AANS/CNS Joint Cerebrovascular Annual Meeting

February 20-21, 2017
Houston, TX

Management of Iatrogenic Intracranial Internal Carotid Artery Injury: Case Series and Proposed Management Algorithm.

Ali Luqman MD; Rodolfo Alcedo-Guardia; Nirav J. Patel MD; Mohammad Ali Aziz-Sultan MD
Brigham and Women's Hospital
Harvard Medical School

Introduction

Internal Carotid Artery (ICA) injury is a rare but severe complication of anterior skull base approaches that necessitates prompt recognition and immediate treatment. There are multiple treatment modalities and techniques for treatment of ICA injury, the most definitive being parent artery sacrifice. Novel endovascular techniques offer comparable results while allowing parent vessel preservation. The authors' purpose a clear and concise algorithm for assessing and treating intracranial ICA injury.

Methods

A retrospective review of 4215 cases from the senior authors' operative database was performed. Only cases of iatrogenic intracranial ICA injury were evaluated. Based on a literature review of ICA injury and management as well as the current case series a treatment algorithm is proposed.

Patient H

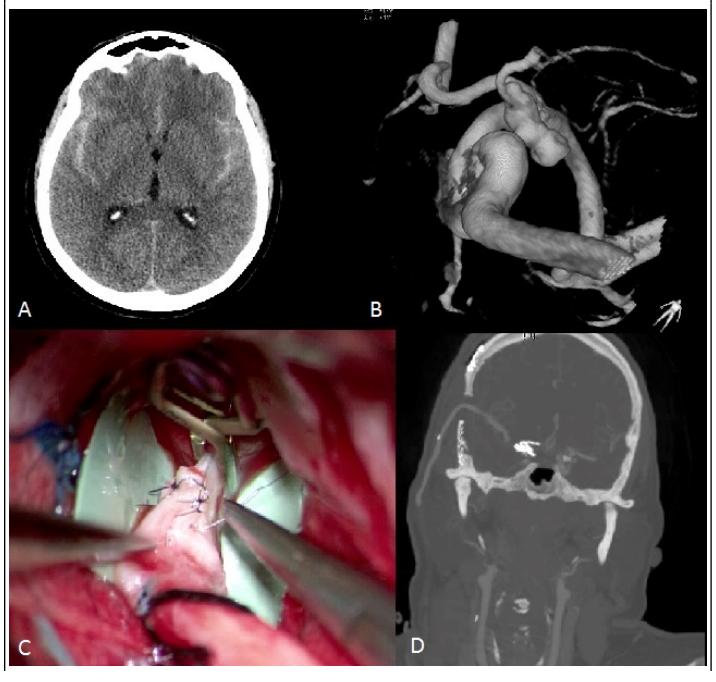

Table 1. Clinical Summary of 8 patients identified with treated ICA injury.

Patient	Diagnosis	Gender	Age	ICA Injury	Treatment	Outcome
A	Recurrent left petrous bone/middle cranial fossa meningioma.	Female	71	Left ICA, subsequent pseudoaneurysm formation.	Covered Stent	Doing well 2 years out, Independent of ADL and IADL. Residual facial palsy from resection. mRS = 1.
B	Previously embolized cavernous right ICA aneurysm, recurrence.	Male	40	Right ICA injury during reembolization, subsequent pseudoaneurysm formation.	PED	During 2 year follow up patient has had interval R functional hemispherectomy for epilepsy, mRS = 3.
C	Tuberculum Sellae Meningioma	Female	49	Contrlateral (right) ICA injury, extravasation.	Clip/Bypass	Deceased. mRS = 6.
D	Pituitary Adenoma	Male	56	Right ICA, extravasation.	ICA Sacrifice	Completed inpatient rehab mRS = 4 at 7 months. Currently lives at home with significant other.
E	Left ICA growing pseudoaneurysm formation after treatment of cervical L ICA dissection.	Male	47	Left ICA, subsequent pseudoaneurysm formation.	Covered Stent	Doing well 1 month out. mRS = 1.
F	Ruptured Left ICA Dorsal Wall Blister Aneurysm. HH3.	Female	44	Left ICA, extravasation after aneurysm avulsion.	ICA Sacrifice	Deceased. mRS = 6.
G	Growing traumatic Right ICA pseudoaneurysm.	Female	33	Right petrous carotid dissection during embolization of growing pseudoaneurysm.	Covered Stent	Lost to follow up.
H	Ruptured Posterior Communicating Artery Aneurysm, HH2.	Female	54	Right ICA, extravasation during attempted clipping.	Clip/Bypass	Home within 2 weeks of admission, mRS = 2 at 3 months.

Results

From the senior authors' cohort of 4215 cases over 10 years (2006-2016) 20 cases of treated iatrogenic ICA injuries were isolated. Of these 8 were identified as injuries involving the intracranial ICA. Mean age was 49.3 years and follow up was up to 5 years. Four were found to have pseudoaneurysm on initial angiogram, four were noted to have active bleeding or extravasation. Three injuries (2 craniotomies and 1 endonasal approach) occurred in the process of tumor resection. Five injuries occurred during vascular procedures. Four injuries were successfully treated with parent vessel preserving techniques (3 Covered Stents and 1 Pipeline embolization device). Four injuries necessitated ICA sacrifice, with two emergent high-flow bypass. There was one mortality, one parent artery sacrifice and bypass. All parent vessel preserving techniques were well tolerated with minimal morbidity.

Discussion:

Based on the results of the data pooled and the senior authors' experiences we proposed an algorithm to facilitate urgent treatment of iatrogenic carotid injuries. In all cases an immediate attempt at direct repair should be made when feasible, if not sustained hemostasis becomes essential. Afterwards cerebral angiogram is performed to assess the extent of injury or any evidence of active extravasation. In the same setting a balloon test occlusion (BTO) is performed, particular attention is made towards the venous phase/delay that can delineate territory at risk in patients without a clinical component of the exam. A venous delay >2 seconds is considered territory at risk and all attempts should be made to utilize parent vessel preserving techniques or bypass [1]. Observation can be an initial option in those injuries without active extravasation. Serial repeat vascular studies are performed both in the acute setting and 4-6 weeks after initial discharge if observation is elected. If trial observation fails either from delayed hemorrhage or growing pseudoaneurysm, than prompt treatment is necessary. Should initial attempts at repair fail, salvage procedures may then be attempted, catering to the modality of the initial treatment. Vessel sacrifice and bypass is an effective management strategy at any time, but as ischemia time prolongs, chance of success decreases.

Conclusions

Urgent identification and management of internal carotid injury is essential in preventing deleterious outcomes. Although parent artery ligation remains the definitive treatment option, an emphasis on parent vessel preservation should be made when possible.

References

1.Abud DG, Spelle L, Piotin M, Mounayer C, Vanzin JR, Moret J. Venous phase timing during balloon test occlusion as a criterion for permanent internal carotid artery sacrifice. AJNR Am J Neuroradiol. 2005 Nov-Dec;26(10):2602-9.