PENAMPILAN DIAGNOSTIK *COMBINED CELL INDEX* (CCI) UNTUK DETEKSI DEFISIENSI BESI PADA DONOR DARAH

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INTISARI

Latar Belakang:
Salah satu risiko yang sering dialami donor darah adalah defisiensi besi. Skrining predonasi menggunakan pemeriksaan hemoglobin idak dapat mendeteksi defisiensi besi tahap awal. Penurunan hemoglobin baru akan terjadi ketika donor sudah mengalami defisiensi besi tahap akhir. Pemeriksaan besi secara kimiawi membutuhkan waktu yang lama, biaya yang tinggi, dan tidak tersedia di semua layanan kesehatan. Parameter CCI yang dihitung dari komponen *Mean Corpuscular Volume* (MCV), *Mean Corpuscular Haemoglobin* (MCH) dan *Red Blood Cell Distribution Width* (RDW) diharapkan dapat memprediksi defisiensi besi tahap awal. Indeks ini menggunakan kombinasi parameter MCV, MCH, dan RDW sehingga mudah, murah, dan cepat karena hasil diperoleh dari alat hematologi otomatis.

Tujuan
Untuk mengevaluasi penampilan diagnostik *Combined Cell Index* dalam deteksi defisiensi besi pada donor.

Metode
Desain penelitian observasional analitik dengan pendekatan potong lintang yang dilakukan di Unit Pelayanan Transfusi Darah RSUP Dr. Sardjito bulan Juli – September 2023. Subjek penelitian adalah donor darah yang lolos seleksi donor dan memenuhi kriteria inklusi dan eksklusi. Subjek diambil darah sebanyak 3 mL untuk pemeriksaan darah lengkap otomatis dan 3 mL untuk pemeriksaan kimia besi dan CRP. *Combined Cell Index* diukur dengan rumus (RDW) × 10^4 × $(MCV)^{-1}$ × $(MCH)^{-1}$. Karakteristik dasar subjek diambil dari anamnesis. Analisis data untuk melihat penampilan diagnostik melalui sensitivitas dan spesifisitas. Kurva *Receiver Operating Characteristic* (ROC) digunakan untuk mendapatkan nilai *cut-off*. Penelitian ini menggunakan baku standar feritin <20 ng/mL untuk menentukan status defisiensi besi. Hasil dianggap bermakna secara statistik jika nilai p<0,05.

Hasil Penelitian :
Total subjek penelitian 137 donor yang terdiri dari 109 (79%) subjek laki- laki dan 28 (21%) perempuan. Berdasarkan kadar feritin terdapat 12 (8,7%) subjek defisiensi besi dan 125 (91,3%) subjek normal. Analisis kurva ROC mendapatkan nilai AUC sebesar 0,832 (IK 95%=0,70 – 0,964) dan nilai *cut-off* indeks CCI >55,99 dengan sensitivitas 92%, spesifisitas 82%, nilai ramal positif 33%, nilai ramal negatif 99%, *likelihood ratio* positif 5,2 dan *likelihood ratio* negatif 0,1.

Kesimpulan :
Parameter *Combined Cell Index* dengan *cut-off* >55,99 memiliki sensitivitas dan spesifisitas yang baik dalam deteksi defisiensi besi donor darah.

Kata kunci : donor darah, defisiensi besi, deteksi, *Combined Cell Index* (CCI)

DIAGNOSTIC PERFORMANCE OF COMBINED CELL INDEX (CCI) IN DETECTING BLOOD DONOR IRON DEFICIENCY

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ABSTRACT

Background:
Iron deficiency is one of the blood donor risk. Current pre-donation selection relies on hemoglobin measurement, which cannot detect early stage iron deficiency. Hemoglobin levels begin to decrease once iron deficiency has reached a late stage. Biochemical iron testing is time-consuming, costly, and not widely available in blood bank. The CCI calculated from Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), and Red Blood Cell Distribution Width (RDW) components, is expected to predict early-stage iron deficiency. This index uses a combination of MCV, MCH, and RDW parameters, making it easy, inexpensive, and quick, as the results are obtained from automated hematology analyzers.
Objective:
To evaluate the diagnostic performance of the Combined Cell Index in detecting iron deficiency among blood donors.
Methods:
An analytical observational study with a cross-sectional design was conducted at Unit Pelayanan Transfusi Darah (UPTD) Dr. Sardjito Hospital between July and September 2023. Subjects were blood donors who passed donor selection and met the inclusion and exclusion criteria. A total 3 mL of blood was collected for complete blood count analysis and an additional 3 mL for iron studies and CRP testing. The Combined Cell Index was measured using the formula $(RDW) \times 10^4 \times (MCV)^{-1} \times (MCH)^{-1}$. Baseline characteristics were obtained through anamnesis.
Data analysis was performed to assess diagnostic performance using sensitivity and specificity. A Receiver Operating Characteristic (ROC) curve was used to determine the cut-off value. A feritin level of <20 ng/mL was used as the reference standard for iron deficiency. Statistical significance was defined as a p-value <0.05.
Results:
Total research subjects were 137 donors, consisting of 109 (79%) male and 28 (21%) female subjects. Based on ferritin levels, there were 12 (8.7%) iron-deficient subjects and 125 (91.3%) normal subjects. ROC curve analysis obtained an AUC value of 0.832 (95% CI=0.70 – 0.964) and a CCI index cut-off value of >55.95 with 92% sensitivity, 82% specificity, 33% positive predictive value, 99% negative predictive value, 5.2 positive likelihood ratio, and 0.1 negative likelihood ratio.
Conclusion:
The Combined Cell Index with a cut-off value of >55.99 demonstrates good sensitivity and specificity for detecting iron deficiency in blood donors.
Keywords: blood donors, iron deficiency, detection, Combined Cell Index (CCI)