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Can Nasal Secretion Dipstick Assay Predict Lund-Mackay Score in Chronic Rhinosinusitis?

Imela Sari[1], Delfitri Munir[2], Ferryan Sofyan[3]

[1, 2, 3]Department of T.H.T.K.L, Faculty of Medicine, Universitas Sumatera Utara, Medan 20155, Indonesia, +6282264321435
imelasari050[at]gmail.com

Abstract: ***Chronic rhinosinusitis (CRS) causes high annual medical cost and decreases quality of life.Researches continue with easier, cheaper and saver approach. This study evaluate nasal secretion disptick assay (NSDA) correlation with Lund-Mackay Score (LMS) in CRS. Its an analytic cross-sectional study. Middle meatus nasal secretion obtained with absorption method, applied to dipstick to read qualitatively. Statistical correlation and sensitivity analysis performed. Most patients are men (59%), 15-24 age group (33.3%), CRS without nasal polyps (71.1%), maxillary involvement (92.3%). LMS correlation with acidity, leukocyte esterase, nitrit, protein and total score, were statistically significant (p<0.05, r=0.652; 0.556; 0.605; 0.503; 0.779 respectively). Sensitivity of NDSA to LMS is 92.6%, specificity 58.3%, positive preditive value 83.3% and negative predictive value 77.8%. Total NSDA has positive strong correlation with LMS. With sensitivity above NSDA can predict LMS value ≥4 in cheaper, easier and saver method.***

Keywords: Lund-Mackay; Dipstick Assay; Chronic Rhinosinusitis

1. Introduction

Chronic rhinosinusitis (CRS), rising health problem, impaired financial, life quality and work productivity.[1] CRS is third most common chronic disease in America, effected 15% adult population.[2] In Indonesia, CRS placed 25th from 50 main disease pattern. In Medan, CRS is the most common patient treated in rhinology division.[3]

Computer tomography (CT Scan) still stand gold-standard to classified sinonasal disease. Lund-Mackay-Score (LMS) has correlation with disease severity thusfurther research recommended. It can effect treatment, outcome and respond.[1] It has limited availability and with high risk of radiation.

Alternative test that easier, faster, saver, cost effective, and readily available is an ideal goal. Studies tried to compose scoring system to identify and diagnose based on dipstick parameters. Association found between nasal secretion dipstick assay (NSDA) and radiologi changes[5], culture and polymerase chain reaction (PCR).[6]

The NSDA parameters are acidity (pH), leukocyte esterase (LE), nitrit and protein. Alkaline pH has proven statistically significant in CRS.[7] LE increasement found in CRS.[6] Nirit reported to increase in CRS.[8] Protein found to increase in CRS inflammation.[9]

Researches on this still scattered and uncommon. Theres yet to find specific study on NSDA and CRS, even more so on its correlation with LMS. We are the first study to do so. For this issue importance, we choose to perform this research as a ground for further study.

2. Methods

This study is analytic cross-sectional study. Sample collected from January to April 2020. Population are all patients with CRS with or without nasal polyps. Sample fulfilled inclusion criterias: All CRS patients with no sinonasal malignancy, and exempt exclusion criterias: has nasal deformity that complicate secret collection, nasal polyp grade III, lost/damaged CT Scan, or decline admission.

Middle meatus nasal secretion obtained with absorption method.[9] Its applied to dipstick Roche Corp, Burlington, MA.[5, 6] Color change compared qualitatively to factory control by two independent examiners after appropriate application time. Parameters recorded and interpreted based on scoring system, with maximum total score of 11, and score ≥4 associated with rhinosinusitis.[5, 6] All datas presented in tables.

NSDA Scoring System

-pH

<7, 5=0; 7.5=1; 8.0=2; 8.5=3

-Leukocyte esterase

<1+=0; 1+=2; ≥2+=3

-Nitrite

No Color=0; Pink=1; Dark Pink = 2

-Protein

<2+=0; 2+=1; 3+=2; 4+=3

LMS computed from Coronal SPN CT Scan ≤2 months, for bilateral maxilla, ethmoid anterior and posterior, frontal and sphenoid sinuses plus osteomeatal complex, with maximum possible score 24.[6] Scoring done separetely by 2 examiners and if theres any different measurement, average score used.

Correlationanalysestatistically with 5% significance level. Cross-tabulation table were made with LMS grouped to two categories with cut-off of 4[1], NSDA grouped with cut-off of 4[5, 6], to calculate sensitivity of NSDA to LMS

3. Result

This study performed to 39 CRS patients registered to Haji Mina Hospital Medan. From datas theres male predominant (59%). Age group 15-24years in 33.3% of subject. CRS without nasal polyps found to 71.1%. Highest involvement

of maxillary sinuses 92.3%. NSDA observed from direct reading. Most patients has pH of 9 (35.9%), LE 10-25 cells (66.7%), negative nitrit (51.3%) and negative protein (69.2%) (Table1)

Table 1: Characteristic Distribution of CRS

Variable		n=39	(%)
Age	15-24	13	33.3
	25-34	3	12.8
	35-44	8	20.5
	45-54	5	12.8
	55-64	3	7.7
	65-74	5	12.8
Sex	Male	23	59
	Female	16	41
Diagnosis	CRS with nasal polyp	11	28.9
	CRS without nasal polyp	27	71.1
Effected Sinus	Maxilla	14	35.9
	Ethmoid	2	5.1
	Sphenoid	1	2.6
	Maxilla, Ethmoid	5	12.8
	Maxilla, Ethmoid, Sphenoid	3	7.7
	Maxilla, Ethmoid, Sphenoid, Frontal	9	23.1
	Maxilla, Sphenoid	3	7.7
	Maxilla, Frontal, Ethmoid	2	5.1
pH	6	9	23.1
	7	8	20.5
	8	8	20.5
	9	14	35.9
LE	Negative	10	25.6
	10--25cells	26	66.7
	<75cells	3	7.7
Nitrit	Negative	20	51.3
	Positive	19	48.7
Protein	Negative	27	69.2
	Positive+	8	20.5
	Positive++	3	7.7
	Positive+++	1	2.6

LMS and parameter pH, LE, nitrit, protein and total score correlation test resulted in stastitically significant positive correlation with various correlation coefficient range from moderate to strong ($p \leq 0.05$, r=0.652; 0.556; 0.605; 0.503; 0.779 respectively) (Table2)

Table 2: LMS correlation with NSDA

	Spearman's	Pearson's	p
	LMS		
LMS	1.000	1.000	
pH	0.652		0.000
LE	0.556		0.000
Nitrit	0, 605		0.000
Protein	0.503		0.001
TotalScore		0.779	0.000

Data categorized (Table3) then sensitivity test calculated with sensitivity result of 92.6%, specificity 58.3%, PPV 83.3% and NPV 77.8%.

Table 3: Cross-tabulation Total NSDA and LMS

		LMS		Total
		≥ 4	<4	
NSDA	≥ 4	25	5	30
	<4	2	7	9
Total		27	12	39

4. Discussion

CRS is rising health problem. Researchers continue to study for ideal method. LMS has correlation with sinonasal inflammation.[4] Dipstick parameters proven to associate with rhinosinusitis.[5, 6] But theres yet to be any research on NSDA with CRS moreover with LMS.

This study of 39 subjects with CRS, one third on 15-24years age group. Parallel with previous studies, most common incidents found in second and third decade of life.[3] Its agreeable with studies that stated adult and young adult were the most common group, due to environment factor, life style, diet and infection. [2, 3, 4]

The slight male predominant result (59%), similar with previous studies.[2, 3] Its associated with high exposure to pollution, dust, weather, and outdoor environtment, result in mucosal change, epitelial disintegrity and ciliary damage.[2, 3, 4]

CRS without nasal polyps found in 71.1% subjects. In accordance with other studies that stated it has higher prevalence to 8:2 compared to CRS with nasal polyp.[10] Maxillary sinus involved in 92.3% of cases, exclusively or in conjuction with other sinuses. Other studies also have highest maxillary involement.[2, 10]

To this date theres has been no establish cut-off, but score ≥ 4 associated with CRS.[1] Infection, positive middle meatal culture, and inflammation has establish its role in effecting LMS CT Scan. LMS associated with inflammation degree[4] but not with symptoms[10], while diagnosis of CRS based on symptom. Thats lead to patient with CRS but with low LMS score.

pH in normal subject maintained in 5-6.5 for mucocilliary and immunity processesfunction. The value did not hinder by allergy, smoking or diurnal variation. pH of more than 8.5 strongly associated with rhinosinusitis and shifted to more acidic in healing period.[5, 7] In another study, pH in CRS statistically significant higher than 7.8.[7] In line with that finding, in this recent study patient found to have pH 9 (35.9%) with statistically significant strong positive correlation with LMS (r=0.652).

Dipstick LE finding positive+ observed in 66.7% of patients. LE found in azurofil leukocytegranule. The advantage of LE is its ability to detect intact or lysis leukocyte [6, 10] Negative result in NSDA doesnt mean absent of LE but the amount that doesn't reach treshold to cause colour reaction.

Correlation between LE with LMS concluded as moderate positive correlation (r=0.556). One other study confirmed that of all positive LE patient only one that didnt had rhinosinusitis, but almost 10% rhinosinusitis had negative LE.[5] This finding show a relationship with possibility of confounding factors

LE expected to escalate in CRS inflammation.[10] In this study LE was detected but not in exaggerated high value. It could be for the lack of specific diagnosis cut-off value and cells pattern in Indonesia especially Medan, to standarized

grading. It has been established that pathogenesis and inflammation pattern in CRS differ by geography, environtment, ethnic and has no consistent diagnosis criteria.[10]

Nitrit, a more stabile, easier to assess metabolite of nitric oxide (NO), with role on inflammation and immun reaction.[8] In CRS, level of nasal NO suggested as screening tool for inflammation and obstruction. NO and its metabolites increase in humming and has positive correlation to CT Scan finding.[5, 6, 8]

In this study 48.9% showed positive nitrit reading. Nitrit has strong positive correlation with LMS (r=0.605). NO level has very strong correlation with CRS radiological presentation, with metabolite elevation suggested.[8]Until recently no study found to assessmetabolite status onCRS. Theres still contestation about nature and standard value of nasal NO metabolite in CRS

Normal nasal secretion contain proteins from transudation and mucosal glands.[9]Infection, allergy, chemicaland environment can alter secretion. Inflammation lead to increase in nasal secretion protein.[9, 10]

This increment has proven significantly higher in CRS with nasal polyps and can be biomarker and new target therapy.[9] In this study, 69.2% patient presented negative protein. Protein showed moderate positive correlation with LMS (r=0.503). Onepossible reason is CRS with nasal polyps only 28.9% of subjects. Significant increase has been established in polyps patients but no research to identify protein on CRS without nasal polyps. And in both categories, no specific cut-off specified.[9]

Total NSDA score had positive strong correlation with LMS (r=0.779). NSDA of ≥4 associated with rhinosinusitis radiology and CRS PCR.[5, 6] Theres still no other similar study in this area. This result can open a stark opportunity for further research, larger sample and different settings condition, to establish the use of NSDA.

Data was tabulated on 2x2 cross-tabulation table to calculate sensitivity test. The sensitivity rate found at 92.6%, specificity 58.3%, PPV 83.3% and NPV 77.8%. As already mentioned above, to this date theres no other specific research on NSDA and LMS let alone its sensitivity test. These values, in conjunction to one another, means that NSDA can predict LMS value of ≥4.

This study done for new possibility so that NSDA can stand to assess CRS and start treatment, with saver, faster, more cost-effective and readily available method. There are still dubious designation and confounding factors that can influence and distort this outcome. Therefore further deeper investigation with various different protocols, intricate frameworks and specific conditions still needed to establish its relationship and clinical usage

References

[1] Lohiya, S.S., Patel, S.V., Pawde, A.M., Bokare, B.D., Sakhare, P.T. Comparative study of nasal endoscopy and CT Scan SPN in diagnosing CRS. *Indian J Otolaryngol Head Neck Surg*. 2016 Apr–Jun;68 (2):224-9. DOI:10.1007/s12070-015-0907-7

[2] Kurniasih, C., Ratnawati, LM. Distribusi penderita RSK menjalani pembedahan di RSUP Sanglah Denpasar. *MEDICINA*. 2019;50 (1):133-7. DOI:10.15562/Medicina.v50i1.2

[3] Dewi. E., Hasibuan, M., Nursiah, S., Harahap, M.P. Akurasi gejala klinis Task Force terhadap indeks LMS CTScan. *Majalah Kedokteran Nusantara*. 2013 Des;46 (2).

[4] Fokkens, W., Lund, V.J., Bachert, C., Mullol, J., Alobid, F., Baroody, F., et al. EPOS. EAACI Task Force. *Rhinol Suppl*. 2012 Mar;50 (23):1-298.

[5] Huang, S.W., Small, P.A. Rapid diagnosis of bacterial sinusitis in patients using a simple test of nasal secretions. *Allergy Asthma Proc*. 2008;29:640-3. DOI:10.2500/aap.2008.29.3163

[6] Song, C., Chorath, J., Pak, Y., Redjal, N. Use of dipstick assay and rapid PCR-DNA analysis of nasal secretions for diagnosis of bacterial sinusitis in children with chronic cough. *Allergy & Rhinology*. 2019;10:1-8. DOI:10.1177/2152656718821281

[7] Bhawana GS., Kumar S., Kumar A. Alkaline pH in middle meatus in cases of chronic rhinosinusitis. *Am J Otolaryngol.* 2014 Jul-Aug; 35 (4):496-9. DOI:10.1016/j.amjoto.2014.02.017

[8] Oliver, J.D., Lim, K.G., O'Brien, E.K. Correlation of exhaled nasal NO with sinus CT Scan and SNOT: a cross-sectional pilot study. *Am J Rhinol Allergy. 2018;* 0 (0):1-6. DOI:10.1177/1945892418801389

[9] Castelli, S., Arasi, S., Pawankar, R., Matricardi, P.M. Collection of nasal secretions and tears and their use in allergology. *Curr Opin Allergy Clin Immunol.* 2017;17:1-9. DOI:10.1097/ACI.0000000000000412

[10] Huriyati, E., Darwin, E., Yanwirasti, Y., Wahid, I. Association of inflamation mediator in mucosal and tissue in CRS with recurrent nasal polyp. *Open Access Maced J Med Sci.* 2019 May;7 (10):1635-40. https://doi.org/10.3889/oamjms.2019.327