

Article

Determinants of Success and Early Complications in Common Femoral Artery Endarterectomy: A Retrospective Study

Marcel Libertus Johannes Quax *, Daniël Eefting  and Herman Joseph Smeets

Department of Surgery, Haaglanden Medical Centre, 2501 CK Den Haag, The Netherlands; d.eefting@haaglandenmc.nl (D.E.); h.smeets@haaglandenmc.nl (H.J.S.)

* Correspondence: m.l.j.quax@lumc.nl

Abstract: Introduction: Common femoral artery endarterectomy (CFE) is considered a relatively simple, successful and safe procedure in the literature, but major complications can occur. This retrospective study was performed in order to define characteristics contributing to success or failure after common femoral artery endarterectomy, either performed as a single or hybrid procedure. Methods: A total of 298 patients who underwent CFE in our hospital between 1 January 2011 and 1 January 2017 were included. After exclusion, 227 patients were analyzed. Patient characteristics and outcomes were derived from the patient records. Follow-up was 30 days postoperatively. Outcomes were analyzed by the chi-square test and regression analysis. Clinical success was defined as a combination of technical success, improvement in the ankle-brachial index, increased walking distance and “no complications.” Results: The procedure was clinically successful in 74.4% of the patients, and in 25.6%, a complication occurred. The Rutherford class improved in 65.1% of the patients with 1.6 (SD 1.3) class points. The ankle-brachial index improved in 44.8% of the cases, with an average of 116.6%. The most contributing factors for complications such as death, unplanned amputation, surgical site infection, thrombosis and longer hospital admission were emergency operation and a higher ASA classification. Significantly more complications also occurred in patients with renal failure, congestive heart disease, a high Rutherford classification and previous groin incision. A higher Rutherford class was the only factor correlating with an increase in the ankle-brachial index. When single CFE (48.9% of cases) and hybrid procedures (51.1%) were compared, no significant difference in success or failure was found. Conclusion: Limb ischemia requiring emergency operation and preoperative comorbidity were identified as the most important factors predictive for complications following femoral artery endarterectomy. Combining femoral endarterectomy with an endovascular intervention does not seem to increase the risk of a postoperative complication.



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1. Introduction

Surgical endarterectomy is usually the preferred option for surgery in patients with isolated significant stenotic atherosclerotic lesions in the common femoral artery [1]. In the case of multilevel lesions, a common femoral endarterectomy procedure (CFE) can be combined with a transluminal angioplasty, a so-called “hybrid procedure” [2]. Although usually considered a relatively simple, successful and safe procedure [3], serious complications following CFE may occur, even leading to major amputation or death. Derksen et al. showed a complication rate within 30 days postoperative of 30.7% [4], Nguyen 23.5% [5] and Zou 24.4% [6]. Unfortunately, the factors that lead to these complications are not fully elucidated yet. Some studies have indicated variables that may correlate with these major complications. However, it remains uncertain which variables, and to what extent, contribute to the occurrence of these complications. Recent studies show no increase in the complication rate when endovascular revascularization is added to CFE in a hybrid

procedure [7]. Most of the literature was focused on factors contributing to complications after CFE, but factors contributing to success were barely analyzed. There is a difference between technically successful and clinically successful outcomes. Technical success is defined as a procedure removal or dilation of significantly obstructing stenosis. When the course is without complications, it is defined as clinically successful. Even procedures that are technically successful can be accompanied by complications that affect the successful clinical outcome, for example, due to infection. Clinical improvement can be seen as a better situation than the situation preoperatively. This retrospective study was performed in order to define characteristics contributing to success or failure after common femoral artery endarterectomy.

2. Materials and Methods

2.1. Design

A retrospective study was performed, including all patients who underwent endarterectomy of the common femoral artery between 1 January 2011 and 1 January 2017 in the Haaglanden Medical Center, The Hague, The Netherlands. The institutional board committee approved this study.

2.2. Patient Selection

All patients who underwent any procedure including CFE were included. Operation indication was either patients with chronic limb ischemia or acute (on chronic) ischemia. Excluded were those in whom additional surgical procedures were performed, such as the insertion of an aorta bifemoral prosthesis or femoral-distal bypass, removal of a foreign body (closure device, stent) and those in whom a false aneurysm of the femoral artery was repaired. Patients additionally undergoing endarterectomy of the superficial or profunda femoral artery, with or without profunda plasty, and patients undergoing any proximal or distal additional endovascular treatment were not excluded. Exclusions are further explained in Section 3.

Patient characteristics were derived from the patient records. For comorbidity analysis, the American Society of Anesthesiologists classification (ASA) was used. Highlighted comorbidities were congestive heart failure, COPD, sepsis (criteria for SIRS [8]), renal failure (eGFR < 60 mL/min/1.73 m²), hemodialysis and diabetes mellitus.

Severity of PAD was scored with the Rutherford classification [9], ankle-brachial index (pre- and postoperative) and TASC classification based on computed tomographic angiography [10].

If the treatment was conducted within 24 h after the presentation of acute ischemia, the intervention was registered as an emergency operation. Furthermore, previous ipsilateral groin incision or PTA (percutaneous transluminal angioplasty) and procedure duration were registered.

2.3. Outcome Parameters

Primary outcome measures were postoperative complications and success of the procedure. The complications were categorized into surgical site infections (SSI), bleeding, reoperation for any reason, unplanned amputation, death and arterial or venous thrombosis. Other complications were categorized as “miscellaneous”. Success of the treatment was defined as improvement in walking distance (which is subjective as it was a question in follow-up), increase in the Rutherford classification and increase in the ankle-brachial index. Clinical success was defined as technical success, success of treatment and “no complications.” Technical success is defined as a procedure removal or dilation of significantly obstructing stenosis. Clinical improvement is seen as improvement in the Rutherford classification.

Secondary outcome measures were the length of admission and healing of peripheral wounds.

Perioperative complications were registered until 30 days postoperative.

2.4. Definitions

Surgical site infections were classified by the Szilagyi classification [11]. Bleeding was included as a complication when reoperation was needed. “Miscellaneous” included cardiac (myocardial infarction, hypotension, atrial fibrillation, congestive heart failure), pulmonary (pneumonia, exacerbated COPD) and renal complications (acute renal insufficiency [12]), as well as stroke, delirium or anemia.

Amputation was defined as a complication if it was unplanned preoperatively. In the analysis, the amputations were divided into toe, lower leg and upper leg amputations.

2.5. Follow-Up

For this study, follow-up was 30 days postoperatively. Only peripheral wound healing was followed until 6 months postoperatively. Follow-up was conducted by a vascular surgeon, a vascular surgery resident or a specialized wound care nurse.

2.6. Data Analysis

Data were registered in Castor electronic data capture (Castor, Amsterdam, The Netherlands). Data analysis was performed by IBM SPSS Statistics for Windows, version 22.0 (IBM Corp. Armonk, NY, USA). The Pearson chi-square test was used to compare the categorical variables. Logistic and linear regressions were used to evaluate risk factors. All *p*-values below 0.05 were interpreted as statistical significance.

3. Results

Of a total of 298 included patients, patients undergoing aorta reconstruction ($n = 19$) or bypass surgery ($n = 43$) were excluded, as well as those patients in whom a foreign body (closure device, stent) was removed ($n = 4$), those who underwent repair of a pseudoaneurysm ($n = 3$) and those who underwent other surgery in combination with CFE ($n = 2$). Baseline characteristics of the remaining 227 are shown in Table 1. Single CFE was performed in 48.9% of the cases, and a hybrid procedure was performed in 51.1%. Of the operated patients, 47.6% suffered intermittent claudication.

Complications and success of the procedures are shown in Table 2. Technical success was achieved in all procedures; 74.4% of the procedures did not have a complication. In 65.1%, the Rutherford classification improved, and in 44.8%, the ankle-brachial index improved after the procedure. The walking distance improved in 68% and peripheral wounds healed within 6 months in 44.8% of the cases.

Grade 1 SSIs were treated with antibiotics, and five out of six patients with a grade 2 infection were reoperated, where one was successfully treated with antibiotics. In the patients with grade 3 infections, four reoperations were performed, while one patient died due to infection 14 days postoperatively.

From the five patients with an arterial thrombosis, four needed reoperation and one patient died due to the thrombosis. In the 30 days postoperatively, 2.2% of the patients had one or multiple toes amputated unplanned; in 1.3%, an unplanned below knee amputation was necessary; and in 2.6%, an unplanned above knee amputation was necessary.

Post-procedure, on average, the ankle brachial index was increased 115.4% (from 0.48 to 0.55, $p < 0.001$), and the Rutherford classification increased, on average, with 1.6 class points (from 5.2 to 3.6, $p < 0.001$, standard deviation 1.3).

Tables 3 and 4 show the regression numbers of the determinants which had a significant correlation with the outcome. Due to the large amount of data collected, only the significant correlations are pointed out (see Appendix A for complete regression outcome). When a factor had a significant correlation with the outcome, the odds ratio is mentioned in this table. Emergency procedure was significantly correlated with complications (OR 3.0), unplanned amputations (OR 3.3), arterial thrombosis (OR 3.8), admission duration (RC 7.05) and death (OR 11.3). High ASA classification had a significantly higher odds ratio on complications (2.4), SSI (2.4), unplanned amputation (2.7) and death (6.9). Previous groin incision was correlated with a significantly higher risk of complications

(OR 2.2), SSI (OR 3.2) and arterial thrombosis (OR 4.3). Renal failure was correlated with complications (OR 2.0), SSI (OR 1.7) and longer peripheral wound healing (RC 9.3).

Higher Rutherford classification had a significant correlation with the increase in the ankle-brachial index (RC 77.9). There were no other factors correlating significantly with successful outcome.

When the correlation between ASA classification and complications was corrected for emergency procedure, no difference in significance was found (OR 2.75, CI 2.44–3.07).

Next, we added the hybrid procedure as a determinant to the regression analysis. In 76.7%, an endovascular procedure was performed in the iliac arteries; in 18.1%, in the femoral arteries; and in 5.2%, in both iliac and femoral arteries. This did not show a significant correlation with complications (CI 0.604–1.771). Finally, outcome after hybrid procedure and that after common femoral artery endarterectomy were compared as separate groups well by the chi-square test, see Table 5. The only, marginal, significant difference was in bleeding needing a reoperation. In 4.3%, re-occlusion occurred in the hybrid group, which was not significantly different from single CFE (6.2%).

Table 1. Baseline characteristics of study group.

Total Group <i>n</i> = 227 (SD ¹)		
Age, in years		70.2
Sex (% male)		59.4
ASA \geq 3 (%)		62.4
Rutherford \geq 4 (%)		52.3
	Rutherford 1	2.2
	Rutherford 2	12.7
	Rutherford 3	32.8
	Rutherford 4	21.8
	Rutherford 5	27.1
	Rutherford 6	3.1
TASC classification (%)	A	13.5
	B	32.8
	C	34.1
	D	19.7
Acute ischemia (%)		14.8
Diabetes mellitus (%)		38.0
Renal dysfunction (%)		27.5
Congestive heart failure (%)		10.5
COPD (%)		20.5
Sepsis (%)		1.3
Smoking (%)		30.1
Body mass index		35.9 (4.95)
Emergency operation (%)		17.0
Operation duration (in minutes)		163.1 (61.97)
Hybrid procedure (%)		51.1
Patch used (%)		95.2
	Venous patch	71.2
	Synthetic patch	18.8
	Bovine patch	3.2

¹ SD = standard deviation.

Table 2. Outcome of treatment in cohort ($n = 227$). SD = standard deviation. First shown is the percentage of operations without any complication. As one patient could suffer from more than one complication, the total number of complications is mentioned as well. Under “Result of complication”, no actual complication is registered but rather the number of operations or mortalities due to the complications mentioned above.

Total Cohort ($n = 227$)		
	n (SD)	%
Operations without complication	169	74.4
Operations with 1 or more complications	58	25.6
Complications total	69	30.2
SSI	26	11.4
Grade 1	15	6.6
Grade 2	6	2.6
Grade 3	5	2.2
Arterial thrombosis	5	2.2
Miscellaneous	28	12.2
Improvement in ankle-brachial index	114	44.8
Percentual improvement in ankle-brachial index	0.48 to 0.55	116.6 (483)
Improvement in Rutherford class	149	65.1
Rutherford improvement in class	3.6 to 5.2	1.6 (1.3)
Improved walking distance (subjective improved)	151	66.8
Healing peripheral wound within 6 months	26	44.1
Result of Complication		
Reoperation	36	15.7
Unplanned amputation	15	6.6
Death	9	3.9

Table 3. Multivariate regression analysis of risk factors vs. outcome.

Complication	Odds	95% CI	Death	Odds	95% CI
Emergency procedure	3.0	1.50–6.17	Emergency procedure	11.3	2.7–47.57
ASA	2.5	2.46–2.63	ASA	6.9	1.55–30.7
Previous groin incision	2.2	1.07–4.52	Renal failure	5.7	1.38–23.4
Renal failure	2.0	1.13–3.70	Acute ischemia	5.0	1.28–19.8
Rutherford	1.7	1.30–2.18	Heart failure	4.7	1.1–20.24
SSI			Thrombosis		
Previous groin incision	3.2	1.32–7.95	Acute ischemia	4.6	1.37–15.5
ASA	2.4	1.06–5.24	Previous groin incision	4.3	1.28–14.3
Renal failure	2.4	1.03–5.36	Emergency procedure	3.8	1.15–12.8
Unplanned Amputation					
Emergency procedure	3.3	1.32–8.06			
ASA	2.7	1.14–6.17			
Rutherford	2.7	1.66–4.30			
TASC	1.9	1.17–3.08			

Table 4. Multivariate regression analysis of risk factor vs. successful outcome.

Duration Admission	RC	95% CI	Increased Walk Distance	Odds	95%CI
Sepsis	54.01	47.4–60.7	Rutherford	0.60	0.45–0.80
Emergency operation	7.05	4.7–9.4	Previous PTA	0.51	0.27–0.95
Acute ischemia	3.88	1.2–6.5	Diabetes mellitus	0.46	0.25–0.84
ASA	2.46	0.8–4.1	Renal failure	0.46	0.24–0.87
Rutherford	1.83	1.1–2.6	ASA	0.41	0.22–0.76
Duration Wound Healing	RC	95% CI	Increased Ankle-Brachial Index	RC	95%CI
Sepsis	55.9	21.6–90.2	Rutherford	77.80	8.9–146.7
Renal failure	9.33	0.8–17.9			

Table 5. Analysis of the outcomes after CFE versus hybrid procedure.

Outcome	CFE	Hybrid	<i>p</i> -Value
Complications total (%)	33.7	26.7	0.304
SSI (%)	10.6	12.1	0.730
Bleeding with reoperation (%)	7.1	1.7	0.047
Thrombosis (%)	1.0	3.4	0.522
Miscellaneous (%)	15.0	9.5	0.199
Bleeding without operation (%)	6.5	4.3	0.199
Ankle-brachial index improvement (%)	103.6	127.2	0.775
Rutherford improvement (in class)	1.56	1.63	0.690
Improved walking distance (%)	63.7	69.8	0.507
Reoperation (%)	15.9	15.5	0.932
Unplanned amputation (%)	6.2	6.9	0.830
Death (%)	4.4	3.4	0.704

4. Discussion

In the current study, we demonstrated that factors that predict a poor clinical outcome of CFE procedures are emergency operation, a high Rutherford class, a high ASA classification, renal failure and previous groin incision. A high Rutherford class and emergency operations suggest the presence of chronic or acute limb-threatening ischemia as a major contributor to poor outcome, together with preoperative comorbidity, as illustrated by high ASA and renal failure. On the positive side, a high preoperative Rutherford class was the only determinant that significantly correlated with an increase in the ankle-brachial index.

The significant complication rate in our overall cohort (25.6%) is in the upper range when compared with the numbers reported in the literature, namely, 14–25% [5,6]. Nguyen et al. [5] reported a 30-day complication rate of 23.5% and Zhou et al. 24.4% [6]. In our population, more patients suffered from ischemic rest pain (52% vs. 23% in Nguyen's and 16% in Zhou's article). Our population also suffered more comorbidities, with 62% of the patients having an ASA classification >3 (62.4% vs. 20.5% in Nguyen's paper), 10.5% suffering from congestive heart disease (vs. 3.0%), 20.5% with COPD (vs 13.7%) and 38% with diabetes mellitus (vs. 33%). Emergency operation was performed more frequently in our population (17% vs. 12.8% in Nguyen's and 7.5% in Zhou's paper). Likely, the worse condition of our patients and the higher number of emergency procedures explain the higher number of complications. Within 30 days postoperatively, mortality in Nguyen's paper was 3.4%, comparable to 3.9% in our population, while 1.5% suffered from cardiovascular complications, acute renal dysfunction (0.9%), pulmonary complications (3.3%) and, in 8.4%, wound-related complications. Our study shows comparable wound-related complications (11.4%), although we did not score wound dehiscence unless there was an infection. Derksen et al. described 14% wound infections [4]; Kechagias described 17% wound infections, 9% hematoma and 5% seroma [13]. Compared to the literature, the population we studied in general

had a more progressed state of peripheral artery disease and had a higher number of emergency operations.

Following emergency operations, our analysis showed more reoperations, amputations, longer hospital admission times and higher mortality rates. Patients undergoing these emergency operations were not observed to have a higher ASA classification. Nguyen et al. showed in their prediction model that the risk on mortality is three times bigger in an emergency procedure [14]. Additionally, Bonvini et al. showed a correlation between emergency procedure and reoperation [15]. It therefore seems that an emergency situation, caused by critical limb-threatening ischemia, is an important risk factor itself.

The observed complication rates implicate that femoral artery endarterectomy, with or without endovascular treatment, should be considered a procedure with a high risk of complications, for which preoperative (multi-)comorbidities and stage of ischemia are the most important risk factors. This calls for a strong preoperative optimization of the patient's condition. In emergency cases, little time for optimization is available, which makes the combination of multimorbidity and emergency surgery ominous and hard to improve.

Regression analysis showed a significantly higher risk on complications and amputations in patients with a higher Rutherford classification as well. When comparing the percentage of complications with those reported in the literature, our results seem worse. However, when the higher comorbidity rate, the higher Rutherford classification and the higher percentage of emergency operations in our population are taken into consideration, our outcomes seem to be better.

Derksen et al. analyzed risk factors for surgical site infections and found a significant correlation between previous groin incision ($p = 0.013$) and surgical site infection [4]. Our study confirmed this correlation (OR 3.2). A correlation between postoperative wound drain and surgical site infections was suggested by Derksen et al. as well. Therefore, the use of wound drains was avoided as a standard in our population. It was to be expected that a higher BMI and a longer operation time would have given a higher risk on infections, but regression analysis showed no significant correlation between BMI and operation duration and surgical site infections (see Appendix A). Nutritional status was not investigated but should be considered as a risk factor as well.

When hybrid procedures and CFE alone were compared, no significant differences in outcome were found, despite a longer duration of the procedure and despite more extended atherosclerotic disease in the "hybrid" patients. A proper explanation for this surprising finding is lacking, but Kang et al. conducted a short analysis as well and described no statistically significant differences in complications [16].

Limitations of this retrospective study are missing data due to incomplete patient files, and selection and observer bias due to the retrospective scoring of comorbidities and postoperative outcomes. By using standardized measure tools and definitions, this bias was reduced to the minimum.

5. Conclusions

In conclusion, we can state that (acute) limb-threatening ischemia and preoperative comorbidity were identified as the most important factors predictive for complications following femoral artery endarterectomy. Preoperative optimization seems mandatory but may be difficult to execute if the time to surgery is short given the seriousness of the ischemia.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board (METC South-West Holland).

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Complete Outcome.

Characteristics	Hospital Stay		Wound Healing		Ankle-Brachial Improvement		Improvement Walking Distance	
	Reg Coef	p-Value	Reg Coef	p	Reg Coef	p	Odds	CI
Procure								
Hybrid	−0.927	0.324	3.768	0.334	23,557	0.775	0.071	0.254
Patient Characteristics								
Age	0.005	0.895	−0.154	0.399	5,492	0.161	0.991	0.965–1.018
Gender	1.288	0.176	−1.03	0.797	155,479	0.063	1.05	0.573–1.927
ASA classification	2.469	0.004	0.915	0.793	83,017	0.306	0.411	0.222–0.763
Rutherford classification	1.828	<0.001	2.224	0.191	77,804	0.027	0.599	0.451–0.796
Ankle-brachial index	−2.432	0.053	1.505	0.872	−704,202	<0.001	1.578	0.384–6.478
TASC	−0.335	0.497	0.279	0.895	76,171	0.074	0.86	0.626–1.181
Acute ischemia	3.88	0.004	6.436	0.263	−73,676	0.677	1.054	0.44–2.527
Comorbidities								
Congestive heart failure	0.833	0.597	9.601	0.171	−87,432	0.523	0.721	0.273–1.905
COPD	−1.263	0.277	−6.442	0.173	105,021	0.305	1.118	0.52–2.403
Sepsis	54,014	<0.001	55,894	0.002			0.195	0.017–2.195
Renal dysfunction	0.65	0.54	9.327	0.033	51,431	0.571	0.461	0.244–0.872
Dialysis	−0.231	0.948	−9.785	0.505	−98,044	0.777	0.393	0.054–2.857
Diabetes mellitus	−0.586	0.549	7.281	0.069	3.248	0.969	0.458	0.25–0.838
Operations Characteristics								
Emergency procedure	7.045	<0.001	−6.276	0.285	16,992	0.919	1.463	0.655–3.270
Previous groin incision	0.337	0.796	3.016	0.581	−65,306	0.623	0.811	0.358–1.841
Previous PTA	−0.332	0.745	−1.852	0.66	25,675	0.769	0.509	0.274–0.946
Antibiotics	1.553	0.101	−3.634	0.358	−138.89	0.092	0.968	0.534–1.756
Antibiotics durations (days)	−0.009	0.872	0.199	0.449	−1.959	0.415	1.019	0.954–1.089
Contralateral groin opened	0.602	0.661	0.386	0.946	−60,337	0.623	1.365	0.553–3.369
Operation duration	0.006	0.44	0.005	0.871	0.254	0.696	1.001	0.996–1.006
Bloodloss	0.003	0.005	−0.009	0.155	0.024	0.873	0.999	0.999–1.000
		Complication			Surgical site infection			Thrombosis
Procure	odds	95% CI	odds	95% CI	odds	95% CI	odds	95% CI
Hybrid	1.034	0.604–1.771	0.947	0.424–2.116	1.466	0.451–4.762		
Patient characteristics								
Age	1.01	0.986–1.034	1.004	0.696–1.040	0.966	0.92–1.015		
Gender	1.46	0.847–2.519	0.503	0.224–1.131	0.469	0.144–1.525		
ASA classification	2.395	1.411–4.066	2.354	1.057–5.243	0.485	0.176–1.339		
Rutherford classification	1.683	1.301–2.175	1.04	0.730–1.483	1.388	0.82–2.35		
Ankle-brachial index	0.282	0.071–1.131	0.98	0.125–7.705	1.615	0.05–52.145		
TASC	1.253	0.941–1.669	1.09	0.713–1.665	1.832	0.937–3.579		
Acute ischemia	1.939	0.93–4.044	1.042	0.335–3.239	4.606	1.370–15.484		
Comorbidities								
Congestive heart failure	2.214	0.943–5.195	1.574	0.494–5.010	0.763	0.094–6.182		
COPD	1.082	0.558–2.095	1.749	0.713–4.289	0.336	0.042–2.67		
Sepsis	big	NS	3.827	0.335–43.688	0	NS		
Renal dysfunction	2.047	1.132–3.701	2.353	1.033–5.358	0.226	0.029–1.786		
Dialysis	0.566	0.058–5.533	0	NS	0	NS		
Diabetes mellitus	1.48	0.853–2.567	0.947	0.413–2.175	0.308	0.066–1.441		
Risk Factor Atherosclerosis								
Hypercholesterolemia	0.573	0.222–1.477	0.471	0.144–1.548	0.762	0.09–6.439		
High LDL	0.584	0.216–1.582	0.61	0.163–2.284	0.67	0.079–5.699		
Smoking	vs. non smoking	1.368	0.713–2.623	1.167	0.461–2.955	4.052	0.761–21.57	
	vs. quit	0.854	0.443–1.646	0.667	0.237–1.873	3.672	0.691–19.512	
BMI	1.037	0.982–1.096	1.013	0.936–1.097	1.048	0.942–1.165		
Operation Characteristics								
Emergency procedure	3.04	1.499–6.165	1.463	0.549–3.902	3.845	1.153–12.823		
Previous groin incision	2.201	1.072–4.518	3.241	1.322–7.946	4.286	1.279–14.357		
Previous PTA	1.615	0.912–2.861	0.908	0.377–2.184	1.096	0.319–3.763		
Antibiotics	0.779	0.454–1.337	0.511	0.223–1.171	2.972	0.783–11.28		
Contralateral groin opened	1.292	0.598–2.791	2.023	0.745–5.495	1.297	0.27–6.218		
Use of patch	0.312	0.089–1.1	1.354	0.166–11.015	0.115	0.026–0.507		
Operation duration	0.999	0.994–1.003	1.001	0.995–1.008	1.004	0.995–1.013		
Bloodloss	1.001	1.00–1.002	1.001	1.0–1.002	1.001	1.0–1.002		

Table A1. Cont.

Characteristics	Hospital Stay		Wound Healing		Ankle-Brachial Improvement		Improvement Walking Distance		
	Reg Coef	p-Value	Reg Coef	p	Reg Coef	p	Odds	CI	
Procedure	odds	95% CI	odds	95% CI	odds	95% CI	odds	95% CI	
Hybrid	0.862	0.441–1.684	0.654	0.281–1.523	0.771	0.202–2.949			
Patient Characteristics									
Age	0.998	0.969–1.028	1.034	0.995–1.075	1.028	0.968–1.093			
Gender	1.42	0.724–2.783	1.244	0.525–2.949	1.875	0.49–7.176			
ASA classification	1.856	0.977–3.526	2.651	1.139–6.17	6.897	1.548–30,727			
Rutherford classification	1.38	1.016–1.873	2.668	1.656–4.299	1.288	0.71–2.335			
Ankle-brachial index	0.351	0.061–2.041	0.048	0.005–0.475	0.099	0.002–6.466			
TASC	1.029	0.723–1.463	1.902	1.174–3.081	1.089	0.697–1.701			
Acute ischemia	1.501	0.625–3.606	1.5	0.522–4.312	5.04	1.281–19,835			
Comorbidities									
Congestive heart failure	1.188	0.417–3.386	1.743	0.544–5.585	4.714	1.098–20.24			
COPD	0.887	0.380–2.069	1.248	0.468–3.324	1.989	0.478–8.267			
Sepsis	big	NS	0	NS	0	NS			
Renal dysfunction	2.07	1.027–4.169	1.887	0.799–4.456	5.684	1.376–23,478			
Dialysis	0	NS	2.778	0.278–27,774	9	0.841–96,338			
Diabetes mellitus	1.818	0.925–3.572	1.425	0.608–3.340	0.804	0.196–3.299			
Risk Factor Atherosclerosis									
Hypercholesterolemia	1.901	0.42–8.596	0.603	0.161–2.249	0.168	0.038–0.734			
High LDL	1.656	0.363–7.565	0.521	0.138–1.971	0.145	0.033–0.643			
Smoking	vs. non smoking	1.3	0.577–2.93	1.819	0.723–4.579	2.672	0.615–11,605		
BMI	vs. quit	1.074	1.007–1.146	0.979	0.159–1.763	0.456	0.046–4.478		
Operation Characteristics									
Emergency procedure	1.703	0.755–3.839	3.262	1.321–8.056	11,333	2.7–47.57			
Previous groin incision	1.336	0.561–3.185	1.395	0.487–3.994	1.563	0.311–7.846			
Previous PTA	2.089	1.052–4.147	2.215	0.956–5.134	2.854	0.743–10,964			
Antibiotics	0.512	0.258–1.017	0.853	0.371–1.959	1.928	0.47–7.905			
Contralateral groin opened	0.624	0.206–1.889	2.261	0.825–6.2	3.429	0.811–14,493			
Use of patch	0.369	0.103–1.325	0.299	0.074–1.212	big	NS			
Operation duration	0.994	0.987–1.0	1.002	0.996–1.009	big	NS			
Bloodloss	1	0.999–1.001	1.001	1.0–1.002	1.001	1.0–1.002			

Significant values are typed in red.

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