Diagnostic evaluation of micromethod erythrocyte sedimentation rate in pediatric infections

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Özet

Pediatrik infeksiyon hastaliklarinda mikrosedimantasyonun tanisal değeri

Amaç: Yenidoğanlarda mikrometod sedimantasyon hızının sedimantasyon hızı ile korele olduğu bildirilmiştir. Çalışmalar özellikle yenidoğan enfeksiyonlarında çalışmalar yapılmıştır. Bazı çalışmalarda yenidoğanlarda sepsis taramalarında ve enfeskiyon varlığında daha değerli olduğu gösterilmiştir. Kolay, hızlı ve ekonomik bir yöntem olması nedeni ile, infeksiyonlarda mikrometod sedimantasyon hızının tanısal değerini ve diğer akut faz reaksiyon parametreleri ilişkilerini araştırmak amacı ile yapıldı. Gereç ve Yöntemler: Süleyman Demirel Üniversitesi Tıp fakültesi Pediatri AD na başvuran 31 hasta ve 24 sağlıklı çocuk çalışmaya alındı. Hasta grbununun 14'ünde alt solunum enfeksiyonu, 8'inde üst solunum yolu enfeksiyonu 6'sında idrar yolu enfeksiyonu ve 3'ünde gastroentestinal enfeksiyon vardı. Kontrol grubunun akut veya kronik enfeksiyonu ve ilaç kullanım öyküsü yoktu. Her iki grupta mikrosedimantasyon yanında, beyaz küre sayımı, sedimantasyon,CRP ve fibrinojen değerlerine bakıldı. Bulgular: Her iki grup arasında yaş (p=0.59) ve cinsiyet (p=0.18). yönünden istatistiksel olarak fark yoktu. Sedimantasyon hızı kontrol grubunda 11.75±5.87 mm/h (4-24) iken hasta grubunda 59.48±26.42 mm/h (10-109) bulundu (p<0.01). Mikrosedimantasyon hızı kontrol grubunda 14.08±5.35 mm/h (4-24) iken hasta grubunda 32±11.31 (12-60) mm/h bulundu (p<0.01). Hasta grubunda beyaz küre sayımı, sedimantasyon hızı, CRP ve fibrinojen değerleri yüksekliği yanında mikrosedimantasyon hızı anlamlı olarak yüksek bulundu (p<0.01). Sonuç olarak; Birkaç çalışmada mikrosedimantasyon hızının makrosedimantasyondan anlamlı olarak bulunduğu fakat klinik düzeyde değerli olmadığı belirtilmiştir. Çalışmamızda ise, hasta ve kontrol grubunda mikrosedimantasyon hızı da sedimantasyon hızı kadar hassas ve özgündü. Mikrosedimantasyon hızının intarvenöz işlem gerekmeden daha basit ve hızlı olması nedeni ile daha kullanışlı olduğuna inanıyoruz .

Anahtar kelimeler: mikrometod sedimantasyon hızı, pediatri, infeksiyon

Abstract

Introduction: Micromethod erythrocyte sedimentation rate (MESR) correlates classic Westergren method in newborn. In literature, MESR or microsedimentation rate has been studied especially newborn infections. Some of them showed that this test is more valuable in the sepsis screening and predicting the presence of infection in neonates .To investigate diagnostic evaluation of MESR in infections as its fast, easy, economic method and the relation between other acute phase reactant parameters. Material and Methods: A total 31 patient and 24 healthy children were admitted in this study in Suleyman Demirel University Medical Faculty Department of Pediatric. The patient group had various infections included 14 lower respiratory tract infection, 8 upper respiratory tract infection, 6 urinary tract infection, 3 gastrointestinal infection. The control group had no acute or chronic infections, no history taken any drugs. We performed same tests (Westergren sedimentation and MESR, CRP, WBC, fibrinogen) into two groups. There is no statistical significant between two groups as age and sex. Results: There was no statistically significant difference of age (p=0.59) and sex (p=0.18). between two groups. Sedimentation was 11.75±5.87 mm/h (4-24) in control group, 59.48±26.42 mm/h (10-109) in patient group (p<0.01). MSER was 14.08±5.35 mm/h (4-24) in control group, 32±11.31 (12-60) mm/h in patient group (p<0.01). Mean of sedimentation rate, MESR, CRP, WBC, and fibrinogen were significantly higher in patient group(p<0.01). Conclusion: In several studies, the MESR values higher than

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the macromethod at values but this difference is not of sufficient magnitude at the clinical decision level . In our study, MESR was as sensitive and specific as erythrocyte sedimentation rate in the patient group than control group. Also, MESR is more practical as it is a simple and quick test which does not need venous sample.

Keywords: erythrocyte sedimentation rate, micromethod erythrocyte sedimentation rate, pediatrics, infection

Introduction

Acute phase proteins are extremely helpful markers for indicating a disturbance of the homeostasis within the organism and for monitoring the course of a disease. The acute phase can be induced not only by bacterial infections, but also by trauma, neoplasm, burn injury, and immunologic disorders. Several proteins, the concentration of which changes significantly during this response were termed as acute phase proteins or acute phase reactants (APRs). We usually measure the concentration of hepatic APRs as the liver is the major organ in the acute phase response. Two families of APRs have been defined recently according to their induction pattern in the liver. Class 1 APRs are induced by interleukin (IL)-1 in synergy with IL-6 (1). The high erythrocyte sedimentation rate (ESR) reflects elevated levels of several APRs, particularly fibrinogen. The ESR is an inexpensive laboratory test that is commonly used to assess the acute phase response. The Westergren method of measuring the ESR has been used since 1924 (2).

Micromethod erythrocyte sedimentation rate (MESR) correlates classic Westergren method in newborn. In literature, MESR or microsedimentation rate has been studied especially newborn infections (4-9). Some of them showed that this test is more valuable in the sepsis screening and predicting the presence of infection in neonates (5, 8-10). MESR is fast, easy and economic method.

Aim of this study was to investigate diagnostic evaluation of MESR in infections and to find ıts correlation between other APRs parameters and modified Westergren method.

Patient group

A total 31 patients and 24 healthy children were included in this study in Suleyman Demirel University Medical Faculty Department of Pediatric. The patient group had various infections including 14 lower respiratory tract infection, 8 upper respiratory tract infection, 6 urinary tract infection, 3 gastrointestinal infection. The control group had no acute or chronic infections, no history taken any drugs.

Blood samples were taken for laboratory investigation including modified Westergren sedimentation, MESR, C-reactive protein (CRP), white blood cell (WBC), and fibrinogen. In Westergren method, citrated blood was allowed to stand vertically in a tube, the red blood cells sink to the bottom of to the tube and leave clear plasma above them (citrate binds calcium and thus prevents coagulation). Microsedimentation method was evaluated as manually using capillary tube. Heparinized capillary tube filled blood from tip of finger or heel. Carefully, air did not mixture to blood. In room temperature, the sample waited one hour then results are enrolled. Samples are also investigated for CBC, fibrinogen, and CRP. Normal values for WBC, sedimentation rate, CRP, and fibrinogen are 4,000-10,000/mm3, 0-20 mm/h, 1-3 mg/L, and 1.5-4.5 g/L respectively. Normal value for MESR is described 0-20 mm/h like ESR (11).

Data analysis

Data were analyzed using the statistical package for Windows (SPSS 11.0.0). Statistical significance was set at the 0,05 level. Results are given as mean ± standard deviation (SD). Independent sample t-test, Fisher exact test were used for statistical analysis. Cut off values has been accepted as upper limit of normal, then diagnostic evaluation of tests have estimated.

Results

We included 31 children as patient group (11 female, 20 male) and 24 children as healthy group (13 female, 11 male) in our study. Mean age was 7.6±4.8 years in patient group, 8.3±3.8 years in the control group. There were no statistical significance between two groups in age (independent t test, $p=0.59$) and sex (fisher exact, $p=0.18$).

ESR was 11.75±5.87 mm/h (4-24) in the control group, 59.48±26.42 mm/h (10-109) in patient group ($p<0.01$). MSER was 14.08±5.35 mm/h (4-24) in control group, 32±11.31 (12-60) mm/h in patient group ($p<0.01$). Means of CRP, WBC, and fibrinogen were significantly higher in the patient group than the control group (Table 1).

Table 1: Laboratory findings in the patient and control group.

Acute phase reactans	Values (mean SD)		p values*
	Patient group (n=31)	Control group (n=24)	
White Blood Cell (WBC) (cells/mm^3)	14,470±8,550	7,780±2,590	<0.05
Erythrocyte Sedimentation rate (ESR) (mm/h)	59.48±26.42	11.75±5.87	<0.01
Micromethod Erythrocyte Sedimentation rate (MESR) (mm/h)	32.00±11.31	14.08±5.35	<0.01
C-Reactive Protein (CRP) (mg/dl)	85.60±82.21	2.39±4.04	<0.01
Fibrinogen (g/dl)	4.06±1.87	2.15±0.79	<0.01

*Mann-Whitney U test
WBC : white blood cells
MESR : micromethod erythrocyte sedimentation rate
CRP : C-reactive protein

When we accepted MESR ≥20 mm/h as threshold, sensitivity and specificity were 90.3%, 83.3% reference to classic sedimentation. Sensitivity was 94.1%, specificity was 60% reference to fibrinogen, sensitivity was 87.9%, specificity was 86.4 reference to CRP. Moreover; sensitivity was 87.1%, specificity was 79.2% when we take MESR ≥20 mm/h as threshold to separate the patient group from control group (Table 2). Sedimentation rate had higher sensitivity and specificity to separate the patient group from control group (93.5%, 91.7% respectively). Sensitivity and specificity in MESR and sedimentation rate have been showed in ROC curve (Figure 1).

Table 2. Validity coefficiency of tests for selected cut off points in the discrimination between control and patient groups.

	Sensitivity	Specificity	Pos pred value	Neg pred value
MESR				
>10 mm/h	100%	25.0%	63.3%	100%
>20 mm/h	87.1%	79.2%	84.4%	82.6%
ESR				
>10mm/h	96.8%	41.7%	68.2%	90.9%
>20 mm/h	93.5%	91.7%	93.5%	91.7%
WBC>10.000/mm3	77.4%	83.3%	85.7%	74.1%
CRP>3 mg/L	96.8%	87.5%	90.9%	95.5%
Fibrinogen>4.5g/L	57.1%	95.8%	94.1%	65.7%

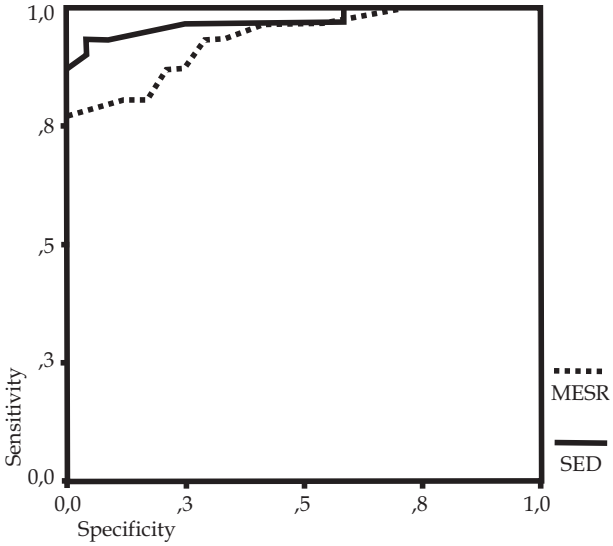

Figure 1: ROC curve between ESR and MESR

Discussion

ESR reflects roulox formation and is the measured descent in a setting of a vertical column of erythrocytes within one hour in avibration free place, at room temperature. The standard method of measuring the ESR is based on the technique first described by Westergren in 1921 and defined by the International Committee for Standardization in Hematology in 1977 (12,13). In Westergren Method, venous blood is anticoagulated with sodium citrate in 4:1 ratio and put in a 200 mm glasstube with a 2.5 mm internal diameter. The second most commonly used method to measure the ESR is the Wintrobe method, performed with a 100 mm tube containing oxalate as the anticoagulant. It requires no dilution and may be more sensitive than the Westergren method (14). ESR has been widely used in clinical medicine. In general, the ESR increases in all acute general infections and localized infections and inflammatory conditions (15,16). In newborn, the ESR is usually low, whereas children and adolescants have the same normal values of men with no difference between boys and girls. In general, normal values are 15 mm/hr or less for men and 20 mm/hr or less for women. The causes of high ESR are female gender, increasing age, infection, inflammation, neoplasm, pregnancy, diabetes mellitus, hypothyroidism, collagen vascular disease and heparin. The causes of low ESR are polycythemia, hemolytic anemia, hereditary spherocytosis, hereditary hypofibrinogenemia, hyperproteinemia, cortisone, disseminated

intravascular coagulation (DIC) and antiinflammatory agents. Multiple studies found the ESR not useful as a screening test for the presence of disease in asymptomatic patients (3).

Weinberg at al.(5) compared micro- and macroerythrocyte sedimentation rate and he found that the micromethod produces values higher than the macromethod at values above 10 mm/h but this difference is not of sufficient magnitude at the clinical decision level, Ibsen et al.(4) suggested that every newborn a high MESR supports the diagnosis of severe infection, whereas a low MESR does not exclude this diagnosis.

In our study, mean of classic sedimentation, MESR, CRP, WBC, and fibrinogen, were found significantly higher in the patient group. MESR was as sensitive and specific as ESR in the patient group than in the control group. In addition MESR is more parctical because it is simple and quick test which does not need a venipuncture and works with a little blood sample.

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