Microangiopatie trombotiche

AN AUTOMATED LABORATORY ALERT ALGORITHM FOR EARLY IDENTIFICATION OF THROMBOTIC THROMBOCYTOPENIC PURPURA IN THE EMERGENCY SETTING

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Background and Aims. Immune thrombotic thrombocytopenic purpura (iTTP) is a life threatening thrombotic microangiopathy requiring rapid recognition and treatment. Clinical presentation is often heterogeneous, and diagnostic delays worsen outcomes. Severe thrombocytopenia and microangiopathic hemolytic anemia (MAHA) are constant laboratory features. No fully automated alert systems for iTTP are currently implemented in emergency practice. We proposed and designed an automated, stepwise laboratory algorithm to support early identification of suspected iTTP.

Methods. We conceptualized a cascade algorithm based on routine emergency tests. Triggered by new onset severe thrombocytopenia (platelet count <50×10⁹/L), the algorithm sequentially evaluates anemia, hemolysis, coagulation and renal function, following the decision pathway illustrated in the accompanying figure. Each step determines whether the process continues or stops, generating specific alerts for suspected iTTP, suspected DIC, or suspected aHUS / renal TMA. All patients diagnosed with TTP between 2023 and 2025 were retrospectively reviewed to assess the algorithm's ability to identify confirmed cases. In addition, emergency admissions over a two year period were examined to estimate the potential operational impact of algorithm activation.

Results. The algorithm correctly identified 10 of 11 patients with confirmed iTTP. The only missed case presented with severe thrombocytopenia and laboratory signs of hemolysis but without anemia, meaning that the algorithm would not have been activated at all, as the first step was not met. In all other cases, the cascade was triggered by thrombocytopenia and MAHA related abnormalities. In the two year emergency cohort (n=249564 patients), the alert would have been triggered in 0.4% of patients (n=998), all of whom presented with both severe thrombocytopenia and anemia, as required by the algorithm. By automatically activating reflex LDH, indirect bilirubin, reticulocyte and schistocyte testing, the algorithm rapidly provides clinicians with all laboratory parameters required for PLASMIC score assessment. Although PLASMIC also includes clinical variables, the algorithm ensures that the laboratory components are delivered immediately, complete and standardized, markedly accelerating the diagnostic workflow. The retrospective operational analysis confirmed that activation frequency remains low, with a limited impact on overall laboratory workload.

Conclusions. A fully automated, stepwise laboratory algorithm based on routine emergency tests may effectively support early identification of suspected iTTP. The missed non anemic presentation highlights the need to evaluate hemolysis markers even in the absence of anemia and to proceed through the diagnostic pathway when hemolysis is documented. This approach strengthens integration between laboratory and clinical workflows, reduces inappropriate ADAMTS13 testing while ensuring complete PLASMIC score assessment, and may facilitate timely initiation of life saving therapies. Prospective validation in a pilot center and evaluation of its impact on diagnostic timing and clinical outcomes are warranted.

