ORIGINAL ARTICLE

A Protocol for Carotid Artery Stenting in COVID Times. A Single Canadian Centre Experience

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ABSTRACT: ***Objectives:*** The COVID-19 pandemic has resulted in huge disruption to healthcare delivery worldwide. There is a need to balance the urgent needs of the neurovascular patient population with the desire to preserve critical inpatient hospital capacity. It is incumbent on neurointerventionalists to advocate for their patients to minimise future disability. Patients still require semiurgent carotid revascularisation after ischaemic embolic events. We present a review of a novel protocol for expediting patient flow through the carotid stenting process, in accordance with government directives to minimise nonessential inpatient admissions, ensure its efficacy, and evaluate its safety. We also evaluate the literature regarding complications with attention to the timing of these related to the procedure. ***Methods:*** A retrospective review of 45 consecutive carotid stenting cases performed at London Health Sciences Centre between March 2020 and March 2021 for symptomatic extracranial internal carotid artery stenosis utilising a default same-day discharge policy was performed. Complications were plotted as a function of time. ***Results:*** Twenty-four patients underwent carotid artery stenting with same-day discharge and 21 patients underwent stenting with an overnight inpatient stay. A single stent occlusion occurred 27 h post stenting. ***Conclusion:*** Simple modification of protocol for symptomatic carotid artery stenting during the COVID-19 outbreak with radial access as first approach appears to provide safe, efficacious care.

RÉSUMÉ : Un protocole s'appliquant à la pose d'endoprothèse vasculaire dans l'artère carotide en ces temps de pandémie de COVID-19 : une expérience menée dans un établissement de santé canadien. ***Objectifs*** **:** La pandémie de COVID-19 a entraîné partout dans le monde d'énormes perturbations dans la prestation des soins de santé. À cet égard, il demeure nécessaire de trouver un juste équilibre entre les besoins urgents des patients atteints de troubles neuro-vasculaires et le souhait de préserver la capacité des hôpitaux en termes d'hospitalisation liée aux soins intensifs. Il incombe donc aux neuro-interventionnistes de défendre les intérêts de leurs patients afin de minimiser les risques de futurs handicaps. On le sait, les patients continue à avoir besoin de revascularisation carotidienne semi-urgente à la suite d'événements ischémiques emboliques. Nous voulons ainsi présenter une analyse d'un nouveau protocole permettant d'accélérer le nombre de patients dont on peut s'occuper par la pose d'endoprothèse vasculaire dans l'artère carotide, et ce, conformément aux lignes directrices gouvernementales pour minimiser les hospitalisations non-essentielles, assurer l'efficacité d'une telle intervention et évaluer sa sécurité. Nous avons aussi évalué la littérature scientifique en ce qui regarde les complications liées à la pose d'endoprothèse vasculaire en portant une attention particulière au moment où ces complications pouvaient survenir en lien avec la pose elle-même. ***Méthodes*** **:** Nous avons ainsi effectué une étude rétrospective de 45 poses consécutives d'endoprothèse vasculaire. Ces poses avaient été réalisées au *London Health Sciences Centre* (LHSC) entre mars 2020 et mars 2021 pour des cas de sténose symptomatique extra-crânienne interne de l'artère carotide, et ce, en vertu d'une politique prévoyant que les patients obtiendraient par défaut leur congé le jour même. Quant aux complications survenues, elles ont été représentées en fonction du temps. ***Résultats*** **:** Au total, 24 patients ont bénéficié de la pose d'endoprothèse vasculaire dans l'artère carotide pour ensuite obtenir leur congé le jour même ; les 21 autres patients, aussi bénéficiaires de cette pose, ont été hospitalisés pour ensuite passer une nuit à l'hôpital. Il est à noter qu'une seule occlusion d'endoprothèse est survenue 27 heures après une telle intervention. ***Conclusion*** **:** Une simple modification du protocole s'appliquant à la pose, avec accès radial, d'endoprothèse vasculaire dans l'artère carotide semble constituer, comme première approche, une intervention sûre et efficace dans le contexte de cette flambée d'infections à la COVID-19.

Keywords: COVID-19, Carotid stenosis, Stent

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Introduction

The COVID-19 pandemic has resulted in a worldwide disruption of standard healthcare delivery across many medical specialities, not least of which has been in neurointerventional surgery. This has resulted from both resource pressures, ranging from availability of ventilators and intensive care unit beds, trained airway-competent staff and personal protective equipment (PPE), and multiple reports of increasing stroke rates in patients with a potential causal

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prothrombotic diathesis in patients.[1] Resources are stretched across hospitals and many have been forced to cease elective and semi-elective work to preserve PPE and prevent cross-contamination of staff and patients, who may take hospital acquired COVID-19 infection back to their community increasing the reproduction number (R_0) and exacerbating the pandemic. Current best-practice guidelines suggest that patients who have suffered transient ischaemic attacks or strokes who have demonstrable significant carotid plaque undergo carotid artery stenting (CAS) or carotid endarterectomy within 14 d of the initial episode.[2] The usual practice of admitting these patients overnight for postinterventional observations results in additional exposure risk of both patients and staff and further burden on precious inpatient resources.

In an effort to balance best neurointerventional practice with safe COVID-19 transmission policies, we have adapted our standard Academic Health Science Centre protocol to single-day stay admission. Patients are referred our dedicated carotid clinic. If appropriate, they are then booked for stenting with the date for intervention falling no more than 14 d from the date of their index episode. Three days prior to day-stay admission, patients undergo COVID-19 polymerase chain reaction testing within the community to prevent unnecessary introduction of COVID-19 to the angiographic unit. They are admitted to the day-stay unit, and then undergo a radial-first approach with placement of a carotid stent as per our usual practice.[3] We have implemented this management algorithm on 45 patients since the beginning of the pandemic and compared our initial outcomes to historical controls within our department.

Methods

We retrospectively reviewed the medical records for 45 consecutive carotid stenting cases performed at London Health Sciences Centre between March 2020 and March 2021 (Table 1). Clinical and angiographic data were collected according to the Canadian Tri-Council policy statement on ethical conduct for research involving the secondary use of data originally collected for healthcare purposes.

All patients had symptomatic extracranial internal carotid artery stenosis and were referred for carotid stenting after outpatient evaluation in the urgent multidisciplinary carotid clinic. This clinic is staffed by both interventional radiologists and dual-trained neurosurgeons. Referrals to the clinic are made by both neurologists and primary-care physicians in community. Decisions as to treatment type (medical vs. surgical; stenting vs. endarterectomy) were made as per literature-based guidelines and consensus opinion.[2,4,5] At the time of clinic appointment, all planned-stenting patients were commenced on aspirin 81 mg daily and clopidogrel 75 mg daily if not already being administered. All patients who were admitted from the outpatient setting were done so with the intent of same-day discharge.

CAS Procedure

After preoperative preparation in the day-stay unit, patients underwent a radial-first approach for placement of a carotid stent (Cordis 8 mm × 40 mm; Cordis Corporation Miami Lakes, Florida), with or without distal embolic protection device or angioplasty as per our usual practice. All patients were treated with monitored anesthesia care by a dedicated neuroanesthesiology team. In cases where a radial artery approach was not considered suitable due to small size, previous surgery, or other anatomic considerations, procedures were performed via a femoral approach. Post procedure, patients were transferred to the anaesthesia recovery unit for 2 h of close observation including vital signs, neurological exam, and puncture site care. Access sites were closed with a TR band (Terumo Medical, Elkton, MD) in the case of radial approach or Angioseal (Terumo Medical, Somerset, NJ) in case of femoral approach. Patients then underwent a further 6 h of monitored recovery in the radiology observation room. Finally, after final assessment, and postoperative education by neurointerventional staff, patients were then discharged home. During this recovery period, if resources permitted, patients underwent a baseline carotid Doppler ultrasound. For those in whom this was not performed on day of stenting, an outpatient carotid Doppler ultrasound was performed as an outpatient the following morning. Patients who were adjudged to have a complex medical history or who did not have sufficient social supports or lived more than an hour from the hospital were admitted overnight for nursing care and monitoring.

Table 1: Patient demographics

Number of cases	45
Number of outpatient same-day discharge	24
Number of outpatients admitted overnight	21
Female (% total)	9 (20%)
Right side (% total)	18 (40%)
Radial (% total)	19 (42%)
Femoral (% total)	25 (55%)
Radial converted to femoral	1 (2%)
Stenting alone (% total)	30 (66%)
Angioplasty and stent (% total)	15 (33%)

Table 2: Timing of postoperative complications

<6 h	0
6–12 h	0
12–24 h	0
1–30 d	1 (2%) (1× stent occlusion)

Table 3: Complications

Complications	Number (% total cohort)
Stent occlusion	1 (2%)

Results

Results were assessed with particular regard to timing of any complications postoperatively (Table 2). A single patient suffered a major complication (Table 3). This patient was discharged the same day after placement of a stent without angioplasty. They returned after 27 h with symptoms of an ipsilateral stroke with National Institutes of Health Stroke Scale of 22 and tandem occlusion of stent with an M1 segment occlusion. They

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underwent endovascular clot retrieval with thrombolysis in cerebral infarction 3 reperfusion and return to baseline state. We do not currently have capacity to perform bedside clopidogrel testing; however, given the possibility that they may have resistance to this medication, their antiplatelet regimen was changed to ticagrelor and aspirin. It is important to note that this complication occurred after the time they would have been discharged had they undergone stenting under a system of overnight admission.

Discussion

The unprecedented COVID-19 pandemic has forced all healthcare providers to modify their practices. In the neurointerventional world, this includes being appropriate stewards of hospital resources and also advocates for timely, evidence-based treatments for our patient population. We believe that, based on our results and a review of previously published neurointerventional and cardiology literature, same-day discharge is safe in CAS. In a 2003 review, Tan et al. reported that 52.6% of adverse events occur in the first 6 h after CAS, 5.3% between 6 and 12 h, 7.9% between 12 and 24 h, and the remaining 34.2% between 1 and 30 d postoperatively.[6] These complications included 7 (3.4%) major access site complications; 18 (8.8%) neurologic events, of which 10 (4.9%) were transient ischemic events and 8 (3.9%) were strokes (including minor, major, and fatal strokes); 8 (3.9%) cardiovascular complications; and 5 (2.5%) other events.

These results would seem to suggest that, once the initial 6 h of observation has been achieved event free, an overnight admission would not pick up a significant increased number of complications. Furthermore, the current pandemic forces a choice between exposure to this risk compared with a delay in definitive treatment. Thus, we advocate for stenting and early discharge as the preferred option. The ongoing debate regarding radial versus femoral access for all areas of intervention has resulted in a plethora of comparative reviews and other, less-formal debate within the neurointerventional community.[7–11] Ruzas et al. have reported that the transradial approach for CAS has similar efficacy and safety as transfemoral, and that hospitalisation is shorter with transradial access.[10]

Conclusion

We have elected to publish this patient cohort and management algorithm prior to the availability of long-term results to ensure that hospitals in acute crisis related to the ongoing pandemic may benefit. Indeed, management options are not limited to a dichotomous approach of either delaying care or prolonged, in-patient resource utilisation, and risk exposure. We believe that this simple modification of protocol may suffice to provide safe, efficacious care. The limitations of this study include that it describes the results of a single centre (albeit with four separate practitioners) that long-term stent patency is not included (as a deliberate choice to expedite the dissemination of what we feel is valuable information). We will report this information as it comes to light. Further assessment of same-day discharge in terms of safety, efficacy, and cost is needed. We would advocate for all units to assess their local capability and the ability to adapt their protocols to balance the resource demands that have occurred during this ongoing pandemic with the complex needs of neurovascular patients.

Disclosures

The authors have no conflicts of interest to declare.

Statement of Authorship

RK contributed in project idea and data collection. RK and AJ wrote the manuscript. MM, MB, and MS made revisions. DP and SP made revisions and approved the final version.

References

1. Abou-Ismail MY, Diamond A, Kapoor S, Arafah Y, Nayak L. The hypercoagulable state in COVID-19: incidence, pathophysiology, and management. Thromb Res. 2020;194:101–15.
2. Meershoek AJA, de Borst GJ. Timing of carotid intervention. Br J Surg. 2018;105:1231–33.
3. Men S, Lownie SP, Pelz DM. Carotid stenting without angioplasty. Can J Neurol Sci. 2002;29:175–79.
4. Powers CJ, Hirsch JA, Hussain MS, et al. Standards of practice and reporting standards for carotid artery angioplasty and stenting. J Neurointerv Surg. 2014;6:87–90.
5. Benes V, Bradac O. Carotid endarterectomy and carotid artery stenting in the light of ICSS and CREST studies. In: Esposito G, Regli L, Kaku Y, Tsukahara T, editors. Trends in the management of cerebrovascular diseases. Cham: Springer International Publishing; 2018, pp. 95–99.
6. Tan KT, Cleveland TJ, Berczi V, McKevitt FM, Venables GS, Gaines PA. Timing and frequency of complications after carotid artery stenting: what is the optimal period of observation? J Vasc Surg. 2003;38:236–43.
7. Goland J, Domitrovic LA, Doroszuk G, et al. Distal radial approach for neurointerventional diagnosis and therapy. Surg Neurol Int. 2019;10:211.
8. Catapano JS, Fredrickson V, Fujii T, et al. Complications of femoral versus radial access in neuroendovascular procedures with propensity adjustment. J Neurointerv Surg. 2020;12:611.
9. Khanna O, Velagapudi L, Das S, et al. A comparison of radial versus femoral artery access for acute stroke interventions. J Neurosurg. 2020;1–6.
10. Ruzsa Z, Nemes B, Pintér L, et al. A randomised comparison of transradial and transfemoral approach for carotid artery stenting: RADCAR (RADial Access for CARotid Artery Stenting) study. EuroIntervention. 2014;10:381–91.
11. Etxegoien N, Rhyne D, Kedev S, et al. The transradial approach for carotid artery stenting. Catheter Cardiovasc Interv. 2012;80:1081–87.

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