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REVIEW ARTICLE

Redo fenestrated/branched EVAR after prior complex endovascular aortic repair: a narrative review

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ABSTRACT

BACKGROUND: Although fenestrated and branched EVAR (f/bEVAR) is increasingly the mainstay for managing juxtarenal and thoracoabdominal aortic aneurysms, long-term surveillance shows a growing need for reintervention because of complications such as type I and III endoleaks, graft migration, and target vessel instability, which may necessitate redo f/bEVAR. This review aims to summarize the current literature on redo f/bEVAR for complex aortic aneurysms.

METHODS: A narrative review of English-language studies published from 2010 through March 2025 was conducted using PubMed and Scopus. Selected articles included registry data, case reports, and clinical series detailing the indications, techniques, and outcomes of redo f/bEVAR. Relevant procedural experience was also incorporated to highlight evolving strategies.

RESULTS: The most common indications for redo f/bEVAR were type Ia and III endoleaks, reported in 2–5% of patients, typically 3–5 years after the index procedure. Technical success rates ranged from 83% to 100%, with low perioperative mortality. Redo procedures were associated with prolonged operative times and increased radiation exposure, but midterm results were favorable, with high secondary clinical success rates and aneurysm sac stability or regression in most cases.

CONCLUSION: Redo f/bEVAR is a feasible and increasingly necessary approach for managing late complications in selected patients after failed f/bEVAR. Its success depends on individualized planning, advanced imaging, and technical expertise. Further studies are needed to guide device selection, predict long-term durability, and define optimal strategies for complex reinterventions.

Keywords: Redo f/bEVAR; Fenestrated EVAR; Branched EVAR; Endovascular reintervention; Complex aortic aneurysms; Endoleak; Bridging stent failure; Graft migration; Aortic reintervention; Secondary endovascular repair; Device durability

INTRODUCTION

The management of complex aortic aneurysms has undergone a significant paradigm shift over the past two decades, transitioning from open surgical and hybrid repairs to advanced endovascular techniques. Fenestrated and branched endovascular aneurysm repair (f/bEVAR) has emerged as a cornerstone for treating juxtarenal, pararenal, and thoracoabdominal aortic aneurysms, offering a minimally invasive alternative with favorable perioperative morbidity and mortality rates compared with open repair. Its adoption has been further propelled by improvements in device design, imaging technology, and operator expertise.[1-3]

With increasing utilization, however, the long-term follow-up of patients undergoing f/bEVAR has revealed a growing incidence of device-related complications and the need

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for secondary interventions. Studies suggest that over 15% of patients require reintervention following f/bEVAR, often due to endoleaks, target-vessel instability, or disease progression.[1,2,4-6] Among these, type I and type III endoleaks—particularly type IIIb (fabric tears) and IIIc (bridging stent disconnections)—pose significant management challenges. When these complications arise in patients with a prior fEVAR, bEVAR, or previous f/bEVAR, reintervention requires highly individualized planning and technically demanding solutions.[7]

Redo f/bEVAR—defined as the endovascular treatment of aortic pathology using fenestrated or branched endografts within or adjacent to previously placed fEVAR or bEVAR devices — has become an increasingly necessary and feasible approach in such scenarios. Yet, this remains a largely underreported area, with most literature limited to case reports, single-center experiences, or registry-based analyses focusing on redo interventions following infrarenal EVAR or open repair.[3-6,8]

Reinterventions following prior complex endovascular repairs introduce a unique set of anatomical and technical difficulties, including reduced aortic lumen size, impaired rotational and longitudinal maneuverability, radiographic interference due to pre-existing metallic components, and loss of reliable anatomic landmarks.[8]

Given the increasing number of patients undergoing complex endovascular aortic repair—and the corresponding rise in late complications—a focused understanding of redo f/bEVAR strategies is urgently needed. This review aims to summarize indications, technical challenges, reintervention strategies, and outcomes in this evolving field.

METHODS

A narrative review was conducted to summarize the most relevant literature and expert experience on redo f/bEVAR in patients previously treated with fEVAR, bEVAR, or f/bEVAR for complex aortic aneurysms.

A focused search of PubMed and Scopus was conducted to identify English-language studies published between 2010 and March 2025. Keywords included fenestrated EVAR, branched EVAR, redo f/bEVAR, endoleak, reintervention, and graft failure. Reference lists of selected articles were manually screened for additional sources. Eligible studies included clinical series, registry data, and technical case reports describing indications, techniques, and outcomes of redo f/bEVAR. Findings are presented thematically, supported by relevant clinical experience to highlight key considerations and evolving strategies in redo procedures.

RESULTS

We retrieved four articles on redo f/bEVAR, including a total of 26 patients (Table 1). The most frequent indications for redo f/bEVAR were type Ia endoleak, graft migration, and type III endoleaks (especially type IIIb due to fabric tears and IIIc due to bridging stent disconnections).[3,5,9]

Incidence and Timing

In single and multicenter experiences, the need for redo f/bEVAR after initial fEVAR or bEVAR is reported in 2–5% of cases, typically occurring 3 to 5 years after the index procedure.[3,5,9] Most failures originated from suboptimal proximal sealing zones or progressive aortic degeneration.

Technical Feasibility and Success

Technical success rates of redo f/bEVAR, defined as completion without type I/III endoleaks, preservation of target vessel patency, and absence of intraoperative conversion, range from 83% to 100%, depending on anatomical complexity and institutional expertise.[5,9] Strategies to overcome anatomical limitations include preloaded delivery systems, which spare fenestration/branch cannulation, progressive deployment techniques (e.g., SCAPED), and fusion guidance, potentially minimizing fenestration, branch, or target vessel mistakes in an already radiopaque marker-crowded environment.[9,10]

Outcomes and Complications

Reported perioperative mortality is low, with series showing no aneurysm-related deaths either in-hospital or at 30-day follow-up. However, redo procedures are associated with prolonged operative times and subsequent increased radiation exposure, and a risk of spinal cord ischemia (SCI), particularly in extensive thoracoabdominal repairs. While some centers reported transient or permanent SCI in up to 15% of cases in primary cases, most recent reports emphasize the feasibility of performing f/bEVAR without routine spinal drainage, relying instead on staging and perioperative hemodynamic optimization.[2,5,9] For redo f/bEVAR, SCI rates vary across studies and can reach up to 11%, depending on the extent of primary and secondary aortic coverage.[2,9]

Durability and Reintervention

Midterm follow-up (12 to 60 months) has shown encouraging durability, with secondary clinical success rates up to 84% and reintervention rates as low as 15–20%.Aneurysm sac stabilization or shrinkage was reported in most patients.

DISCUSSION

As endovascular solutions are more widely adopted for thoracoabdominal and pararenal aortic aneurysms, the need for reintervention in previously treated anatomies is expected to rise. Although many reinterventions after f/bEVAR are limited to some isolated endograft components, total redo f/bEVAR may be the only option in certain patients experiencing failure of prior complex aortic repairs. [11] These complications often occur several years after the initial repair, reinforcing the importance of structured long-term imaging surveillance.

Anatomical constraints posed by previously placed devices, including reduced working space, metallic artifacts, altered aortic compliance, and impaired maneuverability, distinguish redo from index procedures. In particular, the loss of reliable anatomical landmarks and the presence of previously deployed bridging stents complicate both

Table 1. Summary of Key Studies on f/bEVAR After Prior f/bEVAR

Study	N	Initial procedure	Redo Indication	Redo Procedure	Technical success	Procedural notes	Follow-Up
Hongku et al., 2020	5	fEVAR	Type Ia endoleak, graft migration	f/bEVAR	100%	Poor proximal seal in original fEVAR; 2 patients required late reintervention	Median 37 months
Karelis et al., 2021	18	fEVAR	Type Ia endoleak, graft migration	f/bEVAR	83%	3 required late reinterventions; no aneurysm-related deaths	Median 27 months
Driessen et al., 2022	2	f/bEVAR	Type IIIb endoleak (fabric tear)	f/bEVAR	100%	Used preloaded branched devices; no complications; good imaging follow-up	6–12 months
Mirza et al., 2020	1	bEVAR	Occult endoleak with sac expansion	bEVAR	100%	Not specified	Not specified

device positioning and target-vessel cannulation.[5] These constraints may deem a total endovascular repair unfeasible and demand open conversion, or hybrid strategies such as total or partial visceral debranching, or even renal autotransplantation with associated endovascular techniques.[12-17]

A key determinant of technical success in redo f/bEVAR is appropriate preoperative planning and device selection. Recent case-based and registry data suggest that both fenestrated and branched configurations can be used effectively for relining, depending on the available aortic lumen, target vessel orientation, and prior device architecture. Rather than attempting to replicate the original configuration, alternative strategies may be better suited to the new anatomical reality. These may include different variations of fenestrated and or branched solutions. Moreover, the presence of patent and structurally adequate bridging stents makes vessel-sparing techniques feasible: directly relining from the new main graft to the existing stents without reintervention on the target vessels. This not only simplifies the procedural steps but may also mitigate the risk of vessel trauma and contrast overload, factors that are especially pertinent in redo cases with limited reserve.

Advanced intraoperative imaging plays a crucial role in the success of redo procedures. Fusion imaging enhances the visualization of obscured anatomical features in a densely radiopaque environment. As endovascular repairs become increasingly layered and modular, high-resolution imaging and image guidance will remain central to procedural success.

Current data demonstrate that outcomes of redo procedures can approach those of index f/bEVAR in experienced centers.[5,18] Previous studies reported high technical success rates and high secondary clinical success at 2 years in patients undergoing redo f/bEVAR after failed fEVAR, with no aneurysm-related deaths, similar to those in patients undergoing primary f/bEVAR and those reintervened after prior infrarenal EVAR, particularly in high-volume centers with extensive experience.[5,18] However, redo f/bEVAR after prior bEVAR remains underrepresented in large datasets, and current knowledge is primarily derived from isolated case reports.[8]

Despite growing interest, the body of evidence supporting redo f/bEVAR remains limited by small sample sizes, heterogeneity in technique, and lack of long-term outcome data. Most publications are retrospective and single-center, and few compare different reintervention strategies (e.g., endovascular relining vs open conversion or hybrid solutions).

Future studies should aim to: (1) Establish technical and anatomical criteria to guide redo device design (e.g., fenestrated vs branched vs fenestrated and branched); (2) Identify predictors of long-term durability and sac regression; (3) Explore the role of off-the-shelf and preloaded systems in redo scenarios; and (4) Evaluate patient-centered outcomes of redo f/bEVAR.

CONCLUSION

Redo f/bEVAR after prior failed f/bEVAR is a feasible and increasingly necessary solution for managing late complications. Despite technical challenges, high success rates and favorable midterm outcomes can be achieved with careful planning and experienced teams. Future multicenter studies and device registries are critical to define best practices, predict long-term durability, and support guidelines for redo f/bEVAR.

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