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Factors influencing the recurrence of arterial involvement after surgical repair in Behçet disease

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1 **Factors influencing the recurrence of arterial involvement after**
2 **surgical repair in Behçet's disease**

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20 This study was presented in the plenary session at the 2019 Vascular Annual Meeting of the
21 French Society for Vascular and Endovascular Surgery, Lille, June 28-30, 2019.

22 This study has been selected for fast-track presentation at the 2019 Vascular Annual Meeting
23 of the European Society for Vascular and Endovascular Surgery, Hamburg, September 24-27,
24 2019.

26 **ARTICLE HIGHLIGHTS**

27

28 **Type of Research:** single center retrospective study

29

30 **Key Findings:** Twenty-three patients with BD, had aortic and peripheral arterial repair
31 between May 1996 and September 2015. Twenty-four recurrences were noted and forty-seven
32 surgical procedures were performed. Mean follow-up was 8.4 ± 7.5 years. Initial arterial
33 lesions were aneurysms and thrombosis in 85% and 15% of cases, respectively. Recurrence
34 rate was 51%.

35 Preoperative medical treatments, including colchicine, steroids or immunosuppressants,
36 significantly decreased recurrence rate: 28% (7/25) *versus* 75% (15/20) in untreated patients
37 ($P = 0.002$). When anastomoses were protected using a prosthetic sleeving technique, the
38 recurrence rate was threefold lower ($P = 0.08$).

39

40

41 **Take home Message:** Vascular Behçet's disease is responsible for a high rate of recurrence
42 after surgical repair. Perioperative immunosuppressants are essential to reduce this risk. The
43 additional surgical technique consisting in sleeving anastomosis may help to reduce
44 pseudoaneurysm recurrences occurring at the same site in 92% of cases.

45

46

47 **Table of Contents Summary**

48

49 Recurrence after surgical repair occurred in 51% of cases in this retrospective study of 23
50 patients with non-pulmonary arterial involvement of BD. Immunosuppressive treatment but
51 also mechanical sleeving of the anastomosis decrease recurrence rates.

52

53 **Abstract**

54 **Introduction:** Arterial involvement in Behçet's disease (BD) is rare and its surgical
55 management is a major concern because of its high recurrence rate. This study evaluated the
56 influence of the surgical technique, device, and immunosuppressive treatment used on the
57 postoperative recurrence in patients with non-pulmonary arterial BD.

58 **Methods:** Single center retrospective study conducted in 23 patients meeting the International
59 Study Group of BD criteria, who underwent surgery for arterial involvement between May
60 1996 and September 2015. Recurrence was defined as the occurrence of arterial aneurysm or
61 thrombosis during follow-up. Perioperative medical treatment and surgical technique used
62 were reported.

63 **Results:** Forty-seven surgical procedures were performed in 23 patients. Mean follow-up was
64 8.4 ± 7.5 years. Initial arterial lesions were aneurysms and thrombosis in 85% and 15% of
65 cases, respectively. Arterial lesions were aortic and peripheral in 48% and 52% of cases.
66 Recurrence rate was 51%. Recurrences occurred within less than one year in 24% of cases
67 and at the same anatomical site in 92% of cases. Among the 24 recurrences, 17 were false
68 aneurysms, 6 were thrombosis and one was a true aneurysm in a different arterial site. To treat
69 the arterial lesion, direct anastomosis was performed in 6 cases, bypass using the saphenous
70 vein, graft or allograft was performed in 6, 27 and 5 cases, respectively, and stentgraft was
71 used in 3 cases. Vascular lesions involved the aorta in 19 cases and a peripheral artery in 28
72 cases.

73 Preoperative medical treatments, including colchicine, steroids or immunosuppressants,
74 significantly decreased recurrence rate: 28% (7/25) *versus* 75% (15/20) in untreated patients
75 ($P = 0.002$). The recurrence rate was 42.5% (17/40) in patients treated postoperatively *versus*
76 80% (4/5) in untreated patients. The nature of the device used (vein, prosthetic graft, allograft,
77 stent graft or direct anastomosis) did not change the risk of recurrence. When anastomoses

78 were protected using the prosthetic sleeving technique, the recurrence rate was three times
79 lower (P = 0.08).

80 **Conclusion:** Relapse is a main concern after surgical repair of arterial BD. This study
81 suggests the need for targeted perioperative medical management to reduce the risk of arterial
82 recurrence in BD patients. To this end, a multidisciplinary approach is mandatory.

83 The use of sleeve anastomosis is associated with a numerically lower risk of recurrence.

84 However, further studies are needed to confirm this efficacy.

85

86

87 **Key words:** Vascular Behçet's disease, aneurysm, recurrence, sleeve anastomosis.

88

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90

91 **Conflict of interest:** None

92

93 **Introduction**

94 Behçet's disease (BD) is a chronic, relapsing, multisystemic disorder characterized by
95 mucocutaneous, ocular, vascular and central nervous system manifestations^{1, 2}. The
96 pathogenesis of the disease remains unknown, although a genetic predisposition,
97 environmental factors, and immunological abnormalities have been reported^{3, 4}. Vasculitis is
98 thought to underlie the clinical manifestations of BD and is distinguishable because both
99 arteries and veins of all sizes are involved. Arterial complications are less common than
100 venous lesions in BD, and occur in 1-14% of patients⁵⁻⁸. Vascular BD (VBD) patients are at
101 risk of multiple vessel-related complications resulting in an increased risk of mortality.
102 Indeed, the 20-year survival rate decreases from 89 to 73% in case of arterial disease⁹. In a
103 large cohort of 817 BD patients, Saadoun et al.⁸ have shown an overall mortality rate of 5%
104 after a median follow-up of 7.7 years. In this series, the incidence of arterial involvement was
105 3 times higher in patients who died. Unlike venous manifestations¹⁰⁻¹⁵, arterial involvement in
106 BD is rare and a few publications have reported its specific treatment. Vascular surgery is
107 challenging in BD patients and the mortality rate is high¹⁶, mainly due to anastomotic
108 aneurysm relapses and graft thrombosis.

109 There is currently no consensual technique for the surgical management of these patients. The
110 vascular substitutes that can be used include prosthetic materials, venous autografts, arterial
111 allografts or stent grafts⁹. The main concern in these patients, apart from bypass thrombosis,
112 is the formation of anastomotic pseudoaneurysms in the short term, requiring iterative
113 interventions that may be life-threatening in case of rupture.

114 The aim of this study was to retrospectively identify the factors influencing the postoperative
115 recurrence of arterial lesions in BD patients with non-pulmonary arterial involvement.

116

117 **Patients and methods**

118 Population

119 It was a single center retrospective study conducted in 23 BD patients meeting the
120 international criteria for BD¹⁷ who consulted the Departments of vascular surgery and internal
121 medicine of the Pitié-Salpêtrière Hospital, Paris, France between May 1996 and September
122 2015.

123 Associated clinical signs were genital and oral ulcerations, uveitis, folliculitis, arthralgia, and
124 fever. Other aneurysmal locations, a history of deep vein thrombosis and cardiovascular risk
125 factors were identified. Pre- and post-operative medical treatments were recorded. Patients
126 with BD requiring arterial repair in our department were systematically included in the study
127 whether it was a recurrence or a primary surgery. In case of previous arterial repair in another
128 center, the first surgical repair in our department was considered a recurrence. Arterial lesions
129 were defined by the presence of aortic or peripheral aneurysm, pseudoaneurysm or arterial
130 thrombosis. The presence of a potential triggering trauma was also investigated for each
131 arterial lesion. Patients who did not require surgery or with pulmonary artery aneurysms were
132 excluded from the analysis. The indications for surgery were: symptomatic arterial
133 thrombosis; aortic aneurysm greater than 5 cm in diameter or growing by more than 5 mm in
134 6 months, or becoming symptomatic; pseudoaneurysm of more than 2 cm in diameter or
135 growing. Emergency management was limited to ruptured aneurysms or patients with acute
136 ischemia. The radiological diagnosis of aneurysm or pseudoaneurysm was based on arterial
137 Doppler ultrasound combined with computed tomography (CT)-scan. The surgical technique
138 and the material used (prosthetic graft, saphenous autograft, arterial allograft, or stent) were
139 analyzed according to the different anatomical locations. Bypass anastomosis was performed
140 as usual. The choice of the technique used was left to the referee surgeon's discretion. In some
141 cases, a sleeving protection was used, consisting in locating a short prosthetic graft segment
142 around the vascular anastomosis (figures 1 and 2) to reinforce it and to prevent secondary

143 pseudoaneurysm formation. This technique was used when the diagnosis of VBD was
144 confirmed or strongly suspected. In these cases, a sleeve protection was used on each end-to-
145 end anastomosis remote from a bifurcation. For large bypasses (diameter >8 mm), the same
146 graft segment is used for sleeving. For ≤ 8 mm bypasses, a larger (+1mm) segment than the
147 bypass graft is required to avoid stenosis.

148 The postoperative follow-up was based on clinical examination and ultrasound or CT-scan.
149 The primary patency rate was calculated.

150 A recurrence was defined as the reappearance of aneurysm or pseudoaneurysm at the operated
151 site or in another location, or by the occurrence of bypass thrombosis.

152 Early recurrence was defined as the occurrence of arterial aneurysm within less than 1 year,
153 confirmed by arterial Doppler ultrasound or CT-scan. Global doppler ultrasound was
154 systematically performed 6 months after surgery and yearly thereafter during the follow-up.

155 In case of thoracic aortic repair, a CT-scan was performed at the same timepoints. Recurrence
156 at the same arterial site and recurrence at a new site were differentiated. The follow-up was
157 performed by the surgical department and by the referent BD medical department located in
158 the same hospital.

159 The number of recurrences was compared according to the nature of the implanted arterial
160 substitute: synthetic graft, venous autograft, arterial allograft, or stent. The effect of sleeve
161 anastomosis on recurrences was assessed. The recurrence rate in patients receiving dedicated
162 medical treatment for BD was also compared to the recurrence rate in untreated patients,
163 including those who could have benefited from a sleeving or not. Steroids and
164 immunosuppressive treatment were systematically prescribed prior to surgery in BD patients
165 from our institution. However, in some cases, no immunosuppressive treatment was given
166 when patients were referred from other centers or when the diagnosis of BD had not been
167 confirmed prior to surgery.

168

169 Ethical issues

170 The study was conducted in accordance with the ethical principles of the Declaration of
171 Helsinki.

172 The study protocol was assessed by the institutional review board of the *Hôpital Universitaire*
173 *Pitié-Salpêtrière*. Patients were informed that their clinical data were likely to be collected,
174 but in accordance with the French law, since this was an observational study involving only
175 routine clinical practices and therefore with no risk for patients, no informed consent was
176 needed.

177

178 Statistical analysis

179 Statistical analyses were carried out using SAS 9.4 software. Quantitative data with normal
180 distribution are expressed as the mean \pm standard deviation and quantitative data with non-
181 normal distribution as the median (interquartile). The recurrence rate according to the effect
182 of the anastomotic sleeve technique was assessed using the Kaplan-Meier method. The
183 Fischer's exact test was used to study the effect of preoperative and postoperative treatments
184 on the occurrence of recurrences (thrombosis, false aneurysm). A P-value less than 0.05 was
185 considered statistically significant.

186

187 **Results**

188 Population

189 Twenty-three BD patients with arterial involvement were included in our study. A total of 47
190 procedures were performed for arterial lesion, with a mean number of 2.4 ± 0.6 procedures
191 per patient in the 17 patients who experienced recurrence. Except for 7 initial interventions
192 performed in another hospital before the diagnosis of BD, all interventions were performed in

193 our department, including after relapses. Patient demographics are presented in **Table I**. At the
194 time of arterial lesions, the main active clinical sign of BD was oral and genital ulcerations in
195 61% of cases. Peripheral locations were more common than aortic ones (**Table II**).
196 Among patients with peripheral aneurysms, the femoro-popliteal location (48%) was the most
197 common. Among all patients, the first arterial involvement was fusiform aneurysm (n=10),
198 pseudoaneurysm (n=12), or arterial thrombosis (n=1). During the follow-up, including
199 relapses, the treated lesions were pseudoaneurysms in 29 procedures (62%), fusiform
200 aneurysms in 11 procedures (23%) and arterial thrombosis in 7 procedures (15%). The lesions
201 were bilateral in 2 patients (4%): one patient had bilateral iliac thrombosis and one patient had
202 spontaneous bilateral femoral pseudoaneurysms. Arterial puncture resulted in
203 pseudoaneurysm in 2 cases (4%). Emergency management for ruptured aortic
204 pseudoaneurysm below the renal arteries was needed in two cases (4%).

205

206 Surgical technique

207 Among the 47 procedures, 27 prosthetic grafts (57%), 6 venous autologous grafts (13%), 5
208 cryopreserved allografts (11%) and 3 stent grafts (6%) were used (**Table III**). Prosthetic grafts
209 were polyethylene terephthalate (PET) in all cases except one. In this case, graft made with
210 polytetrafluoroethylene (PTFE) was used. All anastomoses were performed using
211 polypropylene suture thread. Stent grafts used were Valiant thoracic endograft (Medtronic,
212 Santa Rosa, CA, USA) in one case and covered stents in two cases (fig 3) for peripheral
213 aneurysms. In 6 cases, reconstruction did not require any material (13%) because short
214 resection with direct end-to-end anastomosis could be performed. The vascular substitutes
215 used, depending on the lesion location, are shown in **Table III**. A total of 95 anastomoses
216 were performed during the 47 procedures. The sleeving technique was used for 25
217 anastomoses (corresponding to 13 bypass procedures): 23 (92%) were graft-to-artery

218 anastomosis (8 aortic, 3 iliac, 11 femoral, and 1 popliteal) and 2 (8%) were venous-to-femoral
219 artery anastomosis.

220 The mean follow-up duration was 8.4 ± 7.5 years. The postoperative mortality rate was 2%.

221 One patient died 1 month after surgery. This patient underwent aortic stent graft in zone 0
222 with supra-aortic trunk debranching for false aneurysm of the aortic arch. He experienced a
223 septic rupture of the brachiocephalic trunk anastomosis due to *Staphylococcus aureus* graft
224 infection. The postoperative morbidity rate was 8% (4/47). Two patients experienced
225 hematoma at the surgical site, one patient had acute renal failure without dialysis after aortic
226 surgery, and one patient had acute lower limb ischemia due to embolization after treatment of
227 abdominal aortic aneurysm.

228 The 5-year primary and secondary patency rates were 94 and 100%, respectively.

229 All patients received antiplatelet therapy (160 mg of acetylsalicylic acid) after bypass surgery
230 regardless of the substitute used. In case of thrombosis, anticoagulant treatment (vitamin K
231 antagonist) was initiated instead of antiplatelet therapy.

232

233 Recurrence after vascular repair

234 A total of 24 recurrences were observed in 17 patients, corresponding to a recurrence rate of
235 51%. Eleven patients (48%) had 1 recurrence, 5 patients (22%) had 2 recurrences and 1
236 patient (4%) had 3 recurrences. In 22 cases (92%), the same arterial anatomical site was
237 involved. Only two patients experienced a recurrence in a different site: one patient had
238 contralateral common femoral artery pseudoaneurysm and one had aortic dilation above a
239 previous infra-renal aortic repair.

240 Lesions recurred as anastomotic pseudoaneurysm in 71% of cases (17/24), bypass thrombosis
241 in 25% of cases (6/24) and aortic fusiform aneurysm above previous infra-renal aortic
242 aneurysm repair in 4% of cases (1/24). Graft thrombosis occurred in three patients (femoro-

243 femoral bypass in two cases and aorto-aortic graft in one case). Graft thrombosis recurred
244 one, two and three times respectively in these three patients.

245 The mean time to recurrence for the overall population was 65 ± 68 months. Among the 24
246 recurrences, 7 (24%) occurred within one year. In the 16 cases that relapsed after one year,
247 the mean time to recurrence was 79.6 ± 59 months. In this group, the median time between
248 the first arterial repair and the first recurrence was 45 months (1-232) and it was 18 months
249 (6-143) between the second intervention and the second relapse. In one patient, the time
250 between the third intervention and the third relapse was 20 years. Recurrences according to
251 the time are presented in **Figure 3**.

252 Anastomotic pseudoaneurysm occurred within the first year in 41% of cases (7/17).

253 The nature of the recurrence observed according to the type of arterial repair is shown in
254 **Table IV**. The differences highlighted were not statistically significant due to the small size of
255 the sample.

256 In 45 out of the 47 procedures performed, the use of pre- or postoperative immunosuppressive
257 treatment was known. Medical treatment included colchicine, steroids or
258 immunosuppressants. Patients received medical treatment preoperatively in 55% of cases
259 (25/45), postoperatively in 89% of cases (40/45) and both pre- and postoperatively in 51% of
260 cases (23/45). No medical treatment was given in 11% (5/45) of cases. Perioperative medical
261 treatments are detailed in **Table V**.

262 The effect of preoperative immunosuppressive treatment on the recurrence rate showed that
263 28% of procedures (7/25) were followed by a recurrence in treated patients compared to 75%
264 (15/20) in untreated patients (OR: 7.31; 95% CI (1.73; 36.81)) (P = 0.002).

265 The effect of postoperative immunosuppressive treatment was also assessed. Forty-two
266 percent of patients who received postoperative treatment (17/40) experienced a recurrence
267 *versus* 80% of untreated patients (4/5) (OR: 5.22; 95% CI (0.46; 277.32)) (P = 0.16).

268 All patients who did not receive any medication before or after surgery (5/5) experienced a
269 recurrence.

270 The effect of the sleeving technique on the occurrence of pseudoaneurysms at anastomosis
271 sites was analyzed and each anastomosis was considered according to the use of a sleeve
272 protection or not. A total of 95 anastomoses were performed, of which 25 were sheathed by a
273 sleeve. The overall pseudoaneurysm rate was 18% (17/95 anastomoses). In the absence of
274 sleeve, the false aneurysm rate was 21% (16/70) but it was only 8% (2/25) in the presence of
275 a sleeve (OR: 2.44; 95% CI (0.89; 6.73)) (p = 0.08) (Figure 4).

276 Regarding patients who received pre- and postoperative medical treatments without sleeve,
277 the recurrence rate for each anastomosis was 32% (12/38 anastomoses), while patients who
278 received medical treatments and sleeve showed a recurrence rate of only 10% (2/19
279 anastomoses) (OR: 0.26; 95% CI (0.03; 1.4)) (p = 0.108).

280

281

282 **Discussion**

283 We provide here the results of a large series of patients who underwent a vascular procedure
284 for arterial lesions of BD. The postoperative mortality rate was low but we observed a high
285 rate of relapse following surgical procedures comparable to those previously published,
286 although our follow-up of 8.4 years was longer¹⁸⁻²⁴. In our series, 51% of BD patients
287 operated for arterial lesions (aneurysms or thrombosis) experienced a relapse which occurred
288 during the first year following surgery in one third of cases.

289 In previous series, recurrence rates of 50% and 56% and postoperative mortality rates of 14%
290 and 15% have respectively been reported in 32 patients who underwent bypass²⁵⁻²⁹ and in 48
291 patients who underwent graft interposition^{22, 26, 28-30}.

292 Device

293 Vasculitis in BD is distinguishable because both arteries and veins of all sizes are involved.
294 Venous complications are more common than arterial lesions in BD, occurring in 30% of
295 patients⁵⁻⁷. VBD patients are at risk of multiple vessel-related complications^{9, 27, 31}. Because
296 of the risk of concomitant venous failure due to BD, we did not use the saphenous vein except
297 in specific cases such as distal bypass or septic surgery. In this study, we used saphenous
298 vein grafts in only 13% of cases and the complication rate was of 50%, exclusively due to
299 pseudoaneurysm formation. In fact, results did not significantly differ from those of prosthetic
300 grafts, but these findings should be interpreted with caution because of the small number of
301 venous bypass procedures performed.

302 The use of prosthetic grafts was associated with a relapse rate of 43%. Thrombosis and
303 pseudoaneurysm occurred after 4/27 (14.8%) and 9/27 (33.3%) procedures, respectively.
304 Thrombosis could be explained by the hypercoagulability secondary to inflammation due to
305 BD in these young patients without atheroma³².

306 Arterial allograft could be another option as we observed a lower complication rate of 20%,
307 but in a limited number of cases (1/5 cases).

308 Arterial wall injury secondary to anastomosis performed between a native artery and a vein or
309 prosthetic graft is a local risk factor for relapse. The endovascular approach has recently been
310 shown to improve results¹⁸ although there may be trauma between a stent and the vascular
311 wall. The endovascular approach was used in only 6% of cases in our study and did not allow
312 concluding to any difference. The endovascular approach could be effective because no
313 anastomosis is needed. The stent should be long enough to cover the lesion in order to seal in
314 a healthy part of the vessel³³. However, arterial puncture is a risk factor for pseudoaneurysm
315 formation^{23, 34, 35} (3 cases in our study). Moreover, data on the long-term results are limited in
316 the literature³⁶.

317 Endovascular procedures are also increasingly used in the management of BD, but their
318 superiority has not been demonstrated. Except for Balcioglu et al³⁷ who have not observed
319 any aneurysm formation nor thrombosis after aortic stent graft placement after a median
320 follow-up of 40 months, all other series have reported a recurrence rate ranging between 8.3
321 and 75% after endovascular procedures^{18-21, 29, 34, 38-40}. Many cases of pseudoaneurysms at the
322 proximal or distal margin of the stent graft have been described^{21, 35, 40, 41} and resulted in
323 patient death in three cases due to rupture^{19, 29, 40}. Despite the less invasive nature of
324 endovascular treatment, interactions between the stentgraft and the vascular wall led to the
325 formation of pseudoaneurysms at both ends. Yin et al¹⁸ have shown that limiting the
326 oversizing to less than 5% could decrease this risk.

327 Liu et al²⁰ have shown better results with bypass surgery than with stent graft in 18
328 procedures on peripheral arteries. However, the results of aortic aneurysm exclusion were
329 disappointing: among 22 procedures for aortic pseudoaneurysms, a stent graft was used in 19
330 cases, resulting in recurrence and mortality rates of 18% and 16%, respectively, after a short
331 median follow-up of 23 months. Kim et al²³ have reported the experience of 20 aneurysms in
332 16 patients treated with stent grafts after a mean follow-up of 4 years. The relapse rate of 19%
333 was low compared to 8 aneurysms in 7 patients who underwent open repair with a relapse rate
334 of 43%.

335 However, the technique consisting in performing bypass without anastomosis, as described in
336 the Viabahn Padova sutureless technique, could be an option⁴².

337

338 **Relapses**

339 In the present study, the recurrence involved the same arterial anatomical site in 92% of cases.
340 Patients who received perioperative steroids and/or immunosuppressants showed a reduced
341 risk of relapse. In line with previous studies and the European League Against Rheumatism

342 (EULAR) recommendations^{20, 26, 27, 31, 36, 37, 43}, anastomotic relapses and graft thrombosis in
343 this series were less common in patients who received aggressive perioperative medical
344 treatment (corticosteroids and immunosuppressants).

345 In our series, patients were treated preoperatively in only 45% of cases but in these cases, the
346 recurrence rate was significantly reduced compared to that found in untreated patients (28%
347 *versus* 75%). In most cases, BD was not diagnosed at the time of surgery.

348 The use of postoperative treatments effectively decreased the recurrence rate of arterial
349 lesions.

350 Many recurrences (24%) occurred during the first year following the surgical procedure but
351 most of them (76%) were delayed with a mean time to recurrence of 6.5 years. These results
352 showed that the risk of recurrence was sustained, whereas in the literature the mean time to
353 recurrence is 10.5 months after a mean follow-up of 6 years^{24, 31, 32, 39}. However, there is
354 currently no consensus regarding the postoperative follow-up of these patients. Therefore,
355 extended monitoring with repeated Doppler ultrasound explorations could be useful to detect
356 as soon as possible early and delayed local recurrences or monitoring with CT-scan for
357 thoracic aorta and intrathoracic supra-aortic trunks.

358

359 Sleeve anastomosis

360 We showed that recurrences occurred mainly at the same site, especially anastomotic
361 pseudoaneurysms, even when optimal medical treatment was given. That is why we added a
362 surgical technique to decrease this risk. Sleeve protection of the anastomosis is an easy and
363 reproducible technique consisting in reinforcing arterial anastomosis by wrapping it with a
364 larger prosthetic graft. This technique had previously been described^{34, 44} but its effects on the
365 risk of recurrence had never been specifically investigated. In our series, we found that
366 anastomoses protected by a sleeve were less often affected by false aneurysm during the

367 follow-up than those that were not protected. This extra-arterial reinforcement provides a
368 mechanical support that decreases the risk of secondary anastomotic rupture, although this
369 result was not statistically significant and further studies are needed to confirm it.

370 This technique was not systematically used when the diagnosis of BD was not suspected at
371 the time of the first surgical procedure or when anastomosis was too close to a collateral
372 artery (such as renal artery or profundis femoral artery). After a mean follow-up of 8 years, it
373 appeared that the rate of anastomotic false aneurysms was decreased when a sleeve was used.
374 Furthermore, even in patients who received medical treatment, adding a sleeve also decreased
375 the risk of anastomotic false aneurysm. The recurrence rate dropped from 32% to 10% of all
376 anastomoses when a sleeve was associated with the surgical procedure.

377

378 The main limitation of this study is its retrospective design. This disease is not common and
379 the diagnosis is often made after the occurrence of one or two arterial events, which limits the
380 possibility of a prospective approach. Moreover, given the small number of patients, the risk
381 of a type 2 statistical error cannot be ruled out. For this reason, we can only conclude that
382 complications tended to decrease when immunosuppressive treatment and the sleeve
383 protection technique were used.

384

385 **Conclusion**

386 Relapse is a major concern after surgical repair of arterial BD. However, the risk seems to be
387 reduced when medical treatment is used in combination with a vascular procedure. This study
388 suggests the need for targeted perioperative medical management to reduce the risk of arterial
389 recurrence in BD patients. To this end, a multidisciplinary approach combining
390 rheumatologists and vascular surgeons is mandatory.

391 The use of sleeve anastomosis may reduce the risk of recurrence in the form of anastomotic
392 pseudoaneurysms. However, further studies are needed to confirm its efficacy.

393

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