

Learning Objectives

Extracranial-intracranial bypass can be an effective technique in the surgical management of blister aneurysms

Introduction

Blister aneurysms (BA) are a rare entity associated with fragile vessel walls, poorly defined anatomy, and a high risk of rupture. Case reports and small case series have reported results of differing surgical techniques in the treatment of BAs, however there is no consensus towards a superior approach. Our objective was to assess the efficacy of extracranial-intracranial (EC-IC) bypass for the treatment of BA as compared to direct clipping, wrap-clipping, and endovascular techniques.

Methods

Outcomes of patients undergoing EC-IC bypass for the treatment of BA were incorporated into the study. Five previous studies, in addition to three cases presented by the authors, identified a total of 28 cases. In addition, reports of microsurgical clipping and wrap-clipping techniques for management of BA identified 55 and 34 cases, respectively. In addition, 74 recently reported endovascular cases of BA are included.

Direct Clipping Cases							
Study	n	Follow	HR	Size (mm)	Location	ICR	Average Temperature at Clip Time (minutes)
Allen 1978	3	n/a	3 (n=1) 4 (n=1) 4 (n=1)	7a	CA	1-2	n/a
Wang 2004	6	n/a	2 (n=2) 3 (n=2) 3 (n=2)	7a	CA	1-2	n/a
Kawashima 2006	11	2 (n=2) 3 (n=2) 4 (n=2)	2 (n=1) 3 (n=1) 3 (n=1)	3 (n=2) 3 (n=2) 3 (n=2)	CA	1-2	n/a
Wang 2010	11	2 (n=2) 3 (n=2) 4 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	2 (n=2) 2 (n=2) 4 (n=2)	CA	1-2	n/a
Kawashima 2012	6	3 (n=2) 4 (n=2) 4 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	2 (n=2) 2 (n=2) 4 (n=2)	CA	1-2	n/a
Kawashima 2013	4	3 (n=2) 4 (n=2) 4 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	2 (n=2) 2 (n=2) 4 (n=2)	CA	1-2	n/a
Wang 2014	8	n/a	2 (n=2) 3 (n=2) 3 (n=2)	7a	Supratentorial	1-2	n/a
Attenello 2015	5	2 (n=2) 3 (n=2) 3 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	7a	Supratentorial	1-2	n/a

55 cases of direct clipping for BA.

ECIC Bypass Cases							
Study	n	Follow	HR	Size (mm)	Location	ICR	Average Temperature at Clip Time (minutes)
Allen 1978	3	n/a	3 (n=1) 4 (n=1) 4 (n=1)	7a	CA	n/a	n/a
Kawashima 2006	4	n/a	2 (n=2) 3 (n=2) 3 (n=2)	7a	CA	0	n/a
Kawashima 2012	2	n/a	2 (n=2) 3 (n=2)	7a	CA	0	n/a
Kawashima 2014	4	2 (n=2) 3 (n=2) 3 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	7a	CA	n/a	n/a

28 reported ECIC cases for BA

Wrap Clipping Cases							
Study	n	Follow	HR	Size (mm)	Location	ICR	Average Temperature at Clip Time (minutes)
Allen 1978	2	n/a	2 (n=2) 3 (n=2)	7a	CA	n/a	n/a
Kawashima 2006	11	n/a	2 (n=2) 3 (n=2) 3 (n=2)	7a	CA	n/a	n/a
Kawashima 2012	2	n/a	2 (n=2) 3 (n=2)	7a	CA	n/a	n/a
Kawashima 2014	11	2 (n=2) 3 (n=2) 4 (n=2)	2 (n=1) 3 (n=1) 4 (n=1)	7a	CA	n/a	n/a

34 cases of wrap clipping for BA

Endovascular Cases							
Study	n	Follow	HR	Size (mm)	Location	ICR	Complications
Allen 2004	15	n/a	1 (n=2) 2 (n=2) 3 (n=2) 4 (n=2) 5 (n=2)	1.5-2.5 (n=2)	CA (n=15)	1-2	Vasospasm (n=2) Reoperation (n=2)
Kawashima 2010	6	1 (n=1) 2 (n=1) 4 (n=1)	1 (n=1) 2 (n=1) 3 (n=1)	2.0-2.5 (n=1)	CA (n=6)	1-2	Vasospasm (n=1) Reoperation (n=1)
Yoon 2014	11	1 (n=1) 2 (n=1) 3 (n=1) 4 (n=1) 4 (n=1)	1 (n=1) 2 (n=1) 3 (n=1) 4 (n=1) 5 (n=1)	2.5-3.5 (n=1)	CA (n=11)	1-2	Death (n=1) MCA (n=1) Cerebral Blindness (n=1)
Pachatz 2011	2	1 (n=1) 4 (n=1)	2 (n=1) 3 (n=1)	n/a	MCA (n=2)	None	Rebleeding (n=1)
Gomez 2014	5	n/a	n/a	1.5-2.5 (n=1)	ICA (n=1) ICA (n=2) PCA (n=2) ICA (n=1)	None	None
Zabramski 2014	8	n/a	n/a	2.0-2.5 (n=1)	ICA (n=7) ICA (n=1)	1-2	None
Kawashima 2016	9	2 (n=1) 3 (n=1) 3 (n=1)	2 (n=1) 3 (n=1) 4 (n=1)	1.5-2.5 (n=1)	ICA (n=9)	1-2	Stroke (n=1) Reoperation (n=3)
Hirano 2017	13	1 (n=1) 2 (n=1) 3 (n=1) 4 (n=1) 4 (n=1)	1 (n=1) 2 (n=1) 3 (n=1) 4 (n=1) 4 (n=1)	1.5-2.5 (n=1)	ICA (n=13)	1-2	None
Walsh 2014	8	2 (n=1) 3 (n=1) 4 (n=1) 4 (n=1) 4 (n=1)	2 (n=1) 3 (n=1) 4 (n=1) 4 (n=1) 4 (n=1)	2.0-2.5 (n=1)	ICA (n=8)	1-2	Reoperation (n=2)

74 reported Endovascular cases for BA

Results

28 patients with BA underwent EC-IC bypass. Postoperative infarction was noted in six (16.7%), delayed cerebral ischemia in four (11.1%), four experienced re-bleeding (11.1%) with two mortalities (5.6%). One patient in the author’s presented series developed vasospasm and hydrocephalus with an ultimate modified Rankin score (mRS) of 3. The remainder of the cases experienced excellent outcomes, described as mRS 0-1. Twelve cases (35.3%) of direct clipping ruptured intraoperatively, seven (20.5%) died within one postoperative week. The remainder of cases described outcomes of mRS 0-1. Four (22.2%) of the wrap-clipping cases ruptured intraoperatively, with ultimate mRS ranging from 1 (n=11), 2 (n=3), and 3 (n=1) of reported outcomes.

Conclusions

Preliminary analysis suggests EC-IC bypass can be successfully implemented in the surgical management of blister aneurysms. Our results, in conjunction with previous reports of EC-IC bypass for blister aneurysms suggests that surgical outcomes and complication rates are comparable, if not safer than other techniques and could provide a safe and effective option for surgical management of BA.

References

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