Supervision Level

Supervision level refers to the degree of direct oversight provided to a surgeon—typically a resident or junior attending—during a procedure. It is a critical factor when interpreting CUSUM results and setting appropriate thresholds or reference values.

Categories of Supervision

- **Direct supervision**: A senior surgeon is physically present and guiding the procedure step-by-step.
- **Indirect supervision**: A supervisor is available on-site but not scrubbed in; the procedure is performed independently.
- **Unsupervised (autonomous)**: The operator performs the procedure independently, without on-site backup.

Impact on CUSUM Interpretation

- With **direct supervision**, the expected complication rate (k) should be **lower**, and the alert threshold **stricter**, since expert guidance minimizes error.
- With **indirect or no supervision**, a slightly higher k or more forgiving threshold may be appropriate to account for operator learning or complexity.

Example:

- For ICP monitor placement under direct supervision → $k = 0.08$, threshold = 2.0
- For independent placements by senior residents → $k = 0.12$, threshold = 2.5

Educational and Clinical Use

CUSUM charts stratified by supervision level allow:

- **Tailored feedback** to individual trainees
- Identification of readiness for **progressive autonomy**
- Adjustment of supervision strategies based on **real-time performance**
- Objective support for credentialing and privileging decisions

By incorporating supervision level into CUSUM analysis, training programs can make more **nuanced, fair, and accurate** judgments about performance and progression.

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