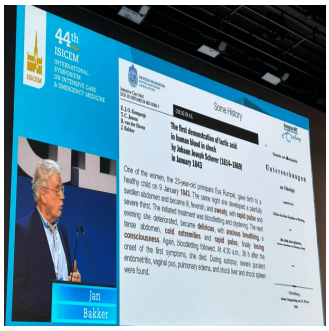
ICU
MANAGEMENT & PRACTICE

Blood Lactate Levels: Past, Present and Future



At the opening session at ISICEM Congress in Brussels, Prof Jan Bakker talked about the past, present and future of blood lactate levels.

Lactate has long been recognised as a crucial biomarker in critical care, particularly in the assessment of circulatory failure and shock. The late Dr Max Harry Weil contributed significantly to this field, emphasising that an elevated lactate level alone is not enough to diagnose shock—it must be interpreted within the broader clinical context.

A landmark discussion on this issue occurred during a workshop, where a clinical case was presented without detailed patient specifics but with numerical data, including a lactate level of 4.5 mmol/L—an indicator often associated with a 50% mortality risk. Expert panellists initially recommended aggressive treatment. However, when the full clinical picture was revealed—that the patient was stable, drinking coffee, and watching television—recommendations changed dramatically. This underscores a key principle: lactate levels should be interpreted in conjunction with clinical signs such as altered mentation, clammy skin, and mottling, rather than in isolation.

Lactate is an integral part of human metabolism. Muscles, the brain, and the heart use lactate as an energy source. The compound itself does not inherently signify tissue hypoxia or shock, as its production can be influenced by various physiological and pathological factors. Early observations from the 19th century linked increased lactate levels to conditions resembling septic shock, characterised by symptoms such as rapid pulse, delirium, cold extremities, and loss of consciousness.

Research over the decades has demonstrated multiple pathways through which lactate levels can rise, independent of oxygen deficiency. These include metabolic overload, when pyruvate accumulation exceeds the capacity of the Krebs cycle, lactate production increases; alkalosis from hyperventilation can elevate lactate levels; and while lactate normalises quickly in reversible circulatory failure (e.g., cardiac tamponade), it remains persistently elevated in sepsis due to ongoing metabolic dysfunction.

Despite its complexities, lactate remains a powerful prognostic tool. Studies dating back to 1965 have shown a clear correlation between lactate levels and mortality. For example, historical data shows that patients with lactate >13 mmol/L had virtually no survival. Modern ICU studies demonstrate that despite advancements in care, mortality remains high for patients with lactate >10 mmol/L. Finally, elevated lactate in emergency settings strongly correlates with poor outcomes.

Changes in lactate over time are as important as absolute values. Studies have shown that failure to clear lactate is associated with increased mortality. In septic shock, targeting lactate clearance has been a key resuscitation strategy, though outcomes remain variable.

The Andromeda Shock Study compared lactate-guided resuscitation to capillary refill time (CRT) assessment. Results indicated that patients with normalised CRT had better outcomes, even when lactate remained elevated. This highlights the risk of over-relying on lactate alone without considering overall perfusion status.

Advancements in continuous lactate monitoring, akin to glucose sensors, may enhance early detection and intervention. However, such technology must be integrated with artificial intelligence (AI) to ensure context-aware decision-making, preventing unnecessary interventions in patients with benign hyperlactataemia.

Lactate remains a valuable tool in critical care, but its interpretation requires careful contextualisation. Increased lactate can signal life-threatening conditions, but without considering clinical signs and perfusion status, misinterpretations can lead to inappropriate management. The challenge for modern practitioners is not just to measure lactate, but to create meaningful clinical context around it.

Source: ISICEM Congress 2025 Presentation

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