Night shift work and the cardiovascular health of medical staff

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This editorial refers to ‘Arrhythmias and increased neuroendocrine stress response during physicians’ night shifts: a randomized cross-over trial†, by M. Rauchenzauner et al., on page 2606

The cardiovascular risks associated with night shift work in medical staff have been suspected for several years. Kawachi et al.1 analysed coronary heart disease (CHD) incidence in 79 109 women from the Nurses Health Study, and observed raised rates among night shift workers, particularly those who had worked for ≥6 years on rotating shifts (51% increased risk). Effects remained significant after controlling for smoking, history of hypertension, body mass, and other factors. Prospective studies have also demonstrated an increased incidence of the metabolic syndrome in shift workers,2 while a recent analysis of the Cardiovascular Risk in Young Finns study showed positive associations between shift work and carotid intima-media thickness and carotid plaque in young men that were independent of standard risk factors.3

On-call duty for physicians involves both increased workload and disturbed sleep. Disturbed sleep is a risk factor for mortality in older adults,4 while Kripke’s analysis of more than 1 million respondents to the cancer prevention study of the American Cancer Society suggested moderately increased death rates over 6 years among individuals who slept ≤6 h per night, compared with those who reported sleeping ~7 h.5 Short sleep hours are also associated with an increased incidence of hypertension.6

The mechanisms underlying these risks have not been fully characterized. Indeed, the epidemiological evidence relating shift work in general with CHD incidence remains inconsistent.7 This may be due to the varying nature, duration, and schedule of shift work, to the inaccuracy of self-reported sleep patterns, and to selection factors. Selection into night shift work or short sleep hours is not randomly distributed in the population. Despite controlling for covariates, it is possible that unmeasured confounding factors are responsible for some of the associations between shift work and cardiovascular risk. Thus a recent prospective study showed that future shift workers smoked more than future day workers, even before they began to work at night.8 There is also evidence that people with cardiovascular disease or risk factors may be more likely to leave shift work at an early stage, diluting its impact.9

The study by Rauschenzauner et al.10 is therefore especially welcome, since it has characterized the biological consequences of on-call duty at night using a within-person randomized design. This reduces the likelihood that confounders contribute to the differences observed between conditions. Cardiovascular, neuroendocrine, and inflammatory processes were monitored during two 24 h periods in 30 healthy physicians. One 24 h period included an 8 h working day followed by 16 h on-duty call, while the control period consisted of work only during the day. The number of awakenings during the night was not large, with a median of one, but total sleep time was ~70 min less on average on the on-call day. This was associated with increased low frequency heart rate variability during the night, increased ambulatory diastolic blood pressure, and heightened noradrenaline excretion. In addition, the inflammatory marker tumour necrosis factor-α (TNF-α) increased during the on-call period, and there was a higher rate of ventricular premature beats in the early hours of the morning.

These findings indicate that on-call duty and the associated sleep disruption results in a broad range of psychobiological disturbances, including a shift of cardiac autonomic control away from parasympathetic towards sympathetic activation, enhanced sympathoadrenal output, and heightened inflammatory responses. Even in these healthy individuals, potentially dangerous responses such as cardiac dysrythmias can be elicited. Similar patterns have been observed during experimental sleep disruption. For example, a recent study of severe circadian misalignment documented simultaneous increases in plasma glucose and insulin, disruption of cortisol output, and increased blood pressure.11 Other work has shown increased levels of circulating proinflammatory cytokines during the night, and the activation of cellular inflammatory signalling pathways.12,13 The pattern observed by Rauchenzauner et al. is also reminiscent of responses to acute psychological stress, that include raised blood pressure, impaired heart rate variability, inflammatory cytokine gene expression, and

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lipid mobilization.\textsuperscript{14} It is notable that these responses occur not only in the laboratory under controlled conditions, but also in working men and women as they go about their normal duties. While probably innocuous on a single occasion, such responses may contribute to health risk if repeated on a regular basis for months or years. Importantly, poor sleep quality in physicians and nurses has been shown not only to increase work stress, but also to disrupt memory performance, and this might have an adverse affect on work effectiveness.\textsuperscript{15} Recent reports in the mass media have attributed serious medical errors to poor adverse affect on work effectiveness.\textsuperscript{15} Recent reports in the mass media have attributed serious medical errors to poor adverse affect on work effectiveness.\textsuperscript{15}

Night work is a necessary evil in modern medicine, since clinical problems do not stop at the end of the working day. However, efforts to ameliorate the adverse effects of disturbed sleep are urgently needed. The controversy surrounding the application of European Working Time Directive to young doctors is indicative of the lack of agreement about how to tackle this problem. There are clearly wide variations in psychological adaptation to night shift work and some people tolerate these work patterns well, but the factors predicting effective adaptation are poorly understood. Interventions with nurses using ergonomic shift criteria have resulted in favourable biological responses, so may potentially reduce risk.\textsuperscript{16} The application of such technologies to physicians might help prevent long-term adverse health consequences among those who are obliged to work at night.

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References