

A626  
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Room Area P

### Cardiopulmonary Bypass and Cardiac Arrest Associated with Inflammatory Responses to CABG Surgery

\*\* Chi-Yuan Li, M.D., M.S., Chien-Sung Tsai, M.D., Feng-Yen Lin, Ph.D.  
Department of Anesthesia, China Medical University Hospital, Taichung, Taiwan

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Cardiovascular surgeons have devoted their efforts to developing a flawless operation process for coronary surgery, such as the off-clamp CPB and off-pump techniques, to reduce postsurgical inflammation and complications and costs. Although the off-pump technique has improved greatly and its use has become widespread, it is still not suitable for many patients in a critical condition or too ill for coronary surgery. Consequently, the hybrid on-pump beating-heart technique, off-clamp CPB, has been used for coronary surgery. Recently, off-clamp CPB has been used for its benefits and safety in emergency myocardial revascularization. In contrast, another group has demonstrated that off-clamp CPB may more readily induce new irreversible myocardial injury than does conventional CPB. This controversy must be clarified and settled before this off-clamp CPB hybrid technique becomes the gold standard technique for critically ill or emergency patients.

We retrospectively studied patients who had undergone isolated emergency or urgent CABG surgery from January 2006 to December 2008. We included 43 patients with impaired cardiac function. Statistical analysis showed that the highest plasma level of creatinine was in the conventional CPB group. The proportion of patients requiring additional intra-aortic balloon pump support, the length of ICU stay, the occurrence of ICU fever, and the mortality rate after surgery was significantly lower in the off-clamp CPB group than in the conventional CPB group.

To explore the possible factors contributing to the potency of off-clamp CPB, 36 patients who underwent elective CABG were randomly divided into three groups: the conventional CPB group, off-clamp CPB group, and off-pump group. Their clinical characteristics were analyzed. The days of ICU stay and incidence of ICU fever were significantly lower in the off-clamp CPB and off-pump technique groups than in the conventional CPB group, and the patients in the conventional CPB group had higher plasma levels of the MB isoform of creatine kinase (CK-MB) at one day after surgery. The plasma levels of TNF- $\alpha$ , IL6, MCP1, and thrombomodulin were measured at baseline, during the operation, and at the end of surgery. Enzyme-linked immunosorbent assays showed a significantly increased release of TNF- $\alpha$ , IL6, MCP1, and thrombomodulin 30 minutes after the commencement of CPB and at the end of surgery in the conventional CPB group, whereas the production of TNF- $\alpha$ , IL6, MCP1, and thrombomodulin increased less markedly in the off-clamp CPB group. We also analyzed membrane thrombomodulin expression on leukocytes. Flow cytometry showed that naïve monocytes expressed more thrombomodulin on the cell surface than did granulocytes or lymphocytes. CPB markedly reduced the thrombomodulin expression on monocytes but not on granulocytes or lymphocytes. We are the first group to simultaneously compare the inflammatory impact of CABG surgery with conventional CPB, off-clamp CPB, and the off-pump technique. Our results show that (1) the off-clamp CPB and off-pump techniques have a lower impact on patients undergoing emergency, urgent, or elective CABG than does conventional CPB. The benefits seem to be predominantly associated with the lower production of inflammation-related proteins; (2) more than TNF $\alpha$ , IL6, and MCP1, thrombomodulin may prove to be a marker of inflammation during surgical procedures.

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