

---

## Editorial II

### Preoperative hypertension: remain wary? 'Yes'—cancel surgery? 'No'

How often have we asked ourselves: shall I go ahead and anaesthetize this patient with uncontrolled hypertension, or should I postpone surgery until the arterial pressure is controlled? Does the benefit of preoperative arterial pressure control justify the inconvenience and financial consequences of postponing surgery? Are patients with uncontrolled hypertension at an increased perioperative risk? Are there any data on which I can base my decision? These and many other questions are addressed in the comprehensive review by Howell, Sear and Foëx in this issue of the Journal.<sup>1</sup>

Hypertension affects one billion individuals worldwide,<sup>2</sup> and is endemic in the western world, particularly in the elderly.<sup>3</sup> Hypertension represents a major risk factor for

coronary artery disease,<sup>4</sup> congestive heart failure,<sup>5</sup> dementia,<sup>6</sup> and renal and cerebrovascular disease,<sup>7</sup> and is associated with dyslipidaemia, diabetes, and obesity.<sup>7</sup> The higher the arterial pressure, the higher the risk of myocardial infarction, heart failure, stroke, or kidney disease. Between the age of 40 and 70 yr, for each increment of 20 mm Hg in systolic or 10 mm Hg in diastolic arterial pressure, the chance of developing cardiovascular disease doubles across the arterial pressure range from 115/75 to 185/115 mm Hg.<sup>8</sup> Therefore, the need for tight arterial pressure control and life-long treatment is undisputed.

In contrast, in the perioperative setting, the situation is less clear. The extensive literature review and meta-analysis of 30 observational studies by Howell and colleagues<sup>1</sup>

concludes that the likelihood of experiencing an adverse perioperative cardiac event is, on average, 1.31-fold (95% confidence interval 1.13–1.51) higher in hypertensive patients than in normotensive patients. Although this difference in outcome between hypertensive and normotensive individuals is statistically significant, it is of questionable clinical relevance. First, for clinical purposes, the mean odds ratio and the 95% confidence interval are very low. Second, the significant heterogeneity between studies makes effective correction for confounding variables almost impossible. Although there seems to be a tendency for an increased incidence of perioperative haemodynamic instability, myocardial ischaemia and cardiac arrhythmias in patients with severe hypertension (systolic blood pressure >180 mm Hg, diastolic blood pressure >110 mm Hg), even for this patient population, existing data do not unequivocally support the hypothesis that postponing surgery to control arterial pressure will improve perioperative cardiac outcome.

In essence, the result of the meta-analysis by Howell and colleagues<sup>1</sup> casts considerable doubt that the perioperative outcome is worse in hypertensive than in normotensive patients. Therefore, in most clinical situations, cancellation of surgery for the sole reason of uncontrolled hypertension hardly seems a defensible option. This is in accordance with recent guidelines of the American College of Cardiology and the American Heart Association,<sup>9</sup> and similar recommendations<sup>10</sup> in which uncontrolled systemic hypertension *per se* is considered only a minor risk factor that does not affect overall perioperative management.

However, are we really justified in interpreting the data as showing that there is never any reason for cancelling surgery because of uncontrolled hypertension? We have to acknowledge that we lack large-scale trials that include a sufficient number of patients with severe hypertension to allow valid statistical analysis and thus for us to draw conclusions in this patient population. The results of investigations that failed to identify mild and moderate hypertension as a predictor of adverse perioperative outcome may not be transferable to the population with poorly controlled severe hypertension. Furthermore, the initial diagnosis of hypertension might have triggered a search for coronary artery disease. If found to be present, this would counteract the impact of hypertension alone in studies that used multivariate models. It therefore seems important to preoperatively differentiate between isolated hypertension and hypertension associated with coronary artery disease.

Why should anaesthetists remain wary of hypertension? For at least three reasons: (i) hypertensive patients tend to be more haemodynamically unstable and prone to myocardial ischaemia in the perioperative period.<sup>1,11</sup> Several studies have demonstrated a significant association between perioperative myocardial ischaemia and postoperative ischaemic cardiac events, such as unstable angina, non-fatal myocardial infarction, and cardiac death.<sup>12,13</sup> (ii)

Hypertension is a major risk factor for coronary artery disease,<sup>4,10</sup> congestive heart failure,<sup>5</sup> and renal and cerebrovascular disease.<sup>7</sup> Any of these factors increase the likelihood of perioperative myocardial infarction or death.<sup>14</sup> And (iii), hypertension is associated with dyslipidaemia, diabetes, and obesity,<sup>7</sup> and the side-effects of drugs needed to treat these diseases.<sup>15,16</sup>

How can we safely anaesthetize hypertensive patients? Essential elements of perioperative management include careful preoperative evaluation, tight perioperative arterial pressure and heart rate control, cardiac protection, and a well trained, experienced and dedicated anaesthetist.

Preoperatively, it may be helpful to contact the referring general practitioner to obtain more realistic arterial pressure values than the ones measured at hospital admission, which might overestimate the long-term arterial pressure level (referred to as 'white coat' or 'isolated office hypertension').<sup>1</sup> Hypertension-induced target organ damage should be sought and, if present, evaluated and appropriately treated. Assessment of physical exercise tolerance is crucial.<sup>9,10,17</sup> In special situations, postponement of surgery in hypertensive patients may be justified to allow for additional preoperative cardiac testing. In the context of isolated hypertension, however, additional testing is rarely indicated and should only be considered in patients scheduled for high-risk surgery (e.g. major vascular surgery). If in addition to an elevated arterial pressure, signs of coronary artery (e.g. ischaemic electrocardiographic changes) or renal disease (e.g. elevated serum creatinine) are discovered, coupled with poor exercise tolerance and an intermediate- or high-risk surgical procedure, then additional preoperative cardiac testing should also be considered.<sup>9,10</sup> However, such testing should only be performed if the results are likely to have an impact on perioperative management (e.g. before coronary revascularization, modification of perioperative monitoring, changes in medical management).

Perioperative arterial pressure and heart rate control is essential in hypertensive patients. While hypertensive peaks need to be avoided, profound (relative) hypotension, especially when associated with baroreflex-mediated tachycardia, can be equally detrimental. Interestingly, in a study of 676 consecutive patients, hypertension at hospital admission was not associated with perioperative cardiac complications, but severe decreases in intraoperative arterial pressure (decrease to <50% of preoperative levels or by >33% for >10 min) was indeed an independent predictor of perioperative adverse events.<sup>18</sup> Maintaining arterial pressure perioperatively at 70–100% of baseline and avoiding tachycardia is a key factor in the optimal management of hypertensive surgical patients.

As hypertension is strongly associated with cardiovascular disease, and as cardiac events are the main cause of adverse perioperative outcome, the perioperative anaesthetic management of hypertensive patients must place particular emphasis on cardiac protection. This may be

achieved by perioperative  $\beta$ -blockade,<sup>19</sup> and possibly by pharmacological preconditioning.<sup>16 20–22</sup>

Two major outcome studies have demonstrated a reduction in mortality in patients with or at risk of coronary artery disease by perioperative  $\beta$ -blocker therapy.<sup>23 24</sup> The study populations included a significant number of hypertensive patients. Although both investigations have been criticized because of considerable methodological limitations,<sup>25</sup> the results, nevertheless, strongly suggest that hypertensive patients with the associated high incidence of coronary artery disease are likely to benefit from aggressive perioperative treatment with  $\beta$ -blockers, preferably  $\beta$ -1 selective antagonists.<sup>17 19 25</sup> Ideally, the referring general practitioner is contacted well ahead of the operation, so that  $\beta$ -blockade may be commenced days to weeks before the surgical intervention.<sup>19</sup>

Pharmacological preconditioning by inhalational anaesthetics may become another means of perioperative cardiac protection.<sup>16 20 21</sup> Inhalational anaesthetics seem to improve tolerance of myocardial ischaemia by acting as openers of mitochondrial and sarcolemmal ATP-regulated potassium ( $K_{ATP}$ ) channels.<sup>16 20 21</sup> This may be of particular benefit in hypertensive patients given the high prevalence of associated coronary artery disease<sup>4</sup> and their vulnerability to perioperative myocardial ischaemia.<sup>11</sup> In contrast, as sulphonylurea hypoglycaemic agents close  $K_{ATP}$  channels to increase insulin release from pancreatic islet cells, they may prevent anaesthetics from exerting pharmacological preconditioning and associated cardiac protection. It is thus advisable to discontinue such drugs 1–2 days before elective surgery.<sup>15</sup>

The review by Howell and colleagues<sup>1</sup> implies that patients are unlikely to die perioperatively from a preoperatively elevated arterial pressure level *per se* but, more likely, from underlying hypertension-associated comorbidities and, possibly, from inadequate perioperative management because of lack of understanding of the pathophysiology of hypertension. Clearly, the difference between an adverse and favourable outcome can be achieved not by treatment of numbers (in this case arterial pressure values), but rather by the appropriate perioperative management of the disease entity. Obviously, hypertension is only one of many risk factors that determine perioperative management and outcome—and, apparently, not the most important one.<sup>9 10</sup>

There is general agreement based on the evidence presented by Howell and colleagues<sup>1</sup> that patients with mild and moderate hypertension and no evidence of coronary artery disease or end-organ damage may safely undergo surgery without delay. In contrast, for patients with severe hypertension, the data are insufficient to allow an unequivocal recommendation as to what constitutes the optimal approach. Any recommendation to postpone elective surgery for the purpose of preoperative arterial pressure control must be balanced against the urgency and benefit of the planned operation; must take into account that arterial

pressure should be corrected slowly, and that up to 2 months may be required to reverse some of the hypertension-induced cardiovascular changes;<sup>14</sup> and must acknowledge the fact that data are lacking to support such practice.

Chronic hypertension may go undetected for a long time. It may well be found for the first time during routine preoperative assessment. Modern anaesthesia provided by a well trained, experienced and dedicated anaesthetist offers sufficient perioperative cardiac protection to make cancellation of surgery for the sole purpose of controlling preoperative hypertension unnecessary under most circumstances. Appropriate evaluation and intervention can be expected to improve perioperative and long-term outcome. When confronted with uncontrolled preoperative hypertension, we need to remain wary but not become unduly alarmed.

D. R. Spahn\*

*Department of Anaesthesiology  
University Hospital Lausanne  
Lausanne  
Switzerland*

H.-J. Priebe

*Department of Anaesthesiology  
University Hospital Freiburg  
Freiburg  
Germany*

\*Corresponding author. E-mail: donat.spahn@chuv.hospvd.ch

## References

- 1 Howell SJ, Sear JW, Foëx P. Hypertension, hypertensive heart disease and perioperative cardiac risk. *Br J Anaesth* 2004; **92**: 570–83
- 2 Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *JAMA* 2003; **289**: 2560–72
- 3 Priebe HJ. The aged cardiovascular risk patient. *Br J Anaesth* 2000; **85**: 763–78
- 4 Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. *JAMA* 1991; **265**: 3255–64
- 5 Levy D, Larson MG, Vasan RS, Kannel WB, Ho KK. The progression from hypertension to congestive heart failure. *JAMA* 1996; **275**: 1557–62
- 6 Forette F, Seux ML, Staessen JA, et al. Prevention of dementia in randomised double-blind placebo-controlled Systolic Hypertension in Europe (Syst-Eur) trial. *Lancet* 1998; **352**: 1347–51
- 7 Kannel WB. Blood pressure as a cardiovascular risk factor: prevention and treatment. *JAMA* 1996; **275**: 1571–6
- 8 Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: a

- meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002; **360**: 1903–13
- 9 Eagle KA, Berger PB, Calkins H, et al. ACC/AHA guideline update for perioperative cardiovascular evaluation for noncardiac surgery—executive summary a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation* 2002; **105**: 1257–67
  - 10 Chassot PG, Delabays A, Spahn DR. Preoperative evaluation of patients with, or at risk of, coronary artery disease undergoing non-cardiac surgery. *Br J Anaesth* 2002; **89**: 747–59
  - 11 Prys-Roberts C, Meloche R, Foëx P. Studies of anaesthesia in relation to hypertension. I. Cardiovascular responses of treated and untreated patients. *Br J Anaesth* 1971; **43**: 122–37
  - 12 Mangano DT, Browner WS, Hollenberg M, London MJ, Tubau JF, Tateo IM. Association of perioperative myocardial ischemia with cardiac morbidity and mortality in men undergoing noncardiac surgery. The Study of Perioperative Ischemia Research Group. *N Engl J Med* 1990; **323**: 1781–8
  - 13 Landesberg G, Luria MH, Cotev S, et al. Importance of long-duration postoperative ST-segment depression in cardiac morbidity after vascular surgery. *Lancet* 1993; **341**: 715–19
  - 14 Fleisher LA. Preoperative evaluation of the patient with hypertension. *JAMA* 2002; **287**: 2043–6
  - 15 Gu W, Pagel PS, Wartier DC, Kersten JR. Modifying cardiovascular risk in diabetes mellitus. *Anesthesiology* 2003; **98**: 774–9
  - 16 Wartier DC, Kersten JR, Pagel PS, Gross GJ. Editorial view: anesthetic preconditioning: serendipity and science. *Anesthesiology* 2002; **97**: 1–3
  - 17 Lee TH. Reducing cardiac risk in noncardiac surgery. *N Engl J Med* 1999; **341**: 1838–40
  - 18 Goldman L, Caldera DL. Risks of general anesthesia and elective operation in the hypertensive patient. *Anesthesiology* 1979; **50**: 285–92
  - 19 Zaugg M, Schaub MC, Pasch T, Spahn DR. Modulation of beta-adrenergic receptor subtype activities in perioperative medicine: mechanisms and sites of action. *Br J Anaesth* 2002; **88**: 101–23
  - 20 Zaugg M, Lucchinetti E, Uecker M, Pasch T, Schaub MC. Anaesthetics and cardiac preconditioning: Part I Signalling and cytoprotective mechanisms. *Br J Anaesth* 2003; **91**: 551–65
  - 21 Zaugg M, Lucchinetti E, Garcia C, Pasch T, Spahn DR, Schaub MC. Anaesthetics and cardiac preconditioning: Part II Clinical implications. *Br J Anaesth* 2003; **91**: 566–76
  - 22 van der Linden PJ, Daper A, Trenchant A, De Hert SG. Cardioprotective effects of volatile anesthetics in cardiac surgery. *Anesthesiology* 2003; **99**: 516–17
  - 23 Mangano DT, Layug EL, Wallace A, Tateo I. Effect of atenolol on mortality and cardiovascular morbidity after noncardiac surgery. Multicenter Study of Perioperative Ischemia Research Group. *N Engl J Med* 1996; **335**: 1713–20
  - 24 Poldermans D, Boersma E, Bax JJ, et al. The effect of bisoprolol on perioperative mortality and myocardial infarction in high-risk patients undergoing vascular surgery. Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography Study Group. *N Engl J Med* 1999; **341**: 1789–94
  - 25 Howell SJ, Sear JW, Foëx P. Peri-operative beta-blockade: a useful treatment that should be greeted with cautious enthusiasm. *Br J Anaesth* 2001; **86**: 161–4

DOI: 10.1093/bja/ae085