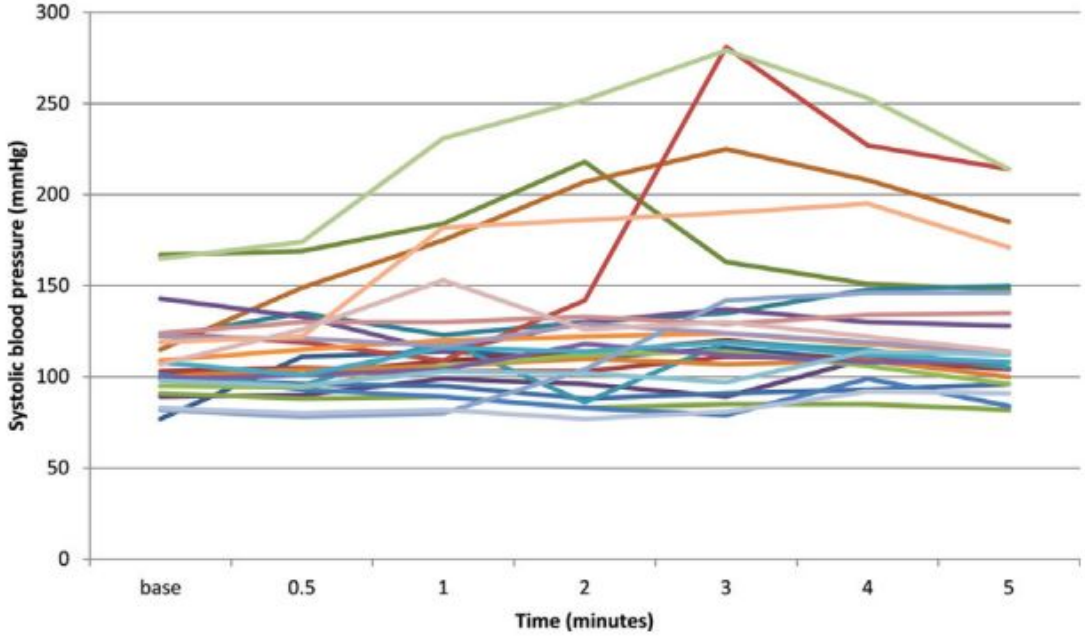


FIGURE 1. Spaghetti plot of all patients' changes in systolic blood pressure over time.

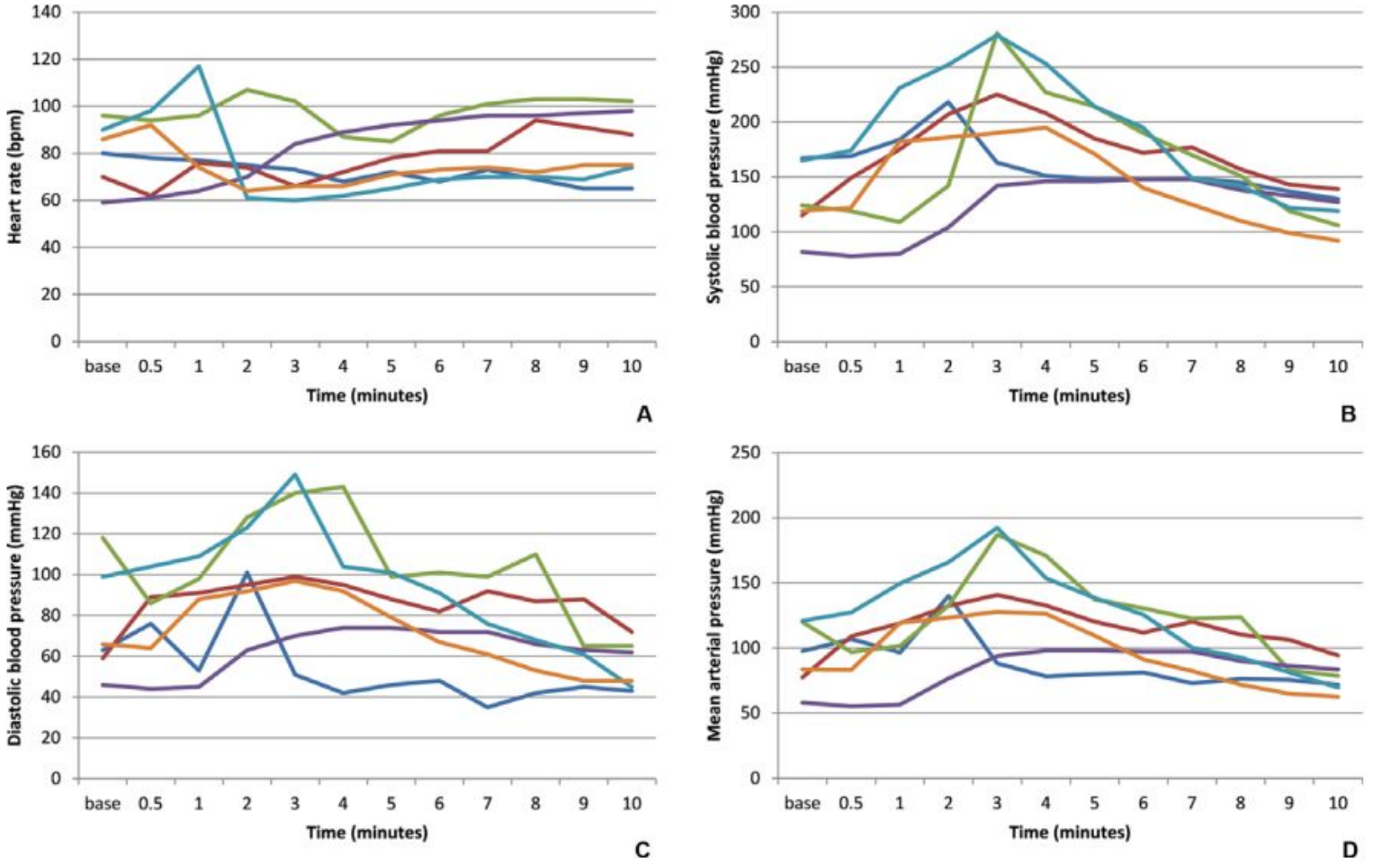


FIGURE 2. The HR (A), SBP (B), DBP (C), and MAP (D) trends of the 6 patients who had hemodynamic changes in response to topical epinephrine. DBP = diastolic blood pressure; HR = heart rate; MAP = mean arterial pressure; SBP = systolic blood pressure.

Topical Infiltration(2017)

Results:

- The majority of patients (**20/26**, 77%) showed **no significant change** in any hemodynamic parameter following the placement of epinephrine-soaked pledgets.
- **6 patients** experienced transient increases in blood pressure, with a few requiring **vasodilatory interventions**.
- **Return to baseline cardiovascular values** occurred on average **7 minutes** after administration.
- There was **no predictive preoperative characteristic** for sensitivity to epinephrine placement.
- No **lasting or permanent effects** were observed.

Topical Infiltration(2017)

Conclusion:

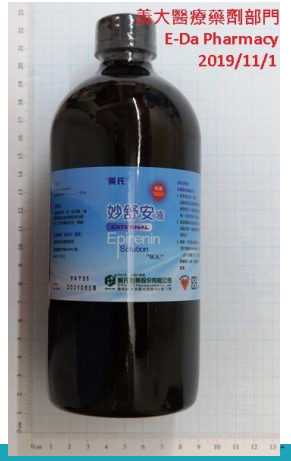
- **Topical 1:1000 epinephrine** generally causes **no substantial hemodynamic changes** in the majority of patients.
- However, in a subset of patients, it can cause **significant transient elevations in blood pressure**, sometimes requiring intervention.
- **Topical epinephrine(1:1000)** should be used **judiciously** in **endoscopic sinus surgery**.

結論

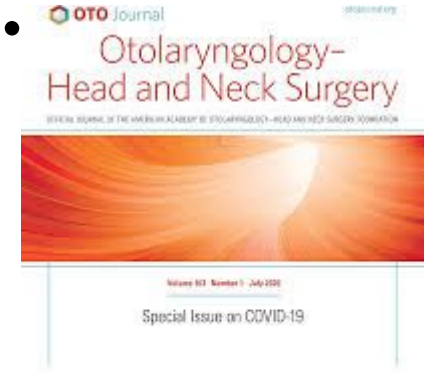
- 儘管大多數患者在使用局部 1:1000 腎上腺素後未出現顯著的血流動力學變化，但在部分患者中，可能會導致血壓顯著暫時性升高，達到需要干預的程度。在內視鏡鼻竇手術中，應謹慎使用局部腎上腺素。

臨床應用

- 依照現行鼻竇手術 局部浸潤麻醉 (infiltration)施行方法，使用純液 (1:1000)進行止血，對部分患者會導致血壓上升，需要醫療介入進行降壓，因此需要謹慎使用。



Topical Infiltration(2019)

- 

Outcomes and Complications with Topical Epinephrine in Endoscopic Sinus Surgery: A Systematic Review and Meta-analysis

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Topical Infiltration(2019)

Objective:

- To evaluate the **safety** and **efficacy** of **topical epinephrine** in adults undergoing **endoscopic sinus surgery (ESS)**.

Review Methods:

- English articles published up to **January 2019** were reviewed.
- **Inclusion Criteria:** Non-case report articles evaluating the use of **topical epinephrine** in adult **ESS**.

Table 1. PICOS Inclusion Criteria.

PICOS	Inclusion Criteria	Exclusion Criteria
Population	Any adult patient (≥18 y), male or female, undergoing endoscopic sinus surgery	Pediatric population (<18 y); combination with other surgical procedures
Intervention	Epinephrine as topical vasoconstrictor	Concurrent use of other topical vasoconstrictors
Comparison	Other methods of hemostatic control	None
Outcome	Operative blood loss, concentration of topical epinephrine, complication rates	None
Study design	Any study design	Case reports

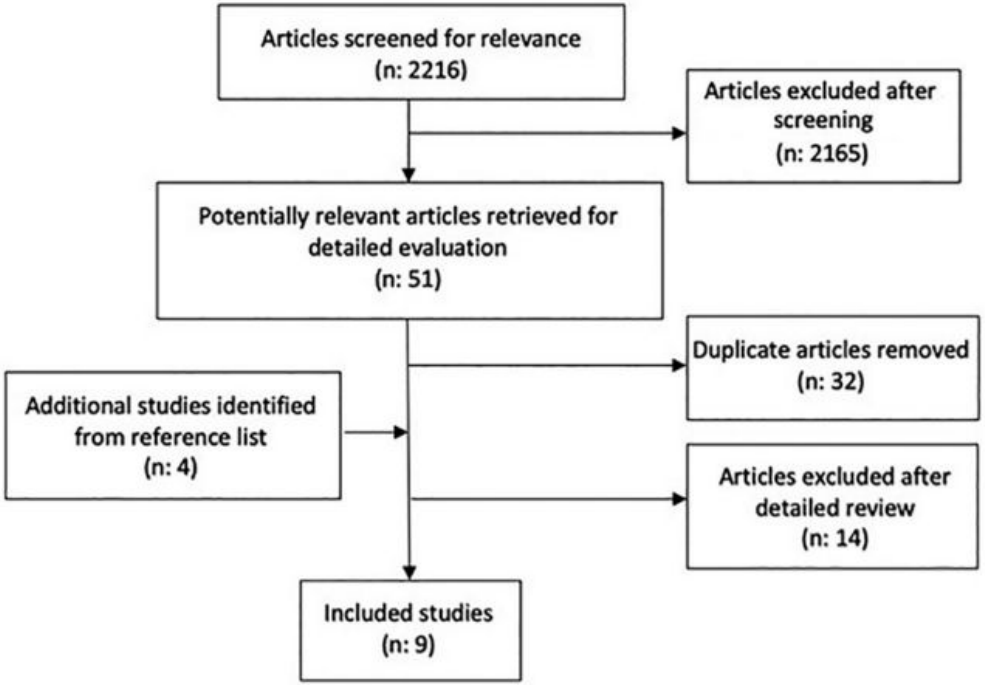


Figure 1. PRISMA flow diagram highlighting the literature selection process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analyses.

Topical Infiltration(2019)

Results:

- **Total articles found:** 2216
- **9 studies** met the inclusion criteria (5043 patients).
- **Safety Assessment:** All 9 studies focused on safety; 3 major complications occurred (rate of **0.06%**).
- **Efficacy Assessment:** 5 studies evaluated efficacy.
- **Intraoperative Average Blood Loss (ABL):**
  - Range: **60 to 426 mL**.
  - Higher concentration epinephrine (**1:10,000**) showed significantly lower ABL (**119.4 mL** vs **372.2 mL**, P = .001).
- **Complications:** No cases of ophthalmic, orbital, skull base injury, or cerebrospinal fluid leaks.

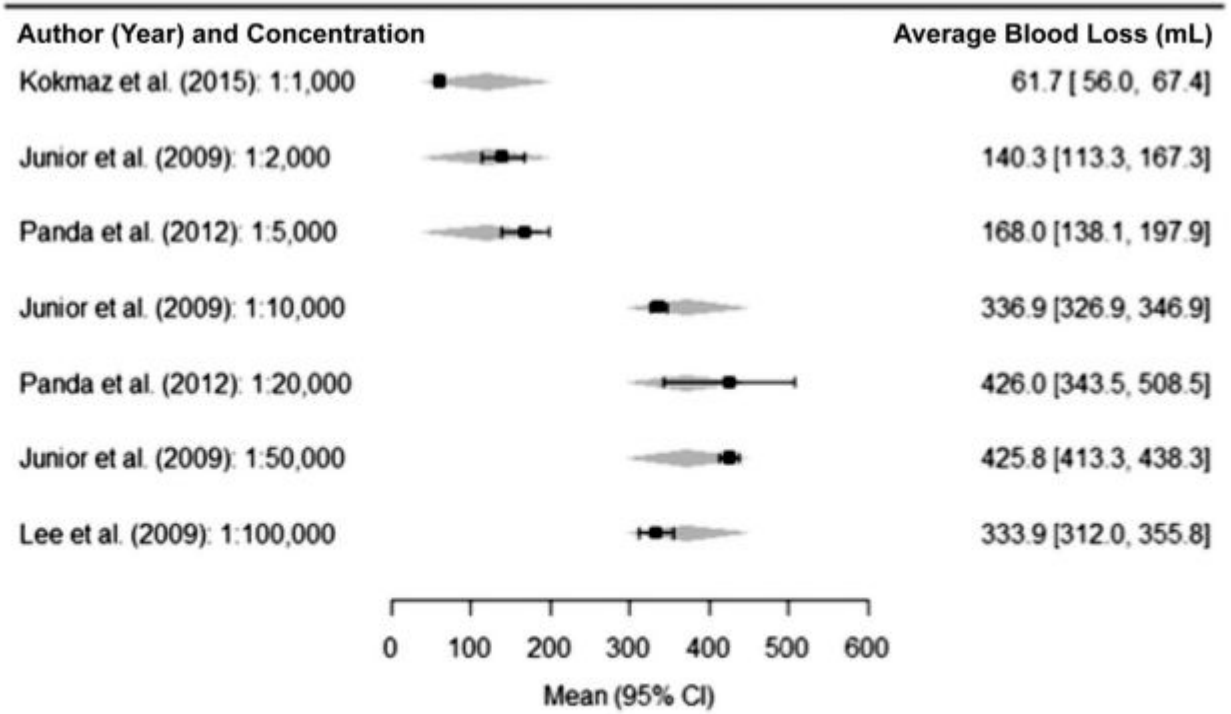


Figure 2. Average blood loss by author (year) and topical epinephrine concentration. Shaded polygons represent metaregression overall estimated mean (95% CI) average blood loss for subgroups defined by high concentration (1:1000-1:5000) versus low concentration (1:10,000-1:100,000).

Topical Infiltration(2019)

Conclusion:

- **Topical epinephrine** is generally **safe** and effective for **hemostasis** during **ESS**.
- **Higher concentrations** (>1:10,000) improve **hemostasis**.
- Caution is recommended for **patients with cardiovascular disease** or when combined with other **vasoconstrictors**.

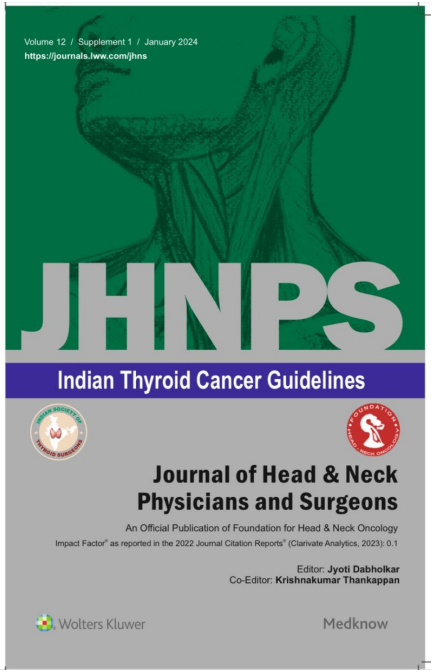
結論

- 局部浸潤使用腎上腺素是安全的，並且在功能性鼻竇手術（FESS）中能提供可接受的止血效果，較高濃度（>1:10,000）能提供更好的止血效果。
- 對於有心血管疾病病史的患者，與其他局部或注射性血管收縮劑合併使用時，須謹慎使用。

臨床應用

- 依照現行鼻竇手術 **局部浸潤麻醉 (infiltration)**施行方法，稀釋 10倍是有研究證實安全麻醉方式。
- 稀釋5倍可以有效降低出血量。
- 對於有心血管疾病病史的患者，搭配局部注射時，要謹慎使用。

Topical vs Local(2021)



- **Hemostatic and Hemodynamic Effects of Topical Administration versus Intranasal Injection of Adrenaline during Endoscopic Sinus Surgery**
  A Prospective Observational Study

  Rasheed, Muhammed; Felix, Vinod; Narendrakumar, Veerasigamani[1]

  Author Information

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0.2

Topical vs Local(2021)

Aim:

The study aims to compare the **hemostatic** and **hemodynamic** effects of **topical application** versus **intranasal injection** of **adrenaline** during **endoscopic sinus surgery (ESS)** under **general anesthesia (GA)**.

Topical vs Local(2021)

Materials and Methods:

- **Design:** A **prospective observational study** conducted at a tertiary hospital over 1 year.
- **Participants:** 50 adults (aged 18–70 years, both sexes) with **bilateral similar sinonasal pathology** who underwent **ESS** under GA.
- **Analysis:** Intraoperative **hemostatic** and **hemodynamic** parameters were analyzed following **topical application** and **intranasal injection** of adrenaline.

Table 1: Fromme–Boezaart grading scale

Grade	Description
Grade 0	No bleeding
Grade 1	Slight bleeding No suctioning required
Grade 2	Slight bleeding Occasional suctioning required Bleeding does not threaten surgical field
Grade 3	Slight bleeding Frequent suctioning required Bleeding threatens surgical field for a few seconds after removal of suction
Grade 4	Moderate bleeding Frequent suctioning required Bleeding threatens surgical field immediately after removal of suction
Grade 5	Severe bleeding Constant suctioning required Bleeding appears faster than it can be removed by suction Surgical field threatened and surgery not possible

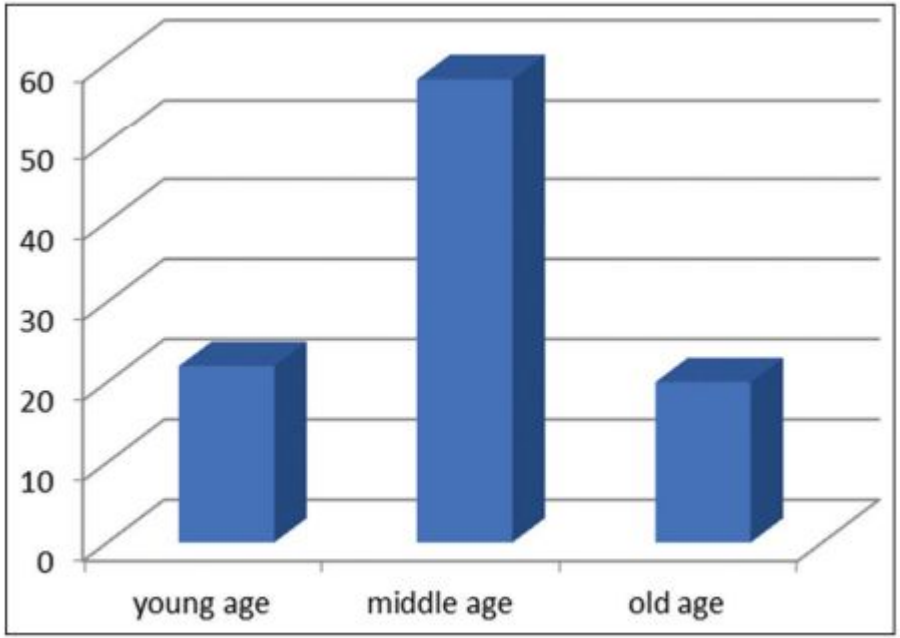


Figure 1: Percentage distribution of age group

Table 3: Distribution patients with comorbidity status

Comorbidity status	Frequency (%)
With comorbidity	20 (40)
Without comorbidity	30 (60)
Total	50 (100)

Table 4: Distribution of patients with disease extension

Disease extension	Frequency (%)
Limited sinus disease	22 (44)
Extensive sinus disease	28 (56)
Total	50 (100)

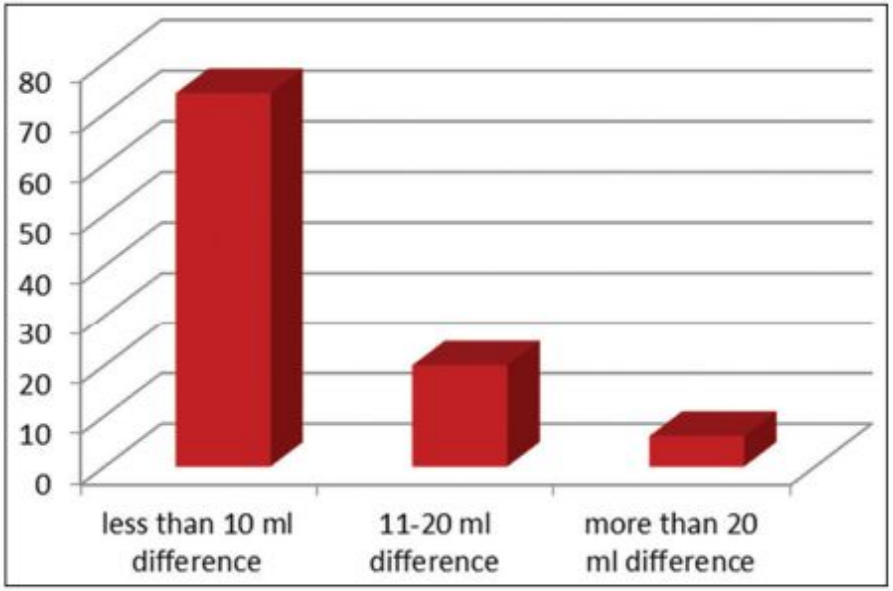


Figure 2: Percentage distribution of difference in blood loss between topical and injection of adrenaline

Table 5: Comparison of Fromme–Boezaart grading with topical versus injection adrenaline

Variables	Median	IQR	*P*
FB grading with topical adrenaline	3	2-3	0.102
FB grading with injection adrenaline	3	2-3	

IQR: Interquartile range, FB: Fromme–Boezaart

Table 6: Comparison of heart rate with topical versus injection adrenaline

Variables	Median	IQR	*P*
HR with topical adrenaline	77	72.49-84	<0.001
HR with injection adrenaline	81.83	74-88.5	

IQR: Interquartile range, HR: Heart rate

Table 7: Comparison of mean arterial pressure with topical versus injection adrenaline

Variables	Median	IQR	*P*
MAP with topical adrenaline	80.33	73.5-88.62	<0.001
MAP with injection adrenaline	83.49	73.49-93.66	

IQR: Interquartile range, MAP: Mean arterial pressure

Topical vs Local(2021)

Conclusions:

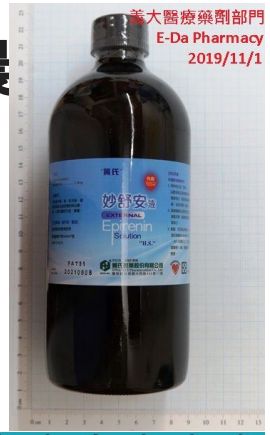
- **Topical application** of **1:2000 dilution of adrenaline** provides similar **hemostatic effects** compared to **intranasal injection** of **1:100,000 dilution** during **ESS**.
- Topical application can help avoid **systemic adverse events** such as **tachycardia**, **arrhythmia**, and **mean arterial pressure changes** caused by adrenaline infiltration.

結論

- 在功能性鼻竇手術(ESS)中，局部浸潤 1:2000 腎上腺素，與鼻腔注射1:100,000 腎上腺素相比，具有相似的止血效果。
- 局部浸潤的方法可以避免因腎上腺素浸潤引起的副作用，如心動過速、心律不整和平均動脈壓變化。

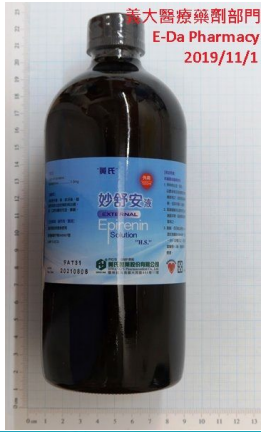
臨床應用

- 依照2021年刊登在JHNPS文獻紀錄來看，現行鼻竇手術**局部浸潤麻醉 (infiltration)**稀釋2倍的效果可以跟**局部注射麻醉 (H+E injection)**稀釋2倍濃止血效果類似。視臨床狀況自行斟酌使用。



總結

- 依照目前局部注射的濃度建議，可以將 local稀釋2~4倍，來達到止血以及麻醉的效果。
- 依照目前局部浸潤的濃度建議，稀釋 5倍是可被接受不會造成併發症，並且可以有效達到止血效果的濃度。



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5. Hemostatic and Hemodynamic Effects of Topical Administration versus Intranasal Injection of Adrenaline during Endoscopic Sinus Surgery

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