

# PARAMETER INFLAMASI DAN INKOMPATIBILITAS SEBAGAI FAKTOR RISIKO TERBENTUKNYA ALOANTIBODI PADA PASIEN *TRANSFUSION DEPENDENT THALASSEMIA*

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## ABSTRAK

**Latar belakang.** *Transfusion-dependent thalassemia* (TDT) memerlukan transfusi darah berulang seumur hidup untuk mempertahankan kadar hemoglobin. Transfusi berulang dapat memicu *iron overload* dan inflamasi kronik yang menyebabkan disregulasi sistem imun. Kondisi ini berpotensi meningkatkan pembentukan aloantibodi terhadap antigen eritrosit donor. Parameter inflamasi seperti *monocyte-lymphocyte ratio* (MLR) dan feritin dapat mencerminkan derajat inflamasi kronik. Inkompatibilitas transfusi yang ditandai dengan hasil *direct antiglobulin test* (DAT) positif dan riwayat inkompatibilitas sebelumnya juga dapat memicu sensitisasi imun.

**Tujuan.** Membuktikan parameter inflamasi (MLR dan feritin) dan inkompatibilitas (DAT dan riwayat inkompatibilitas) sebagai faktor risiko terbentuknya aloantibodi pada pasien TDT di RS Dr. Kariadi.

**Metode.** Penelitian observasional dengan desain *cross-sectional* dilakukan pada 43 pasien TDT di RS Dr. Kariadi (Juli–Agustus 2025) dengan metode *consecutive sampling*. Pemeriksaan hematologi rutin menggunakan *hematology analyzer* berbasis impedansi, kadar feritin dengan chemiluminescent immunoassay (CLIA), skrining antibodi dengan gel *test*, serta DAT menggunakan *gel card direct antiglobulin test*. Analisis dilakukan menggunakan uji chi-square/Fisher's Exact, serta kurva ROC untuk menentukan nilai *cut off* MLR dan feritin dengan tingkat kemaknaan  $p < 0,05$ .

**Hasil.** Dari 43 pasien, 3 (7,0%) ditemukan aloantibodi positif. Nilai *cut off* MLR adalah 0,274 (AUC 72,7%,  $p = 0,043$ ), dengan 20 pasien (46,5%) memiliki  $MLR \geq 0,274$ . Tidak terdapat hubungan bermakna antara MLR dan aloantibodi ( $p = 0,308$ ). Feritin memiliki *cut off* 2186,7 ng/mL (AUC 84,2%,  $p = 0,010$ ); 33 pasien (76,7%) memiliki kadar  $\geq 2186,7$  ng/mL. Terdapat hubungan signifikan antara feritin dan aloantibodi ( $p = 0,010$ ) namun bukan sebagai faktor risiko terbentuknya aloantibodi. DAT positif ditemukan pada 22 pasien (51,2%) tetapi tidak berhubungan signifikan dengan aloantibodi ( $p = 0,125$ ). Riwayat inkompatibilitas transfusi tidak menunjukkan hubungan bermakna ( $p > 0,05$ ).

**Simpulan.** MLR, Feritin, DAT, dan riwayat inkompatibilitas tidak terbukti sebagai faktor risiko terbentuknya aloantibodi pada pasien TDT

**Kata kunci:** *transfusion dependent thalassemia*, aloantibodi, *monocyte lymphocyte ratio*, feritin, *direct antiglobulin test*, inkompatibilitas transfusi

# **INFLAMMATORY PARAMETERS (MLR AND FERRITIN) AND INCOMPATIBILITY (DAT AND HISTORY OF INCOMPATIBILITY) AS RISK FACTORS FOR ALLOANTIBODY FORMATION IN PATIENTS WITH TRANSFUSION-DEPENDENT THALASSEMIA (TDT)**

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## **ABSTRACT**

**Background.** *Transfusion-dependent thalassemia (TDT) requires repeated blood transfusions throughout life to maintain adequate hemoglobin levels. Repeated transfusions can lead to iron overload and chronic inflammation, resulting in immune dysregulation. This condition may increase the risk of alloantibody formation against donor erythrocyte antigens. Inflammatory parameters such as the monocyte-lymphocyte ratio (MLR) and ferritin can reflect the degree of chronic inflammation. Transfusion incompatibility, indicated by a positive direct antiglobulin test (DAT) result and a previous history of incompatibility, may also trigger immune sensitization*

**Aim.** *To prove that inflammatory (MLR and ferritin) and incompatibility (DAT and history of incompatibility) parameters are risk factors for the formation of alloantibodies in TDT patients at Dr. Kariadi General Hospital.*

**Methods.** *An observational study with a cross-sectional design was conducted on 43 TDT patients at Dr. Kariadi General Hospital (July–August 2025) using consecutive sampling. Laboratory tests included routine hematology using an impedance-based hematology analyzer (for MLR calculation), ferritin levels using chemiluminescent immunoassay (CLIA), antibody screening using a gel test, and DAT using a gel card direct antiglobulin test. Analysis was performed using the chi-square/Fisher's Exact test and ROC curve to determine the MLR and ferritin cut off values with a significance level of  $p < 0.05$ .*

**Results.** *Of 43 patients, 3 (7.0%) were positive for alloantibodies. The MLR cut off value was 0.274 (AUC 72.7%,  $p = 0.043$ ), with 20 patients (46.5%) showing  $MLR \geq 0.274$ . No significant association was found between MLR and alloantibody formation ( $p = 0.308$ ). The ferritin cut off value was 2186.7 ng/mL (AUC 84.2%,  $p = 0.010$ ); 33 patients (76.7%) had ferritin levels  $\geq 2186.7$  ng/mL. A significant association was observed between ferritin and alloantibodies ( $p = 0.010$ ), although ferritin was not established as a risk factor for alloantibody formation. Positive DAT results were found in 22 patients (51.2%), but there was no significant association with alloantibodies ( $p = 0.125$ ). A history of transfusion incompatibility also showed no significant association ( $p > 0.05$ ).*

**Conclusion.** *MLR, ferritin, DAT, and history of incompatibility were not proven to be risk factors for the formation of alloantibodies in TDT patients.*

**Keywords:** *transfusion dependent thalassemia, alloantibodies, monocyte lymphocyte ratio, ferritin, direct antiglobulin test, transfusion incompatibility*