heterotopic valves were shown by an increase of CO and a decrease of venous regurgitation in an animal model of acute TR. Valve function was confirmed by echocardiography and angiography. Compared with orthotopic valve implantation, this approach allows sufficient valve fixation and carries a potentially lower risk of injury to cardiac structures by avoiding the introduction of foreign material in the RV inflow tract. Except for 1 case of device migration, no further complications associated with the implantation and function of the valves were observed in this short-term study. Catheter introduction, valve deployment, and fixation were straightforward.

Several limitations exist and should be considered when applying this concept to human patients. First, TR in human patients is often secondary to annular dilation, with substantially higher venous pressures. Thus, this animal model of acute TR only partially represents the hemodynamic conditions in chronic TR. Second, anatomic differences should be considered because the human IVC is shorter than that in sheep, with inflow of hepatic veins close to the right atrium. These differences require further development of the device and will be surmountable with evolving technology. Third, heterotopic valve replacement reduces venous regurgitation; however, RV and atrial volume overload persist. The implications on cardiac and hepatic function and potential deleterious effects are unknown, and further studies are currently being performed to evaluate long-term follow-up. In conclusion, the concept of heterotopic valve implantation is feasible and has the potential to broaden the therapeutic options for patients with tricuspid valve disease.

*Alexander Lauten, MD
Friedrich-Schiller University Jena
Cardiology, Angiology, Pneumology and Intensive Care
Erlanger Allee 101
07747 Jena
Germany
E-mail: alexander.lauten@med.uni-jena.de

Hans R. Figulla, MD
Christoph Willich, MS
Christian Jung, MD
Wilma Rademacher, MD
Harald Schubert, MD
Markus Ferrari, MD


Please note: This study was supported by research grants from the Federal Ministry of Education and Research and by grants from JenaValve Technology Inc., Wilmington, Delaware. Drs. Ferrari and Figulla are members of the scientific board of and own shares of JenaValve.

REFERENCES

Letters to the Editor

Occurrence of Tako-Tsubo Cardiomyopathy and Chronobiological Variation

We read with great interest the paper by Citro et al. (1), in which the investigators found significant chronobiological vari-
peak of occurrence was April, whereas only 12% of TTC occurred in summer (Fig. 1). The morning and the afternoon were the most frequent periods of onset of TTC. However, in our series, the onset of the disease may differ according to the stressful event: all TTC after surgery (n = 6) occurred in the morning, whereas aggression or robbery (n = 9) were found whatever the time of day.

TTC is defined as transient left ventricular dysfunction triggered by stress, with left ventricular regional wall motion abnormalities extending beyond a single epicardial coronary distribution and without any coronary lesion (2,3). This new cardiomyopathy preferentially occurred after an emotional or stressful event, and catecholamine excess remains the main hypothesis (2,4–6). Different types of stress are involved in the process of TTC, leading to differing results in TTC studies.

**REFERENCES**


**Reply**

We thank Dr. Mansencal and colleagues for their comments on our study (1). They reviewed 51 cases of Tako-Tsubo cardiomyopathy (TTC) from 2008 to 2009 and did not replicate our findings. They found a peak onset of TTC in April and not in summer, and morning and afternoon were the preferred periods. The main limitation of epidemiological studies on TTC derives from the limited size of populations, so that very few cases may cause significant changes. As for seasonal variation, a further study from our Network, conducted on an enlarged population of 112 patients, confirmed the summer preference of onset of TTC for subjects either age <65 or ≥65 years (2). Moreover, a summer preference has been reported previously in a German single-center study (31 cases) (3), and more recently also confirmed for 70 patients included in an American registry (4). The existence of a main morning peak of occurrence was observed in a Japanese cohort of 50 cases (5). We do not suggest that our results are definitely conclusive. However, our study was conducted on one of the largest populations of TTC patients available in the literature to date (6), and first used a validated chronobiological method of analysis, focused on searching for underlying rhythmic reproducible patterns of occurrence, not only peaks of higher frequencies. Although the role of stress hormones remains controversial (7), the exposure to catecholamines and beta-receptor agonists could precipitate the clinical scenario of TTC (8). We agree with Dr. Mansencal and colleagues that stress events may play a pivotal role. Thus, their hypothesis...