Cognitive Impairment in Heart failure

Summary

The issues discussed in this thesis result from a systematic literature review addressing the association between heart failure (HF) and cognitive impairment. This review and meta-analysis are being described in chapter 2. Pooled analysis of data derived from 22 reviewed studies showed diminished neuropsychological performance expressed by significant differences in effect sizes for memory scores and psychomotor speed/attention when comparing HF patients with controls. In a pooled sample of 2937 heart-failure patients and 14848 control subjects, the odds ratio for cognitive impairment was 1.62 (95% confidence interval:1.48-1.79, p<0.0001) among subjects with HF. Review of the literature also showed that depression was more prevalent among patients with HF. Although neuropsychological data are becoming increasingly available in these populations, our review made clear that many of these studies had major methodological limitations. Particularly, the lack of studies that systematically performed neuropsychological examinations by use of an extensive battery was striking. Information on the prevalence and severity of cognitive impairment in the different etiological subgroups of HF was therefore not interpretable. With respect to underlying pathophysiological mechanisms, assessment of alterations in brain structures by neuroimaging was sparse or unrepresentative of general populations with HF.

In chapter three, a sample of 64 HF outpatients, 53 controls diagnosed with cardiovascular disease uncomplicated by HF (cardiac controls) and 42 healthy controls underwent neuropsychological assessment including tests of mental speed, executive functions, memory, language and visuospatial functions, as well as measures of cardiovascular function and laboratory investigation. Effect sizes (z-scores) were computed from the neuropsychological data and composite z-scores were defined for five cognitive domains. Global cognitive performance was estimated by calculating a mean overall z-score that included these five assessed domains. Neuropsychological performance was compared between the three groups. Independent demographic and clinical predictors of cognitive impairment were identified with linear regression analysis, thereby adjusting for confounding cardiovascular risk factors. The findings showed that HF patients demonstrated a pattern of general cognitive impairment, that included executive functions, memory, mental speed and attention. Cognitive impairment was present in 25% of HF patients, relative to 15% of the cardiac controls and 4% of the healthy controls. Age, estimated intelligence, NYHA-class and presence of the apolipoprotein E-4 allele were independent determinants of cognitive impairment in HF patients.

In chapter 4 describes the results of neuroimaging in a sample of 58 HF patients, 48 cardiac controls and 42 healthy controls. Presence and severity of deep, periventricular and total white matter hyperintensities (WMH), lacunar and cortical infarcts, global and medial temporal lobe atrophy (MTA) were compared between groups. The results of the brain magnetic resonance imaging (MRI) showed that HF patients had significantly more WMH, lacunar infarcts and MTA, whereas cardiac controls only had more MTA, compared to healthy controls. Age and left ventricular ejection fraction (LVEF) were independently associated with total WMH. Age and systolic hypotension were associated with MTA in HF patients and cardiac controls.

The possible relationship between the main findings described in chapter 3 and 4 is further evaluated in chapter 5. Here we investigated the relationship of cognitive performance to cerebral abnormalities on magnetic resonance imaging (MRI) in 58 nondemented outpatients with HF. Correlations between MRI-parameters and the cognitive measures were calculated and independent baseline correlates of overall cognitive performance were identified with stepwise linear regression analysis. The results of this study indicated that MTA correlated with memory (r=-0.353, p<0.01) and executive functions (r=-0.383, p<0.01) as well as the overall cognitive domain score (r=-0.383, p<0.01) and the Mini Mental State Examination(r=-0.343, p<0.05). Total WMH and deep WMH were found to correlate with depression and anxiety scores, but not with cognitive measures. Not surprisingly, age and estimated premorbid intelligence but, more important, MTA were independent predictors of worse cognitive performance in HF patients.

Chapter 6 addressed the hypothesis that cerebral hypoperfusion is one of the main mechanisms underlying cognitive impairment in HF. To investigate the relation of cerebral blood flow reductions to the cognitive deficits and MRI brain abnormalities, described in the previous chapters, we determined the cerebral blood flow velocity (CBF-V), measured by transcranial doppler ultrasound (TCD) in 46
outpatients with HF, 33 cardiac controls and 22 healthy controls. The findings of this study confirmed the hypothesis that CBF-V was reduced in outpatients with HF compared to controls. The mean middle cerebral artery (ACM) CBF-V differed significantly between HF patients (47.1 cm/sec) and healthy controls (56.1 cm/sec), but not between the HF patients and the cardiac controls (49.8 cm/sec). The ACM pulsatility index was significantly higher in the two patient groups relative to the healthy controls. Against our expectation, no correlations were found between the neuropsychological results and the CBF-V parameters. But, in concordance with other reports in literature, deep and total WMH were more prevalent in HF patients with a systolic CBF-V of less than 62.5 cm/sec.