## Hémodynamique

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# Mean Arterial Pressure Control Using a Norepinephrine Closed-Loop System after High-Risk Abdominal Surgery: A Randomized Controlled Trial

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**Position du problème et objectif(s) de l'étude:**
Postoperative epinephrine infusions after high-risk surgery are adjusted manually by intensive care unit (ICU) nurses to achieve a predefined mean arterial pressure (MAP) target. Precise titration requires continuous vigilance and automated systems may be a solution to this challenge (1,2). We hypothesized that closed-loop norepinephrine titration would maintain MAP more often in target than manual titration after high-risk abdominal surgery.

**Matériel et méthodes:**
We have developed a closed-loop vasopressor (CLV) controller to better maintain MAP within a narrow range during the perioperative period. After IRB approval on August, 24, 2020 (CPP Sud-Est 1), the study was registered on clinical trial gov (NCT04639037) on November 20, 2020 before patient inclusion. All patients gave written informed consent to participate. Patients admitted to the ICU after high-risk abdominal surgery were randomized into two groups for a two-hour study period between January 8, 2021 and January 26, 2022. In all patients, the objective was to maintain MAP between 80-90 mmHg using norepinephrine and the primary outcome was the percent time in target. In the CLV group, the norepinephrine infusion was controlled via the CLV system; in the control group, it was adjusted manually by the ICU nurse. Fluid administration was standardized in both groups.

**Résultats & Discussion:**
A total of 53 patients were randomized. Over the two-hour study period, the percentage of time with MAP "in target" was greater in the CLV group (79 [69-88] vs 43 [23-65]; p less than 0.001) than in the control group. The percentage of time with a MAP less than 65 and less than 80 mmHg was significantly lower in the CLV than in the control group (0 [0-0] vs 0 [0-2.5] and 1.1 [0 - 4.9] vs 28.3 [18.2 - 75.9] respectively; p less than 0.001 for both). The percentage of time with a MAP greater than 90 mmHg was not statistically different between groups. Outcomes are shown in Table 1. No adverse event occurred during the study period in either group.

**Conclusion:**
Closed-loop control of norepinephrine infusion better maintain MAP in target and significantly decreases postoperative hypotension when compared to manual control in patients admitted to the ICU after high-risk abdominal surgery.

**Références bibliographiques:**
1) J Clin Monit Comput 2018;32:5–11 2) Br J Anaesth 2019;123:430–8.

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Table 1

| Variables | Control group (N=27) | CLV group (N=26) | P value |
|---|---|---|---|
| Primary outcome | | | |
| Percentage of protocol period with a MAP between 80-90 mmHg | 43 [23 - 65] | 79 [69 - 88] | **<0.001** |
| Secondary outcomes (2-hours protocol period) | | | |
| Percentage of protocol period with a MAP > 90 mmHg | 13.9 [1.5 - 21.3] | 16.4 [8.4 - 30.3] | 0.230 |
| Percentage of protocol period with a MAP < 80 mmHg | 28.3 [18.2 - 75.9] | 1.1 [0 - 4.9] | **<0.001** |
| Percentage of protocol period with a MAP < 65 mmHg | 0 [0 - 2.5] | 0 [0 - 0] | **<0.001** |
| Amount of crystalloid received (ml) | 1250 [1050 - 1500] | 1250 [1100 - 1500] | 0.877 |
| Amount of noradrenaline received (mg) | 1.2 [1.1 - 1.3] | 1.1 [1.1 - 1.2] | 0.090 |
| Length of stay in the ICU (hours) | 86 [36-110] | 70 [46 - 120] | 0.735 |
| Length of stay in the hospital (days) | 19 [15 - 29] | 16 [12 - 19] | 0.137 |

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