"Stent thrombosis has almost been conquered," Prof. Colombo said. "Hopefully, late and very late thrombosis will be reduced by the new generation stents and possibly bioabsorbable stents," he concluded.

While late stent thrombosis is infrequent, it remains an important concern in patients who have received coronary stents. The combination of more potent and less variable antiplatelet agents and later-generation stents provides hope for continued reductions in the rates of stent thrombosis. The optimal duration of dual antiplatelet therapy, however, remains an open question, particularly in the setting of newer-generation and bioabsorbable stents.

Pitfalls in Troponin Evaluation

Written by Maria Vinall

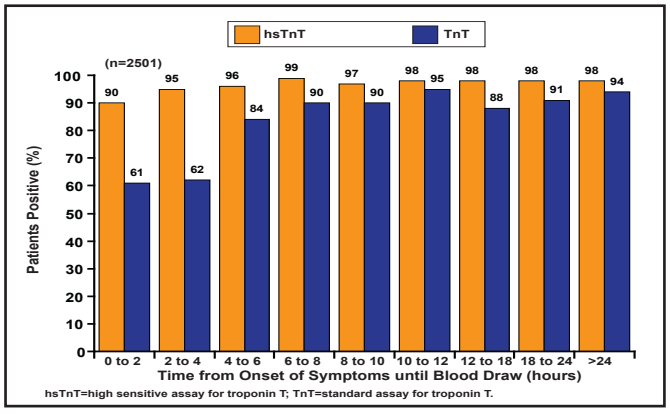
The Joint European Society of Cardiology/American College of Cardiology (ESC/ACC) Committee's 2007 consensus document for the redefinition of myocardial infarction (MI) places significant emphasis on the detection of troponin T and troponin I [Thygessen. *Eur Heart J* 2007]. Although the ability to measure cardiac troponin quickly and accurately has improved the cardiologist's ability to detect myocardial injury in the setting of acute coronary syndrome (ACS), there are a variety of noncoronary cardiac conditions that also lead to elevated troponin concentrations. Christian W. Hamm, MD, Kerckhoff Klinik, Bad Nauheim, Germany, discussed the implications of elevated troponin concentration in patients with noncoronary cardiopulmonary conditions, such as myocarditis, congestive heart failure, pulmonary embolism, and septic shock and in critically ill patients in whom there is myocardial necrosis but not necessarily ST or non-ST elevation myocardial infarction.

An elevated troponin concentration is relatively common in critically ill patients and is strongly predictive of adverse outcomes. Compared with patients who have ACS, critically ill patients without ACS but with an elevated troponin concentration have poorer outcomes [Alcalai R et al. *Arch Intern Med* 2007]. In patients with congestive heart failure, an elevated troponin concentration is correlated with the severity of symptoms and is more frequently detected in patients with NYHA class III or IV compared with class II symptoms (p=0.02). Patients with severe heart failure and elevated troponin have significantly worse outcomes than similar patients with no troponin elevation [Setsuta K et al. *Am J Med* 2002]. Similar findings have been reported for patients with myocarditis [Smith SC et al. *Circulation* 1997]. Troponin may also improve risk stratification in pulmonary embolism, as in-hospital death, prolonged hypotension, cardiogenic shock, and the need for resuscitation have been associated with elevated troponin concentration [Giannitsis E et al. *Circulation* 2000].

Low-level troponin elevations have been observed in patients with chronic renal failure. However, in this setting, the elevation is generally characterized not by a rise and fall (which is typical with ACS) but a constant elevation. Outcomes have been associated with the degree of elevation in this population, with a greater-than-7-fold increase in mortality risk when concentrations of cardiac troponin T reach levels >0.10 ng/mL [Dierkes J et al. *Circulation* 2000]. This prognostic ability of troponin T is retained, regardless of the creatinine clearance level, an indicator of kidney function [Aviles RJ et al. *N Engl J Med* 2002].

Improvements in the analytical performance of current-generation troponin assays have led to better prognostic assessment. The fourth- and fifth-generation assays are now 10 to 15 times more sensitive and are capable of detecting troponin within the first 2 hours of symptom onset in 90% of patients with MI compared with 61% of patients, using the older standard assays (Figure 1) [Weber M et al. *Am Heart J* 2011]. The ESC/ACC Consensus Document states the troponin assay performance must be in the 99th percentile of the reference control group and have a coefficient of variation ≤10% [Alpert JS. *Eur Heart J* 2000]. There are four assays, two each for troponin T and I, that satisfy this requirement.

Figure 1. High-Sensitivity Assay Troponin T in AMI.



hsTnT = high-sensitivity assay for troponin T; TnT = standard assay for troponin T; "Reprinted from the *American Heart Journal*, Weber M et al, Improved diagnostic and prognostic performance of a new high-sensitive troponin T assay in patients with acute coronary syndrome. July 2011;162(1):81-88, with permission from Elsevier.

Cardiac troponin remains the preferred biomarker of myocardial injury and a central component in the diagnosis of myocardial infarction. Troponin, even at low-level elevations, remains one of the most powerful

prognostic biomarkers across a variety of clinical settings. Analytical improvements in assay performance, however, have enabled the detection of myocardial injury at very low levels and in an increasing number of patients with diagnoses other than ACS. The increased frequency of detection and the decreased specificity for ACS have presented a challenge for clinicians. Consideration of the specific clinical context is critical in interpreting the significance of an elevated troponin concentration and understanding the therapeutic implications.

Are Treatment Effects Different in Women?

Written by Rita Buckley

Gender-specific differences in cardiovascular (CV) medical treatment are not entirely unexpected, due to gender differences in physiology and pharmacodynamics, symptomology, treatment response, and representation in clinical trials. Ernst Van der Wall, MD, PhD, Leiden University Medical Center, Leiden, the Netherlands, discussed these differences.

Cardiovascular disease (CVD) is the primary cause of death among women, killing 8.6 million women worldwide every year. Yet, a significant gender gap exists in treatments that are offered to women compared with men. For example, the time from symptom onset to hospital presentation for myocardial infarction (MI) is greater in women (3.46% longer time to presentation; 95% CI, 1.06 to 5.92; p=0.005), despite national campaigns that are aimed at increasing women's awareness of their risk of heart disease [Dierks DB et al. *Am Heart J* 2010].

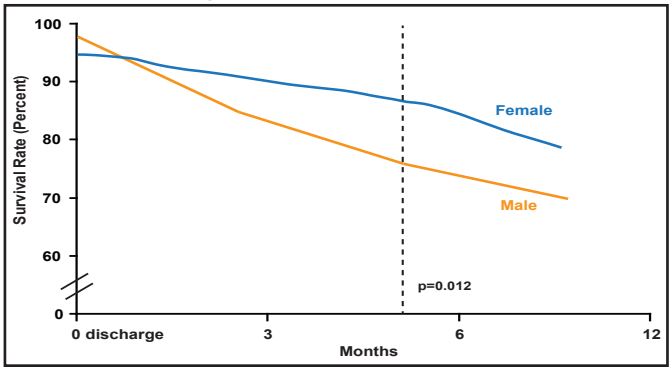
Historically, randomized clinical trials have included a majority of men, although this has changed over time. A systematic review of treatment of mild to moderate hypertension [Ljungman C et al. J *Womens Health* 2009] showed an increase in the proportion of women with hypertension (r=0.27; p<0.05). Another study found that all treatments that were studied provided broadly similar protection against major CV events in men and women (p-homogeneity >0.08) [Turnbull F et al. *Eur Heart J* 2008].

A meta-analysis on statin therapy in the two sexes found that statin therapy reduced the risk of coronary heart disease events in men without prior CVD but not in women. No differences between the genders were found regarding total mortality [Petretta M et al. *Int J Cardiol* 2010]. Another study showed that women might be less responsive to aspirin than men in preventing nonfatal MI. Trials predominantly with female subjects indicated a much lower risk reduction than those that were made up mostly of men (RR, 0.87 [95% CI, 0.71 to 1.06] vs RR, 0.62 [95% CI; 0.54 to 0.71]) [Yerman T et al. *BMC Med* 2007].

Evidence-based guidelines for CVD prevention in women have been revised on the basis of more definitive data about menopause, aspirin, and folic acid therapies. Class III interventions that are not useful/effective and may be harmful for CVD or MI prevention in women have been specified. Hormone therapy and selective estrogen receptor modulators, antioxidant vitamin supplements (vitamins E, C, and beta-carotene), and folic acid should not be used for primary or secondary prevention of CVD [Mosca L et al. *Circulation* 2007].

Prof. van der Wall pointed out that there may be differences in the underlying causes of and outcomes that are related to heart failure in women compared with men. For example, women who are admitted to the hospital with heart failure have better 1-year survival rates than their male peers (Figure 1) [Mejhert M et al. *Eur J Heart Failure* 1999]. In addition, testosterone treatment may not benefit men with heart failure but may benefit women [van der Wall EE. *Neth Heart J* 2011]. Of note, 30-day mortality after PCI in men and women has decreased in the past 25 years, with no differences in short- or long-term mortality between men and women [Prasad A et al. *JACC* 2008].

Figure 1. Survival Rates with Respect to Gender in Patients Admitted with Heart Failure 1 Year After Hospital Discharge.



Reproduced with permission from Oxford University Press. Diagnostic tests, treatment and follow-up in heart failure patients — is there a gender bias in the coherence to guidelines? Mejhert M et al. *Eur J Heart Fail.* Dec 17, 1999.

Many women are unaware of specific risk factors and assume they are less likely to suffer from stroke, heart failure, or heart attack. But, this assumption is incorrect. Prof. van der Wall noted that prescribing physicians should be aware of gender-specific treatments, that all guidelines should account for gender-specific differences, and that such guidelines should be implemented accordingly.