February 20-21, 2017 Houston, TX Management of latrogenic Intracranial Internal Carotid Artery Injury: Case Series and Proposed Management Algorithm.

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



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.



| Diagnosis | Gender | Age | ICA Injury | Treatment | Outcome |
|--|--|---|--|--|--|
| 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. |
| Previously embolized cavernous right ICA aneurysm, recurrence. | Male | 40 | Right ICA injury during reembolization, subsequent pseudoaneurtysm formation. | PED | During 2 year follow up patient has had interval R functional hemispherectomy for epilepsy, mRS = 3. |
| Tuberculum Sellae Meningioma | Female | 49 | Contrlateral (right) ICA injury, extravasation. | Clip/Bypass | Deceased. mRS = 6. |
| Pituitary Adenoma | Male | 56 | Right ICA, extravasation. | ICA Sacrifice | Completed inpatient rehab mRS = 4 at 7 months. Currently lives at home with significant other. |
| Left ICA growing pseudoaneurysm formation after treatment of cervical LICA dissection. | Male | 47 | Left ICA, subsequent pseudoaneurysm formation. | Covered Stent | Doing well 1 month out. mRS = 1. |
| Ruptured Left ICA Dorsal Wall Blister Aneurysm. HH3. | Female | 44 | Left ICA, extravasation after aneurysm avulsion. | ICA Sacrifice | Deceased. mRS = 6. |
| Growing traumatic Right ICA pseudoaneurysm. | Female | 33 | Right petrous carotid dissection during embolization of growing pseudoaneurysm. | Covered Stent | Lost to follow up. |
| 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. |
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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 >2seconds 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.