A Comparison between Endoscopically Middle Meatal Aspiration Culture Using Modified Aspiration Instrument and Direct Maxillary Antral Tap Culture in Chronic Rhinosinusitis

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Objectives: *To evaluate the accuracy of endoscopically guided middle meatal aspiration culture by comparing the culture results between middle meatal aspiration using the modified aspiration instrument and direct maxillary antral tap.*
Material and Method: *Sixteen patients with chronic rhinosinusitis underwent functional endoscopic sinus surgery (FESS) were enrolled. Both endoscopically middle meatal aspiration culture (EMAC) using modified aspiration instrument and direct antral tap culture (ATC) were performed before FESS. Microbiologic data were compared and analyzed for any statistical differences between EMAC and ATC.*
Results: *The positive culture rates were 93.75% in both EMAC and ATC groups. Aerobic and facultative anaerobic bacteria were found in 87.5% of EMAC group and 81.25% of ATC group. The two most common bacteria in both groups were coagulase-negative Staphylococcus and Staphylococcus aureus. The association between EMAC and ATC was strong to moderate (13/16) 81.25%.*
Conclusion: *EMAC appears to be a valuable alternative to ATC for guiding bacterial-specific therapy in chronic rhinosinusitis. This modified aspiration instrument should be useful in clinical practice and serve as a cost effective procedure.*

Keywords: *Chronic rhinosinusitis, Culture, Aspiration instrument, Middle meatal aspiration, Antral tap*

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Rhinosinusitis is one of the 10 most common diagnoses made in ambulatory practice and is the fifth most common diagnosis for which antibiotics are prescribed[1]. Acute rhinosinusitis is usually caused by a few well-known pathogens, in particular Streptococcus pneumoniae and Haemophilus influenzae, which respond reliably to empiric antibiotics[2,3]. Chronic rhinosinusitis has a broader spectrum of possible pathogens[4-9]. The polymicrobial nature of chronic rhinosinusitis increases the likelihood of the presence of residual organisms and reduces the efficacy of empiric antibiotics[10-12]. The identification of causative organisms is crucial to successful treatment.

The current standard for obtaining reliable sinus culture is maxillary antral tap, however aspiration of the sinus is an invasive procedure that requires local or general anesthesia and can be associated with discomfort, pain and complications[13]. Therefore, a diagnostic procedure that is more practical and acceptable to patients is needed.

Recently, rigid nasal endoscopy affords access to the sinus ostia, mucopus emanating from the sinus ostia and meati can be directly taken. Because

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sinus secretion moves from the sinus through its ostia, there should be no significant bacterial change of pus between these two locations. A culture obtained from purulent secretion existing close to the ostia should correlate well with a culture taken directly from the sinus.

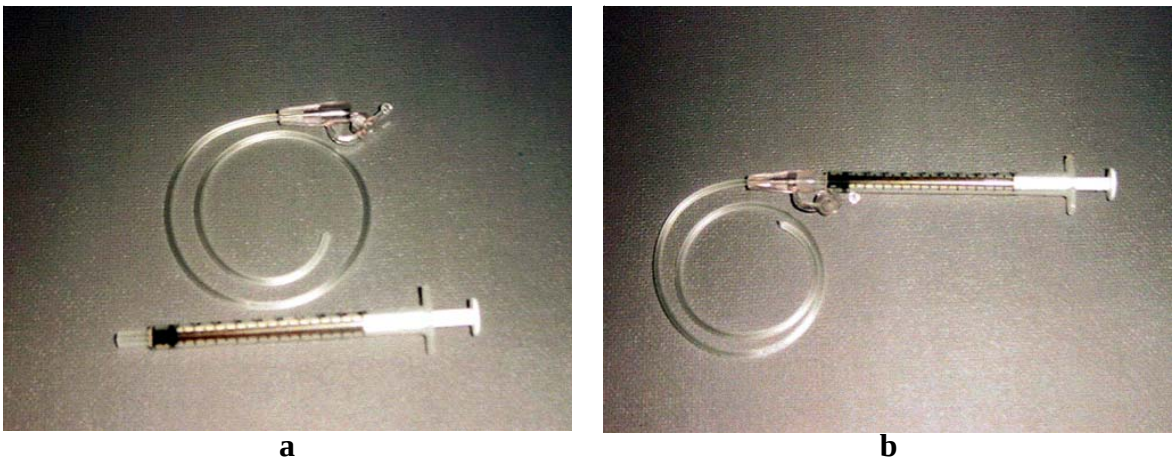
Middle meatal secretion can be taken endoscopically by aspiration and swab techniques. Aspiration technique tended to have less risk of contamination than the swab technique because the culture sample is trapped in a sterile container before the suction is withdrawn through the contaminated nasal vestibule[14], However, the commercial aspiration instruments are expensive. The authors developed a small and flexible aspiration instrument which was modified from a pediatric scalp vein catheter and 1 cc tuberculin syringe (Fig 1a, 1b). The authors evaluated the accuracy of endoscopically guided middle meatal aspiration using this modified aspiration instrument by comparing the culture results between middle meatal aspiration and direct maxillary antral tap, and studied the prevalence of bacteriology in chronic rhinosinusitis.

Material and Method

A prospective study was conducted at Songklanagarind Hospital between January 2001 and July 2002. Adult patients with chronic rhinosinusitis in whom medical treatment had failed and who were willing to undergo FESS for surgical treatment were included in the present study. The diagnosis of chronic rhinosinusitis was based on a positive history of rhinosinusitis ($\geq$ 2 nasal symptoms of nasal blockage, rhinorrhea/postnasal drip, facial pain/pressure or hyposmia) for more than 3 months, positive finding on nasal endoscopy (nasal mucosal inflammation and discharge from the middle meatus) and maxillary sinus disease on preoperative computed tomography. The definition of medical failure was that the rhinosinusitis symptoms and abnormal endoscopic finding persisted after at least 2 courses of two weeks of first and second line antibiotics. Any patient who had a history of immunodeficiency or took antibiotics within 1 week before FESS was excluded from the study. Informed consent was obtained with a detailed form that was reviewed and approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University.

Nasal vestibules, anterior nasal cavity and adjacent face were disinfected for 10 minutes with 10% povidine iodine solution and removed with a moist swab. After the application of topical 1% ephredine, discharge was taken directly from the middle meatus close to the maxillary ostium into 1 cc tuberculin syringe via pediatric scalp vein catheter (Fig. 1b). While performing these procedures, the catheter tip was grasped with alligator forceps and carefully pointed to the middle meatus without touching the adjacent structures (Fig. 2).

Inferior meatus, on the side of the endoscopic culture, was disinfected with 10% povidine iodine solution and removed with a moist swab. A No. 22 Gauge spinal needle was inserted through the naso-antral wall of the inferior meatus, approximately 1 cm behind the anterior tip of the inferior turbinate and directed toward the lateral canthus. The needle was advanced until it abutted the opposite antral wall and then withdrawn several millimeters. The inner trocar



a **b**

Fig. 1 Shows the aspiration instrument which was modified from 1 cc tuberculin syringe and pediatric scalp vein catheter (1a and 1b)

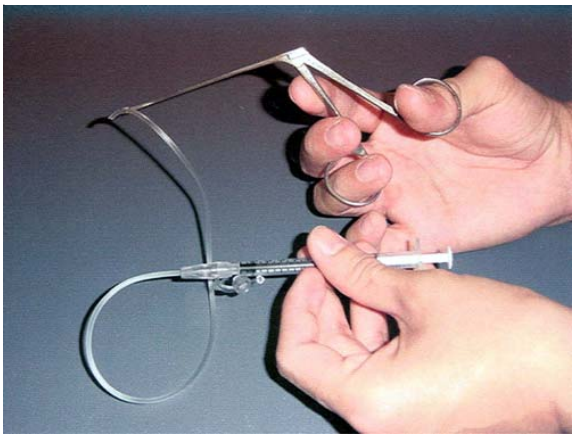


Fig. 2 Aspiration technique: the catheter tip was grasped with alligator forceps and carefully pointed to the middle meatus

was then removed. 30 cc syringe was connected to a canula and then aspirated. If the aspiration failed to demonstrate discharge, lavage of the sinus with saline solution was done and the fluid was sent for culture.

Aspiration materials were taken to enriched thioglycolate broth. Samples were sent to the microbiology laboratory immediately and incubated onto 5% sheep blood agar at 37 C for 24 hours for aerobic bacteria. Anaerobic bacteria were incubated on to anaerobic blood agar at 37 c for 48-72 hours.

The results of the culture were correlated between the middle meatal and maxillary sinus discharges. Strong correlation was implied if the same bacteria were grown from both middle meatal and maxillary sinus discharges or if there was no bacterial growth from either location. Moderate correlation was implied if bacteria recovered from the middle meatus was different from maxillary sinus by not more than 1 bacterial type. No correlation was implied if bacteria recovered from the middle meatus was different from the maxillary sinus by more than 1 bacterial type.

Statistical analysis

The data were presented as numbers and percentages. The statistical significance of difference in prevalence between middle meatal aspiration and antral tap organisms was presented.

Results

A total of 16 eligible patients with chronic rhinosinusitis were included in the present study. Their age ranged from 15 to 66 years old with a mean of 41.75 years. There were 9 male and 7 female patients.

A total of 16 culture sets were obtained for analysis. Bacterial growth was presented in 15 of 16 cases (93.75%) in both middle meatal and maxillary sinus specimens. The types of bacterial growth of EMAC and ATC are shown in Table 1. Most of the specimens were aerobic and facultative anaerobic bacteria, which were presented in 14 cases (87.5%) of the EMAC group and 13 cases (81.25%) of the ATC group.

Table 1. Types of bacteria and culture rate

Types of bacteria	EMAC (No. of specimen)	ATC (No. of specimen)
- Aerobic and facultative anaerobic bacteria	14	13
- Anaerobic bacteria	1	0
- Mixed bacteria	0	2
- No growth	1	1
- Positive rate of culture	15 (93.75%)	15 (93.75%)

Table 2. EMAC vs ATC bacterial findings

Organisms	ATC Positive (n = 15)		EMAC Negative (n = 1)	Totals
	Single organism	Polymicrobial		
EMAC Postitive (n = 15)				
Single organism	5	6	0	11
Polymicrobial (> 1 organism)	0	4	0	4
ATC Negative (n = 1)	0	0	1	1
Totals	5	10	1	16

10 patients (62.5%) had a polymicrobial (> 1 organisms) culture isolated by either EMAC or ATC group. 4 of 15 positive EMAC (26.67%) and 10 of the 15 positive ATC (66.67%) were polymicrobial (Table 2). The total number of organisms cultured was not significantly different between the EMAC and ATC groups (20 vs 26, p = 0.376).

Coagulase-negative Staphylococcus was the most common isolate in both EMAC and ATC groups (8 cases both), followed by Staphylococcus aureus (3 cases both) (Table 3). The association between cultures obtained from the middle meatus with those from the maxillary antrum was demonstrated in 13 of 16 specimens (81.25%) (Table 4).

Table 3. Bacteriology of EMAC and ATC

Organisms	EMAC	ATC
Aerobic and facultative anaerobic bacteria		
- Gram positive organism		
Coagulase-negative Staphylococcus	8	8
Staphylococcus aureus	3	3
Alpha Streptococcus Not gr D	1	3
Beta Streptococcus Not gr A, B, D	1	1
Micrococcus spp.	0	1
- Gram negative organism		
Klebsiella pneumoniae	3	2
Pseudomonas aeruginosa	1	2
Escherichia coli	0	2
Enterobactor aerogenes	1	1
Proteus mirabilis	1	0
Citrobacter diversus	0	1
Microaerophilic bacteria		
Microaerophilic sterptococcus	0	1
Anaerobic bacteria		
Peptostreptococcus productus	0	1
Eubacterium Contorium	1	0

Discussion

Antimicrobial therapy for acute rhinosinusitis is straightforward because the causative organisms have been well defined. In contrast to chronic rhinosinusitis, the polymicrobial nature and the growing problem of antibiotic resistance of many organisms

Table 4. Comparison of bacterial culture results between EMAC and ATC

No.	Sex	Age	EMAC	ATC	Correlation
1	Female	15	- Coagulase-negative staphylococcus	- Alpha streptococcus not gr D - Citrobacter diversus	None
2	Male	15	- Staphylococcus aureus - Coagulase-negative staphylococcus	- Staphylococcus aureus - Coagulase-negative staphylococcus	Strong
3	Male	18	- Coagulase-negative staphylococcus	- Coagulase-negative staphylococcus - Escherichia coli	Moderate
4	Male	19	- Pseudomonas aeruginosa - Klebsiella pneumoniae	- Pseudomonas aeruginosa - Micrococcus spp.	Moderate
5	Male	24	- Staphylococcus aureus - Proteus mirabilis - Klebsiella pneumoniae	- Staphylococcus aureus - Peptostreptococcus productus - Alpha Streptococcus not gr D	None
6	Female	39	- Coagulase-negative staphylococcus	- Coagulase-negative staphylococcus - Escherichia coli	Moderate
7	Female	41	- Staphylococcus aureus	- Staphylococcus aureus - Pseudomonas aeruginosa	Moderate
8	Male	44	- Coagulase-negative staphylococcus - Enterobactor aerogenes	- Coagulase-negative staphylococcus - Enterobactor aerogenes	Strong
9	Male	47	- Alpha Streptococcus not gr.D	- Alpha Streptococcus not gr D	Strong
10	Female	47	- Coagulase-negative staphylococcus	- Coagulase-negative staphylococcus	Strong
11	Female	47	- Coagulase-negative staphylococcus	- Coagulase-negative staphylococcus	Strong
12	Female	54	- Eubacterium contorium	- Coagulase-negative staphylococcus	None
13	Female	62	- Klebsiella pneumoniae	- Klebsiella pneumoniae - Microaerophillic streptococcus	Moderate
14	Male	64	- Coagulase-negative staphylococcus	- Coagulase-negative staphylococcus - Klebsiella pneumoniae	Moderate
15	Male	65	- No growth	- No growth	Strong
16	Male	66	- Beta Streptococcus not gr A, B,D	- Beta Streptococcus not gr A, B, D	Strong

have made successful treatment far more difficult. The efficacy of antibiotics in treatment of chronic rhinosinusitis depends on appropriate culture and sensitivity analysis of specimens obtained from the sinuses. Although maxillary antral tap is considered to be the gold standard for identifying sinus pathogens, it is a painful and invasive procedure.

Modern endoscopic technique allows for direct examination of the sinus ostial region and culture mucopus emanating from the ostia. This would be a safe and more effective way to address the microbiologic status of maxillary sinus. In recent studies, a good correlation was found between middle meatal and maxillary sinus cultures if middle meatal specimens were taken endoscopically[15-17], ranging from 60-85%[7,18,19]. Middle meatal secretion can be obtained endoscopically using swab and aspiration techniques[20]. The aspiration technique tended to have less risk of contamination than the swab technique because the culture sample is trapped in a sterile container before the suction is withdrawn through the contaminated nasal vestibule[14]. The authors developed a small and flexible aspiration instrument, which is easily made and cheaper than commercial ones for approaching the middle meatus. The results showed that the correlation rate between the middle meatal and maxillary sinus specimens was 81.25%

In the present study, coagulase-negative staphylococcus and Staphylococcus aureus were the two most common organisms recovered in both EMAC and ATC, which were similar to the results of previous studies[5,10]. Coagulase-negative staphylococcus, which has long been considered to be a contaminant, has been noted to be resistant to a broad spectrum of antimicrobials and might in fact be a problem[5,21,22]. Chan J et al found that 39% of coagulase-negative staphylococcus was penicillin resistant[6]. This highly resistant organism may become pathogenic and develop subsequent cross-resistance to other antibiotics. However, further investigation is needed to clarify the role of coagulase-negative staphylococcus in rhinosinusitis.

As empiric medical treatment for chronic rhinosinusitis becomes more and more uncertain, culture-directed therapy, especially in cases of treatment failure, complicated rhinosinusitis and immunocompromised host, is a valuable therapeutic tool. The presented data demonstrated that specimen obtained via endoscopically directed middle meatal aspiration yields reliable, sensitive and specific information. This procedure is quick, safe and well tolerated by the patient, as opposed to maxillary antral tap. With the development of this small and flexible aspiration instrument, the likelihood of contamination of the specimen from nasal secretion should be minimized. This simple, cheap and self-made aspiration instrument should prove useful in clinical practice, provide guidance for the selection of appropriate antimicrobial therapy, and could serve as an acceptable and cost-effective alternative to the traditional antral tap.

Conclusion

Endoscopically guided middle meatal aspiration culture using an aspiration instrument which was modified from a 1 cc tuberculin syringe and pediatric scalp vein catheter is as reliable as maxillary antral tap culture in determining the bacteria responsible for chronic rhinosinusitis, with a correlation rate of 81.25%. The most common pathogens recovered in both middle meatus and maxillary sinus specimens were coagulase-negative staphylococcus and Staphylococcus aureus, and correlated well with previous microbiologic studies of chronic rhonosinusitis.

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การเปรียบเทียบผลเพาะเชื้อหนองที่ได้จากการส่องกล้องดูดเก็บบริเวณ middle meatus ด้วยเครื่องมือที่ประดิษฐ์ขึ้นกับการเจาะดูดจากโพรงอากาศแมกซิลลารโดยตรงในโพรงอากาศข้างจมูกอักเสบเรื้อรัง

วิรัช เกียรติศรีสกุล, ญาณินทร์ ฉัตรวิวัฒน์, วราพร เลาหพฤฒิสาร

***วัตถุประสงค์**: เพื่อศึกษาหาความแม่นยำในการวินิจฉัยเชื้ออันเป็นสาเหตุของโพรงอากาศข้างจมูกอักเสบเรื้อรัง โดยการส่องกล้องดูดเก็บหนองจากบริเวณ middle meatus ด้วยเครื่องมือที่ประดิษฐ์ขึ้น โดยการเปรียบเทียบผลการเพาะเชื้อที่ได้จาก middle meatus กับการเจาะดูดหนองจากโพรงอากาศแมกซิลลารโดยตรง*

***วัสดุและวิธีการ**: ทำการศึกษาในผู้ป่วยโพรงอากาศข้างจมูกอักเสบเรื้อรังที่ต้องได้รับการผ่าตัด Functional endoscopic sinus surgery (FESS) จำนวน 16 ราย ทำการส่องกล้องดูดเก็บหนองจากบริเวณ middle meatus และเจาะดูดหนองจากโพรงอากาศแมกซิลลารโดยตรงก่อนการผ่าตัด FESS ส่งหนองที่ได้เพื่อเพาะเชื้อแบคทีเรียทั้งชนิดใช้และไม่ใช้ออกซิเจน เปรียบเทียบและวิเคราะห์เชื้อแบคทีเรียทั้ง 2 ตำแหน่ง*

***ผลการศึกษา**: ร้อยละ 93.75 ของหนองทั้งบริเวณ middle meatus และโพรงอากาศแมกซิลลารมีผลการเพาะเชื้อเป็นบวก ร้อยละ 87.5 ของหนองบริเวณ middle meatus และร้อยละ 81.25 ของหนองจากโพรงอากาศ แมกซิลลารขึ้นเชื้อแบคทีเรียชนิดใช้หรือกึ่งใช้ออกซิเจน เชื้อที่พบได้บ่อยที่สุดทั้ง 2 ตำแหน่งคือ coagulase-negative Staphylococcus และ Staphylococcus aureus ความสัมพันธ์ของเชื้อที่ขึ้นระหว่าง middle meatus และโพรงอากาศแมกซิลลารคิดเป็นร้อยละ 81.25*

***สรุป**: การส่องกล้องดูดเก็บหนองเพื่อเพาะเชื้อบริเวณ middle meatus เป็นอีกทางเลือกหนึ่งในการช่วยบ่งชี้เชื้อที่เป็นสาเหตุของโพรงอากาศข้างจมูกอักเสบเรื้อรัง เครื่องมือดูดเก็บหนองขนาดเล็กที่ประดิษฐ์ขึ้นสามารถทำได้ง่ายและต้นทุนต่ำ จะทำให้การดูดเก็บหนองในทางปฏิบัติง่ายและคุ้มทุนมากขึ้น*