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Ischemia detected by postoperative continuous 12-lead electrocardiographic monitoring in high-risk vascular surgery patients

BACKGROUND AND GOAL OF THE STUDY

Elderly patients undergoing vascular surgery are at major risk for perioperative cardiac complications. We investigated continuous wireless electrocardiographic monitoring (cECG) in a postoperative setting to determine (1) the degree of postoperative ischemia load (IL) and its possible associations with patient-centred outcomes, and (2) the sensitivity of different lead combinations in detection of ischemia.

MATERIAL AND METHODS

cECG recordings of 51 patients aged 65 years or older having undergone peripheral arterial surgery were analysed. cECG monitoring was started straight after surgery and continued for 72 hours, or until discharge. The impact of posture changes on ischemia detection was evaluated with a 3-axis accelerometer. A standard 12-lead ECG, a measurement of high-sensitive troponin T (TnT), and an enquiry of ischemic symptoms were obtained preoperatively, and on the 1st, 2nd and 3rd postoperative day. Our primary outcomes were perioperative myocardial infarction (PMI) and postoperative ischemia load (IL)/patient. This we expressed as an area under the function of ischemic ST-segment deviation and ischemic time. We calculated the sensitivity of the different leads in detecting ischemia, and areas under receiver operating characteristics curves (AUCs) with 95% CIs for IL.

Figure 1. The Holter device (SEER-12: manufacturer Getemed, Teltow, Germany, and distributor GE, Freiburg, Germany) and accelerometer (Faros 360° eMotion, Mega Electronics Ltd, Kuopio, Finland) on a patient.

RESULTS AND DISCUSSION

During 3262.7 patient-hours of monitoring, 17 patients (33.3%) had 608 transient ischemic events, all denoted by ST-segment depression. Of 17 with ischemia, 5 patients suffered PMI. IL predicted PMI with an AUC (95 % CI) of 0.87 (0.75 – 0.99). The best cut-off point for IL was 12.5 $\mu\text{V}^*\text{min}$, and sensitivity, specificity, and positive likelihood ratio (LR+ [95 % CI]) for this point were 1.0, 0.74, and 3.83 (2.36 – 6.23) respectively.

Figure 2. Cumulative IL/TnT-count during the 72 hours follow-up in (1) all patients with postoperative ischemia (2) patients with PMI.

Lead V4 was most frequently (51.4 %) the first one to demonstrate ST-segment depression followed by leads II, aVF, and V5 (39.4, 33.8, and 24.7 % respectively) ($p = 0.096$ for V4 vs. II, $p < 0.001$ for V4 vs. aVF, and $p < 0.001$ for V4 vs. V5 respectively). At peak ischemia, ST-segment depression was most frequently (45.7 %) noted in lead V4 followed by leads II (25.2 %) and V5 (17.4 %) ($p < 0.001$ for V4 vs. II, and $p < 0.001$ for V4 vs. V5, respectively). Ischemia was detected best with the axial leads and V4+V5 (97.2 %) (I), followed by the axial leads and V4 (92.0 %) (II), or V5 (63.3 %) (III) ($p < 0.001$ for I vs. II, $p < 0.001$ for I vs. III and $p < 0.001$ for II vs. III).

CONCLUSION

Postoperative silent cardiac ischemia is common in high-risk surgery patients, and may develop into PMI. A possibility for immediate ischemia diagnosis and treatment would further enhance the value of the surveillance.

ACKNOWLEDGEMENTS

GE Healthcare Finland was a sponsor of this investigator-initiated study. GE had no contribution to the design of the study or the interpretation of the results.