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Editorial

We Need More Complex Systems Modeling in Anesthesiology

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Editorial

Complex does not mean complicated. Despite some controversies in its definition, complex systems features include coupled rule-independent subsystems which emerge a counterintuitive or difficult to understand phenomena [1]. The simple uncoupled models' (such as multiple regressions) limits have been reached in some knowledge, making it necessary to advance to complex systems modeling for new knowledge to emerge.

There are many strategies for modeling a complex system. One can try to study simulating the interaction of known simple subsystems, for example. Agent based modeling and discrete event modeling have been applied to simulate surgical ward's flow in the field of operating room management [2]. One can try to apply artificial intelligence models to real data to try to get complex models which may fit complex systems, such as artificial neural networks [3]. We did model complex systems when we modeled three compartment models for target controlled infusions. It is also possible to study complex systems by coupling differential equations, such as some famous studies in anesthesia induced loss of consciousness [4-6].

Although some publications using complex systems modeling exist, they are still rare. Most of it is not published in anesthesia journals. If we consider physicians' knowledge about both Bayesian and frequentist statistics is still low, we must consider they know even less about modeling complex systems. Some basic complex systems' knowledge are phase transitions, hysteresis, percolation and hormesis.

Complex systems modeling may help understanding why the system resist some changes, which is the answer to Claude Bernard and Walter Cannon's questions about homeostasis. The interaction between sympathetic and parasympathetic systems may propose a simpler, yet complex, model to explain probable hormesis such as bradycardia result of low dose atropine. It may bring simpler answers to explain remifentanil's withdraw hyperalgesia, which may result from an abrupt misbalance between analgesic and algogenic subsystems.

As a conclusion, I think anesthesiologists must consider studying complex systems if they want to produce more significant advances in the next years.

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