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Geometric Analysis of the Gore Excluder Conformable Endoprosthesis in the Infrarenal Aortic Neck: One Year Results of the EXCeL Registry

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Running titles:

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WHAT THIS PAPER ADDS

This study provides insight into the post-operative geometry of the Gore Excluder Conformable Endoprosthesis (CEXC) through computed tomography applied analysis of endograft apposition, endograft position, and aortic geometry. Geometric analysis enables in depth examination of the early achieved sealing zone and allows for the detection of subtle alterations during follow up. The findings demonstrate good performance of the CEXC in patients with and without challenging neck anatomy. Analysis of aortic curvature showed no changes after implementation of the CEXC, which supports its claimed conformability. These data might help endovascular specialists to determine the optimal treatment strategy for patients with abdominal aortic aneurysms.

Objective: The Gore Excluder Conformable Endoprosthesis (CEXC) is designed to treat challenging infrarenal anatomy because of its active angulation control, repositionability, and enhanced conformability. This study evaluated 30 day and one year position and apposition of the CEXC in the infrarenal neck.

Methods: Patients treated with the CEXC between 2018 and 2022 with an available 30 day computed tomography angiography (CTA) were selected from four hospitals in a prospective registry. Endograft apposition (shortest apposition length [SAL]) and position (shortest fabric distance [SFD]) were assessed on the 30 day and one year CTAs. Maximum infrarenal aortic curvature was compared between the pre-operative and post-operative CTAs to evaluate conformability of the CEXC.

Results: There were 87 patients with a 30 day CTA, and for 56 of these patients the one year CTA was available. Median (interquartile range [IQR]) pre-operative neck length was 22 mm (IQR 15, 32) and infrarenal angulation was 52° (IQR 31, 72). Median SAL was 21.2 mm (IQR 14.0, 29.3) at 30 days for all included patients. The SAL in 13 patients (15%) was < 10 mm at 30 days, and one patient had a SAL of 0 mm and a type Ia endoleak. There was no significant difference in SAL between patients within and outside instructions for use. The SAL significantly increased by 1.1 mm (IQR −2.3, 4.7; p = .042) at 1 year. The SAL decreased in seven patients (13%), increased in 13 patients (23%), and remained stable in 36 patients (64%). Median SFD was 2.0 mm (IQR 0.5, 3.6) at 30 days, which slightly increased by 0.3 mm (IQR −0.5, 1.8; p = .019) at 1 year. One patient showed migration (SFD increase ≥ 5 mm). Median endograft tilt was 15.8° (IQR 9.7, 21.4). Pre-operative maximum infrarenal curvature was 36 m^{-1} (IQR 26, 56) and did not significantly change thereafter.

Conclusion: In most patients, the CEXC was implanted close to the renal arteries, and sufficient (≥ 10 mm) post-operative apposition was acquired at 30 days, which slightly increased at one year. Post-operative endograft tilt was relatively low, and aortic geometry remained unchanged after implantation of the CEXC, probably due to its high conformability.

Keywords: Abdominal aortic aneurysm, Apposition, Computed tomography angiography, Endovascular aneurysm repair, Endovascular procedure

INTRODUCTION

Endovascular aneurysm repair (EVAR) outcomes are notably compromised in patients presenting with challenging neck anatomy characterised by short, angulated, wide, or severely calcified infrarenal necks, which increase the risk of endograft migration, type Ia endoleak, and subsequent re-interventions.[1–3] Current guidelines recommend determining the optimal treatment based on aortic neck anatomy, life expectancy, anaesthetic risk, and comorbidities.[4–6]

The Gore Excluder Conformable AAA Endoprosthesis with ACTIVE CONTROL System (CEXC) (W.L. Gore & Associates Inc., Flagstaff, AZ, USA) is designed to address the endeavours associated with challenging neck anatomy.[7] The CEXC combines enhanced conformability with an active control mechanism, aiming to optimise graft positioning and allowing repositioning and angulation control to ultimately enhance maximal apposition in the infrarenal neck.[8,9] Results regarding short term effectiveness and safety are promising, even in angulated neck anatomy.[9–12] The current study evaluated 30 day and 1 year position and apposition of the CEXC using vascular image analysis (VIA) software. In addition, the conformability of the CEXC was evaluated by comparing pre-operative and post-operative aortic curvature.

MATERIALS AND METHODS

Study design

This multicentre study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and the principles of the Declaration of Helsinki.[13,14] Patients were drawn from the "Assessment of the GORE EXCLUDER Conformable AAA Endoprosthesis in the Treatment of Abdominal Aortic Aneurysms" (EXCeL) registry.[15] Approval for the EXCeL registry was obtained from the Medical Research Ethics Committees United (MEC-U 2015.78), after which approval from each participating centre was acquired. Informed consent was obtained from all patients.

Patient selection

Inclusion criteria for the EXCeL registry were (1) an abdominal aortic aneurysm (AAA) combined with one of the following: maximum aneurysm diameter ≥ 50 mm, aneurysm growth > 5 mm in six months, or the presence of clinical symptoms; (2) adequate aortic anatomy: adequate iliac or femoral access, aortic neck diameter 16 – 32 mm, distal iliac seal zone ≥ 10 mm, and an iliac artery diameter between 8 mm and 25 mm; (3) capability of adhering to the follow up protocol; and (4) age > 18 years and life expectancy > 2 years.[15] The most important exclusion criteria were (1) mycotic, ruptured, or saccular aneurysm; (2) presence of a concomitant thoracic aortic aneurysm necessitating surgical intervention; (3) renal insufficiency, with a glomerular filtration rate < 30 mL/min/1.73m^2; and (4) systemic infection or connective tissue disease.[15] The full list of inclusion and exclusion criteria is available in the EXCeL protocol (ClinicalTrials.gov identifier NCT03743142).[15]

The study included all patients in the EXCeL registry in Catharina Hospital (Eindhoven), Rijnstate Hospital (Arnhem), and Elisabeth TweeSteden Hospital (Tilburg) in the Netherlands, and San Martino Hospital (Genoa, Italy) between September 2018 and September 2022. These hospitals were selected because of the high volume of EVAR procedures. The choice of treatment method and endograft were at the discretion of the treating vascular team.

Because the aim of this study was to analyse apposition of the CEXC, patients without an available 30 day computed tomography angiography (CTA) (~1 – 90 days post-operatively) to assess baseline apposition were excluded. Patients with adjuncts to fixate the proximal part of the endoprosthesis were excluded. Patients treated with a Gore Aortic Extender were not excluded because this is an optional component of the CEXC. For each included patient, the pre-operative, 30 day, and (if available) one year (~275 – 455 days post-operatively) CTA were requested. If patients underwent a re-intervention in the proximal neck (e.g., for type Ia endoleak or migration), the succeeding CTA was excluded from apposition analysis. Follow up data were last updated in June 2023.

Clinical characteristics

Patient characteristics were gathered using an electronic case report form. Pre-operative aortic characteristics were assessed by the core laboratory after centre lumen line (CLL) reconstruction. Neck diameter was measured from adventitia to adventitia at the inferior border of the lowest renal artery. Neck length was defined as the CLL distance between the lowest renal artery and the point where the diameter

of the neck increased by 10%.[16] Infrarenal angulation was defined as the CLL angle between the longitudinal axis of the aortic neck and the aneurysm sac. Suprarenal angulation was defined as the CLL angle between the longitudinal axis of the suprarenal aorta and the aortic neck.[17] Intended oversizing was calculated as (nominal endograft diameter/pre-EVAR neck diameter) × 100%.[18]

Patients were assigned to within instructions for use (IFU) or outside IFU subgroups based on neck length and infrarenal neck angulation. To classify as within IFU, one of the following criteria were met: (1) neck length ≥ 15 mm and infrarenal angulation ≤ 90°; or (2) neck length ≥ 10 mm and infrarenal angulation ≤ 60°. The aim of this study was to analyse geometric results of the CEXC. A comprehensive overview of clinical results of the EXCeL registry will be published in a later phase.

Analysis of endograft position and apposition

Endograft apposition and position were calculated using VIA software (Endovascular Diagnostics B.V., Bussum, the Netherlands) according to published and validated protocols.[8,19,20] Each CTA was pre-processed by an experienced observer (R.Z.) using a 3mensio Vascular Workstation (Pie Medical Imaging B.V., Maastricht, the Netherlands). A CLL reconstruction was created, coordinates were placed at the orifice of the renal artery, the endograft fabric markers, and the end of circumferential apposition, and a mesh of the aortic lumen was created. The CLL, the coordinates, and the mesh were exported to VIA to calculate aortic and endograft dimensions. The shortest apposition length (SAL), shortest fabric distance (SFD), contralateral fabric distance (CFD), and endograft tilt were computed. An example of post-operative VIA output is shown in Figure 1.

The SAL is the shortest length between the proximal endograft fabric and the first slice where circumferential apposition between the endograft and the aortic wall is lost. The SFD is the shortest distance between the endograft fabric and the lowest renal artery. The CFD is the distance between the endograft fabric and the highest renal artery (after CLL reconstruction). A SAL of < 10 mm was considered insufficient because this is associated with a high risk for type Ia endoleak.[7,21,22] A SAL increase or decrease of ≥ 5 mm between the 30 day and one year CTA was classified as clinically relevant. An SFD increase of ≥ 5 mm was classified as clinically relevant. The SAL/neck length ratio demonstrates which portion of the pre-operative neck length is sealed post-operatively.[18] A ratio of < 1 means that the pre-operative neck length is not completely sealed, whereas a ratio of > 1 means that more than the pre-operative neck length is sealed (probably due to larger oversizing). Tilt was defined as the angle between the axis of the proximal endograft fabric and the directional vector of the CLL.[8]

Analysis of aortic curvature

Aortic curvature analysis was conducted in VIA on the CLL of the pre-operative, 30 day, and 1 year CTAs. The protocol was previously published.[8,23] Aortic curvature is calculated as the inverse of the radius of a circle that fits over the CLL at a certain location, which is expressed as inverse meters (m^{-1}). Maximum infrarenal curvature was computed along the CLL of the anticipated proximal neck for the pre-operative CTA, and along the CLL of the actual sealing zone for the post-operative CTAs. In addition, the distance between the lowest renal artery baseline and the point where the maximum infrarenal curvature was located was calculated.

Statistical methods

Data were analysed using IBM SPSS Statistics Version 28 (IBM Corp., Armonk, NY, USA). Normality was evaluated using histograms and quantile–quantile (Q-Q) plots. Skewed data are expressed as median with interquartile range (IQR). Categorical data are presented as number and percentage. Post-operative outcomes regarding apposition and position were compared using the Wilcoxon signed rank test. Differences in procedural characteristics and 30 day apposition and position between the within and outside IFU subgroups were tested using the Mann–Whitney *U* test or Fisher's exact test. A *p* value of ≤ .050 was considered statistically significant.

RESULTS

Patient demographics and comorbidities

There were 156 patients enrolled in the EXCeL registry, of which 113 were from the four participating centres. Of these 113 patients, 25 were excluded due to absence of a 30 day CTA, and 1 patient was excluded due to use of a Cheatham Platinum (Numed Inc., Hopkinton, NY, USA) stent. The remaining 87 patients were included in this study. Median age was 78 years (IQR 72, 82), 66 patients (76%) were male, and 58 (67%) had an American Society of Anesthesiologists (ASA) classification of ≥ III.

Pre-operative anatomical characteristics

An overview of anatomical characteristics is provided in Table 1. Median neck length was 22 mm (IQR 15, 32) and median infrarenal angulation was 52° (IQR 31, 72). In

total, 72 patients (83%) were classified as within IFU and 15 (17%) as outside IFU. Reasons for being outside IFU among the 15 patients were infrarenal angulation > 90° in eight patients (53%), infrarenal angulation > 60° and neck length < 15 mm in three patients (20%), and neck length < 10 mm in four patients (27%).

Procedural and follow up details

Procedural characteristics are presented in Table 2. Angulation control was used in 25 patients (35%) within IFU and in 11 patients (73%) outside IFU (p = .032). Repositioning and reconstraining were used in 37 patients (51%) within IFU and 9 patients (60%) outside IFU (p = .82). On the completion angiography, 16 endoleaks were observed: 1 type Ia, 1 type Ib, and 14 type II. One type Ib endoleak was left untreated and one type Ia endoleak (in a patient outside IFU, neck length 12 mm, infrarenal angulation 94°) persisted despite remodelling and placement of an extension cuff. The assisted technical success rate was 98%.

Thirty day endograft position and apposition

Median time between EVAR and the 30 day CTA was 42 days (IQR 29, 69). Table 3 provides an overview of endograft position and apposition results on the 30 day CTA. Median SAL was 21.2 mm (IQR 14.0, 29.3; range 0.0 – 41.8 mm), and the median SFD was 2.0 mm (IQR 0.5, 3.6). No significant differences were found between the within and outside IFU subgroups for SAL (21.1 mm [IQR 14.9, 29.1] *vs.* 24.6 mm [9.8, 30.2]; p = .95), SFD (1.8 mm [IQR 0.1, 3.5] *vs.* 2.8 mm [IQR 0.8, 4.8]; p = .17), CFD (p = .89), and tilt (p = .36), respectively. No significant difference in tilt was found for patients with angulation control *vs.* patients without (p = .61). SAL was

< 10 mm in 13 patients, of which 4 (31%) were treated outside IFU. These 13 patients had a median SAL of 6.8 mm (IQR 5.1, 9.3), median neck length of 16 mm (IQR 15, 25), and median infrarenal angulation of 59.0° (IQR 35.5, 75.5). The SAL in one patient was 0 mm; this patient had a newly detected type Ia endoleak that was successfully treated with a proximal cuff and EndoAnchors (Medtronic Cardiovascular, Santa Rosa, CA, USA). The previously detected type Ia endoleak (at the completion CTA) had spontaneously resolved at the 30 day CTA.

One year endograft position and apposition

A 1 year CTA was analysed for 56 patients. Median time between EVAR and the 1 year CTA was 12.5 months (IQR 11.0, 13.8). Median SAL significantly increased by 1.1 mm (IQR −2.3, 4.7) to 24.8 mm (IQR 16.9, 31.1; p = .042). Median SFD significantly increased by 0.3 mm (IQR −0.5, 1.8) to 2.1 mm (IQR 0.5, 4.3 mm; p = .019). Figure 2 shows the differences between the 30 day and 1 year CTAs.

The CFD (p = .096), SAL/neck length ratio (p = .091), and tilt (p = .34) did not significantly change between the 30 day and one year CTAs. Maximum aneurysm diameter did not significantly change between the pre-operative and 1 year CTA (p = .70). The SAL decreased ≥ 5 mm in seven patients (13%), increased ≥ 5 mm in 13 patients (23%), and remained stable in 36 patients (64%). Of the 13 patients with a SAL < 10 mm at the 30 day CTA, two patients had a SAL increase to ≥ 10 mm at 1 year. Three patients had persisting SAL < 10 mm at 1 year, and they also had an increasing aneurysm diameter (≥ 5 mm), without the presence of a core laboratory diagnosed endoleak. One patient required a re-intervention for a type Ia endoleak, which was previously mentioned. The remaining seven patients had no one year

CTA because follow up was continued with duplex ultrasound imaging that showed no type Ia endoleak (*n* = 4), the one year CTA was omitted (*n* = 1) or not yet performed (*n* = 1), or the patient died of an unknown cause (*n* = 1, due to loss to follow up) during the first year after EVAR. One patient (2%) had clinically relevant migration (SFD increase ≥ 5 mm); nonetheless, the SAL increased.

Aortic curvature

The median pre-operative maximum infrarenal curvature was 36 m^{-1} (IQR 26, 56). Figure 3 shows the change in maximum infrarenal curvature at the 30 day CTA and one year CTA with respect to the pre-operative measurement. The maximum infrarenal curvature did not change at the 30 day CTA (−2.0 m^{-1} [IQR −13.0, 7.0]; p = .18) or at the 1 year CTA (−3.0 m^{-1} [IQR −13.0, 10.8]; p = .48). The distance between the point of the maximum infrarenal curvature and the lowest renal artery did not significantly change.

DISCUSSION

This study shows that the CEXC enables the achievement of sufficient SAL (≥ 10 mm) in 85% of patients and a median SFD of 2.0 mm at 30 days after the initial procedure, even in challenging anatomies. This illustrates the achievement of adequate post-operative endograft apposition to the infrarenal neck in most patients, and placement of the endograft close to the lowest renal artery with a relatively low endograft tilt. At one year, the median SAL showed a significant increase. Aortic curvature did not change after implementation of the CEXC, which supports its claimed conformability.

Securing a sufficient infrarenal sealing zone after EVAR is crucial to prevent neck related complications such as type Ia endoleak and migration.[22] This acquired apposition should be stable over time, because decreasing SAL is an indicator for type Ia endoleak as well.[19,24] This study found a significant increase in SAL at one year, and the SAL increased ≥ 5 mm in almost one quarter of patients. We hypothesise that this is due to ongoing endograft expansion and/or aneurysm shrinkage, which leads to collapse of the aortic wall against the endograft in the infrarenal aortic neck.

It would be interesting to investigate whether the SAL further increases over a longer period of time. In 13 patients, a SAL < 10 mm was found at 30 days and/or one year, possibly due to the relatively challenging anatomy in this cohort. Of these patients, four had serious concerns during follow up, of which there was one type Ia endoleak and three patients with persisting SAL < 10 mm at one year (with simultaneous sac growth). Patients with a SAL < 10 mm have a high risk of developing type Ia endoleak and should be monitored closely. van der Riet *et al.* found a comparable percentage of SAL < 10 mm at 30 days in patients treated with the Endurant device (Medtronic).[18] The current study had a higher percentage of outside IFU treatment, and median SAL values were comparable. Comparable SAL and SFD values were found in two previous studies with patients who were mostly treated with the Endurant (Medtronic) endograft. Notably, these studies only selected patients with uncomplicated follow up.[19,24] In patients with a neck length < 10 mm and/or infrarenal angulation > 90°, EVAR should not be used or only in exceptional cases (e.g., patients with multiple comorbidities and need for urgent endovascular repair).[4]

The acquired post-operative sealing zone depends on many factors, of which the proximity of the device to the renal arteries is one. Landing directly below the renal arteries is extra difficult in patients with angulated aortic neck anatomy.[25] This study demonstrated that it is possible to place the CEXC close to the lowest renal artery. Comparable SFD values were acquired in the within and outside IFU groups. The significant increase in SFD at the 1 year follow up was only 0.3 mm and therefore negligible. This was also found in previous studies with various endografts and could be due to physiological haemodynamic and mechanical forces.[19,24] Significant migration (SFD increase ≥ 5 mm) was found in one patient who had sufficient SAL (≥ 10 mm) at the one year CTA, without a type Ia endoleak. In addition, an endograft tilt of 0° means that the endograft is placed perpendicular to the CLL. In the current study, patients had a median tilt of 15.8°, which is comparable with previous studies.[12,19] Tilt values did not differ between the within and outside IFU groups, possibly due to the angulation control.

In previous studies, the CEXC has demonstrated promising results regarding technical success and neck related complications in the short term.[26] This holds true in patients with angulated anatomy.[11] The current study found no significant difference in apposition (SAL) and position (SFD) between the within and outside IFU subgroups. This offers future possibilities for EVAR with the CEXC in patients with challenging neck anatomy. However, this should be interpreted with caution because the pre-operative aortic neck length is not necessarily equivalent to the acquired post-operative sealing zone length. Especially in patients with severely angulated anatomy, the sealing zone length at the inner or outer curve could be

considerably shorter.[27] Pre-operative EVAR planning in patients with a short neck length and angulated anatomy should consider the reciprocal influence of neck length and angulation.

Use of less conformable endografts during EVAR may cause straightening of the aorta, potentially resulting in tension on the endograft in the sealing zones.[28] A previous study demonstrated that the infrarenal curvature changes after EVAR, which may increase the risk for neck related complications.[23] Moreover, most endografts cannot entirely conform to angulated anatomy.[23] The CEXC was not included in that study. The current study showed that the infrarenal curvature did not significantly change after implementation of the CEXC, probably due to its enhanced conformability. Notably, the current methodology was applied to static CTA images, whereas electrocardiogram gated CTA offers analysis of cardiac pulsatility induced motion, which might provide even more insight into the conformability of the CEXC.[29,30]

Limitations and recommendations

Patients without a 30 day CTA were excluded, which might have resulted in selection bias. For example, absence could be due to renal function disorders or logistical reasons. Not all patients had an available one year CTA, mostly because duplex ultrasound imaging was used or the CTA was omitted or planned in the future. As a result, the 1 year CTA could not be analysed in seven patients with a SAL of < 10 mm at 30 days. Pre-operative neck calcification and thrombus were not assessed, and these factors might also influence the post-operative apposition. The absence of a significant difference between the within and outside IFU subgroups might be due

to the small sample size. Seven patients were treated with an additional extension cuff. A large part of these patients were treated outside the IFU, and in most cases both the infrarenal and suprarenal angles were high, resulting in a “siphon like” shape of the aorta. Future studies should investigate mid to long term follow up, especially because most complications present during this period.[31] It would be interesting to update the current study after follow up of the EXCeL registry is completed, especially in patients with a SAL < 10 mm. Additionally, it would be valuable to compare the standard Gore Excluder with the CEXC to examine the SAL, SFD, curvature, and tilt to establish the added value of the angulation control. Lastly, the VIA software is not currently publicly available owing to the absence of a Conformité Européenne (CE) mark. The apposition length measured along the CLL would be the best temporary substitute, although this might overestimate the actual apposition length.

Conclusion

In most patients who underwent EVAR with the CEXC, the device was implanted close to the renal arteries. Sufficient (≥ 10 mm) post-operative apposition was acquired in most patients, which remained stable at the 1 year CTA. Notably, at least four of the 13 patients with a SAL of < 10 mm at the 30 day CTA had concerns at follow up. These patients might benefit from intensified follow up or early re-intervention. Aortic curvature remained unchanged after implementation, which suggests high conformability of the CEXC.

CONFLICTS OF INTEREST

Jean-Paul de Vries and Richte Schuurmann are co-founders of the company Endovascular Diagnostics B.V. (Bussum, the Netherlands), which holds patent rights over the software used to determine endograft apposition and position. Jan Heyligers and Michel Reijnen are consultants for W.L. Gore & Associates Inc. (Flagstaff, AZ, USA).

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Figure 1. Example of post-operative vascular image analysis output. The blue circle marks the renal arteries, the white circle marks the endograft fabric markers, and the red circle marks the first slice where circumferential apposition is lost. The grey area represents the sealing zone (i.e., apposition surface). The white line marks the shortest apposition length (SAL), and the blue lines the shortest fabric distance (SFD) and the contralateral fabric distance (CFD). The SAL is the shortest length between the proximal endograft fabric and the first slice where circumferential apposition between the endograft and the aortic wall is lost. The SFD is the shortest distance between the endograft fabric and the lowest renal artery. The CFD is the shortest distance between the endograft fabric and the highest renal artery. The SAL quantifies the sealing zone, the SFD the proximity of the endograft to the lowest renal artery, and the CFD the proximity of the endograft to the highest renal artery. The tilt (T) is the angle between the axis of the proximal endograft fabric and the directional vector of the centre lumen line (CLL). Aortic curvature is shown as a heatmap projected over the CLL (blue = low curvature; red = high curvature).

Figure 2. Box and whisker plot showing the difference in (A) shortest apposition length (SAL), (B) shortest fabric distance (SFD), and (C) contralateral fabric distance (CFD) between the 30 day post-operative computed tomography angiography (CTA) and the one year post-operative CTA. The line in the middle of each box indicates the median, and the top and bottom borders of the box mark the 75th and 25th percentiles, respectively. The upper and lower whiskers extend from the hinge to the highest value and lowest value, respectively, that is within 1.5 interquartile range of the hinge, and the circles indicate outliers. * $p \leq .050$ (statistically significant).

Figure 3. Box and whisker plot showing the change in maximum infrarenal curvature at the 30 day computed tomography angiography (CTA) and one year CTA with respect to the pre-operative CTA. The line in the middle of each box indicates the median, and the top and bottom borders of the box mark the 75th and 25th percentiles, respectively. The upper and lower whiskers extend from the hinge to the highest value and lowest value, respectively, that is within 1.5 interquartile range of the hinge, and the circles indicate outliers.

Table 1. Pre-operative core laboratory assessed anatomic characteristics of patients (*n* = 87) included in the analysis.	
Characteristic	**Patients (*n* = 87)**
Neck diameter – mm	21 (20, 24)
Neck diameter >28 mm	0 (0)
Neck length – mm	22 (15, 32)
Neck length <10 mm	4 (5)
Infrarenal angulation – °	52 (31, 72)
Infrarenal angulation 60–90°	27 (31)
Infrarenal angulation >90°	8 (9)
Suprarenal angulation – ° *	17 (11, 35)
Maximum aneurysm diameter – mm	59 (53, 64)

Data are presented as the median (interquartile range) or *n* (%).

* The suprarenal angulation could not be assessed for two patients.

Table 2. Procedural characteristics for patients (*n* = 87) included in the study.	
Characteristic	**Patients (*n* = 87)**
Endograft diameter – mm	28 (26, 28)
Intended oversizing – %	23.1 (16.7, 35.3)
Repositioning and constraining attempts	
0	40 (46)
1	31 (36)
2	7 (8)
≥3	8 (9)
Unknown	1 (1)
Angulation control attempts	
0	49 (56)
1	26 (30)
2	8 (9)
3	1 (1)
Unknown	3 (3)
Use of proximal extensions	
Yes	7 (8)
No	80 (92)
Successful deployment in planned position	87 (100)
Assisted technical success	85 (98)

Data are presented as median (interquartile range) or *n* (%).

Table 3. Thirty day endograft position and apposition for patients (*n* = 87) included in the study.	
Variable	**Patients (*n* = 87)**
Shortest apposition length – mm	21.2 (14.0, 29.3)
Shortest apposition length/neck length ratio	0.8 (0.6, 1.2)
Shortest apposition length <10 mm	13 (15)
Shortest fabric distance – mm	2.0 (0.5, 3.6)
Contralateral fabric distance – mm	8.1 (4.6, 14.8)
Endograft tilt – °	15.8 (9.7, 21.4)

Data are presented as median (interquartile range) or *n* (%).