George Geroulakos
Bauer Sumpio
Editors

Vascular Surgery

Cases, Questions and Commentaries

Fourth Edition

Springer

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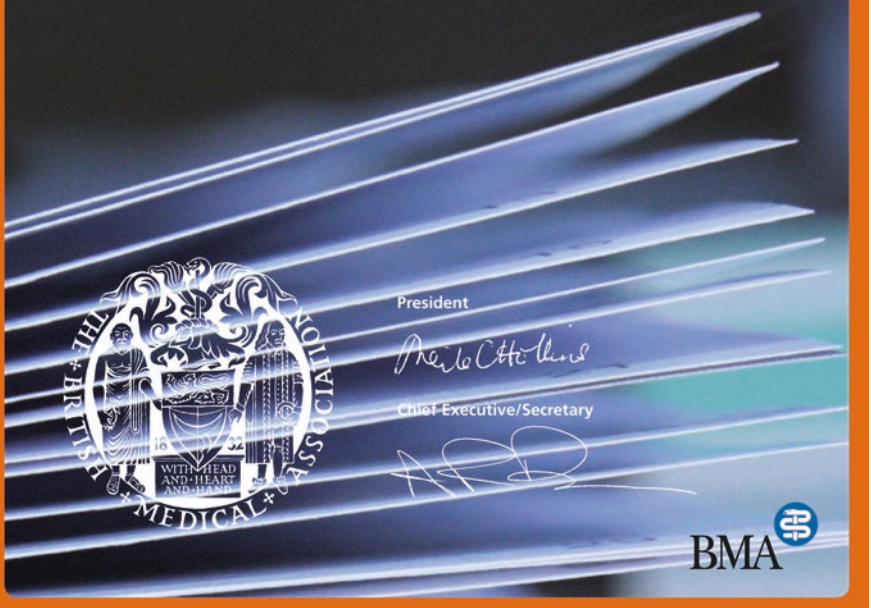
Vascular Surgery Cases: Questions and Commentaries



The late Dr. Robert W. Hobson II
Co-editor of the first and second edition of this book.
Humanitarian, charismatic surgeon, distinguished academic and role model for an entire generation of American vascular surgeons.
Dr. William Smead with profound gratitude for supporting me to become clinical vascular fellow at the Ohio State University Hospital.
Professor John Lumley (St Bartholomew's Hospital, London) and Professor Brian Hopkinson (University Hospital, Nottingham).
Heartfelt gratitude to my mentors, friends, and teachers.

George Geroulakos

Union Européenne des Médecins Spécialistes

SECTION AND BOARD OF VASCULAR SURGERY

Vascular Surgery is a discipline that deals with one of the true plagues of the 20th century. Moreover, atherothrombosis will continue to be the main cause of death in the near future.

New developments in the investigation and endoluminal treatment of vascular disease have recently attracted significant publicity from the mass media and patient groups and have significantly changed the management of the vascular patient.

The provision of a high quality vascular service is closely linked with the need to give residents an appropriate training and to further introduce vascular surgery as an outstanding specialty.

The book, *Vascular Surgery: Cases, Questions and Commentaries*, by Mr. Geroulakos, Prof. Hero van Urk, and Dr. R W Hobson II, will indeed contribute to a better understanding of vascular surgery as a specialty that deals with the pathology of arteries, veins, and lymphatics. The experience and the teaching capabilities of the authors are unquestionable.

This book, being so comprehensive, enhances the idea of considering vascular surgery as an independent entity from other specialties. Before achieving adequate competence to deal with the variety of cases presented in the book, the need for an appropriate training is obvious. Besides, the present text will help candidates to better prepare for the EBSQ-Vasc examination. The book utilizes a time proven concept for teaching by questions and answers based on real problems, an essential part of CME. The book proposes learning following the Socratic method, by exercising our mind rather than reading told facts. On the other hand, it may improve our clinical practice and care of our vascular patients, as it incites Continuous Professional Development as a step forward in CME.

The European Board of Vascular Surgery congratulates the authors for their initiative and gladly endorses the book.

Barcelona, March 2006

Marc Cairols
Secretary General
UEMS Section and Board of Vascular Surgery

Foreword to the First Edition

This book is rather unique among textbooks in vascular surgery. Most cover the surgical management of vascular diseases, in whole or in part, in standard textbook fashion, with the text organized to cover the topics methodically in a didactic manner, and supported by tables, illustrations, and references. Others have special purposes, such as atlases on technique or algorithm-based books on decision-making. All have their place, but if the educational goals are training of the young surgeon, self-assessment, and continuing medical education for the practitioner or preparation for oral examination, this book fills a special need, and fills it very well by breaking away from the didactic approach.

It has long been recognized by educators that retention of knowledge, i.e., true learning, is much better achieved using the Socratic method of questions and answers, as opposed to simply reading or being told facts. In this book this approach is developed and presented in a very effective manner. In each "chapter," one is presented with a case report representing a real life scenario. The case reports-scenarios in this book together cover most of vascular surgery experience. Following the case report, one is presented with questions and answers based on various aspects of the case, forcing the reader to commit to an answer. Whether the answer is right or wrong is not critical, in fact getting a wrong answer may be more beneficial in terms of correcting knowledge and retaining information. The commentary and conclusions that follow analyze the choice of answers, correct and incorrect, and discuss them in concise, authoritative detail, many of which are truly "pearls of information." The conclusion then summarizes the current state of knowledge on the clinical issues under consideration. Numerous references are included. Together, these components constitute one of the most effective vehicles for self-education in vascular surgery today. Importantly, all aspects of management are covered: diagnostic evaluation and appropriate treatment, whether it is nonoperative or interventional, endovascular or open surgery.

To accomplish their goals the editors have gathered together a large number of experienced contributors, many well known for their special areas of interest within vascular surgery, reflected in the contributions they make to this book. As such, the book should be useful to future and practicing vascular surgeons all over the world. It is full of statements covering most of the current state of knowledge in vascular surgery, and it does so in an entertaining and effective manner.

Boerne, TX, USA — Robert B. Rutherford

Foreword

The editors are very pleased to announce that the third edition of our book won the highly commended award in the 2013 BMA (British Medical Association) book competition in London.

The fourth edition includes recent updates on the endovascular management of arterial and venous conditions and on risk factor control. As more experience is gained on mesenteric artery dissection, a new chapter is added on the management of this condition. In addition the increased use of pacing wires, defibrillators and central lines was associated with an increase in the incidence of benign stenosis/occlusion of the superior vena cava. This is also covered in a new chapter.

We are most grateful to our international faculty for dedicating their time, valuable experience and energy revising chapters of the new edition and our editor at Springer for the continuous advice and support.

London, UK — George Geroulakos
Connecticut, USA — Bauer Sumpio

Preface to the First Edition

This book is a unique collection of real life case histories written by experts that highlight the diversity of problems that may be encountered in vascular surgery. Each case scenario is interrupted by several questions that aim to engage the reader in the management of the patient and to give him the opportunity to test his knowledge. The comments reflect to as much as possible the principles of evidence-based medicine and provide the answers to the questions.

Several chapters are authored by individuals that contributed to the development of innovations in the management and prevention of vascular disease and are of interest for both the vascular trainee and the experienced vascular specialist. The goal of this book is to help vascular trainees review for Board and other examinations as well as to provide vascular surgeons who wish to expand or refresh their knowledge with an update and interactive source of information relevant to case scenarios that could be encountered in their practice.

The European Boards in Vascular Surgery is a relatively new examination. Although the American Boards in Vascular Surgery were established many years earlier, there are no "dedicated" guides to cover the needs of these examinations. We hope that our book will provide a helpful hand that does not come from the standard textbooks, but directly from daily practice and therefore contains a high content of "how to do it" and "why we do it." The references show the close relation between daily practice and "evidence-based" practice, and we hope the two are not too different.

We would like to thank all the authors who have contributed generously their knowledge and time to this project.

London, UK — George Geroulakos
Rotterdam, The Netherlands — Hero van Urk
Philadelphia, PA — Keith D. Calligaro
New Jersey, NJ — Robert W. Hobson II

Preface to the Second Edition

The author's principal objective of the first edition was the presentation of the principles of vascular and endovascular surgery through interactive real life clinical scenarios. The success of the first edition has been gratifying. We have received many suggestions for additions and changes from vascular trainees, specialists, and teachers at various institutions in Europe, USA, and other parts of the world. These comments have been well received and have been important in improving and expanding the second edition. We wish to acknowledge our appreciation and gratitude to our authors and publishers.

London, UK — George Geroulakos
Rotterdam, The Netherlands — Hero van Urk
New Jersey, NJ — Robert W. Hobson II

Preface to the Third Edition

The third edition updated most chapters that were focusing on the endovascular management of arterial and venous disease providing the reader with practical and updated, well-referenced information on the full spectrum of options for the management of vascular disease. We are pleased to report the translation of the second edition of our book to Portuguese. We wish to express our thanks to our authors and publishers for their contribution to this project.

London, UK — George Geroulakos
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Part I

Arterial Aneurysms

Preoperative Cardiac Risk Assessment and Management of Elderly Men with an Abdominal Aortic Aneurysm

1

Don Poldermans

Case Report

A 70-year old man presented with an abdominal aortic aneurysm. He was worried as his mother died suddenly of a ruptured aortic aneurysm at the age of 55 years and requested for an ultrasound examination. The ultrasound showed an aortic aneurysm of 72 mm. The patient was referred to a vascular surgeon. He gave a history of hypercholesterolemia but was intolerant to statins. Interestingly muscle complaints did not resolved after stopping statins. Two years earlier he had started beta-blocker therapy for mild hypertension. He smoked ten cigarettes a day for the last 40 years, but stopped when the aneurysm was diagnosed. He had chest pain which progressed the year prior to his admission and dyspnea with moderate exercise at a round of golf. He was referred to a cardiologist for preoperative screening. Physical examination showed a friendly man, with blood pressure 145/58 mmHg and an irregular pulse of 88 bpm. Examination of the chest revealed no abnormalities of the heart. Palpation of the abdomen showed an aortic aneurysm with an estimated diameter of 7 cm. Routine preoperative blood tests showed an elevated fasting glucose of 5.2 mmol/L and low-density lipoprotein (LDL) cholesterol of 4.8 mmol/L. Electrocardiography showed atrial fibrillation and pathological Q-waves in leads V1–V3, suggestive of an old anterior myocardial infarction. A coronary CT-scan was performed that revealed a significant lesion of the left anterior descending coronary artery (LAD). Left ventricular function was

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normal with an ejection fraction of 48%. The recently diagnosed atrial fibrillation was managed with Coumadin therapy. Coronary angiography was requested. It confirmed the presence of single-vessel coronary artery disease and in the same session a coronary stent was placed successfully in the LAD (Fig. 1.1a, b).

Question 1
Which of the following statements regarding postoperative outcome in patients undergoing major vascular surgery is correct?

A. Cardiac complications are the major cause of perioperative morbidity and mortality.
B. Perioperative myocardial infarctions are related to fixed coronary artery stenosis in all patients.
C. Perioperative cardiac events are related to a sudden, unpredictable progression of a nonsignificant coronary artery stenosis in all patients.
D. Perioperative cardiac complications are related to both fixed and unstable coronary artery lesions.

This patient has several problems that need to be addressed prior to surgery. In addition the preoperative screening offers the opportunity to identify and treat cardiovascular risk factors that might influence long-term outcome after surgery. Our patient experienced angina pectoris during moderate exercise. Additional testing identified two problems; atrial fibrillation and a significant coronary artery lesion of the LAD. Figure 1.1a, b shows a significant lesion of the LAD, with a successful treatment after stent placement.

Question 2
Which of the following statements regarding the type of coronary stent in relation to the planned surgical intervention is correct?

A. Drug eluting stents are preferred immediately prior to surgery.
B. Bare metal stents are preferred immediately prior to surgery as the duration of dual antiplatelet therapy after stent placement is shorter than drug eluting stents.
C. Both bare metal and drug eluting stents have a comparable treatment after placement.
D. Late stent thrombosis occurs more frequently after drug eluting stent placement, necessiting more frequent reinterventions.

Question 3
Which of the following statements regarding perioperative management of Coumadin therapy is correct?

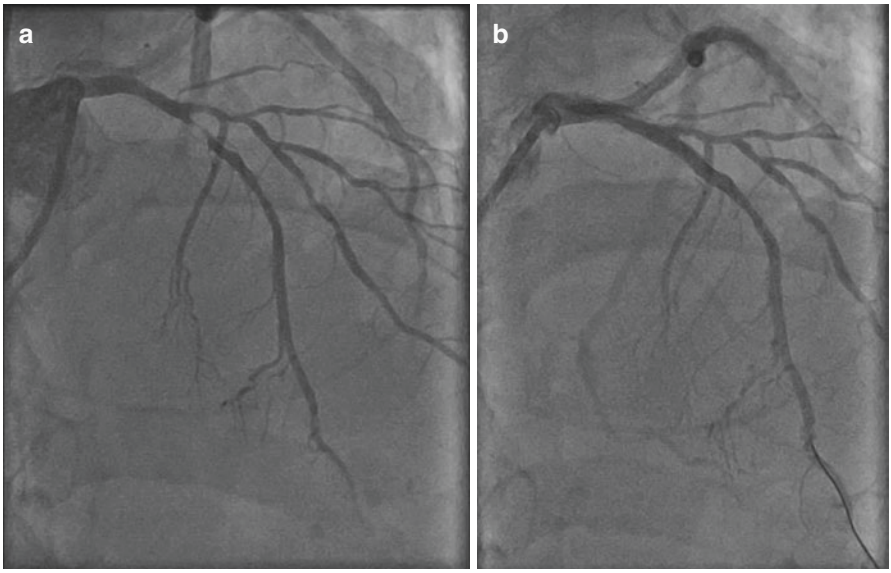

Fig. 1.1 (**a**, **b**) Preoperative evaluation in patient with significant LAD lesion (*top*), successfully treated with BMS (*bottom*)

A. Perioperative bridging of Coumadin using low molecular weight heparin is recommended in all patients undergoing surgery.
B. Using the BRIDGE trial outcome and the $CHADSVasc_2$ score perioperative bridging in this patient is not necessary.
C. Perioperative bridging is recommended because of the coronary stent placement.
D. Coumadin therapy using a therapeutic dose can be continued during major vascular surgery in combination with anti-platelet therapy.

Question 4
Statin therapy is recommended in all vascular surgery patients to improve long-term outcome. Which of the following statements of preoperative starting of statins is correct for the immediate perioperative period?

A. Withdrawal of perioperative statin therapy is associated with an increased perioperative cardiac event rate.
B. Perioperative statin use is associated with an increased incidence of myopathy.
C. Perioperative statin use is associated with a reduced perioperative myocardial infarct rate in vascular surgery patients.
D. During surgery statins can be prescribed intravenously.

Question 5
Perioperative beta-blockers have been discussed widely in vascular surgery patients. Which of the following statements regarding beta-blockers is correct?

A. Patients on chronic beta-blocker therapy should continue medication during surgery.
B. Perioperative beta-blocker therapy is associated with a reduced perioperative myocardial infarction rate.
C. High-dose beta-blocker therapy is associated with an increased risk of perioperative stroke.
D. All statements are correct.

Question 6
Preoperative cardiac imaging for the detection and management of coronary artery disease in vascular surgery patients can be performed using CT-angiography. Which statement is correct?

A. In addition to the revised cardiac risk index the sensitivity is increased to: 50%.
B. In addition to the revised cardiac risk index the sensitivity is increased to: 76%.
C. In addition to the revised cardiac risk index the sensitivity is decreased to: 42%.
D. In addition to the revised cardiac risk index the sensitivity is decreased to: 20%.

Question 7
Preoperative coronary revascularization seems to be an attractive option to improve not only direct postoperative outcome in high-risk patients but also long-term survival after surgery.

A. Preoperative coronary revascularization improves postoperative outcome in all patients with significant coronary artery disease prior to major vascular surgery.
B. Preoperative coronary revascularization in patients with one- or two-vessel disease is not associated with an improved postoperative outcome compared to patients receiving medical therapy.
C. Preoperative coronary revascularization is associated with an improved 2-year outcome compared to medical therapy.
D. Patients with proven coronary artery disease who are treated medically are at increased risk of late coronary revascularization after surgery. After late revascularization, long-term outcome is similar to that with revascularization prior to surgery.

This 70-year-old male had multiple cardiac risk factors: elderly age, progressive angina pectoris, hypercholesterolemia, atrial fibrillation, and a previous MI. He underwent a coronary CT-scan showing left anterior descending artery (LAD)

disease. A PTCA-procedure was successfully performed prior to surgery using a drug eluting stent. After stent placement dual antiplatelet therapy (DAPT) was initiated (clopidogrel and aspirin). In addition warfarin and statins were started prior to surgery. Warfarin was not bridged during surgery, but beta-blockers and statins were continued in the perioperative period. Surgery was performed 3 months after the coronary stent deployment using a single antiplatelet agent. The timing of surgery was discussed by the surgeon, anesthesiologist and cardiologist. After consideration of the aneurysm size, coronary stent anatomy, a single stent without bifurcation, the period of DAPT was shortened to 3 months, instead of 6 months DAPT. Bridging clopidogrel using intravenous glycoprotein IIb/IIIa inhibitor was not considered. The outcome was uneventful.

Commentary

Annually more than 230 million major surgical procedures are performed worldwide in an aging population as life expectancy is extending. Age is a significant risk factor for peripheral vascular disease and this growth is expected to continue for the next few decades. Therefore the number of peripheral vascular interventions will increase over time. Cardiac complications are the major cause of perioperative morbidity and mortality, which may occur in 1–5% of unselected patients undergoing major vascular surgery [1]. [**Q1: A**] This high frequency of cardiac complications is related to the high prevalence of coronary artery disease; 54% of patients undergoing major vascular surgery have advanced or severe coronary artery disease and only 8% of patients have normal coronary arteries [2]. Perioperative cardiac complications are equally caused by coronary artery plaque rupture with subsequent thrombus formation and coronary artery occlusion and by prolonged myocardial ischemia or, respectively type I and type II myocardial infarctions according to the ESC guidelines [1, 3] (Table 1.1). [**Q1: B, C, D**] Prolonged perioperative myocardial ischemia usually occurs from either increased myocardial oxygen demand or reduced supply, or from a combination of the two. If all perioperative cardiac events would be related to a preoperative critical coronary artery stenosis, revascularization would be the best treatment option. However, if events also at locations without a critical stenosis, medical therapy would be preferred. The relationship between the location of a preoperative assessed coronary artery stenosis and the occurrence of intraoperative ischemia using transesophageal echocardiography was assessed in a group of 56 vascular surgery patients [4]. New wall motion abnormalities, a marker of myocardial ischemia, detected by intraoperative transesophageal echocardiography had 100% positive predictive value and better agreement with the location of perioperative MI compared with preoperative dobutamine echocardiography. This demonstrates that although preoperative dobutamine echocardiography can predict patients who are at risk for perioperative MI, it could not predict the location of those perioperative MIs. The author's hypothised that its failure in identifying the specific region at risk can be explained by the rupture and instability of less obstructive plaques that caused no flow reduction.

Table 1.1 The two most frequent types of perioperative myocardial infarction according to the current definition of myocardial infarction, according to the ESC guidelines [3]

Type I myocardial infarction	Definition	Myocardial necrosis due to impaired blood flow to the myocardium
	Pathophysiology	Related to rupture of an atherosclerotic plaque, with resulting intracoronary thrombus leading to occlusion or distal embolisation in one or more coronary arteries
	Relation to CAD	Most patients have underlying severe CAD, but on occasion nonobstructive or no CAD
	Therapy	Preoperative revascularization, dual antiplatelet therapy, statins, and beta-blockers
Type II myocardial infarction	Definition	Myocardial injury with necrosis caused by an imbalance between myocardial oxygen supply and demand
	Pathophysiology	A condition other than CAD contributes to an imbalance between myocardial oxygen supply and/or demand, e.g. coronary artery spasm, coronary embolism, tachy-/bradyarrhythmias, anemia, respiratory failure, hypotension and hypertension, pain, and surgical stress
	Relation to CAD	The patient may or may not have underlying CAD
	Therapy	Correction of underlying disease, antiplatelet therapy, statins, and beta-blockers

CAD coronary artery disease

There are several perioperative factors that can increase myocardial oxygen demand including tachycardia and hypertension resulting from surgical stress, postoperative pain, interruption of beta-blocker use, or the use sympathomimetic drugs. Decreased oxygen supply, on the other hand, can occur as a result of hypotension, vasospasm, and anemia, hypoxia or coronary artery plaque rupture. Beta-blockers primarily reduce myocardial oxygen demand, while statins may prevent coronary artery plaque rupture [5].

Although myocardial ischemia occurs frequently, more than 80% of the patients experiencing perioperative myocardial injury remain asymptomatic, probably related to the surgical setting with anesthesia, nausea and pain complaints as part of the procedure itself [5]. This silent presentation results in reduced awareness among both clinicians and the public. However, preventive treatment is important as perioperative myocardial injury increases 30-day mortality nearly tenfold [6–8].

Beta-Adrenergic Antagonists

The main rationale for perioperative beta-blocker use is to decrease myocardial oxygen consumption by reducing heart rate, leading to a longer diastolic filling period and decreased myocardial contractility. Initial studies beginning in the 1990s

showed a favorable outcome, but evidence has been conflicting since then [9, 10]. Especially after the publication of negative results from several studies, including the Perioperative Ischemic Evaluation (POISE) trial in 2008 the beta blocker use has been declied [11].

Recently a meta-analysis was performed of 17 studies, of which 16 were randomized clinical trials (RCTs) (12,043 participants) and 1 was a cohort study (348 participants) [12]. Patients participating in the DECREASE trials were evaluated weeks prior to surgery using (stress) echocardiography. Bisoprolol, started 30 days prior to surgery in a low 5–10 mg dose, aiming at a target heart rate between 60 and 70 bpm. All other RCTs initiated beta- blockers within 1 day or less prior to surgery. Among RCTs, beta-blockers decreased nonfatal myocardial infarction (MI) (RR: 0.69; 95% confidence interval [CI]: 0.58–0.82) but increased nonfatal stroke (RR: 1.76; 95% CI: 1.07–2.91), hypotension (RR: 1.47; 95% CI: 1.34–1.60), and bradycardia (RR: 2.61; 95% CI: 2.18–3.12).

Though, a favorable effect on non-fatal cardiac events was noted, an increased mortality in patients randomized to beta-blockers was observed, predominantly driven by the large number of patients of the POISE trial (8.351 patients) [11]. This may be related to the beta-blocker regimen used; metoprolol, started 2–4 h prior to surgery, with a dose that could be as high as 400 mg within 12 h post surgery. The incidence of perioperative myocardial infarctions was reduced (4.2% vs. 5.7% in controls), but the incidence of hypotension, brachycardia and stroke (1.0% vs. 0.5%) was increased.

Currently there is discussion whether the design of the studies using beta-blockers, i.e. type, dosing and timing of beta-blockers is related to the differences in outcome, or that beta-blockers should not be used to prevent perioperative ischemia.

Type of beta-blockers: more cardioselective agent's bisoprolol and atenolol were associated with better outcomes than metoprolol. Cardioselective beta-blockers blunt perioperative tachycardia, whereas non-selective blockers may block systemic or cerebral vasodilatation. Studies comparing the three beta-blockers found better outcomes with atenolol and bisoprolol than with metoprolol—fewer stroke a lower mortality rate, and a better composite outcome [12]. Timing and dosing of beta-blockers: The best results were achieved when beta-blockers were started approximately 1 month before surgery and titrated to control the heart rate giving adequate time for dose titration and tighter heart rate control.

Implications: At present there are concerns about the safety and efficacy of preventive beta-blockers in the perioperative setting, particularly regarding the risk of stroke [13]. If prophylactic beta-blockers are to be effective they should be cardioselective, started at least 1 week before surgery, using dose-adjustments for heart rate control to avoid overdosing, and only in high-risk patients with multiple risk factors. Additional trials using different dosing regimens are needed to clarify this issue.

For those patients using chronic beta-blockers or with other indications for beta-blockers therapy, i.e. coronary artery disease, heart failure or atrial fibrillation for

rate control, medication should be continued and if time permits perform dose adjustments aiming at a heart rate between 60 and 70 bpm. [**Q5: A, B, C, D**]

3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase Inhibitors (Statins)

There is abundant evidence demonstrating the cardiovascular protective effects of statin use, especially in patients with multiple cardiac risk factors. However, the effects of statin use to improve postoperative outcome has been less well defined. The so-called pleiotropic effects of statins may attenuate coronary artery plaque inflammation and influence plaque stability in addition to antithrombogenic, antiproliferative and leukocyte-adhesion inhibiting effects [14, 15]. All these effects of statins may stabilize unstable coronary artery plaques, thereby reducing myocardial ischemia and subsequent myocardial damage. In addition, patients with peripheral vascular disease should be on statins after surgery anyhow according to the ESC-guidelines [15]. There are only RCTs that have evaluated the beneficial effects of perioperative statin use in reducing perioperative cardiac complications.

Recently, a meta-analysis performed by Antoniou et al. evaluated postoperative outcome after vascular surgery and endovascular interventions in more than 20,000 patients using four randomized controlled trials and 20 observational cohorts or case-control studies [16]. The randomized studies enrolled 675 patients, and the observational studies enrolled 22,861 patients. Statin therapy was associated with a significantly lower risk of all-cause mortality OR, 0.54; 95% CI, 0.38–0.78, MI (OR, 0.62; 95% CI, 0.45–0.87), stroke (OR, 0.51; 95% CI, 0.39–0.67), and the composite of MI, stroke, and death (OR, 0.45; 95% CI, 0.29–0.70). No significant differences in cardiovascular mortality (OR, 0.82; 95% CI, 0.41–1.63) and the incidence of kidney injury (OR, 0.90; 95% CI, 0.58–1.39) between the groups were identified.

When just the RCTs data were pooled, only a reduction in MI was observed in the statin group; there was no difference in the other outcomes in the statin group versus placebo group. [**Q4, C**]

Though statin use is associated with an improved postoperative outcome, initially, statin use was contraindicated in the perioperative period. It was thought that drug interactions might increase the incidence of myopathy and in combination with analgesics this might even remain asymptomatic. However, the DECREASE III study showed no increased incidence of myopathy among statin users [17].

The results of these studies are important indications of the possible beneficial effect of perioperative statin use. However, there are certain limitations; the retrospective nature of the studies, the relatively small sample sizes and outcomes, the lack of information about the optimal timing and duration of statin therapy and it is also possible that statin use is a marker for overall better management of medical co morbidities.

In addition, there is an important practical issue. Statin intolerance is frequently observed, limiting the more widespread use of statins. However, the discussion of statin intolerance is cumbersome as there is a huge difference in the incidence of reported side effects and there is no objective biomarker. Observational studies report an incidence of up to 20%, while in randomized controlled trials the incidence is no more than placebo. The GAUSS-3 trial addressed this issue [18]. The GAUSS-3 trial assessed statin intolerance in a group of patients with a history of at least two different statins using a blinded, placebo-controlled re-challenge design followed by two alternative therapies, ezetimibe or evolocumab. The design, a blinded cross-over study was used to confirm true statin intolerance. In patients with known statin intolerance a total of 43% reported muscle complaints while taking the statin and not on placebo, so those patients had a true statin intolerance. However, a large number of patients were able to tolerate statins even after a history of statin intolerance using a rechallenge. Using the glass-half-full analogy, one could say that 60% didn't have statin intolerance even though they had tried and failed to tolerate at least two statins previously. So; for intolerant patients, first do a rechallenge with a low dose regimen, rosuvastatine 5 mg once or twice a week, using an up titration scheme. If complaints reoccur consider alternative treatment like ezetimibe, though there are no data on postoperative outcome. PCSK9 inhibitors do not have a place yet for perioperative use, as outcome data are lacking and safety data in the perioperative period are not available.

Implications: Statins are beneficial in improving postoperative outcomes and should be considered as part of the optimization strategy in vascular surgery patients for prevention of adverse cardiovascular events.

Anti-Platelet Therapy

Continuation or cessation of aspirin is a topic of considerable debate. One should balance the benefits of preventing tromboembolic events versus the risk of bleeding. A large meta-analysis, including 41 studies in 49,590 patients, which compared peri-procedural withdrawal vs. bleeding risks of aspirin, concluded that the risk of bleeding complications with aspirin therapy was increased by 50%, but that aspirin did not lead to greater severity of bleeding complications [19]. However, in subjects at risk of—or with proven—ischemic heart disease, aspirin non-adherence or withdrawal tripled the risk of major adverse cardiac events.

The effect of aspirin initiation was studied in the POISE-2 trial, randomizing 10,010 patients undergoing noncardiac surgery to aspirin or placebo [20]. Aspirin (at a dose of 200 mg) or placebo was started just before surgery and continued it daily (at a dose of 100 mg) for 30 days. Aspirin did not reduce the rates of death or non-fatal myocardial infarction at 30 days (7.0% in the aspirin group vs. 7.1% in the placebo group; HR 0.99; 95% CI 0.86–1.15; $P = 0.92$). Major bleeding was more common in the aspirin group than in the placebo group (4.6% vs. 3.8%, respectively; HR 1.23; 95% CI 1.01–1.49; $P = 0.04$).

Implications: Aspirin use should be based on an individual decision, depending on the perioperative bleeding risk, weighed against the risk of thrombotic complications.

Anticoagulant Therapy in Patients with Atrial Fibrillation

Should we provide bridging in patients with atrial fibrillation (AF)? Or is this a bridge too far? The management of perioperative anticoagulation in patients undergoing vascular surgery is challenging, as interruption may cause tromboembolism, while continuation is associated with an increased bleeding risk. Current guidelines recommend consideration or administration of bridging therapy for many patients with AF. A recent meta-analysis of all bridging studies showed that vitamin K antagonist-treated patients receiving periprocedural heparin bridging appear to be at increased risk of overall and major bleeding and at similar risk of thromboembolic events compared to nonbridged patients [18] (Table 1.2).

The BRIDGE trial was designed to answer whether perioperative anticoagulant bridging is useful in patients with AF [21]. In this non-inferiority trial, 1884 patients (mean age 71 years, 73% male) with chronic non-valvular AF (including paroxysmal AF) or atrial flutter taking warfarin for at least 3 months scheduled to undergo an invasive procedure requiring warfarin interruption were recruited; 934 were randomized to receive BA with dalteparin (100 IU/kg/bid) and 950 were randomized to receive placebo in an identical manner. Importantly, patients with a mechanical heart valve, and a recent stroke were excluded. The primary outcomes were arterial tromboembolic events (stroke, transient ischemic attack, and systemic embolism) and major bleeding within 30 days. The results of the trial were clear. Bridging did not reduce risk of embolism but increases bleeding risk. However, only few patients with high CHADS2 score of 5 or 6 (congestive heart failure, hypertension, age, diabetes, stroke) were included (mean score = 2.3) (Table 1.3). [**Q3, B**]

Table 1.2 Meta analysis of perioperative bridging trials for the prevention of tromboembolic events [22]

	Bridged ($N = 7118$)	Nonbridged ($N = 5160$)	HR
Embolic event	1.1%	0.9%	0.8 (0.4–1.5)
Bleeding	11%	2%	5.4 (3.0–9.7)
Serious bleeding	3.7%	0.9%	3.6 (1.5–8.5)

HR hazard ratio

Table 1.3 The BRIDGE trial [21]

	Bridged ($N = 895$)	Nonbridged ($N = 918$)	
Embolic event	0.3%	0.4%	Non-inferior
Bleeding	21%	12%	NNH 12
Serious bleeding	3.2%	1.3%	NNH 53

NNH number needed to harm