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Risk for Surgery with General Anaesthesia post Stroke

Date requested: 4th February 2020
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SUMMARY

- Delay non-urgent surgery for at least 9 months after an ischaemic stroke unless the benefits of earlier surgery outweigh the increased risks of perioperative stroke during this time.
- There are few prospective data on which to base recommendations for intraoperative care of patients with a previous stroke. However, if surgery is performed within 9 months of a stroke, arterial pressure should be controlled as far as possible with appropriate monitoring and interventions throughout the perioperative period.
- Concurrent medications should be managed according to existing guidelines, though these should be considered on a case-specific basis and the individual risks and benefits acknowledged.
- The benefits of central neuraxial blockade must be balanced against the increased risk of cerebrovascular thrombosis related to the withdrawal of clopidogrel therapy (1)
- There are no differences in postoperative 30-day death, stroke, or MI in early and delayed CEA after an acute stroke. These results substantiate the recommendation for early (<7 days) CEA after acute strokes (2)
- Previous stroke is a major risk factor of recurrent ischemic stroke and MACE in patients undergoing SAVR, especially if time elapsed between previous stroke and surgery is less than 3 months. (3)
The issue of optimal timing for an elective surgery in a patient with recent ischemic stroke is inadequately studied. For carotid endarterectomy (CEA), many studies recommended waiting for at least 4 to 6 weeks to reduce perioperative risk of complications. However, more recent studies have found reduced risk of second stroke with no difference in perioperative complications after early CEA within 1 to 2 weeks. [4]

Adverse cardiovascular outcomes and mortality were greatly increased among patients with recent stroke. However, events were higher 4 to 14 days after stroke compared with 1 to 3 days after stroke [5]

In patients who have had a recent stroke or TIA, current evidence suggests that it would be safer to delay elective surgery for 3 months. This will need to take into account the urgency of surgery and an individualised approach to the risk and benefit of proceeding with early surgery will need to be made. For example, in the case of non-urgent surgery – such as an elective joint replacement – waiting the full 3 months would be prudent, whereas in cancer surgery the likely mortality benefit from urgent surgical treatment may outweigh the stroke risk and early surgery may be considered [6]

In 2014, a consensus statement from the Society for Neuroscience in Anaesthesiology and Critical Care (Mashour et al, 2014) addressed timing of elective surgery after recent stroke. They recommended that a delay period of approximately 4 weeks should be considered between the stroke and elective surgery, but also recommended that the decision to delay surgery should be a balance between risks of peri-operative stroke and the risks of the surgical pathology, as there is no clear relationship between timing of previous stroke and incidence of perioperative cerebrovascular accident. However, Jørgensen et al (2014) have since shown that patients who had a stroke within 3 months before surgery had incidence rates of 30-day ischaemic stroke 149.6-fold higher than patients who had not had a stroke. They also found that all-cause mortality was 12.6-fold higher in this group.

SEARCH RESULTS

1. Minhas JS, Rook W, Panerai RB, et al. Pathophysiological and clinical considerations in the perioperative care of patients with a previous ischaemic stroke: a multidisciplinary narrative review. BJA: The British Journal of Anaesthesia 2020;124(2):183-96. Abstract: With an ageing population and increasing incidence of cerebrovascular disease, an increasing number of patients presenting for routine and emergency surgery have a prior history of stroke. This presents a challenge for pre-, intra-, and postoperative management as the neurological risk is considerably higher. Evidence is lacking around anaesthetic practice for patients with vascular neurological vulnerability. Through understanding the pathophysiological changes that occur after stroke, insight into the susceptibilities of the cerebral vasculature to intrinsic and extrinsic factors can be developed. Increasing understanding of post-stroke systemic and cerebral haemodynamics has provided improved outcomes from stroke and more robust secondary prevention, although this knowledge has yet to be applied to our delivery of anaesthesia in those with prior stroke. This review describes the key pathophysiological and clinical considerations that inform clinicians providing perioperative care for patients with a prior diagnosis of stroke.

have been associated with delayed carotid endarterectomy (CEA) for patients who present with acute strokes. As such, earlier intervention has been advocated to preserve cerebral function and expedient rehabilitation. We sought to determine the differences in 30-day postoperative major adverse clinical events (MACEs) for patients who undergo early (<=7 days) and delayed (>7 days) CEA after acute stroke. Method(s): Our sample consisted of patients captured in the CEA-targeted American College of Surgeons National Surgical Quality Improvement Program data set between 2011 and 2015. The primary outcome was 30-day postoperative MACEs (death, stroke, or myocardial infarction [MI]). Differences in postoperative MACEs were determined between early and delayed CEA treatment. In addition, multivariable analyses were done to determine the association between various patient factors and postoperative complications after CEA for patients who presented with acute strokes. Result(s): A total of 3,427 patients were identified who underwent CEA for acute stroke in the CEA-targeted files between 2011 and 2015. Overall, perioperative rates of 30-day death, stroke, or MI were 1.30% (n = 43), 2.74% (n = 94), and 0.96% (n = 33), respectively. There were no differences in 30-day postoperative death, stroke, or MI for early or delayed CEA after acute strokes. On multivariable analysis, independent predictors for postoperative MACEs in patients with acute stroke were age >=80 years (OR 2.41; 95% CI [1.15-5.06]), preoperative beta-blocker use (OR 2.11; 95% CI [1.13-3.93]), and operative time > 150 min (OR 2.39; 95% CI [0.82-4.98]). Conclusion(s): There are no differences in postoperative 30-day death, stroke, or MI in early and delayed CEA after an acute stroke. These results substantiate the recommendation for early (<7 days) CEA after acute strokes.
with patients with no prior stroke (18.4% [37 of 201] vs 1.2% [160 of 13219]; odds ratio, 14.69; 95% CI, 9.69-22.27). Likewise, compared with patients without stroke, patients with stroke less than 3 months prior surgery were at significantly increased risk of MACE (23.3% [53 of 227] vs 5.7% [768 of 13414]; odds ratio, 4.57; 95% CI, 3.24-6.44) but not all-cause mortality (6.8% [50 of 730] vs 3.6% [374 of 10370]; odds ratio, 1.45; 95% CI, 0.83-2.54). Spline analyses supported a declining risk over time, reaching nadir after 2 to 4 months.

Conclusions and Relevance: Previous stroke is a major risk factor of recurrent ischemic stroke and MACE in patients undergoing SAVR, especially if time elapsed between previous stroke and surgery is less than 3 months.

4. Hemangi S. Anesthesia for patients with prior stroke J Neuroanaesthesiol Crit Care 2018;5:150–157 Abstract: An increasing number of patients with a prior history of stroke present for various types of surgeries. They have varying degree of neurological disability and associated co-morbidities, which pose challenges for their perioperative management. There is paucity in literature about their management guidelines for noncardiac, noncarotid surgeries. The available literature suggests higher risk of perioperative stroke, postoperative neurological deficits, and other morbidities. Measures to reduce perioperative risks are discussed in this review. Prior optimization by improving modifiable risk factors, choosing appropriate timing of elective surgery, and careful titration of anesthesia and close monitoring are needed.

5. Christiansen MN, Andersson C, Gislason GH, et al. Risks of Cardiovascular Adverse Events and Death in Patients with Previous Stroke Undergoing Emergency Noncardiac, Nonintracranial Surgery: The Importance of Operative Timing Anesthesiology 2017;127(1):9-19. Abstract: The outcomes of emergent noncardiac, nonintracranial surgery in patients with previous stroke remain unknown. Method(s): All emergency surgeries performed in Denmark (2005 to 2011) were analyzed according to time elapsed between previous ischemic stroke and surgery. The risks of 30-day mortality and major adverse cardiovascular events were estimated as odds ratios (ORs) and 95% CIs using adjusted logistic regression models in a priori defined groups (reference was no previous stroke). In patients undergoing surgery immediately (within 1 to 3 days) or early after stroke (within 4 to 14 days), propensity-score matching was performed. Result(s): Of 146,694 nonvascular surgeries (composing 98% of all emergency surgeries), 5.3% had previous stroke (mean age, 75 yr [SD = 13]; 53% women, 50% major orthopedic surgery). Antithrombotic treatment and atrial fibrillation were more frequent and general anesthesia less frequent in patients with previous stroke (all P < 0.001). Risks of major adverse cardiovascular events and mortality were high for patients with stroke less than 3 months (20.7 and 16.4% events; OR = 4.71 [95% CI, 4.18 to 5.32] and 1.65 [95% CI, 1.45 to 1.88]), and remained increased for stroke within 3 to 9 months (10.3 and 12.3%; OR = 1.93 [95% CI, 1.55 to 2.40] and 1.20 [95% CI, 0.98 to 1.47]) and stroke more than 9 months (8.8 and 11.7%; OR = 1.62 [95% CI, 1.43 to 1.84] and 1.20 [95% CI, 1.08 to 1.34]) compared with no previous stroke (2.3 and 4.8% events). Major adverse cardiovascular events were
significantly lower in 323 patients undergoing immediate surgery (21%) compared with 323 successfully propensity-matched early surgery patients (29%; P = 0.029). Conclusion(s): Adverse cardiovascular outcomes and mortality were greatly increased among patients with recent stroke. However, events were higher 4 to 14 days after stroke compared with 1 to 3 days after stroke.

6. Mehdi Z. Perioperative management of adult patients with a history of stroke or transient ischaemic attack undergoing elective non-cardiac surgery. Clin Med 2016;16(6):535-40. Abstract: It is increasingly common for physicians and anaesthetists to be asked for advice in the medical management of surgical patients who have an incidental history of stroke or transient ischaemic attack (TIA). Advising clinicians requires an understanding of the common predictors, outcomes and management of perioperative stroke. The most important predictor of perioperative stroke is a previous history of stroke, and outcomes associated with such an event are extremely poor. The perioperative management of this patient group needs careful consideration to minimise the thrombotic risk and a comprehensive, individualised approach is crucial. Although there is literature supporting the management of such patients undergoing cardiac surgery, evidence is lacking in the setting of non-cardiac surgical intervention. This article reviews the current evidence and provides a pragmatic interpretation to inform the perioperative management of patients with a history of stroke and/or TIA presenting for elective non-cardiac surgery.

7. McCarthy ÁF, Deasy J, Moore MF. Timing of surgery following recent ischaemic stroke. British Journal of Hospital Medicine (17508460) 2015;76(11):666-67. Abstract: The article presents a case study involving the management of patients who are recommended for surgery after an ischemic stroke. Topics covered include perioperative stroke, complications of cerebrovascular accident, and the association of the timing of surgery with the recurrence of perioperative stroke. The recommended delay for surgery is also mentioned [Full text available with NHS OpenAthens].

8. Jorgensen ME. Time Elapsed After Ischemic Stroke and Risk of Adverse Cardiovascular Events and Mortality Following Elective Noncardiac Surgery. JAMA 2014;312(3):269-77. Abstract: IMPORTANCE The timing of surgery in patients with recent ischemic stroke is an important and inadequately addressed issue. OBJECTIVE To assess the safety and importance of time elapsed between stroke and surgery in the risk of perioperative cardiovascular events and mortality. DESIGN, SETTING, AND PARTICIPANTS Danish nationwide cohort study (2005-2011) including all patients aged 20 years or older undergoing elective noncardiac surgeries (n=481 183 surgeries). EXPOSURES Time elapsed between stroke and surgery in categories and as a continuous measure. MAIN OUTCOMES AND MEASURES Risk of major adverse cardiovascular events (MACE; including ischemic stroke, acute myocardial infarction, and cardiovascular mortality) and all-cause mortality up to 30 days after surgery. Odds ratios (ORs) were calculated by multivariable logistic regression models. RESULTS Crude incidence rates of MACE among patients with (n = 7137)
and without (n = 474,046) prior stroke were 54.4 (95% CI, 49.1-59.9) vs 4.1 (95% CI, 3.9-4.2) per 1000 patients. Compared with patients without stroke, ORs for MACE were 14.23 (95% CI, 11.61-17.45) for stroke less than 3 months prior to surgery, 4.85 (95% CI, 3.32-7.08) for stroke 3 to less than 6 months prior, 3.04 (95% CI, 2.13-4.34) for stroke 6 to less than 12 months prior, and 2.47 (95% CI, 2.07-2.95) for stroke 12 months or more prior. MACE risks were at least as high for low-risk (OR, 9.96; 95% CI, 5.49-18.07 for stroke <3 months) and intermediate-risk (OR, 17.12; 95% CI, 13.68-21.42 for stroke <3 months) surgery compared with high-risk surgery (OR, 2.97; 95% CI, 0.98-9.01 for stroke <3 months) (P = .003 for interaction). Similar patterns were found for 30-day mortality: ORs were 3.07 (95% CI, 2.30-4.09) for stroke less than 3 months prior, 1.97 (95% CI, 1.22-3.19) for stroke 3 to less than 6 months prior, 1.45 (95% CI, 0.95-2.20) for stroke 6 to less than 12 months prior, and 1.46 (95% CI, 1.21-1.77) for stroke 12 months or more prior to surgery compared with patients without stroke. Cubic regression splines performed on the stroke subgroup supported that risk leveled off after 9 months. CONCLUSIONS AND RELEVANCE A history of stroke was associated with adverse outcomes following surgery, in particular if time between stroke and surgery was less than 9 months. After 9 months, the associated risk appeared stable yet still increased compared with patients with no stroke. The time dependency of risk may warrant attention in future guidelines.

9. Nho JH, Lee YK, Kim YS, et al. Mobility and one-year mortality of stroke patients after hip-fracture surgery. Journal of Orthopaedic Science 2014;19(5):756-61. Abstract: Background: History of stroke is a risk factor for hip fracture. We investigated one-year mortality and change of mobility differences between stroke patients and non-stroke patients after hip-fracture surgery., Methods: We retrospectively evaluated 548 patients who had hip-fracture surgery from May 2003 to Dec 2008 and were older than 50 years at the time of surgery. We identified 77 patients with a history of stroke and 471 patients with no history of stroke. We compared postoperative change of mobility and 1-year mortality for the two groups., Results: Although stroke patients had lower preinjury mobility (p < 0.001) and higher American Society of Anesthesiologists score (p < 0.001), 1-year mortality and the decrease of mobility were similar to those for non-stroke patients., Conclusions: History of stroke did not affect 1-year mortality and the decrease of mobility after hip fracture., Level of evidence: Therapeutic level III.Copyright © 2014, The Japanese Orthopaedic Association.

10. Sanders RD, Bottle A, Jameson SS, et al. Independent preoperative predictors of outcomes in orthopedic and vascular surgery: the influence of time interval between an acute coronary syndrome or stroke and the operation. Annals of surgery 2012;255(5):901-07. Abstract: OBJECTIVETo identify independent preoperative predictors of outcome for total hip or knee replacement (THKR) and abdominal aortic aneurysm (AAA) repair, including the importance of the time interval between an acute coronary syndrome (ACS) or stroke and surgery.BACKGROUNDPresent guidelines do not advocate a prolonged delay after ACS though recent data suggest delaying operations by 8 weeks. There is a lack of data on when to schedule surgery following stroke.METHODS The Hospital Episode Statistics database was analyzed for elective admissions for THKR and AAA surgery
between 2006-2007 and 2009-2010. Patient factors influencing mortality, length of stay, and readmission rates were identified by logistic regression. **RESULTS** A total of 414,985 THKRs (mortality: 0.2%) and 14,524 AAA repairs (mortality: 3.5%) were included. Heart failure, renal failure, liver disease, peripheral vascular disease, and non-atrial fibrillation arrhythmia increased the odds of mortality for both surgeries. Among other factors, previous ACS and stroke predicted mortality after THKR but not AAA surgery. Compared with more delayed surgery, THKR surgery performed within 6 months of an ACS (odds ratio [OR]: 3.81; 95% confidence interval [CI]: 1.55-9.34), but not stroke, increased the odds of mortality. The effect of ACS persisted up to 12 months (OR: 1.99; 95% CI: 1.02-3.88) and was not altered by exclusion of patients who received percutaneous coronary intervention or coronary artery bypass grafting for treatment of their ACS. **CONCLUSIONS** Previous stroke and ACS increased the odds of perioperative mortality from THKR but not AAA surgery; THKR surgery conducted up to 12 months after an ACS was associated with increased mortality.

11. **RA B. Risks of stroke from general surgical procedures in stroke patients. Neurol Clin 2006;24:777-82.** Abstract: Neurologists often assess the risk of stroke from general surgical procedures in patients who have cerebrovascular disease. Common questions for neurologists include: Should a symptomatic or an asymptomatic carotid stenosis be revascularized before general surgery? What is the risk of surgery in patients who have stenoses in the cervicocephalic vasculature? What is the risk of recurrent stroke in patients who have a history of stroke requiring surgery? Can antithrombotic therapy be interrupted for surgery? and How soon after a stroke may elective surgeries be performed? Although definite answers to these questions are lacking, available clinical evidence and knowledge of cerebrovascular pathophysiology can help inform recommendations.

12. **Hinohara H, Kadoi Y, Takahashi KI, et al. Cerebrovascular carbon dioxide reactivity with propofol anesthesia in patients with previous stroke. Journal of Clinical Anesthesia 2004;16(7):483-87.** Abstract: Study objective To examine whether patients with previous stroke have impaired cerebrovascular carbon dioxide (CO2) reactivity when receiving propofol anesthesia. Design Prospective, controlled study. Setting University hospital. Patients 34 consecutive patients, 17 of whom had previous stroke and were scheduled for elective cardiac surgery, and 17 control age-matched patients without previous stroke who were also scheduled for cardiac surgery. Interventions Anesthesia was induced and a 2.5-MHz pulsed transcranial Doppler probe was attached to the patient’s head at the right temporal window. Mean blood flow velocity of the middle cerebral artery (Vmca) was measured continuously. Measurements After establishing baseline Vmca, arterial blood gases and cardiovascular hemodynamic values, partial pressure of end-tidal CO2 (PETCO2) was increased by changing the ventilatory frequency by 2 to 5 breaths/min. The measurements were repeated when PETCO2 increased and remained stable for 5 to 10 minutes. Main results Values for absolute CO2 reactivity in the control patients and in those with previous stroke were 2.6 +/- 0.5 and 2.9 +/- 0.7 cm/sec/mmHg, respectively, a nonsignificant difference in these values. Values for relative CO2 reactivity in control
patients and in patients with previous stroke were 6.4 +/- 1.4 and 6.1 +/- 1.4%/mmHg, respectively, with no significant difference noted. Conclusions Cerebrovascular CO2 reactivity in patients with previous stroke is normal during propofol anesthesia. © 2004 Elsevier Inc.

**Databases searched:** CINAHL, Cochrane, EMBASE, EMCARE, MEDLINE, NICE Evidence, PubMed. Also checked Royal College of Surgeons and Anaesthesia UK websites but couldn’t find any there.

**Search terms:**

**MEDLINE**

"ANESTHESIA, GENERAL"

("post stroke" OR (after ADJ2 stroke)OR (following ADJ2 stroke)OR (had ADJ2 stroke)).ti,ab

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"ELECTIVE SURGICAL PROCEDURES"/

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STROKE PATIENTS OR STROKE/ OR CEREBRAL ISCHEMIA/ OR INTRACRANIAL HEMORRHAGE

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ANESTHESIA, GENERAL

SURGERY, OPERATIVE/ OR SURGERY, ELECTIVE

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