Factors Affecting Successful Insertion of Framing Coils in Endovascular Coiling for Patients With Unruptured Intracranial Aneurysms: How to Select Framing Coils to Improve Short- and Long-Term Outcomes?

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Introduction

The importance of a framing coil (FC), the first coil inserted into an aneurysm during endovascular coiling, is widely recognized. We previously demonstrated that the percentage of FC volume in total coil volume (FCP) >32% was an independent predictor of long-term outcomes including recanalization and retreatment. However, factors affecting successful insertion of FCs are not well-established, and thus we aimed to identify them in our retrospective cohort.

Methods

A retrospective review of patients who underwent endovascular coiling for unruptured intracerebral aneurysms from 2008 to 2015 in a single center identified 247 patients with a minimum two-year follow-up. They were classified into the two groups: cases with failed attempts to place FCs that were initially selected (Group A, n=63, 25.5%) and those without (Group B, n=184). Data on aneurysmal volume, FCs, reasons for unsuccessful initial attempts, strategies adopted to overcome them, framing coil volume packing density (FVPD, FC volume/aneurysm volume), and FCP are collected and statistically analyzed.

Results

No significant differences in baseline characteristics were identified between the groups. Among the 63 cases, 13 cases were attributed to excessive coil length and thus required decreases in length (Figure 1). In aneurysms<7mm, FVPD>18% had sensitivity of 71.4% and specificity of 87.8% for detecting failure due to excessive coil length, whereas FVPD>10% had sensitivity of 66.6% and specificity of 65.2% in aneurysms>7mm. The AUC of FVPD for detecting excessive coil length was 0.867 in aneurysms<7mm (p<0.001, Figure 2A), 0.676 in aneurysms>7mm (p=0.385, Figure 2B), and 0.742 in all aneurysms (p<0.001). A linear correlation was identified between FVPD and FCP (p<0.001, Figure 2C). There were four incidents of intraoperative aneurysmal rupture, none of which were attributable to FC insertion.

Conclusions

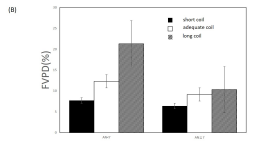
To successfully insert FCs and also improve long-term outcomes, prospectively calculating FVPD prior to selecting FCs and thereby maximizing FVPD and FCP might be beneficial.

Figure 1

(A)

	N = 63
Decrease in coil length	13
Increase in coil length	18
Decrease in loop diameter	20
Increase in loop diameter	14
Change in coil type	24
Change in catheter	3
Change in assist technique	16

(B)



	short (n=18)	adequate(n=206)	long (n=13)	*P* value
AN<7	7.69 ± 2.63	12.3 ± 5.12	21.3 ± 6.76	< 0.001
AN>7	6.40 ± 3.57	9.15 ± 4.15	10.3 ± 2.04	0.050

(A) Strategy to overcome framing coil failure and (B) the average FVPD (framing coil volume packing densities) of framing coils deemed short, adequate, and long, stratified by maximal diameters of aneurysms (> 7mm)

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of framing coils in endovascular coiling for unruptured intracerebral aneurysms with special attention to FVPD, 2) Discuss, in small groups, how to select an appropriate framing coil, and 3) Identify an effective treatment forunruptured intracerebral aneurysms

Figure 2

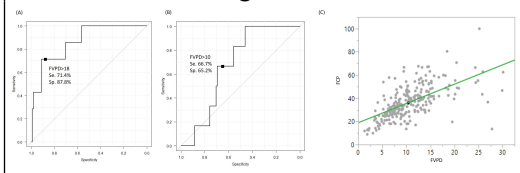


Figure 1 (A) ROU curves of FVPD in aneurysms less than 7 mm and (B) more than 7 mm for detecting excessive framing coil length. (C)Pearson' test to evaluate the linear relationship (P < 0.001) between FVPD and FCP (framing coil percentage = the percentage of a framing coil volume in total coil volume)

References

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