



UMC Utrecht

# BP telemonitoring post CEA discharge: is it of any benefit?

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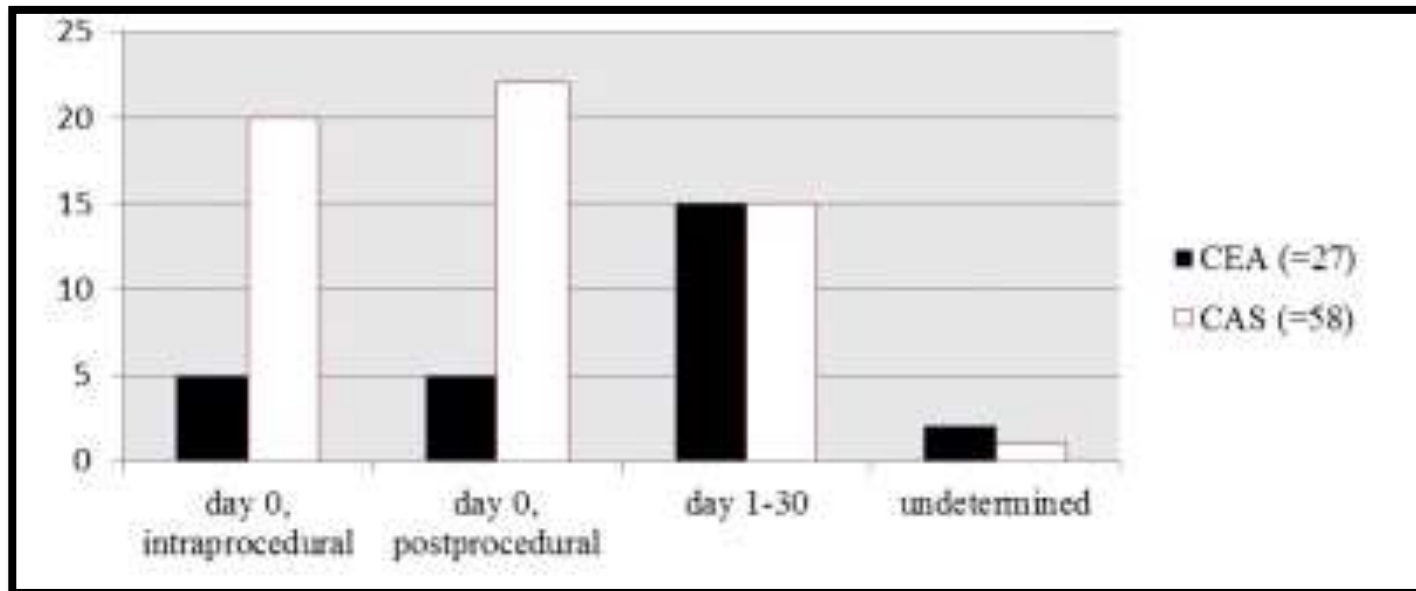


# Disclosures

During the study, MJMB was part-time employee of Luscii Healthtech BV (Health IT company, Amsterdam, The Netherlands)

# Introduction

Hemodynamic disturbances related to half the strokes after carotid revascularization up to 30 days



- Intra-operative → cerebral hypoperfusion
- Post-operative → cerebral hyperperfusion



# Introduction

## ESVS guidelines 2017

- (Non-) invasive BP-monitoring first 24h
- No recommendations regarding absolute perioperative or postoperative BP- thresholds

Writing Group, Naylor AR, Ricco JB, de Borst GJ, Debus S, de Haro J, et al. Management of atherosclerotic carotid and vertebral artery disease: 2017 clinical practice guidelines of the european society for vascular surgery (ESVS). EJVES 2017.



## Upper Extremity Blood Pressure Difference in Patients Undergoing Carotid Revascularisation

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Table 1. Number of patients with inter-arm blood pressure differences.

SBP inter-arm difference	Number of patients (%) (n = 182)
<10 mmHg	116 (64)
10–14 mmHg	27 (15)
15–19 mmHg	9 (5)
≥20 mmHg	30 (16)

SBP = systolic blood pressure.

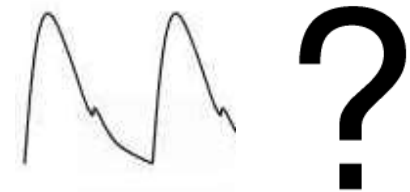
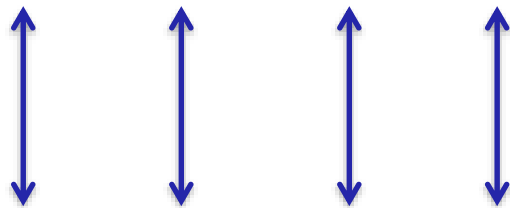


# Introduction

## UMC Utrecht

- Intra-operative: TCD + non-invasive + invasive BP-monitoring
- Postoperative: TCD + BP-monitoring
  - $\pm 6h$  invasive BP  $\rightarrow$  non-invasive BP 24u

- 2<sup>nd</sup> day postoperative: discharge



- 3 months postoperative: duplex + follow-up outpatient visit



# Role of Telemonitoring

- eHealth
- Benefits:
  - patient-centered care
  - patient friendly
  - early detection of postoperative hemodynamic deterioration ?



# Aim

## **Primary:**

*Patients' experience and feasibility of daily home blood pressure monitoring during the first month postoperatively following CEA*

## **Secondary:**

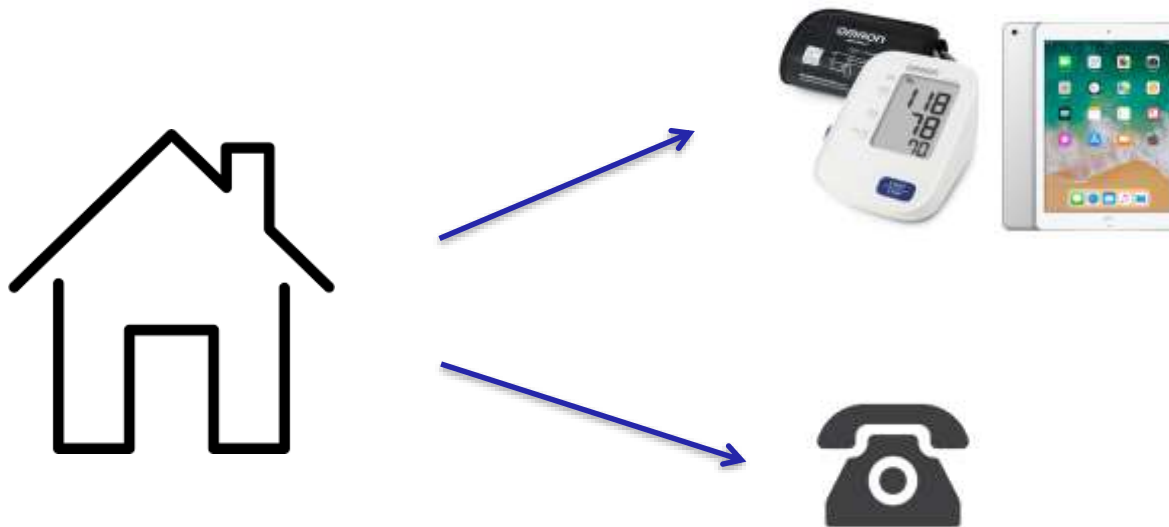
*To gain insight into postoperative BP trends the first month following CEA*





# Methods

- Pilot-study N= 30
- Inclusion criteria:
  - ADL-independent
  - Access to wireless internet



# Methods

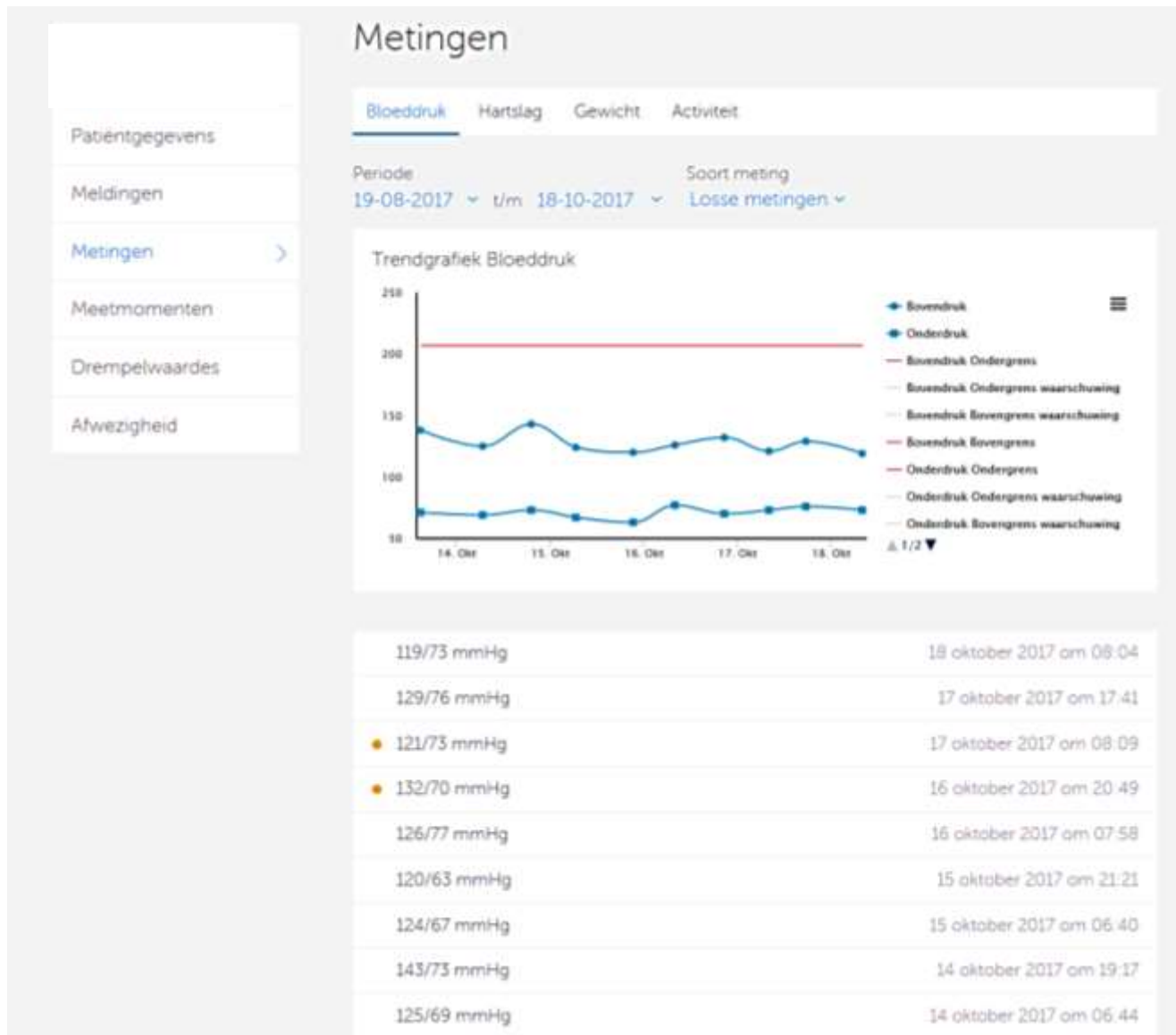
- BP-monitoring twice daily/30 days
- Individual systolic BP thresholds
  - Exceeding threshold with  $\geq 15\%$  → alert
- Daily follow-up BP
  - 4 consecutive alerts → outpatient clinic visit



# What does the patient see?



# What does the specialist see?



# Results (1)

- In total, 42 CEA patients eligible
  - too much effort = 5
  - Excluded for logistic reasons
- 30 CEA patients included
  - 4 drop-outs before start → replaced



## Results (2)

<b>Baseline characteristics</b>	<b>Total (n=30)</b>
Age, years (range)	69 (50-93)
Sex, male (%)	26 (87)
Symptomatic, (%)	27 (90)
Hypertension, (%)	26 (87)
Hypercholesterolemia, (%)	19 (63)
Smoker, (%)	25 (83)
Statin-use, (%)	26 (87)
$\beta$ -blockers, (%)	10 (33)
Cerebral hyperperfusion, (%)	2 (7)
Prolonged admission HCU, (%)	5 (17)
Postoperative events, (%)	6 (20)



# Results (3)

Postoperative events	Total (n=30)
In-hospital events	
- TIA	1
- wound haematoma	1
Out-of-hospital events	
- Wound haematoma	2
- Myocardial infarction	1
- Stress-related admission	1
GP visit	8
Medication changes	2



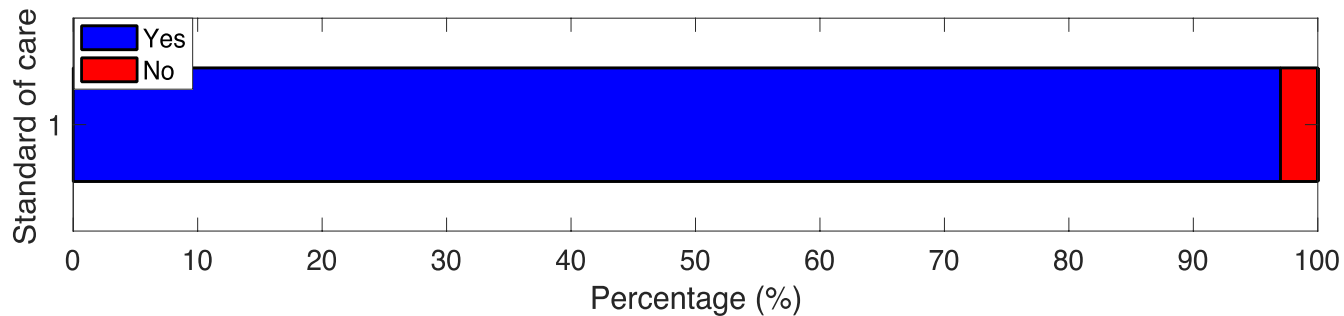
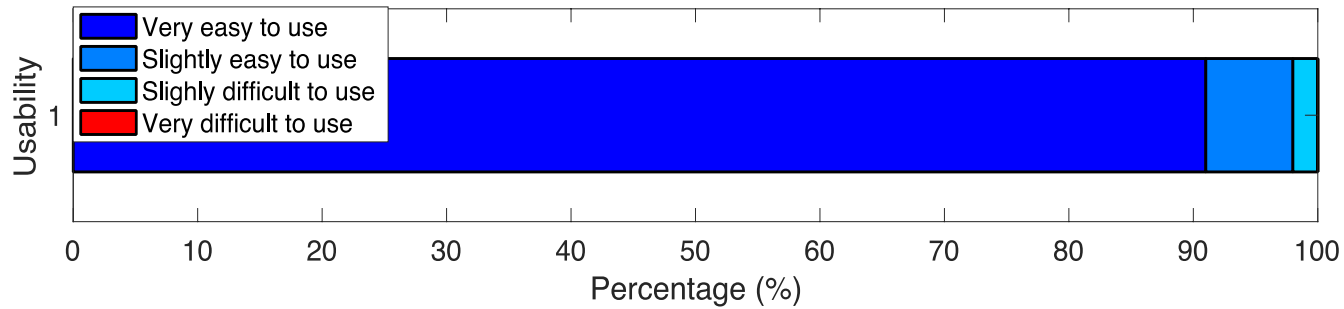
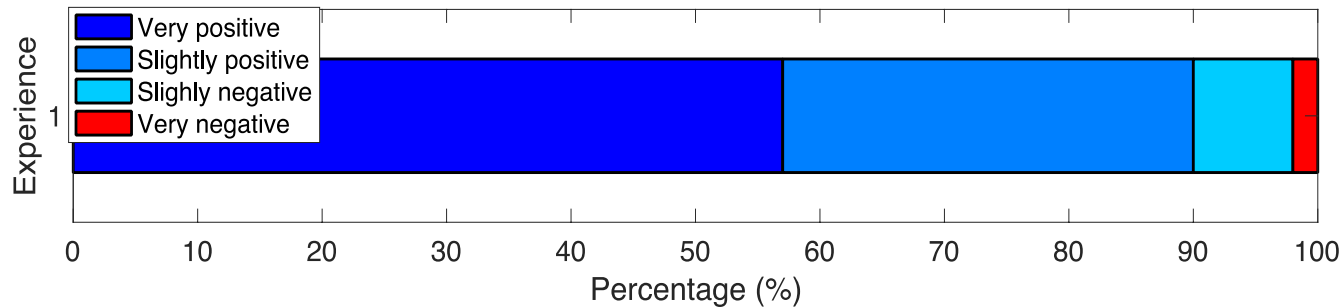
## Results (4) – Feasibility

- Adherence
  - 24 patients >90% expected measurements
  - Mean: 4.4 measurements missing

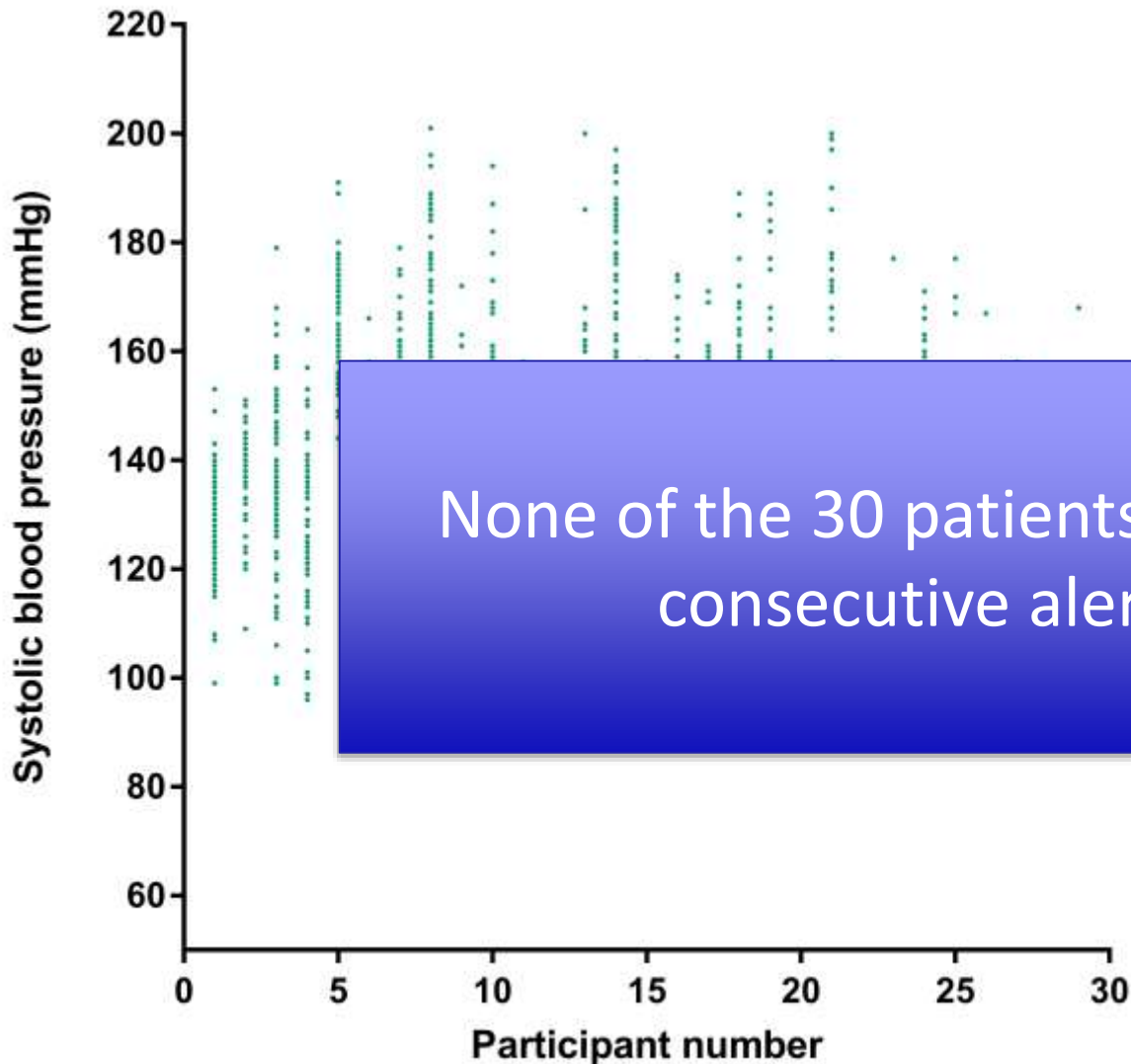




# Results (4) – Feasibility



# Results (5) – BP trends



# Conclusion

BP telemonitoring by CEA patients post discharge is well accepted and recommended

*Future studies need to determine the role of home BP monitoring to timely recognize patients at risk for postoperative hemodynamic deterioration.*



# Thank you

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REVIEW

## Editor's Choice — Cerebral Hyperperfusion Syndrome After Carotid Artery Stenting: A Systematic Review and Meta-analysis

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### WHAT THIS PAPER ADDS

Cerebral hyperperfusion syndrome (CHS) is a preventable cause of stroke after carotid artery endarterectomy (CEA). Currently, there are no pooled data available on the incidence of CHS after carotid artery stenting (CAS). This systematic review and meta-analysis assesses the clinical relevance of CHS in relation to the procedural stroke rate following CAS.

**Introduction:** Cerebral hyperperfusion syndrome (CHS) is a preventable cause of stroke after carotid endarterectomy (CEA). There are currently no pooled data available on the incidence of CHS after carotid artery stenting (CAS). The aim of this review was to assess the relevance of CHS in the procedural stroke rate following CAS.

**Method:** A systematic search on incidence rates of CHS after CAS was conducted in the MEDLINE, EMBASE, and Cochrane databases in November 2017. A meta-regression analysis was performed on CHS to explain heterogeneity and determine the impact of potential risk factors on observed CHS. The methodological quality of the included studies was assessed using the Cowley criteria.

**Results:** The pooled CHS risk across 33 studies concerning 8731 CAS patients was 4.6% (3.1–6.8%). Stroke occurred in 47% of CHS patients, of which 54% were fatal or disabling. Average time from procedure to symptoms was 12 h (IQR 8–36 h). Impaired cerebrovascular reserve (CVR) was associated with a higher risk of CHS after CAS (RR 5.18; 95% CI 1.0–26.8;  $p = .049$ ). Symptomatic status was associated with a lower risk of CHS (RR 0.20; 95% CI 0.07–0.59;  $p = .001$ ).

**Conclusion:** CHS is a serious and frequent complication in patients undergoing carotid angioplasty with stenting, and is most likely to occur in the very early post-procedural period. Future studies are encouraged to investigate the effect of intensive haemodynamic monitoring, including blood pressure control and assessment of cerebral blood flow, on the incidence of stroke caused by CHS after CAS.



# Re-appraisal of hemodynamic control

Eur J Vasc Endovasc Surg (2015) 50, 281–288

## Mechanism of Procedural Stroke Following Carotid Endarterectomy or Carotid Artery Stenting Within the International Carotid Stenting Study (ICSS) Randomised Trial

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### WHAT THIS PAPER ADDS

Stroke is a complication of carotid revascularisation that limits the benefit of the procedure in overall stroke prevention. To decrease the risk of revascularisation it is important to understand the mechanism of stroke. In a recent randomised trial in which patients were treated with carotid artery stenting (CAS) or carotid endarterectomy (CEA), one-third of the procedural strokes were caused by periprocedural haemodynamic disturbances. This suggests that careful attention to blood pressure control could lower the incidence of procedural stroke.

